THE NIAGARA RIVER MUSSEL BIOMONITORING PROGRAM (*ELLIPTIO COMPLANATA*): AN UPDATE IN LONG-TERM WATER QUALITY TRENDS USING PASSIVE SAMPLERS (2012-2018).

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Executive Summary

The Niagara River is the interconnecting channel between Lake Erie and Lake Ontario. Historically numerous persistent toxic and bioaccumulative contaminants from waste disposal sites, industrial outfalls, and municipal point and non-point sources were discharged to the Niagara River. Since 1983 the Ontario Ministry of Environment, Conservation and Parks (MECP) has been committed to the biomonitoring of contaminants in the Niagara River using caged mussels (*Elliptio complanata*) and more recently using passive samplers: semi-permeable membrane devices (SPMDs) and polyethylene devices (PEDs) as part of Ontario's commitment to the binational Niagara River Toxics Management Plan (NRTMP). These studies have provided information on suspected contaminant sources and source areas between Fort Erie (FE) and downstream at the mouth at Niagara-on-the-Lake (NOTL) on both the Canadian and American sides of the river.

The water quality dataset (1986-2015; Hill, 2018) from the Environment and Climate Change Canada (ECCC) Upstream/Downstream (US/DS) Niagara River Monitoring Program identified contaminants that exceed water quality criteria (WQC) at FE and/or NOTL. These data also showed evidence of Niagara River sources: i.e., contaminants that have statistically significant higher water concentrations at NOTL compared with FE. The historical (1983-2018) caged mussel data set and SPMD data (2012-2018) were used to identify the sources of these contaminants to the river. SPMD data were used to estimate nearshore and tributary dissolved water concentrations of the detected contaminants.

Sources of contaminants were not identified on the Canadian side of the river. However, metabolites of DDT and other organochlorinated pesticides such as chlordane and dieldrin that had historical widespread use throughout the watershed (and Great Lakes basin) were present at almost all Canadian sites. Low concentrations of total PCBs (< 1 ng/L) and chlorinated benzenes (<0.01 ng/L) were also present.

Total PCBs have exceeded the New York State Water Quality Criteria (WQC) of 0.001 ng/L at all stations monitored in the Niagara River between 2012-2018, however, concentrations were consistently higher in the Tonawanda Channel compared with the Chippawa Channel (Canadian side of the river) highlighting sources on the US side (e.g., Two Mile Creek, the Pettit Flume, North Tonawanda shoreline, Little Niagara River downstream of 102nd St Hazardous Waste site). Total PCBs ranged from 2 ng/L to 387 ng/L in the nearshore of the upper river compared to <0.8 ng/L in the Chippawa Channel.

Niagara River contaminant sources highlighted in Table ES1 were located on the American side of the river, primarily in the Tonawanda Channel, with one site in the lower Niagara (Bloody Run Creek: associated with the Hyde Park Hazardous Waste site). Estimated water concentrations of contaminants using SPMD data provided in earlier reports from 2012-2015 have been updated for this report to reflect changes in the Performance Reference Compound (PRCs) values used for the calculations. Reviewing the 2012-2018 data showed that spatial patterns of contamination and identified sources have remained consistent through time. Estimated water concentrations for dieldrin, DDT metabolites (p,p'-DDE and p,p'-DDD), mirex,

octachlorostyrene (OCS), hexachlorobenzene (HCB), hexachlorobutadiene (HCBD), alpha hexachlorocyclohexane (α-HCH) and total PCBs exceed the most stringent of the four agencies' water quality criteria at multiple stations. Since the SPMDs only characterize the dissolved phase and many of the priority toxic contaminants tend to be present on suspended particles, the data could underestimate the actual concentrations and environmental implications of a contaminant at a location. Chlorinated industrial compounds and organochlorinated pesticides in general, however, were present at low concentrations throughout the Niagara River, with the exceptions noted in Table ES1.

***Table ES1**: Niagara River sources identified using caged mussel and/or SPMD/PED data (2012-2018) for compounds listed in the ECCC US/DS water quality monitoring dataset that have concentrations higher at NOTL than at FE*.

ECCC Upstream/Downstream (U/D) data suggest NR sources	***NR sources identified by Caged Mussels and/or SPMD Data***
Di and Tri-chlorinated Benzenes	Gill Creek, Pettit Flume Cove, Occidental Chemical Buffalo Ave. Plant,
1,2,3,4-Tetrachlorobenzene Pentachlorobenzene Hexachlorobenzene[1]	Pettit Flume Cove, Bloody Run Creek, Occidental Chemical Buffalo Ave. Plant , 102nd Street Waste Site (Little Niagara River/Cayuga Ck.)
α-HCH[2] γ-HCH (Lindane)	Cayuga Creek and Gill Creek
Mirex[2]	Occidental Chemical Buffalo Ave. Plant and associated sites
Octachlorostryene (OCS)[2]	Bloody Run Creek, Occidental Chemical Buffalo Ave. Plant
α-chlordane	Low concentrations present at all stations sampled on the river (relatively higher concentrations present at:Two Mile Creek, Cayuga Creek, Pettit Flume)
pp-DDE[3] and/or pp-DDD	Present at all stations sampled on the river (relatively higher concentrations present at:Two Mile Creek, Cayuga Creek, 102nd St., Pettit Flume)
Dieldrin[3]	Two Mile Creek
Hexachlorobutadiene (HCBD)	Occidental Chemical Buffalo Ave plant[2] and Gill Creek
Total PCBs[3]	Two Mile Creek/Rattlesnake Creek, Occidental Chemical Buffalo Ave plant[4], Pettit Flume cove, River Road (North Tonawanda)

WQC: The most stringent Water Quality Criteria of the four agencies is used for comparison with water concentrations.

[1]HCB present at most sites on the US side of the river >WQC

[2]α-HCH; OCS; Mirex >WQC at these sites; HCBD > WQC at OCC Chem.

[3]pp-DDE; dieldrin; Total PCBs present at all sites in the river >WQC

[4]Note that [TPCBs] at OCC were significantly lower in 2018 compared with 2012-2015

The Niagara River also has significant localized sources of dioxins and furans. The 2018 mussel, SPMD and sediment data confirm the previous survey data that showed the Pettit Flume cove (North Tonawanda) and Bloody Run Creek to be sources of dioxins and furans to the river. Sediment dioxin contamination in the Pettit Flume cove in 2018 was high and previous surveys showed that dioxin contaminated sediment from the Pettit Flume is likely migrating off-site. Estimated water concentrations using the SPMD data in 2012 had high concentrations of dioxins and furans within the cove and at the downstream end of the cove (range 4 to 10 pg TEQ/L) compared to the upstream SPMDs (0.03 pg TEQ/L). Sediment and caged mussels collected downstream of Bloody Run Creek also show movement of dioxins and furans off-site. Without further remedial actions at these sites, they are likely to remain on-going sources to the Niagara River.

Long-term trends for caged mussel data showed that at American locations that were remediated, contaminants of concern (COCs) remained low (e.g., PCBs in mussels at Gill Creek). For sites that were not remediated, COCs in mussel tissue remain consistent through time (e.g., PCBs in mussels at Two Mile Creek, chlorinated benzenes in mussels and SPMDs at Bloody Run Creek), and the sites remain a source to the river of contaminants that are bioavailable.

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INTRODUCTION

The Niagara River flows 60 km (37 mi) connecting Lake Erie and Lake Ontario. Since the first investigation of the river by the International Joint Commission (IJC) in 1912 as part of its larger study of the pollution of the Great Lakes boundary waters between Canada and the United States (IJC, 1918), numerous water quality problems have been identified in the river. Between the late 1970 and early 1980s the four environmental agencies in Canada and the United States [Environment and Climate Change Canada (ECCC), the Ontario Ministry of the Environment, Conservation and Parks (MECP), New York State Department of Environmental Conservation (NYSDEC), and the United States Environmental Protection Agency Region II (USEPA II)] identified significant contamination of the river by a variety of toxic chemicals, many of which were both persistent and bioaccumulative (COA, 1979; COA, 1981; IJC, 1981; JGLR, 1983; NRTC, 1984). Most contaminants were entering the river via municipal and industrial outfalls (e.g., steel, petrochemical, and chemical manufacturing industries), hazardous waste landfills and other non-point sources (e.g., surface run-off). Additionally, Lake Erie and areas upstream also contributed some contamination to the river. These reported findings and recommendations of the Niagara River Toxics Committee (NRTC) led to the creation of a four-party agreement between Canada and Ontario, and the US Federal and State governments: the Niagara River Toxic Management Plan (NRTMP) in February 1987. The overall goal was to reduce the concentrations of toxic chemicals by reducing inputs from sources along the river.

As part of Ontario's commitment to the NRTMP, the MECP has monitored the concentrations of contaminants in caged mussel tissue (*Elliptio complanata*) and bottom sediments at over seventy-three sites on both the Canadian and American side of the Niagara River since 1983 to describe the general contamination of the river, identify contaminant sources, and document the effectiveness of remedial actions implemented at sources along the river. Results from this long-term monitoring program from 1983-2009 were reported in Richman et al., 2011. Since 2012, MECP has also been using passive samplers such as semi-permeable membrane devices (SPMDs) and polyethylene devices (PEDs) to augment the caged mussel data in support of the NRTMP (Richman 2015; Richman 2018). The intent of this report is to update the long-term trend analysis of water quality in the Niagara River in the nearshore using the 2018 caged mussel data in conjunction with the passive sampler data which have been used to estimate water concentrations. The spatial trends identified using the two monitoring tools were compared. Estimated water concentrations of contaminants using SPMD data from 2012-2015 have also been updated for this report (relative to Richman 2015; Richman 2018) to reflect changes in the Performance Reference Compound (PRCs) values used in the calculations.

The NRTMP uses biomonitoring to complement the ECCC Upstream/Downstream (U/D) water monitoring program which identifies "Priority Toxic Chemicals" at the head (Fort Erie: FE) and mouth (Niagara-on-the-Lake:

NOTL) of the river (Hill, 2018). A statistical comparison of water and suspended sediment concentrations of priority chemicals at these two locations was used to determine which chemicals were primarily originating upstream (i.e., Lake Erie and above) versus those being actively discharged from sources within the Niagara River watershed. Several organic contaminants exceeded water quality criteria (WQC) at NOTL and exceeded concentrations present at FE, e.g., hexachlorobenzene (HCB), octachlorostyrene (OCS), mirex, hexachlorobutadiene (HCBD), alpha hexachlorocyclohexane (α-HCH) and polychlorinated biphenyls (total PCBs). Exceedances of these two criteria provided evidence of 1) the presence of contaminants at concentrations of concern; and 2) Niagara River sources.

The consistency in the spatial patterns of contamination in the caged mussels and more recently the SPMDs and PEDs resulted in the identification of these site-specific sources of organochlorine pesticides (e.g., mirex, lindane), and persistent organic contaminants such as chlorinated benzenes (e.g., 1,2,3,4 tetra-, penta-chlorobenzene and HCB), hexachlorobutadiene (HCBD), OCS, PCBs and dioxins and furans.

The water quality in the river has improved through time since the inception of the NRTMP for many chemicals (e.g., chlorinated benzenes, mirex, PCBs), mainly due, to programs initiated by the Canadian and the United States governments to remediate hazardous waste sites and to control discharges from point and non-point sources (Hill, 2018; Richman and Somers, 2010; Richman et al., 2011; Williams et al., 2000; Williams et al., 2003). Additionally, for other contaminants (e.g., concentrations of dieldrin), decreases have been due to reduced inputs from areas upstream of the river.

The principle behind the biomonitoring program is to take organisms from a relatively uncontaminated site and place them in an environment that was known or suspected of being contaminated with persistent bioaccumulative substances and assess tissue contaminant concentrations after exposure. Mussels are abundant, easily collected and transported, and sedentary. They are responsive to their surrounding environment often reflecting short-term fluctuations in contaminant concentrations which may not be detected by routine water quality monitoring (Kauss and Hamdy, 1991; Metcalfe and Charlton, 1990; Muncaster et al., 1989). *Elliptio complanata* is a filter feeder, feeding on plankton and organic detritus and will accumulate contaminants directly from both the water column and particulate matter (Pennak, 1978). This makes it a good biomonitor since contaminants often partition between the dissolved and particulate phases.

SPMDs and other passive samplers efficiently sequester hydrophobic contaminants dissolved in the water and may be more reliable monitors than the caged mussels since the monitoring method is standardized among all stations (Huckins et al., 1996; Petty et al., 2000; Zhang et al., 2020). Biota don't always survive the exposure, or they may be stressed which can affect uptake and depuration leading to inaccurate measurements of ambient exposure concentrations. Additionally, there may be variability in the bioaccumulation due to their physical condition, sex or age (Lobel et al., 1991). The SPMD data were extremely informative for identifying areas where contaminants were present and were easily converted to estimate water concentrations. These values were compared with the most stringent of the relevant NYSDEC guidelines, the EPA guidelines, ECCC and/or MECP Provincial Water Quality Objectives, or with the water concentrations reported by the ECCC U/D water quality monitoring program. However, the passive samplers only reflect the concentration of chemicals in the dissolved phase and since many of the priority toxic contaminants tend to be present on suspended particles, and water quality criteria are general based on both the dissolved phase and particulate phase of contaminants, the data could underestimate the actual concentrations and environmental implications of a contaminant at a location.

We now have a comprehensive database for SPMDs throughout the river collected over 3 surveys from 2012-2018. This data can assist with the track-down of new sources prompting further investigations and, potentially, the implementation of additional remedial measures where there is evidence of on-going sources of contaminants of concern (COCs) to the Niagara River. The caged mussel data from 2018 was consistent with the earlier trends presented between 1983-2015 (Richman et al. 2011; Richman 2015; Richman 2018) and will be discussed only briefly.

METHODS

Sampling Locations

In all surveys, including the most recent in 2018, caged mussels and passive samplers were deployed at stations on the Canadian and American side of the river for 21 days of exposure. During the week of July 9th, 2018, mussels were deployed at 25 stations and SPMDs and PEDs were deployed at 32 and 14 stations respectively (Figure 1; Appendix A -Table 1;). Monitors were retrieved during the week of July 31st, 2018. Historically, caged mussels deployed on the Canadian side of the river in tributaries typically did not have detectable concentrations of organochlorine (OC) pesticides or chlorinated benzene compounds. Accordingly, in 2018 caged mussels and/or passive samplers were deployed only at the head of the river in FE and at the mouth in NOTL.

On the US side, stations included those with long-term monitoring datasets such as industrial outfalls (e.g., OCC 003: the Occidental Chemical Corp. [Buffalo Ave facility] sewer 003), tributaries to the Niagara River (Gill Creek, Two Mile Creek, Cayuga Creek), and sites associated with historical Hazardous Waste sites (e.g., Pettit Flume [Occidental Durez site], Bloody Run Creek [Hyde Park site],102nd St. Hazardous Waste Site and the Little Niagara River (LNR), and Gratwick Riverside Park [GRP]).

Mussels, SPMDs and PEDs were analysed for organochlorine pesticides, PCBs, and chlorinated benzenes, and for mussels, percent lipid. Caged mussels from selected sites were also analysed for polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans (PCDD/F). Sediment has historically been collected from selected stations and analysed for PCBs, organochlorinated pesticides and PCDD/F (Richman et al., 2011; Richman 2015; Richman 2018).

Figure 1: Niagara River 2012-2018 caged mussel and passive ampler deployment locations associated with sampling sites. Individual sampling sites are not provided.

Field Sampling

Mussels

A detailed description of the mussel deployments was provided in Richman et al. 2011; Richman 2015; Richman 2018. Briefly, mussels of approximately the same size (6.5 to 7.2 cm) were collected by divers from Balsam Lake, a relatively uncontaminated lake located in Victoria County, Ontario. Three to five, randomly selected mussels per collection, were submitted for analysis to determine initial tissue contaminant concentrations. These mussels were referred to as the Balsam Lake control mussels. Additionally, 5 mussels were used as travel blanks for the week of mussel deployment and were kept in site water in buckets alongside all sample mussels until the end of the survey. At each station, at least five mussels (or more dependent on the yearly study objectives) were placed in cages which were anchored to the river bottom using a cement block, pegs or rocks. Cages were usually located within two to three meters from shore since the study was designed to investigate the impact of shore-based sources on water quality rather than ambient river conditions. Mussels were consistently deployed in July and retrieved in August.

Upon retrieval, mussels were immediately shucked, excess water drained, and the soft tissues weighed, individually wrapped in hexane-rinsed aluminum foil, placed in plastic bags and frozen until analysed (Appendix A-Table 2). Typically, three individual mussels from each station were analysed for the parameters listed above. All mussel data were reported as ng/g wet weight (wt.), except for congener specific PCBs which were analysed on composites of 6-12 freeze dried mussels and reported as both ng/g dry weight and wet weight (dry wt. data were converted to wet wt. using the percent water content of the mussels: Appendix A-Table 2).

SPMDs

SPMDs were obtained from Environmental Sampling Technologies (EST) (St. Joseph, Missouri, USA), the manufacturer of the SPMD equipment, media preparation and dialysis services. Analysis of the SPMDs for contaminants of interest was performed by SGS AXYS Analytical Services Ltd. in Sidney, British Columbia, Canada. SPMDs were deployed concurrent with the caged mussels. Additionally, SPMDs were deployed in Balsam Lake for three weeks to compare uptake with the Balsam Lake control mussels.

Briefly, 91.4 cm x 2.5 cm low density polyethylene lay-flat tubing was filled with 1 mL of high purity triolein then heat-sealed and stored frozen in aluminum canisters for transportation to the Niagara River. EST also spiked the SPMDs with Performance Reference Compounds (PRC). These compounds were used to measure rates of loss, which allow adjustment of the SPMD data to reflect field sampling conditions. According to the protocol each SPMD was to be spiked with 60 ng/SPMD of PCB 14, PCB 29 and PCB 50. However, a review of the data for an SPMD identified as “time zero” and the field blanks exposed only to air showed that initial spiking with PRCs was far less than the required 60 ng: the mean concentration for the field blanks and time zero SPMD were 32 ng for PCB 14, 26 ng for PCB 29 and 18 ng for PCB 50.

At each site in 2012 and 2015 three SPMDs were placed on a “spider carrier” within a galvanized metal shroud and deployed by placing them in the current on the sediment using site rocks or steel pegs to hold them in place. In 2018 only one or two SPMDs were deployed at stations since the 2012 and 2015 data showed low variability among replicate samples (i.e., 90% of samples had a coefficient of variation < 20%) (Richman 2015, 2018). In 2018, the coefficient of variation was <20% in 86% of the samples for stations with replicate SPMDs. Three or four field blanks were opened and exposed to the air for the duration of the deployment and retrieval to assess the impact of atmospheric contamination on the SPMDs. Two sites were on the US side and one or two sites were on the Canadian side depending on the sampling year. Contaminant concentrations were low or below the detection limits in the field blanks so data from deployed SPMDs were not blank subtracted. The PRC PCBs (14, 29 and 50) remaining in the SPMDs following retrieval were subtracted from the total PCB data and for the description of homologue patterns.

SPMDs were retrieved simultaneously with the caged mussels, placed in metal containers, and stored on ice until return to the laboratory where they were stored frozen until analysis by SGS AXYS Analytical. All SPMD data were reported ng/SPMD.

PEDs

Low density polyethylene sheeting (PolyTarp) 5 cm x 60 cm in size with a thickness of approximately 1 mm was obtained from a local hardware centre. All equipment used for preparation of the PEDs were triple rinsed in hexane. PEDs (n=2) were deployed concurrent with the SPMDs and caged mussels in precleaned hexane rinsed tube shrouds.

The PEDs were prepared in the MECP laboratory following the methodology described in Zhang et al. 2020. Briefly, they are placed in beakers (40 PEDs per beaker) and soaked in acetone for a few hours or overnight, followed by hexane overnight (2 times), then acetone (about 2 hours) then a methanol rinse (1-2 hours). PEDs were wiped with clean kimwipes to remove excess solvent before placing into spike diffusion jars.

PRCs were loaded into PEDs to aid estimation of uptake rates and extent of equilibrium (Booij et al., 2002). Individual standards (PRCs; non-Aroclor PCBs not found in the environment; PCB-30, 62, 127, 166,197; UltraScientific, Inc.) were measured by syringe into GC vials (1 per 1.2 L mixing jar), mixed with acetone, and transferred by pipette to the mixing jars containing 800 mL Methanol and 200 mL HPLC water (mixed). PEDs (20 per jar) were then placed in the mixing jars and equilibrated by being placed on a roller for a minimum of 2 weeks shielded from light. They were checked daily to ensure strips were turning in the jars to ensure even diffusion. If strips were not sufficiently turning the jars were mixed 2 times per day. The amounts to spike were determined as per Booij et al., (2002) but generally ranged from 300 to 700 ng per flask for PCBs.

After equilibrating, PEDs were wiped with clean kimwipes to remove residual solvent and water and placed into clean labeled glass jars and stored at -20°C until deployment. Additionally, 2 PEDs from each spiked jar were kept in marked 40 mL Pro-Clean vials as spiking benchmarks for later analysis with field deployed samplers and field blanks. Two or three field blanks were opened and exposed to the air for the duration of the deployment and retrieval to assess the impact of atmospheric contamination on the PEDs. Concentrations were below the detection limits in all cases.

Sediment

The surface sediment, (1-3 cm dependent on bottom type and sampling method), was collected with a stainless-steel spoon or a Mini-Ponar. A Mini Ponar was the preferred sampling method when possible, however, at most stations the bottom was not suitable for ponar use.

All sampling equipment, mixing trays (Pyrex) and utensils (stainless steel) were washed with site water and rinsed with hexane prior to sample processing. The samples collected at each station were homogenized, divided into the appropriate sample containers and kept on ice in the field (at 4°C in the dark) until delivery to the MECP laboratory. Samples were delivered to the laboratory no more than 1 week following collection. The general sample composition (e.g., sand, silt etc.), sediment colour, any unusual features and the number of grabs required for the composite were recorded in field notes.

Samples were submitted to the MECP Laboratory Services Branch (Rexdale laboratory) and analysed, dependent on the sampling location, for PCDD/F, PCBs, OC pesticides or chlorinated industrial compounds (e.g., chlorobenzenes). All sediment samples were analysed for particle size and total organic carbon (TOC) to aid in interpretation of results.

Water Quality Measurements

Water temperature, dissolved oxygen (DO) and conductivity were measured *in situ* during deployment and retrieval of mussels at all stations using a YSI sonde; results for the 2018 survey are shown in Appendix A-Table 3.

Analytical Methods

Details on the analysis of the caged mussels were provided in Richman et al. 2011; Richman 2015 and Richman 2018. Briefly, the mussel samples were analyzed for total-PCB and OC pesticides using the OMOE method E3136 (OMOE, 2008a; summarized in Richman and Somers, 2010). PCB congeners were analysed in biota using OMOE method E3411 and E3485 (OMOE, 2008b; MECP, 2020). The seventeen 2,3,7,8-substituted toxic PCDD/Fs and dioxin/furan homologue totals were analysed in mussels and sediment using the OMOE method DFPCB-E3418 (OMOE, 2008c; Richman and Somers, 2005). Particle size and TOC in sediment were analyzed by OMOE methods E3328A and E3142A, respectively (OMOE, 2008d-e; described in Richman and Milani, 2010).

For a subset of mussel samples, analytical surrogates were not added to the samples and so surrogate recovery data was not available. All the spike recoveries associated with the requested tests passed the method criteria, so it was expected that the samples behaved the same way in most of the cases. The results could potentially be biased low if any losses occurred during the sample prep steps. At some stations, mussel samples were archived and so these samples were also analysed using appropriate surrogates for comparison and are identified in the data tables.

SPMDs were analysed for PCBs congeners, OC pesticides, chlorinated benzenes and dioxins and furans by AXYS with a combined gas chromatography/low resolution mass spectrometry (GC/LRMS) analysis (based on EPA Method 8270 OC/D, EPA Method 625, EPA Method 1613B respectively). Prior to the analysis, all parameters were co-extracted (AXYS in house method MLA-013 [fractionation only]). Detailed descriptions of analytical methods can be provided upon request. All SPMD data are reported as ng/SPMD (equivalent to ng/mL triolein) unless otherwise noted.

PEDs were analysed by the MECP laboratory for PCBs congeners in 2012, 2015 and 2018 using method PCBC3488. In 2018, chlorobenzenes and

OC pesticides were also analysed in addition to PCBs by MECP at the Rexdale laboratory using methods CB3488 and OC3488, respectively (MECP 2020).

Data Analysis

Caged mussel data were compared with the SPMD and PED data to assess if trends and spatial patterns in the presence and absence of contaminants were consistent among the three deployed monitors and the legacy of contaminants associated with historical sources.

SPMD data, reported as ng/SPMD were used to estimate mean water concentrations (ng/L) using the United States Geological Survey (USGS) SPMD Water Concentration Estimator (Passive Sampling Using SPMDs and POCIS | U.S. Geological Survey (usgs.gov) . These values were compared with the most stringent of the relevant water quality guidelines from either the New York State Department of Environmental Conservation (NYSDEC) (Water Quality Standards and Classifications - NYS Dept. of Environmental Conservation, the US Environmental Protection Agency (EPA) (National Recommended Water Quality Criteria - Human Health Criteria Table | US EPA), Canadian Water Quality Guidelines (Canadian Council of Ministers of the Environment | Le Conseil canadien des ministres de l'environment (ccme.ca) and/or Ontario's Provincial Water Quality Objectives (MOEE, 1994). This approach is consistent with that used by the NRTMP in evaluating results of ECCC's Upstream/Downstream water quality monitoring in the Niagara River.

RESULTS AND DISCUSSION

Quality Assurance/Quality Control (QA/QC)

Balsam Lake Control and Travel Blanks: Caged Mussels, SPMDs and PEDs

Consistent with previous publications, mussels collected from Balsam Lake in 2018 (including the travel blanks), did not have detectable concentrations of organochlorine pesticides or chlorinated benzenes (Appendix A-Table 4), and only trace concentrations of some PCB congeners were detected (total PCBs range 3.5 to 4.1 ng/g wet wt.) (Appendix A-Table 5). Based on historical data and homologue patterns, the likely source of PCBs was atmospheric deposition to Balsam Lake (Curry, 1977/78; Kauss et al., 1981; Kauss and Hamdy, 1985; Richman et al., 2011).

Results for SPMDs deployed in Balsam Lake in 2018 were consistent with the caged mussels with relatively low concentrations of DDT metabolites and HCB (<2 ng/SPMD; estimated water concentration 0.005 ng/L) (Appendix A - Table 6 and 10) and PCBs (Total PCBs: 9 ng/SPMD; 0.09 ng/L; Appendix A-Table 7 and 10) compared to sites along the Niagara River. Similar to 2012 and

2015, the SPMDs also accumulated contaminants not previously detected in the mussels from Balsam Lake: low concentrations (< 1 ng/SPMD) of alpha-chlordane, gamma chlordane and trans-nonachlor (a component of the pesticide chlordane), and dieldrin (mean 2.0 ng/SPMD). Other contaminants inconsistently detected in Balsam Lake among the surveys at low concentrations in the SPMDs included: heptachlor epoxide (< 1 ng/SPMD), 2,3,6-trichlorotoluene (<2 ng/SPMD), and hexachlorobutadiene (< 0.5 ng/SPMD).

With few exceptions, the travel blanks (and laboratory blanks: Appendix B-SPMD data) did not have detectable concentrations of compounds analysed, providing confidence that the SPMDs and PEDs deployed at sites along the Niagara River were providing information on site-specific contaminant concentrations. In 2018 SPMD travel blanks were exposed to air at the Occidental Chemical Corp. Sewer 003 (OCC sewer 003) in the upper river, and Bloody Run Creek (BRC) in the lower river, both on the US side, and at Fort Erie on the Canadian side. Total PCB concentrations ranged between 2-4 ng/SPMD. All three travel blanks had non-detectable concentrations of most compounds, (Appendix A-Table 6 and 7), accordingly, data for sample sites were not blank subtracted.

PEDs were deployed in Balsam Lake in 2012 and 2015 and were only analysed for PCBs. Blank PEDs were exposed to air in 2012 at NOTL, OCC sewer 003 and GRP and in 2015 at OCC sewer 003 and the Pettit Flume. In all cases total PCBs were below the method detection limit (MDL) (< 10 ng/PED). In 2018, there were PED blanks at OCC sewer 003 and FE and samples were analysed for PCBs and OC pesticides and chlorinated industrial compounds. All parameters were below the MDL (Appendix A-Table 8 and 9).

The Niagara River: Source Identification and Trends Through Time

It is the overall consistency of the dataset over time (1983-2018), spatially, and among multiple water quality monitoring tools (i.e., mussels or passive samplers), that provides confidence in the identification of contaminant sources.

Caged Mussels

Based on the caged mussel data from earlier surveys and from 2012-2018, significant sources of contaminants were not identified on the Canadian side of the river. Low concentrations of the metabolites of DDT were present at FE in 2018 (p,p'-DDE ranged from ND - 6 ng/g wet wt.). In 2018 there was a DDT track-down study using SPMDs because of the variable concentrations of DDT metabolites detected in mussels at this site through time. This data is discussed later in the report.

PCBs were reported at low concentrations in mussels at FE (2018: 1.2-6.5 ng/g wet wt.) and NOTL (2018: 5.5-8.0 ng/g wet wt. (52 congeners) (Appendix A-Table 5). These concentrations were lower than those measured in mussels deployed at many stations on the US side of the river (Figure 2).

Concentrations of PCBs at FE and NOTL in 2018 were similar to 2012, while in 2015 they were below detection at both stations.

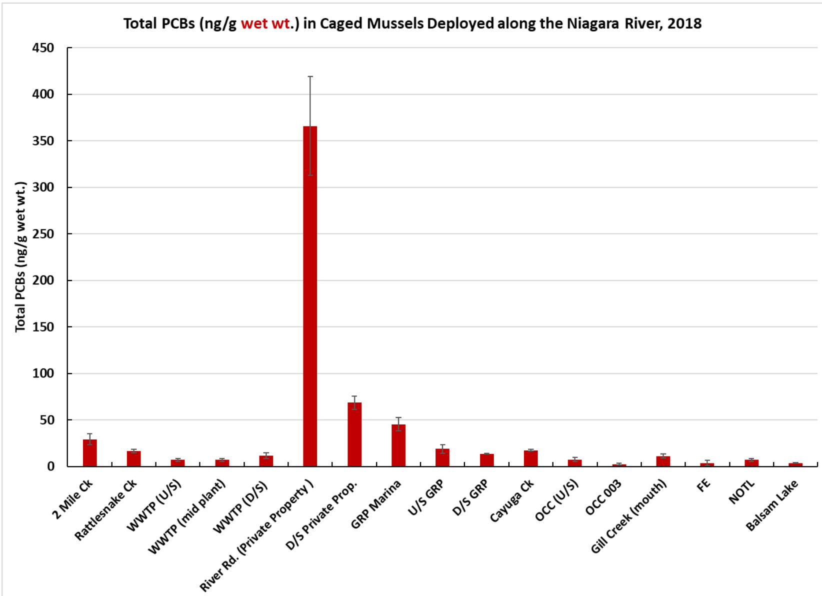


Figure 2: Mean (+/-SD) Total PCB concentrations (ng/g wet wt.) in caged mussels deployed in the Niagara River, 2018. WWTP (North Tonawanda Waste Water Treatment Plant); GRP (Gratwick Riverside Park); OCC (Occidental Chem Co.)

The caged mussel data from sites on the American side of the river from 2018 were similar to earlier surveys. At locations that were remediated, COCs remained low relative to pre-remediation concentrations (e.g., PCBs at Gill Creek) (Figure 3). For sites that were not remediated, COCs were consistent through time, and the sites remain a source of bioavailable contaminants to the river (e.g., PCBs at Two Mile Creek; chlorinated benzenes and PCDD/F at Bloody Run Creek: Figures 4-5). The long-term caged mussel data show a downward trend in 2015 and 2018 compared with earlier surveys from the 1990's for chlorinated industrial compounds at OCC sewer 003 (Figure 6) and for PCBs.

Mussels deployed at the Pettit Flume cove (a site that has been monitored since 1985), did not survive in 2018. Upon retrieval, cages were covered in black slime-like organic matter and the cove had a distinct odour of sewage and rotting organic matter. This may have contributed to mussel death. Conductivity and temperature readings were not unusual, but the YSI probe would not provide a proper dissolved oxygen measurement despite recalibration on-site (Appendix A-Table 3). Contaminants detected in the SPMDs (discussed below) were consistent with contaminants routinely measured in the caged mussels from this site.

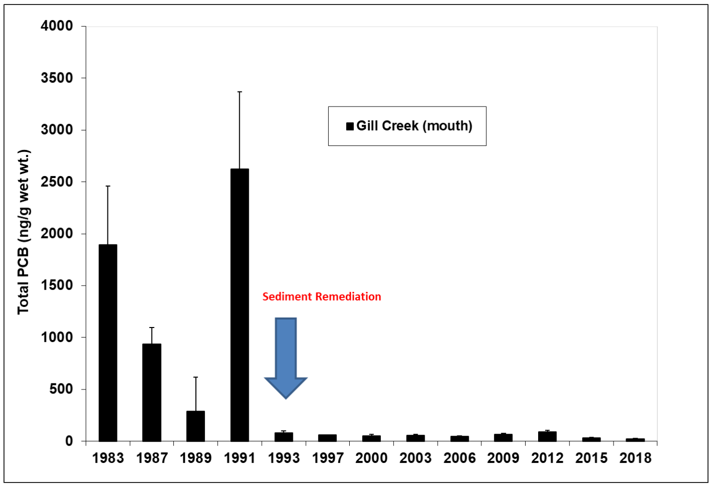


Figure 3: Mean (+/- SD) total PCB concentrations (Aroclor analytical method) (ng/g wet wt.) in caged mussels deployed at the mouth of Gill Creek through time (1983-2018).

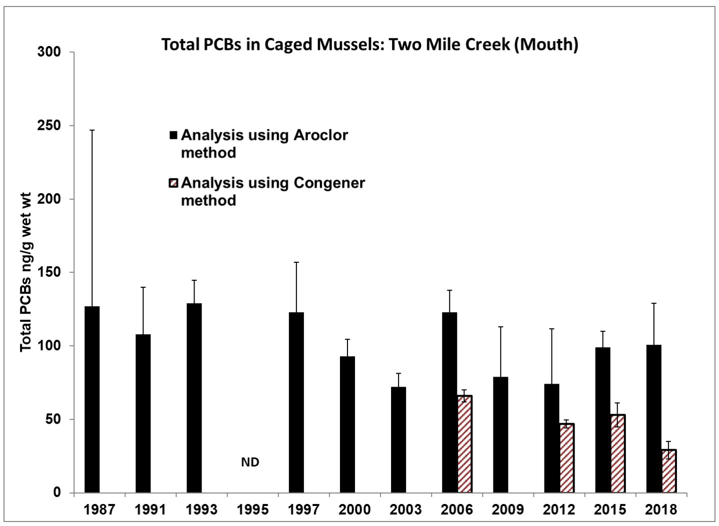


Figure 4: Mean (+/- SD) Total PCB concentrations (Aroclor analytical method) (ng/g wet wt.) in caged mussels deployed at the mouth of Two Mile Creek (1987-2018) and congener specific method (2006-2018).

a)

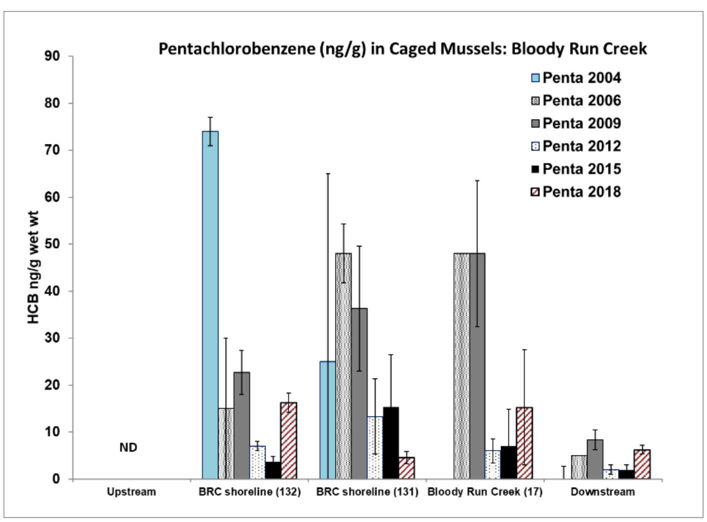
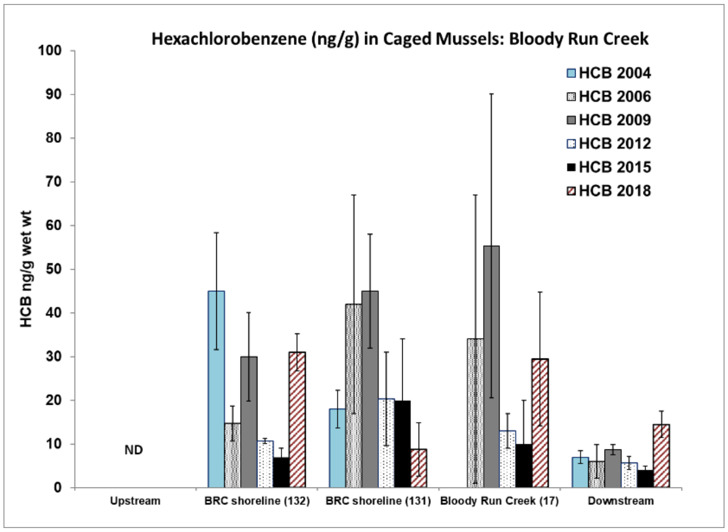


Figure 5: a) Mean (+/- SD) concentrations of a) pentachlorobenzene; b) hexachlorobenzene, at various stations along the Niagara River shoreline at the mouth of Bloody Run Creek 2004-2018 (ND: non detect); cages at the upstream location for 2012 and 2018 were not retrieved.

b)



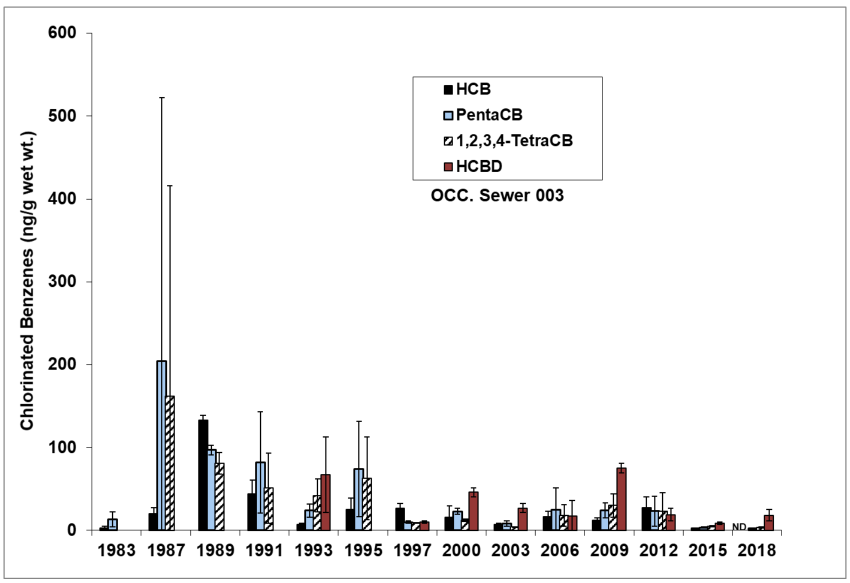


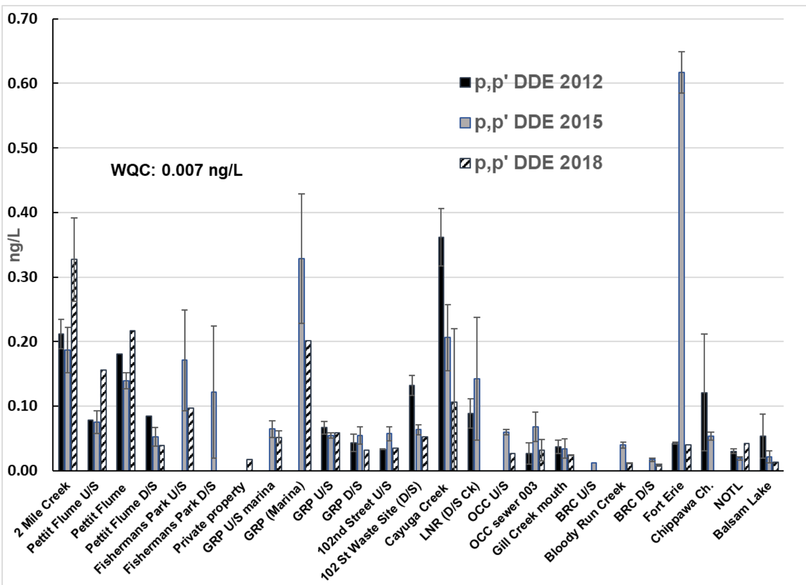
Figure 6: Mean (+/- SD) concentrations of chlorinated organic compounds in caged mussels deployed at the Occidental Chemical Company sewer 003, through time (1987-2018).

SPMDs and PEDs

Organochlorinated Pesticides

The ECCC U/D water monitoring data showed higher concentrations of industrial organic contaminants like di- tri-, tetra-, penta, and hexa-chlorinated benzene at NOTL compared with FE indicating the presence of sources of these compounds within the river, which is also the case for PCBs, DDT, mirex and OCS (Hill, 2018). The SPMD and PED databases from 2012-2018 augments the caged mussel data by both confirming contaminant sources previously identified by the caged mussels, and by providing information for contaminants not previously measured in the caged mussels due to analytical detection limits. This was particularly true for the organochlorinated pesticides. While metabolites of DDT (specifically DDE) were usually present at trace concentrations in caged mussels at several stations, the SPMDs detected both DDE and DDD at all sites surveyed (Figure 7), as well as dieldrin, and metabolites of chlordane which were typically below the detection limit in the mussels (Figures 8-9). The 2018 PED data was consistent with the SPMDs for some of the stations, however, with the exception of p,p'-DDE, the SPMDs had a greater ability to detect the presence of these OC pesticides than the PEDs (Appendix A -Table 8; Appendix C).

a)



b)

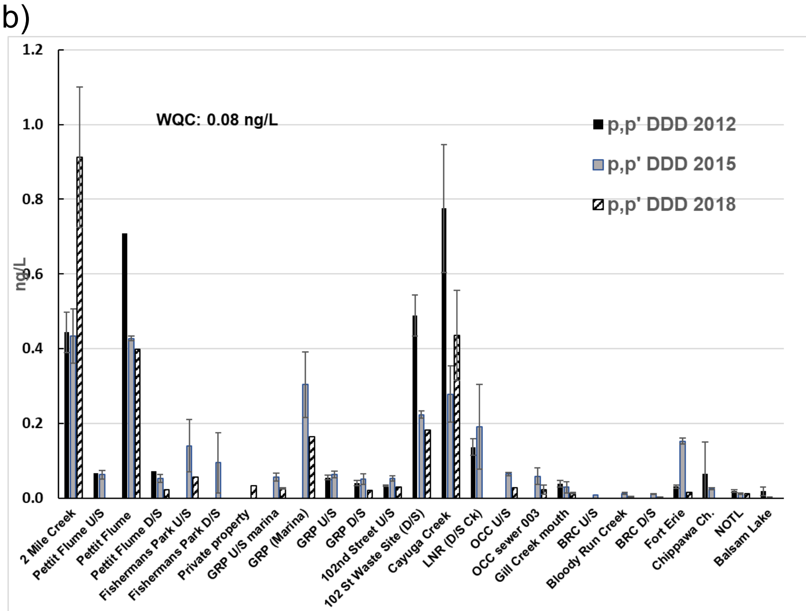


Figure 7: Mean (+/-SD) water concentrations of DDT metabolites (a) DDE and b) DDD from SPMDs deployed in the Niagara River, 2012-2018. GRP (Gratwick Riverside Park); Chippawa Channel and LNR (Little Niagara River): sampled 2012, 2015); BRC (Bloody Run Creek: sampled in 2015, 2018); Private property sampled 2018.

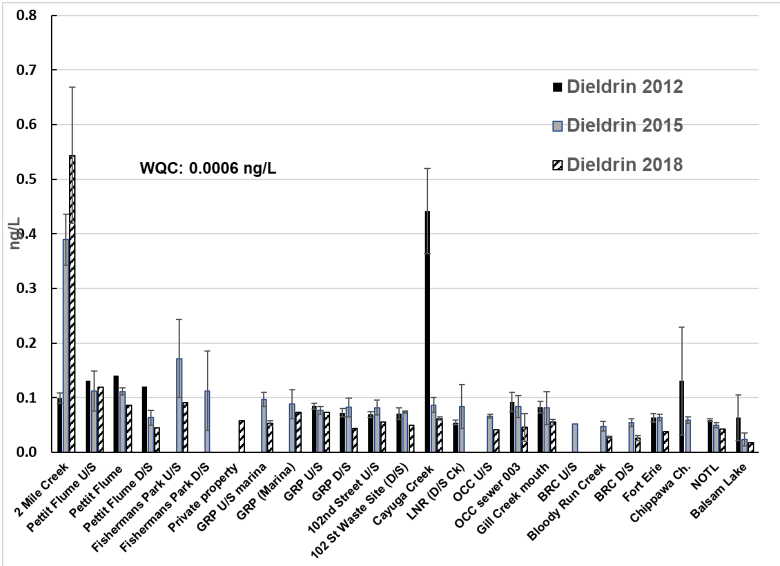


Figure 8: Mean (+/-SD) water concentrations of dieldrin from SPMDs deployed in the Niagara River, 2012-2018. GRP (Gratwick Riverside Park); Chippawa Channel and LNR (Little Niagara River): sampled 2012, 2015); BRC (Bloody Run Creek: sampled in 2015, 2018); Private property sampled 2018.

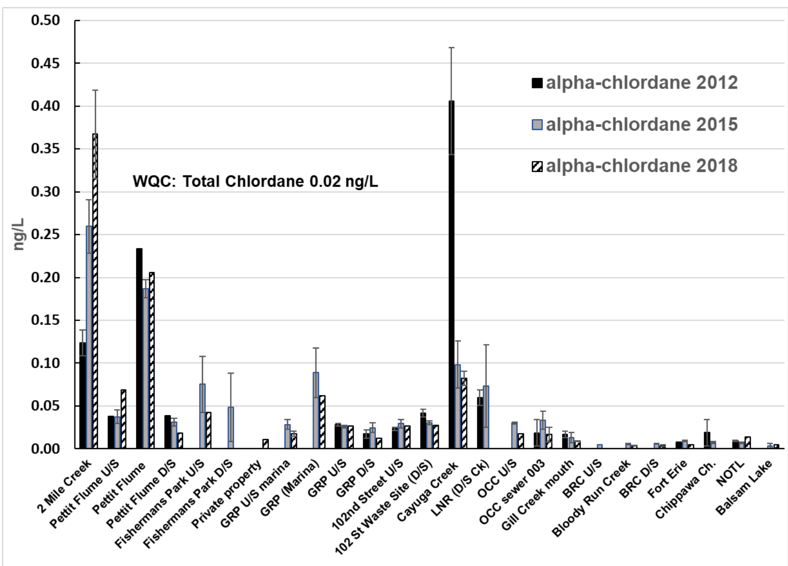


Figure 9: Mean (+/-SD) water concentrations of α-chlordane from SPMDs deployed in the Niagara River, 2012-2018. GRP (Gratwick Riverside Park); Chippawa Channel and LNR (Little Niagara River): sampled 2012, 2015); BRC (Bloody Run Creek: sampled in 2015, 2018); Private property sampled 2018.

Source identification and spatial patterns for individual contaminants were consistent among the three SPMD surveys. Downward trends through time were apparent at some stations (e.g., p,p'-DDE and/or p,p'-DDD, dieldrin and α-chlordane at the Pettit Flume cove, Gratwick Riverside Park (GRP: downstream station), 102nd St waste site, Cayuga Creek and Gill Creek), while increasing concentrations of DDT metabolites, dieldrin and α-chlordane were present at Two Mile Creek from 2012 to 2018. Other stations showed no temporal patterns (e.g., GRP: upstream station and 102nd St waste site: upstream station). The ratio of total DDT (o,p'-DDT and p,p'-DDT) to DDD+DDE was <1 at all stations indicating long-term biotransformation of the parent product DDT to its metabolites on both the Canadian and US side of the river which suggested widespread historical use of DDT within the Niagara River watershed (Wang et al. 2009; Yang 2014). Nevertheless, estimated water concentrations in SPMDs for p,p'-DDE and p,p'-

DDE were greater than the NYDEC WQC (0.007 ng/L and 0.08 ng/L respectively) at almost every station. For p,p'-DDE concentrations at most sites on the US side of the upper Niagara River and at NOTL were 2 to 5 times greater than concentrations measured at Balsam Lake (Appendix A-Table 10).

SPMD concentrations of dieldrin were similar on both sides of the river with concentrations in 2018 lower than in previous surveys, except for Two Mile Creek where concentrations were higher overall. Although SPMD estimated water concentrations of dieldrin exceeded the WQC (0.0006 ng/L) at all stations, concentrations at Two Mile Creek were greater than 900 times the NYSDEC WQC.

Cayuga Creek and Gill Creek were identified as sources of α-HCH, β-HCH, and δ-HCH (isomers of γ-HCH, the insecticide Lindane), and had elevated concentrations compared to other locations (Figure 10; Appendix A-Table 6). The presence of higher concentrations of the isomers compared with lindane suggested historical use of the pesticide in these tributaries rather than current use (Li and MacDonald 2005; Wu et al. 1997). Estimated water concentrations of α-HCH were greater than the NYSDEC WQC (2 ng/L) at Cayuga Creek and Gill Creek (Table 10). The SPMD data is consistent with the long-term mussel data since these isomers have been measured at trace concentrations in caged mussels almost exclusively at Cayuga and Gill Creek since the late 1980's to 2012 (Richman et al 2011). Concentrations of all three of these isomers in mussels deployed at Gill Creek were below the detection limit in 2015 and 2018 but the SPMDs indicated these isomers were present in both creeks. Concentrations in 2018 were lower than in 2015, however the lowest concentrations were present in 2012. Cayuga Creek was the only location that had detectable concentrations of these isomers in the PEDs in 2018.

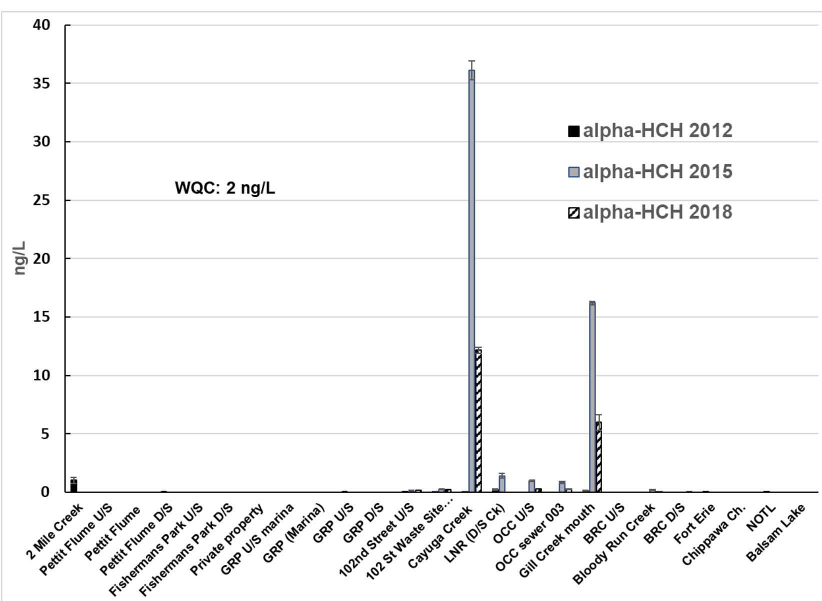


Figure 10: Mean (+/-SD) estimated water concentrations of α-HCH from SPMDs deployed in the Niagara River, 2012-2018.

Occidental sewer 003 and hazardous waste sites associated with OCC (i.e., 102nd St., Cayuga Creek (Love Canal) and Bloody Run Creek (Hyde Park waste site: Figure 1) were identified as sources of mirex to the Niagara River in surveys from 2012-2018, although the SPMD data demonstrated inconsistent trends through time (Figure 11). OCC sewer 003 was the only site where mirex was detected in the PEDs (Appendix A-Table 8). This presence of mirex at these sites was not surprising since OCC was the sole producer of mirex until its use was restricted in 1976 by both Canadian and U.S. legislation (Apeti and Lauenstein 2006; Interagency Task Force on Hazardous Waste, 1979). Caged mussels have had trace concentrations of mirex at these locations and other sites and sewers associated with the OCC Buffalo Avenue facility since 1985, when monitoring first began in this area (Richman et al., 2011). Based on the SPMD deployments, estimated water concentrations exceeded the mirex NYSDEC WQC (0.001 ng/L) at OCC sewer 003 by over three-orders-of magnitude in 2015, however concentrations were lower in 2018 (Appendix A:Table 10). Mirex was also detected at BRC in 2018.

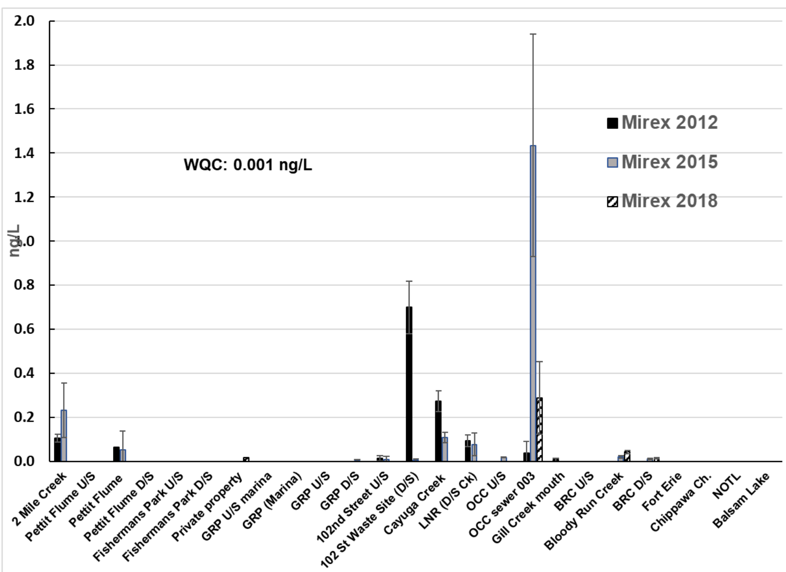


Figure 11: Mean (+/- SD) water concentrations of mirex from SPMDs deployed in the Niagara River, 2012-2018. GRP (Gratwick Riverside Park); Chippawa Channel and LNR (Little Niagara River): sampled 2012, 2015); BRC (Bloody Run Creek: sampled in 2015, 2018); Private property sampled 2018.

Industrial Compounds and Chlorinated Benzenes

Estimated water concentrations from 2012-2018 were less than the most stringent WQC for most chlorinated benzenes and HCBD at most locations, however, concentrations were greater on the US side than the Canadian side of the river and compared with NOTL and Balsam Lake (Appendix A-Table 10). Octachlorostyrene exceeded WQC at about half of the stations with the highest concentrations associated with OCC sewer 003. HCB exceeded the NYSDEC WQC (0.03 ng/L) at all stations on the US side of the river in 2018 from 2 to 122 times the criteria.

The highest concentrations of chlorinated benzenes in SPMDs were present at OCC sewer 003, the Pettit Flume Cove, and Bloody Run Creek

(Figure 12; Figure 13). The Pettit Flume is a storm sewer on the US side of the river that received wastewater from the Occidental Chemical Corporation's Durez Division plant and hazardous waste site (Geologic Testing Consultants Ltd., 1984). The storm sewer discharges from the shore into a cove of the Niagara River. Historically the COCs were inorganic and organic wastes including chlorinated phenols, chlorotoluene, dioxins and furans and phenol tar containing chlorinated benzenes to name just a few (Interagency Task Force on Hazardous Waste, 1979; US EPA and NYSDEC, 2004). The site was remediated from 1990 to 1995 and included on-site containment of contaminants, removal of contaminated sediment from sewer lines, and sediment removal from the cove. Following remediation, chlorinated benzenes in the caged mussels decreased and have remained low since 1995 (Richman 2018), however, the mussels, SPMDs (Appendix A-Table 6) and PEDs (Appendix A-Table 8; Figures - Appendix C) from this area continued to have elevated concentrations of these compounds relative to other sites on the river. Camera inspections (authorized by Occidental) of the sewer line in 2008 and 2009 identified sediment deposits throughout the sewer. Chemical analysis of the sediment detected contaminants associated with the waste deposited in the cove. A decision to manually vacuum the sediment deposits and line portions of the sewer with resin coated liner tubes to prevent further infiltration of contaminated water and sediment was announced by NYSDEC in October 2013 (NYSDEC Fact Sheet 2013) with work completed by 2014. The ongoing elevated levels of COCs in media sampled from Pettit Flume are likely due to residual contamination in the sediment and sewer system. Surface sediment (top 2 cm) collected in 2018 from the cove at the mouth of the culvert had high concentrations of 1,2,3,4 tetrachlorobenzene (3200 ng/g), pentachlorobenzene (7600 ng/g) and hexachlorobenzene (4800 ng/g) with concentrations decreasing within the cove to 54 ng/g, 75 ng/g and 110 ng/g respectively (Appendix A-Table 11). There are no Sediment Quality Guidelines (SQG) for tetra- or pentachlorobenzene, but the Ontario SQG Severe Effect Level for HCB (4080 ng/g) was exceeded based on a site-specific derivation using measured TOC in the sediment.

Bloody Run Creek runs adjacent to the Hyde Park hazardous waste site and drains storm water run-off and overburden leachate overflow from the site, eventually discharging it into the lower Niagara River (Figure 1). Approximately 55,000 tons of halogenated wastes including chlorinated benzenes, toluenes and phenols were buried at this site (Interagency Task Force on Hazardous Waste, 1979). Despite the remediation at the Hyde Park site and the upper section of the Creek throughout the early 1990's, the lower section continues to be a source of contaminants to the Niagara River. Long-term data for caged mussels, passive samplers and/or sediment for locations sampled along the shoreline of the Niagara River at the mouth of BRC identified this area as a source of tetra, penta and hexachlorobenzene (Figure 5 and Figure 12).

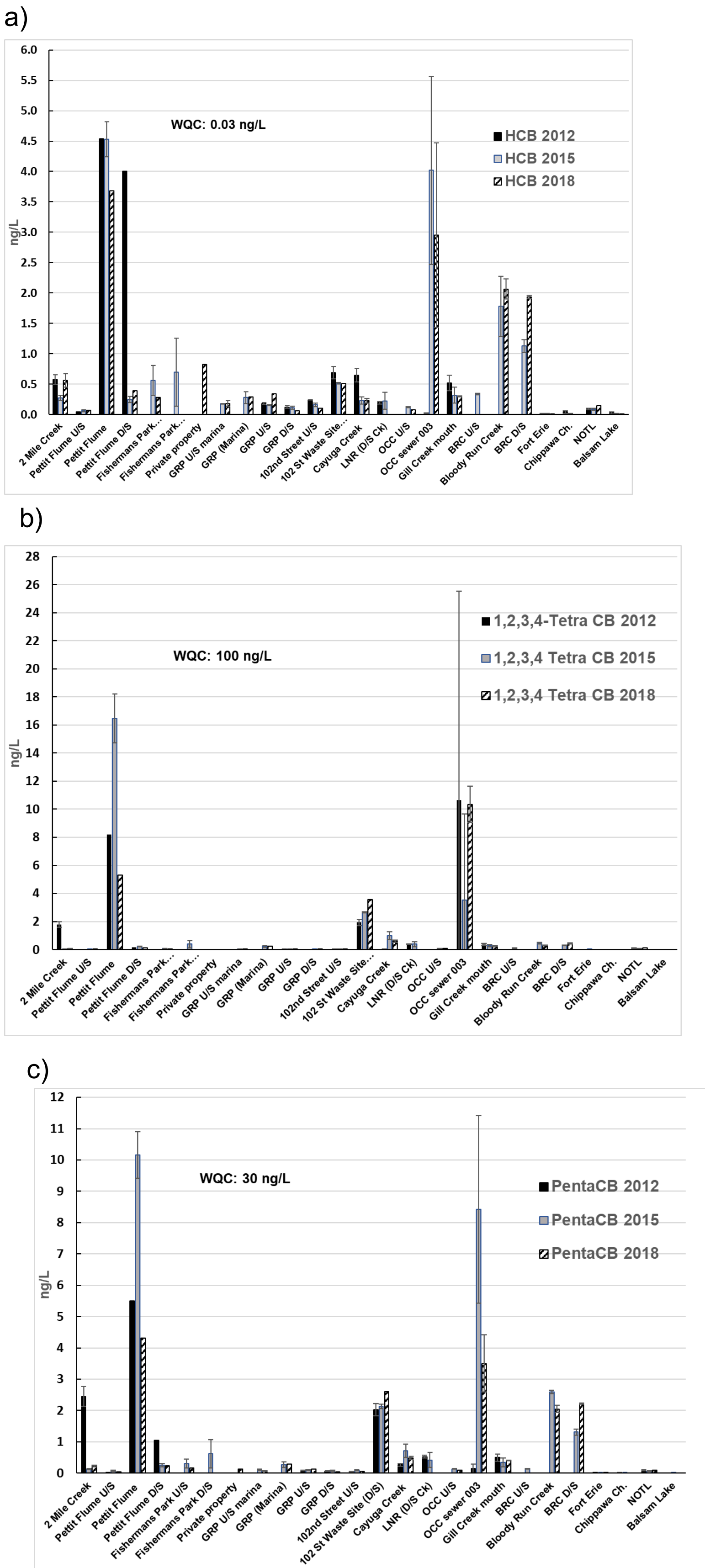
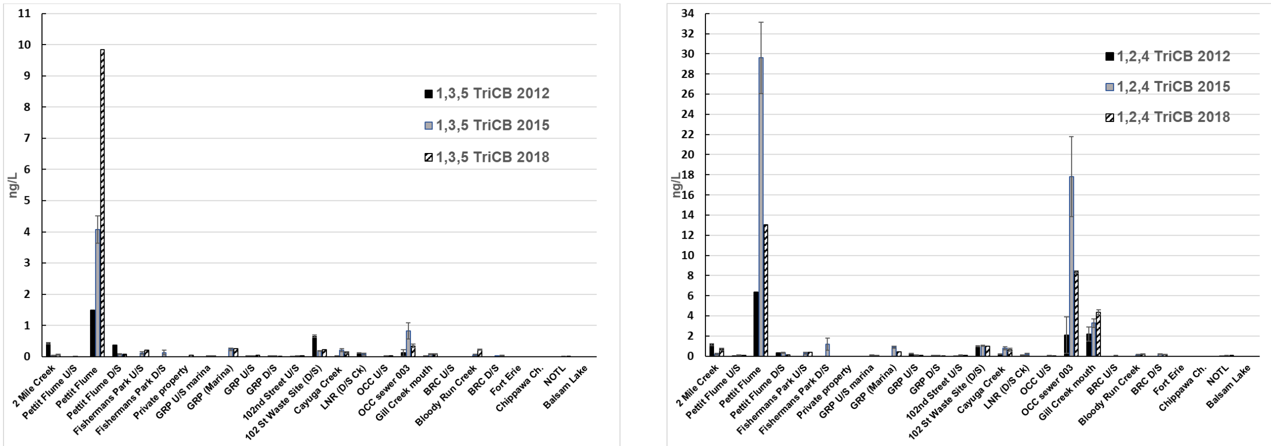


Figure 12: Mean (+/- standard deviation) water concentrations a) hexachlorobenzene b) 1,2,3,4-tetrachlorobenzene and c) pentachlorobenzene from SPMDs deployed in the Niagara River, 2012-2018. GRP (Gratwick Riverside Park); Chippawa Channel and LNR (Little Niagara River): sampled 2012, 2015); BRC (Bloody Run Creek: sampled in 2015, 2018); Private property sampled 2018.

a)



b)

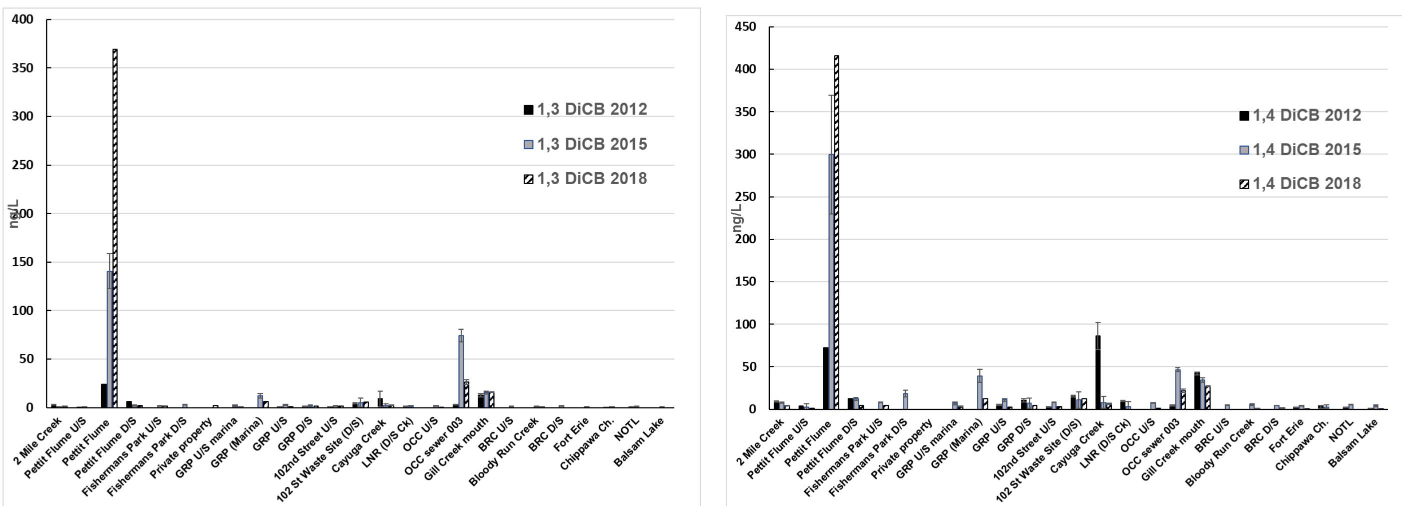


Figure 13: Mean (+/- SD) water concentrations a) 1,2,4 and 1,3,5-trichlorobenzene b) 1,3 and 1,4-dichlorobenzene from SPMDs deployed in the Niagara River, 2012-2018. GRP (Gratwick Riverside Park); Chippawa Channel and LNR (Little Niagara River): sampled 2012, 2015); BRC (Bloody Run Creek: sampled in 2015, 2018); Private property sampled 2018.

The 102nd St Hazardous Waste Site was also identified as having elevated levels of chlorinated benzenes, likely due to residuals present in the sediment following the remediation of the site and removal of highly contaminated sediment in 1999 since this waste site was known to contain chlorinated benzenes (US EPA/NYSDEC, 2004). PEDs were not deployed at Bloody Run Creek but the highest concentrations of these contaminants were also present at the Pettit Flume, OCC sewer 003 and 102nd St. (Figures - Appendix C).

Sources of hexachlorobutadiene (HCBD) were identified consistently in mussels, SPMDs and PEDs at OCC sewer 003 and Gill Creek, and depending on the survey year, estimated water concentrations were greater than the WQC (10 ng/L). Additionally, all three monitors identified OCC sewer 003 as a source of 2,3,6- and 2,4,5-trichlorotoluene (Figure 14 a-c; Figures - Appendix C).

Overall, there were no consistent temporal patterns in contamination among the stations between 2012-2018 for these organic compounds with the following exception: concentrations of most compounds appear to be decreasing at the mouth of Gill Creek except for tri-chlorobenzene; and the lowest concentrations of HCB, tetra-chlorobenzene and pentachlorobenzene at the Pettit Flume were present in 2018 while the opposite occurred for di and trichlorobenzene.

a)

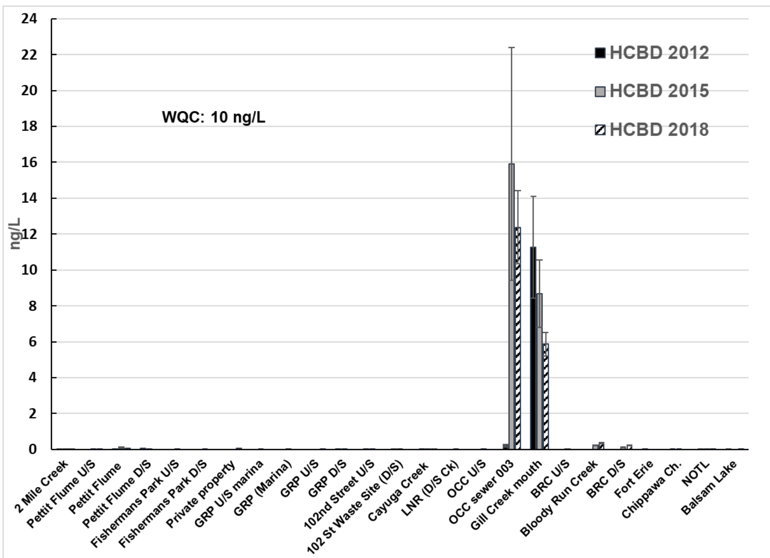
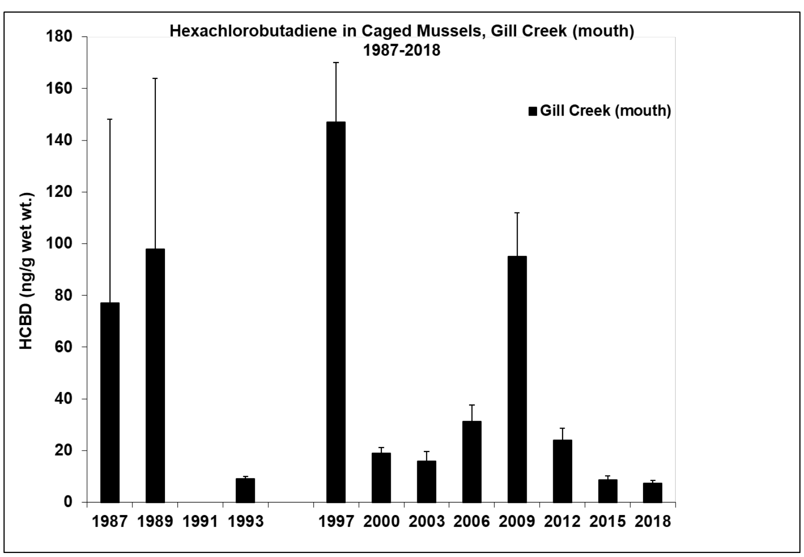
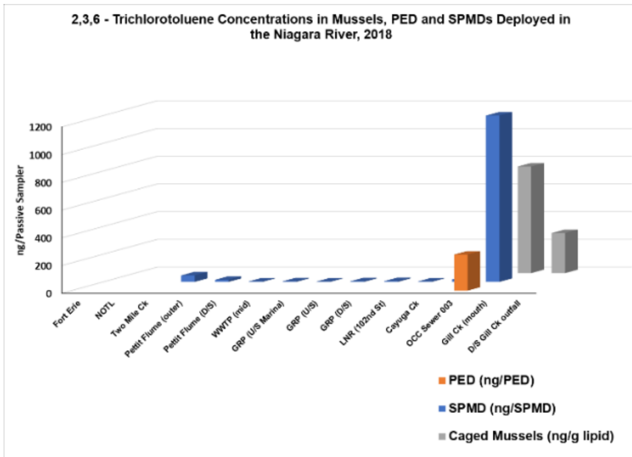


Figure 14: a) Mean; (+/- SD) water concentrations of hexachlorobutadiene from SPMDs deployed in the Niagara River, 2012-2018. GRP (Gratwick Riverside Park); Chippawa Channel and LNR (Little Niagara River): sampled 2012, 2015); BRC (Bloody Run Creek: sampled in 2015, 2018); Private property sampled 2018;



b) Mean (+/- standard deviation) hexachlorobutadiene in caged mussels deployed at the mouth of Gill Creek, Niagara River, 1987-2018;

c)



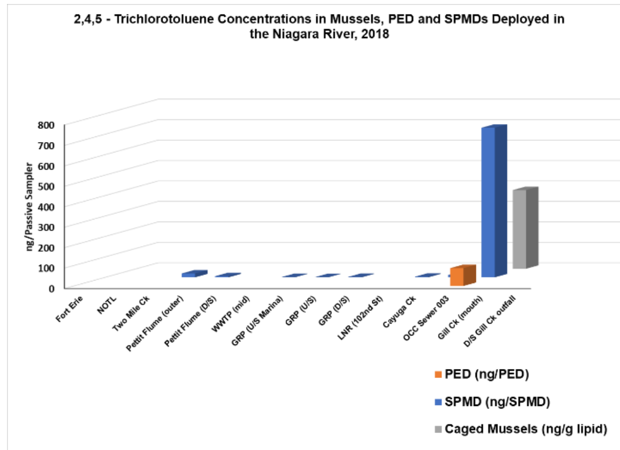


Figure 14 c): mean concentrations of tri-chlorotoluene in SPMDs, PEDs and caged mussels, 2018.

Polychlorinated biphenyls (PCBs)

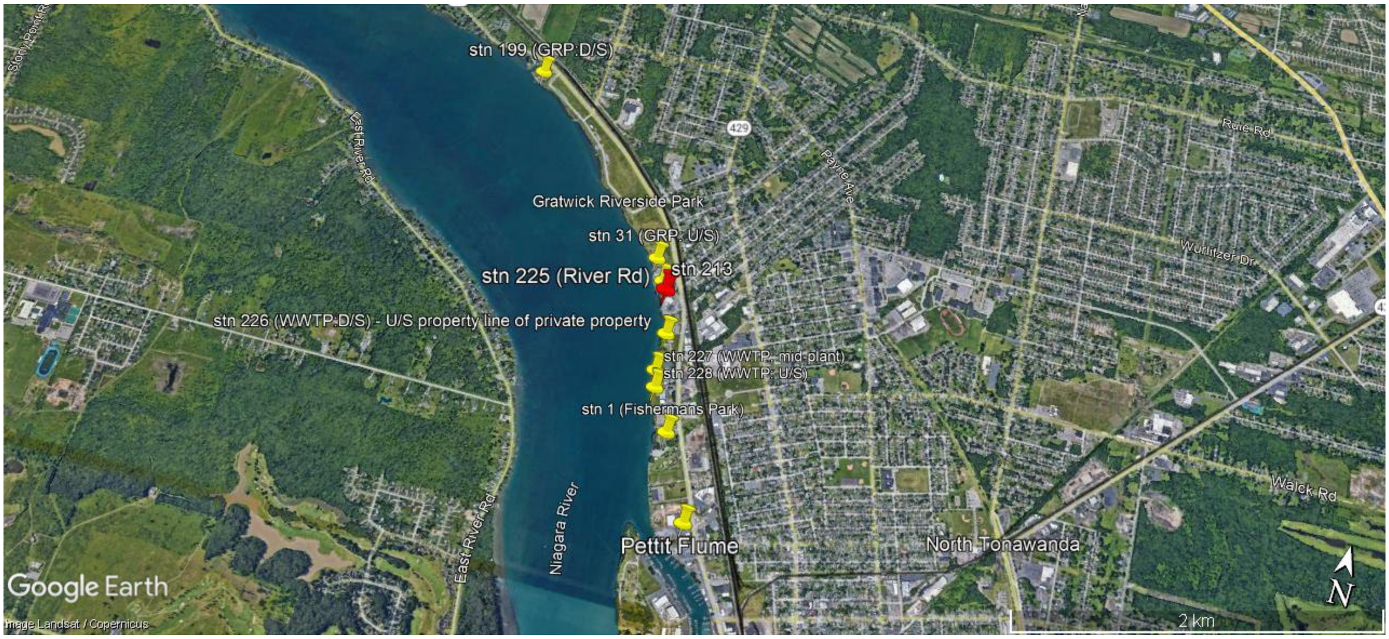
The 2012 SPMD and caged mussel data identified high PCB concentrations on the American side of the river at the upstream end of Gratwick Riverside Park (GRP), a State Superfund site located along the shore of the Niagara River in the city of North Tonawanda (Figure 15). GRP was remediated between 1999 and 2003 and so the presence of relatively high PCB concentrations near the area remediated suggested two possibilities: 1) PCBs were still leaching into the river from the former waste site; 2) there were other sources of PCBs upstream of GRP.

The 2015 survey concluded that a source existed upstream of GRP (Richman 2018), and in 2018 additional sampling stations were located to bound the area of high contamination and identify the source(s) of PCBs to the Niagara River in the nearshore. The new sampling locations included stations upstream and downstream of the North Tonawanda Wastewater Treatment Plant (WWTP) and a shore-based outfall, possibly a storm sewer (Stn 225), which was located at a private property along River Rd. (Figure 15).

The 2018 caged mussel (Appendix A-Table 5; Figure 2), SPMD (Appendix A-Table 7; Figure 16), and sediment data (Appendix A-Table 11) all identified a source of PCBs along the shoreline of the private property. The source could be the shore-based outfall adjacent to the location of the SPMDs and mussels, however, additional monitoring in the vicinity of the outfall would be required for confirmation and to assess the extent of contamination. The outfall was not active on the day of deployment or retrieval of mussels and SPMDs.

Concentrations of PCBs in mussels and estimated water concentrations from SPMDs at all stations upstream of the private property (i.e., Fishermans Park and all 3 locations associated with the WWTP) were low.

a)



b)

Figure 15: a) 2018 SPMD and caged mussel sampling locations for PCB source trackdown; b) magnified view U/S and D/S of private property (River Rd – red placemark).

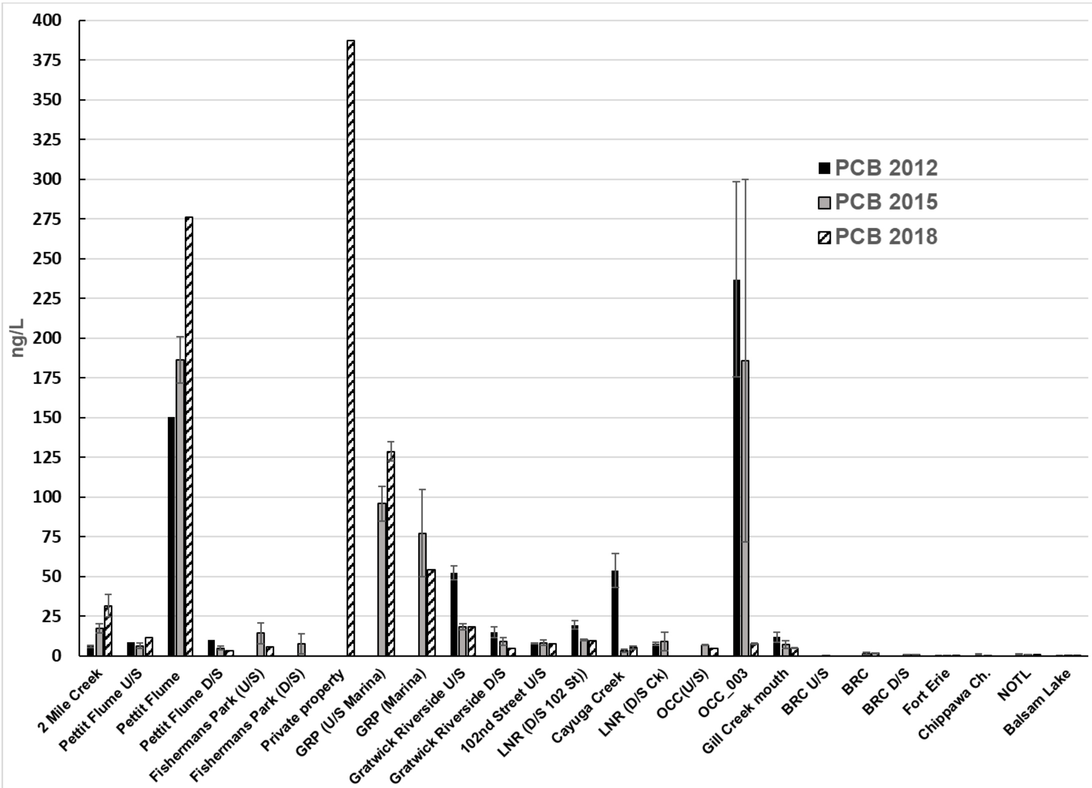
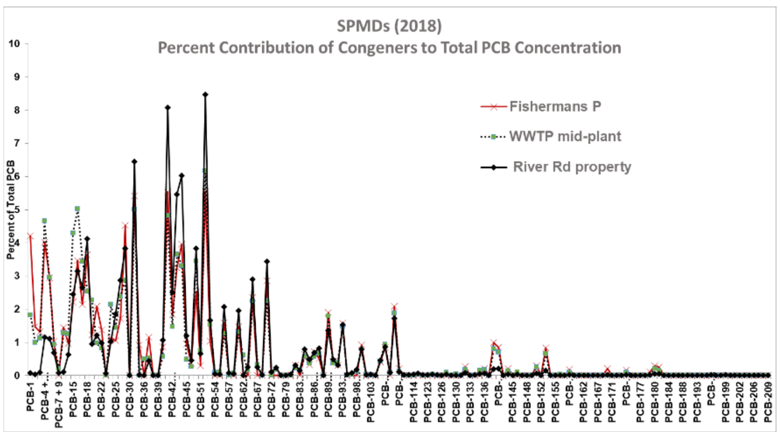


Figure 16: Mean (+/- SD) total PCB water concentrations (ng/L) from SPMDs deployed in the Niagara River, 2012- 2018. GRP (Gratwick Riverside Park); Chippawa Channel and LNR (Little Niagara River): sampled 2012, 2015); BRC (Bloody Run Creek: sampled in 2015, 2018); Private property sampled 2018.

Mussel PCB tissue concentrations at stations upstream along the river ranged from 5.1 to 14.7 ng/g (wet wt) compared with mussels deployed at the River Rd. outfall where mean PCB concentrations were 366 ng/g (wet wt.) (standard deviation 53 ng/g) (Figure 2). The SPMD data showed the same spatial pattern with concentrations at the River Rd. outfall more than 95 times higher (37,542 ng/SPMD) than at Fishermans Park and the WWTP (ranging from 135 ng/SPMD - 392 ng/SPMD). The estimated water concentration was 387 ng/L compared with a range of 2.8-5.8 ng/L at these upstream stations. The sediment PCB concentration from the Private Property (42,000 ng/g) was more than four times the site-specific Severe Effect Level (SEL) derived from Ontario's Sediment Quality Guidelines (Appendix A-Table 11; Fletcher et al 2008) and was approaching Ontario's definition of PCB hazardous waste (50,000 ng/g; R.R.O. 1990, Reg. 362: WASTE MANAGEMENT - PCB'S (ontario.ca)). Concentrations of PCBs decreased with increasing distance downstream of the River Rd. outfall for caged mussels, SPMDs, and sediment. The SPMDs were also analyzed for OC pesticides and chlorinated benzenes and concentrations were similar to other locations along the nearshore, suggesting the Private Property is not an anomalous source of these other compound classes.

Congener patterns for the SPMDs were similar at all sampling locations along the River Rd shoreline (Figure 17a). The caged mussel congener profiles differed from the SPMDs, and in general, the mussels had a higher proportion of tetra and penta chlorinated PCB congeners. Figure 17b provides an example using the River Rd mussel and SPMD data. It is hypothesized that this difference between media is due to the mussels accumulating PCBs from both the dissolved and particulate phase, whereas SPMDs only accumulate PCBs from the dissolved phase. The higher chlorinated PCB congeners tend to be less water soluble and adhere to particulate matter. However, different analytical methods (and laboratories) were used for the analysis which could also contribute to the variable patterns.

a)



b)

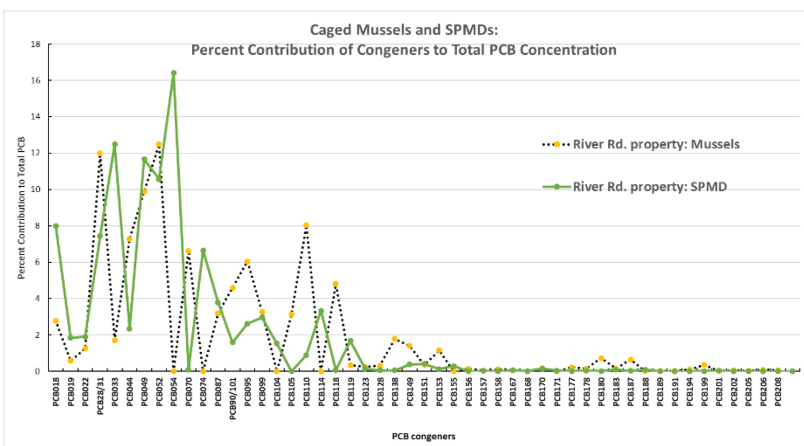


Figure 17: a) Congener patterns (percent contribution of each congener to total PCB concentration) in the SPMDs deployed along the Niagara shoreline, North Tonawanda and b) a comparison of congener patterns in mussels and SPMDs deployed at the private property along River Rd. North Tonawanda, 2018. A reduced list of SPMD congeners were used to match the congeners analysed in mussels.

When mussels, SPMDs and PEDs were deployed in 2018 at the same locations, identification of PCBs sources were consistent among the three methods (Figure 18). The data using all three monitors showed Two Mile Creek and the Pettit Flume with relatively higher concentrations of PCBs compared to other stations in the survey (in addition to the stations associated with the River Rd. source). SPMDs have consistently shown high PCB concentrations at the Pettit Flume almost exclusively attributed to the three mono-chlorinated PCBs (PCB1, PCB2 and PCB3) which represented 88% of the total PCB concentration (Table 7). OCC sewer 003 has had high concentrations of PCBs in all three monitors in 2012 and 2015, however, in 2018 concentrations were consistently lower than previous years (Figure 19).

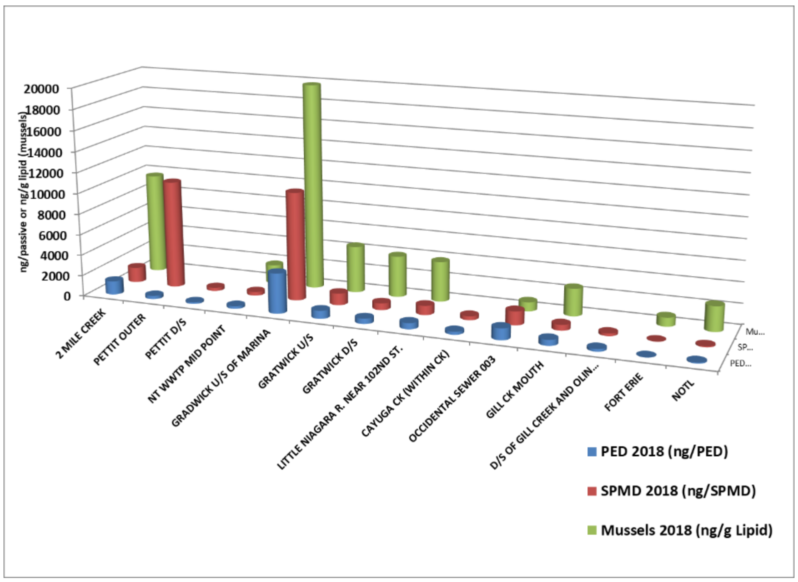


Figure 18: PCB concentrations (ng/passive sampler: SPMD & PEDs; ng/g lipid: mussel) in SPMDs, PEDs and caged mussels deployed in the Niagara River, 2018. Data for caged mussels was not available at the Pettit Flume cove stations, Cayuga Creek and D/S of Gill Creek and Olin outfall.

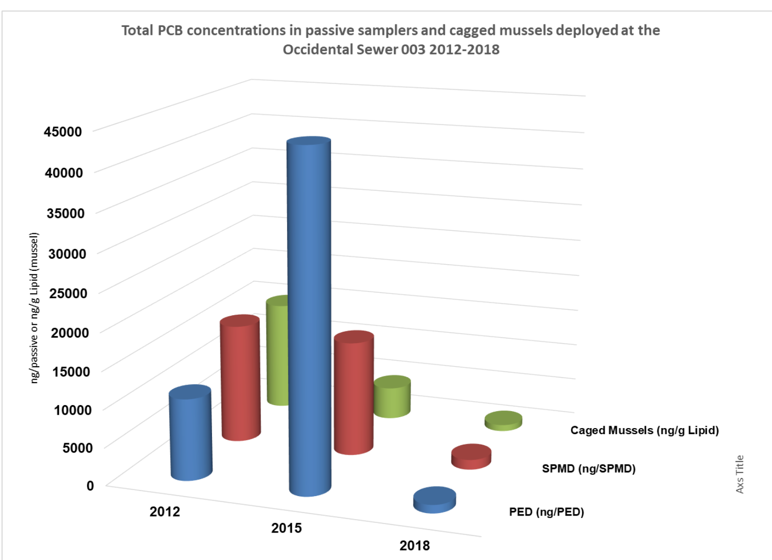
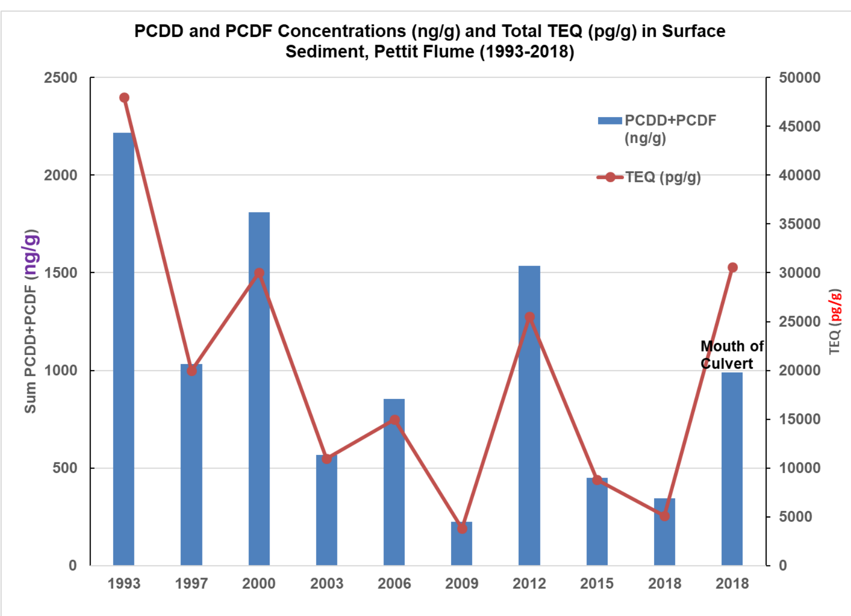


Figure 19: Total PCB concentrations in passive samplers and caged mussels deployed at Occidental sewer 003 through time.

Polychlorinated dibenzo-p-dioxins and Polychlorinated dibenzofurans (PCDD/F)

Notwithstanding the historical decrease in tissue concentrations for chlorinated benzenes in mussels deployed at the Pettit Flume, concentrations of PCDD/F in mussels and sediment remain high in the cove suggesting that the source of dioxins and furans was not adequately removed during the remedial actions in the early 1990's and between 2000-2016 (Glenn Springs Holdings, Inc. 2020; US EPA and NYSDEC 2002). Additionally, estimated water concentrations using the SPMD data in 2012 had high concentrations of dioxins and furans within the cove and at the downstream end of the cove (range 4 to 10 pg TEQ/L) compared to the upstream SPMDs (0.03 pg TEQ/L) (Appendix A-Table 10). Prior to remediation the total TEQ (using the Fish TEF) for sediment was 48,000 pg TEQ/g, over three orders-of-magnitude greater than the Canadian Council of Ministers of Environment interim SQG probable effect level of 21.1 pg TEQ/g (CCME 2001). From 2000-2018 the PCDD/F TEQ was comparatively lower and ranged from 3800 to 30,000 pg TEQ/g indicating significant year to year variability (Appendix D). The sediment collected from the cove has a unique congener pattern for PCDD/F that is not present in sediment collected upstream or at other sites along the Niagara River and has been consistent through time (Richman 2015; 2018) (Figure 20). PCDD/F concentrations in sediment at the sewer mouth in 2018 were extremely high at 30,558 pg TEQ/g compared with 5,090 pg TEQ/g at the center of the cove (Appendix A-Table 12) and consistent with data reported by Glenn Springs Holdings, Inc. (2020) a subsidiary of Occidental Petroleum.

a)



b)

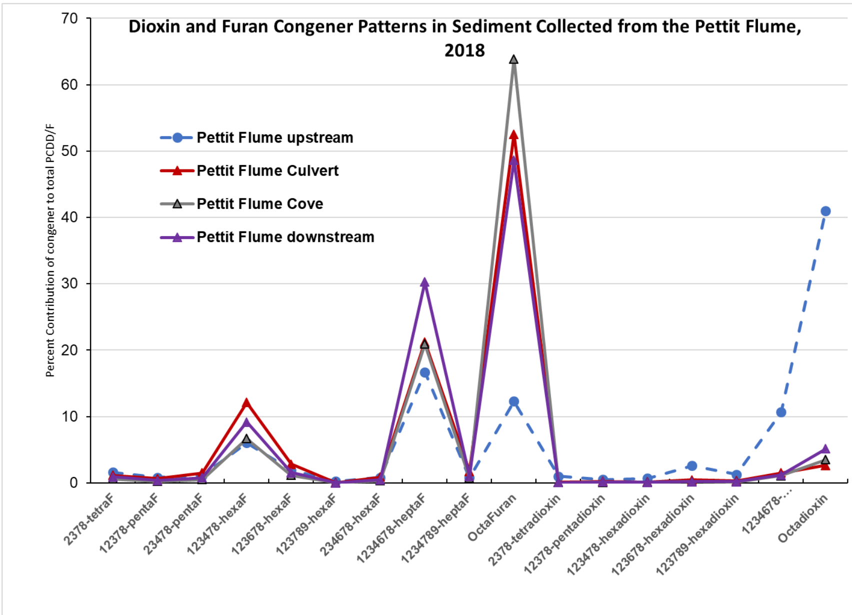


Figure 20: a) Sediment PCDD+PCDF concentrations (ng/g) and total TEQ (pg TEQ/g) in surface sediment collected from the Pettit Flume (1993 – 2018); b) Dioxin and Furan congener patterns in sediment from the Pettit Flume cove, Niagara River, 2018.

In contrast, sediment collected upstream of the cove in the marina remained low and ranged from 10 to 20 pg TEQ/g up to the most recent survey in 2018. Data from downstream of the cove from 2000-2018 has been consistent in showing that contaminated sediment may be migrating out of the cove into the Niagara River: PCDD/Fs ranged from 260 pg TEQ/g to 7200 pg TEQ/g (with no temporal pattern), and isomer patterns were consistent with those observed in cove sediments (Appendix D). Burniston et al. (2015) reported several event-based suspended sediment samples collected at NOTL as part of the ECCC U/D water monitoring program with significantly higher PCDD/F concentrations compared with ambient concentrations and congener profiles representative of the patterns from the Pettit Flume Cove. The authors hypothesized that loadings of dioxins and furans from hazardous waste sites in the river and in particular the Pettit Flume, were occurring episodically and can be measured on suspended sediments at NOTL.

Bloody Run Creek has consistently high concentrations of PCDD/Fs in sediment along the Niagara River shoreline (Appendix D). The Hyde Park Hazardous Waste site was a known significant source of dioxins and furans to Lake Ontario (Interagency Task Force on Hazardous Waste, 1979). The PCDD/F isomer patterns found in Bloody Run Creek sediments were distinct from those seen at other sites in the Niagara River, with lower concentrations of octachlorodibenzo-*p*-dioxin relative to the 1,2,3,4,6,7,8-heptachlorodioxin (Figure

21). Typically, at most sites where atmospheric deposition is the source of PCDD/F, octachlorodibenzo-*p*-dioxin is a dominant isomer. Furthermore, consistent with the Hyde Park Waste site all the tetra dioxin was in the form of 2,3,7,8-TCDD, the most toxic form of dioxin. The unique congener pattern present in the sediment was also present in the SPMDs and caged mussels demonstrating consistency in source among matrices and bioavailability of the contaminants. Additionally, sediment and caged mussels collected downstream of Bloody Run Creek continue to identify movement of dioxins and furans offsite (Appendix A-Table 12).

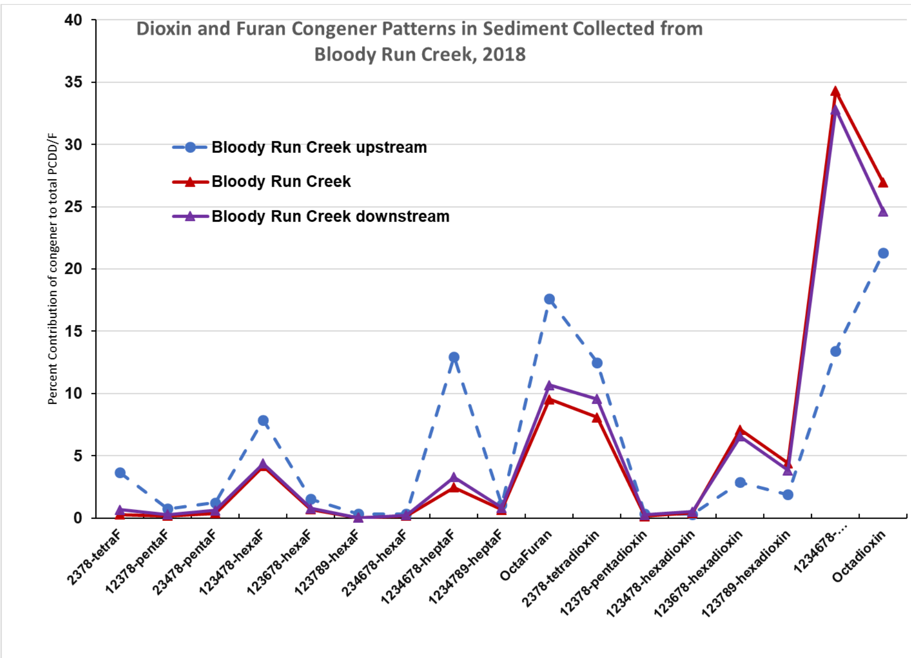


Figure 21: Dioxin and Furan congener patterns in sediment collected from Bloody Run Creek, Niagara River, 2018.

DDT Track-Down: Fort Erie, Ontario

From 1952 to 1967, DDT was applied to trees and shrubs in Fort Erie every two weeks from June through to the end of September to control caddisflies (Fredeen 1971). The area sprayed included 8 km of riverbank and shrubbery and trees extending about 1 km from the river along every street. Additionally, an area extending beyond the city limits for about 1.6 km north and a large park to the south of Fort Erie were also routinely sprayed with DDT. Technical grade DDT, the grade that was generally used as an insecticide, was composed of up to fourteen chemical compounds with the highest percentage represented by p,p'-DDT and o,p-DDT. Impurities or metabolites of technical DDT also include p,p'-DDE, p,p'-DDD, o,p'-DDE, and o,p'-DDD.

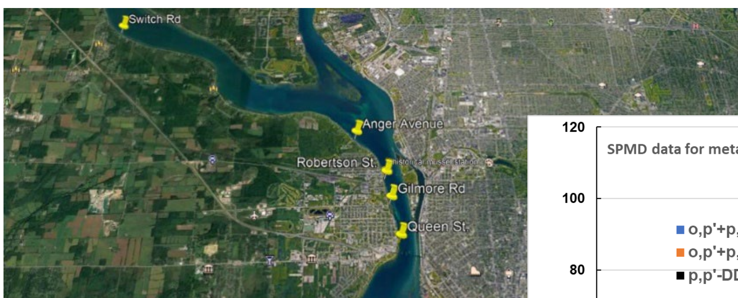
The Fort Erie Robertson St. station has been monitored using caged mussels since 1983. The tissue concentrations of p,p'-DDE and p,p'-DDD have been variable and inconsistent through time with concentrations ranging from below the detection limit to greater than 20 ng/g in the early 1990's (Richman 1999). In 2015, the highest estimated water concentration of p,p'-DDE in the survey was measured in the SPMDs (0.62 ng/L; Figure 7) and caged mussels (3-16 ng/g wet wt: Richman 2018) deployed at Fort Erie. Estimated water concentrations exceeded the NYSDEC WQC of 0.007 ng/L by almost an order-of-magnitude and was greater than concentrations estimated at all other stations which ranged from 0.02 ng/L- 0.33 ng/L. The 2015 results strongly contrast to the 2012 FE data as the SPMD p,p'-DDE water concentration was low (.04 ng/L), and p,p'-DDE and p,p'-DDD were below the detection limit in the caged mussels (Richman 2018).

The historic use of DDT in the area, and variable, but at times relatively high concentrations of DDT metabolites in SPMDs and caged mussels at the Robertson St. site compared with other locations in the river led to the deployment of SPMDs and collection of sediment at six stations along the shoreline in 2018 (Figure 22). The objective was to assess the legacy contamination of the area and determine if there was an ongoing source. The Thunder Bay, Lake Erie site served as an upstream reference site for the six Fort Erie nearshore sites.

The 2018 results demonstrated that concentrations of total DDT (the sum of all isomers analysed and detected), and metabolites p,p'-DDD and p,p'-DDE were relatively low in sediment collected from all stations (Appendix A-Table 13), and similar to other tributaries in the Niagara Region which have been previously described as representative of historical agricultural use of the pesticide (Clerk 2018). Clerk (2018) analysed sediment from 3 Niagara Region tributaries in 2014: 15 Mile Creek, 18 Mile Creek and 30 Mile Creek where total DDT across these three watersheds ranged from 21 to 117 ng/g. The highest concentrations of total DDT in sediment collected from the Fort Erie shoreline were similar and concentrations overall ranged from 4 ng/g at Adelaide St. to 115 ng/g at Switch Rd.

Concentrations were particularly low in sediment collected upstream of Gilmore Rd. from Thunder Bay Lake Erie, Adelaide St. and Queen St. (total DDT was 4-5 ng/g) (Appendix A-Table 13). The relatively higher concentrations of DDT at the downstream stations may be due to variability in the locations of historical spraying of DDT but are likely also influenced by sediment particle size. The sediment collected from Thunder Bay, Adelaide St and Queen St. had particularly high sand content at 78% to 96% sand. Organic compounds such as DDT would likely bind more to fine particles than sand. However, Robertson St. sediment also had high % sand (90%) but nonetheless still had higher total DDT (38 ng/g) relative to the more upstream stations, so proximity to historical spraying and runoff from soil may also account for some of the differences. Concentrations of DDT and metabolites at all stations were less than the Ontario Sediment Quality Guideline Severe Effect Level (SEL) for total DDT and metabolites, although in some cases the LEL was exceeded.

The SPMD data found a lower proportion of parent DDT (o,p'-DDT + p,p'-DDT) compared to metabolites (DDD and DDE) suggesting historical use of DDT rather than ongoing current sources. This conclusion is applicable to all sites assessed on the Niagara River since at many stations only metabolites of DDT were detected (Appendix A-Table 4; Table 6; Figure 22). Similar to the sediment data, the highest concentrations of DDT metabolites in SPMDs in Fort Erie were at the stations downstream of Gilmore Rd. (but also included Queens St. which had low sediment DDT concentrations). The highest concentrations were present at Anger Ave. with p,p'-DDE at 0.97 ng/L, while the remaining Fort Erie stations ranged from 0.01-0.07 ng/L. Except for Anger Ave., all metabolite concentrations at the remaining stations were within the range of concentrations reported for other sites assessed on the Niagara River, as well as the Balsam Lake control where the estimated p,p'-DDE water concentration was 0.01 ng/L suggesting it is unlikely that there is an ongoing source of DDT at Fort Erie. The relatively higher p,p'-DDE concentrations in SPMDs deployed at Anger Ave. in Fort Erie in 2018 were similar to the concentrations measured about 1.5 km upstream in 2015 at the Fort Erie Robertson station. Although there appears to be annual variability in uptake by both mussels and SPMDs at these sites, the data do not suggest a current local source of DDT, particularly since DDT was historically used in the Fort Erie area and sediment concentrations were within regional concentrations.



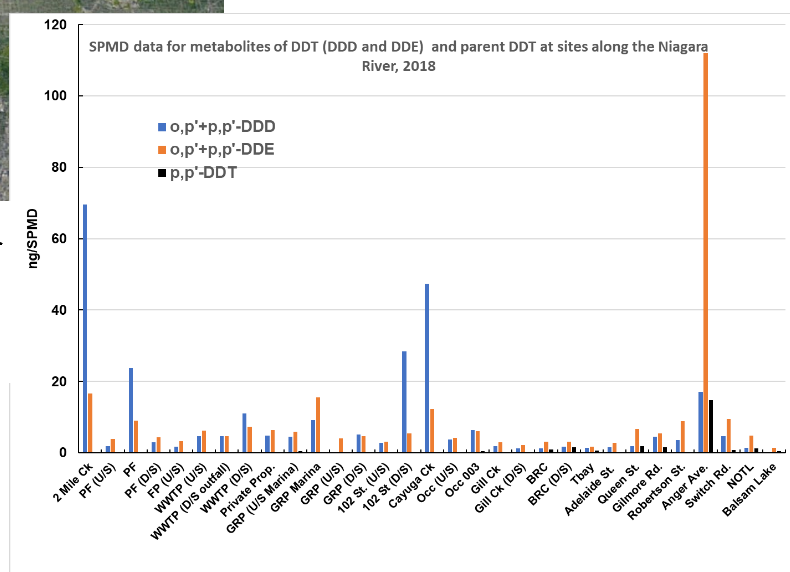


Figure 22: SPMD data (ng/SPMD) for metabolites of DDT (DDD and DDE) and for DDT, Niagara River 2018.

CONCLUSIONS

The Niagara River remains a source of chlorinated industrial organic compounds, dioxins and furans, PCBs and organochlorinated (OC) pesticides to Lake Ontario. Specific nearshore sources of these contaminants were identified using caged mussels and passive samplers, and COCs were consistent with those measured at higher concentrations at NOTL compared with FE by ECCC's long-term Niagara River Upstream/Downstream monitoring program. The various COCs present along the nearshore of the Niagara River have a range of potential toxicological impacts including stress to aquatic life and contribute to fish consumption advisories in the Niagara River and/or Lake Ontario (Bhavsar et al. 2007; Whittle and Fitzsimons 1983). Of the Great Lakes, Lake Ontario continues to have the highest levels of multiple contaminants, with a large proportion attributable to the Niagara River given that the river contributes over 80% of tributary inflow (Eadie and Robertson, 1976), 85% of the total input water budget and 50% of fine-grained sediments (Allen et al., 1983; Kemp and Harper 1976). The consistency in specific source identification through time and with multiple monitoring tools provides confidence in these long-term datasets which extend from 1983-2018.

Water concentrations estimated from SPMD data for dieldrin, metabolites of DDT, total chlordane, total PCBs and HCB (hexachlorobenzene) exceeded WQC at almost every station in the survey on both the American and Canadian sides of the river. However, higher concentrations of total PCBs and HCB have been noted on the US side in general, and with particularly high concentrations at specific locations: Pettit Flume cove (PCBs, dioxins/furans, tetra-, penta- and HCB), Two Mile Creek and a private property on River Road in North Tonawanda (PCBs), Little Niagara River downstream of the 102nd St Hazardous Waste Site (PCBs, tetra- and penta-chlorobenzenes), Occidental Chemical Co. Buffalo Ave plant outfall Sewer 003 (mirex, OCS, HCBD, tetra-, penta- and HCB, and tri-chlorotoluene), Bloody Run Creek (dioxins/furans, mirex, penta- and HCB), Cayuga Creek and Gill Creek (alpha-HCH). Apart from these exceptions, chlorinated benzenes (di, tri, tetra and penta) industrial organic compounds and OC pesticides were present at most sampling locations at concentrations that were less than the most stringent water quality criteria. Sites that have been remediated continue to demonstrate relatively lower levels of contamination.

Without further remedial actions at the sites identified as sources nearshore contaminant trends are unlikely to change in the future. Long-term monitoring plans should be revisited considering the consistency of the data through time regarding the frequency of monitoring (i.e., number of stations and frequency of surveys), continued use of both caged mussels and passive samplers (SPMDs preferentially over PEDs), and whether any further remediation projects are planned or occurring.

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Appendix A:

Table 1: Niagara River 2018 Caged Mussel, SPMD and PED Deployment Locations.

Table 2: 2018 Mussel Tissue Wet and Dry Weights.

Table 3: Water Temperature, Dissolved Oxygen and Conductivity Data.

Table 4: 2018 Caged Mussel Tissue Contaminant Data: OC Pesticides, Chlorinated Benzenes and Chlorinated Industrial Compounds.

Table 5: 2018 Caged Mussel Data: Congener Specific PCBs.

Table 6: 2018 SPMD Data: OC Pesticides, Chlorinated Benzenes and Chlorinated Industrial Compounds.

Table 7: 2018 SPMD Data: PCBs Homologue Groups.

Table 8: 2018 PED Data: OC Pesticides, Chlorinated Benzenes and Chlorinated Industrial Compounds.

Table 9: 2012-2018 PED Data: Total PCBs.

Table 10: Mean estimated water concentrations (ng/L) using 2012, 2015 and 2018 SPMD data and the USGS Water Concentration Estimator.

Table 11: Surface Sediment Concentrations of PCBs along the Niagara River shoreline in North Tonowanda and Industrial Chlorinated Compounds in the Pettit Flume Cove, Niagara River, 2018.

Table 12: 2018 Dioxin and Furan Concentrations in Mussel Tissue and Sediment.

Table 13: Concentrations (ng/g) of organochloride pesticides in surface sediment (0-2 cm) collected from the Fort Erie shoreline, Niagara River, 2018.

Table 1: 2018 Niagara River Caged Mussels, SPMD and PE Deployment Locations

√√ indicates mussels were analysed for both congener specific PCBs and OC pesticide scan

√ indicates mussels were analysed for congener specific PCBs or OC pesticides scan

Stn ID	General Location	Mussels	SPMD	PED	Latitude (DMS)	Longitude (DMS)	Northing	Easting	Accuracy (+/-)
18 01 0001	Balsam Lake (Control)	√√	√		44° 34' 32.1" N	78° 47' 52.7" W	4 938 163.45	674 830.65	*not measured*
05 02 0001	Fisherman's Park (Upstream)		√		43° 02' 19.9" N	78° 53' 17.7" W	4 769 145.32	671 972.90	8m
05 02 0031	Upstream end of GRP	√	√	√	43° 02' 52.4" N	78° 53' 32.9" W	4 768 288.33	671 650.36	8m
05 02 0037	Gill Creek (Mouth)	√√	√	√	43° 04' 41.9" N	79° 01' 34.0" W	4 771 401.48	660 686.16	6m
05 02 0042	Occidental's Sewer 003	√√	√	√	43° 04' 30.0" N	79° 00' 26.4" W	4 771 070.54	662 223.55	12m
05 02 0093	102nd Street (upstream)		√		43° 04' 15.6" N	78° 56' 43.8" W	4 770 747.80	667 268.45	8m
05 02 0095	Little Niagara River (102nd st waste site)		√	√	43° 04' 23.2" N	78° 57' 05.1" W	4 770 970.46	666 781.00	5m
05 02 0097	Upstream Occidental	√	√		43° 04' 25.2" N	79° 00' 01.1" W	4 770 936.09	662 799.23	6m
05 02 0122	GRP Marina (1st bay)	√	√		43° 02' 52.9" N	78° 53' 28.0" W	4 768 306.54	671 760.83	8m
05 02 0185	Pettit Flume (upstream)	√	√		43° 02' 01.5" N	78° 53' 07.4" W	4 766 732.67	672 266.86	5m
05 02 0186	Pettit Flume Cove outer	√	√	√	43° 02' 03.9" N	78° 53' 08.7" W	4 766 805.96	672 235.57	7m
05 02 0187	Pettit Flume (downstream)	√	√	√	43° 02' 03.6" N	78° 53' 11.3" W	4 766 795.22	672 176.97	9m
05 02 0197	Two Mile Creek (Mouth)	√√	√	√	43° 00' 34.6" N	78° 54' 24.0" W	4 764 008.49	670 600.26	13m
05 02 0199	D/S end of Gratwick Riverside Park (GRP)	√	√	√	43° 03' 25.0" N	78° 54' 17.8" W	4 769 268.55	670 609.39	9m
05 02 0203	Fort Erie at Robertson St.	√	√	√	42° 55' 41.7" N	78° 54' 47.6" W	4 754 959.79	670 290.39	7m
05 02 0213	GRP U/S of marina	√	√	√	43° 02' 48.1" N	78° 53' 29.5" W	4 768 157.62	671 730.61	11m
05 02 0225	Private Property U/S of marina (870 River Rd)	√	√		43° 02' 46.4" N	78° 53' 28.1" W	4 768 105.97	671 763.61	7m
05 02 0226	Downstream of North Tonawanda WWTP	√	√		43° 02' 38.1" N	78° 53' 24.7" W	4 767 851.86	671 846.97	9m
05 02 0227	North Tonawanda WWTP mid-plant downstream of outfall	√	√	√	43° 02' 30.7" N	78° 53' 24.6" W	4 767 623.64	671 854.97	9m
05 02 0228	Upstream end of North Tonawanda WWTP	√	√		43° 02' 27.5" N	78° 53' 23.5" W	4 767 525.55	671 882.35	7m
05 02 0229	Downstream of Gill Creek and Olin Outfall	√	√	√	43° 04' 41.7" N	79° 01' 36.9" W	4 771 393.77	660 620.73	4m
05 02 0230	Adelaide St. Fort Erie		√		42° 53' 16.8" N	78° 55' 24.7" W	4 750 469.13	669 559.72	5m
05 02 0231	Queen St. Fort Erie		√		42° 54' 35.6" N	78° 54' 31.0" W	4 752 930.10	670 717.39	9m
05 02 0232	Gilmore Rd. Fort Erie		√		42° 55' 14.5" N	78° 54' 42.1" W	4 754 123.82	670 435.90	7m
05 02 0233	Anger Ave. Fort Erie		√		42° 56' 28.8" N	78° 55' 30.6" W	4 756 388.60	669 279.78	6m
05 02 0234	Switch Rd. Fort Erie		√		42° 58' 38.1" N	79° 01' 05.3" W	4 760 194.22	661 600.15	5m
05 15 0031	Cayuga Creek	√	√	√	43° 04' 53.3" N	78° 57' 37.2" W	4 771 881.31	666 032.46	7m
05 15 0038	Rattlesnake Creek	√			43° 00' 26.2" N	78° 54' 27.7" W	4 763 747.27	670 552.95	9m
05 15 0130	Rattlesnake Creek (Culvert)	√			43° 00' 26.4" N	78° 54' 27.2" W	4 763 753.73	670 534.12	8m
11 02 0009	Niagara on the Lake	√√	√	√	43° 15' 13.8" N	79° 03' 36.2" W	4 790 830.36	657 471.11	9m
11 02 0017	Bloody Run Creek (BRC)	√	√		43° 08' 16.0" N	79° 02' 33.9" W	4 777 974.41	659 177.38	16m
11 02 0018	BRC - upstream	√	√		43° 08' 13.1" N	79° 02' 36.8" W	4 777 883.42	659 113.95	17m
11 02 0025	BRC - downstream	√			43° 08' 16.9" N	79° 02' 33.1" W	4 778 002.59	659 194.80	14m
11 02 0131	BRC 6th fence post	√			43° 08' 15.4" N	79° 02' 35.0" W	4 777 955.32	659 152.96	10m
11 02 0132	BRC 4th fence post	√			43° 08' 15.6" N	79° 02' 34.7" W	4 777 961.65	659 159.59	9m
16 01 1327	Thunder Bay, Lake Erie		√		42° 52' 03.6" N	79° 00' 30.5" W	4 748 043.43	662 676.57	6m

Table 2: 2018 Niagara River Mussel Weights

Station Name	Station #	GL #	n	Wet Weight (g)	Dry Weight (g)	percent Dry	percent Wet	ratio dry/wet	Archive Weight (g)
Balsam Lake	18 01 0001	GL185045	1	7.28	N/A				
Balsam Lake	18 01 0001	GL185046	1	6.67	N/A				
Balsam Lake	18 01 0001	GL185047	1	6.32	N/A				
Balsam Lake	18 01 0001	GL185048	1	6.10	N/A				
Balsam Lake	18 01 0001	GL185049	1	6.43	N/A				
Balsam Lake	18 01 0001	GL185050	6	44.30	3.87	8.7	91.3	0.09	
Balsam Lake	18 01 0001	GL185051	6	39.87	3.25	8.2	91.8	0.08	
Balsam Lake	18 01 0001	GL185052	6	41.19	2.94	7.1	92.9	0.07	
Balsam Lake (Travel Blank)	18 01 0001	GL185053	1	7.08	N/A				
Balsam Lake (Travel Blank)	18 01 0001	GL185054	1	7.29	N/A				
Balsam Lake (Travel Blank)	18 01 0001	GL185055	1	7.82	N/A				
Robertson Street - Fort Erie	05 02 0203	GL185143	1	6.35	N/A				8.08
Robertson Street - Fort Erie	05 02 0203	GL185144	1	6.89	N/A				
Robertson Street - Fort Erie	05 02 0203	GL185145	1	7.11	N/A				
Robertson Street - Fort Erie	05 02 0203	GL185146	6	44.66	3.19	7.1	92.9	0.07	
Robertson Street - Fort Erie	05 02 0203	GL185147	6	42.48	4.07	9.6	90.4	0.10	
Robertson Street - Fort Erie	05 02 0203	GL185148	6	41.34	5.41	13.1	86.9	0.13	
Niagara on the Lake	11 02 0009	GL185056	1	6.58	N/A				7.60
Niagara on the Lake	12 02 0009	GL185057	1	7.95	N/A				
Niagara on the Lake	13 02 0009	GL185058	1	5.11	N/A				
Niagara on the Lake	11 02 0009	GL185059	6	38.55	3.77	9.8	90.2	0.10	
Niagara on the Lake	12 02 0009	GL185060	6	34.52	3.96	11.5	88.5	0.11	
Niagara on the Lake	13 02 0009	GL185061	6	42.14	3.47	8.2	91.8	0.08	
Two Mile Creek (Mouth)	05 02 0197	GL185062	1	6.51	N/A				5.47
Two Mile Creek (Mouth)	05 02 0197	GL185063	1	7.93	N/A				
Two Mile Creek (Mouth)	05 02 0197	GL185064	1	7.38	N/A				
Two Mile Creek (Mouth)	05 02 0197	GL185065	6	37.95	3.49	9.2	90.8	0.09	
Two Mile Creek (Mouth)	05 02 0197	GL185066	6	39.85	4.31	10.8	89.2	0.11	
Two Mile Creek (Mouth)	05 02 0197	GL185067	6	41.82	4.06	9.7	90.3	0.10	
Rattlesnake Creek	05 15 0038	GL185068	6	40.15	3.35	8.3	91.7	0.08	#1 = 6.32 / #2 = 5.62
Rattlesnake Creek	05 15 0038	GL185069	6	37.24	4.35	11.7	88.3	0.12	
Rattlesnake Creek	05 15 0038	GL185070	6	42.13	4.06	9.6	90.4	0.10	
Rattlesnake Creek Culvert	05 15 0130	GL185071	1	5.70	N/A				#1 = 5.41 / #2 = 5.85
Rattlesnake Creek Culvert	05 15 0130	GL185072	1	5.40	N/A				
Rattlesnake Creek Culvert	05 15 0130	GL185073	1	4.48	N/A				
Pettit Flume - Upstream	05 02 0185	GL185074	1	5.38	N/A				#1 = 6.74 / #2 = 5.07
Pettit Flume - Upstream	05 02 0185	GL185075	1	3.76	N/A				
Pettit Flume - Upstream	05 02 0185	GL185076	1	6.02	N/A				
Pettit Flume - Upstream	05 02 0185	GL185077	4	24.93	N/A				
Pettit Flume - Downstream	05 02 0187	GL185078	1	6.32	N/A				6.10
Pettit Flume - Downstream	05 02 0187	GL185079	1	5.99	N/A				
Pettit Flume - Downstream	05 02 0187	GL185080	1	5.98	N/A				
Pettit Flume - Downstream	05 02 0187	GL185081	4	25.98	N/A				
Upstream end of N Tonawanda WWTP	05 02 0228	GL185106	6	37.78	3.87	10.2	89.8	0.10	6.75
Upstream end of N Tonawanda WWTP	05 02 0228	GL185107	6	38.58	4.40	11.4	88.6	0.11	
Upstream end of N Tonawanda WWTP	05 02 0228	GL185108	6	41.51	3.30	7.9	92.1	0.08	
N Tonawanda WWTP - Mid Plant D/S of Outfall	05 02 0227	GL185103	6	42.93	3.98	9.3	90.7	0.09	#1 = 6.52 / #2 = 4.92
N Tonawanda WWTP - Mid Plant D/S of Outfall	05 02 0227	GL185104	6	34.91	4.26	12.2	87.8	0.12	
N Tonawanda WWTP - Mid Plant D/S of Outfall	05 02 0227	GL185105	6	37.26	2.77	7.4	92.6	0.07	

Station Name	Station #	GL #	n	Wet Weight (g)	Dry Weight (g)	percent Dry	percent Wet	ratio dry/wet	Archive Weight (g)
Downstream of N Tonawanda WWTP	05 02 0226	GL185100	6	41.33	4.35	10.5	89.5	0.11	#1 = 5.47 / #2 = 5.27
Downstream of N Tonawanda WWTP	05 02 0226	GL185101	6	37.95	6.28	16.5	83.5	0.17	
Downstream of N Tonawanda WWTP	05 02 0226	GL185102	6	39.47	3.70	9.4	90.6	0.09	
Private Property Upstream of GRP Marina	05 02 0225	GL185097	6	36.12	4.25	11.8	88.2	0.12	5.91
Private Property Upstream of GRP Marina	05 02 0225	GL185098	6	42.21	5.08	12.0	88.0	0.12	
Private Property Upstream of GRP Marina	05 02 0225	GL185099	6	37.54	4.49	12.0	88.0	0.12	
Downstream of Private Property- Upstream of Marina	05 02 0123	GL185094	6	44.45	4.31	9.7	90.3	0.10	#1 = 6.80 / #2 = 6.14
Downstream of Private Property- Upstream of Marina	05 02 0123	GL185095	6	42.06	3.53	8.4	91.6	0.08	
Downstream of Private Property- Upstream of Marina	05 02 0123	GL185096	6	36.80	4.47	12.1	87.9	0.12	
Upstream end of GRP - in Marina	05 02 0122	GL185091	6	47.85	5.71	11.9	88.1	0.12	6.53
Upstream end of GRP - in Marina	05 02 0122	GL185092	6	37.57	4.66	12.4	87.6	0.12	
Upstream end of GRP - in Marina	05 02 0122	GL185093	6	39.36	4.61	11.7	88.3	0.12	
Upstream end of GRP	05 02 0031	GL185088	6	38.98	4.91	12.6	87.4	0.13	#1 = 7.11 / #2 = 6.11
Upstream end of GRP	05 02 0031	GL185089	6	41.05	3.52	8.6	91.4	0.09	
Upstream end of GRP	05 02 0031	GL185090	6	42.30	4.81	11.4	88.6	0.11	
Downstream end of GRP	05 02 0199	GL185085	6	36.58	4.51	12.3	87.7	0.12	#1 = 5.55 / #2 = 5.81
Downstream end of GRP	05 02 0199	GL185086	6	40.34	4.57	11.3	88.7	0.11	
Downstream end of GRP	05 02 0199	GL185087	6	40.22	3.77	9.4	90.6	0.09	
Cayuga Creek	05 15 0031	GL185082	6	48.17	5.73	11.9	88.1	0.12	#1 = 6.86 / #2 = 7.05
Cayuga Creek	05 15 0031	GL185083	6	48.09	6.82	14.2	85.8	0.14	
Cayuga Creek	05 15 0031	GL185084	6	49.70	5.72	11.5	88.5	0.12	
Upstream Occidental	05 02 0097	GL185131	6	44.97	3.97	8.8	91.2	0.09	#1 = 5.28 / #2 = 6.36
Upstream Occidental	05 02 0097	GL185132	6	40.23	3.69	9.2	90.8	0.09	
Upstream Occidental	05 02 0097	GL185133	6	37.19	1.97	5.3	94.7	0.05	
Occidental Sewer 003	05 02 0042	GL185125	1	5.75	N/A				
Occidental Sewer 003	05 02 0042	GL185126	1	7.02	N/A				
Occidental Sewer 003	05 02 0042	GL185127	1	6.90	N/A				
Occidental Sewer 003	05 02 0042	GL185128	4	23.76	2.00	8.4	91.6	0.08	
Occidental Sewer 003	05 02 0042	GL185129	4	26.29	1.30	4.9	95.1	0.05	
Occidental Sewer 003	05 02 0042	GL185130	4	25.40	1.70	6.7	93.3	0.07	
Gill Creek (Mouth)	05 02 0037	GL185134	1	8.44	N/A				
Gill Creek (Mouth)	05 02 0037	GL185135	1	6.58	N/A				
Gill Creek (Mouth)	05 02 0037	GL185136	1	7.07	N/A				
Gill Creek (Mouth)	05 02 0037	GL185137	4	40.07	3.69	9.2	90.8	0.09	
Gill Creek (Mouth)	05 02 0037	GL185138	4	42.59	3.74	8.8	91.2	0.09	
Gill Creek (Mouth)	05 02 0037	GL185139	4	44.74	4.49	10.0	90.0	0.10	
Downstream of Gill Creek & Olin Outfall	05 02 0229	GL185140	1	8.21	N/A				6.62
Downstream of Gill Creek & Olin Outfall	05 02 0229	GL185141	1	8.15	N/A				
Downstream of Gill Creek & Olin Outfall	05 02 0229	GL185142	1	4.84	N/A				
Bloody Run Creek	11 02 0131	GL185117	1	4.82	N/A				6.28
Bloody Run Creek	11 02 0131	GL185118	1	5.43	N/A				
Bloody Run Creek	11 02 0131	GL185119	1	6.23	N/A				
Bloody Run Creek	11 02 0131	GL185120	4	24.60	N/A				
Bloody Run Creek	11 02 0132	GL185121	1	4.67	N/A				#1 = 5.27 / #2 = 6.34
Bloody Run Creek	11 02 0132	GL185122	1	4.93	N/A				
Bloody Run Creek	11 02 0132	GL185123	1	7.43	N/A				
Bloody Run Creek	11 02 0132	GL185124	4	26.41	N/A				
Bloody Run Creek	11 02 0017	GL185113	1	6.66	N/A				6.68
Bloody Run Creek	11 02 0017	GL185114	1	4.53	N/A				
Bloody Run Creek	11 02 0017	GL185115	1	4.91	N/A				
Bloody Run Creek	11 02 0017	GL185116	4	21.56	N/A				
Bloody Run Creek - Downstream	11 02 0025	GL185109	1	5.35	N/A				#1 = 4.90 / #2 = 6.22
Bloody Run Creek - Downstream	11 02 0025	GL185110	1	6.94	N/A				
Bloody Run Creek - Downstream	11 02 0025	GL185111	1	4.88	N/A				
Bloody Run Creek - Downstream	11 02 0025	GL185112	4	23.82	N/A				

Table 3: 2018 Niagara River Biomonitoring

Field Water Quality Measurements

Sonde = YSI 600 QS

Temperature compensated conductivity values were acquired by using the equation: $C_{25} = \frac{C_t}{1+\alpha(t-25)}$

Excel formula: "=(uncompensated cond.)/(1+0.019*(temp.-25))"

C25 = compensated conductivity at 25°C, Ct = uncompensated conductivity at the given temperature, α = linear temperature coefficient, t = temperature

A linear temperature coefficient of 0.019 was used for this calculation. This is the same coefficient that the YSI600QS would use to compensate to 25°C (according to the user manual).

Station Name	Station #	Depth (m)	Date	Cond. (μs/cm) (uncompensated)	Cond. (μs/cm) (Temp. compensated to 25°C)	Temp. (°C)	DO (%)	DO (mg/L)
Balsam Lake (Control)	18 01 0001	1.6	9 JUL 2018	139		26.4	105	8.09
			30 JUL 2018	129		24.9	100.5	8.32
Niagara on the Lake	11 02 0009	1.0	10 JUL 2018	267		23.2	102.4	9.70
			31 JUL 2018	266		23.3	110.9	9.49
Two Mile Creek (Mouth)	05 02 0197	1.0	10 JUL 2018	1534		24.1	37.3	3.12
			31 JUL 2018	384		22.7	78.7	6.80
Rattlesnake Creek	05 15 0038	0.2	10 JUL 2018	4900		23.3	140 [a]	not measured
			31 JUL 2018	4398		21.9	136.9	11.57
Rattlesnake Creek (Culvert)	05 15 0130	0.2	10 JUL 2018	2248		20.2	104.1	9.36
			31 JUL 2018	4343		21.2	115.3	10.04
Pettit Flume (Upstream)	05 02 0185	1.4	10 JUL 2018	279		24.3	97.5	8.11
			31 JUL 2018	273		23.7	104.1	8.77
Pettit Flume (Downstream)	05 02 0187	*not measured*	10 JUL 2018	278		24.3	95.6	8.00
			31 JUL 2018	273		23.7	103.1	8.71
Pettit Flume Core Outer	05 02 0186	1.1	10 JUL 2018	330		25.7	140 [a]	11.55
			31 JUL 2018	355		24.3	160.3	13.37
102nd Street (Upstream)	05 02 0093	0.9	10 JUL 2018	278		26.4	155 [a]	not measured
			31 JUL 2018	274		25.7	158.8	13.00
Little Niagara River (102nd St Waste Site)	05 02 0095	0.9	10 JUL 2018	276		26.4	99.4	8.40
			31 JUL 2018	274		25.9	100.1	8.13
Cayuga Creek	05 15 0031	0.6	10 JUL 2018	1146		26.4	67.5	5.42
			31 JUL 2018	652		23.8	55.9	4.64
D/S end of Gratwick Riverside Park (GRP)	05 02 0199	1.0	11 JUL 2018	276		23.7	91.7	7.72
			1 AUG 2018	277		23.2	74.0	6.30
Upstream end of GRP	05 02 0031	*not measured*	11 JUL 2018	275		23.8	88.2	7.45
			1 AUG 2018	274		23.4	98.9	8.41
GRP Marina (1st bay)	05 02 0122	1.5	11 JUL 2018	280		24.3	100.6	8.40
			1 AUG 2018	299		23.9	73.5	6.15
GRP U/S of marina	05 02 0213	1.3	11 JUL 2018	275		24.0	93.8	7.89
			1 AUG 2018	273		23.5	99.1	8.43
Private Property U/S of marina (870 River Rd)	05 02 0225	*not measured*	11 JUL 2018	276		24.0	96	8-8.5
			1 AUG 2018	273		23.5	100.0	8.45
Downstream of North Tonawanda WWTP	05 02 0226	1.2	11 JUL 2018	279		24.5	101	8.43
			1 AUG 2018	274		23.5	105.8	8.97
North Tonawanda WWTP mid-plant downstream of	05 02 0227	1.2	11 JUL 2018	281		24.2	99.9	8.38
			1 AUG 2018	274		23.5	102.9	8.74
Upsteram end of North Tonawanda WWTP	05 02 0228	*not measured*	11 JUL 2018	281		24.2	98	8.20
			1 AUG 2018	276		23.6	103.6	8.77
Fisherman's Park (Upstream)	05 02 0001	*not measured*	11 JUL 2018	306		25.7	75.6	6.16
			1 AUG 2018	303		23.5	5.7	0.67
BRC Bloody Run Creek	11 02 0017	0.9	12 JUL 2018	266		23.3	111.6	9.50
			2 AUG 2018	267		23.1	120.9	10.34
BRC 6th fence post	11 02 0131	1.0	12 JUL 2018	266		23.2	110.8	9.46
			2 AUG 2018	267		23.1	120.9	10.34
BRC 4th fence post	11 02 0132	0.8	12 JUL 2018	266		23.2	110.8	9.46
			2 AUG 2018	267		23.1	120.9	10.34
BRC - upstream	11 02 0018	0.7	12 JUL 2018	266		23.2	110.8	9.46
			2 AUG 2018	Not Measured				
BRC - downstream	11 02 0025	0.8	12 JUL 2018	266		23.2	110.8	9.46
			2 AUG 2018	267		23.1	120.9	10.34
Occidental Sewer 003	05 02 0042	0.8	12 JUL 2018	306		28.0	80.3	6.28
			2 AUG 2018	373		27.1	89.8	7.13
Upstream Occidental	05 02 0097	*not measured*	12 JUL 2018	276		23.8	95.1	8.03
			2 AUG 2018	276		23.5	108.5	9.19
Gill Creek (mouth)	05 02 0037	*not measured*	12 JUL 2018	277		23.7	93	7.89
			2 AUG 2018	274		23.3	96.6	8.23
Downstream of Gill Creek and Olin Outfall	05 02 0229	0.6	12 JUL 2018	272		23.9	99.4	8.36
			2 AUG 2018	271		24.0	102.2	8.58
Thunder Bay, Lake Erie	16 01 1327	0.5	12 JUL 2018	279		25.8	123	10.10
			2 AUG 2018	277		25.4	108.5	8.89
Adelaide St. Fort Erie	05 02 0230	0.3	12 JUL 2018	270		26.1	137	11.15
			2 AUG 2018	274		26.5	127.8	10.28
Queen St. Fort Erie	05 02 0231	0.7	13 JUL 2018	267		23.4	95.6	8.13
			3 AUG 2018	271		23.6	92.9	7.84
Gilmore Rd. Fort Erie	05 02 0232	0.8	13 JUL 2018	264		23.1	112.9	9.69
			3 AUG 2018	266		23.0	98.6	8.43
Fort Erie at Robertson St.	05 02 0203	1.0	13 JUL 2018	261		23.2	130.1	11.10
			3 AUG 2018	266		23.1	95.4	8.17
Anger Ave. Fort Erie	05 02 0233	0.7	13 JUL 2018	269		23.7	116	9.81
			3 AUG 2018	266		23.6	119.1	10.09
Switch Rd. Fort Erie	05 02 0234	0.9	13 JUL 2018	273		23.8	109.4	9.20
			3 AUG 2018	268		23.8	112.8	9.52

[a] *YSI DO may not have been working correctly for this station (abnormally high for both deployment and retrieval, calibrating on station did not change values)*

Table 4:Tissue concentrations (ng/g wet wt.) of organic compounds in caged mussels, Niagara River, 2018. <=W= no measurable response; <T= measurable trace amount;
PS1=PCB resembled mixture of Aroclor 1248,1254,1260; PS40= resemble Aroclor 1254 AND 1260; MCP= max poss. Conc'n due to chromatographic overlap

Station Description	Station ID	Station Number	Sampling Date	Samp No	Lipid	cis-nonachlor	DDT & Metabolites	Aldrin	a-BHC (hexachlorocyclo-hexane)	b-BHC (hexachlorocyclo-hexane)	g-BHC (hexachlorocyclo-hexane)	a-Chlordane	g-Chlordane	Heptachlor	Mirex	Oxychlordane
	(body of water, stn type)				%	ng/g wet wt.	ng/g wet wt.	ng/g wet wt.	ng/g wet wt.	ng/g wet wt.	ng/g wet wt.	ng/g wet wt.	ng/g wet wt.	ng/g wet wt.	ng/g wet wt.	ng/g wet wt.
Canadian Sites																
Fort Erie (FE)	00000500020203	203	3-AUG-2018	GL185143	0.75	2 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	2 <=W	2 <=W	1 <=W	5 <=W	2 <=W
FE	00000500020203	203	3-AUG-2018	GL185144	0.98	2 <=W	6 <T	1 <=W	1 <=W	1 <=W	1 <=W	2 <=W	2 <=W	1 <=W	5 <=W	2 <=W
FE	00000500020203	203	3-AUG-2018	GL185145	1.4	2 <=W	5 <T	1 <=W	1 <=W	1 <=W	1 <=W	2 <=W	2 <=W	1 <=W	5 <=W	2 <=W
FE (archive)			3-AUG-2018	GL185559	0.72	2 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	2 <=W	2 <=W	1 <=W	5 <=W	2 <=W
Niagara-on-the-Lake (NOTL)	00001100020009	9	31-JUL-2018	GL185056	0.47	2 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	2 <=W	2 <=W	1 <=W	5 <=W	2 <=W
NOTL	00001100020009	9	31-JUL-2018	GL185057	0.72	2 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	2 <=W	2 <=W	1 <=W	5 <=W	2 <=W
NOTL	00001100020009	9	31-JUL-2018	GL185058	0.64	2 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	2 <=W	2 <=W	1 <=W	5 <=W	2 <=W
NOTL (archive)			31-JUL-2018	GL185549	0.55	2 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	2 <=W	2 <=W	1 <=W	5 <=W	2 <=W
American sites																
2 Mile Ck (mouth)	00000500020197	197	31-JUL-2018	GL185062	0.52	2 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	2 <=W	2 <=W	1 <=W	5 <=W	2 <=W
2 Mile Ck (mouth)	00000500020197	197	31-JUL-2018	GL185063	0.5	2 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	2 <=W	2 <=W	1 <=W	5 <=W	2 <=W
2 Mile Ck (mouth)	00000500020197	197	31-JUL-2018	GL185064	0.85	2 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	2 <=W	2 <=W	1 <=W	5 <=W	2 <=W
2 Mile Ck (archive)			31-JUL-2018	GL185550	0.75	2 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	2 <=W	2 <=W	1 <=W	5 <=W	2 <=W
Rattlesnake Ck (culvert)	00000500150130	130	31-JUL-2018	GL185071	0.58	2 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	2 <=W	2 <=W	1 <=W	5 <=W	2 <=W
Rattlesnake Ck (culvert)	00000500150130	130	31-JUL-2018	GL185072	0.65	2 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	2 <=W	2 <=W	1 <=W	5 <=W	2 <=W
Rattlesnake Ck (culvert)	00000500150130	130	31-JUL-2018	GL185073	0.72	2 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	2 <=W	2 <=W	1 <=W	5 <=W	2 <=W
Rattlesnake Ck (culvert) (archive)			31-JUL-2018	GL185551	0.66	2 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	2 <=W	2 <=W	1 <=W	5 <=W	2 <=W
Pettit Flume (U/S)	00000500020185	185	31-JUL-2018	GL185074	0.54	2 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	2 <=W	2 <=W	1 <=W	5 <=W	2 <=W
Pettit Flume (U/S)	00000500020185	185	31-JUL-2018	GL185075	0.46	2 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	2 <=W	2 <=W	1 <=W	5 <=W	2 <=W
Pettit Flume (U/S)	00000500020185	185	31-JUL-2018	GL185076	0.57	2 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	2 <=W	2 <=W	1 <=W	5 <=W	2 <=W
Pettit Flume (U/S) (archive)			31-JUL-2018	GL185552	0.58	2 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	2 <=W	2 <=W	1 <=W	5 <=W	2 <=W
Pettit Flume (D/S)	00000500020187	187	31-JUL-2018	GL185078	0.54	2 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	2 <=W	2 <=W	1 <=W	5 <=W	2 <=W
Pettit Flume (D/S)	00000500020187	187	31-JUL-2018	GL185079	0.63	2 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	2 <=W	2 <=W	1 <=W	5 <=W	2 <=W
Pettit Flume (D/S)	00000500020187	187	31-JUL-2018	GL185080	0.57	2 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	2 <=W	2 <=W	1 <=W	5 <=W	2 <=W
Pettit Flume (D/S) (archive)			31-JUL-2018	GL185553	0.38	2 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	2 <=W	2 <=W	1 <=W	5 <=W	2 <=W
OCC 003	00000500020042	42	2-AUG-2018	GL185125	0.54	2 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	2 <=W	2 <=W	1 <=W	5 <=W	2 <=W
OCC 003	00000500020042	42	2-AUG-2018	GL185126	0.61	2 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	2 <=W	2 <=W	1 <=W	5 <=W	2 <=W
OCC 003	00000500020042	42	2-AUG-2018	GL185127	0.93	2 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	2 <=W	2 <=W	1 <=W	5 <=W	2 <=W
Gill Ck (mouth)	00000500020037	37	2-AUG-2018	GL185134	0.54	2 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	2 <=W	2 <=W	1 <=W	5 <=W	2 <=W
Gill Ck (mouth)	00000500020037	37	2-AUG-2018	GL185135	0.64	2 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	2 <=W	2 <=W	1 <=W	5 <=W	2 <=W
Gill Ck (mouth)	00000500020037	37	2-AUG-2018	GL185136	0.55	2 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	2 <=W	2 <=W	1 <=W	5 <=W	2 <=W
Gill Ck/Olin outfall (D/S)	00000500020229	229	2-AUG-2018	GL185140	0.1	2 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	2 <=W	2 <=W	1 <=W	5 <=W	2 <=W
Gill Ck/Olin outfall (D/S)	00000500020229	229	2-AUG-2018	GL185141	0.8	2 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	2 <=W	2 <=W	1 <=W	5 <=W	2 <=W
Gill Ck/Olin outfall (D/S)	00000500020229	229	2-AUG-2018	GL185142	0.64	2 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	2 <=W	2 <=W	1 <=W	5 <=W	2 <=W
Gill Ck/Olin outfall (D/S) (archive)			2-AUG-2018	GL185558	0.58	2 <=W	8 <T	1 <=W	1 <=W	1 <=W	1 <=W	2 <=W	2 <=W	1 <=W	5 <=W	2 <=W
BRC	00001100020017	17	2-AUG-2018	GL185113	0.55	2 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	2 <=W	2 <=W	1 <=W	5 <=W	2 <=W
BRC	00001100020017	17	2-AUG-2018	GL185114	0.45	2 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	2 <=W	2 <=W	1 <=W	5 <=W	2 <=W
BRC	00001100020017	17	2-AUG-2018	GL185115	0.98	2 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	2 <=W	2 <=W	1 <=W	5 <=W	2 <=W
BRC (archive)			2-AUG-2018	GL185555	0.57	2 <=W	9 <T	1 <=W	1 <=W	1 <=W	1 <=W	2 <=W	2 <=W	1 <=W	5 <=W	2 <=W
BRC (131)	00001100020131	131	2-AUG-2018	GL185117	0.58	2 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	2 <=W	2 <=W	1 <=W	5 <=W	2 <=W
BRC (131)	00001100020131	131	2-AUG-2018	GL185118	0.56	2 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	2 <=W	2 <=W	1 <=W	5 <=W	2 <=W
BRC (131)	00001100020131	131	2-AUG-2018	GL185119	0.66	2 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	2 <=W	2 <=W	1 <=W	5 <=W	2 <=W
BRC (7th_ 8th pole from S) (archive)			2-AUG-2018	GL185556	0.61	2 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	2 <=W	2 <=W	1 <=W	5 <=W	2 <=W
BRC (132)	00001100020132	132	2-AUG-2018	GL185121	0.7	2 <=W	3 <T	1 <=W	1 <=W	1 <=W	1 <=W	2 <=W	2 <=W	1 <=W	5 <=W	2 <=W
BRC (132)	00001100020132	132	2-AUG-2018	GL185122	0.56	2 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	2 <=W	2 <=W	1 <=W	5 <=W	2 <=W
BRC (132)	00001100020132	132	2-AUG-2018	GL185123	0.57	2 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	2 <=W	2 <=W	1 <=W	5 <=W	2 <=W
BRC (4th_5th pole) U/S stn 131 (archive)			2-AUG-2018	GL185557	0.55	2 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	2 <=W	2 <=W	1 <=W	5 <=W	2 <=W
BRC (D/S)	00001100020025	25	2-AUG-2018	GL185109	0.57	2 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	2 <=W	2 <=W	1 <=W	5 <=W	2 <=W
BRC (D/S)	00001100020025	25	2-AUG-2018	GL185110	0.6	2 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	2 <=W	2 <=W	1 <=W	5 <=W	2 <=W
BRC (D/S)	00001100020025	25	2-AUG-2018	GL185111	0.56	2 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	2 <=W	2 <=W	1 <=W	5 <=W	2 <=W
BRC (D/S) (archive)			2-AUG-2018	GL185554	0.35	2 <=W	3 <T	1 <=W	1 <=W	1 <=W	1 <=W	2 <=W	2 <=W	1 <=W	5 <=W	2 <=W
Balsam Lake Control	00001800010001	1	9-JUL-2018	GL185045	0.47	2 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	2 <=W	2 <=W	1 <=W	5 <=W	2 <=W
Balsam Lake Control	00001800010001	1	9-JUL-2018	GL185046	0.56	2 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	2 <=W	2 <=W	1 <=W	5 <=W	2 <=W
Balsam Lake Control	00001800010001	1	9-JUL-2018	GL185047	0.62	2 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	2 <=W	2 <=W	1 <=W	5 <=W	2 <=W
Balsam Lake Control	00001800010001	1	9-JUL-2018	GL185048	0.57	2 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	2 <=W	2 <=W	1 <=W	5 <=W	2 <=W
Balsam Lake Control	00001800010001	1	9-JUL-2018	GL185049	0.49	2 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	2 <=W	2 <=W	1 <=W	5 <=W	2 <=W
Travel Blank	00001800010001	1	13-JUL-2018	GL185053	0.64	2 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	2 <=W	2 <=W	1 <=W	5 <=W	2 <=W
Travel Blank	00001800010001	1	13-JUL-2018	GL185054	0.47	2 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	2 <=W	2 <=W	1 <=W	5 <=W	2 <=W
Travel Blank	00001800010001	1	13-JUL-2018	GL185055	0.56	2 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	2 <=W	2 <=W	1 <=W	5 <=W	2 <=W

Table 4:Tissue concentrations (ng/g wet wt.) of organic compounds in caged mussels, Niagara River, 2018. <W= no measurable response; <T= measurable trace amount;

PS1=PCB resembled mixture of Aroclor 1248,1254,1260; PS40= resemble Aroclor 1254 AND 1260; MCP= max poss. Conc'n due to chromatographic overlap

Station Description	op-DDT	Total PCB	Photomirex	pp-DDD	pp-DDE	pp-DDT	Toxaphene	Total Technical Chlordane	trans-nonachlor	Hexachloro-butadiene	1,2,3-trichlorobenzene	1,2,3,4-tetrachlorobenzene	1,2,3,5-tetrachlorobenzene
	ng/g wet wt.	ng/g wet wt.	ng/g wet wt.	ng/g wet wt.	ng/g wet wt.	ng/g wet wt.	ng/g wet wt.	ng/g wet wt.	ng/g wet wt.	ng/g wet wt.	ng/g wet wt.	ng/g wet wt.	ng/g wet wt.
Canadian Sites													
Fort Erie (FE)	5 <=W		4 <=W	5 <=W	1 <=W	5 <=W	50 <=W	2 <=W	2 <=W	1 <=W	2 <=W	1 <=W	1 <=W
FE	5 <=W		4 <=W	5 <=W	6 <T	5 <=W	50 <=W	2 <=W	2 <=W	1 <=W	2 <=W	1 <=W	1 <=W
FE	5 <=W		4 <=W	5 <=W	5 <T	5 <=W	50 <=W	2 <=W	2 <=W	1 <=W	2 <=W	1 <=W	1 <=W
FE (archive)	5 <=W		4 <=W	5 <=W	1 <=W	5 <=W	50 <=W	2 <=W	2 <=W	1 <=W	2 <=W	1 <=W	1 <=W
Niagara-on-the-Lake (NOTL)	5 <=W		4 <=W	5 <=W	1 <=W	5 <=W	50 <=W	2 <=W	2 <=W	1 <=W	2 <=W	1 <=W	1 <=W
NOTL	5 <=W		4 <=W	5 <=W	1 <=W	5 <=W	50 <=W	2 <=W	2 <=W	1 <=W	2 <=W	1 <=W	1 <=W
NOTL	5 <=W		4 <=W	5 <=W	1 <=W	5 <=W	50 <=W	2 <=W	2 <=W	1 <=W	2 <=W	1 <=W	1 <=W
NOTL (archive)	5 <=W	20 <=W	4 <=W	5 <=W	1 <=W	5 <=W	50 <=W	2 <=W	2 <=W	1 <=W	2 <=W	1 <=W	1 <=W
American sites													
2 Mile Ck (mouth)	5 <=W	100 <T	4 <=W	5 <=W	1 <=W	5 <=W	50 <=W	2 <=W	2 <=W	1 <=W	2 <=W	1 <=W	1 <=W
2 Mile Ck (mouth)	5 <=W	63 <T	4 <=W	5 <=W	1 <=W	5 <=W	50 <=W	2 <=W	2 <=W	1 <=W	2 <=W	1 <=W	1 <=W
2 Mile Ck (mouth)	5 <=W	130 <T	4 <=W	5 <=W	2 <T	5 <=W	50 <=W	2 <=W	2 <=W	1 <=W	2 <=W	1 <=W	1 <=W
2 Mile Ck (archive)	5 <=W	**110 P40**	4 <=W	5 <=W	1 <=W	5 <=W	50 <=W	2 <=W	2 <=W	1 <=W	2 <=W	1 <=W	1 <=W
Rattlesnake Ck (culvert)	5 <=W	27 <T	4 <=W	5 <=W	1 <=W	5 <=W	50 <=W	2 <=W	2 <=W	1 <=W	2 <=W	1 <=W	1 <=W
Rattlesnake Ck (culvert)	5 <=W	20 <=W	4 <=W	5 <=W	1 <=W	5 <=W	50 <=W	2 <=W	2 <=W	1 <=W	2 <=W	1 <=W	1 <=W
Rattlesnake Ck (culvert)	5 <=W	20 <=W	4 <=W	5 <=W	1 <=W	5 <=W	50 <=W	2 <=W	2 <=W	1 <=W	2 <=W	1 <=W	1 <=W
Rattlesnake Ck (culvert) (archive)	5 <=W	**30 P40**	4 <=W	5 <=W	1 <=W	5 <=W	50 <=W	2 <=W	2 <=W	1 <=W	2 <=W	1 <=W	1 <=W
Pettit Flume (U/S)	5 <=W		4 <=W	5 <=W	2 <T	5 <=W	50 <=W	2 <=W	2 <=W	1 <=W	2 <=W	1 <=W	1 <=W
Pettit Flume (U/S)	5 <=W		4 <=W	5 <=W	1 <=W	5 <=W	50 <=W	2 <=W	2 <=W	1 <=W	2 <=W	1 <=W	1 <=W
Pettit Flume (U/S)	5 <=W		4 <=W	5 <=W	1 <=W	5 <=W	50 <=W	2 <=W	2 <=W	1 <=W	2 <=W	1 <=W	1 <=W
Pettit Flume (U/S) (archive)	5 <=W		4 <=W	5 <=W	1 <=W	5 <=W	50 <=W	2 <=W	2 <=W	1 <=W	2 <=W	1 <=W	1 <=W
Pettit Flume (D/S)	5 <=W		4 <=W	5 <=W	1 <=W	5 <=W	50 <=W	2 <=W	2 <=W	1 <=W	2 <=W	1 <=W	1 <=W
Pettit Flume (D/S)	5 <=W		4 <=W	5 <=W	1 <=W	5 <=W	50 <=W	2 <=W	2 <=W	1 <=W	2 <=W	1 <=W	1 <=W
Pettit Flume (D/S)	5 <=W		4 <=W	5 <=W	1 <=W	5 <=W	50 <=W	2 <=W	2 <=W	1 <=W	2 <=W	1 <=W	1 <=W
Pettit Flume (D/S) (archive)	5 <=W		4 <=W	5 <=W	1 <=W	5 <=W	50 <=W	2 <=W	2 <=W	1 <=W	2 <=W	1 <=W	1 <=W
OCC 003	5 <=W		4 <=W	5 <=W	1 <=W	5 <=W	50 <=W	2 <=W	2 <=W	**11**	2 <=W	3 <T	1 <=W
OCC 003	5 <=W		4 <=W	5 <=W	1 <=W	5 <=W	50 <=W	2 <=W	2 <=W	**19**	2 <=W	4 <T	1 <=W
OCC 003	5 <=W		4 <=W	5 <=W	1 <=W	5 <=W	50 <=W	2 <=W	2 <=W	**25**	2 <=W	4 <T	1 <=W
Gill Ck (mouth)	5 <=W	20 <=W	4 <=W	5 <=W	1 <=W	5 <=W	50 <=W	2 <=W	2 <=W	6 <T	2 <=W	1 <=W	1 <=W
Gill Ck (mouth)	5 <=W	**22 P40**	4 <=W	5 <=W	1 <=W	5 <=W	50 <=W	2 <=W	2 <=W	8 <T	2 <=W	1 <=W	1 <=W
Gill Ck (mouth)	5 <=W	**26 P40**	4 <=W	5 <=W	1 <=W	5 <=W	50 <=W	2 <=W	2 <=W	8 <T	2 <=W	1 <=W	1 <=W
Gill Ck/Olin outfall (D/S)	5 <=W	20 <=W	4 <=W	5 <=W	1 <=W	5 <=W	50 <=W	2 <=W	2 <=W	2 <T	2 <=W	1 <=W	1 <=W
Gill Ck/Olin outfall (D/S)	5 <=W	20 <=W	4 <=W	5 <=W	1 <=W	5 <=W	50 <=W	2 <=W	2 <=W	2 <T	2 <=W	1 <=W	1 <=W
Gill Ck/Olin outfall (D/S)	5 <=W	20 <=W	4 <=W	5 <=W	1 <=W	5 <=W	50 <=W	2 <=W	2 <=W	2 <T	2 <=W	1 <=W	1 <=W
Gill Ck/Olin outfall (D/S) (archive)	5 <=W	20 <=W	4 <=W	5 <=W	8 <T	5 <=W	50 <=W	2 <=W	2 <=W	2 <T	2 <=W	1 <=W	1 <=W
BRC	5 <=W		4 <=W	5 <=W	1 <=W	5 <=W	50 <=W	2 <=W	2 <=W	1 <=W	2 <=W	1 <=W	1 <=W
BRC	5 <=W		4 <=W	5 <=W	1 <=W	5 <=W	50 <=W	2 <=W	2 <=W	1 <=W	2 <=W	1 <=W	1 <=W
BRC	5 <=W		4 <=W	5 <=W	2 <T	5 <=W	50 <=W	2 <=W	2 <=W	2 <T	2 <=W	2 <T	2 <T
BRC (archive)	5 <=W		4 <=W	5 <=W	9 <T	5 <=W	50 <=W	2 <=W	2 <=W	2 <T	2 <=W	1 <=W	1 <=W
BRC (131)	5 <=W		4 <=W	5 <=W	1 <=W	5 <=W	50 <=W	2 <=W	2 <=W	1 <=W	2 <=W	1 <=W	1 <=W
BRC (131)	5 <=W		4 <=W	5 <=W	1 <=W	5 <=W	50 <=W	2 <=W	2 <=W	1 <=W	2 <=W	1 <=W	1 <=W
BRC (131)	5 <=W		4 <=W	5 <=W	1 <=W	5 <=W	50 <=W	2 <=W	2 <=W	1 <=W	2 <=W	1 <=W	1 <=W
BRC (7th_ 8th pole from S) (archive)	5 <=W		4 <=W	5 <=W	2 <T	5 <=W	50 <=W	2 <=W	2 <=W	1 <=W	2 <=W	1 <=W	1 <=W
BRC (132)	5 <=W		4 <=W	5 <=W	3 <T	5 <=W	50 <=W	2 <=W	2 <=W	2 <T	2 <=W	1 <=W	1 <=W
BRC (132)	5 <=W		4 <=W	5 <=W	1 <=W	5 <=W	50 <=W	2 <=W	2 <=W	2 <T	2 <=W	1 <=W	2 <T
BRC (132)	5 <=W		4 <=W	5 <=W	1 <=W	5 <=W	50 <=W	2 <=W	2 <=W	2 <T	2 <=W	1 <=W	1 <=W
BRC (4th_5th pole) U/S stn 131 (archive)	5 <=W		4 <=W	5 <=W	1 <=W	5 <=W	50 <=W	2 <=W	2 <=W	2 <T	2 <=W	1 <=W	1 <=W
BRC (D/S)	5 <=W		4 <=W	5 <=W	1 <=W	5 <=W	50 <=W	2 <=W	2 <=W	1 <=W	2 <=W	1 <=W	1 <=W
BRC (D/S)	5 <=W		4 <=W	5 <=W	1 <=W	5 <=W	50 <=W	2 <=W	2 <=W	1 <=W	2 <=W	1 <=W	1 <=W
BRC (D/S)	5 <=W		4 <=W	5 <=W	1 <=W	5 <=W	50 <=W	2 <=W	2 <=W	1 <=W	2 <=W	1 <=W	1 <=W
BRC (D/S) (archive)	5 <=W		4 <=W	5 <=W	3 <T	5 <=W	50 <=W	2 <=W	2 <=W	1 <=W	2 <=W	1 <=W	1 <=W
Balsam Lake Control	5 <=W		4 <=W	5 <=W	1 <=W	5 <=W	50 <=W	2 <=W	2 <=W	1 <=W	2 <=W	1 <=W	1 <=W
Balsam Lake Control	5 <=W		4 <=W	5 <=W	1 <=W	5 <=W	50 <=W	2 <=W	2 <=W	1 <=W	2 <=W	1 <=W	1 <=W
Balsam Lake Control	5 <=W		4 <=W	5 <=W	1 <=W	5 <=W	50 <=W	2 <=W	2 <=W	1 <=W	2 <=W	1 <=W	1 <=W
Balsam Lake Control	5 <=W		4 <=W	5 <=W	1 <=W	5 <=W	50 <=W	2 <=W	2 <=W	1 <=W	2 <=W	1 <=W	1 <=W
Balsam Lake Control	5 <=W		4 <=W	5 <=W	1 <=W	5 <=W	50 <=W	2 <=W	2 <=W	1 <=W	2 <=W	1 <=W	1 <=W
Travel Blank	5 <=W	20 <=W	4 <=W	5 <=W	1 <=W	5 <=W	50 <=W	2 <=W	2 <=W	1 <=W	2 <=W	1 <=W	1 <=W
Travel Blank	5 <=W	20 <=W	4 <=W	5 <=W	1 <=W	5 <=W	50 <=W	2 <=W	2 <=W	1 <=W	2 <=W	1 <=W	1 <=W
Travel Blank	5 <=W	20 <=W	4 <=W	5 <=W	1 <=W	5 <=W	50 <=W	2 <=W	2 <=W	1 <=W	2 <=W	1 <=W	1 <=W

Table 4:Tissue concentrations (ng/g wet wt.) of organic compounds in caged mussels, Niagara River, 2018. <W= no measurable response; <T= measurable trace amount;

PS1=PCB resembled mixture of Aroclor 1248,1254,1260; PS40= resemble Aroclor 1254 AND 1260; MCP= max poss. Conc'n due to chromatographic overlap

Station Description	1,2,4-trichlorobenzene ng/g wet wt.	1,2,4,5-tetrachlorobenzene ng/g wet wt.	1,3,5-trichlorobenzene ng/g wet wt.	Hexachlorobenzene ng/g wet wt.	Hexachloroethane ng/g wet wt.	Octachlorostyrene ng/g wet wt.	Pentachlorobenzene ng/g wet wt.	2,3,6-trichlorotoluene ng/g wet wt.	2,4,5-trichlorotoluene ng/g wet wt.
Canadian Sites									
Fort Erie (FE)	2 <=W	1 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	2 <T	1 <=W
FE	2 <=W	1 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	1 <=W	1 <=W
FE	2 <=W	1 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	2 <T	1 <=W
FE (archive)	2 <=W	1 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	1 <=W	1 <=W
Niagara-on-the-Lake (NOTL)	2 <=W	1 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	1 <=W	1 <=W
NOTL	2 <=W	1 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	1 <=W	1 <=W
NOTL	2 <=W	1 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	1 <=W	1 <=W
NOTL (archive)	2 <=W	1 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	1 <=W	1 <=W
American sites									
2 Mile Ck (mouth)	2 <=W	1 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	1 <=W	1 <=W
2 Mile Ck (mouth)	2 <=W	1 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	1 <=W	1 <=W
2 Mile Ck (mouth)	2 <=W	1 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	1 <=W	1 <=W
2 Mile Ck (archive)	2 <=W	1 <=W	2 <=W	2 <T	1 <=W	1 <=W	1 <=W	1 <=W	1 <=W
Rattlesnake Ck (culvert)	2 <=W	1 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	1 <=W	1 <=W
Rattlesnake Ck (culvert)	2 <=W	1 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	1 <=W	1 <=W
Rattlesnake Ck (culvert)	2 <=W	1 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	2 <T	1 <=W
Rattlesnake Ck (culvert) (archive)	2 <=W	1 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	1 <=W	1 <=W
Pettit Flume (U/S)	2 <=W	1 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	1 <=W	1 <=W
Pettit Flume (U/S)	2 <=W	1 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	2 <T	1 <=W
Pettit Flume (U/S)	2 <=W	1 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	1 <=W	1 <=W
Pettit Flume (U/S) (archive)	2 <=W	1 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	1 <=W	1 <=W
Pettit Flume (D/S)	2 <=W	1 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	1 <=W	1 <=W
Pettit Flume (D/S)	2 <=W	1 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	1 <=W	1 <=W
Pettit Flume (D/S)	2 <=W	1 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	1 <=W	1 <=W
Pettit Flume (D/S) (archive)	2 <=W	1 <=W	2 <=W	3 <T	1 <=W	1 <=W	1 <=W	1 <=W	1 <=W
OCC 003	2 <=W	1 <=W	2 <=W	1 <=W	1 <=W	1 <=W	2 <T	5 <T	2 <T
OCC 003	3 <T	1 <=W	2 <=W	1 <=W	1 <=W	1 <=W	2 <T	5 <T	3 <T
OCC 003	3 <T	1 <=W	2 <=W	1 <=W	1 <=W	1 <=W	3 <T	6 <T	3 <T
Gill Ck (mouth)	2 <=W	1 <=W	2 <=W	5 <T	1 <=W	1 <=W	1 <=W	1 <=W	1 <=W
Gill Ck (mouth)	2 <=W	1 <=W	2 <=W	6 <T	1 <=W	1 <=W	1 <=W	2 <T	1 <=W
Gill Ck (mouth)	2 <=W	1 <=W	2 <=W	4 <T	1 <=W	1 <=W	1 <=W	2 <T	1 <=W
Gill Ck/Olin outfall (D/S)	2 <=W	1 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	2 <T	1 <=W
Gill Ck/Olin outfall (D/S)	2 <=W	1 <=W	2 <=W	2 <T	1 <=W	1 <=W	1 <=W	1 <=W	1 <=W
Gill Ck/Olin outfall (D/S)	2 <=W	1 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	2 <T	1 <=W
Gill Ck/Olin outfall (D/S) (archive)	2 <=W	1 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	1 <=W	1 <=W
BRC	2 <=W	1 <=W	2 <=W	**29**	1 <=W	1 <=W	**13**	1 <=W	1 <=W
BRC	2 <=W	1 <=W	2 <=W	**22**	1 <=W	2 <T	**10**	1 <=W	1 <=W
BRC	2 <=W	2 <T	2 <=W	**51**	1 <=W	2 <T	**33**	2 <T	2 <T
BRC (archive)	2 <=W	1 <=W	2 <=W	**16**	1 <=W	2 <T	5 <T	2 <T	2 <T
BRC (131)	2 <=W	1 <=W	2 <=W	7 <T	1 <=W	1 <=W	3 <T	1 <=W	1 <=W
BRC (131)	2 <=W	1 <=W	2 <=W	**15**	1 <=W	1 <=W	6 <T	1 <=W	1 <=W
BRC (131)	2 <=W	1 <=W	2 <=W	1 <=W	1 <=W	1 <=W	4 <T	1 <=W	1 <=W
BRC (7th_ 8th pole from S) (archive)	2 <=W	1 <=W	2 <=W	**12**	1 <=W	1 <=W	5 <T	1 <=W	1 <=W
BRC (132)	2 <=W	1 <=W	2 <=W	**36**	1 <=W	4 <T	**18**	2 <T	4 <T
BRC (132)	3 <T	2 <T	2 <=W	**28**	1 <=W	1 <=W	**14**	2 <T	6 <T
BRC (132)	2 <=W	1 <=W	2 <=W	**33**	1 <=W	2 <T	**18**	2 <T	4 <T
BRC (4th_5th pole) U/S stn 131 (archive)	2 <=W	1 <=W	2 <=W	**27**	1 <=W	2 <T	**15**	2 <T	4 <T
BRC (D/S)	2 <=W	1 <=W	2 <=W	**12**	1 <=W	1 <=W	5 <T	1 <=W	1 <=W
BRC (D/S)	2 <=W	1 <=W	2 <=W	**16**	1 <=W	1 <=W	7 <T	1 <=W	1 <=W
BRC (D/S)	2 <=W	1 <=W	2 <=W	**18**	1 <=W	1 <=W	7 <T	1 <=W	1 <=W
BRC (D/S) (archive)	2 <=W	1 <=W	2 <=W	**12**	1 <=W	1 <=W	6 <T	1 <=W	1 <=W
Balsam Lake Control	2 <=W	1 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	1 <=W	1 <=W
Balsam Lake Control	2 <=W	1 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	1 <=W	1 <=W
Balsam Lake Control	2 <=W	1 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	1 <=W	1 <=W
Balsam Lake Control	2 <=W	1 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	1 <=W	1 <=W
Balsam Lake Control	2 <=W	1 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	1 <=W	1 <=W
Travel Blank	2 <=W	1 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	1 <=W	1 <=W
Travel Blank	2 <=W	1 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	1 <=W	1 <=W
Travel Blank	2 <=W	1 <=W	2 <=W	1 <=W	1 <=W	1 <=W	1 <=W	1 <=W	1 <=W

Table 5: Congener specific PCB tissue concentrations (ng/g **dry** wt.) in caged mussels, Niagara River, 2018. <MDL= method detection limit
Total PCB concentrations are provided on a **dry** and **wet** wt basis.

Station Description	Station ID	Station Number	Collection Date	Samp No	LIPID	P1PCBT	P1PCBT	PCB018	PCB019		PCB022		PCB28/31	PCB033	PCB044	
					%	ng wet/g	ng dry/g	ng/g	ng/g		ng/g		ng/g	ng/g	ng/g	
Two Mile Creek (mouth)	500020197	197	31-JUL-2018	GL185065	2.9	23	250	6	1		2		17	2	11	
Two Mile Creek (mouth)	500020197	197	31-JUL-2018	GL185066	2.8	35	320	6	3		2		17	3	14	
Two Mile Creek (mouth)	500020197	197	31-JUL-2018	GL185067	3.4	30	310	6	2		2		18	3	13	
Rattlesnake Creek	500150038	38	31-JUL-2018	GL185068	3.9	14	170	9	2		1		23	3	13	
Rattlesnake Creek	500150038	38	31-JUL-2018	GL185069	2.7	18	150	10	3		2		19	4	11	
Rattlesnake Creek	500150038	38	31-JUL-2018	GL185070	3.7	17	180	10	2		2		20	4	13	
Tonawanda WWTP (U/S)	500020228	228	01-AUG-2018	GL185106	4.5	8	76	3	1		2		13	3	5	
Tonawanda WWTP (U/S)	500020228	228	01-AUG-2018	GL185107	4.1	8	73	4	1		2		14	4	4	
Tonawanda WWTP (U/S)	500020228	228	01-AUG-2018	GL185108	3.5	5	66	3	1		2		13	3	4	
Tonawanda WWTP (mid plant)	500020227	227	01-AUG-2018	GL185103	4.9	8	85	3	1		2		14	4	5	
Tonawanda WWTP (mid plant)	500020227	227	01-AUG-2018	GL185104	3.7	8	68	4	1		1		12	3	4	
Tonawanda WWTP (mid plant)	500020227	227	01-AUG-2018	GL185105	3.7	5	68	3	1		2		13	4	4	
Tonawanda WWTP (D/S)	500020226	226	01-AUG-2018	GL185100	4.6	12	110	3	2		2		12	3	5	
Tonawanda WWTP (D/S)	500020226	226	01-AUG-2018	GL185101	3.8	15	89	3	2		2		11	3	5	
Tonawanda WWTP (D/S)	500020226	226	01-AUG-2018	GL185102	4.2	9	94	4	1		2		14	3	5	
U/S GRP (Private Prop.)	500020225	225	01-AUG-2018	GL185097	4.2	306	2600	79	16		33		320	45	190	
U/S GRP (Private Prop.)	500020225	225	01-AUG-2018	GL185098	4.4	385	3200	91	18		42		390	57	230	
U/S GRP (Private Prop.)	500020225	225	01-AUG-2018	GL185099	4.1	407	3400	84	19		41		390	55	250	
GRP (U/S Marina)	500020213	213	01-AUG-2018	GL185094	2.7	61	630	19	5		8		75	12	42	
GRP (U/S Marina)	500020213	213	01-AUG-2018	GL185095	4.6	70	830	21	4		9		94	16	57	
GRP (U/S Marina)	500020213	213	01-AUG-2018	GL185096	3.2	75	620	19	4		8		78	13	41	
GRP (Marina)	500020122	122	01-AUG-2018	GL185091	3.6	48	400	13	3		5		52	8	25	
GRP (Marina)	500020122	122	01-AUG-2018	GL185092	3.2	37	300	11	2		4		40	6	17	
GRP (Marina)	500020122	122	01-AUG-2018	GL185093	4.1	52	440	12	3		5		53	8	26	
U/S GRP	500020031	31	01-AUG-2018	GL185088	3.3	23	180	8	2		3		27	4	11	
U/S GRP	500020031	31	01-AUG-2018	GL185089	4.4	14	160	8	1		2		25	4	11	
U/S GRP	500020031	31	01-AUG-2018	GL185090	3.9	20	180	8	2		2		28	4	12	
D/S GRP	500020199	199	01-AUG-2018	GL185085	2.6	14	110	6	1		1		16	2	7	
D/S GRP	500020199	199	01-AUG-2018	GL185086	3.7	14	120	7	1	<MDL	1	<MDL	21	3	8	
D/S GRP	500020199	199	01-AUG-2018	GL185087	3.3	14	150	8	1		2		26	4	10	
Cayuga Creek	500150031	31	31-JUL-2018	GL185082	3.7	17	140	4	1	<MDL	1	<MDL	13	2	6	
Cayuga Creek	500150031	31	31-JUL-2018	GL185083	3.5	18	130	5	1		1		12	2	6	
Cayuga Creek	500150031	31	31-JUL-2018	GL185084	3.7	17	150	4	2		2		13	2	6	
OCC (U/S)	500020097	97	02-AUG-2018	GL185131	3.9	9	100	4	3		2		14	4	5	
OCC (U/S)	500020097	97	02-AUG-2018	GL185132	4	9	94	3	2		2		14	5	1	<MDL
OCC (U/S)	500020097	97	02-AUG-2018	GL185133	5	5	94	4	1		2		13	3	6	
OCC 003	500020042	42	02-AUG-2018	GL185128	5.1	3	30	2	1		1		8	2	3	
OCC 003	500020042	42	02-AUG-2018	GL185129	2.9	2	32	3	1		1		10	3	3	
OCC 003	500020042	42	02-AUG-2018	GL185130	5.4	4	53	4	1		2		13	4	5	
Gill Creek (mouth)	500020037	37	02-AUG-2018	GL185137	4.4	12	130	4	1		2		15	4	8	
Gill Creek (mouth)	500020037	37	02-AUG-2018	GL185138	4.1	9	99	3	1		2		13	4	6	
Gill Creek (mouth)	500020037	37	02-AUG-2018	GL185139	5.2	13	130	3	1		2		13	4	7	
FE	500020203	203	03-AUG-2018	GL185146	4.1	1	17	1	1		1		6	1	1	<MDL
FE	500020203	203	03-AUG-2018	GL185147	5.1	4	39	2	1	<MDL	1		11	2	3	
FE	500020203	203	03-AUG-2018	GL185148	3.3	7	50	4	1		2		14	4	4	
NOTL	1100020009	9	31-JUL-2018	GL185059	2.5	8	77	7	2		1		16	2	5	
NOTL	1100020009	9	31-JUL-2018	GL185060	2.6	8	70	7	2		1		14	2	5	
NOTL	1100020009	9	31-JUL-2018	GL185061	3.8	6	67	6	1		2		13	2	4	
Balsam Lake (control)	1800010001	1	09-JUL-2018	GL185050	2.7	3	40	4	1		1		10	1	3	
Balsam Lake (control)	1800010001	1	09-JUL-2018	GL185051	2.5	4	45	4	2		1		12	2	4	
Balsam Lake (control)	1800010001	1	09-JUL-2018	GL185052	3.4	4	58	6	2		2		15	2	5	

Table 5: Congener specific PCB tissue concentrations (ng/g **dry** wt.) in caged mussels, Niagara River, 2018. <MDL= method detection limit

Station Description	PCB049	PCB052	PCB054		PCB070	PCB074		PCB087		PCB90/101		PCB095	PCB099		PCB104		PCB105		PCB110	
	ng/g	ng/g	ng/g		ng/g	ng/g		ng/g				ng/g	ng/g		ng/g		ng/g		ng/g	
Two Mile Creek (mouth)	14	21	1	<MDL	7	1	<MDL	10		17		16	10		1	<MDL	7		19	
Two Mile Creek (mouth)	18	27	1		10	1	<MDL	13		24		25	13		1	<MDL	9		27	
Two Mile Creek (mouth)	17	26	1	<MDL	9	1	<MDL	12		22		21	12		1	<MDL	8		23	
Rattlesnake Creek	16	25	1	<MDL	7	1	<MDL	5		9		12	6		1	<MDL	1		7	
Rattlesnake Creek	13	19	1	<MDL	6	1	<MDL	5		7		10	5		1	<MDL	3		8	
Rattlesnake Creek	15	24	2		7	1	<MDL	5		9		12	6		1	<MDL	3		10	
Tonawanda WWTP (U/S)	6	8	1	<MDL	4	1	<MDL	2		3		3	2		1	<MDL	2		8	
Tonawanda WWTP (U/S)	6	7	1	<MDL	3	1	<MDL	2		3		3	2		1	<MDL	2		7	
Tonawanda WWTP (U/S)	6	8	1	<MDL	3	1	<MDL	1		2		2	2		1	<MDL	1		6	
Tonawanda WWTP (mid plant)	7	9	1	<MDL	4	1	<MDL	2		4		3	2		1	<MDL	2		8	
Tonawanda WWTP (mid plant)	6	8	1		3	1	<MDL	2		2		3	2		1	<MDL	1		6	
Tonawanda WWTP (mid plant)	6	7	1	<MDL	3	1	<MDL	2		3		3	2		1	<MDL	2		6	
Tonawanda WWTP (D/S)	7	9	1	<MDL	4	1	<MDL	2		5		4	3		1	<MDL	2		9	
Tonawanda WWTP (D/S)	6	8	1	<MDL	3	1	<MDL	2		4		4	2		1	<MDL	2		8	
Tonawanda WWTP (D/S)	6	9	1	<MDL	4	1	<MDL	2		4		3	2		1	<MDL	2		7	
U/S GRP (Private Prop.)	250	320	1	<MDL	170	1	<MDL	84		130		150	90		1	<MDL	86		210	
U/S GRP (Private Prop.)	320	400	1	<MDL	210	1	<MDL	99		140		180	100		1	<MDL	100		250	
U/S GRP (Private Prop.)	340	430	1	<MDL	230	1	<MDL	110		150		230	110		1	<MDL	100		280	
GRP (U/S Marina)	56	65	1	<MDL	45	1	<MDL	21		32		29	22		1	<MDL	21		43	
GRP (U/S Marina)	73	87	1	<MDL	68	1	<MDL	28		43		42	29		1	<MDL	26		58	
GRP (U/S Marina)	55	64	1	<MDL	46	1	<MDL	20		30		28	21		1	<MDL	20		43	
GRP (Marina)	35	43	1	<MDL	26	1	<MDL	10		22		19	14		1	<MDL	7		23	
GRP (Marina)	24	30	1		19	1	<MDL	7		16		13	10		1	<MDL	6		17	
GRP (Marina)	36	45	1	<MDL	30	1	<MDL	11		24		21	16		1	<MDL	8		27	
U/S GRP	17	21	1	<MDL	10	1	<MDL	5		9		9	6		1	<MDL	4		13	
U/S GRP	15	18	1	<MDL	9	1	<MDL	5		8		7	5		1	<MDL	4		10	
U/S GRP	18	21	1	<MDL	11	1	<MDL	5		8		8	6		1	<MDL	5		12	
D/S GRP	10	14	1	<MDL	5	1	<MDL	3		5		5	3		1	<MDL	2		7	
D/S GRP	13	15	1	<MDL	7	1	<MDL	3		6		6	4		1	<MDL	2		6	
D/S GRP	14	18	1	<MDL	7	1	<MDL	3		6		6	4		1	<MDL	3		10	
Cayuga Creek	8	12	1	<MDL	5	1	<MDL	5		10		7	5		1	<MDL	4		9	
Cayuga Creek	8	12	1	<MDL	5	1	<MDL	5		9		8	5		1	<MDL	4		9	
Cayuga Creek	8	11	1	<MDL	5	1	<MDL	5		10		8	5		1	<MDL	4		10	
OCC (U/S)	9	11	1	<MDL	5	1	<MDL	2		5		4	3		1	<MDL	3		7	
OCC (U/S)	8	11	1	<MDL	4	1	<MDL	3		5		4	3		1	<MDL	2		7	
OCC (U/S)	7	9	1	<MDL	5	1	<MDL	2		4		4	3		1	<MDL	2		7	
OCC 003	4	5	1	<MDL	2	1	<MDL	1		1	<MDL	1	1		1	<MDL	1		1	
OCC 003	4	5	1	<MDL	2	1	<MDL	1		1		1	1	<MDL	1	<MDL	1		1	
OCC 003	6	7	1	<MDL	3	1	<MDL	1		2		2	1		1	<MDL	1		2	
Gill Creek (mouth)	11	14	1	<MDL	9	1	<MDL	4		7		6	5		1	<MDL	4		7	
Gill Creek (mouth)	8	11	1	<MDL	6	1	<MDL	3		5		4	4		1	<MDL	3		5	
Gill Creek (mouth)	9	12	1	<MDL	7	1	<MDL	4		7		6	5		1	<MDL	4		7	
FE	2	3	1	<MDL	1	1	<MDL	1	<MDL	1		1	1	<MDL	1	<MDL	1	<MDL	1	<MDL
FE	5	7	1	<MDL	2	1	<MDL	1		1		1	1		1	<MDL	1	<MDL	1	
FE	5	7	1	<MDL	2	1	<MDL	1		1	<MDL	2	1		1	<MDL	1		1	
NOTL	8	11	1	<MDL	3	1	<MDL	1		3		4	2		1	<MDL	1		2	
NOTL	7	10	1	<MDL	3	1	<MDL	1		2		3	2		1	<MDL	1		2	
NOTL	7	9	1	<MDL	2	1	<MDL	1		3		3	1		1	<MDL	1		2	
Balsam Lake (control)	5	7	1	<MDL	2	1	<MDL	1		1		2	1		1	<MDL	1		1	
Balsam Lake (control)	6	7	1	<MDL	2	1	<MDL	1		1		2	1		1	<MDL	1		1	
Balsam Lake (control)	7	10	1	<MDL	2	1	<MDL	1		2		3	1		1	<MDL	1		2	

Table 5: Congener specific PCB tissue concentrations (ng/g **dry** wt.) in caged mussels, Niagara River, 2018. <MDL= method detection limit

Station Description	PCB114		PCB118		PCB119		PCB123		PCB128		PCB138		PCB149		PCB151		PCB153		PCB155		PCB156	
	ng/g		ng/g		ng/g		ng/g		ng/g		ng/g		ng/g		ng/g		ng/g		ng/g		ng/g	
Two Mile Creek (mouth)	1	<MDL	11		1		1	<MDL	3		21		14		4		14		1	<MDL	1	
Two Mile Creek (mouth)	1	<MDL	14		1		1	<MDL	4		26		18		6		17		1	<MDL	2	
Two Mile Creek (mouth)	1	<MDL	14		1		1	<MDL	4		25		17		5		17		1	<MDL	2	
Rattlesnake Creek	1	<MDL	4		1	<MDL	1	<MDL	1	<MDL	8		6		2		5		1	<MDL	1	
Rattlesnake Creek	1	<MDL	3		1	<MDL	1	<MDL	1		6		5		2		4		1	<MDL	1	<MDL
Rattlesnake Creek	1	<MDL	4		1	<MDL	1	<MDL	1		8		6		2		5		1	<MDL	1	
Tonawanda WWTP (U/S)	1	<MDL	2		1	<MDL	1	<MDL	1	<MDL	3		2		1	<MDL	3		1	<MDL	1	<MDL
Tonawanda WWTP (U/S)	1	<MDL	2		1	<MDL	1	<MDL	1	<MDL	3		2		1	<MDL	2		1	<MDL	1	<MDL
Tonawanda WWTP (U/S)	1	<MDL	2		1	<MDL	1	<MDL	1	<MDL	2		2		1	<MDL	2		1	<MDL	1	<MDL
Tonawanda WWTP (mid plant)	1	<MDL	2		1	<MDL	1	<MDL	1	<MDL	3		2		1	<MDL	3		1	<MDL	1	<MDL
Tonawanda WWTP (mid plant)	1	<MDL	2		1	<MDL	1	<MDL	1	<MDL	3		2		1	<MDL	2		1	<MDL	1	<MDL
Tonawanda WWTP (mid plant)	1	<MDL	2		1	<MDL	1	<MDL	1	<MDL	3		2		1	<MDL	2		1	<MDL	1	<MDL
Tonawanda WWTP (D/S)	1	<MDL	4		1	<MDL	1	<MDL	1		7		5		2		5		1	<MDL	1	
Tonawanda WWTP (D/S)	1	<MDL	3		1	<MDL	1	<MDL	1		5		4		1		5		1	<MDL	1	<MDL
Tonawanda WWTP (D/S)	1	<MDL	3		1	<MDL	1	<MDL	1		5		4		1		5		1	<MDL	1	<MDL
U/S GRP (Private Prop.)	1	<MDL	130		7		1	<MDL	9		49		37		8		32		1	<MDL	4	
U/S GRP (Private Prop.)	1	<MDL	160		16		1	<MDL	10		57		44		12		37		1	<MDL	5	
U/S GRP (Private Prop.)	1	<MDL	150		9		25		10		57		47		13		36		1	<MDL	5	
GRP (U/S Marina)	1	<MDL	32		2		1	<MDL	3		15		12		5		10		1	<MDL	1	
GRP (U/S Marina)	1	<MDL	41		2		1	<MDL	3		18		14		6		13		1	<MDL	2	
GRP (U/S Marina)	1	<MDL	31		2		1	<MDL	2		14		11		5		10		1	<MDL	1	
GRP (Marina)	1	<MDL	16		1		1	<MDL	2		14		11		4		11		1	<MDL	1	
GRP (Marina)	1	<MDL	12		1		1	<MDL	2		11		9		3		9		1	<MDL	1	
GRP (Marina)	1	<MDL	18		1		1	<MDL	2		16		13		5		13		1	<MDL	1	
U/S GRP	1	<MDL	6		1	<MDL	1	<MDL	1		5		4		2		4		1	<MDL	1	<MDL
U/S GRP	1	<MDL	6		1	<MDL	1	<MDL	1		4		4		1		3		1	<MDL	1	
U/S GRP	1	<MDL	7		1	<MDL	1	<MDL	1		5		4		1		4		1	<MDL	1	
D/S GRP	1	<MDL	4		1	<MDL	1	<MDL	1	<MDL	3		3		1		3		1	<MDL	1	<MDL
D/S GRP	1	<MDL	5		1	<MDL	1	<MDL	1	<MDL	4		3		1		3		1	<MDL	1	
D/S GRP	1	<MDL	4		1	<MDL	1	<MDL	1		4		3		1		3		1	<MDL	1	<MDL
Cayuga Creek	1	<MDL	7		1	<MDL	1	<MDL	2		10		7		2		7		1	<MDL	1	
Cayuga Creek	1	<MDL	7		1	<MDL	1	<MDL	2		10		7		3		7		1	<MDL	1	
Cayuga Creek	1	<MDL	8		1	<MDL	1	<MDL	2		12		7		3		8		1	<MDL	1	
OCC (U/S)	1	<MDL	4		1	<MDL	1	<MDL	1		5		3		1		4		1	<MDL	1	<MDL
OCC (U/S)	1	<MDL	3		1	<MDL	1	<MDL	1		5		3		1		4		1	<MDL	1	<MDL
OCC (U/S)	1	<MDL	4		1	<MDL	1	<MDL	1	<MDL	5		3		1	<MDL	4		1	<MDL	1	<MDL
OCC 003	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL
OCC 003	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL
OCC 003	1	<MDL	1		1	<MDL	1	<MDL	1	<MDL	1		1		1	<MDL	1		1	<MDL	1	<MDL
Gill Creek (mouth)	1	<MDL	5		1	<MDL	1	<MDL	1		6		4		1		4		1	<MDL	1	
Gill Creek (mouth)	1	<MDL	4		1	<MDL	1	<MDL	1	<MDL	5		3		1	<MDL	4		1	<MDL	1	
Gill Creek (mouth)	1	<MDL	5		1	<MDL	1	<MDL	1		5		4		1		4		1	<MDL	1	
FE	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1		1	<MDL	1	<MDL	1		1	<MDL	1	<MDL
FE	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1		1		1	<MDL	1		1	<MDL	1	<MDL
FE	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1		1		1	<MDL	1		1	<MDL	1	<MDL
NOTL	1	<MDL	1		1	<MDL	1	<MDL	1	<MDL	2		1		1		2		1	<MDL	1	<MDL
NOTL	1	<MDL	1		1	<MDL	1	<MDL	1	<MDL	2		1		1		1		1	<MDL	1	<MDL
NOTL	1	<MDL	1		1	<MDL	1	<MDL	1	<MDL	2		1		1		2		1	<MDL	1	<MDL
Balsam Lake (control)	1	<MDL	1		1	<MDL	1	<MDL	1	<MDL	1		1		1	<MDL	1		1	<MDL	1	<MDL
Balsam Lake (control)	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1		1		1	<MDL	1		1	<MDL	1	<MDL
Balsam Lake (control)	1	<MDL	1		1	<MDL	1	<MDL	1	<MDL	1		1		1	<MDL	1		1	<MDL	1	<MDL

Table 5: Congener specific PCB tissue concentrations (ng/g **dry** wt.) in caged mussels, Niagara River, 2018. <MDL= method detection limit

Station Description	PCB157		PCB158		PCB167		PCB168		PCB170		PCB171		PCB177		PCB178		PCB180	PCB183	
	ng/g		ng/g		ng/g		ng/g		ng/g		ng/g		ng/g		ng/g		ng/g	ng/g	
Two Mile Creek (mouth)	1		2		1		1	<MDL	2		1	<MDL	2		1		6	1	
Two Mile Creek (mouth)	1		3		1		1	<MDL	2		1	<MDL	2		1		7	2	
Two Mile Creek (mouth)	1		3		1		1	<MDL	3		1	<MDL	2		1		8	2	
Rattlesnake Creek	1	<MDL	1		1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1		3	1	
Rattlesnake Creek	1	<MDL	1		1	<MDL	1	<MDL	1	<MDL	1	<MDL	1		1		2	1	<MDL
Rattlesnake Creek	1	<MDL	1		1	<MDL	1	<MDL	1		1	<MDL	1	<MDL	1		3	1	
Tonawanda WWTP (U/S)	1	<MDL	1		1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	2	1	<MDL
Tonawanda WWTP (U/S)	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	2	1	<MDL
Tonawanda WWTP (U/S)	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	2	1	<MDL
Tonawanda WWTP (mid plant)	1	<MDL	1		1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	2	1	<MDL
Tonawanda WWTP (mid plant)	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	2	1	<MDL
Tonawanda WWTP (mid plant)	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	2	1	<MDL
Tonawanda WWTP (D/S)	1	<MDL	1		1	<MDL	1	<MDL	1		1	<MDL	1		1		4	1	
Tonawanda WWTP (D/S)	1	<MDL	1		1	<MDL	1	<MDL	1	<MDL	1	<MDL	1		1	<MDL	4	1	<MDL
Tonawanda WWTP (D/S)	1	<MDL	1		1	<MDL	1	<MDL	1		1	<MDL	1		1		4	1	<MDL
U/S GRP (Private Prop.)	1		5		2		1	<MDL	5		1	<MDL	6		4		20	4	
U/S GRP (Private Prop.)	2		6		2		1	<MDL	5		1	<MDL	7		5		24	5	
U/S GRP (Private Prop.)	1		1	<MDL	2		1	<MDL	5		1	<MDL	8		5		22	5	
GRP (U/S Marina)	1		2		1		1	<MDL	2		1	<MDL	2		2		8	1	
GRP (U/S Marina)	1		2		1		1	<MDL	2		1	<MDL	3		2		10	2	
GRP (U/S Marina)	1		2		1	<MDL	1	<MDL	1		1	<MDL	2		2		8	2	
GRP (Marina)	1	<MDL	2		1		1	<MDL	2		1	<MDL	2		1		7	2	
GRP (Marina)	1	<MDL	1		1	<MDL	1	<MDL	1		1	<MDL	2		1		6	1	
GRP (Marina)	1		2		1		1	<MDL	2		1	<MDL	2		2		8	2	
U/S GRP	1	<MDL	1		1	<MDL	1	<MDL	1	<MDL	1	<MDL	1		1		3	1	<MDL
U/S GRP	1	<MDL	1		1	<MDL	1	<MDL	1	<MDL	1	<MDL	1		1		3	1	
U/S GRP	1	<MDL	1		1	<MDL	1	<MDL	1	<MDL	1	<MDL	1		1		3	1	
D/S GRP	1	<MDL	1		1	<MDL	1	<MDL	1	<MDL	1	<MDL	1		1	<MDL	2	1	<MDL
D/S GRP	1	<MDL	1		1	<MDL	1	<MDL	1		1	<MDL	1		1		3	1	
D/S GRP	1	<MDL	1		1	<MDL	1	<MDL	1	<MDL	1	<MDL	1		1		2	1	<MDL
Cayuga Creek	1	<MDL	1		1	<MDL	1	<MDL	1		1	<MDL	1		1		4	1	
Cayuga Creek	1	<MDL	1		1	<MDL	1	<MDL	1		1	<MDL	1	<MDL	1		4	1	
Cayuga Creek	1		2		1		1	<MDL	1		1	<MDL	1		1		4	1	
OCC (U/S)	1	<MDL	1		1	<MDL	1	<MDL	1	<MDL	1	<MDL	1		1		3	1	<MDL
OCC (U/S)	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1		1		3	1	<MDL
OCC (U/S)	1	<MDL	1		1	<MDL	1	<MDL	1	<MDL	1	<MDL	1		1		3	1	<MDL
OCC 003	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	1	<MDL
OCC 003	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	1	<MDL
OCC 003	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	1	<MDL
Gill Creek (mouth)	1	<MDL	1		1	<MDL	1	<MDL	1	<MDL	1	<MDL	1		1		3	1	<MDL
Gill Creek (mouth)	1	<MDL	1		1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1		2	1	<MDL
Gill Creek (mouth)	1		1		1		1	<MDL	1		1	<MDL	1		1		3	1	
FE	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	1	<MDL
FE	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	1	<MDL
FE	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	1	<MDL
NOTL	1	<MDL	1		1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	1	<MDL
NOTL	1	<MDL	1		1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1		1	1	<MDL
NOTL	1	<MDL	1		1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1		1	1	<MDL
Balsam Lake (control)	1	<MDL	1		1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	1	<MDL
Balsam Lake (control)	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	1	<MDL
Balsam Lake (control)	1	<MDL	1		1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	1	<MDL

Table 5: Congener specific PCB tissue concentrations (ng/g **dry** wt.) in caged mussels, Niagara River, 2018. <MDL= method detection limit

Station Description	PCB187		PCB188		PCB189		PCB191		PCB194		PCB199		PCB201		PCB202		PCB205		PCB206		PCB208	
	ng/g		ng/g		ng/g		ng/g		ng/g		ng/g		ng/g		ng/g		ng/g		ng/g		ng/g	
Two Mile Creek (mouth)	4		1	<MDL	1		1	<MDL	1		1		1	<MDL	1	<MDL	1	<MDL	1		1	
Two Mile Creek (mouth)	5		1	<MDL	1		1	<MDL	1		2		1	<MDL	1	<MDL	1	<MDL	1		1	
Two Mile Creek (mouth)	5		1	<MDL	1		1	<MDL	1		2		1	<MDL	1	<MDL	1	<MDL	1		1	
Rattlesnake Creek	1	<MDL	1	<MDL	1		1	<MDL	1	<MDL	1		1	<MDL	1	<MDL	1	<MDL	1		1	
Rattlesnake Creek	1		1	<MDL	1		1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL
Rattlesnake Creek	1		1	<MDL	1		1	<MDL	1	<MDL	1		1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL
Tonawanda WWTP (U/S)	1		1	<MDL	1	<MDL	1	<MDL	1	<MDL	1		1	<MDL	1	<MDL	1	<MDL	1		1	
Tonawanda WWTP (U/S)	1		1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1		1	<MDL
Tonawanda WWTP (U/S)	1		1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL
Tonawanda WWTP (mid plant)	1		1	<MDL	1	<MDL	1	<MDL	1	<MDL	1		1	<MDL	1	<MDL	1	<MDL	1		1	<MDL
Tonawanda WWTP (mid plant)	1		1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL
Tonawanda WWTP (mid plant)	1		1	<MDL	1	<MDL	1	<MDL	1	<MDL	1		1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL
Tonawanda WWTP (D/S)	3		1	<MDL	1		1	<MDL	1		1		1	<MDL	1	<MDL	1	<MDL	1		1	
Tonawanda WWTP (D/S)	2		1	<MDL	1	<MDL	1	<MDL	1	<MDL	1		1	<MDL	1	<MDL	1	<MDL	1		1	<MDL
Tonawanda WWTP (D/S)	2		1	<MDL	1	<MDL	1	<MDL	1		1		1	<MDL	1	<MDL	1	<MDL	1		1	<MDL
U/S GRP (Private Prop.)	18		1	<MDL	1		1		1	<MDL	10		1		2		1		3		1	
U/S GRP (Private Prop.)	20		1	<MDL	1		1	<MDL	6		11		1		2		1		3		2	
U/S GRP (Private Prop.)	21		1	<MDL	1		1		5		11		1		3		1		3		2	
GRP (U/S Marina)	7		1	<MDL	1		1	<MDL	2		4		1		1		1	<MDL	1		1	
GRP (U/S Marina)	8		1	<MDL	1		1	<MDL	2		5		1		1		1	<MDL	1		1	
GRP (U/S Marina)	7		1	<MDL	1		1	<MDL	2		4		1	<MDL	1		1	<MDL	1		1	
GRP (Marina)	5		1	<MDL	1		1		1		2		1		1		1	<MDL	1		1	
GRP (Marina)	4		1	<MDL	1		1		1		2		1		1	<MDL	1	<MDL	1		1	
GRP (Marina)	6		1	<MDL	1		1		1		3		2		1		1	<MDL	1		1	
U/S GRP	2		1	<MDL	1		1	<MDL	1		1		1	<MDL	1	<MDL	1	<MDL	1		1	
U/S GRP	2		1	<MDL	1		1	<MDL	1		1		1	<MDL	1	<MDL	1	<MDL	1		1	
U/S GRP	2		1	<MDL	1	<MDL	1	<MDL	1		1		1	<MDL	1	<MDL	1	<MDL	1		1	
D/S GRP	1		1	<MDL	1	<MDL	1	<MDL	1	<MDL	1		1	<MDL	1	<MDL	1	<MDL	1		1	
D/S GRP	2		1	<MDL	1		1	<MDL	1		1		1	<MDL	1	<MDL	1	<MDL	1		1	
D/S GRP	2		1	<MDL	1	<MDL	1	<MDL	1	<MDL	1		1	<MDL	1	<MDL	1	<MDL	1		1	
Cayuga Creek	2		1	<MDL	1		1	<MDL	1		1		1	<MDL	1	<MDL	1	<MDL	1		1	
Cayuga Creek	2		1	<MDL	1		1	<MDL	1	<MDL	1		1	<MDL	1	<MDL	1	<MDL	1		1	
Cayuga Creek	2		1	<MDL	1		1	<MDL	1		1		1	<MDL	1	<MDL	1	<MDL	1		1	
OCC (U/S)	2		1	<MDL	1	<MDL	1	<MDL	1	<MDL	1		1	<MDL	1	<MDL	1	<MDL	1		1	<MDL
OCC (U/S)	2		1	<MDL	1	<MDL	1	<MDL	1	<MDL	1		1	<MDL	1	<MDL	1	<MDL	1		1	<MDL
OCC (U/S)	2		1	<MDL	1	<MDL	1	<MDL	1	<MDL	1		1	<MDL	1	<MDL	1	<MDL	1		1	<MDL
OCC 003	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL
OCC 003	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL
OCC 003	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL
Gill Creek (mouth)	2		1	<MDL	1	<MDL	1	<MDL	1	<MDL	1		1	<MDL	1	<MDL	1	<MDL	1		1	<MDL
Gill Creek (mouth)	1		1	<MDL	1	<MDL	1	<MDL	1	<MDL	1		1	<MDL	1	<MDL	1	<MDL	1		1	<MDL
Gill Creek (mouth)	2		1	<MDL	1		1	<MDL	1		1		1	<MDL	1	<MDL	1	<MDL	1		1	
FE	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL
FE	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1		1	<MDL
FE	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL
NOTL	1		1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL
NOTL	1		1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL
NOTL	1		1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1		1	<MDL
Balsam Lake (control)	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL
Balsam Lake (control)	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL
Balsam Lake (control)	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	

Table 6: SPMD data for 2018 deployments, Niagara River. Concentrations represent ng/SPMD

CLIENT_ID	Robertson St., Fort Erie - GL185404 (Field Blank)			D/S Bloody Run Creek - GL185257 (Field Blank)			Occidental sewer 003 - GL185261 (Field Blank)			DAY ZERO			Balsam Lake (control) - GL185233		
Axys ID	L29833-40			L29833-25			L29833-30			L29631-1			L29833-1		
Method	SGS AXYS METHOD MLA-007 Rev 13			SGS AXYS METHOD MLA-007 Rev 13			SGS AXYS METHOD MLA-007 Rev 13			SGS AXYS METHOD MLA-007 Rev 13			SGS AXYS METHOD MLA-007 Rev 13		
WORKGROUP	WG65418			WG65417			WG65418			WG65416			WG65416		
Sample Size	1sample			1sample			1sample			1sample			1sample		
UNITS	flag	ng/sample	ng/sample (RL)	flag	ng/sample	ng/sample (RL)	flag	ng/sample	ng/sample (RL)	flag	ng/sample	ng/sample (RL)	flag	ng/sample	ng/sample (RL)
1,3-Dichlorobenzene	ND		1.07	ND		0.95	ND		0.646	ND		1.54	ND		0.686
1,4-Dichlorobenzene	J	1.61	1.12	NDR J	2.37	0.99	J	1.73	0.674	ND		1.61	J	1.1	0.715
1,2-Dichlorobenzene	ND		1.07	ND		0.948	ND		0.645	ND		1.54	ND		0.684
1,3,5-Trichlorobenzene	ND		1.37	ND		1.03	ND		0.912	ND		1.69	ND		0.857
1,2,4-Trichlorobenzene	ND		1.4	ND		1.06	ND		0.935	ND		1.74	ND		0.879
1,2,3-Trichlorobenzene	ND		1.45	ND		1.1	ND		0.97	ND		1.8	ND		0.912
1,2,4,5-/1,2,3,5-Tetrachlorobenzene	ND		0.301	ND		0.175	ND		0.312	ND		0.436	ND		0.198
1,2,3,4-Tetrachlorobenzene	ND		0.303	J	0.33	0.176	J	0.473	0.314	ND		0.439	ND		0.199
Hexachlorobutadiene	ND		0.303	ND		0.176	ND		0.314	ND		0.439	J	0.408	0.199
Pentachlorobenzene	ND		0.45	ND		0.501	ND		0.418	ND		0.508	ND		0.451
Hexachlorobenzene	ND		0.288	ND		0.181	ND		0.395	ND		0.249	NDR J	0.614	0.201
HCH, alpha	ND		1.48	ND		1.94	ND		2.09	ND		1.35	ND		1.06
HCH, beta	ND		1.39	ND		2.03	ND		2.18	ND		1.07	ND		1.42
HCH, gamma	ND		1.26	ND		1.93	ND		1.38	ND		1.06	ND		1.24
Heptachlor	ND		3.09	ND		1.08	ND		1.54	ND		1.41	ND		0.789
Aldrin	ND		0.874	ND		1.04	ND		1.23	ND		0.516	ND		1.4
Chlordane, gamma (trans)	ND		0.268	ND		0.457	ND		0.381	ND		0.313	J	0.504	0.378
Chlordane, alpha (cis)	ND		0.312	ND		0.532	ND		0.444	ND		0.365	J	0.606	0.44
Octachlorostyrene	ND		0.151	ND		0.497	ND		0.179	ND		0.321	ND		0.231
Chlordane, oxy-	ND		3.75	ND		4.62	ND		5.12	ND		2.27	ND		5.06
Nonachlor, trans-	ND		0.168	ND		0.246	ND		0.219	ND		0.147	NDR J	0.216	0.171
Nonachlor, cis-	ND		0.188	ND		0.276	ND		0.246	ND		0.165	ND		0.192
Mirex	ND		0.452	ND		0.499	ND		0.406	ND		0.342	ND		0.412
2,4'-DDE	ND		0.154	ND		0.174	ND		0.237	ND		0.202	ND		0.37
4,4'-DDE	NDR J	0.354	0.214	ND		0.242	ND		0.33	ND		0.281	J	1.45	0.515
2,4'-DDD	ND		0.203	ND		0.2	ND		0.153	ND		0.168	ND		0.478
4,4'-DDD	ND		0.186	ND		0.303	ND		0.375	ND		0.139	ND		0.409
2,4'-DDT	ND		0.192	ND		0.313	ND		0.387	ND		0.143	ND		0.422
4,4'-DDT	ND		0.211	ND		0.345	ND		0.426	ND		0.158	J	0.481	0.465
Hexachloroethane	ND		2.53	ND		1.61	ND		2.32	ND		2	ND		1.06
2,4,5-Trichlorotoluene	ND		0.948	ND		0.354	ND		1.46	ND		0.795	ND		1.51
2,3,6-Trichlorotoluene	ND		1.07	NDR	0.648	0.4	ND		1.64	ND		0.903	NDR	3.74	1.71
Photomirex	ND		0.492	ND		0.899	ND		0.481	ND		1.34	ND		0.857
HCH, delta	ND		0.295	ND		0.0419	ND		0.31	ND		0.41	ND		0.34
Heptachlor Epoxide	ND		0.289	ND		0.028	ND		0.126	ND		0.298	J Q	0.983	0.432
Dieldrin	ND		0.405	J	0.207	0.0441	ND		0.41	ND		0.3		1.68	0.501
Endrin	ND		0.45	ND		0.049	ND		0.456	ND		0.334	ND		0.556
Endrin Aldehyde	ND		0.732	ND		0.0797	ND		0.741	ND		0.543	ND		0.904
Endrin Ketone	ND		0.0266	ND		0.0144	ND		0.0854	ND		0.0593	ND		0.189
Methoxychlor	ND		0.0671	ND		0.0362	ND		0.215	ND		0.15	ND		0.476
alpha-Endosulphan	ND		0.396	ND		0.0714	ND		0.329	ND		0.248	ND		0.377
beta-Endosulphan	ND		0.435	ND		0.115	ND		0.441	ND		0.323	ND		0.538
Endosulphan Sulphate	ND		0.602	ND		0.0656	ND		0.609	ND		0.446	ND		0.743
Technical Toxaphene	ND		36.2	ND		57	ND		31.8	ND		41.7	ND		41.2

(RL) - Reporting Limit.
D - dilution data
J - concentration less than lowest calibration equivalen
ND- not detected at RL
NDR -peak detected but did not meet quantification criteria, result reported represents the estimated maximum possible concentration
NQ - data not quantifiable
T - result recalculated against alternate labeled compound(s) or internal standard
V - surrogate recovery is not within method/contract control limits

Table 6: SPMD data for 2018 deployments, Niagara River. Concentrations represent ng/SPMD

CLIENT_ID	Two Mile Creek (mouth) - GL185235 (1 OF 2)			Two Mile Creek (mouth) - GL185235 (2 OF 2)			Pettit Flume (upstream) - GL185237			Pettit Flume Cove (outer - site B) - GL185239			Pettit Flume (downstream) - GL185238			Fishermans Park (Upstream) - GL185254		
Axys ID	L29833-3			L29833-4			L29833-5 i			L29833-7			L29833-6			L29833-22		
Method	SGS AXYS METHOD MLA-007 Rev 13			SGS AXYS METHOD MLA-007 Rev 13			SGS AXYS METHOD MLA-007 Rev 13			SGS AXYS METHOD MLA-007 Rev 13			SGS AXYS METHOD MLA-007 Rev 13			SGS AXYS METHOD MLA-007 Rev 13		
WORKGROUP	WG65416			WG65416			WG65416			WG65416			WG65416			WG65417		
Sample Size	1sample			1sample			1sample			1sample			1sample			1sample		
UNITS	flag	ng/sample	ng/sample (RL)	flag	ng/sample	ng/sample (RL)	flag	ng/sample	ng/sample (RL)	flag	ng/sample	ng/sample (RL)	flag	ng/sample	ng/sample (RL)	flag	ng/sample	ng/sample (RL)
		2 Mile Ck(1)			2 Mile Ck(2)			PF U/S			PF			PF D/S			FP U/S	
1,3-Dichlorobenzene	J	3.07	1.43	ND		3.05	ND		1.92		896	2.73		4.87	1.42		4.37	2.32
1,4-Dichlorobenzene		11.3	1.49		9.57	3.18		3.26	2.01		1010	2.85		10.4	1.48		11	2.42
1,2-Dichlorobenzene	ND		1.43	ND		3.04	ND		1.92		613	2.73	J	1.83	1.41	ND		2.31
1,3,5-Trichlorobenzene	J	2.86	0.528	J	2.51	0.58	ND		0.965		392	1.3		7.41	0.869		5.43	1.08
1,2,4-Trichlorobenzene		20.9	0.541		21.1	0.595	J	1.73	0.989		346	1.33		6.22	0.891		6.69	1.1
1,2,3-Trichlorobenzene		7.54	0.562		6.87	0.617	NDR J	2	1.03		105	1.38	J	2.4	0.925	ND		1.15
1,2,4,5-/1,2,3,5-Tetrachlorobenzene	J	4.91	0.747	J	4.8	0.741	J	0.794	0.255		254	0.386		11.8	0.35	J	4.07	0.422
1,2,3,4-Tetrachlorobenzene		4.03	0.753		4.15	0.747	J	0.311	0.257		225	0.389		13.3	0.353	J	1.33	0.425
Hexachlorobutadiene	J	0.922	0.753	ND		0.747	J	0.517	0.257	J	2.76	0.389	ND		0.353	ND		0.425
Pentachlorobenzene		12.8	0.538		14.2	0.365	NDR J	1.26	0.307		211	0.217		28	0.144		4.95	0.299
Hexachlorobenzene		31.9	0.312		33.5	0.198	J	2.01	0.209		176	0.189		49.1	0.131		8.43	0.205
HCH, alpha	ND		5.87	ND		4.55	ND		2.25	ND		3.04	ND		1.69	ND		1.33
HCH, beta	ND		12.8	ND		17.2	ND		2.02	ND		9.47	ND		2.21	ND		1.8
HCH, gamma	ND		9.3	ND		4.94	ND		2.98	ND		5.54	ND		2.98	ND		1.79
Heptachlor	ND		3.57	ND		2.52	ND		1.99	ND		6.27	ND		1.61	ND		1.07
Aldrin	ND		4.89	ND		2.81	ND		0.917	ND		2.44	ND		1.72	ND		2.57
Chlordane, gamma (trans)		13.6	0.595		14	1.28	J	1.61	0.35		6.47	0.394	J	2.05	0.353	J	1.42	0.283
Chlordane, alpha (cis)		21	0.692		23.7	1.49	J	2.1	0.407		10.3	0.458	J	2.34	0.411	J	1.31	0.329
Octachlorostyrene	ND		0.5	ND		0.802	ND		0.221	ND		0.908	ND		0.374	ND		0.393
Chlordane, oxy-	ND		52.1	ND		18.2	ND		7.09	ND		26.2	ND		9.02	ND		4.28
Nonachlor, trans-		8.84	0.389		9.51	0.276	J	1.02	0.167	J	3.86	0.178	J	1.44	0.121	J	0.71	0.121
Nonachlor, cis-	J	2.33	0.437	J	2.23	0.31	J	0.433	0.187	J	0.955	0.2	J	0.302	0.136	J	0.208	0.136
Mirex	ND		11.1	ND		5.9	ND		1.05	ND		5.16	ND		2.09	ND		0.96
2,4'-DDE	ND		5.35	ND		3.68	ND		0.679	ND		2.01	ND		0.781	NDR J	0.77	0.199
4,4'-DDE		16.2	7.45		17	5.12		3.93	0.946		9.03	2.8		4.35	1.09	J	2.49	0.278
2,4'-DDD		15.8	2.81		18.5	3.7	J	1.88	1.54		4.88	2.13	ND		1.79	ND		0.755
4,4'-DDD	NDR	51.6	6.04		53.3	8.44	ND		2.94		18.9	3.26	J	2.91	2.18	J	1.64	1.56
2,4'-DDT	ND		6.23	ND		8.72	ND		3.03	ND		3.37	ND		2.26	NDR J	1.83	1.61
4,4'-DDT	ND		6.87	ND		9.6	ND		3.34	ND		3.71	ND		2.48	ND		1.77
Hexachloroethane	ND		2.12	ND		4.05	ND		0.994	ND		2.51	ND		1.74	ND		2.3
2,4,5-Trichlorotoluene	NDR	18	4.58	NDR	19.8	5.02	NDR	1.51	1.38	NDR	5.47	2.2	ND		2.39	NDR	1.93	1.14
2,3,6-Trichlorotoluene	NDR	43.4	5.2	NDR	50.1	5.7	NDR	2.4	1.57	NDR	14.7	2.5	NDR	3.56	2.72	NDR	4.9	1.29
Photomirex	ND		5.66	ND		4.84	ND		1.87	ND		4.11	ND		1.57	ND		1.6
HCH, delta	ND		0.715	ND		1.29	ND		0.484	ND		0.357	ND		0.669	J Q	0.199	0.0789
Heptachlor Epoxide		11.4	0.216		11	0.529	Q	1.42	0.832	J	0.755	0.537	Q	3.44	0.962	J Q	0.437	0.0747
Dieldrin		27.8	0.707		26.8	1.14		3.17	0.399		3.65	0.509		4.39	0.951		2.48	0.133
Endrin	ND		0.785	ND		1.27	ND		0.443	ND		0.565	ND		1.06	ND		0.208
Endrin Aldehyde	ND		1.28	ND		2.06	ND		0.72	ND		0.919	ND		1.72	ND		0.241
Endrin Ketone	ND		0.533	ND		0.548	ND		0.798	ND		0.271	ND		0.543	ND		0.057
Methoxychlor	ND		1.34	ND		1.44	ND		0.776	ND		0.684	ND		1.01	ND		0.144
alpha-Endosulphan	ND		0.585	ND		1.03	ND		0.34	ND		0.494	ND		0.735	ND		0.121
beta-Endosulphan	ND		0.76	ND		1.23	ND		0.428	ND		0.547	ND		1.02	ND		0.143
Endosulphan Sulphate	ND		1.99	ND		1.69	ND		0.592	J Q	0.923	0.756	ND		1.41	ND		0.198
Technical Toxaphene	ND		421	ND		330	ND		84.5	ND		269	ND		97.2	ND		122

Table 6: SPMD data for 2018 deployments, Niagara River. Concentrations represent ng/SPMD

CLIENT_ID	U/S N Tonawanda WWTP - GL18523			Tonawanda WWTP -D/S of outfall (1 of 2) - GL185251			Tonawanda WWTP -D/S of outfall (2 of 2) - GL185252			D/S of N Tonawanda WWTP - GL185250			Private property - U/S of GRP/Marina - GL185249			Gratwick Riverside Park - U/S of Marina (1 of 2) - GL185247			Gratwick Riverside Park - U/S of Marina (2 of 2) - GL185248		
Axys ID	L29833-21			L29833-19			L29833-20			L29833-18			L29833-17			L29833-15			L29833-16		
Method	SGS AXYS METHOD MLA-007 Rev 13			SGS AXYS METHOD MLA-007 Rev 13			SGS AXYS METHOD MLA-007 Rev 13			SGS AXYS METHOD MLA-007 Rev 13			SGS AXYS METHOD MLA-007 Rev 13			SGS AXYS METHOD MLA-007 Rev 13			SGS AXYS METHOD MLA-007 Rev 13		
WORKGROUP	WG65417			WG65417			WG65417			WG65417			WG65417			WG65417			WG65417		
Sample Size	1sample			1sample			1sample			1sample			1sample			1sample			1sample		
UNITS	flag	ng/sample	ng/sample (RL)	flag	ng/sample	ng/sample (RL)	flag	ng/sample	ng/sample (RL)	flag	ng/sample	ng/sample (RL)	flag	ng/sample	ng/sample (RL)	flag	ng/sample	ng/sample (RL)	flag	ng/sample	ng/sample (RL)
		WWTP U/S			WWTP D/S outfall (1)			WWTP D/S outfall (2)			WWTP D/S			Private Prop.			GRP U/S Marina (1)			GRP U/S Marina (2)	
1,3-Dichlorobenzene		3.06	1.3	J	2.18	1.76	ND		1.46		3.15	2.02	ND		2.31	NDR J	2.6	2.15	J	1.99	1.07
1,4-Dichlorobenzene		7.81	1.36		6.31	1.83		8.33	1.52		7.04	2.11		5.95	2.4		8.89	2.24		7.38	1.12
1,2-Dichlorobenzene	ND		1.3	ND		1.76	ND		1.46	ND		2.02	ND		2.3	ND		2.14	ND		1.07
1,3,5-Trichlorobenzene	J	2.64	1.5	J	2.4	0.828	NDR	3.29	0.747	J	2.83	0.768	J	2.2	0.896	J	2.33	1.57	J	2.21	0.597
1,2,4-Trichlorobenzene	J	2.29	1.54	J	2.65	0.849	J	2.63	0.766	J	2.81	0.787	J	1.81	0.919	J	2.7	1.61	J	2.47	0.612
1,2,3-Trichlorobenzene	ND		1.59	NDR J	0.97	0.881	ND		0.795	ND		0.817	ND		0.953	ND		1.67	ND		0.635
1,2,4,5-/1,2,3,5-Tetrachlorobenzene	NDR J	3.01	0.471	J	2.74	0.416	J	3.19	0.386	J	2.39	0.268	J	2.74	0.402	J	2.35	0.352	J	2.18	0.394
1,2,3,4-Tetrachlorobenzene	J	1.84	0.475	J	1.81	0.419	J	1.78	0.389	J	1.56	0.27	J	2.17	0.405	J	1.56	0.354	J	1.45	0.397
Hexachlorobutadiene	ND		0.475	ND		0.419	NDR J	0.468	0.389	ND		0.27	ND		0.405	ND		0.354	ND		0.397
Pentachlorobenzene		10.4	0.43		8.94	0.372		10.3	0.329		7.25	0.258		8.65	0.352		6.96	0.413		6.96	0.345
Hexachlorobenzene		24.4	0.29		22.9	0.277		24.2	0.298		16.8	0.136		16.4	0.225		20	0.278		16.3	0.288
HCH, alpha	ND		1.35	ND		0.932	ND		1.5	ND		0.99	ND		2.36	ND		0.918	ND		1.23
HCH, beta	ND		2.91	ND		1.34	ND		1.54	ND		1.25	ND		1.68	ND		1.46	ND		1.01
HCH, gamma	NDR J	4.7	1.89	NDR J	2.86	1.33	NDR J	3.21	1.91	NDR J	4.64	1.04	NDR J	6.12	1.43	NDR J	4.09	1.45	NDR	10.2	1.09
Heptachlor	ND		1.13	ND		0.672	ND		1.14	ND		0.691	ND		1.11	ND		1.2	NDR J	0.583	0.448
Aldrin	ND		2.04	ND		1.25	ND		1.95	ND		1.32	ND		1.05	ND		0.891	ND		0.784
Chlordane, gamma (trans)	J	2.41	0.525	J	1.6	0.558	J	1.32	0.563	J	3.03	0.302	J	1.39	0.341	J	1.43	0.284	J	1.4	0.581
Chlordane, alpha (cis)	J	2.95	0.611	J	2.01	0.649	J	1.87	0.655	J	3.46	0.351	J	2.13	0.396	J	1.89	0.331	J	1.8	0.676
Octachlorostyrene	ND		0.337	ND		0.386	ND		0.337	ND		0.3	ND		0.289	ND		0.271	ND		0.431
Chlordane, oxy-	ND		7.42	ND		5.8	ND		13.8	ND		6.26	ND		8.3	ND		8.04	ND		3.02
Nonachlor, trans-	J	1.7	0.31	J	1.27	0.161	J	1.19	0.141	J	1.91	0.102	J	0.997	0.109	J	1.06	0.144	J	1.06	0.231
Nonachlor, cis-	NDR J	0.453	0.349	J	0.379	0.181	NDR J	0.339	0.158	J	0.496	0.114	J	0.302	0.122	NDR J	0.321	0.161	J	0.333	0.26
Mirex	ND		1.98	ND		2.59	ND		1.85	ND		0.996	ND		2.12	ND		2.39	ND		1.37
2,4'-DDE	NDR J	1.31	0.682	NDR J	1.04	0.657	NDR J	1.19	0.323	NDR J	1.89	0.589	NDR J	1.6	0.545	NDR J	1.05	1	NDR J	1.17	0.733
4,4'-DDE		4.89	0.95		5.09	0.915		4.26	0.449		5.46	0.821		4.73	0.759		3.7	1.4	NDR	5.75	1.02
2,4'-DDD	NDR J	1.72	1.06	J	1.69	0.8	J	2.04	1	J	2.53	1.08	J	1.89	0.842	J	1.31	0.93	J	2.2	1.04
4,4'-DDD	J	2.93	2.33	J	3.05	0.909	NDR J	2.48	1.32		8.48	1.32	J	2.96	0.649	J	2.32	1.08	J	3.08	0.441
2,4'-DDT	NDR J	2.93	2.41	NDR J	2.46	0.938	NDR J	3.01	1.37	NDR	4.56	1.36	NDR	3.99	0.67	NDR J	2.86	1.12	NDR J	3.12	0.456
4,4'-DDT	ND		2.65	ND		1.03	ND		1.5	ND		1.5	ND		0.738	ND		1.23	J	0.857	0.502
Hexachloroethane	ND		2.11	ND		3.54	ND		2.88	ND		2.76	ND		2.59	ND		2.03	ND		1.78
2,4,5-Trichlorotoluene	NDR	1.91	1.23	NDR	1.49	1.38	NDR	1.44	1.09	NDR	1.96	0.817	NDR	2.96	1.81	NDR	1.92	1.08	ND		1.06
2,3,6-Trichlorotoluene	NDR	4.41	1.39	NDR	3.84	1.57	NDR	4.81	1.24	NDR	4.75	0.926	NDR	4.78	2.06	NDR	3.65	1.23	NDR	1.84	1.2
Photomirex	ND		2.22	ND		1.85	ND		3.54	ND		3.29	NDR	3.04	2.33	ND		2.19	ND		2.89
HCH, delta	J	0.223	0.106	J Q	0.123	0.082	J	0.147	0.0764	J Q	0.233	0.0619	J	0.195	0.144	J	0.211	0.179	J Q	0.121	0.0373
Heptachlor Epoxide	Q	1.65	0.116		2.09	0.14		2.21	0.0577	Q	1.76	0.0582		2.16	0.109		1.78	0.125		2	0.114
Dieldrin		6.46	0.0613		4.98	0.0979		5.61	0.0677		4.49	0.119		5.49	0.084		4.27	0.0726		4.36	0.0998
Endrin	J	0.124	0.0681	ND		0.109	ND		0.137	ND		0.132	ND		0.0933	J Q	0.136	0.125	ND		0.111
Endrin Aldehyde	ND		0.111	ND		0.177	ND		0.122	ND		0.215	ND		0.241	ND		0.131	ND		0.286
Endrin Ketone	J Q	0.372	0.0519	J Q	0.516	0.0401	J	0.889	0.041	J	0.679	0.0542	J	0.586	0.0413	J Q	0.308	0.0892	J Q	0.083	0.0366
Methoxychlor	ND		0.131	ND		0.101	ND		0.104	ND		0.286	ND		0.225	ND		0.225	ND		0.191
alpha-Endosulphan	J	0.065	0.0495	ND		0.194	ND		0.0955	ND		0.102	ND		0.0671	ND		0.0839	ND		0.162
beta-Endosulphan	ND		0.0659	ND		0.105	ND		0.0728	ND		0.128	ND		0.0903	ND		0.0781	ND		0.107
Endosulphan Sulphate	J Q	0.143	0.0911	ND		0.145	J Q	0.132	0.101	ND		0.176	ND		0.125	J Q	0.125	0.108	ND		0.148
Technical Toxaphene	ND		117	ND		151	ND		152	ND		90.9	ND		142	ND		88.1	ND		111

Table 6: SPMD data for 2018 deployments, Niagara River. Concentrations represent ng/SPMD

CLIENT_ID	U/S of Gratwick Riverside Park - In Marina - GL185246			U/S End of Gratwick Riverside Park - GL185245			D/S End of Gratwick Riverside Park - GL185244			102nd Street (upstream) - GL185240			Little Niagara River (102nd st, waste site) - GL185241		
Axys ID	L29833-14			L29833-13			L29833-12			L29833-8 i			L29833-9		
Method	SGS AXYS METHOD MLA-007 Rev 13			SGS AXYS METHOD MLA-007 Rev 13			SGS AXYS METHOD MLA-007 Rev 13			SGS AXYS METHOD MLA-007 Rev 13			SGS AXYS METHOD MLA-007 Rev 13		
WORKGROUP	WG65416			WG65416			WG65416			WG65416			WG65416		
Sample Size	1sample			1sample			1sample			1sample			1sample		
UNITS	flag	ng/sample	ng/sample (RL)	flag	ng/sample	ng/sample (RL)	flag	ng/sample	ng/sample (RL)	flag	ng/sample	ng/sample (RL)	flag	ng/sample	ng/sample (RL)
		GRP Marina			GRP U/S			GRP D/S			102 St. U/S			102 St D/S	
1,3-Dichlorobenzene		14.7	3.97	J	2.67	2.03		4.58	3.81		3.79	1.55		13.4	2.56
1,4-Dichlorobenzene		29.5	4.14		6.43	2.12	NDR	11	3.97		7.59	1.61		30.1	2.66
1,2-Dichlorobenzene	ND		3.96	ND		2.03	ND		3.8	ND		1.55	ND		2.55
1,3,5-Trichlorobenzene		12.2	1.41	J	2.76	1.64	J	2.09	1.2	J	2.63	1.21		18.1	2.03
1,2,4-Trichlorobenzene		13.5	1.44	J	2.72	1.68	J	2.67	1.23		3.3	1.24		46.4	2.08
1,2,3-Trichlorobenzene	NDR J	2.68	1.5	ND		1.74	ND		1.27	ND		1.29		7.48	2.16
1,2,4,5-/1,2,3,5-Tetrachlorobenzene		13.9	0.216	J	2.7	0.344	J	1.94	0.462		8.82	0.54		101	0.267
1,2,3,4-Tetrachlorobenzene		12.3	0.218	J	1.46	0.347	J	1.26	0.466	J	2.39	0.544		327	0.269
Hexachlorobutadiene	ND		0.218	J	0.424	0.347	ND		0.466	ND		0.544	ND		0.269
Pentachlorobenzene		16.5	0.314		9.56	0.397		5.08	0.619		6.38	0.235		298	0.238
Hexachlorobenzene		16.5	0.145		26.4	0.406		10.6	0.312		9.97	0.317		59.9	0.256
HCH, alpha	ND		1.68	ND		3.56	ND		3.55		6.33	2.71		8.36	3.18
HCH, beta	ND		4.27	ND		4.78	ND		2.71	ND		2.56	ND		2.55
HCH, gamma	ND		6.17	ND		3.27	ND		2.29	ND		2.19	ND		2.53
Heptachlor	ND		1.83	ND		2.34	ND		2	ND		2.16	ND		2.41
Aldrin	ND		6.99	ND		2.14	ND		2.2	ND		1.56	ND		1.47
Chlordane, gamma (trans)	J	2.88	0.335	J	1.87	0.475	J	1.37	0.45	J	2.07	0.354	J	2.81	0.272
Chlordane, alpha (cis)	J	3.65	0.39	J	2.18	0.552	J	2.02	0.523	J	2.77	0.412	J	3.26	0.316
Octachlorostyrene	ND		0.484	ND		0.305	ND		0.25	ND		0.225	ND		0.116
Chlordane, oxy-	ND		41.4	ND		16.9	ND		13.2	ND		14.9	ND		9.6
Nonachlor, trans-	J	1.55	0.197	J	1.33	0.181	J	1.16	0.285	J	1.56	0.31	J	1.76	0.195
Nonachlor, cis-	J	0.68	0.221	NDR J	0.278	0.203	ND		0.32	ND		0.349	J	0.481	0.219
Mirex	ND		8.88	ND		1.06	ND		2.24	ND		1.85	ND		1.8
2,4'-DDE	NDR	5.53	1.78	ND		1.1	ND		1.33	ND		0.854	ND		1.34
4,4'-DDE	NDR	9.99	2.49		4.02	1.53		4.68	1.85	J	3.07	1.19		5.45	1.86
2,4'-DDD	ND		4.17	ND		1.53	J	1.8	1.28	ND		1.56		7.26	1.44
4,4'-DDD		9.24	6.86	ND		2.67	J	3.37	2.93	J	2.88	1.52		21.2	1.54
2,4'-DDT	NDR	15.7	7.08	ND		2.76	ND		3.03	ND		1.57	J	1.68	1.59
4,4'-DDT	ND		7.8	ND		3.04	ND		3.34	ND		1.73	ND		1.75
Hexachloroethane	ND		1.43	ND		2.02	ND		2.4	ND		1.79	ND		1.76
2,4,5-Trichlorotoluene	NDR	18.4	1.84	NDR	2.25	1.82	ND		2.02	ND		1.56	NDR	2.97	0.941
2,3,6-Trichlorotoluene	NDR	36.7	2.1	NDR	4.59	2.08	NDR	5.41	2.3	NDR	3.98	1.78	NDR	3.61	1.07
Photomirex	ND		4.27	ND		1.48	ND		1.78	ND		1.49	ND		1.22
HCH, delta	ND		3.19	ND		0.637	ND		0.525	ND		0.462	J	0.769	0.368
Heptachlor Epoxide	ND		0.873	Q	1.72	0.797	Q	2.13	0.54	Q	1.54	0.933	Q	1.63	0.287
Dieldrin		3.64	0.552		4.76	0.355		5.15	0.819		4.49	0.672		4.52	0.794
Endrin	ND		0.613	ND		0.395	ND		0.91	ND		0.747	ND		0.882
Endrin Aldehyde	ND		0.997	ND		0.642	ND		1.48	ND		1.21	ND		1.43
Endrin Ketone	ND		0.323	J Q	0.526	0.372	J Q	0.733	0.541	J Q	0.923	0.603	J Q	0.672	0.516
Methoxychlor	ND		0.813	ND		0.941	ND		0.474	ND		0.553	ND		0.475
alpha-Endosulphan	ND		0.486	ND		0.45	ND		0.744	ND		0.576	ND		0.686
beta-Endosulphan	ND		0.593	ND		0.382	ND		0.88	ND		0.722	ND		0.853
Endosulphan Sulphate	ND		0.82	ND		0.528	ND		1.22	ND		0.998	ND		1.18
Technical Toxaphene	ND		113	ND		141	ND		160	ND		127	ND		72.2

Table 6: SPMD data for 2018 deployments, Niagara River. Concentrations represent ng/SPMD

CLIENT_ID	Cayuga Creek - GL185242 (1 OF 2)			Cayuga Creek - GL185243 (2 OF 2)			Upstream Occidental sewer 003 - GL185263			Occidental sewer 003 - GL185260 (1 of 2)		
Axys ID	L29833-10			L29833-11			L29833-31			L29833-28		
Method	SGS AXYS METHOD MLA-007 Rev 13			SGS AXYS METHOD MLA-007 Rev 13			SGS AXYS METHOD MLA-007 Rev 13			SGS AXYS METHOD MLA-007 Rev 13		
WORKGROUP	WG65416			WG65416			WG65418			WG65417		
Sample Size	1sample			1sample			1sample			1sample		
UNITS	flag	ng/sample	ng/sample (RL)	flag	ng/sample	ng/sample (RL)	flag	ng/sample	ng/sample (RL)	flag	ng/sample	ng/sample (RL)
		Cayuga Ck (1)			Cayuga Ck (2)			Occ U/S			Occ 003 (1)	
1,3-Dichlorobenzene		5.82	0.535		6.25	2.68	J	1.53	0.941		68.2	12.4
1,4-Dichlorobenzene		17.1	0.557		15.1	2.79		3.23	0.981		56.5	12.9
1,2-Dichlorobenzene	J	2.78	0.534		4.9	2.67	ND		0.939	ND		12.4
1,3,5-Trichlorobenzene		10.3	1.31		8.21	0.763	J	2.49	1.43		37	1.96
1,2,4-Trichlorobenzene		29.8	1.34		22.7	0.782	J	1.85	1.47		431	2.01
1,2,3-Trichlorobenzene	J	2.66	1.39	NDR J	2.11	0.812	ND		1.52		71.2	2.09
1,2,4,5-/1,2,3,5-Tetrachlorobenzene		43.7	0.247		35.5	0.428	J	4.43	1.1		263	0.682
1,2,3,4-Tetrachlorobenzene		46.5	0.249		42.2	0.432		7.41	1.11		1190	0.687
Hexachlorobutadiene	J	1.51	0.249	J	0.79	0.432	ND		1.11		1770	0.687
Pentachlorobenzene		45.4	0.404		42.3	0.144		13.3	0.418		559	0.239
Hexachlorobenzene		21.8	0.454		19.5	0.13		10.8	0.296	D	568	0.703
HCH, alpha		383	4.68		392	2.6		10.5	2.43		11	1.86
HCH, beta		121	8.39		112	4.78	ND		2.75	NDR J	5.33	1.86
HCH, gamma		23.9	3.64		22.3	2.13	ND		2.08	J	3.4	1.6
Heptachlor	ND		1.94	ND		1.19	ND		3.31	ND		1.65
Aldrin	ND		2.76	ND		0.96	ND		1.11	ND		1.7
Chlordane, gamma (trans)	J	5.61	0.516	J	4.36	0.39	J	2.1	0.588	J	1.99	0.275
Chlordane, alpha (cis)		7.89	0.6		7.61	0.454	J	2.57	0.684	J	3.28	0.32
Octachlorostyrene	NDR J	0.449	0.405	ND		0.278	ND		0.451		20.1	0.465
Chlordane, oxy-	ND		23.2	ND		16.3	ND		15.5	ND		3.22
Nonachlor, trans-	J	4.17	0.184	J	3.65	0.142	J	1.47	0.353	J	2.02	0.132
Nonachlor, cis-	J	1.13	0.206	J	0.956	0.159	ND		0.397	J	0.539	0.149
Mirex	ND		6.07	ND		4.39	ND		3.82		34.6	1.38
2,4'-DDE	NDR	3.6	1.26	NDR	3.06	2.32	NDR J	0.902	0.647	NDR J	1.01	0.28
4,4'-DDE	NDR J	1.94	1.75		15.9	3.23		3.33	0.902	NDR	5.47	0.39
2,4'-DDD		8.83	2.59		7.52	2.72	ND		1.74	J	2.62	0.709
4,4'-DDD	NDR	44.8	3.89		33.6	4.76		3.79	3.26		4.31	0.784
2,4'-DDT	NDR	4.94	4.02	ND		4.91	ND		3.36	NDR J	3.27	0.809
4,4'-DDT	ND		4.42	ND		5.41	ND		3.71	NDR J	1.1	0.891
Hexachloroethane	ND		1.05	ND		2.33	ND		2.71		3470	4.86
2,4,5-Trichlorotoluene		11.8	6.89	NDR	11.6	2.06	ND		3.31		774	38.9
2,3,6-Trichlorotoluene	NDR	16.1	7.84	NDR	19.5	2.35	ND		3.72		1310	43.8
Photomirex	ND		4.34	ND		2.38	ND		1.86	ND		2.17
HCH, delta		49.4	1.02		66.7	1.26	ND		0.849	J Q	0.479	0.258
Heptachlor Epoxide		3.41	0.608		3.24	0.879	Q	1.5	0.965		1.98	0.304
Dieldrin		4.56	0.86		4.7	0.773		4.41	1.13		6.68	0.25
Endrin	ND		0.955	ND		0.858	ND		1.25	ND		0.278
Endrin Aldehyde	ND		1.55	ND		1.4	ND		2.04	ND		0.452
Endrin Ketone	ND		0.413	ND		0.661	J Q	0.93	0.39		1.93	0.174
Methoxychlor	ND		1.04	ND		1.67	ND		0.87	ND		0.44
alpha-Endosulphan	ND		0.87	ND		0.711	ND		1.1	ND		0.215
beta-Endosulphan	ND		0.924	ND		0.83	ND		1.21	ND		0.269
Endosulphan Sulphate	ND		1.28	ND		1.15	ND		1.68	ND		0.237
Technical Toxaphene	ND		156	ND		81.2	ND		115	ND		70.4

CLIENT_ID	Occidental sewer 003 - GL185260 (2 of 2)			Gill Creek Mouth - GL185264 (1 of 2)			Gill Creek Mouth - GL185265 (2 of 2)		
Axys ID	L29833-29			L29833-32			L29833-33		
Method	SGS AXYS METHOD MLA-007 Rev 13			SGS AXYS METHOD MLA-007 Rev 13			SGS AXYS METHOD MLA-007 Rev 13		
WORKGROUP	WG65418			WG65418			WG65418		
Sample Size	1sample			1sample			1sample		
UNITS	flag	ng/sample	ng/sample (RL)	flag	ng/sample	ng/sample (RL)	flag	ng/sample	ng/sample (RL)
		Occ 003 (2)			Gill Ck (1)			Gill Ck (2)	
1,3-Dichlorobenzene		60	0.872		39.2	1.08		38.6	0.549
1,4-Dichlorobenzene		49	0.909		66.6	1.12		65.1	0.572
1,2-Dichlorobenzene		4.83	0.87		42.7	1.08		46	0.548
1,3,5-Trichlorobenzene	T	44.3	1.59	T	8.38	1.22	T	9	1.96
1,2,4-Trichlorobenzene	T	505	1.62	T	215	1.25	T	227	2.01
1,2,3-Trichlorobenzene	T	90	1.68	T	65.3	1.3	T	60.2	2.09
1,2,4,5-/1,2,3,5-Tetrachlorobenzene		304	0.779		52	0.371		51.2	0.228
1,2,3,4-Tetrachlorobenzene	D	1620	1.25		27.4	0.374		27.6	0.23
Hexachlorobutadiene	D	2560	1.25		708	0.374		776	0.23
Pentachlorobenzene	D	733	0.949		57.7	0.418		53.7	0.308
Hexachlorobenzene	D	574	0.979		41.9	0.196		40.9	0.179
HCH, alpha		9.81	1.65		209	1.06		240	1.79
HCH, beta		7.38	2		25.8	1.48		28.9	2.48
HCH, gamma	ND		2.41		24	2.09		26.8	2.26
Heptachlor	ND		2.24	ND		1.43	ND		2.05
Aldrin		14.4	2.1	ND		1.14	ND		1.24
Chlordane, gamma (trans)	J	1.79	0.346	J	0.912	0.346	J	1.02	0.284
Chlordane, alpha (cis)	J	3.11	0.403	J	1.24	0.402	J	1.28	0.33
Octachlorostyrene		16	0.261	J	1.16	0.153	J	1.21	0.614
Chlordane, oxy-	ND		7.86	NDR	14.9	5.79	ND		9.52
Nonachlor, trans-	J	1.95	0.211	J	0.818	0.291	J	0.858	0.24
Nonachlor, cis-	J	0.503	0.238	ND		0.327	J	0.289	0.27
Mirex		33.7	1.99	ND		1.67	ND		1.34
2,4'-DDE	ND		1.06	ND		0.847	ND		0.682
4,4'-DDE		5.57	1.47		3.18	1.18	J	2.89	0.95
2,4'-DDD	J	1.61	1.17	ND		0.7	ND		1.17
4,4'-DDD		4.12	1.91	NDR J	1.86	0.882	J	2.02	0.862
2,4'-DDT	NDR J	3.13	1.97	ND		0.91	ND		0.89
4,4'-DDT	ND		2.17	ND		1	ND		0.981
Hexachloroethane		2510	4.49		353	2.76		328	1.47
2,4,5-Trichlorotoluene		689	2.19	ND		1.81	ND		11.1
2,3,6-Trichlorotoluene		1090	2.45	ND		2.03	ND		12.5
Photomirex	ND		2.72	ND		1.02	ND		0.756
HCH, delta	ND		0.669		10.5	1.02		10	0.399
Heptachlor Epoxide		2.32	0.62	Q	1.78	0.589	Q	1.69	0.536
Dieldrin		4.77	0.613		5.52	0.667		5.97	0.477
Endrin	ND		0.681	ND		0.741	ND		0.53
Endrin Aldehyde	ND		1.11	ND		1.21	ND		0.861
Endrin Ketone		1.48	0.483	ND		0.262	J Q	0.266	0.262
Methoxychlor	ND		1.22	ND		1.19	ND		0.373
alpha-Endosulphan	ND		0.588	ND		0.642	ND		0.417
beta-Endosulphan	ND		0.659	ND		0.717	ND		0.512
Endosulphan Sulphate	ND		0.911	ND		0.991	ND		0.708
Technical Toxaphene	ND		102	ND		72.3	ND		70.6

Table 6: SPMD data for 2018 deployments, Niagara River. Concentrations represent ng/SPMD

CLIENT_ID	D/S Gill Creek and Gill Outfall - GL185266			Bloody Run Creek - GL185258 (1 of 2)			Bloody Run Creek - GL185258 (2 of 2)			D/S Bloody Run Creek - GL185255 (1 of 2)			D/S Bloody Run Creek - GL185255 (2 of 2)		
Axys ID	L29833-34			L29833-26			L29833-27			L29833-23			L29833-24		
Method	SGS AXYS METHOD MLA-007 Rev 13			SGS AXYS METHOD MLA-007 Rev 13			SGS AXYS METHOD MLA-007 Rev 13			SGS AXYS METHOD MLA-007 Rev 13			SGS AXYS METHOD MLA-007 Rev 13		
WORKGROUP	WG65418			WG65417			WG65417			WG65417			WG65417		
Sample Size	1sample			1sample			1sample			1sample			1sample		
UNITS	flag	ng/sample	ng/sample (RL)	flag	ng/sample	ng/sample (RL)	flag	ng/sample	ng/sample (RL)	flag	ng/sample	ng/sample (RL)	flag	ng/sample	ng/sample (RL)
		Gill Ck D/S			BRC (1)			BRC (2)			BRC D/S (1)			BRC D/S (2)	
1,3-Dichlorobenzene		6.39	0.815	J	2.36	1.92	J	2.11	1.78	ND		1.86	ND		3.19
1,4-Dichlorobenzene		12.6	0.849	J	2.23	2	NDR J	1.92	1.86	NDR J	2.1	1.94	NDR	3.47	3.32
1,2-Dichlorobenzene		5.66	0.813	ND		1.92	ND		1.78	ND		1.86	ND		3.18
1,3,5-Trichlorobenzene	J T	2.23	1.46		31.1	0.723		34.3	1.1		5.27	1.47		5.76	2.18
1,2,4-Trichlorobenzene	T	40.9	1.5		14.2	0.742		15	1.13		10.5	1.51		11.2	2.23
1,2,3-Trichlorobenzene	T	12.6	1.55	NDR J	2	0.77	J	2.76	1.18		3.31	1.57		4.25	2.32
1,2,4,5-/1,2,3,5-Tetrachlorobenzene		14.6	0.412		62.6	0.24		67.1	0.228		72.7	0.454		76.1	0.475
1,2,3,4-Tetrachlorobenzene		7.47	0.415		47.8	0.242		50.3	0.23		79.1	0.458		85.4	0.479
Hexachlorobutadiene		186	0.415		69.7	0.242		79.2	0.23		55.7	0.458		60.6	0.479
Pentachlorobenzene		14.7	0.46		488	0.272		513	0.364	D	688	1.5		677	0.736
Hexachlorobenzene		13.1	0.254	D	566	0.923	D	614	1.03	D	770	0.78		750	0.378
HCH, alpha		39	2.35	J	2.18	1.24	J	2.03	1.5	ND		1.49	J	1.67	1
HCH, beta	NDR J	5.67	1.26	ND		2.17	ND		0.988	ND		1.1	ND		1.42
HCH, gamma	J	5.54	1.49	NDR	9.7	2.25	NDR	8.5	1.54	NDR J	5.48	1.47	NDR	8.39	1.95
Heptachlor	ND		1.75	ND		1.13	ND		1.47	ND		1.12	ND		2.14
Aldrin	ND		1.4	NDR J	1.65	1.13	NDR J	1.98	1.52	NDR J	2.1	1.58	NDR J	2.74	1.23
Chlordane, gamma (trans)	J	1.53	0.38	J	0.734	0.51	NDR J	0.636	0.351	NDR J	0.549	0.267	J	0.615	0.441
Chlordane, alpha (cis)	J	1.68	0.442	NDR J	1.09	0.593	J	0.867	0.408	J	1.02	0.311	J	1.52	0.513
Octachlorostyrene	ND		0.572		4.39	0.317		4.34	0.293		3.5	0.278		3.69	0.581
Chlordane, oxy-	ND		11.2	ND		4.34	ND		3.78	NDR	7.26	2.91	ND		4.15
Nonachlor, trans-	J	1.12	0.339	NDR J	0.56	0.158	J	0.797	0.128	NDR J	0.642	0.209	J	0.746	0.181
Nonachlor, cis-	ND		0.381	NDR J	0.216	0.178	J	0.204	0.144	NDR J	0.242	0.235	NDR J	0.309	0.204
Mirex	ND		1.03		8.65	0.999		6.78	0.766		3.43	0.892		3.8	0.865
2,4'-DDE	ND		0.688	ND		0.353	ND		0.349	NDR J	0.281	0.247	ND		0.513
4,4'-DDE	J	2.14	0.958		3.05	0.491		3.04	0.486	J	2.73	0.343		3.31	0.714
2,4'-DDD	ND		0.715	ND		0.557	ND		0.438	J	0.433	0.346	NDR J	0.379	0.364
4,4'-DDD	J	1.23	0.746	J	1.35	0.586	J	1.02	0.879	J	1.35	0.475	J	1.35	0.713
2,4'-DDT	ND		0.77	ND		0.605	ND		0.907	J	0.737	0.49	NDR J	0.964	0.736
4,4'-DDT	ND		0.848	J	0.931	0.667	J	1.01	0.999	J	1.36	0.54	J	1.62	0.811
Hexachloroethane		62.1	2.73	ND		2.87	ND		1.2	ND		1.97	ND		4.36
2,4,5-Trichlorotoluene	ND		7.36		134	1.84		138	1.24		71.9	1.03		80.1	2.99
2,3,6-Trichlorotoluene	ND		8.27		167	2.07		174	1.4		149	1.17		159	3.37
Photomirex	ND		0.772	ND		0.82	ND		0.706	ND		0.574	ND		0.941
HCH, delta		1.99	0.496	Q	3.34	0.17	Q	1.75	0.273		2.3	0.141		1.99	0.0612
Heptachlor Epoxide	Q	2.01	0.472	Q	1.3	0.112	Q	1.32	0.253	Q	1.31	0.0926	Q	1.44	0.196
Dieldrin		5.75	0.405		4.42	0.125		4.8	0.252		4.27	0.161		5.58	0.125
Endrin	ND		0.45	J	0.7	0.139	J	0.752	0.28	J Q	0.643	0.179	J	0.647	0.139
Endrin Aldehyde	ND		0.731	ND		0.227	ND		0.455	ND		0.291	ND		0.227
Endrin Ketone	ND		0.236	J Q	0.238	0.0802	J Q	0.242	0.0478	J Q	0.216	0.0511	J Q	0.196	0.0613
Methoxychlor	ND		0.174	ND		0.0808	ND		0.0825	ND		0.136	ND		0.111
alpha-Endosulphan	ND		0.353		1.79	0.126	J Q	1.23	0.256	J	0.534	0.174	J Q	0.401	0.268
beta-Endosulphan	ND		0.435	J	0.8	0.135	ND		0.365	ND		0.294	J	0.438	0.135
Endosulphan Sulphate	ND		0.601	ND		0.802	J Q	0.694	0.457	J Q	0.637	0.368	J	1.01	0.186
Technical Toxaphene	ND		110	ND		137	ND		135	ND		77.3	ND		113

Table 6: SPMD data for 2018 deployments, Niagara River. Concentrations represent ng/SPMD

CLIENT_ID	Thunder Bay, Lake Erie - GL185267			Adelade St., Fort Erie - GL185268			Queen St., Fort Erie - GL185401			Gilmore Rd., Fort Erie - GL185402			Robertson St., Fort Erie - GL185403		
Axys ID	L29833-35			L29833-36			L29833-37			L29833-38			L29833-39		
Method	SGS AXYS METHOD MLA-007 Rev 13			SGS AXYS METHOD MLA-007 Rev 13			SGS AXYS METHOD MLA-007 Rev 13			SGS AXYS METHOD MLA-007 Rev 13			SGS AXYS METHOD MLA-007 Rev 13		
WORKGROUP	WG65418			WG65418			WG65418			WG65418			WG65418		
Sample Size	1sample			1sample			1sample			1sample			1sample		
UNITS	flag	ng/sample	ng/sample (RL)	flag	ng/sample	ng/sample (RL)	flag	ng/sample	ng/sample (RL)	flag	ng/sample	ng/sample (RL)	flag	ng/sample	ng/sample (RL)
		Tbay			Adelaide St.			Queen St.			Gilmore Rd.			Robertson St.	
1,3-Dichlorobenzene	ND		1.74	ND		1.99	ND		1.03	ND		1.5	ND		1.06
1,4-Dichlorobenzene	ND		1.81	ND		2.07	J	1.84	1.07	NDR J	2.63	1.57	J	1.95	1.11
1,2-Dichlorobenzene	ND		1.73	ND		1.98	ND		1.03	NDR J	2.08	1.5	ND		1.06
1,3,5-Trichlorobenzene	ND		1.21	ND		0.91	ND		1.19	ND		1.68	ND		1.12
1,2,4-Trichlorobenzene	ND		1.24	ND		0.933	ND		1.22	ND		1.72	ND		1.15
1,2,3-Trichlorobenzene	ND		1.29	ND		0.968	ND		1.26	ND		1.78	ND		1.19
1,2,4,5-/1,2,3,5-Tetrachlorobenzene	ND		0.544	ND		0.534	ND		0.404	ND		0.604	ND		0.584
1,2,3,4-Tetrachlorobenzene	ND		0.548	ND		0.538	ND		0.407	ND		0.608	ND		0.588
Hexachlorobutadiene	ND		0.548	ND		0.538	ND		0.407	ND		0.608	ND		0.588
Pentachlorobenzene	NDR J	0.513	0.473	NDR J	0.837	0.529	NDR J	1.35	0.425	J	0.877	0.458	NDR J	0.944	0.37
Hexachlorobenzene	J	1.92	0.327	J	2.95	0.567	J	2.7	0.235	J	1.94	0.261	J	2.42	0.397
HCH, alpha	ND		1.98	ND		1.95	ND		2.51	ND		0.882	ND		3.84
HCH, beta	ND		2.26	ND		3.15	ND		1.87	ND		0.796	ND		3.85
HCH, gamma	ND		1.86	ND		2.56	ND		2.77	ND		1.44	ND		4.51
Heptachlor	ND		2.32	ND		2.13	ND		1.54	ND		1.35	ND		3.51
Aldrin	ND		1.45	ND		1.49	ND		1.53	ND		1.33	ND		2.43
Chlordane, gamma (trans)	NDR J	0.975	0.367	J	1.16	0.332	J	1.56	0.451	J	1.18	0.344	J	0.814	0.378
Chlordane, alpha (cis)	J	1.13	0.427	J	1.38	0.386	J	1.53	0.524	J	1.5	0.4	J	1.22	0.44
Octachlorostyrene	ND		0.349	ND		0.555	ND		0.178	ND		0.31	ND		0.276
Chlordane, oxy-	ND		15.8	ND		8.75	ND		5.29	ND		7.63	ND		8.08
Nonachlor, trans-	J	0.8	0.231	J	1.07	0.403	NDR J	0.814	0.211	NDR J	0.641	0.216	NDR J	0.733	0.247
Nonachlor, cis-	ND		0.26	ND		0.453	ND		0.237	ND		0.243	J	0.295	0.277
Mirex	ND		0.792	ND		0.981	ND		1.18	ND		1.28	ND		0.758
2,4'-DDE	ND		0.31	ND		0.489	ND		0.576	ND		0.471	ND		0.65
4,4'-DDE	J	1.74	0.432	J	2.8	0.681		6.66	0.802		5.49	0.655		8.84	0.906
2,4'-DDD	ND		0.459	ND		0.502	ND		0.693	ND		0.845	ND		0.771
4,4'-DDD	J	1.33	0.479	J	1.51	1.08	NDR J	1.92	1.06		4.52	0.821		3.55	1.02
2,4'-DDT	ND		0.494	ND		1.11	ND		1.1	ND		0.847	ND		1.06
4,4'-DDT	J	0.67	0.545	ND		1.22	J	1.81	1.21	J	1.55	0.933	ND		1.16
Hexachloroethane	ND		1.32	ND		3.45	ND		2.18	ND		4.16	ND		2.08
2,4,5-Trichlorotoluene	ND		1.28	ND		1.28	ND		1.36	ND		2.79	ND		0.919
2,3,6-Trichlorotoluene	ND		1.44	ND		1.44	ND		1.53	ND		3.15	ND		1.04
Photomirex	ND		1.23	ND		0.575	ND		0.89	ND		1.53	ND		0.916
HCH, delta	ND		0.788	ND		0.63	ND		0.632	ND		0.693	ND		0.665
Heptachlor Epoxide	Q	1.35	0.528	J Q	1.21	0.521	Q	1.32	0.838	Q	1.83	0.683	Q	1.77	1.39
Dieldrin		5.19	0.87		4.77	0.417		5.5	0.869		5.15	0.425		5.73	0.336
Endrin	ND		0.967	ND		0.463	ND		0.965	ND		0.473	ND		0.373
Endrin Aldehyde	ND		1.57	ND		0.753	ND		1.57	ND		0.769	ND		0.607
Endrin Ketone	ND		0.283	J	0.389	0.172	J Q	0.479	0.133	J Q	0.332	0.262	ND		0.2
Methoxychlor	ND		0.34	J	1.05	0.435	ND		0.312	ND		0.414	ND		0.367
alpha-Endosulphan	ND		0.771	ND		0.425	ND		0.834	ND		0.429	ND		0.316
beta-Endosulphan	ND		0.935	ND		0.448	ND		0.933	ND		0.457	ND		0.963
Endosulphan Sulphate	ND		1.29	ND		0.619	ND		1.29	ND		0.632	ND		0.499
Technical Toxaphene	ND		80.7	ND		88.6	ND		59.2	ND		45.2	ND		83.6

Table 6: SPMD data for 2018 deployments, Niagara River. Concentrations represent ng/SPMD

CLIENT_ID	Anger Ave., Fort Erie - GL185405			Switch Rd., Fort Erie - GL185406			Niagara on the Lake - GL185234		
Axys ID	L29833-41			L29833-42			L29833-2		
Method	SGS AXYS METHOD MLA-007 Rev 13			SGS AXYS METHOD MLA-007 Rev 13			SGS AXYS METHOD MLA-007 Rev 13		
WORKGROUP	WG65418			WG65418			WG65416		
Sample Size	1sample			1sample			1sample		
UNITS	flag	ng/sample	ng/sample (RL)	flag	ng/sample	ng/sample (RL)	flag	ng/sample	ng/sample (RL)
		Anger Ave.			Switch Rd.			NOTL	
1,3-Dichlorobenzene	ND		2.03	ND		1.27	ND		2.96
1,4-Dichlorobenzene	ND		2.11	ND		1.32	ND		3.08
1,2-Dichlorobenzene	ND		2.02	ND		1.26	ND		2.95
1,3,5-Trichlorobenzene	ND		1.82	ND		0.813	NDR J	1.41	0.802
1,2,4-Trichlorobenzene	ND		1.87	ND		0.833		3.15	0.822
1,2,3-Trichlorobenzene	ND		1.94	ND		0.865	ND		0.853
1,2,4,5-/1,2,3,5-Tetrachlorobenzene	ND		0.549	ND		0.528	J	3.72	0.433
1,2,3,4-Tetrachlorobenzene	ND		0.553	ND		0.531		11.8	0.436
Hexachlorobutadiene	ND		0.553	ND		0.531	J	2.39	0.436
Pentachlorobenzene	NDR J	0.926	0.434	J	0.908	0.59		11.6	0.304
Hexachlorobenzene	J	1.99	0.322	NDR J	1.65	0.287		18.2	0.329
HCH, alpha	ND		1.78	ND		1.06	ND		1.76
HCH, beta	ND		2.37	ND		2.57	ND		2.11
HCH, gamma	ND		2.09	ND		2.97	ND		2.17
Heptachlor	ND		1.49	ND		2.07	ND		0.924
Aldrin	ND		2.06	ND		1.68	ND		2.74
Chlordane, gamma (trans)	J	1.56	0.445	J	1.13	0.424	J	2.25	0.359
Chlordane, alpha (cis)	J	1.61	0.518	J	1.3	0.493	J	1.79	0.418
Octachlorostyrene	ND		0.455	ND		0.236	ND		0.587
Chlordane, oxy-	ND		5.79	ND		6.13	ND		8.37
Nonachlor, trans-	J	1.39	0.24	NDR J	0.662	0.226	J	1.92	0.16
Nonachlor, cis-	J	0.394	0.27	ND		0.254	J	0.555	0.179
Mirex	ND		1.16	ND		1.25	ND		1.3
2,4'-DDE	ND		0.79	ND		0.549	ND		0.383
4,4'-DDE		112	1.1		9.41	0.765		4.84	0.533
2,4'-DDD	J	2.2	0.414	J	0.817	0.381	ND		0.488
4,4'-DDD		14.9	0.524		3.79	0.369	J	1.47	0.864
2,4'-DDT	J	1.58	0.541	NDR J	0.805	0.381	ND		0.892
4,4'-DDT		14.7	0.596	J	0.857	0.419	J	1.27	0.982
Hexachloroethane	ND		3.44	ND		2.78	ND		1.89
2,4,5-Trichlorotoluene	NDR	7.19	1.87	ND		1.99	ND		1.85
2,3,6-Trichlorotoluene	NDR	3.91	2.11	ND		2.24	ND		2.1
Photomirex	ND		1.2	ND		1.05	ND		1.24
HCH, delta	ND		1.19	ND		1.01	ND		0.562
Heptachlor Epoxide	Q	1.54	0.565	ND		1.12	Q	1.54	0.249
Dieldrin		5.72	0.934		4.19	0.794		4.18	0.416
Endrin	ND		1.04	ND		0.882	ND		0.462
Endrin Aldehyde	ND		1.69	ND		1.44	ND		0.751
Endrin Ketone	ND		0.344	ND		0.192	J Q	0.224	0.0997
Methoxychlor	ND		0.713	ND		0.421	ND		0.41
alpha-Endosulphan	ND		0.868	ND		0.826	ND		0.338
beta-Endosulphan	ND		1	ND		0.853	ND		0.447
Endosulphan Sulphate	ND		1.39	ND		1.18	ND		0.617
Technical Toxaphene	ND		102	ND		81.7	ND		75

Table 7: PCB homologue data for SPMDs deployed in the Niagara River, 2018 (ng/SPMD). Individual congener data can be obtained on request.

Station ID	OCC Sewer (Blank)	BRC (D/S) (Blank)	Roebertson St. (FE) (Blank)	DAY ZERO	Balsam Lake	Two Mile Ck (1 OF 2)	Two Mile Ck (2 OF 2)	Pettit Flume (U/S)	Pettit Flume Cove	Pettit Flume (D/S)
Axys ID	L29833-30	L29833-25	L29833-40	L29631-1	L29833-1	L29833-3	L29833-4	L29833-5 i	L29833-7 NK	L29833-6
WORKGROUP	WG65418	WG65417	WG65418	WG65416	WG65416	WG65416	WG65416	WG65416	WG65416	WG65416
UNITS	ng/sample	ng/sample	ng/sample	ng/sample	ng/sample	ng/sample	ng/sample	ng/sample	ng/sample	ng/sample
Total Monochloro Biphenyls								1.54	9170	88.2
Total Dichloro Biphenyls						65.4	68	39.2	1079.9	56.1
Total Trichloro Biphenyls		1.5	1.7	1.6	2.4	157.6	162.6	88.8	8.3	66.6
Total Tetrachloro Biphenyls			0.8	0	3.6	590.1	603.3	84.9	21.5	62.8
Total Pentachloro Biphenyls					0.781	386	392	29.6	21	19.6
Total Hexachloro Biphenyls						137	140	6.22	30	6.94
Total Heptachloro Biphenyls						22.4	24	1.57	9.24	1.47
Total Octachloro Biphenyls							0.897			
Total Nonachloro Biphenyls										
Decachloro Biphenyl										
Total PCB (sum of congeners)					**9**	**1437**	**1442**	**264**	**10355**	**316**
PCB-14 (PRC)	32.2	32	31.9	32.2	24.2	28	28.1	26.4	30.1	25.9
PCB-29 (PRC)	25.9	25.8	25.7	26.5	23.1	25.4	24.4	25.2	24.9	22.5
PCB-50 (PRC)	18.6	18.4	17.8	18.1	16.1	18.9	19.7	18.1	19.5	16.1

Station ID	Fishermans Park (U/S)	Tonawanda WWTP (U/S)	Tonawanda WWTP (mid-plant) (1 of 2)	Tonawanda WWTP (mid-plant) (2 of 2)	Tonawanda WWTP (D/S)	U/S Marina (Private property)	U/S of GRP Marina (1 of 2)	U/S of GRP Marina (2 of 2)
Axys ID	L29833-22 L	L29833-21	L29833-19	L29833-20	L29833-18 i	L29833-17	L29833-15	L29833-16
WORKGROUP	WG65417	WG65417	WG65417	WG65417	WG65417	WG65417	WG65417	WG65417
UNITS	ng/sample	ng/sample	ng/sample	ng/sample	ng/sample	ng/sample	ng/sample	ng/sample
Total Monochloro Biphenyls	7.69	14.1	14.1	13.9	18.9	73	37.4	40.2
Total Dichloro Biphenyls	13.8	40.8	38.2	36.1	55.4	2346.9	645.1	705
Total Trichloro Biphenyls	39.1	128.8	98.2	109.5	99.9	11177.6	2816.5	3027.6
Total Tetrachloro Biphenyls	46.2	133.1	110.8	119.9	118.6	19168.4	5029.6	5689.6
Total Pentachloro Biphenyls	14.7	35.2	35.2	39.9	39.9	4350	1090	1330
Total Hexachloro Biphenyls	5.19	10.8	10.2	12.3	17.9	396	137	157
Total Heptachloro Biphenyls	1.4	1.77	2.62	1.72	5.16	84.2	44.5	50.3
Total Octachloro Biphenyls					0.248	21.4	10.9	10.8
Total Nonachloro Biphenyls						1.15	0.687	0.716
Decachloro Biphenyl						0.139		
Total PCB (sum of congeners)	**135**	**392**	**341**	**369**	**375**	**37542**	**9857**	**11022**
PCB-14 (PRC)	31.4	21.6	23.6	23.3	25.6	23.1	25.9	25
PCB-29 (PRC)	24.5	21.2	21.8	21.5	22.1	22.4	23.5	22.4
PCB-50 (PRC)	17.6	15.9	17.2	17.1	16.4	31.6	20.4	20.4

Table 7: PCB homologue data for SPMDs deployed in the Niagara River, 2018 (ng/SPMD). Individual congener data can be obtained on request.

Station ID	Marina	Gratwick Riverside Park (GRP) (U/S)	Gratwick Riverside Park (GRP) (D/S)	102nd Street (U/S)	102nd St. waste site	Cayuga Creek (1 OF 2)	Cayuga Creek (2 OF 2)	OCC (U/S)
Axys ID	L29833-14	L29833-13	L29833-12	L29833-8 i	L29833-9	L29833-10	L29833-11	L29833-31
WORKGROUP	WG65416	WG65416	WG65416	WG65416	WG65416	WG65416	WG65416	WG65418
UNITS	ng/sample	ng/sample	ng/sample	ng/sample	ng/sample	ng/sample	ng/sample	ng/sample
Total Monochloro Biphenyls	16.9	17.7	17.9	16.4	25.3			
Total Dichloro Biphenyls	284.7	114.6	111	236.4	307.8	29.1	30.8	172.4
Total Trichloro Biphenyls	695.3	339.6	188.1	134.7	213.5	61	54.1	134.3
Total Tetrachloro Biphenyls	1031.3	496.6	240.5	154.9	213.6	135.6	113.9	164.5
Total Pentachloro Biphenyls	281	115	65.2	51.9	72.7	102	79.4	45.6
Total Hexachloro Biphenyls	64.7	18.8	12.9	13.7	19.2	40.4	30.8	11.9
Total Heptachloro Biphenyls	13.7	4.35	2.31	1.48	3.16	6.68	4.89	1.63
Total Octachloro Biphenyls	1.47	0.559				0.461	0.434	
Total Nonachloro Biphenyls								
Decachloro Biphenyl								
Total PCB (sum of congeners)	**2416**	**1123**	**647**	**615**	**880**	**402**	**338**	**546**
PCB-14 (PRC)	29.3	26.4	23	24.6	26.2	24.9	25.5	23.6
PCB-29 (PRC)	24.7	24.4	21.9	23.3	22.5	23.5	23.2	21.7
PCB-50 (PRC)	18.7	18.4	15.5	17.1	16.4	17.4	17.1	16.5

Station ID	OCC Sewer 003 (1 of 2)	OCC Sewer 003 (2 of 2)	Gill Ck (1 of 2)	Gill Ck (2 of 2)	D/S Gill Ck and Olin Outfall	Bloody Run Ck (1 of 2)	Bloody Run Ck (2 of 2)	D/S Bloody Run Ck (1 of 2)	D/S Bloody Run Ck (2 of 2)
Axys ID	L29833-28	L29833-29	L29833-32	L29833-33	L29833-34	L29833-26	L29833-27	L29833-23	L29833-24
WORKGROUP	WG65417	WG65418	WG65418	WG65418	WG65418	WG65417	WG65417	WG65417	WG65417
UNITS	ng/sample	ng/sample	ng/sample	ng/sample	ng/sample	ng/sample	ng/sample	ng/sample	ng/sample
Total Monochloro Biphenyls	10.9								
Total Dichloro Biphenyls	168.1	161.7	8.4	10.4	8.2	0.6	0.4	0	2.4
Total Trichloro Biphenyls	372.5	337.5	134.1	138	76.8	87.2	93.7	65.3	69
Total Tetrachloro Biphenyls	670.3	603.3	298.9	295.2	130.5	231.7	232.2	145.4	154.8
Total Pentachloro Biphenyls	136	115	81.5	81.3	33.4	63.5	66.6	37.6	41.2
Total Hexachloro Biphenyls	16.9	13	14.4	13.3	5.11	6.76	11	8.47	7.5
Total Heptachloro Biphenyls	2.67	1.6	1.72	1.35	0.371	0.568	0.9	0.619	
Total Octachloro Biphenyls									
Total Nonachloro Biphenyls									
Decachloro Biphenyl	0.305	0.419				0.12			
Total PCB (sum of congeners)	**1391**	**1245**	**558**	**553**	**260**	**416**	**433**	**274**	**295**
PCB-14 (PRC)	16.9	19.3	24.2	22.7	23.2	19.3	20.7	15.7	17.1
PCB-29 (PRC)	16.5	17.5	21.9	22	20.7	17.8	18.3	15.7	15.2
PCB-50 (PRC)	12.7	12.7	16.1	16.8	14.5	13.3	12.8	10.6	11.2

Table 7: PCB homologue data for SPMDs deployed in the Niagara River, 2018 (ng/SPMD). Individual congener data can be obtained on request.

Station ID	Thunder Bay, Lake Erie	Adelade St., Fort Erie	Queen St., Fort Erie	Gilmore Rd., Fort Erie	Robertson St., Fort Erie	Anger Ave., Fort Erie	Switch Rd., Fort Erie	Niagara on the Lake
Axys ID	L29833-35	L29833-36	L29833-37	L29833-38	L29833-39	L29833-41	L29833-42	L29833-2
WORKGROUP	WG65418	WG65418	WG65418	WG65418	WG65418	WG65418	WG65418	WG65416
UNITS	ng/sample	ng/sample	ng/sample	ng/sample	ng/sample	ng/sample	ng/sample	ng/sample
Total Monochloro Biphenyls							0.495	
Total Dichloro Biphenyls	0	1.7	1.4	0.8	0	0	1.2	4.1
Total Trichloro Biphenyls	4.4	3.5	5.9	5.8	5.6	5.6	5.2	31.4
Total Tetrachloro Biphenyls	9.8	9.2	10.9	9.3	8.5	10.8	10	39.2
Total Pentachloro Biphenyls	1.85	5.02	3.02	1.86	2.35	4.75	1.94	12.6
Total Hexachloro Biphenyls	1.42	2.1	1.93	1.42	1.43	2.07	2.06	3.44
Total Heptachloro Biphenyls								0.737
Total Octachloro Biphenyls								
Total Nonachloro Biphenyls								
Decachloro Biphenyl								
Total PCB (sum of congeners)	**26**	**25**	**30**	**22**	**20**	**28**	**26**	**102**
PCB-14 (PRC)	21.3	18.1	22.1	22.4	20.2	22.9	24.7	24.4
PCB-29 (PRC)	21.8	18.1	21	21.5	18.7	21.7	22.1	23.3
PCB-50 (PRC)	17.1	15	15.7	15.5	14.8	17	15.5	15.9

Table 8: 2018 PED Data: Organochlorinated Pesticides, Chlorinated Benzenes and Chlorinated Industrial Compounds.

				Aldrin		a-BHC (hexachlorocyclo-hexane)		b-BHC (hexachlorocyclo-hexane)		g-BHC (hexachlorocyclo-hexane)		a-Chlordane		g-Chlordane			cis-nonachlor/2,3,4,4',5-pentachPCB(114)			trans-nonachlor		Dieldrin		Endosulphan I		Endosulphan II	
				ng/PED		ng/PED		ng/PED		ng/PED		ng/PED		ng/PED			ng/PED			ng/PED		ng/PED		ng/PED		ng/PED	
TWO MILE CREEK MOUTH	500020197	GL185203	MOE-PED 1 OF 2	2	<MDL	2	<MDL	2	<MDL	2	<MDL	12		30		ABIAS	4		ABIAS	7		9		2	<MDL	2	<MDL
TWO MILE CREEK MOUTH	500020197	GL185204	MOE-PED 2 OF 2	2	<MDL	2	<MDL	2	<MDL	2	<MDL	11		33		ABIAS	3		ABIAS	7		9		2	<MDL	2	<MDL
PETIT FLUME COVE OUTER SITE B	500020186	GL185207	MOE-PED 1 OF 2	2	<MDL	2	<MDL	2	<MDL	2	<MDL	5		6		ABIAS	1		ABIAS	2		2	<MDL	2	<MDL	2	<MDL
PETIT FLUME COVE OUTER SITE B	500020186	GL185208	MOE-PED 2 OF 2	2	<MDL	2	<MDL	2	<MDL	2	<MDL	4		7		ABIAS	1		ABIAS	2		2		2	<MDL	2	<MDL
PETIT FLUME D/S	500020187	GL185205	MOE-PED 1 OF 2	2	<MDL	2	<MDL	2	<MDL	2	<MDL	2	<MDL	2		ABIAS	1		ABIAS	2	<MDL	2	<MDL	2	<MDL	2	<MDL
PETIT FLUME D/S	500020187	GL185206	MOE-PED 2 OF 2	2	<MDL	2	<MDL	2	<MDL	2	<MDL	2		3		ABIAS	1		ABIAS	2		2		2	<MDL	2	<MDL
NORTH TONAWANDA WWTP MID POINT D/S OF OUTFALL	500020227	GL185220	MOE-PED 1 OF 2	2	<MDL	2	<MDL	2	<MDL	2	<MDL	2		4		ABIAS	1		ABIAS	2		2	<MDL	2	<MDL	2	<MDL
NORTH TONAWANDA WWTP MID POINT D/S OF OUTFALL	500020227	GL185221	MOE-PED 2 OF 2	2	<MDL	2	<MDL	2	<MDL	2	<MDL	2		6		ABIAS	1		ABIAS	2		2		2	<MDL	2	<MDL
GRADWICH RIVERSIDE PARK U/S OF MARINA	500020031	GL185218	MOE-PED 1 OF 2	2	<MDL	2	<MDL	2	<MDL	2	<MDL	2		2		ABIAS	5		ABIAS	5		2	<MDL	2	<MDL	2	<MDL
GRADWICH RIVERSIDE PARK U/S OF MARINA	500020031	GL185219	MOE-PED 2 OF 2	2	<MDL	2	<MDL	2	<MDL	2	<MDL	2		53		ABIAS	5		ABIAS	5		2	<MDL	2	<MDL	2	<MDL
U/S END OF GRADWICH RIVERSIDE PARK	500020031	GL185216	MOE-PED 1 OF 2	2	<MDL	2	<MDL	2	<MDL	2	<MDL	2		10		ABIAS	1		ABIAS	2		2	<MDL	2	<MDL	2	<MDL
U/S END OF GRADWICH RIVERSIDE PARK	500020031	GL185217	MOE-PED 2 OF 2	2	<MDL	2	<MDL	2	<MDL	2	<MDL	2	<MDL	8		ABIAS	1		ABIAS	2		2	<MDL	2	<MDL	2	<MDL
D/S END OF GRADWICH RIVERSIDE PARK	500020199	GL185213	MOE-PED 1 OF 2	2	<MDL	2	<MDL	2	<MDL	2	<MDL	2	<MDL	5		ABIAS	1		ABIAS	2	<MDL	2		2	<MDL	2	<MDL
D/S END OF GRADWICH RIVERSIDE PARK	500020199	GL185214	MOE-PED 2 OF 2	2	<MDL	2	<MDL	2	<MDL	2	<MDL	2	<MDL	2		ABIAS	1		ABIAS	2	<MDL	2	<MDL	2	<MDL	2	<MDL
LITTLE NIAGARA RIVER 102ND ST WASTE SITE	500020095	GL185209	MOE-PED 1 OF 2	2	<MDL	2	<MDL	2	<MDL	2	<MDL	5		3		ABIAS	1		ABIAS	2	<MDL	2	<MDL	2	<MDL	2	<MDL
LITTLE NIAGARA RIVER 102ND ST WASTE SITE	500020095	GL185210	MOE-PED 2 OF 2	2	<MDL	2	<MDL	2	<MDL	2	<MDL	4		4		ABIAS	1		ABIAS	2		2		2	<MDL	2	<MDL
CAYUGA CREEK	500150031	GL185211	MOE-PED 1 OF 2	2	<MDL	25		2		2		5		10		ABIAS	1		ABIAS	3		2		2	<MDL	2	<MDL
CAYUGA CREEK	500150031	GL185212	MOE-PED 2 OF 2	2	<MDL	18		2		2		4		7		ABIAS	1		ABIAS	3		2		2	<MDL	2	<MDL
OCCIDENTAL SEWER 003	500020042	GL185222	MOE-PED 1 OF 2	2	<MDL	2	<MDL	2	<MDL	2	<MDL	6		1	<MDL	ABIAS	1	<MDL	ABIAS	2	<MDL	2		2	<MDL	2	<MDL
OCCIDENTAL SEWER 003	500020042	GL185223	MOE-PED 2 OF 2	2	<MDL	2	<MDL	2	<MDL	2	<MDL	7		1		ABIAS	1	<MDL	ABIAS	2	<MDL	2	<MDL	2	<MDL	2	<MDL
GILL CREEK MOUTH	500020037	GL185225	MOE-PED 1 OF 2	11		2	<MDL	2		2	<MDL	2		1	<MDL	ABIAS	2		ABIAS	2		2		2	<MDL	2	<MDL
GILL CREEK MOUTH	500020037	GL185226	MOE-PED 2 OF 2	2	<MDL	2	<MDL	2	<MDL	2	<MDL	2	<MDL	1	<MDL	ABIAS	1		ABIAS	2		2		2	<MDL	2	<MDL
D/S OF GILL CREEK AND OLIN OUTFALL	500020229	GL185227	MOE-PED 1 OF 2	2	<MDL	2		2	<MDL	2	<MDL	2	<MDL	1	<MDL	ABIAS	1		ABIAS	2	<MDL	2	<MDL	2	<MDL	2	<MDL
D/S OF GILL CREEK AND OLIN OUTFALL	500020229	GL185228	MOE-PED 2 OF 2	2	<MDL	2	<MDL	2	<MDL	2	<MDL	2	<MDL	1	<MDL	ABIAS	1		ABIAS	2	<MDL	2		2	<MDL	2	<MDL
FORT ERIE AT ROBERTSON STREET	500020203	GL185229	MOE-PED 1 OF 2	2	<MDL	2	<MDL	2	<MDL	2	<MDL	2	<MDL	1		ABIAS	1		ABIAS	2	<MDL	2		2	<MDL	2	<MDL
FORT ERIE AT ROBERTSON STREET	500020203	GL185230	MOE-PED 2 OF 2	2	<MDL	2	<MDL	2	<MDL	2	<MDL	2	<MDL	1		ABIAS	1		ABIAS	2	<MDL	2	<MDL	2	<MDL	2	<MDL
NIAGARA ON THE LAKE	1100020009	GL185201	MOE-PED 1 OF 2	2	<MDL	2	<MDL	2	<MDL	2	<MDL	2	<MDL	1		ABIAS	1		ABIAS	2		2	<MDL	2	<MDL	2	<MDL
NIAGARA ON THE LAKE	1100020009	GL185202	MOE-PED 2 OF 2	2	<MDL	2	<MDL	2	<MDL	2	<MDL	2	<MDL	1		ABIAS	1		ABIAS	2		2		2	<MDL	2	<MDL
Blank: FORT ERIE AT ROBERTSON STREET	500020203	GL185231		2	<MDL	2	<MDL	2	<MDL	2	<MDL	2	<MDL	1		ABIAS	1		ABIAS	2	<MDL	2	<MDL	2	<MDL	2	<MDL
Blank: D/S END OF GRADWICH RIVERSIDE PARK	500020199	GL185215		2	<MDL	2	<MDL	2	<MDL	2	<MDL	2	<MDL	1		ABIAS	1		ABIAS	2	<MDL	2	<MDL	2	<MDL	2	<MDL
Blank: OCCIDENTAL SEWER 003	500020042	GL185224		2	<MDL	2	<MDL	2	<MDL	2	<MDL	2	<MDL	1		ABIAS	1		ABIAS	2	<MDL	2	<MDL	2	<MDL	2	<MDL

IS	INTERFERENCE SUSPECTED
ND	NOT DETECTED
RDS	RESULT OBTAINED ON DILUTED SAMPLE
ABIAS	APPROX. RESULT: MAY BE BIASED DUE TO COELUTIONS
X1	DILUTED BY 10 DETECTION LIMITS 10 TIMES NORMAL
<MDL	LESS THAN METHOD DETECTION LIMIT
NDIS	NO DATA: INSUFFICIENT SAMPLE

Table 8: 2018 PED Data: Organochlorinated Pesticides, Chlorinated Benzenes and Chlorinated Industrial Compounds.

	Endosulphan sulphate		Endrin		H-Epoxide/2,4,4',5-tetrachloroPCB(74)			DMDT/2,2',3,3',4,4',6-heptachPCB(171)			Heptachlor		Mirex		Photomirex		Oxychlordane		op-DDT		pp-DDD		pp-DDE		pp-DDT		2,6-dichlorobenzyl chloride		1,2,3,4-tetrachlorobenzene	
	ng/PED		ng/PED		ng/PED			ng/PED			ng/PED		ng/PED		ng/PED		ng/PED		ng/PED		ng/PED		ng/PED		ng/PED		ng/PED		ng/PED	
TWO MILE CREEK MOUTH	2	<MDL	2		16		ABIAS	2		ABIAS	4		2	<MDL	2	<MDL	2	<MDL	2	<MDL	17		11		5		5	<MDL	5	<MDL
TWO MILE CREEK MOUTH	2	<MDL	2		16		ABIAS	3		ABIAS	4		2	<MDL	2	<MDL	2	<MDL	2	<MDL	18		9		5		5	<MDL	5	<MDL
PETIT FLUME COVE OUTER SITE B	2	<MDL	2	<MDL	2		ABIAS	1		ABIAS	2	<MDL	2	<MDL	2	<MDL	2	<MDL	2	<MDL	6		4		2	<MDL	5	<MDL	70	
PETIT FLUME COVE OUTER SITE B	2	<MDL	2	<MDL	2		ABIAS	1	<MDL	ABIAS	2	<MDL	2		2	<MDL	2	<MDL	2	<MDL	6		3		2	<MDL	5	<MDL	130	
PETIT FLUME D/S	2	<MDL	2	<MDL	1		ABIAS	1	<MDL	ABIAS	2		2	<MDL	2	<MDL	2	<MDL	2	<MDL	2	<MDL	2		2	<MDL	5	<MDL	5	<MDL
PETIT FLUME D/S	2	<MDL	2	<MDL	2		ABIAS	1		ABIAS	2	<MDL	2	<MDL	2	<MDL	2	<MDL	2	<MDL	2		3		2		5	<MDL	5	<MDL
NORTH TONAWANDA WWTP MID POINT D/S OF OUTFALL	2	<MDL	2	<MDL	3		ABIAS	1	<MDL	ABIAS	2	<MDL	2	<MDL	2	<MDL	2	<MDL	2	<MDL	2		3		3		5	<MDL	5	<MDL
NORTH TONAWANDA WWTP MID POINT D/S OF OUTFALL	2	<MDL	2	<MDL	3		ABIAS	1	<MDL	ABIAS	2	<MDL	2	<MDL	2	<MDL	2	<MDL	2	<MDL	2	<MDL	3		2	<MDL	5	<MDL	5	<MDL
GRADWICH RIVERSIDE PARK U/S OF MARINA	2	<MDL	2	<MDL	94		ABIAS	1		ABIAS	9		2	<MDL	2	<MDL	2	<MDL	2	<MDL	2	<MDL	2	<MDL	2	<MDL	5	<MDL	5	<MDL
GRADWICH RIVERSIDE PARK U/S OF MARINA	2	<MDL	2	<MDL	86		ABIAS	1		ABIAS	9		2	<MDL	2	<MDL	2	<MDL	2	<MDL	2	<MDL	2		7		5	<MDL	5	<MDL
U/S END OF GRADWICH RIVERSIDE PARK	2	<MDL	2	<MDL	16		ABIAS	1	<MDL	ABIAS	2		2	<MDL	2	<MDL	2	<MDL	2	<MDL	2	<MDL	2		5		5	<MDL	5	<MDL
U/S END OF GRADWICH RIVERSIDE PARK	2	<MDL	2	<MDL	13		ABIAS	1		ABIAS	2	<MDL	2	<MDL	2	<MDL	2	<MDL	2	<MDL	2	<MDL	2		5		5	<MDL	5	<MDL
D/S END OF GRADWICH RIVERSIDE PARK	2	<MDL	2	<MDL	8		ABIAS	1		ABIAS	2	<MDL	2	<MDL	2	<MDL	2	<MDL	2		2	<MDL	2		4		5	<MDL	5	<MDL
D/S END OF GRADWICH RIVERSIDE PARK	2	<MDL	2	<MDL	8		ABIAS	1	<MDL	ABIAS	2		2	<MDL	2	<MDL	2	<MDL	2	<MDL	2	<MDL	2		5		5	<MDL	5	<MDL
LITTLE NIAGARA RIVER 102ND ST WASTE SITE	2	<MDL	2	<MDL	7		ABIAS	1		ABIAS	2	<MDL	2	<MDL	2	<MDL	2	<MDL	2	<MDL	13		4		4		5	<MDL	130	
LITTLE NIAGARA RIVER 102ND ST WASTE SITE	2	<MDL	2	<MDL	8		ABIAS	1		ABIAS	2	<MDL	2	<MDL	2	<MDL	2	<MDL	2	<MDL	9		4		5		5	<MDL	27	
CAYUGA CREEK	2	<MDL	2	<MDL	6		ABIAS	1	<MDL	ABIAS	2	<MDL	2		2	<MDL	2	<MDL	2	<MDL	14		10		2		5	<MDL	8	
CAYUGA CREEK	2	<MDL	2	<MDL	3		ABIAS	1	<MDL	ABIAS	2		2		2	<MDL	2	<MDL	2	<MDL	12		10		2		5	<MDL	5	
OCCIDENTAL SEWER 003	2	<MDL	2	<MDL	24		ABIAS	4		ABIAS	2		44		2	<MDL	2	<MDL	2	<MDL	2		6		13		20		150	
OCCIDENTAL SEWER 003	2	<MDL	2	<MDL	29		ABIAS	1	<MDL	ABIAS	3		35		2	<MDL	2	<MDL	2	<MDL	2	<MDL	6		13		18		150	
GILL CREEK MOUTH	2	<MDL	2	<MDL	1	<MDL	ABIAS	1	<MDL	ABIAS	2	<MDL	2	<MDL	2	<MDL	2	<MDL	2		2	<MDL	2		2		5	<MDL	5	<MDL
GILL CREEK MOUTH	2	<MDL	2	<MDL	9		ABIAS	1	<MDL	ABIAS	2		2	<MDL	2	<MDL	2	<MDL	2		2	<MDL	2		2	<MDL	5	<MDL	5	<MDL
D/S OF GILL CREEK AND OLIN OUTFALL	2	<MDL	2	<MDL	5		ABIAS	1	<MDL	ABIAS	2	<MDL	2	<MDL	2	<MDL	2	<MDL	2	<MDL	2	<MDL	2		2	<MDL	5	<MDL	5	<MDL
D/S OF GILL CREEK AND OLIN OUTFALL	2	<MDL	2	<MDL	4		ABIAS	11		ABIAS	2	<MDL	2	<MDL	2	<MDL	2	<MDL	2	<MDL	2	<MDL	2		2	<MDL	5	<MDL	5	<MDL
FORT ERIE AT ROBERTSON STREET	2	<MDL	2	<MDL	1	<MDL	ABIAS	1	<MDL	ABIAS	2	<MDL	2	<MDL	2	<MDL	2	<MDL	5		2		5		2	<MDL	5	<MDL	5	<MDL
FORT ERIE AT ROBERTSON STREET	2	<MDL	2	<MDL	1	<MDL	ABIAS	1	<MDL	ABIAS	2	<MDL	2	<MDL	2	<MDL	2	<MDL	3		2		6		2		5	<MDL	5	<MDL
NIAGARA ON THE LAKE	2	<MDL	2	<MDL	1		ABIAS	1	<MDL	ABIAS	2	<MDL	2	<MDL	2	<MDL	2	<MDL	2	<MDL	2	<MDL	4		2	<MDL	5	<MDL	5	<MDL
NIAGARA ON THE LAKE	2	<MDL	2	<MDL	1		ABIAS	1	<MDL	ABIAS	2	<MDL	2	<MDL	2	<MDL	2	<MDL	2	<MDL	2	<MDL	4		2		5	<MDL	5	<MDL
Blank: FORT ERIE AT ROBERTSON STREET	2	<MDL	2	<MDL	1	<MDL	ABIAS	1	<MDL	ABIAS	2	<MDL	2	<MDL	2	<MDL	2	<MDL	2	<MDL	2	<MDL	2	<MDL	2		5	<MDL	5	<MDL
Blank: D/S END OF GRADWICH RIVERSIDE PARK	2	<MDL	2	<MDL	1	<MDL	ABIAS	1	<MDL	ABIAS	2	<MDL	2	<MDL	2	<MDL	2	<MDL	2	<MDL	2	<MDL	2	<MDL	2		5	<MDL	5	<MDL
Blank: OCCIDENTAL SEWER 003	2	<MDL	2	<MDL	1	<MDL	ABIAS	1	<MDL	ABIAS	2	<MDL	2	<MDL	2	<MDL	2	<MDL	2	<MDL	2	<MDL	2	<MDL	2		5	<MDL	5	<MDL

IS	INTERFERENCE SUSPECTED
ND	NOT DETECTED
RDS	RESULT OBTAINED ON DILUTED SAMPLE
ABIAS	APPROX. RESULT: MAY BE BIASED DUE TO COELUTIONS
X1	DILUTED BY 10 DETECTION LIMITS 10 TIMES NORMAL
<MDL	LESS THAN METHOD DETECTION LIMIT
NDIS	NO DATA: INSUFFICIENT SAMPLE

Table 8: 2018 PED Data: Organochlorinated Pesticides, Chlorinated Benzenes and Chlorinated Industrial Compounds.

	1,2,3,5/1,2,4,5-tetrachlorobenzene		1,2,3-trichlorobenzene		1,2,4-trichlorobenzene			1,3,5-trichlorobenzene			Hexachlorobenzene		Hexachloro-butadiene		Hexachloroethane		Octachlorostyrene		Pentachlorobenzene		2,3,6-trichlorotoluene		2,4,5-trichlorotoluene	
	ng/PED		ng/PED		ng/PED			ng/PED			ng/PED		ng/PED		ng/PED		ng/PED		ng/PED		ng/PED		ng/PED	
TWO MILE CREEK MOUTH	5	<MDL	5	<MDL	5	<MDL	NDIS	5	<MDL	IS	11		0	<MDL	5	<MDL	5	<MDL	5	<MDL	5	<MDL	5	<MDL
TWO MILE CREEK MOUTH	5	<MDL	0	<MDL	5	<MDL	NDIS	5	<MDL	IS	14		5	<MDL	5	<MDL	5	<MDL	5	<MDL	0	<MDL	5	<MDL
PETIT FLUME COVE OUTER SITE B	46		5	<MDL	22		NDIS	1	<MDL	IS	46		0	<MDL	5	<MDL	5	<MDL	91		5	<MDL	5	<MDL
PETIT FLUME COVE OUTER SITE B	110		38		5	<MDL	NDIS	48		IS	61		5	<MDL	5	<MDL	5	<MDL	110		5	<MDL	5	<MDL
PETIT FLUME D/S	5	<MDL	5	<MDL	5	<MDL	NDIS	5	<MDL	IS	11		5	<MDL	5	<MDL	5	<MDL	5		5	<MDL	5	<MDL
PETIT FLUME D/S	5	<MDL	5	<MDL	5	<MDL	NDIS	5	<MDL	IS	16		5	<MDL	5	<MDL	5	<MDL	7		5	<MDL	5	<MDL
NORTH TONAWANDA WWTP MID POINT D/S OF OUTFALL	5	<MDL	5	<MDL	5	<MDL	NDIS	5	<MDL	IS	10		5	<MDL	5	<MDL	5	<MDL	5	<MDL	5	<MDL	5	<MDL
NORTH TONAWANDA WWTP MID POINT D/S OF OUTFALL	5	<MDL	5	<MDL	5	<MDL	NDIS	5	<MDL	IS	15		5	<MDL	5	<MDL	5	<MDL	5	<MDL	5	<MDL	5	<MDL
GRADWICH RIVERSIDE PARK U/S OF MARINA	5	<MDL	5	<MDL	5	<MDL	NDIS	5	<MDL	IS	5		0	<MDL	5	<MDL	5	<MDL	5	<MDL	5	<MDL	5	<MDL
GRADWICH RIVERSIDE PARK U/S OF MARINA	5	<MDL	5	<MDL	5	<MDL	NDIS	5	<MDL	IS	5	<MDL	5	<MDL	5	<MDL	5	<MDL	5	<MDL	5	<MDL	5	<MDL
U/S END OF GRADWICH RIVERSIDE PARK	5	<MDL	5	<MDL	5	<MDL	NDIS	5	<MDL	IS	5		5	<MDL	5	<MDL	5	<MDL	5	<MDL	5	<MDL	5	<MDL
U/S END OF GRADWICH RIVERSIDE PARK	5	<MDL	5	<MDL	5	<MDL	NDIS	5	<MDL	IS	5	<MDL	5	<MDL	5	<MDL	5	<MDL	5	<MDL	5	<MDL	5	<MDL
D/S END OF GRADWICH RIVERSIDE PARK	5	<MDL	5	<MDL	0	<MDL	NDIS	5	<MDL	IS	5	<MDL	5	<MDL	5	<MDL	5	<MDL	5	<MDL	5	<MDL	5	<MDL
D/S END OF GRADWICH RIVERSIDE PARK	5	<MDL	5	<MDL	5	<MDL	NDIS	5	<MDL	IS	5		5	<MDL	5	<MDL	5	<MDL	5	<MDL	5	<MDL	5	<MDL
LITTLE NIAGARA RIVER 102ND ST WASTE SITE	5	<MDL	7		5	<MDL	NDIS	23		IS	31		5	<MDL	5	<MDL	5	<MDL	150		5	<MDL	5	<MDL
LITTLE NIAGARA RIVER 102ND ST WASTE SITE	14		5	<MDL	5	<MDL	NDIS	7		IS	29		5	<MDL	5	<MDL	5	<MDL	84		5	<MDL	5	<MDL
CAYUGA CREEK	9		5	<MDL	5	<MDL	NDIS	7		IS	11		5	<MDL	5	<MDL	5	<MDL	14		5	<MDL	5	<MDL
CAYUGA CREEK	5	<MDL	5	<MDL	5	<MDL	NDIS	5	<MDL	IS	9		5	<MDL	5	<MDL	5	<MDL	10		5	<MDL	5	<MDL
OCCIDENTAL SEWER 003	6		82		5	<MDL	NDIS	0	<MDL	IS	310		910		220		65		140		300		94	
OCCIDENTAL SEWER 003	6		32		5	<MDL	NDIS	6		IS	240		750		220		51		120		220		80	
GILL CREEK MOUTH	5	<MDL	12		5	<MDL	NDIS	0	<MDL	IS	34		290		40		5	<MDL	21		5	<MDL	5	<MDL
GILL CREEK MOUTH	5	<MDL	7		5	<MDL	NDIS	0	<MDL	IS	23		200		20		5	<MDL	16		5	<MDL	5	<MDL
D/S OF GILL CREEK AND OLIN OUTFALL	5		5	<MDL	5		NDIS	7			8		55		5		5	<MDL	5		5	<MDL	5	<MDL
D/S OF GILL CREEK AND OLIN OUTFALL	5	<MDL	5	<MDL	5	<MDL	NDIS	0	<MDL	IS	9		47		5	<MDL	5	<MDL	5	<MDL	5	<MDL	5	<MDL
FORT ERIE AT ROBERTSON STREET	5	<MDL	5	<MDL	5	<MDL	NDIS	5	<MDL	IS	5	<MDL	5	<MDL	5	<MDL	5	<MDL	5	<MDL	5	<MDL	5	<MDL
FORT ERIE AT ROBERTSON STREET	5	<MDL	5	<MDL	5	<MDL	NDIS	5	<MDL	IS	5	<MDL	5	<MDL	5	<MDL	5	<MDL	5	<MDL	5	<MDL	5	<MDL
NIAGARA ON THE LAKE	5	<MDL	5	<MDL	5	<MDL	NDIS	5	<MDL	IS	6		5	<MDL	5	<MDL	5	<MDL	5	<MDL	0	<MDL	5	<MDL
NIAGARA ON THE LAKE	5	<MDL	5	<MDL	5	<MDL	NDIS	11		IS	6		5	<MDL	5	<MDL	5	<MDL	5	<MDL	5	<MDL	5	<MDL
Blank: FORT ERIE AT ROBERTSON STREET	5	<MDL	5	<MDL	5	<MDL	NDIS	5	<MDL	IS	5	<MDL	5	<MDL	5	<MDL	5	<MDL	5	<MDL	5	<MDL	5	<MDL
Blank: D/S END OF GRADWICH RIVERSIDE PARK	5	<MDL	5	<MDL	5	<MDL	NDIS	5	<MDL	IS	5	<MDL	5	<MDL	5	<MDL	5	<MDL	5	<MDL	5	<MDL	5	<MDL
Blank: OCCIDENTAL SEWER 003	5	<MDL	5	<MDL	5	<MDL	NDIS	5	<MDL	IS	5	<MDL	5	<MDL	5	<MDL	5	<MDL	5	<MDL	5	<MDL	5	<MDL

IS	INTERFERENCE SUSPECTED
ND	NOT DETECTED
RDS	RESULT OBTAINED ON DILUTED SAMPLE
ABIAS	APPROX. RESULT: MAY BE BIASED DUE TO COELUTIONS
X1	DILUTED BY 10 DETECTION LIMITS 10 TIMES NORMAL
<MDL	LESS THAN METHOD DETECTION LIMIT
NDIS	NO DATA: INSUFFICIENT SAMPLE

Table 9: 2012-2018 PED Data: Total PCBs.

Station	Site Description		Total PCBs ng/PED 2012	VQ	Total PCBs ng/PED 2015	VQ	Total PCBs ng/PED 2018	VQ
500020197	TWO MILE CREEK MOUTH		1200		630		1300	
500020197	TWO MILE CREEK MOUTH				600		1300	
500020186	PETIT FLUME COVE OUTER SITE B		730		790		310	
500020186	PETIT FLUME COVE OUTER SITE B						320	
500020187	PETIT FLUME D/S				210		120	
500020187	PETIT FLUME D/S						180	
500020227	NORTH TONAWANDA WWTP MID POINT D/S OF OUTFALL						240	
500020227	NORTH TONAWANDA WWTP MID POINT D/S OF OUTFALL						270	
500020031	GRADWICH RIVERSIDE PARK U/S OF MARINA						3800	
500020031	GRADWICH RIVERSIDE PARK U/S OF MARINA						3900	
500020031	U/S END OF GRADWICH RIVERSIDE PARK				880		810	
500020031	U/S END OF GRADWICH RIVERSIDE PARK						720	
500020199	D/S END OF GRADWICH RIVERSIDE PARK		640		370		490	
500020199	D/S END OF GRADWICH RIVERSIDE PARK						530	
500020095	LITTLE NIAGARA RIVER 102ND ST WASTE SITE		240		390		590	
500020095	LITTLE NIAGARA RIVER 102ND ST WASTE SITE						590	
500150031	CAYUGA CREEK		210				270	
500150031	CAYUGA CREEK						290	
500020096	LITTLE NIAGARA R. D/S CAYUGA CK		390		340			
500020042	OCCIDENTAL SEWER 003		15000		44000		1000	
500020042	OCCIDENTAL SEWER 003		6700				1200	
500020037	GILL CREEK MOUTH		590		300		630	
500020037	GILL CREEK MOUTH				320		490	
500020022	GILL CK (U/S IN THE CK)		480					
500020229	D/S OF GILL CREEK AND OLIN OUTFALL						270	
500020229	D/S OF GILL CREEK AND OLIN OUTFALL						210	
500020203	FORT ERIE AT ROBERTSON STREET		10	<MDL	18		10	<MDL
500020203	FORT ERIE AT ROBERTSON STREET						10	<MDL
1100020009	NIAGARA ON THE LAKE		62		56		91	
1100020009	NIAGARA ON THE LAKE		56				84	
1800010001	BALSAM LAKE		13		10	<MDL		
500020199	D/S END OF GRADWICH RIVERSIDE PARK	Blank	10	<MDL			10	<MDL
500020042	OCCIDENTAL SEWER 003	Blank	10	<MDL	10	<MDL	10	<MDL
500110009	NIAGARA ON THE LAKE	Blank	10	<MDL				
500020203	FORT ERIE AT ROBERTSON STREET	Blank					10	<MDL
500020186	PETIT PLUME	Blank			10	<MDL		
<MDL	LESS THAN METHOD DETECTION LIMIT							

Table 10: Mean estimated water concentrations (ng/L) using 2012, 2015 and 2018 SPMD data and the USGS Water Concentration Estimator.

Concentrations were compared with Water Quality Criteria

Values that exceed the criteria were highlighted in **red**. U/S = upstream; D/S = downstream

			2012[b]		2015[b]		2018		2012	2015		2018	2012	2015		2018	2012	2015		2018
			Two Mile Ck		Two Mile Ck		2 Mile Ck		Pettit Flume (U/S)	Pettit Flume (U/S)		Pettit Flume (U/S)	Pettit Flume	Pettit Flume		Pettit Flume	Pettit Flume (D/S)	Pettit Flume (D/S)		Pettit Flume (D/S)
	Water Quality	Agency	mean	SD	mean	SD	mean	SD		mean	SD			mean	SD			mean	SD	
	Criteria (ng/L)		(ng/L)		(ng/L)		(ng/L)		(ng/L)	(ng/L)		(ng/L)	(ng/L)	(ng/L)		(ng/L)	(ng/L)	(ng/L)		(ng/L)
1,3-Dichlorobenzene	2500	MECP	3.2	0.35	0.90	0.23	0.63	0.894	0.42	0.29	0.51		24	141	18.0	369	6.1	2.2	0.47	2.0
1,4-Dichlorobenzene	4000	MECP	9.3	0.61	7.8	0.91	4.3	0.506	3.7	2.4	4.20	1.4	72	300	69.8	416	12.4	12	1.9	4.3
1,2-Dichlorobenzene	3000	NYSDEC	0.69	0.11	1.0	0.04			0.88	0.43	0.75		36	72	14.3	252	0.69	1.6	0.40	0.75
1,3,5-Trichlorobenzene	650	MECP	0.42	0.03	0.03	0.01	0.06	0.017		0.003	0.01		1.5	4.1	0.44	9.8	0.36	0.08	0.01	0.08
1,2,4-Trichlorobenzene	500	MECP	1.1	0.10	0.21	0.05	0.69	0.108	0.04	0.12	0.02	0.10	6.4	30	3.55	13	0.32	0.34	0.05	0.13
1,2,3-Trichlorobenzene	900	MECP	0.08	0.01	0.06	0.02	0.21	0.049		0.04	0.01	0.10	3.2	15	1.94	3.5	0.05	0.12	0.02	0.04
1,2,4,5-/1,2,3,5-Tetrachlorobenzene			1.3	0.15	0.04	0.01	0.10	0.021	0.01	0.04	0.01	0.03	4.5	10	0.93	6.0	0.27	0.18	0.03	0.12
1,2,3,4-Tetrachlorobenzene	100	MECP	1.8	0.20	0.04	0.01	0.08	0.015	0.01	0.02	0.001	0.01	8.2	16	1.74	5.3	0.14	0.22	0.03	0.14
Hexachlorobutadiene	10	NYSDEC	0.03	0.003	0.01	0.01	0.01	0.013		0.00	0.002	0.02	0.03	0.10	0.02	0.06	0.06	0.00	0.001	
Pentachlorobenzene	30	MECP	2.5	0.32	0.13	0.02	0.23	0.033	0.02	0.07	0.02	0.04	5.5	10	0.74	4.3	1.0	0.25	0.05	0.23
Hexachlorobenzene	0.03	NYSDEC	**0.57**	0.08	**0.28**	0.04	**0.56**	0.109	**0.05**	**0.06**	0.02	**0.07**	**4.5**	**4.5**	0.29	**3.7**	**4.0**	**0.25**	0.05	**0.39**
HCH, gamma (lindane)	8	NYSDEC	1.03	0.05																
HCH, alpha	2	NYSDEC	**38**	0.39																
HCH, beta			12	1.60																
HCH, delta			1.0	0.26	0.01	0.01				0.01	0.01			0.004	0.01		0.01	0.003	0.003	
Aldrin	2	NYSDEC	0.004	0.01																
Octachlorostyrene	0.006	NYSDEC	**0.01**	0.002	0.004	0.01							**0.03**	**0.03**	0.002		**0.04**			
o,p'-DDE			0.03	0.001	0.01	0.01			0.02	0.01	0.01		0.02	0.02	0.003		0.02	0.01	0.01	
p,p'-DDE	0.007	NYSDEC	**0.21**	0.02	**0.19**	0.04	**0.33**	0.064	**0.08**	**0.08**	0.02	**0.16**	**0.18**	**0.14**	0.01	**0.22**	**0.08**	**0.05**	0.01	**0.04**
o,p'-DDD			0.10	0.02	0.13	0.03	0.33	0.039		0.02	0.01	0.07	0.22	0.11	0.004	0.11		0.01	0.001	
p,p'-DDD	0.08	NYSDEC	**0.44**	0.05	**0.43**	0.07	**0.91**	0.188	0.07	0.06	0.01		**0.71**	**0.43**	0.01	**0.40**	0.07	0.05	0.01	0.02
o,p'-DDT			0.05	0.01	0.06	0.01			0.03	0.05	0.01		0.02	0.03	0.03		0.03	0.02	0.01	
p,p'-DDT	0.01	NYSDEC	**0.02**	0.01	**0.07**	0.01								**0.03**	0.02					
Mirex	0.001	NYSDEC	**0.11**	0.02	**0.23**	0.12							**0.06**	**0.05**	0.09					
Chlordane, alpha (cis)			0.12	0.01	0.26	0.03	0.37	0.051	0.04	0.04	0.01	0.07	0.23	0.19	0.01	0.21	0.04	0.03	0.004	0.02
Chlordane, gamma (trans)			0.08	0.01	0.16	0.02	0.23	0.047	0.03	0.03	0.01	0.05	0.14	0.11	0.01	0.13	0.03	0.02	0.004	0.02
Nonachlor, cis-			0.02	0.00	0.03	0.00	0.05	0.012		0.01	0.002	0.02	0.03	0.02	0.001	0.02	0.01	0.01	0.001	
Nonachlor, trans-			0.07	0.01	0.13	0.02	0.20	0.036	0.03	0.03	0.01	0.04	0.12	0.09	0.004	0.10	0.03	0.02	0.01	0.01
Heptachlor	0.2	NYSDEC																		
Heptachlor Epoxide	0.3	NYSDEC	0.03	0.003	0.13	0.02	0.24	0.053	0.03	0.06	0.02	0.06	0.05	0.05	0.01	0.02	0.02	0.04	0.01	
alpha-Endosulphan	3	MECP (proposed)	0.32	0.01	0.04	0.07							0.04				0.07			
beta-Endosulphan			0.68	0.05						0.005	0.01		0.19							
Endosulphan Sulphate			0.22	0.20	0.06	0.11			0.16	0.01	0.01		0.61	0.18	0.15		0.09			
Dieldrin	0.0006	NYSDEC	**0.10**	0.01	**0.39**	0.05	**0.54**	0.125	**0.13**	**0.11**	0.04	**0.12**	**0.14**	**0.11**	0.01	**0.09**	**0.12**	**0.06**	0.01	**0.05**
Endrin	2	NYSDEC								0.001	0.001									
Methoxychlor	30	NYSDEC	0.13	0.01	0.05	0.05														
Total PCB	0.001	NYSDEC	**6.2**	0.74	**17**	2.90	**32**	7.24	**8.8**	**6.4**	1.84	**12**	**151**	**186**	14.5	**276**	**10**	**4.9**	1.19	**3.1**

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Table 10: Mean estimated water concentrations (ng/L) using 2012, 2015 and 2018 SPMD data and the USGS Water Concentration Estimator.

Concentrations were compared with Water Quality Criteria

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			2015[b]		2018	2015		2018	2018		2018	2018	2015		2018		2015		2018
			Fishermans Park (U/S)		Fishermans Park (U/S)	Fishermans Park (D/S)		WWTP[a] U/S	WWTP D/S outfall		WWTP D/S	Private Prop.	GRP[a] (U/S Marina)		GRP (U/S Marina)		GRP (Marina)		GRP (Marina)
	Water Quality	Agency	mean	SD		mean	SD		mean	SD			mean	SD	mean	SD	mean	SD	
	Criteria (ng/L)		(ng/L)		(ng/L)	(ng/L)		(ng/L)	(ng/L)		(ng/L)	(ng/L)	(ng/L)		(ng/L)		(ng/L)		(ng/L)
1,3-Dichlorobenzene	2500	MECP	1.9	0.06	1.8	3.1	0.47	1.3	0.45	0.634	1.3		1.9	0.76	0.94	0.177	12	2.46	6.0
1,4-Dichlorobenzene	4000	MECP	7.9	0.40	4.6	18	3.91	3.2	3.0	0.588	2.9	2.4	6.9	1.58	3.3	0.439	39	7.75	12
1,2-Dichlorobenzene	3000	NYSDEC	1.2	0.14		2.0	0.70						0.56	0.48			4.9	1.25	
1,3,5-Trichlorobenzene	650	MECP	0.11	0.04	0.21	0.13	0.07	0.02	0.03	0.006	0.03	0.03	0.03	0.003	0.03	0.004	0.23	0.05	0.26
1,2,4-Trichlorobenzene	500	MECP	0.29	0.09	0.37	1.2	0.61	0.04	0.06	0.002	0.06	0.04	0.10	0.01	0.06	0.008	0.88	0.10	0.45
1,2,3-Trichlorobenzene	900	MECP	0.04	0.02		0.35	0.19		0.01	0.012			0.02	0.03			0.16	0.06	0.08
1,2,4,5-/1,2,3,5-Tetrachlorobenzene			0.20	0.08	0.15	0.32	0.23	0.02	0.03	0.002	0.02	0.03	0.05	0.01	0.03	0.004	0.31	0.08	0.28
1,2,3,4-Tetrachlorobenzene	100	MECP	0.07	0.03	0.05	0.39	0.26	0.01	0.02	0.001	0.02	0.02	0.03	0.004	0.02	0.003	0.24	0.06	0.25
Hexachlorobutadiene	10	NYSDEC	0.01	0.004		0.01	0.01		0.002	0.003			0.01	0.004			0.01	0.01	
Pentachlorobenzene	30	MECP	0.31	0.14	0.16	0.62	0.46	0.06	0.08	0.005	0.06	0.07	0.11	0.02	0.07	0.008	0.27	0.08	0.29
Hexachlorobenzene	0.03	NYSDEC	0.56	0.25	0.28	0.69	0.56	0.14	0.19	0.002	0.13	0.14	0.18	0.01	0.18	0.048	0.28	0.10	0.29
HCH, gamma (lindane)	8	NYSDEC						0.63	0.41	0.033	0.62	0.82			0.96	0.580			
HCH, alpha	2	NYSDEC																	
HCH, beta																			
HCH, delta			0.003	0.01		0.002	0.002	0.003	0.001	0.002		0.003			0.003	0.001			
Aldrin	2	NYSDEC																	
Octachlorostyrene	0.006	NYSDEC															0.02	0.00	
o,p'-DDE			0.01	0.01	0.03	0.01	0.02	0.01	0.01		0.01	0.01	0.01	0.01	0.01		0.08	0.07	0.09
p,p'-DDE	0.007	NYSDEC	0.17	0.08	0.10	0.12	0.10	0.03	0.04	0.008	0.05	0.04	0.06	0.01	0.05	0.010	0.33	0.10	0.20
o,p'-DDD						0.03	0.03	0.01	0.02	0.001	0.02	0.02			0.02	0.004			
p,p'-DDD	0.08	NYSDEC	0.14	0.07	0.06	0.09	0.08	0.02	0.02	0.004	0.07	0.02	0.06	0.01	0.03	0.002	0.30	0.09	0.16
o,p'-DDT			0.08	0.07	0.06	0.05	0.05	0.02	0.02	0.002	0.04	0.03	0.04	0.04	0.03	0.002	0.27	0.02	0.27
p,p'-DDT	0.01	NYSDEC													0.004	0.005			
Mirex	0.001	NYSDEC																	
Chlordane, alpha (cis)			0.08	0.03	0.04	0.05	0.04	0.02	0.02	0.002	0.03	0.02	0.03	0.01	0.02	0.003	0.09	0.03	0.06
Chlordane, gamma (trans)			0.05	0.02	0.05	0.03	0.03	0.01	0.01	0.002	0.02	0.01	0.02	0.004	0.01	0.002	0.07	0.02	0.05
Nonachlor, cis-			0.02	0.01	0.01	0.01	0.01	0.003	0.003	0.0004	0.005	0.003	0.01	0.001	0.004	0.0004	0.02	0.01	0.01
Nonachlor, trans-			0.05	0.02	0.03	0.04	0.03	0.01	0.01	0.001	0.02	0.01	0.02	0.004	0.01	0.002	0.04	0.01	0.03
Heptachlor	0.2	NYSDEC													0.003	0.004			
Heptachlor Epoxide	0.3	NYSDEC	0.08	0.04		0.04	0.03		0.02			0.02	0.06	0.01	0.02	0.0003	0.02	0.02	
alpha-Endosulphan	3	MECP (proposed)						0.007											
beta-Endosulphan																			
Endosulphan Sulphate						0.02	0.03	0.02	0.01	0.015									
Dieldrin	0.0006	NYSDEC	0.17	0.07	0.09	0.11	0.07	0.05	0.06	0.003	0.05	0.06	0.10	0.01	0.05	0.004	0.09	0.03	0.07
Endrin	2	NYSDEC						0.001											
Methoxychlor	30	NYSDEC				0.01	0.02												
Total PCB	0.001	NYSDEC	14	6.34	5.8	7.6	6.45	2.8	3.6	0.025	3.7	387	96	10.95	129	6.0	77	27.34	54

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			2012[b]		2015[b]		2018	2015		2012		2015		2018	2012		2015		2018	2012		2015		2018
			GRP (U/S)		GRP (U/S)		GRP (U/S)	GRP (mid)		GRP (D/S)		GRP (D/S)		GRP (D/S)	102 St. (U/S)		102 St. (U/S)		102 St. (U/S)	LNR (D/S 102 St.)		LNR (D/S 102 St.)		LNR (D/S 102 St.)
	Water Quality	Agency	mean	SD	mean	SD		mean	SD	mean	SD	mean	SD		mean	SD	mean	SD		mean	SD	mean	SD	
	Criteria (ng/L)		(ng/L)		(ng/L)		(ng/L)	(ng/L)		(ng/L)		(ng/L)		(ng/L)	(ng/L)		(ng/L)		(ng/L)	(ng/L)		(ng/L)		(ng/L)
1,3-Dichlorobenzene	**2500**	MECP	1.11	0.12	2.6	0.69	1.1	2.4	0.77	1.46	0.21	1.3	1.18	1.9	1.1	0.12	2.1	0.36	1.6	4.60	0.68	5.1	4.61	5.5
1,4-Dichlorobenzene	**4000**	MECP	5.2	0.49	11	1.91	2.6	11	1.21	10.44	2.04	7.1	6.21	4.5	2.8	0.11	8.0	0.50	3.1	15.33	0.84	11	9.55	12
1,2-Dichlorobenzene	**3000**	NYSDEC	0.53	0.00	1.5	0.50		1.7	0.49	1.01	0.13	1.1	0.94		3.5	1.10	0.98	0.11		0.64	0.05	0.83	0.73	
1,3,5-Trichlorobenzene	**650**	MECP	0.03	0.00	0.03	0.002	0.05	0.03	0.01	0.02	0.00	0.02	0.002	0.02	0.003	0.01	0.03	0.004	0.04	0.65	0.04	0.18	0.01	0.22
1,2,4-Trichlorobenzene	**500**	MECP	0.26	0.03	0.13	0.01	0.07	0.34	0.04	0.07	0.01	0.09	0.01	0.05	0.03	0.002	0.14	0.01	0.08	1.00	0.06	1.03	0.04	0.99
1,2,3-Trichlorobenzene	**900**	MECP	0.03	0.004	0.03	0.02		0.06	0.01	0.02	0.004	0.01	0.01		0.005	0.01	0.02	0.002	0.00	0.13	0.01	0.22	0.00	0.13
1,2,4,5-/1,2,3,5-Tetrachlorobenzene			0.04	0.002	0.06	0.003	0.04	0.07	0.01	0.03	0.002	0.04	0.01	0.02	0.09	0.01	0.17	0.02	0.11	1.37	0.24	0.81	0.06	1.1
1,2,3,4-Tetrachlorobenzene	**100**	MECP	0.02	0.004	0.04	0.02	0.02	0.04	0.01	0.02	0.003	0.02	0.003	0.01	0.03	0.004	0.04	0.01	0.03	1.93	0.23	2.7	0.05	3.6
Hexachlorobutadiene	**10**	NYSDEC					0.01	0.01	0.003	0.001	0.001	0.001	0.001		0.01	0.001	0.003			0.01	0.01	0.004	0.001	
Pentachlorobenzene	**30**	MECP	0.08	0.01	0.11	0.004	0.12	0.11	0.01	0.07	0.01	0.08	0.01	0.03	0.06	0.001	0.09	0.01	0.06	2.0	0.20	2.1	0.07	2.6
Hexachlorobenzene	**0.03**	NYSDEC	**0.18**	0.02	**0.15**	0.01	**0.34**	**0.18**	0.04	**0.12**	0.02	**0.11**	0.02	**0.06**	**0.24**	0.004	**0.16**	0.03	**0.10**	**0.69**	0.10	**0.52**	0.01	**0.51**
HCH, gamma (lindane)	**8**	NYSDEC	0.12	0.11						0.07	0.07				0.03	0.06	0.06	0.11				0.06	0.06	
HCH, alpha	**2**	NYSDEC								0.08	0.14						0.07	0.12	0.19	0.42	0.04	0.25	0.03	0.24
HCH, beta																								
HCH, delta			0.003	0.01											0.01	0.004	0.01	0.01		0.03	0.004	0.02	0.001	0.01
Aldrin	**2**	NYSDEC										0.001	0.002									0.005	0.004	
Octachlorostyrene	**0.006**	NYSDEC																						
o,p'-DDE			0.02	0.002	0.005	0.01		0.01	0.01	0.01	0.01	0.01	0.003		0.01	0.002	0.01	0.002		0.01	0.01	0.01	0.002	
p,p'-DDE	**0.007**	NYSDEC	**0.07**	0.01	**0.05**	0.004	**0.06**	**0.08**	0.01	**0.04**	0.01	**0.05**	0.01	**0.03**	**0.03**	0.001	**0.06**	0.01	**0.03**	**0.13**	0.02	**0.06**	0.01	**0.05**
o,p'-DDD			0.00	0.01	0.01	0.01		0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.01		0.02	0.002		0.13	0.02	0.06	0.003	0.07
p,p'-DDD	**0.08**	NYSDEC	0.05	0.01	0.06	0.01		0.06	0.005	0.04	0.01	0.05	0.01	0.02	0.03	0.002	0.05	0.01	0.03	**0.49**	0.05	**0.22**	0.01	**0.18**
o,p'-DDT			0.04	0.00	0.03	0.03		0.02	0.03	0.01	0.01	0.03	0.01		0.01	0.002	0.02	0.005		0.04	0.004	0.02	0.003	0.01
p,p'-DDT	**0.01**	NYSDEC	0.003	0.01								0.002	0.004		0.004	0.004	0.01	0.01				0.01	0.01	
Mirex	**0.001**	NYSDEC										**0.003**	0.005		**0.01**	0.01	**0.01**	0.01		**0.70**	0.12	**0.004**	0.01	
Chlordane, alpha (cis)			0.03	0.001	0.03	0.002	0.03	0.04	0.01	0.02	0.005	0.02	0.01	0.01	0.02	0.002	0.03	0.01	0.03	0.04	0.004	0.03	0.002	0.03
Chlordane, gamma (trans)			0.02	0.001	0.02	0.001	0.02	0.03	0.002	0.01	0.002	0.02	0.003	0.01	0.02	0.002	0.02	0.004	0.02	0.03	0.01	0.02	0.001	0.02
Nonachlor, cis-			0.01	0.002	0.01	0.001	0.004	0.01	0.001	0.004	0.001	0.01	0.002		0.01	0.001	0.01	0.002		0.01	0.01	0.01	0.001	0.005
Nonachlor, trans-			0.02	0.001	0.02	0.001	0.02	0.02	0.004	0.02	0.003	0.02	0.003	0.01	0.02	0.001	0.02	0.004	0.02	0.03	0.01	0.02	0.001	0.02
Heptachlor	**0.2**	NYSDEC										0.001	0.002				0.002	0.004						
Heptachlor Epoxide	**0.3**	NYSDEC	0.02	0.003	0.05	0.004		0.06	0.01	0.02	0.002	0.04	0.01		0.01	0.002	0.04	0.004		0.01	0.002	0.04	0.002	0.02
alpha-Endosulphan	**3**	MECP (proposed)	0.05	0.05						0.05	0.05				0.20	0.04				0.13	0.01			
beta-Endosulphan																				0.19	0.01			
Endosulphan Sulphate															0.03	0.05				0.03	0.06			
Dieldrin	**0.0006**	NYSDEC	**0.08**	0.01	**0.08**	0.01	**0.07**	**0.09**	0.01	**0.07**	0.01	**0.08**	0.02	**0.04**	**0.07**	0.01	**0.08**	0.01	**0.06**	**0.07**	0.01	**0.07**	0.002	**0.05**
Endrin	**2**	NYSDEC																						
Methoxychlor	**30**	NYSDEC	0.01	0.02											0.002	0.003								
Total PCB	**0.001**	NYSDEC	**52**	4.46	**18**	1.87	**18**	**15**	2.67	**15**	3.44	**9.0**	2.30	**4.8**	**7.9**	0.04	**8.3**	1.64	**7.7**	**19**	2.64	**10**	0.52	**9.4**

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			2012[b]		2015[b]		2018		2012		2015		2015		2018	2015		2015		2015	
			Cayuga Ck		Cayuga Ck		Cayuga Ck		LNR (D/S Cayuga Ck)		LNR (D/S Cayuga Ck)		OCC U/S		OCC U/S	Storm Sewer A		Storm Sewer B		Storm Sewer C	
	Water Quality Criteria (ng/L)	Agency	mean (ng/L)	SD	mean (ng/L)	SD	mean (ng/L)	SD	mean (ng/L)	SD	mean (ng/L)	SD	mean (ng/L)	SD	(ng/L)	mean (ng/L)	SD	mean (ng/L)	SD	mean (ng/L)	SD
1,3-Dichlorobenzene	**2500**	MECP	9.1	7.90	2.0	1.88	2.5	0.125	1.2	0.18	0.88	1.52	2.1	0.27	0.63	1.7	1.58	1.2	1.16	1.6	1.41
1,4-Dichlorobenzene	**4000**	MECP	86	15.8	8.0	6.95	6.6	0.582	9.7	0.72	3.3	5.73	7.7	0.33	1.3	4.8	4.25	7.3	1.00	6.7	0.83
1,2-Dichlorobenzene	**3000**	NYSDEC	0.13	0.22	1.5	1.39	1.6	0.617	0.08	0.14	0.23	0.40	0.57	0.51		0.62	0.54	0.38	0.66	0.66	0.57
1,3,5-Trichlorobenzene	**650**	MECP	0.03	0.00	0.21	0.05	0.13	0.030	0.12	0.01	0.08	0.04	0.03	0.001	0.03	0.02	0.01	0.03	0.004	0.06	0.005
1,2,4-Trichlorobenzene	**500**	MECP	0.20	0.01	0.81	0.15	0.64	0.150	0.11	0.02	0.19	0.10	0.07	0.003	0.04	0.08	0.01	0.09	0.01	0.14	0.01
1,2,3-Trichlorobenzene	**900**	MECP	0.04	0.033	0.08	0.02	0.05	0.010	0.03	0.01	0.05	0.02	0.01	0.01		0.02	0.00	0.02	0.005	0.02	0.02
1,2,4,5-/1,2,3,5-Tetrachlorobenzene			0.06	0.01	0.67	0.20	0.53	0.111	0.28	0.01	0.25	0.14	0.07	0.002	0.04	0.07	0.01	0.10	0.02	0.23	0.02
1,2,3,4-Tetrachlorobenzene	**100**	MECP	0.06	0.01	1.0	0.27	0.59	0.079	0.37	0.02	0.38	0.19	0.07	0.005	0.07	0.19	0.01	0.21	0.03	0.31	0.02
Hexachlorobutadiene	**10**	NYSDEC	0.001	0.002	0.02	0.01	0.01	0.007			0.005	0.003	0.003			0.01	0.00	0.02	0.01	0.03	0.01
Pentachlorobenzene	**30**	MECP	0.27	0.04	0.71	0.22	0.48	0.059	0.53	0.05	0.42	0.23	0.14	0.01	0.10	0.24	0.05	0.32	0.06	0.55	0.04
Hexachlorobenzene	**0.03**	NYSDEC	**0.65**	0.11	**0.23**	0.06	**0.23**	0.035	**0.19**	0.02	**0.22**	0.14	**0.12**	0.01	**0.08**	**0.10**	0.01	**0.12**	0.02	**0.70**	0.08
HCH, gamma (lindane)	**8**	NYSDEC			0.72	0.02	3.1	0.154	0.52	0.23	0.03	0.05	0.02	0.04						0.03	0.05
HCH, alpha	**2**	NYSDEC			**36**	0.79	**12**	0.247	**2.7**	0.22	1.4	0.20	0.97	0.07	0.28	0.68	0.15	0.53	0.07	0.48	0.01
HCH, beta					9.5	0.29	3.7	0.334	1.34	0.24	0.55	0.15	0.08	0.14		0.16	0.14			0.43	0.08
HCH, delta			0.040	0.015	0.81	0.29	1.2	0.193	0.21	0.05	0.05	0.03	0.01	0.002		0.01	0.004	0.01	0.002	0.01	0.002
Aldrin	**2**	NYSDEC									0.002	0.004	0.002	0.004		0.001	0.002			0.001	0.002
Octachlorostyrene	**0.006**	NYSDEC	**0.01**	0.01	**0.01**	0.001	**0.01**	0.009			**0.01**	0.01	**0.01**	0.001		**0.01**	0.002	**0.01**	0.004	**0.10**	0.01
o,p'-DDE			0.056	0.010	0.02	0.01	0.04	0.007	0.02	0.001	0.02	0.02	0.01	0.001	0.01	0.01	0.01				
p,p'-DDE	**0.007**	NYSDEC	**0.36**	0.04	**0.21**	0.05	**0.11**	0.114	**0.09**	0.02	**0.14**	0.10	**0.06**	0.004	**0.03**	**0.04**	0.003	**0.04**	0.01	**0.04**	0.003
o,p'-DDD			0.208	0.046	0.06	0.02	0.10	0.019	0.04	0.01	0.06	0.03	0.02	0.002		0.01	0.01	0.005	0.01	0.003	0.01
p,p'-DDD	**0.08**	NYSDEC	**0.78**	0.17	**0.28**	0.08	**0.44**	0.121	**0.14**	0.02	**0.19**	0.11	0.06	0.01	0.03	0.04	0.01	0.03	0.01	0.03	0.001
o,p'-DDT			0.104	0.024	0.05	0.02	0.03	0.040	0.03	0.01	0.07	0.04	0.03	0.003		0.01	0.01	0.01	0.01		
p,p'-DDT	**0.01**	NYSDEC	**0.06**	0.01					0.01	0.01						0.01	0.005				
Mirex	**0.001**	NYSDEC	**0.27**	0.05	**0.11**	0.02			**0.09**	0.03	**0.08**	0.05	**0.02**	0.001		**0.01**	0.01			**0.11**	0.01
Chlordane, alpha (cis)			0.406	0.062	0.10	0.03	0.08	0.008	0.06	0.01	0.07	0.05	0.03	0.001	0.02	0.02	0.001	0.02	0.002	0.02	0.002
Chlordane, gamma (trans)			0.256	0.043	0.06	0.02	0.05	0.013	0.04	0.01	0.05	0.03	0.02	0.001	0.01	0.01	0.001	0.01	0.002	0.01	0.001
Nonachlor, cis-			0.051	0.008	0.01	0.004	0.01	0.003	0.01	0.003	0.02	0.01	0.01			0.004	0.001	0.005	0.001	0.004	0.001
Nonachlor, trans-			0.216	0.039	0.05	0.01	0.05	0.009	0.05	0.01	0.06	0.04	0.02	0.001	0.01	0.01	0.001	0.01	0.002	0.01	
Heptachlor	**0.2**	NYSDEC									0.002	0.003	0.002	0.003		0.002	0.003				
Heptachlor Epoxide	**0.3**	NYSDEC	0.15	0.019	0.05	0.02	0.05	0.005	0.01	0.01	0.05	0.02	0.04	0.001		0.04	0.002	0.04	0.003	0.03	0.001
alpha-Endosulphan	**3**	MECP (proposed)	0.17	0.150					0.18	0.05											
beta-Endosulphan									0.21	0.25											
Endosulphan Sulphate			0.51	0.20					0.10	0.10											
Dieldrin	**0.0006**	NYSDEC	**0.44**	0.08	**0.09**	0.01	**0.06**	0.003	**0.05**	0.004	**0.08**	0.04	**0.07**	0.004	**0.04**	**0.06**	0.002	**0.06**	0.01	**0.06**	0.001
Endrin	**2**	NYSDEC																			
Methoxychlor	**30**	NYSDEC	0.30	0.05					0.02	0.04								0.01	0.01		
Total PCB	**0.001**	NYSDEC	**54**	10.8	**3.3**	0.81	**5.1**	1.027	**7.7**	1.00	**9.3**	5.85	**6.8**	0.22	**4.8**	**4.8**	0.40	**4.8**	0.96	**5.0**	0.09

[a] WWTP: Waste Water Treatment Plant; GRP: Gratwick Riverside Park; BRC: Bloody Run Creek; Tbay: Thunder Bay; NOTL: Niagara on the Lake

[b] Data were revised from Richman 2015 and Richman 2018 using updated PRCs and will replace previously reported estimated concentrations.

Table 10: Mean estimated water concentrations (ng/L) using 2012, 2015 and 2018 SPMD data and the USGS Water Concentration Estimator.

Concentrations were compared with Water Quality Criteria

Values that exceed the criteria were highlighted in **red**. U/S = upstream; D/S = downstream

			2012[b]		2015[b]		2018		2015		2012		2012		2015		2018		2018	2015		2015		2018		2015		2018	
			OCC 003		OCC 003		OCC 003		U/S Gill Ck (in NR)		Gill Ck (U/S in ck)		Gill Ck (mouth)		Gill Ck (mouth)		Gill Ck (mouth)		D/S Gill Ck (in NR)	BRC (U/S)		BRC		BRC[a]		BRC (D/S)		BRC (D/S)	
	Water Quality	Agency	mean	SD	mean	SD	mean	SD	mean	SD	mean	SD	mean	SD	mean	SD	mean	SD		mean	SD	mean	SD	mean	SD	mean	SD	mean	SD
	Criteria (ng/L)		(ng/L)		(ng/L)		(ng/L)		(ng/L)		(ng/L)		(ng/L)		(ng/L)		(ng/L)		(ng/L)	(ng/L)		(ng/L)		(ng/L)		(ng/L)		(ng/L)	
1,3-Dichlorobenzene	**2500**	MECP	3.0	0.50	74	6.43	26	2.4	0.81	0.73	3.0	0.46	13	1.57	15	1.50	16	0.17	2.6	1.4	0.04	1.2	0.16	0.92	0.073	1.8	0.28		
1,4-Dichlorobenzene	**4000**	MECP	4.4	0.75	46	2.47	22	2.2	2.8	2.44	24	7.73	42	1.66	34	2.55	27	0.44	5.2	4.9	0.17	5.6	0.99	0.85	0.090	4.2		1.1	0.399
1,2-Dichlorobenzene	**3000**	NYSDEC	0.78	0.24	5.3	0.21	0.99	1.41	0.48	0.42	3.5	1.19	29	1.74	15	1.45	18	0.960	2.3	0.55	0.78	0.65	0.93			1.1	0.01		
1,3,5-Trichlorobenzene	**650**	MECP	0.12	0.11	0.83	0.26	0.34	0.060	0.01	0.01	0.14	0.08	0.03	0.01	0.08	0.02	0.09	0.008	0.02			0.04	0.03	0.23	0.018	0.03		0.03	0.002
1,2,4-Trichlorobenzene	**500**	MECP	2.1	1.81	18	3.95	8.4	0.136	0.04	0.04	1.30	0.68	2.20	0.73	3.3	0.41	4.4	0.263	0.72	0.08	0.001	0.13	0.09	0.24	0.010	0.24	0.002	0.18	0.008
1,2,3-Trichlorobenzene	**900**	MECP	0.41	0.33	2.52	0.62	1.1	0.007	0.01	0.01	0.11	0.04	0.51	0.17	0.80	0.13	1.0	0.032	0.18	0.04	0.003	0.05	0.04	0.03	0.007	0.07	0.01	0.05	0.008
1,2,4,5-/1,2,3,5-Tetrachlorobenzene			8.8	1.50	3.6	0.98	2.1	0.504	0.10	0.08	0.62	0.30	0.74	0.13	0.51	0.16	0.49	0.014	0.11	0.06	0.005	0.39	0.03	0.39	0.024	0.25	0.01	0.39	0.017
1,2,3,4-Tetrachlorobenzene	**100**	MECP	11	14.9	3.5	6.14	10	1.274	0.04	0.03	0.37	0.15	0.36	0.07	0.28	0.09	0.26	0.012	0.06	0.10	0.004	0.46	0.06	0.30	0.014	0.32	0.02	0.43	0.028
Hexachlorobutadiene	**10**	NYSDEC	0.20	0.07	**16**	6.48	**12**	2.05	0.01	0.005	0.02	0.02	**11**	2.84	8.7	1.88	5.9	0.650	1.1	0.02	0.001	0.25	0.01	0.33	0.035	0.12	0.01	0.21	0.017
Pentachlorobenzene	**30**	MECP	0.14	0.14	8.4	3.00	3.5	0.914	0.06	0.05	0.38	0.15	0.49	0.11	0.35	0.14	0.42	0.001	0.08	0.15	0.004	2.6	0.05	2.1	0.108	1.3	0.09	2.2	0.024
Hexachlorobenzene	**0.03**	NYSDEC	0.02	0.01	**4.0**	1.55	**3.0**	1.52	**0.09**	0.07	**0.42**	0.18	**0.52**	0.13	**0.32**	0.13	**0.30**	0.011	**0.07**	**0.34**	0.01	**1.8**	0.50	**2.1**	0.165	**1.1**	0.11	**1.9**	0.027
HCH, gamma (lindane)	**8**	NYSDEC	0.11	0.01	0.07	0.06	0.23	0.323			3.9	0.73	1.0	0.23	1.1	0.19	3.4	0.266	0.74	0.06	0.09	0.30	0.15	1.2	0.114	0.17	0.24	0.93	0.276
HCH, alpha	**2**	NYSDEC	0.21	0.29	0.84	0.09	0.26	0.042			**68**	5.10	**26**	1.36	**16**	0.16	**6.0**	0.678	0.96			0.20	0.01	0.05	0.002			0.02	0.028
HCH, beta			0.12	0.16	0.73	0.16	0.16	0.024			18.08	0.64	5.99	0.65	2.4	0.18	0.73	0.070	0.14										
HCH, delta					0.03	0.01	0.004	0.005	0.01	0.01	1.34	0.34	0.14	0.01	0.22	0.06	0.17	0.001	0.03	0.005	0.01	0.01	0.01			0.004	0.01	0.03	0.003
Aldrin	**2**	NYSDEC	0.67	0.65	0.004	0.01	0.03	0.042			0.02	0.02			0.002	0.003						0.01	0.002	0.01	0.001			0.01	0.002
Octachlorostyrene	**0.006**	NYSDEC	**2.8**	3.92	**0.47**	0.19	**0.23**	0.161	**0.02**	0.01	**0.02**	0.03	**0.02**	0.01	**0.02**	0.01	**0.02**	0.002		**0.07**	0.003	**0.10**	0.02	**0.03**	0.001	**0.10**	0.01	**0.02**	0.002
o,p'-DDE			0.04	0.01	0.01	0.01	0.004	0.005	0.003	0.01	0.02	0.01	0.003	0.003								0.001	0.001						
p,p'-DDE	**0.007**	NYSDEC	**0.03**	0.02	**0.07**	0.02	**0.03**	0.017	**0.03**	0.02	**0.22**	0.08	**0.04**	0.01	**0.03**	0.01	**0.02**		**0.01**	**0.01**		**0.04**	0.005	**0.01**		**0.02**	0.003	**0.01**	0.001
o,p'-DDD					0.01	0.01	0.01	0.010			0.06	0.02	0.01	0.002								0.003	0.001			0.001	0.002	0.001	
p,p'-DDD	**0.08**	NYSDEC			0.06	0.02	0.02	0.012	0.02	0.02	**0.30**	0.13	0.04	0.01	0.03	0.02	0.01	0.002	0.01	0.01		0.01	0.003	0.004	0.001	0.01	0.001	0.003	
o,p'-DDT					0.02	0.02	0.02	0.009	0.01	0.004	0.04	0.01	0.01	0.002	0.01	0.01				0.002	0.003					0.002	0.003	0.002	
p,p'-DDT	**0.01**	NYSDEC					0.004	0.005														0.01	0.002	0.003		0.003	0.005	0.004	0.001
Mirex	**0.001**	NYSDEC	**0.04**	0.05	**1.4**	0.51	**0.29**	0.165			**0.08**	0.04	**0.01**	0.01								0.02	0.01	**0.04**	0.006	**0.01**	0.002	**0.01**	0.002
Chlordane, alpha (cis)			0.02	0.02	0.03	0.01	0.02	0.009	0.01	0.01	0.09	0.04	0.02	0.004	0.01	0.01	0.01	0.001	0.01	0.005		0.01	0.001	0.003		0.01	0.001	0.003	0.001
Chlordane, gamma (trans)			0.35	0.46	0.02	0.01	0.01	0.006	0.01	0.01	0.06	0.03	0.01	0.003	0.01	0.003	0.01	0.001	0.01	0.003		0.004	0.001	0.002		0.004	0.001	0.002	
Nonachlor, cis-			0.03	0.05	0.01	0.002	0.003	0.002	0.003	0.002	0.02	0.01	0.002	0.002	0.004	0.002	0.001	0.002		0.001		0.002		0.001		0.002		0.001	
Nonachlor, trans-			0.04	0.05	0.02	0.01	0.01	0.007	0.01	0.01	0.05	0.03	0.01	0.003	0.01	0.004	0.01	0.001	0.01	0.004		0.01	0.001	0.003	0.001	0.005	0.001	0.002	
Heptachlor	**0.2**	NYSDEC	**0.32**	0.41	0.01	0.01														0.001	0.002								
Heptachlor Epoxide	**0.3**	NYSDEC	0.03	0.004	0.06	0.02	0.02	0.004	0.06	0.04	0.01	0.01	0.01	0.002	0.04	0.02				0.02	0.001	0.02	0.01			0.02	0.002		
alpha-Endosulphan	**3**	MECP (proposed)	0.41	0.16							0.36	0.10	0.18	0.01								0.16	0.02	0.10	0.142				
beta-Endosulphan											0.19	0.08										0.07	0.10	0.09	0.133			0.05	0.073
Endosulphan Sulphate											0.24	0.00	0.10	0.01														0.08	0.115
Dieldrin	**0.0006**	NYSDEC	**0.09**	0.02	**0.08**	0.02	**0.05**	0.025	**0.10**	0.06	**0.20**	0.07	**0.08**	0.01	**0.08**	0.03	**0.05**	0.005	**0.04**	**0.05**		**0.05**	0.01	**0.03**	0.002	**0.05**	0.01	**0.03**	0.005
Endrin	**2**	NYSDEC																						0.004				0.002	0.002
Methoxychlor	**30**	NYSDEC																											
Total PCB	**0.001**	NYSDEC	**237**	61.37	**186**	114.3	**7.8**	0.459	**0.56**	0.48	**19**	8.04	**12**	3.28	**7.0**	2.50	**5.0**	0.244	**1.6**	**0.27**	0.02	**1.6**	0.61	**1.8**	0.093	**0.75**	0.11	**0.84**	0.075

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	Water Quality Criteria (ng/L)	Agency	2018 Tbay[a] Lake Erie (ng/L)	2018 Adelaide St. Fort Erie (ng/L)	2018 Queen St. Fort Erie (ng/L)	2018 Gilmore Rd. Fort Erie (ng/L)	2012[b] Robertson St. Fort Erie mean (ng/L)	SD	2015[b] Robertson St. Fort Erie mean (ng/L)	SD	2018 Robertson St. Fort Erie (ng/L)	2018 Anger Ave. Fort Erie (ng/L)	2018 Switch Rd. Fort Erie (ng/L)	2012 Millers Creek mean (ng/L)	SD	2012 Boyers Creek mean (ng/L)	SD	2015 Ushers Ck mean (ng/L)	SD
1,3-Dichlorobenzene	**2500**	MECP							0.46	0.40				0.37	0.06	0.15	0.14	0.26	0.46
1,4-Dichlorobenzene	**4000**	MECP			0.76	1.1	2.25	0.15	4.4	0.23	0.80			2.39	0.42	2.12	0.06	4.0	0.54
1,2-Dichlorobenzene	**3000**	NYSDEC				0.86	2.19	1.63	0.37	0.32						0.09	0.15	0.69	0.70
1,3,5-Trichlorobenzene	**650**	MECP												0.005	0.001			0.002	0.004
1,2,4-Trichlorobenzene	**500**	MECP												0.01	0.001	0.004	0.01		
1,2,3-Trichlorobenzene	**900**	MECP														0.01	0.01	0.01	0.02
1,2,4,5-/1,2,3,5-Tetrachlorobenzene							0.002	0.003	0.001	0.001				0.01	0.001	0.002	0.004	0.01	0.01
1,2,3,4-Tetrachlorobenzene	**100**	MECP					0.01	0.01	0.002					0.003		0.002	0.003	0.003	0.003
Hexachlorobutadiene	**10**	NYSDEC					0.01									0.004	0.01	0.002	0.004
Pentachlorobenzene	**30**	MECP	0.004	0.004	0.01	0.005	0.01	0.002	0.01	0.001	0.004	0.01	0.01	0.01	0.002	0.01	0.004	0.05	0.01
Hexachlorobenzene	**0.03**	NYSDEC	0.01	0.01	0.02	0.01	0.02	0.001	0.02	0.002	0.01	0.02	0.01	0.01	0.002	0.01	0.01	0.02	0.01
HCH, gamma (lindane)	**8**	NYSDEC					0.17	0.17	0.06	0.10						0.37	0.40		
HCH, alpha	**2**	NYSDEC																	
HCH, beta																			
HCH, delta							0.01	0.001						0.001	0.001	0.01	0.01		
Aldrin	**2**	NYSDEC																	
Octachlorostyrene	**0.006**	NYSDEC																	
o,p'-DDE									0.01										
p,p'-DDE	**0.007**	NYSDEC	**0.01**	**0.01**	**0.04**	**0.04**	**0.04**	0.001	**0.62**	0.03	**0.04**	**0.97**	**0.07**	**0.19**	0.04	**0.03**	0.01	**0.13**	0.03
o,p'-DDD							0.01	0.001	0.03	0.002		0.02	0.01	0.03	0.01			0.01	0.003
p,p'-DDD	**0.08**	NYSDEC	0.01	0.01	0.01	0.03	0.03	0.004	**0.15**	0.01	0.01	0.12	0.03	**0.15**	0.02			0.04	0.01
o,p'-DDT							0.002	0.003	0.01	0.001		0.01	0.01					0.001	0.001
p,p'-DDT	**0.01**	NYSDEC	0.005		0.01	0.01	0.002	0.003	**0.03**	0.002		0.11	0.01		0.004			0.01	0.002
Mirex	**0.001**	NYSDEC																	
Chlordane, alpha (cis)			0.01	0.005	0.01	0.01	0.01		0.01	0.001	0.01	0.01	0.01	0.01	0.003	0.01	0.01	0.02	0.003
Chlordane, gamma (trans)			0.01	0.005	0.01	0.01	0.003	0.004	0.01		0.003	0.01	0.01	0.01	0.001	0.01	0.01	0.01	0.003
Nonachlor, cis-							0.003		0.003		0.001	0.003		0.00	0.001			0.01	0.000
Nonachlor, trans-			0.01	0.005	0.01	0.004	0.01	0.001	0.01		0.004	0.013	0.005	0.01	0.002	0.01	0.01	0.03	0.01
Heptachlor	**0.2**	NYSDEC																	
Heptachlor Epoxide	**0.3**	NYSDEC					0.01		0.03	0.001				0.003	0.003			0.02	0.005
alpha-Endosulphan	**3**	MECP (proposed)					0.07	0.02						0.14	0.004	0.38	0.02		
beta-Endosulphan														0.07	0.06	0.25	0.01		
Endosulphan Sulphate							0.04	0.06						0.07	0.06	0.50	0.06		
Dieldrin	**0.0006**	NYSDEC	**0.05**	**0.03**	**0.04**	**0.04**	**0.06**	0.01	**0.06**	0.01	**0.04**	**0.06**	**0.04**	**0.03**	0.01	**0.04**	0.01	**0.04**	0.01
Endrin	**2**	NYSDEC																	
Methoxychlor	**30**	NYSDEC		0.01															
Total PCB	**0.001**	NYSDEC	**0.24**	**0.12**	**0.21**	**0.16**	**0.27**	0.02	**0.20**	0.01	**0.10**	**0.27**	**0.21**	**0.47**	0.13	**0.70**	0.30	**0.12**	0.04

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			2012[b]		2015[b]		2012		2015		2018	2012		2015		2018
			Chippawa Channel		Chippawa Channel		NOTL[a]		NOTL		NOTL	Balsam Lake		Balsam Lake		Balsam Lake
	Water Quality Criteria (ng/L)	Agency	mean (ng/L)	SD	mean (ng/L)	SD	mean (ng/L)	SD	mean (ng/L)	SD	(ng/L)	mean (ng/L)	SD	mean (ng/L)	SD	(ng/L)
1,3-Dichlorobenzene	**2500**	MECP	0.37	0.34	0.30	0.52	0.40	0.35	1.3	0.25				0.95	0.30	
1,4-Dichlorobenzene	**4000**	MECP	3.00	1.61	2.7	2.39	1.88	0.29	5.6	0.41		1.32	0.14	4.1	0.71	0.45
1,2-Dichlorobenzene	**3000**	NYSDEC	1.54	2.66	0.18	0.31	3.04	0.27	0.29	0.50				0.70	0.64	
1,3,5-Trichlorobenzene	**650**	MECP							0.003	0.004	0.02					
1,2,4-Trichlorobenzene	**500**	MECP					0.05	0.01	0.08	0.001	0.06					
1,2,3-Trichlorobenzene	**900**	MECP	0.005	0.01	0.02	0.01	0.02	0.002	0.01	0.02						
1,2,4,5-/1,2,3,5-Tetrachlorobenzene			0.001	0.002	0.001	0.002	0.04	0.01	0.04	0.01	0.04					
1,2,3,4-Tetrachlorobenzene	**100**	MECP	0.005	0.004			0.10	0.02	0.08	0.01	0.12					
Hexachlorobutadiene	**10**	NYSDEC	0.005	0.004	0.002	0.003	0.03	0.01	0.01	0.001	0.02	0.01	0.02			0.003
Pentachlorobenzene	**30**	MECP	0.02	0.01	0.01	0.003	0.10	0.02	0.07	0.01	0.09			0.004	0.003	
Hexachlorobenzene	**0.03**	NYSDEC	**0.04**	0.02	0.02	0.003	**0.09**	0.01	**0.08**	0.02	**0.14**	**0.03**	0.02	0.01	0.01	0.005
HCH, gamma (lindane)	**8**	NYSDEC	0.14	0.14			0.09	0.03								
HCH, alpha	**2**	NYSDEC					0.03	0.06								
HCH, beta																
HCH, delta							0.01	0.01	0.004	0.01						
Aldrin	**2**	NYSDEC														
Octachlorostyrene	**0.006**	NYSDEC					**0.01**	0.001	**0.04**	0.01						
o,p'-DDE			0.01	0.01			0.005	0.001								
p,p'-DDE	**0.007**	NYSDEC	**0.12**	0.09	**0.05**	0.01	**0.03**	0.003	**0.02**	0.003	**0.04**	**0.05**	0.03	**0.02**	0.01	**0.01**
o,p'-DDD			0.01	0.02	0.005	0.001	0.00	0.003								
p,p'-DDD	**0.08**	NYSDEC	0.07	0.08	0.03	0.003	0.02	0.004	0.01	0.002	0.01	0.02	0.01	0.001	0.002	
o,p'-DDT			0.05	0.09			0.01	0.001	0.003	0.01						
p,p'-DDT	**0.01**	NYSDEC	0.01	0.02	0.01	0.001	0.01	0.01			0.01					0.004
Mirex	**0.001**	NYSDEC														
Chlordane, alpha (cis)			0.02	0.02	0.01	0.001	0.01	0.001	0.01	0.001	0.01			0.003	0.003	0.005
Chlordane, gamma (trans)			0.01	0.01	0.005	0.001	0.01		0.01	0.001	0.02			0.003	0.002	0.004
Nonachlor, cis-			0.01	0.01	0.001	0.001	0.003		0.002	0.001	0.005					
Nonachlor, trans-			0.02	0.01	0.01	0.001	0.01	0.001	0.01	0.002	0.02	0.01	0.01	0.004	0.002	0.002
Heptachlor	**0.2**	NYSDEC					0.003	0.01	0.01	0.01				0.05	0.05	
Heptachlor Epoxide	**0.3**	NYSDEC	0.03	0.03	0.02	0.003	0.01	0.001	0.02	0.003				0.01	0.004	
alpha-Endosulphan	**3**	MECP (proposed)	0.08	0.07			0.11	0.02				0.12	0.03			
beta-Endosulphan			0.27	0.28												
Endosulphan Sulphate			0.04	0.07			0.06	0.05				0.22	0.05			
Dieldrin	**0.0006**	NYSDEC	**0.13**	0.10	**0.06**	0.01	**0.06**	0.003	**0.05**	0.005	**0.04**	**0.06**	0.04	0.02	0.01	**0.02**
Endrin	**2**	NYSDEC														
Methoxychlor	**30**	NYSDEC					0.002	0.003								
Total PCB	**0.001**	NYSDEC	**0.79**	0.53	**0.12**	0.04	**0.99**	0.19	**0.64**	0.14	**0.99**	**0.13**	0.05	**0.06**	0.02	**0.09**

[a] WWTP: Waste Water Treatment Plant; GRP: Gratwick Riverside Park; BRC: Bloody Run Creek; Tbay: Thunder Bay; NOTL: Niagara on the Lake

[b] Data were revised from Richman 2015 and Richman 2018 using updated PRCs and will replace previously reported estimated concentrations.

Table 10: Mean estimated water concentrations (pg/L) and TEQ (pg TEQ/L) using 2012 (Pettit Flume) and 2015 (Bloody Run Creek) SPMD data and the USGS Water Concentration Estimator.

	TEF(Fish)	Pettit Flume upstream (1) (pg/L)	Pettit Flume upstream (2) (pg/L)	Pettit Flume Cove (1) (pg/L)	Pettit Flume Cove (2) (pg/L)	Pettit Flume Downstream (1) (pg/L)	Pettit Flume Downstream (2) (pg/L)		Pettit Flume upstream (1) TEQ (pg/L)	Pettit Flume upstream (2) TEQ (pg/L)	Pettit Flume Cove (1) TEQ (pg/L)	Pettit Flume Cove (2) TEQ (pg/L)	Pettit Flume Downstream (1) TEQ (pg/L)	Pettit Flume Downstream (2) TEQ (pg/L)
2,3,7,8-Tetrachloro-dibenzo-p-dioxin	1			0.28	0.29	0.20	0.12				0.278	0.295	0.199	0.122
1,2,3,7,8-Pentachloro-dibenzo-p-dioxin	1			0.93	1.03	0.64	0.58				0.928	1.025	0.643	0.576
1,2,3,4,7,8-Hexachloro-dibenzo-p-dioxin	0.5			0.44	0.55	0.58	0.32				0.219	0.275	0.291	0.162
1,2,3,6,7,8-Hexachloro-dibenzo-p-dioxin	0.01	0.14	0.15	0.92	1.19	1.40	1.03		0.001	0.001	0.009	0.012	0.014	0.010
1,2,3,7,8,9-Hexachloro-dibenzo-p-dioxin	0.01	0.15	0.13	0.79	0.89	0.76	0.54		0.002	0.001	0.008	0.009	0.008	0.005
1,2,3,4,6,7,8-Heptachloro-dibenzo-p-dioxin	0.001	1.41	1.66	2.96	3.42	3.17	2.77		0.001	0.002	0.003	0.003	0.003	0.003
Octachloro-dibenzo-p-dioxin	0	4.73	5.05	4.31	4.75	4.80	4.41							
2,3,7,8-Tetrachlorodibenzofuran	0.05	0.10	0.11	4.65	5.50	9.14	4.39		0.005	0.005	0.232	0.275	0.457	0.219
1,2,3,7,8-Pentachlorodibenzofuran	0.05			0.93	0.98	1.15	0.71				0.047	0.049	0.057	0.035
2,3,4,7,8-Pentachlorodibenzofuran	0.5	0.04	0.03	2.02	2.54	6.69	3.52		0.018	0.017	1.009	1.270	3.343	1.762
1,2,3,4,7,8-Hexachlorodibenzofuran	0.1	0.05	0.04	8.23	10.4	37.6	20.8		0.005	0.004	0.823	1.038	3.755	2.079
1,2,3,6,7,8-Hexachlorodibenzofuran	0.1			1.67	1.97	4.86	2.86				0.167	0.197	0.486	0.286
1,2,3,7,8,9-Hexachlorodibenzofuran	0.1			0.02	0.02						0.002	0.002		
2,3,4,6,7,8-Hexachlorodibenzofuran	0.1			0.59	0.70	1.67	0.92				0.059	0.070	0.167	0.092
1,2,3,4,6,7,8-Heptachlorodibenzofuran	0.01	0.23	0.21	16.0	19.7	53.9	32.4		0.002	0.002	0.160	0.197	0.539	0.324
1,2,3,4,7,8,9-Heptachlorodibenzofuran	no water estimate equation to calculate													
Octachlorodibenzofuran	0.0001	0.65	0.48	15.3	21.1	106.9	57.9		0.0001	0.00005	0.002	0.002	0.011	0.006
Sum total PCDD/PCDF (pg/L)		7.5	7.9	60	75	233	133	**Total TEQ (pg/L)**	**0.03**	**0.03**	**3.9**	**4.7**	**10.0**	**5.7**

	TEF(Fish)	Bloody Run Creek Upstream (pg/L)	Bloody Run Creek (pg/L)	Bloody Run Creek Downstream (pg/L)		Bloody Run Creek Upstream TEQ (pg/L)	Bloody Run Creek TEQ (pg/L)	Bloody Run Creek Downstream TEQ (pg/L)
2,3,7,8-Tetrachloro-dibenzo-p-dioxin	1	0.03	1.01	0.26		0.0293	1.0103	0.2583
1,2,3,7,8-Pentachloro-dibenzo-p-dioxin	1		0.06				0.0602	
1,2,3,4,7,8-Hexachloro-dibenzo-p-dioxin	0.5		0.07	0.04			0.0344	0.0184
1,2,3,6,7,8-Hexachloro-dibenzo-p-dioxin	0.01		0.74	0.23			0.0074	0.0023
1,2,3,7,8,9-Hexachloro-dibenzo-p-dioxin	0.01	0.05	0.40	0.16		0.0005	0.0040	0.0016
1,2,3,4,6,7,8-Heptachloro-dibenzo-p-dioxin	0.001	0.23	1.83	0.78		0.0002	0.0018	0.0008
Octachloro-dibenzo-p-dioxin	0	0.58	0.94	0.74				
2,3,7,8-Tetrachlorodibenzofuran	0.05	0.02	0.06	0.03		0.0008	0.0030	0.0015
1,2,3,7,8-Pentachlorodibenzofuran	0.05		0.03				0.0014	
2,3,4,7,8-Pentachlorodibenzofuran	0.5	0.01	0.04	0.02		0.0049	0.0206	0.0093
1,2,3,4,7,8-Hexachlorodibenzofuran	0.1	0.01	0.09	0.04		0.0012	0.0089	0.0037
1,2,3,6,7,8-Hexachlorodibenzofuran	0.1	0.01		0.01		0.0008		0.0011
1,2,3,7,8,9-Hexachlorodibenzofuran	0.1							
2,3,4,6,7,8-Hexachlorodibenzofuran	0.1							
1,2,3,4,6,7,8-Heptachlorodibenzofuran	0.01	0.03	0.08	0.06		0.0003	0.0008	0.0006
1,2,3,4,7,8,9-Heptachlorodibenzofuran	no water estimate equation to calculate							
Octachlorodibenzofuran	0.0001	0.23	0.38	0.46		0.00002	0.00004	0.00005
Sum total PCDD/PCDF (pg/L)		1.2	5.7	2.8	**Total TEQ (pg/L)**	**0.04**	**1.2**	**0.30**

Table 11: Concentrations (ng/g) of PCBs in surface sediment (0-2 cm) along the Niagara River shoreline (River Road, North Tonawanda),
and industrial organic compound in surface sediment (0-2 cm) collected from the Pettit Flume Cove, North Tonawanda, Niagara River, 2018

				GL185185					GL185184					GL185183			
				Station 1					Station 226					Station 225			
				FISHERMAN'S PARK					**DOWNSTREAM OF WWTP**					**PRIVATE PROPERTY**			
				(UPSTREAM)										**(870 River Rd.)**			
				01-AUG-2018					01-AUG-2018					01-AUG-2018			
				Sediment (top 2 cm)					Sediment (top 2 cm)					Sediment (top 2 cm)			
Very coarse Sand: % 1000-2000 um				0.5					45					25.5			
Silt: % <62 um, >2.63 um, sum	%			40.6					5.1					2.5			
Sand: % <1000 um, >62 um, sum	%			50.2					48.8					71.3			
Clay: % <2.63 um, >0.10 um, sum	%			9.2					0.9					0.8			
TOC	%			8.5					4.1					1.7			
Parameter Name	Units		SEL				LEL	SEL				LEL	SEL				
PCB; total	ng/g	**70**	**47600**	**2000**			70	**22960**	**120**			70	**9520**	**42000**			
2,2'-/2,6-dichloroPCB(4/10)	ng/g			5	<MDL				5	<MDL				30			X1
2,3'-dichloroPCB(6)	ng/g			12					5	<MDL				75			X1
2,4'-dichloroPCB(8)	ng/g			12					5	<MDL				110			X1
4,4'-dichloroPCB(15)	ng/g			43					5	<MDL				140			X1
2,2',3-trichloroPCB(16)	ng/g			49					2					1100			X1
2,2',5-trichloroPCB(18)	ng/g			71					2	<MDL				690			X1
2,2',6-trichloroPCB(19)	ng/g			10					2	<MDL				410			X1
2,3,4'-trichloroPCB(22)	ng/g			4					2	<MDL				400			X1
2,4,4'-/2,4',5-trichloroPCB(28/31)	ng/g			200					5					3100			X1
2',3,4-trichloroPCB(33)	ng/g			46					2	<MDL				920			X1
3,4,4'-trichloroPCB(37)	ng/g			46					2	<MDL				180			X1
2,2',3,3'-tetrachloroPCB(40)	ng/g			32					1					610			X1
2,2',3,4-tetrachloroPCB(41)	ng/g			28					1					720			X1
2,2',3,5'-tetrachloroPCB(44)	ng/g			120					4					2400			X1
2,2',4,5'-tetrachloroPCB(49)	ng/g			110					4					2800			X1
2,2',5,5'-tetrachloroPCB(52)	ng/g			170					7					3500			X1
2,2',6,6'-tetrachloroPCB(54)	ng/g			1					1	<MDL				45			X1
G-CHLA/2,3,4,4'-tetrachloroPCB(60)	ng/g			8		ABIAS			2		ABIAS			1600		ABIAS	X1
2,3',4,4'-tetrachloroPCB(66)	ng/g			130					5					3500			X1
2,3',4',5-tetrachloroPCB(70)	ng/g			34					3					2200			X1
H-Epoxide/2,4,4',5-tetrachloroPCB(74)	ng/g			1	<MDL	ABIAS			2		ABIAS			1300		ABIAS	X1
3,3',4,4'-tetrachloroPCB(77)	ng/g			8					1					400			X1
3,4,4',5-tetrachloroPCB(81)	ng/g			1	<MDL				1	<MDL				1	<MDL		X1
2,2'3,3',6-pentachloroPCB(84)	ng/g			51					4					990			X1
2,2',3,4,4'-pentachloroPCB(85)	ng/g			40					3					760			X1
2,2',3,4,5'-pentachloroPCB(87)	ng/g			42					5					1200			X1
2,2'3,4'5-/2,2'4,5,5'-pentachPCB(90/101)	ng/g			67					9					1500			X1
2,2',3,5',6-pentachloroPCB(95)	ng/g			92					8					1300			X1
2,2',3',4,5-pentachloroPCB(97)	ng/g			1					3					890			X1
2,2',4,4',5-pentachloroPCB(99)	ng/g			3					3					1100			X1
2,2',4,6,6'-pentachloroPCB(104)	ng/g			1	<MDL				1	<MDL				1	<MDL		X1
2,3,3',4,4'-pentachloroPCB(105)	ng/g			37					3					1100			X1
2,3,3',4',6-pentachloroPCB(110)	ng/g			90					8					1800			X1
cis-nonachlor/2,3,4,4',5-pentachPCB(114)	ng/g			5		ABIAS			1		ABIAS			76		ABIAS	X1
2,3',4,4',5-pentachloroPCB(118)	ng/g			58					7					1700			X1
2,3',4,4',6-pentachloroPCB(119)	ng/g			4					1	<MDL				170			X1
2',3,4,4',5-pentachloroPCB(123)	ng/g			6					1					230			X1
3,3',4,4',5-pentachloroPCB(126)	ng/g			1					1					8			X1
2,2',3,3',4,4'-hexachloroPCB(128)	ng/g			11					2					110			X1
22',33',4,5-hexachloroPCB(129)	ng/g			6					1					44			X1
2,2',3,3',5,6'-hexachloroPCB(135)	ng/g			6					1					87			X1
2,2',3,4,4',5-hexachloroPCB(137)	ng/g			2					1					40			X1
2,2',3,4,4',5'-hexachloroPCB(138)	ng/g			56					8					480			X1
2,2',3,4,5,5'-hexachloroPCB(141)	ng/g			12					2					98			X1
2,2',3,4',5',6-hexachloroPCB(149)	ng/g			36					5					370			X1
2,2',3,5,5',6-hexachloroPCB(151)	ng/g			14					1					100			X1
22',44',55'-hexachloroPCB(153)	ng/g			54					5					440			X1
2,2',4,4',6,6'-hexachloroPCB(155)	ng/g			1	<MDL				1	<MDL				1	<MDL		X1
2,3,3',4,4',5-hexachloroPCB(156)	ng/g			6					1					68			X1
2,3,3',4,4',5'-hexachloroPCB(157)	ng/g			3					1					18			X1
2,3,3'4,4'6-hexachloroPCB(158)	ng/g			4					1					60			X1
2,3',4,4',5,5'-hexachloroPCB(167)	ng/g			2					1					28			X1
23',44',5'6-hexachloroPCB(168)	ng/g			1					1	<MDL				2			X1
3,3',4,4',5,5'-hexachloroPCB(169)	ng/g			16					2					1	<MDL		X1
2,2',3,3',4,4',5-heptachloroPCB(170)	ng/g			14					2					63			X1
DMDT/2,2',3,3',4,4',6-heptachPCB(171)	ng/g			7		ABIAS			1		ABIAS			1		ABIAS	X1
2,2',3,3',4,5,6'-heptachloroPCB(174)	ng/g			12					1					84			X1
2,2',3,3',4',5,6-heptachloroPCB(177)	ng/g			10					1					43			X1
2,2',3,3',5,5',6-heptachloroPCB(178)	ng/g			5					1					23			X1
22'344'55'-heptachloroPCB(180)	ng/g			24					2					130			X1
2,2',3,4,4',5',6-heptachloroPCB(183)	ng/g			9					1					43			X1
2,2',3,4',5,5',6-heptachloroPCB(187)	ng/g			17					1					120			X1
2,2',3,4',5,6,6'-heptachloroPCB(188)	ng/g			1	<MDL				1	<MDL				1	<MDL		X1
2,3,3',4,4',5,5'-heptachloroPCB(189)	ng/g			3					1					3			X1
2,3,3',4,4',5',6-heptachloroPCB(191)	ng/g			8					1					5			X1
233'4'55'6-heptachloroPCB(193)	ng/g			1	<MDL				1	<MDL				12			X1
2,2',3,3',4,4',5,5'-octachloroPCB(194)	ng/g			9					1					52			X1
2,2',3,3',4,5,5',6'-octachloroPCB(199)	ng/g			10					1					75			X1
2,2',3,3',4,5,6,6'-octachloroPCB(200)	ng/g			5					1	<MDL				15			X1
2,2',3,3',4,5',6,6'-octachloroPCB(201)	ng/g			1	<MDL				1	<MDL				1	<MDL		X1
2,2',3,3',5,5',6,6'-octachloroPCB(202)	ng/g			2					1	<MDL				16			X1
2,2',3,4,4',5,5',6-octachloroPCB(203)	ng/g			9					1					62			X1
2,3,3',4,4',5,5',6-octachloroPCB(205)	ng/g			1					1	<MDL				4			X1
22'33'44'55'6-nonachloroPCB(206)	ng/g			5					1					31			X1
22'33'44'566'-nonachloroPCB(207)	ng/g			1	<MDL				1	<MDL				5			X1
22'33'455'66'-nonachloroPCB(208)	ng/g			1	<MDL				1	<MDL				12			X1

ABIAS	APPROX. RESULT: MAY BE BIASED DUE TO COELUTIONS
X1	DILUTED BY 10 DETECTION LIMITS 10 TIMES NORMAL
<MDL	LESS THAN METHOD DETECTION LIMIT
Ontario Sediment Quality Guidelines	
LEL	Lowest Effect Level
SEL	Severe Effect Level - calculated by converting the SEL for Total PCB (530 ug/g organic carbon) to a bulk sediment concentration.
	This is done by multiplying the actual TOC concentration of the sample (to a max of 10%) by 530 ug/g organic carbon.

Table 11: Concentrations (ng/g) of PCBs in surface sediment (0-2 cm) along the Niagara River shoreline (River Road, North Tonawanda), and industrial organic compound in surface sediment (0-2 cm) collected from the Pettit Flume Cove, North Tonawanda, Niagara River, 2018

				GL185182					GL185181		
				Station 213					Station 231		
				D/S PRIVATE PROPERTY					**U/S end of GRP**		
				(U/S of GRP marina)					**GRATWIDE RIVERSIDE PARK**		
				01-AUG-2018					01-AUG-2018		
				Sediment (top 2 cm)					Sediment (top 2 cm)		
Very coarse Sand: % 1000-2000 um				28.5					24.5		
Silt: % <62 um, >2.63 um, sum	%			3.4					3.1		
Sand: % <1000 um, >62 um, sum	%			67.2					71.5		
Clay: % <2.63 um, >0.10 um, sum	%			0.9					0.8		
TOC	%			2.6					3		
Parameter Name	Units	LEL	SEL				LEL	SEL			
PCB; total	ng/g	70	**14560**	**5700**			70	**16800**	**150**		
2,2'-/2,6-dichloroPCB(4/10)	ng/g			5	<MDL				5	<MDL	
2,3'-dichloroPCB(6)	ng/g			26					5	<MDL	
2,4'-dichloroPCB(8)	ng/g			20					5	<MDL	
4,4'-dichloroPCB(15)	ng/g			61					5	<MDL	
2,2',3-trichloroPCB(16)	ng/g			92					7		
2,2',5-trichloroPCB(18)	ng/g			150					6		
2,2',6-trichloroPCB(19)	ng/g			14					6		
2,3,4'-trichloroPCB(22)	ng/g			2	<MDL				2	<MDL	
2,4,4'-/2,4',5-trichloroPCB(28/31)	ng/g			430					12		
2',3,4-trichloroPCB(33)	ng/g			150					3		
3,4,4'-trichloroPCB(37)	ng/g			19					3		
2,2',3,3'-tetrachloroPCB(40)	ng/g			86					2		
2,2',3,4-tetrachloroPCB(41)	ng/g			110					2		
2,2',3,5'-tetrachloroPCB(44)	ng/g			330					7		
2,2',4,5'-tetrachloroPCB(49)	ng/g			420					7		
2,2',5,5'-tetrachloroPCB(52)	ng/g			500		RDS		X1	10		
2,2',6,6'-tetrachloroPCB(54)	ng/g			1					1	<MDL	
G-CHLA/2,3,4,4'-tetrachloroPCB(60)	ng/g			160		ABIAS			3		ABIAS
2,3',4,4'-tetrachloroPCB(66)	ng/g			430					6		
2,3',4',5-tetrachloroPCB(70)	ng/g			410					6		
H-Epoxide/2,4,4',5-tetrachloroPCB(74)	ng/g			120		ABIAS			2		ABIAS
3,3',4,4'-tetrachloroPCB(77)	ng/g			44					1		
3,4,4',5-tetrachloroPCB(81)	ng/g			1	<MDL				1	<MDL	
2,2'3,3',6-pentachloroPCB(84)	ng/g			140					2		
2,2',3,4,4'-pentachloroPCB(85)	ng/g			96					2		
2,2',3,4,5'-pentachloroPCB(87)	ng/g			150					3		
2,2'3,4'5-/2,2'4,5,5'-pentachPCB(90/101)	ng/g			230					5		
2,2',3,5',6-pentachloroPCB(95)	ng/g			210					6		
2,2',3',4,5-pentachloroPCB(97)	ng/g			120					2		
2,2',4,4',5-pentachloroPCB(99)	ng/g			150					3		
2,2',4,6,6'-pentachloroPCB(104)	ng/g			1	<MDL				1	<MDL	
2,3,3',4,4'-pentachloroPCB(105)	ng/g			160					2		
2,3,3',4',6-pentachloroPCB(110)	ng/g			270					6		
cis-nonachlor/2,3,4,4',5-pentachPCB(114)	ng/g			3		ABIAS			1		ABIAS
2,3',4,4',5-pentachloroPCB(118)	ng/g			250					3		
2,3',4,4',6-pentachloroPCB(119)	ng/g			9					1	<MDL	
2',3,4,4',5-pentachloroPCB(123)	ng/g			1	<MDL				1	<MDL	
3,3',4,4',5-pentachloroPCB(126)	ng/g			2					1		
2,2',3,3',4,4'-hexachloroPCB(128)	ng/g			15					1		
22',33',4,5-hexachloroPCB(129)	ng/g			6					1	<MDL	
2,2',3,3',5,6'-hexachloroPCB(135)	ng/g			13					1		
2,2',3,4,4',5-hexachloroPCB(137)	ng/g			5					1		
2,2',3,4,4',5'-hexachloroPCB(138)	ng/g			69					5		
2,2',3,4,5,5'-hexachloroPCB(141)	ng/g			14					2		
2,2',3,4',5',6-hexachloroPCB(149)	ng/g			46					4		
2,2',3,5,5',6-hexachloroPCB(151)	ng/g			15					1		
22',44',55'-hexachloroPCB(153)	ng/g			56					5		
2,2',4,4',6,6'-hexachloroPCB(155)	ng/g			1	<MDL				1	<MDL	
2,3,3',4,4',5-hexachloroPCB(156)	ng/g			8					1		
2,3,3',4,4',5'-hexachloroPCB(157)	ng/g			3					1		
2,3,3'4,4'6-hexachloroPCB(158)	ng/g			9					1	<MDL	
2,3',4,4',5,5'-hexachloroPCB(167)	ng/g			6					1	<MDL	
23',44',5'6-hexachloroPCB(168)	ng/g			1	<MDL				1	<MDL	
3,3',4,4',5,5'-hexachloroPCB(169)	ng/g			1	<MDL				2		
2,2',3,3',4,4',5-heptachloroPCB(170)	ng/g			11					2		
DMDT/2,2',3,3',4,4',6-heptachPCB(171)	ng/g			1	<MDL	ABIAS			1		ABIAS
2,2',3,3',4,5,6'-heptachloroPCB(174)	ng/g			14					2		
2,2',3,3',4',5,6-heptachloroPCB(177)	ng/g			7					1		
2,2',3,3',5,5',6-heptachloroPCB(178)	ng/g			4					1		
22'344'55'-heptachloroPCB(180)	ng/g			20					3		
2,2',3,4,4',5',6-heptachloroPCB(183)	ng/g			7					1		
2,2',3,4',5,5',6-heptachloroPCB(187)	ng/g			16					2		
2,2',3,4',5,6,6'-heptachloroPCB(188)	ng/g			1	<MDL				1	<MDL	
2,3,3',4,4',5,5'-heptachloroPCB(189)	ng/g			2					1		
2,3,3',4,4',5',6-heptachloroPCB(191)	ng/g			1	<MDL				1	<MDL	
233'4'55'6-heptachloroPCB(193)	ng/g			2					1	<MDL	
2,2',3,3',4,4',5,5'-octachloroPCB(194)	ng/g			9					1		
2,2',3,3',4,5,5',6'-octachloroPCB(199)	ng/g			12					1		
2,2',3,3',4,5,6,6'-octachloroPCB(200)	ng/g			6					1	<MDL	
2,2',3,3',4,5',6,6'-octachloroPCB(201)	ng/g			1					1	<MDL	
2,2',3,3',5,5',6,6'-octachloroPCB(202)	ng/g			3					1	<MDL	
2,2',3,4,4',5,5',6-octachloroPCB(203)	ng/g			9					1		
2,3,3',4,4',5,5',6-octachloroPCB(205)	ng/g			1					1		
22'33'44'55'6-nonachloroPCB(206)	ng/g			4					1		
22'33'44'566'-nonachloroPCB(207)	ng/g			1					1	<MDL	
22'33'455'66'-nonachloroPCB(208)	ng/g			1					1	<MDL	

ABIAS	APPROX. RESULT: MAY BE BIASED DUE TO COELUTIONS
X1	DILUTED BY 10 DETECTION LIMITS 10 TIMES NORMAL
<MDL	LESS THAN METHOD DETECTION LIMIT
Ontario Sediment Quality Guidelines	
LEL	Lowest Effect Level
SEL	Severe Effect Level - calculated by converting the SEL for Total PCB (530 ug/g organic carbon) to a bulk sediment concentration.
	This is done by multiplying the actual TOC concentration of the sample (to a max of 10%) by 530 ug/g organic carbon.

Table 11: Concentrations (ng/g) of PCBs in surface sediment (0-2 cm) along the Niagara River shoreline (River Road, North Tonawanda), and industrial organic compound in surface sediment (0-2 cm) collected from the Pettit Flume Cove, North Tonawanda, Niagara River, 2018

				GL185180						GL185179	
				Station 235						Station 186	
				PETTIT FLUME COVE - NEAR CULVERT						PETTIT FLUME COVE	
				31-JUL-2018						31-JUL-2018	
				Sediment						Sediment	
%Sand,very coarse(1000-2000um)				31						0.5	
Silt	%			12.6						62.4	
Sand	%			53.9						23.7	
Clay	%			2.3						13.9	
TOC	%			17						10	
Parameter Name	Units	LEL	SEL					LEL	SEL		
1,2,3,5-/1,2,4,5-tetrachlorobenzene	ng/g			1700		RDS	X1			46	
Hexachlorobutadiene	ng/g			120						1	
1,2,3-trichlorobenzene	ng/g			170						44	
1,2,3,4-tetrachlorobenzene	ng/g			3200		RDS	X1			54	
1,2,4-trichlorobenzene	ng/g			300						100	
1,3,5-trichlorobenzene	ng/g			70						28	
Hexachlorobenzene	ng/g	20	**4080**	**4800**		RDS	X1	20	**2400**	110	
Hexachloroethane	ng/g			1	<MDL					1	
Octachlorostyrene	ng/g			39						2	
Pentachlorobenzene	ng/g			7600		RDS	X2			75	
2,3,6-trichlorotoluene	ng/g			17						1	
2,4,5-trichlorotoluene	ng/g			13						1	<MDL
2,6-dichlorobenzyl chloride	ng/g			67						1	<MDL

RDS	RESULT OBTAINED ON DILUTED SAMPLE
<	ACTUAL RESULT IS LESS THAN THE REPORTED VALUE
X1	DILUTED BY 10 DETECTION LIMITS 10 TIMES NORMAL
X2	DILUTED BY 100 DETECTION LIMITS 100 TIMES NORMAL
<MDL	LESS THAN METHOD DETECTION LIMIT
Ontario Sediment Quality Guidelines	
LEL	Lowest Effect Level
SEL	Severe Effect Level - calculated by converting the SEL for HCB (24 ug/g organic carbon) to a bulk sediment concentration.
	This is done by multiplying the actual TOC concentration of the sample (to a max of 10%) by 24 ug/g organic carbon.

Table 12: Concentrations of Polychlorinated dibenzo-p-dioxins and Polychlorinated dibenzofurans in caged mussels and surface sediment (0-2 cm) collected from the Pettit Flume Cove, North Tonawanda, and Bloody Run Creek, Niagara River, 2018

			GL185177			GL185179			GL185180			GL185178		
			500020185			500020186			500020235			500020187		
			PETTIT FLUME (UPSTREAM)			**PETTIT FLUME COVE (OUTER)**			**PETTIT FLUME COVE - (CULVERT)**			**PETTIT FLUME (DOWNSTREAM)**		
			31-JUL-2018			31-JUL-2018			31-JUL-2018			31-JUL-2018		
			Sediment			**Sediment**			**Sediment**			**Sediment**		
Sediment sample depth			0-1 cm			0-3 cm			0-3 cm			0-1 cm		
Silt		%	9			62.4			12.6			67.8		
Sand		%	73.9			23.7			53.9			11.8		
Clay		%	2.5			13.9			2.3			20.4		
TOC		mg/g	23			100			170			27		
Parameter Name	Test Code	Units	Reportable Result											
2378-tetrachlorofuran	P4F378	pg/g dry	5.8		DB5	2000	DB5		11000	DB5		130		DB5
12378-pentachlorofuran	P5F378	pg/g dry	3			790			6100			54		
23478-pentachlorofuran	P5F478	pg/g dry	4			1700			15000			110		
123478-hexachlorofuran	P6F478	pg/g dry	22		DB5	23000	DB5	SR	120000	DB5		1300		DB5
123678-hexachlorofuran	P6F678	pg/g dry	7			3900			28000			220		
123789-hexachlorofuran	P6F789	pg/g dry	1.7	<		42			300			4.7	<	
234678-hexachlorofuran	P6F234	pg/g dry	3			1100			8600			67		
1234678-heptachlorofuran	P7F678	pg/g dry	61			72000	SRH		210000	SRH		4300		
1234789-heptachlorofuran	P7F789	pg/g dry	2.8			2500			17000			140		
Octachlorofuran	P98CDF	pg/g dry	45			220000			520000			6900		
2378-tetrachlorodioxin	P4D378	pg/g dry	3.7			110			1000			5.1		
12378-pentachlorodioxin	P5D378	pg/g dry	1.8			290			2400			16		
123478-hexachlorodioxin	P6D478	pg/g dry	2.5			230			1400			13		
123678-hexachlorodioxin	P6D678	pg/g dry	9.4			570			4300			24		
123789-hexachlorodioxin	P6D789	pg/g dry	4.7		DB5	460	DB5		3300	DB5		23		DB5
1234678-heptachlorodioxin	P7D678	pg/g dry	39			3700			15000			170		
Octachlorodioxin	P98CDD	pg/g dry	150			12000			26000			730		
Sum Dioxins		pg/g dry	211			17360			53400			981		
Sum Furans		pg/g dry	155			327032			936000			13226		
Sum Dioxins and Furans			366			344392			989400			14207		
TEQ (WHO 2005) Mammals [a]		pg TEQ/g dry	**13**			**4916**			**28357**			**282**		
TEQ (WHO) Fish [a]		pg TEQ/g dry	**13**			**5090**			**30558**			**296**		
TEQ (WHO) Birds [a]		pg TEQ/g dry	**20**			**7818**			**48483**			**474**		
Dioxin-Like PCBs														
3,3',4,4'-tetrachlorobiphenyl	PCB077	pg/g dry	100			430			720	DB5		150		
3,4,4',5-tetrachlorobiphenyl	PCB081	pg/g dry	4			53			300	DB5	TEXT	9.9		
2,3,3'4,4'-pentachlorobiphenyl	PCB105	pg/g dry	380			2800			4500			540		
2,3,4,4',5-pentachlorobiphenyl	PCB114	pg/g dry	18			700			3200	DB5		74		
2,3'4,4',5-pentachlorobiphenyl	PCB118	pg/g dry	710			8000			26000			1200		
2'3,4,4',5-pentachlorobiphenyl	PCB123	pg/g dry	97		DB5	790	DB5		2900	DB5		58		DB5
3,3'4,4',5-pentachlorobiphenyl	PCB126	pg/g dry	6.4			100			410	DB5		15		
2,3,3'4,4'5-hexachlorobiphenyl	PCB156	pg/g dry	120			3400			11000			220		
2,3,3'44'5'-hexachlorobiphenyl	PCB157	pg/g dry	36		DB5	390	DB5		920	DB5		44		DB5
23',44',55'-hexachlorobiphenyl	PCB167	pg/g dry	67			1200			3700			69		
3,3'4,4'55'-hexachlorobiphenyl	PCB169	pg/g dry	1.2			21			110	DB5		6.6		
233'44'55'-heptachlorobiphenyl	PCB189	pg/g dry	28			840			2700			42		
TEQ DLPCB (WHO 2005) Mammals[a]			0.7			11			46			1.8		
TEQ DLPCB (WHO) Fish [a]			0.04			0.6			2			0.1		
TEQ DLPCB (WHO) Birds [a]			1			16			73			2.6		

[a] TEQs were calculated using 1/2 the detection limit (DL) when data were below the DL

Table 12: Concentrations of Polychlorinated dibenzo-p-dioxins and Polychlorinated dibenzofurans in caged mussels and surface sediment (0-2 cm) collected from the Pettit Flume Cove, North Tonawanda, and Bloody Run Creek, Niagara River, 2018

		GL185187			GL185186		GL185188		
		1100020026			1100020131		1100020025		
		BRC UPSTREAM			**BLOODY RUN CREEK**		**BRC DOWNSTREAM**		
		02-AUG-2018			02-AUG-2018		02-AUG-2018		
		Sediment			**Sediment**		**Sediment**		
Sediment sample depth		0-1 cm			0-1 cm		0-1 cm		
Silt	%	19.9			5.2		14.1		
Sand	%	54.3			81.6		70		
Clay	%	3.5			1.2		3.8		
TOC	mg/g	8.5			12		10		
Parameter Name	Units								
2378-tetrachlorofuran	pg/g dry	7.9		DB5	120	DB5	25		DB5
12378-pentachlorofuran	pg/g dry	1.6			77		10		
23478-pentachlorofuran	pg/g dry	2.7			160		23		
123478-hexachlorofuran	pg/g dry	17		DB5	1700	DB5	160		DB5
123678-hexachlorofuran	pg/g dry	3.3			290		28		
123789-hexachlorofuran	pg/g dry	1.4	<		8.5		2.2	<	
234678-hexachlorofuran	pg/g dry	1.4	<		69		8.7		
1234678-heptachlorofuran	pg/g dry	28			1000		120		
1234789-heptachlorofuran	pg/g dry	2.3			270		30		
Octachlorofuran	pg/g dry	38			3900		390		
2378-tetrachlorodioxin	pg/g dry	27			3300		350		
12378-pentachlorodioxin	pg/g dry	1.7	<		62		9.6		
123478-hexachlorodioxin	pg/g dry	1.3	<		170		19		
123678-hexachlorodioxin	pg/g dry	6.2			2900		240		
123789-hexachlorodioxin	pg/g dry	4.1		DB5	1800	DB5	140		DB5
1234678-heptachlorodioxin	pg/g dry	29			14000		1200		
Octachlorodioxin	pg/g dry	46			11000		900		
Sum Dioxins	pg/g dry	115			33232		2859		
Sum Furans	pg/g dry	104			7595		797		
Sum Dioxins and Furans		219			40827		3656		
TEQ (WHO 2005) Mammals [a]	pg TEQ/g dry	**33**			**4275**		**443**		
TEQ (WHO) Fish [a]	pg TEQ/g dry	**32**			**3818**		**409**		
TEQ (WHO) Birds [a]	pg TEQ/g dry	**41**			**4102**		**449**		
Dioxin-Like PCBs									
3,3',4,4'-tetrachlorobiphenyl	pg/g dry	360			4600		710		
3,4,4',5-tetrachlorobiphenyl	pg/g dry	19			960		130		
2,3,3'4,4'-pentachlorobiphenyl	pg/g dry	1100			14000		2100		
2,3,4,4',5-pentachlorobiphenyl	pg/g dry	62			2700		290		
2,3'4,4',5-pentachlorobiphenyl	pg/g dry	1800			23000		3500		
2'3,4,4',5-pentachlorobiphenyl	pg/g dry	70		DB5	1100	DB5	160		DB5
3,3'4,4',5-pentachlorobiphenyl	pg/g dry	9.4			600		65		
2,3,3'4,4'5-hexachlorobiphenyl	pg/g dry	77			2400		240		
2,3,3'44'5'-hexachlorobiphenyl	pg/g dry	23		DB5	1300	DB5	130		DB5
23',44',55'-hexachlorobiphenyl	pg/g dry	32			1300		160		
3,3'4,4'55'-hexachlorobiphenyl	pg/g dry	0.7	<		120		13		
233'44'55'-heptachlorobiphenyl	pg/g dry	6.9			510		48		
TEQ DLPCB (WHO 2005) Mammals[a]		1			65		7		
TEQ DLPCB (WHO) Fish [a]		0.1			4		0.4		
TEQ DLPCB (WHO) Birds [a]		3			158		20		

[a] TEQs were calculated using 1/2 the detection limit (DL) when data were below the DL

Table 12: Concentrations of Polychlorinated dibenzo-p-dioxins and Polychlorinated dibenzofurans in caged mussels and surface sediment (0-2 cm) collected from the Pettit Flume Cove, North Tonawanda, and Bloody Run Creek, Niagara River, 2018

		GL185077	GL185081	GL185116	GL185120	GL185124	GL185112
		500020185	500020187	1100020017	1100020131	1100020132	1100020025
		Pettit Flume (U/S)	**Pettit Flume (D/S)**	**BRC**	**BRC (131)**	**BRC (132)**	**BRC (D/S)**
		31-JUL-2018	31-JUL-2018	2-AUG-2018	2-AUG-2018	2-AUG-2018	2-AUG-2018
		Mussels	**Mussels**	**Mussels**	**Mussels**	**Mussels**	**Mussels**
Percent Lipid (%)		0.48	0.6	0.52	0.67	0.61	0.57
2378-tetrachlorofuran	pg/g dry	0.18 <	2	0.93	0.64	1.2	0.59
12378-pentachlorofuran	pg/g dry	0.19 <	0.8	0.26	0.25	0.35	0.35
23478-pentachlorofuran	pg/g dry	0.23 <	1.6	0.59	0.31	0.73	0.49
123478-hexachlorofuran	pg/g dry	0.16 <	12	1.6	1.7	1.7	1.3
123678-hexachlorofuran	pg/g dry	0.14 <	2.1	0.36	0.26	0.47	0.3
123789-hexachlorofuran	pg/g dry	0.24 <	0.26 <	0.31 <	0.23 <	0.21 <	0.33 <
234678-hexachlorofuran	pg/g dry	0.13 <	0.58	0.19 <	0.19 <	0.17 <	0.29 <
1234678-heptachlorofuran	pg/g dry	0.2 <	27	0.74 <	0.77 <	0.94 <	0.9 <
1234789-heptachlorofuran	pg/g dry	0.11 <	0.98	0.29	0.5	0.26	0.32
Octachlorofuran	pg/g dry	0.15 <	34	1.6	1.5	2.1	2
2378-tetrachlorodioxin	pg/g dry	0.1 <	0.29 <	17	10	22	7.2
12378-pentachlorodioxin	pg/g dry	0.15 <	0.34 <	0.23 <	0.2 <	0.43 <	0.24 <
123478-hexachlorodioxin	pg/g dry	0.11 <	0.26 <	0.23 <	0.21 <	0.34	0.18 <
123678-hexachlorodioxin	pg/g dry	0.18 <	0.4	2.2	2.2	2.5	1.4
123789-hexachlorodioxin	pg/g dry	0.12 <	0.28 <	1.1	1.3	1.6	0.71
1234678-heptachlorodioxin	pg/g dry	0.37 <	1.3	6.8	9.9	7.8	4.2
Octachlorodioxin	pg/g dry	2.4	4.6	5.9	7.7	5.4	4.7
PCB077	pg/g dry	22	14	38	21	50	20
PCB081	pg/g dry	0.64 <	0.45 <	8	4.4	12	3.7
PCB105	pg/g dry	100	77	180	99	230	110
PCB114	pg/g dry	7.1	6.8	28	16	37	18
PCB118	pg/g dry	230	160	320	170	400	190
PCB123	pg/g dry	4.2	3.6	13	7.4	17	8
PCB126	pg/g dry	0.88	0.95	3.8	2.3	5.7	2.3
PCB156	pg/g dry	20	20	21	12	26	16
PCB157	pg/g dry	4.2	3.8	9.8	6.3	13	6.6
PCB167	pg/g dry	7.9	6.6	14	7	18	9.3
PCB169	pg/g dry	0.15 <	0.2 <	0.56	0.25 <	0.96	0.31 <
PCB189	pg/g dry	1.9	2.3	2.6	1.9	3.6	2.2
Sum Furans	pg/g dry	0.9	81	6.3	5.8	7.5	6.1
Sum dioxins	pg/g dry	2.9	6.9	33	31	40	18
Sum Dioxins + Furans	pg/g dry	3.8	88	39	37	47	25
Sum Dioxin-Like PCBs	pg/g dry	377	281	601	326	763	366
TEQ (WHO 2005) Mammals [a]	pg TEQ/g dry	0.2	2.9	18	11	23	8.0
TEQ (WHO) Fish [a]	pg TEQ/g dry	**0.3**	**3.1**	**18**	**11**	**23**	**7.9**
TEQ (WHO) Birds [a]	pg TEQ/g dry	0.4	5.8	19	11	25	8.7
TEQ (WHO) Fish (corrected for % Lipid)		53	515	3422	1586	3790	1383
Total TEQ (dioxins +dlPCBs)							
Mammals[a]	pg TEQ/g dry	0.3	3.0	18	11	24	8.2
Fish[a]	pg TEQ/g dry	0.3	3.1	18	11	23	7.9
Birds[a]	pg TEQ/g dry	0.5	5.9	20	12	26	9.3

[a] TEQs were calculated using 1/2 the detection limit (DL) when data were below the DL

Table 13: Concentrations (ng/g) of organochloride pesticides in surface sediment (0-2 cm) collected from the Fort Erie shoreline, Niagara River, 2018

Sample ID				GL185189				GL185190					GL185191					GL185192		
Station Number				1600011327				500020230					500020231					500020232		
				THUNDER BAY, LAKE ERIE				**ADELAIDE ST, FORT ERIE**					**QUEEN STREET - FORT ERIE**					**GILMORE ROAD - FORT ERIE**		
Sample Date				02-AUG-2018				02-AUG-2018					03-AUG-2018					03-AUG-2018		
				Sediment				Sediment					Sediment					Sediment		
%Sand,very coarse(1000-2000um)				0.5				3.5					0.5					0.5		
Silt			%	2.6				4.8					17.8					35.8		
Sand			%	96.4				89.9					77.7					57.3		
Clay			%	1				1.6					4.5					6.9		
TOC			%	0.51				0.69					1.4					2		
	LEL	SEL				LEL	SEL				LEL	SEL				LEL	SEL			
Aldrin			ng/g	1	<MDL			1					1	<MDL				1	<MDL	
a-BHC (hexachlorocyclohexane)			ng/g	1	<MDL			1	<MDL				1	<MDL				1	<MDL	
b-BHC (hexachlorocyclohexane)			ng/g	1	<MDL			1	<MDL				1	<MDL				1	<MDL	
g-BHC (hexachlorocyclohexane)			ng/g	1	<MDL			1					1					1		
a-Chlordane			ng/g	1	<MDL			1	<MDL				1	<MDL				1	<MDL	
Dieldrin			ng/g	1	<MDL			1	<MDL				1					1		
Endosulphan I			ng/g	1	<MDL			1	<MDL				1	<MDL				1	<MDL	
Endosulphan II			ng/g	1	<MDL			1	<MDL				1	<MDL				1		
Endrin			ng/g	1	<MDL			1	<MDL				1	<MDL				1		
Endosulphan sulphate			ng/g	1	<MDL			1	<MDL				1	<MDL				1		
Heptachlor			ng/g	1				1	<MDL				1	<MDL				1	<MDL	
Mirex			ng/g	1	<MDL			1	<MDL				1	<MDL				1	<MDL	
Oxychlordane			ng/g	1	<MDL			1	<MDL				1	<MDL				1		
Photomirex			ng/g	1	<MDL			1	<MDL				1	<MDL				1	<MDL	
op-DDT			ng/g	1	<MDL			1	<MDL				1	<MDL				1		
pp-DDT			ng/g	1				1					1					5		
op + pp-DDT	8		ng/g	2		8		2			8		2			8		6		
pp-DDD	8		ng/g	1		8		1			8		1			8	120	**12**		
pp-DDE	5		ng/g	1		5		1			5		2			5	380	**10**		
Total DDT	7					7		4			7		5			7	240	**28**		
G-CHLA/2,3,4,4'-tetrachloroPCB(60)			ng/g	1	<MDL			1		ABIAS			1		ABIAS			1	<MDL	ABIAS
H-Epoxide/2,4,4',5-tetrachloroPCB(74)			ng/g	1	<MDL			1	<MDL	ABIAS			1	<MDL	ABIAS			1		ABIAS
cis-nonachlor/2,3,4,4',5-pentachPCB(114)			ng/g	1	<MDL			1		ABIAS			1	<MDL	ABIAS			1		ABIAS
DMDT/2,2',3,3',4,4',6-heptachPCB(171)			ng/g	1	<MDL			1	<MDL	ABIAS			1	<MDL	ABIAS			1		ABIAS
trans-nonachlor			ng/g	1	<MDL			1					1					1		

ABIAS: RESULT: MAY BE BIASED DUE TO COELUTIONS
<MDL: LESS THAN METHOD DETECTION LIMIT
Ontario Sediment Quality Guidelines

LEL	Lowest Effect Level
SEL	Severe Effect Level - calculated by converting the SEL for the compound (e.g. DDD 6 ug/g organic carbon; DDE 19 ug/g organic carbon) to a bulk sediment concentration.
	This is done by multiplying the actual TOC concentration of the sample (to a max of 10%) by e.g. 6 or 19 ug/g organic carbon.

Table 13: Concentrations (ng/g) of organochloride pesticides in surface sediment (0-2 cm) collected from the Fort Erie shoreline, Niagara River, 2018

Sample ID				GL185193					GL185194					GL185195		
Station Number				500020203					500020233					500020234		
				FORT ERIE AT ROBERSTON STREET					**ANGER AVENUE - FORT ERIE**					**SWITCH ROAD - FORT ERIE**		
Sample Date				03-AUG-2018					03-AUG-2018					03-AUG-2018		
				Sediment					Sediment					Sediment		
%Sand,very coarse(1000-2000um)				5					0.5					0.5		
Silt	%			2					31.6					41.1		
Sand	%			92.4					60.8					48.6		
Clay	%			0.6					7.5					10.3		
TOC	%			1					4.8					1.6		
		LEL	SEL				LEL	SEL				LEL	SEL			
Aldrin	ng/g			1					1	<MDL				1	<MDL	
a-BHC (hexachlorocyclohexane)	ng/g			1	<MDL				1					1		
b-BHC (hexachlorocyclohexane)	ng/g			1	<MDL				1	<MDL				1	<MDL	
g-BHC (hexachlorocyclohexane)	ng/g			1					1					1		
a-Chlordane	ng/g			1	<MDL				1	<MDL				1	<MDL	
Dieldrin	ng/g			1	<MDL				1					1		
Endosulphan I	ng/g			1	<MDL				1	<MDL				1	<MDL	
Endosulphan II	ng/g			1	<MDL				1					1		
Endrin	ng/g			1	<MDL				1					1	<MDL	
Endosulphan sulphate	ng/g			1	<MDL				1	<MDL				1	<MDL	
Heptachlor	ng/g			1	<MDL				1	<MDL				1	<MDL	
Mirex	ng/g			1	<MDL				1	<MDL				1	<MDL	
Oxychlordane	ng/g			1	<MDL				1	<MDL				1	<MDL	
Photomirex	ng/g			1	<MDL				1	<MDL				1	<MDL	
op-DDT	ng/g			1					2					11		
pp-DDT	ng/g			6					8					16		
op + pp-DDT	ng/g	8		7			8		**10**			8	1136	**27**		
pp-DDD	ng/g	8	60	**8**			8	288	**9**			8	96	**11**		
pp-DDE	ng/g	5	190	**23**			5	912	**64**			5	304	**77**		
Total DDT		7	120	**38**			7	576	**83**			7	192	**115**		
G-CHLA/2,3,4,4'-tetrachloroPCB(60)	ng/g			1	<MDL	ABIAS			1	<MDL	ABIAS			1	<MDL	ABIAS
H-Epoxide/2,4,4',5-tetrachloroPCB(74)	ng/g			1		ABIAS			1	<MDL	ABIAS			1	<MDL	ABIAS
cis-nonachlor/2,3,4,4',5-pentachPCB(114)	ng/g			1	<MDL	ABIAS			1		ABIAS			1		ABIAS
DMDT/2,2',3,3',4,4',6-heptachPCB(171)	ng/g			1	<MDL	ABIAS			1		ABIAS			1	<MDL	ABIAS
trans-nonachlor	ng/g			1					1					1		

ABIAS: RESULT: MAY BE BIASED DUE TO COELUTIONS

<MDL: LESS THAN METHOD DETECTION LIMIT

Ontario Sediment Quality Guidelines

LEL Lowest Effect Level

SEL Severe Effect Level - calculated by converting the SEL for the compound (e.g. DDD 6 ug/g organic carbon; DDE 19 ug/g organic carbon) to a bulk sediment concentration.
This is done by multiplying the actual TOC concentration of the sample (to a max of 10%) by e.g. 6 or 19 ug/g organic carbon.

Appendix B: Lab Blanks - SPMD

Appendix B: SPMD lab blanks and Spike samples, 2018 Niagara River Survey.

CLIENT_ID	Lab Blank DB17			Lab Blank DB5			Spiked Matrix DB17			Spiked Matrix DB5			Lab Blank DB17			Lab Blank DB5		
Axys ID	WG65416-101			WG65416-101			WG65416-102			WG65416-102			WG65417-101			WG65417-101		
Method	SGS AXYS METHOD MLA-007 Rev 13			SGS AXYS METHOD MLA-007 Rev 13			SGS AXYS METHOD MLA-007 Rev 13			SGS AXYS METHOD MLA-007 Rev 13			SGS AXYS METHOD MLA-007 Rev 13			SGS AXYS METHOD MLA-007 Rev 13		
WORKGROUP	WG65416			WG65416									WG65417			WG65417		
Sample Size																		
UNITS	flag	ng/sample	ng/sample (RL)	flag	ng/sample	ng/sample (RL)	flag	% Recovery	-	flag	% Recovery	-	flag	ng/sample	ng/sample (RL)	flag	ng/sample	ng/sample (RL)
HCH, delta	ND		0.291	ND		0.291		106			106		ND		0.0426	ND		0.0419
Heptachlor Epoxide	ND		0.231	ND		0.131		96.1			95.4		ND		0.0203	ND		0.0153
Dieldrin	ND		0.423	ND		0.325		114			110		J	0.176	0.0671	J	0.176	0.0395
Endrin	ND		0.494	ND		0.361		107			101		ND		0.0783	ND		0.0439
Endrin Aldehyde	ND		0.682	ND		0.587		74.7			67.9		ND		0.108	ND		0.0713
Endrin Ketone	ND		0.148	ND		0.0891		90.6			88.3		J	0.021	0.0131	ND		0.0145
Methoxychlor	ND		0.375	ND		0.225		90			88.1		ND		0.0332	ND		0.0365
alpha-Endosulphan	ND		0.336	ND		0.275		98.1			93.3		ND		0.0613	ND		0.0394
beta-Endosulphan	ND		0.483	ND		0.349		98.4			86.6		ND		0.0765	ND		0.0424
Endosulphan Sulphate	ND		0.605	ND		0.482		94.5			90.7		ND		0.0959	ND		0.0587
Technical Toxaphene	ND		47					81.3					ND		17.4			
D4-alpha-Endosulphan (% Recovery) DB5					82.6						80.6						85.5	
D4-beta-Endosulphan (% Recovery) DB5					72.8						75.7						87.3	
D4-alpha-Endosulphan (% Recovery) DB17		88.2						90.9						89.9				
D4-beta-Endosulphan (% Recovery) DB17		74.9						79.8						89.7				
13C-PCB 159 (% Recovery)		80.2						87						95.3				

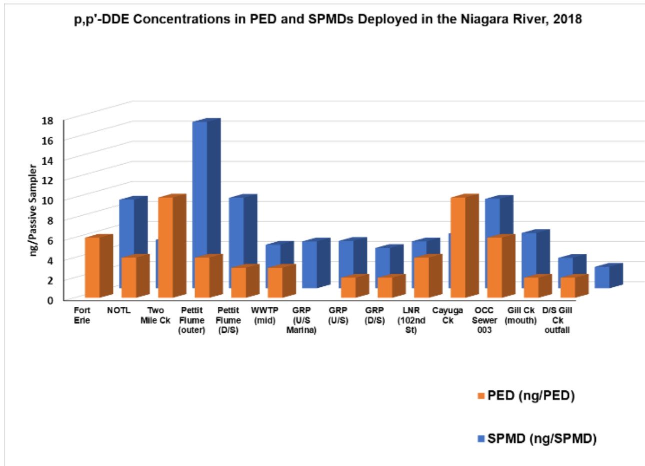
CLIENT_ID	Lab Blank (101)			Spiked Matrix (102)			Lab Blank (101)		
Axys ID	WG65416-101			WG65416-102			WG65417-101		
Method	SGS AXYS METHOD MLA-007 Rev 13			SGS AXYS METHOD MLA-007 Rev 13			SGS AXYS METHOD MLA-007 Rev 13		
WORKGROUP	WG65416			WG65416			WG65417		
Sample Size	1sample						1sample		
UNITS	flag	ng/sample	ng/sample (RL)	flag	% Recovery	-	flag	ng/sample	ng/sample (RL)
1,3-Dichlorobenzene	ND		0.976		103		ND		1.82
1,4-Dichlorobenzene	ND		1.02		75.8		ND		1.89
1,2-Dichlorobenzene	ND		0.974		104		ND		1.81
1,3,5-Trichlorobenzene	ND		0.448		86.7		NDR J	1.23	0.842
1,2,4-Trichlorobenzene	ND		0.459		91.7		ND		0.863
1,2,3-Trichlorobenzene	ND		0.476		99.6		ND		0.896
1,2,4,5-/1,2,3,5-Tetrachlorobenzene	ND		0.326		96.1		ND		0.379
1,2,3,4-Tetrachlorobenzene	ND		0.329		100		ND		0.382
Hexachlorobutadiene	ND		0.329				ND		0.382
Pentachlorobenzene	ND		0.659		103		ND		0.502
Hexachlorobenzene	ND		0.25		101		ND		0.387
HCH, alpha	ND		1.38		94.4		ND		1.81
HCH, beta	ND		1.35		102		ND		0.867
HCH, gamma	ND		1.25		101		ND		1.24
Heptachlor	ND		1.02		99.4		ND		0.88
Aldrin	ND		0.786		96.8		ND		1.11
Chlordane, gamma (trans)	ND		0.125		98.7		ND		0.34
Chlordane, alpha (cis)	ND		0.146		99.8		ND		0.395
Octachlorostyrene	ND		0.462		92.5		ND		0.4
Chlordane, oxy-	ND		2.84		98.9		ND		3.16
Nonachlor, trans-	ND		0.269		104		ND		0.193
Nonachlor, cis-	ND		0.302		118		ND		0.217
Mirex	ND		0.239	N	132		ND		0.547
2,4'-DDE	ND		0.218		99.4		ND		0.106
4,4'-DDE	ND		0.303		97		ND		0.147
2,4'-DDD	ND		0.289		81.5		ND		0.151
4,4'-DDD	ND		0.204		93.7		ND		0.16
2,4'-DDT	ND		0.21		84.6		ND		0.165
4,4'-DDT	ND		0.232		96.6		ND		0.182
Hexachloroethane	ND		1.12		122		ND		0.892
2,4,5-Trichlorotoluene	ND		0.799		109		ND		0.702
2,3,6-Trichlorotoluene	ND		0.908		110		ND		0.796
Photomirex	ND		0.391		105		ND		0.419
13C-1,4-Dichlorobenzene (% Recovery)		17.2			11			13	
13C-1,2,3-Trichlorobenzene (% Recovery)		30			25.1			21.5	
13C-1,2,3,4-Tetrachlorobenzene (% Recovery)		34.6			28.6			24.1	
13C-Pentachlorobenzene (% Recovery)		35			31.8		V	25.3	
13C-Hexachlorobenzene (% Recovery)		41.3			39.9			35.8	
13C-beta-HCH (% Recovery)		48.9			52.5			60.9	
13C-gamma-HCH (% Recovery)		49.3			52.6			50.7	
13C-Heptachlor (% Recovery)		47.7			32.9			56.3	
13C-Aldrin (% Recovery)		51.1			52			53.6	
13C-Chlordane, gamma (trans) (% Recovery)		61.5			70.1			71.3	
13C-Nonachlor, trans- (% Recovery)		63.9			70.5			73.5	
13C-4,4'-DDE (% Recovery)		70.2			80.6			86.2	
13C-4,4'-DDT (% Recovery)		80			106			108	

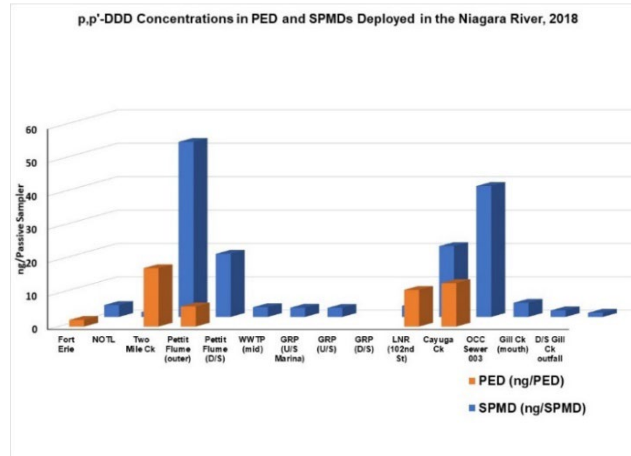
Appendix B: SPMD lab blanks and Spike samples, 2018 Niagara River Survey.

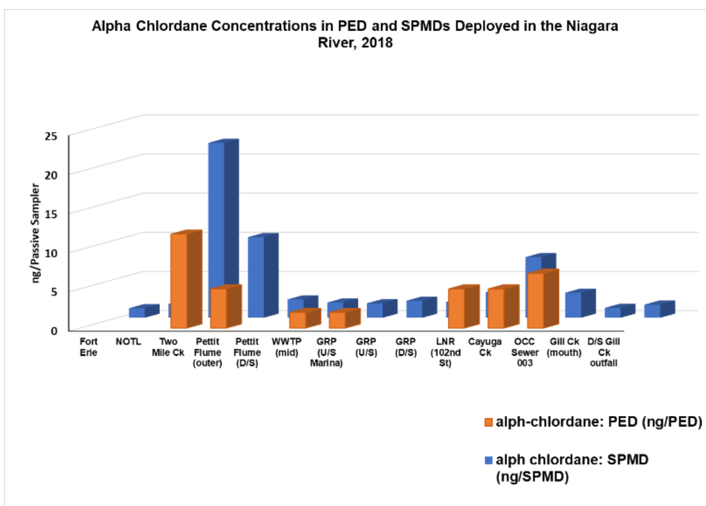
CLIENT_ID	Spiked Matrix DB17			Spiked Matrix DB5			Lab Blank DB17			Lab Blank DB5			Spiked Matrix DB17			Spiked Matrix DB5		
Axys ID	WG65417-102			WG65417-102			WG65418-101			WG65418-101			WG65418-102			WG65418-102		
Method	SGS AXYS METHOD MLA-007 Rev 13			SGS AXYS METHOD MLA-007 Rev 13			SGS AXYS METHOD MLA-007 Rev 13			SGS AXYS METHOD MLA-007 Rev 13			SGS AXYS METHOD MLA-007 Rev 13			S AXYS METHOD MLA-007 Rev		
WORKGROUP	WG65417			WG65417			WG65418			WG65418			WG65418			WG65418		
Sample Size							1sample			1sample								
UNITS	flag	% Recover	-	flag	% Recovery	-	flag	ng/sample	ng/sample (RL)	flag	ng/sample	ng/sample (RL)	flag	% Recover	-	flag	% Recover	-
HCH, delta		78.1			83.8		ND		0.111	ND		0.0989		92			103	
Heptachlor Epoxide		85.7			84.8		ND		0.139	ND		0.0927		90.6			92	
Dieldrin		121			118		ND		0.395	ND		0.144		112			108	
Endrin		114			109		ND		0.461	ND		0.16		107			103	
Endrin Aldehyde		66.8			62.3		ND		0.637	ND		0.26		88.1			78.7	
Endrin Ketone		96.4			92.7		ND		0.0177	ND		0.0353		111			107	
Methoxychlor		92.4			87.9		ND		0.0447	ND		0.0891		107			100	
alpha-Endosulphan		95.5			92.4		ND		0.316	ND		0.125		94.8			91.7	
beta-Endosulphan		97.8			88.4		ND		0.45	ND		0.155		94.4			83.6	
Endosulphan Sulphate		97.1			91.6		ND		0.564	ND		0.214		114			109	
Technical Toxaphene		85.2					ND		40					80.4				
D4-alpha-Endosulphan (% Recovery) DB5					88.4						101						72.5	
D4-beta-Endosulphan (% Recovery) DB5					80.8						89.1						76.8	
D4-alpha-Endosulphan (% Recovery) DB17		97.4						109						82.9				
D4-beta-Endosulphan (% Recovery) DB17		85.6						93.1						82.3				
13C-PCB 159 (% Recovery)		89.9						91.8						81.4				

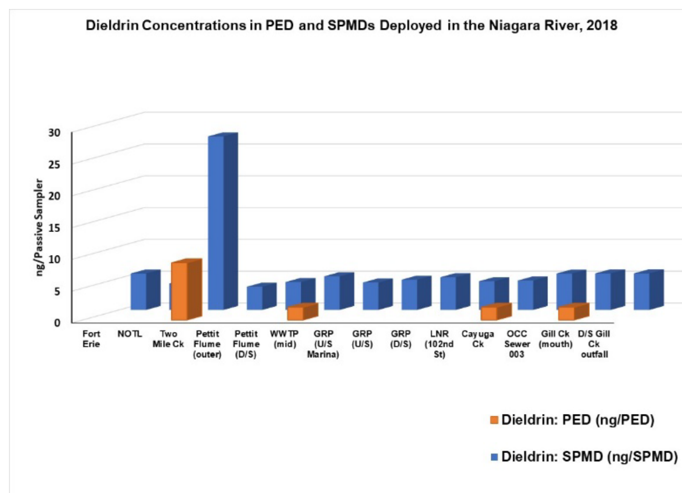
CLIENT_ID	Spiked Matrix (102)			Lab Blank (101)			Spiked Matrix (102)		
Axys ID	WG65417-102			WG65418-101			WG65418-102		
Method	SGS AXYS METHOD MLA-007 Rev 13			SGS AXYS METHOD MLA-007 Rev 13			SGS AXYS METHOD MLA-007 Rev 13		
WORKGROUP	WG65417			WG65418			WG65418		
Sample Size				1sample					
UNITS	flag	% Recover	-	flag	ng/sample	ng/sample (RL)	flag	% Recover	-
1,3-Dichlorobenzene		125		ND		0.796		121	
1,4-Dichlorobenzene		96.7		ND		0.83		72.8	
1,2-Dichlorobenzene		118		ND		0.795		100	
1,3,5-Trichlorobenzene		93.6		ND		0.613		93.5	
1,2,4-Trichlorobenzene		95.4		ND		0.628		97.6	
1,2,3-Trichlorobenzene		95		ND		0.652		108	
1,2,4,5-/1,2,3,5-Tetrachlorobenzene		99.1		ND		0.183		99.3	
1,2,3,4-Tetrachlorobenzene		98.8		ND		0.184		99.5	
Hexachlorobutadiene				ND		0.184			
Pentachlorobenzene		101		ND		0.298		99	
Hexachlorobenzene		103		ND		0.196		102	
HCH, alpha		89.3		ND		1.14		93.2	
HCH, beta		97.5		ND		0.618		98.9	
HCH, gamma		99		ND		0.916		101	
Heptachlor		99		ND		1.18		103	
Aldrin		94.4		ND		0.857		92.5	
Chlordane, gamma (trans)		98.9		ND		0.213		101	
Chlordane, alpha (cis)		103		ND		0.247		101	
Octachlorostyrene		95.2		ND		0.227		94.5	
Chlordane, oxy-		103		ND		2.73		104	
Nonachlor, trans-		99.4		ND		0.162		98.9	
Nonachlor, cis-		112		ND		0.182		112	
Mirex		129		ND		0.267		122	
2,4'-DDE		95.3		ND		0.195		94.2	
4,4'-DDE		96.9		ND		0.271		96.1	
2,4'-DDD		75.7		ND		0.139		83.3	
4,4'-DDD		90.5		ND		0.302		95.7	
2,4'-DDT		86.1		ND		0.311		90.9	
4,4'-DDT		95.9		ND		0.343		95.1	
Hexachloroethane	N	158		ND		1.65		120	
2,4,5-Trichlorotoluene		110		ND		0.531		107	
2,3,6-Trichlorotoluene		111		ND		0.596		107	
Photomirex		106		ND		0.682		104	
13C-1,4-Dichlorobenzene (% Recovery)		11.9			19.1			24.6	
13C-1,2,3-Trichlorobenzene (% Recovery)		24.8			38.2			37.6	
13C-1,2,3,4-Tetrachlorobenzene (% Recovery)		26.6			39.6			38.2	
13C-Pentachlorobenzene (% Recovery)		30.4			40.1			40.1	
13C-Hexachlorobenzene (% Recovery)		41.3			48.3			46	
13C-beta-HCH (% Recovery)		53.4			56.9			53.1	
13C-gamma-HCH (% Recovery)		51			54.9			53.1	
13C-Heptachlor (% Recovery)		58.1			34.1			39.3	
13C-Aldrin (% Recovery)		54.7			60.9			56.4	
13C-Chlordane, gamma (trans) (% Recovery)		69.2			71.1			64	
13C-Nonachlor, trans- (% Recovery)		73.2			72.8			67.9	
13C-4,4'-DDE (% Recovery)		84.4			85.2			77.5	
13C-4,4'-DDT (% Recovery)		121			90.9			98	

Appendix C: Comparison of Site-Specific PED and SPMD data

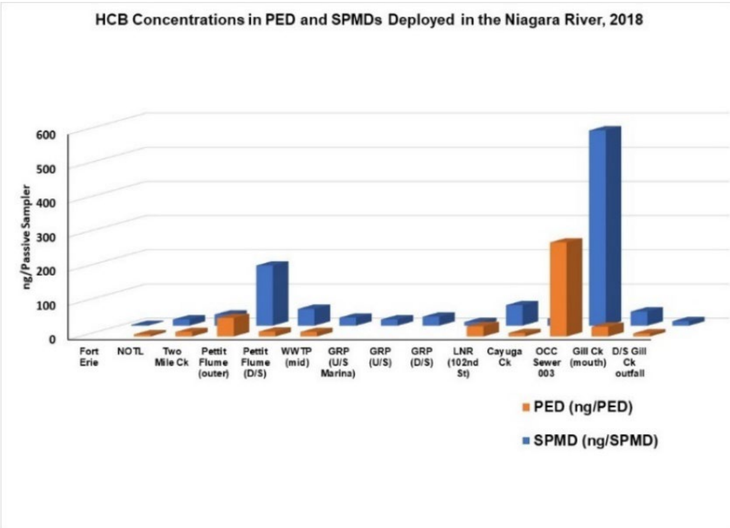


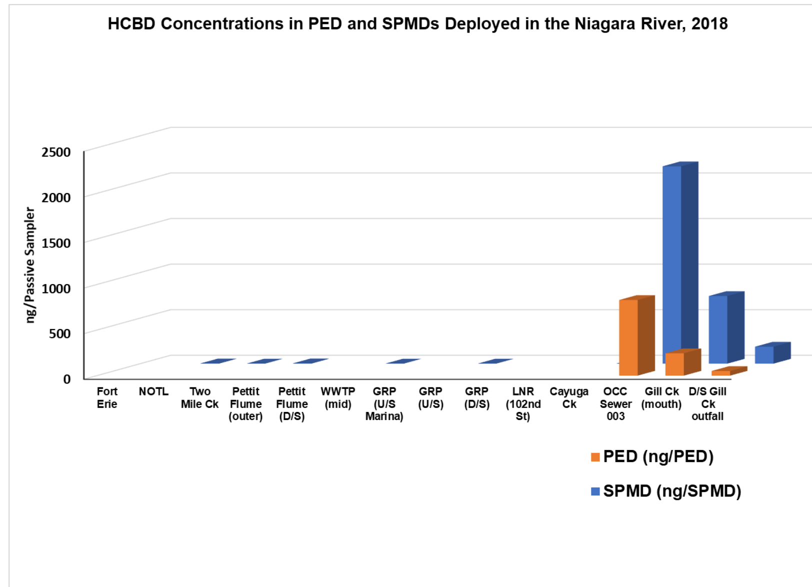


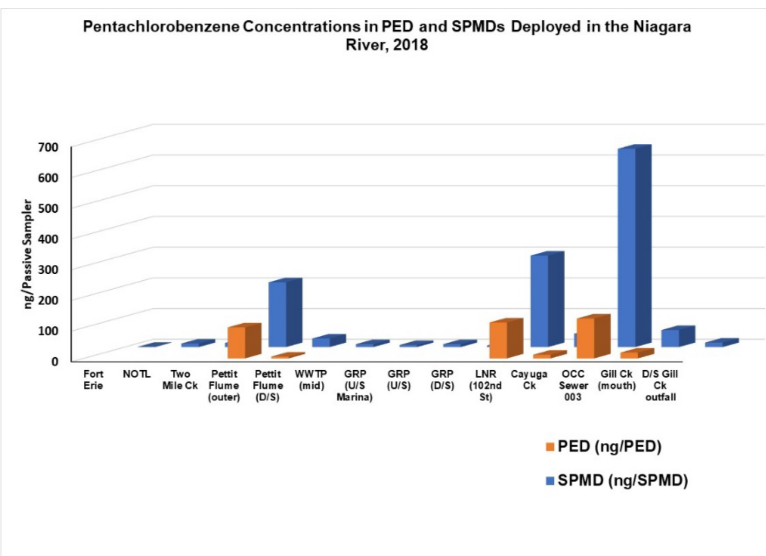




Appendix C: Comparison of Site-Specific PED and SPMD data







Appendix D: Dioxin and Furan Concentrations in Mussels and Sediment 1985-2018

Appendix D. Total TEQ pg/g* and TEQ for Dioxin-Like (DL) PCBs(pg/g)** in caged mussels (wet wt.) and sediment (dry wt.) collected from the Niagara River (1987-2018).

NR-Niagara River; ND-below the detection limit; NA-not available - cages were not retrieved

		Mussels		Sediment				
STATION	**YEAR**	**Total TEQ**	**DL-PCB TEQ**	**Total TEQ**	**DL-PCB TEQ**	**TOC (mg/g)**	**pg/g Sum PCDD/F**	**ng/g**
Canadian Sites								
NR - Fort Erie	1995	ND		0.9				
	1997			10		20		
	2000	0.01	0.01	2	0.01	9		
NR - Chippawa Channel	2000	ND	ND	0.01	0.01	5		
Niagara-on-the-Lake	1993	ND		13				
	1995	ND		14				
	1997	ND						
	2000	0.01	0.01					
	2003			8	0.05	7		
American Sites								
Tonawanda Channel (U/S Two Mile Ck.)	2009	0.01						
Scajaquada Creek	2009	0.03		13		45		
Rattlesnake Creek	2009	0.11		13		30		
Two Mile Creek	2000			30	3.3	39		
	2003			52	1.4	65		
Two Mile Creek (near HWY 290)	2015			1		10		
Two Mile Creek (near Sheridan Rd.)	2015			27		82		
Exalon (upstream) in Erie Canal	2003	0.04	0.04	77	0.2	33		
NR - Gratwick /Riverside Park	1991	15						
NR - Wheatfield	1987	ND						
Little Niagara River (downstream 102nd St.)	2006	16		300	2.1	43		
Cayuga Creek	1995	18		18				
	2003	0.16	0.05	59	0.3	82		
Little Niagara River (downstream Cayuga Ck.)	2006	8		140	0.6	110		
Occidental Sewer 003	1991	ND						
Gill Creek (upstream in Creek)	2000			71	0.8	14		
	2003	0.44	0.08	88	1.0	17		
	2006	1		28	0.3	8		
NR - 102nd Street	1991	70						
	1993	96		230				
	1995	130		500				
	1997	1		ND		ND		
Pettit Flume (upstream)	1991	5						
	1993	ND		26			2510	2.5
	2000	ND	0.05	13	0.3	23	1355	1.4
	2003	ND	ND	37	0.3	34	1858	1.9
	2006	0.03		15			807	0.8
	2009	0.010		21		44	1471	1.5
	2012	0.10						
	2015	ND		10		35	671	0.7
	2018	**0.30**	**0.01**	**13**	**0.04**	**23**	**366**	**0.4**
Pettit Flume Cove (site A)	1991	960						
	1993	200		48000			2218010	2218
Pettit Flume Cove (site B)	1997	46		20000		110	1031930	1032
	2000	74	ND	30000	2.6	120	1811130	1811
	2003	60	0.05	11000	1.4	120	568409	568
	2006	190		15000			854720	855
	2009	46		3800		71	224563	225
	2012	4		25500		83	1535620	1536
	2015	11		8800		100	450979	451
	2018	**NA**		**5090**	**0.60**	**100**	**344392**	**344**
Pettit Flume Cove (Culvert mouth)	**2018**			**30558**	**2.00**	**170**	**989400**	**989**
Pettit Flume (downstream)	2000	3	0.03	490	0.2	33	26799	27
	2003	0.36	0.01	2000	0.3	20	123786	124
	2006	5		680			34626	35
	2009	1		7200		47	288990	289
	2012	8		380		26	24371	24
	2015	0.4		840		22	42812	43
	2018	**3.1**	**0.01**	**296**	**0.10**	**27**	**14204**	**14**
Fisherman's Park (upstream inlet)	2012	3		330		37	21121	21
	2015	0.3		840		83	44508	45
Fisherman's Park (downstream inlet)	2012	0.4		210		41		
	2015	0.2		390		49		
NR - upstream of Bloody Run Creek	2000	ND	ND	43	0.3	5	475	0.5
	2003			180	0.4	5	1290	1.3
	2004	0.01	0.01					
	2006	2		36		12	341	0.3
	2009	ND		44		9	281	0.3
	2012			346		10		
	2015	ND		88		21		
	2018	**NA**		**32**	**0.1**	**8.5**	**216**	**0.2**
NR- Bloody Run Creek (BRC)	1993	270		120000			1351500	1352
	1994	56						
	1995	120		61000			617220	617
	1997	84		52000		29	541909	542
	2000	23	0.04	3300		7	33512	34
	2003			110000	6.2	22	988590	989
	2004	46	0.06					
	2006	45		4200		14	34676	35
	2009	18		48000		16	451921	452
	2012	9		4000		5	35098	35
	2015	7		11000		24	101113	101
	2018	**17**	**0.03**	**3818**	**4.0**	**12**	**40827**	**41**
Bloody Run Creek (downstream)	2004	9	0.02					
	2006	6		220		7		
	2009	6		2200		22		
	2012	1						
	2015	1		150		12		
	2018	**8**	**0.02**	**409**	**0.4**	**10**	**3654**	**3.7**

*Dioxin, furan and dioxin-like PCB concentrations were multiplied by the WHO Toxicity *Equivalency Factors (TEF) for protection of fish to express their respective toxicity* on a common basis and then summed to yield a total toxic equivalent (TEQ).

** Analysis for dioxin-like PCBs was not available prior to 2000