Chemicals of Emerging Concern in the Bay of Fundy Watershed: What Are the Risks?

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BoFEP Technical Report No. 7

December 2012

This project was undertaken with the financial support of the Government of Canada.

Ce projet a été réalisé avec l'appui financier du gouvernement du Canada.

Canada

This publication should be cited as:

Kidd, K.A. and A. Mercer. 2012. *Chemicals of Emerging Concern in the Bay of Fundy Watershed: What Are the Risks?* Bay of Fundy Ecosystem Partnership Technical Report No. 7. Bay of Fundy Ecosystem Partnership, Tantallon, NS. 16 p. + Appendices

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ISBN 978-0-9783120-4-6

1.0 Introduction

Hundreds of chemicals are present in the cleaning and personal care products and pharmaceuticals that we use every day in our homes (Figure 1). These chemicals include the active ingredients in pharmaceuticals (e.g. antibiotics, blood pressure regulators, hormonal contraceptives), and additives in personal care products (i.e. shampoos, soaps, lotions, cosmetics) and cleaners to make them smell better, last longer or be more effective. Pharmaceuticals are excreted in urine and faeces by people taking these medications and flushed down the toilet, while other chemicals are washed down the drain in sinks and showers. All of these chemicals end up in municipal wastewaters, and are often collectively referred to as "Chemicals of Emerging Concern" or CECs.

> CECs = Chemicals of Emerging Concern

Although the use of chemicals in products in Canada is regulated by Health Canada under the Food and Drugs Act, there are no regulations or guidelines for the discharge of CECs into the aquatic environment from municipal wastewater treatment plants. In addition, little is known about how long these chemicals persist in the environment and the effects they have on fish and other aquatic life. They are of "recent concern" or "emerging concern" because we have started to find them in the environment over the past decade and have recognized that some can affect the health of wildlife.

Sewage treatment plants (STPs) were designed to remove bacteria, solids, and nutrients from sewage before it is discharged into streams, rivers, lakes, estuaries or coastal marine areas. Because STPs were not designed to remove CECs, some of these chemicals are found in the final effluents from STPs and in waters downstream of these outfalls. It is only recently that the technology has been available to measure these chemicals in sewage or in the environment since many are present at very low parts per trillion (ppt or ng/L) concentrations. In the last 5 to 10 years we have gained much more information on what is present in household sewage, what is or is not removed by STPs, and the types and levels of CECs that are present in the environment.

> 1 ppt = 1/20th of drop water in an Olympic-size swimming pool

Hundreds of CECs have been measured in household wastewaters. Herein we report on 31 CECs from several broad classes of chemicals that are used in households, as well as on 3 of the natural hormones excreted by humans that also affect aquatic life (Table 1 and Appendix A). All of the CECs listed in Table 1 occur in untreated and treated municipal wastewaters. The individual CAS numbers (unique chemical identifiers) are included for tracking purposes as each of these chemicals has many different names in the literature. These CECs include several types of human pharmaceuticals (antibiotics, antiepileptics, antidepressants, analgesics, blood lipid regulators, heart and blood pressure medications) and several chemicals found in personal care products and household

cleaners (fragrances, preservatives, plasticizers, solvents, sunscreens, insect repellents). They were also chosen because of their potential risk to aquatic organisms and because they have a range of chemical properties (i.e. affinity to accumulate in lipids or remain in water, environmental persistence). Some are persistent in the environment (weeks to months) whereas others are broken down easily and persist only for hours to days. Some CECs will accumulate in fatty tissues of aquatic animals whereas others will stay mainly in the water. This report does not include chemicals found in houses but mainly used outside (e.g. pesticides), or chemicals that are present in homes in electronics, furniture, carpets, or building materials (e.g. PBDEs used as flame retardants in furniture and carpets, metals in electronics). Here we present information on the occurrence of CECs in influents, effluents and surface waters, removal efficiencies in different types of sewage treatment, potential risks to aquatic organisms with respect to their toxicity and ability to disrupt the hormone system (endocrine disruptors). The report includes information from Atlantic Canada (when available), studies from other locations in Canada, and some international data when Canadian data were unavailable. At the end of the report we discuss what is not known.

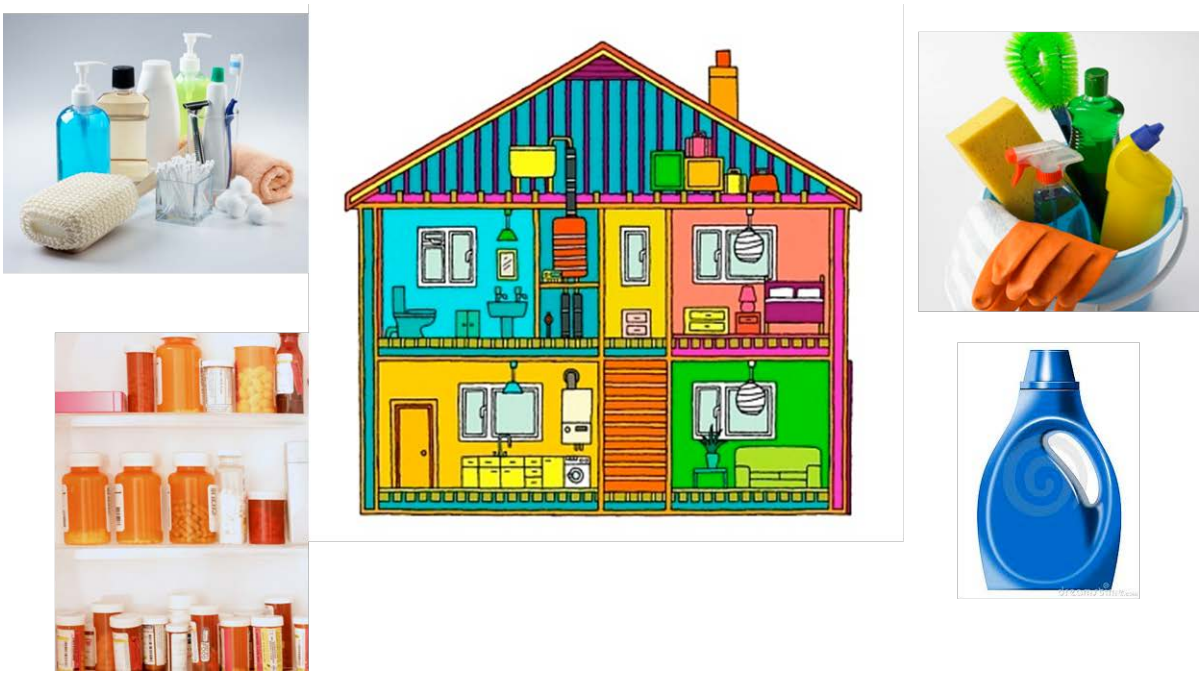

Figure 1: Sources of chemicals of emerging concern in households.

The detailed information used for this report is available as appendices.

The objectives of this report are to:

- Summarize data from Atlantic Canada, supplemented with data from elsewhere in Canada, on representative CECs in municipal wastewaters and receiving waters (Section 2)
- Summarize the types of sewage treatment used in Atlantic Canada (Section 3)
- Describe the efficiency of removal of CECs during sewage treatment (Section 4)
- Assess the risks of CECs to aquatic life (Section 5) and the unknowns for CECs for the Bay of Fundy and its watershed (Section 6)

Table 1: Select chemicals of emerging concern (CECs) present in municipal wastewaters (summary of Appendix A).

General Category	Class	Chemical	Uses	CAS#
Personal care and household products	Antimicrobials	Triclocarban[4]	Soaps, deodorants, cleaning products	101-20-2
		Triclosan[4]	Soaps, deodorants, cleaning products	3380-34-5
	Fragrances	Galaxolide[5]	Cosmetics, soaps, shampoos	1222-05-5
		Vanillin[4]	Cosmetics, soaps, shampoos	121-33-5
		Camphor[4]	Household cleaners	76-22-2
	Insect repellent	DEET[1,4]		134-62-3
	Plasticizers	Bisphenol A[4]		80-05-7
		Dibutyl phthalate[4]		84-74-2
	Preservatives/ antioxidants	BHA[2]		25013-16-5
		BHT[3]		128-37-0
		Propylparaben[4]		94-13-3
	Sunscreens	3-benzylidene camphor[5]		
		4-methylbenzylidene camphor[5]		36861-47-9
	Solvents	Cyclic methylsiloxanes (D4, D5, D6)	Various (lotions, shampoos, cleaners)	
Pharmaceuticals	Analgesics/anti-inflammatories	Naproxen[6,13]		22204-53-1
		Salicylic acid[6]	Metabolite of acetylsalicylic acid	69-72-7
	Antibiotics	Amoxicillin[6]		26787-78-0
		Doxycycline		17086-28-1
		Erythromycin[6]		114-07-8
		Sulfacetamide[6]		144-80-9
		Sulfamethoxazole[4,6]		723-46-6
		Sulfapyridine[6]		144-83-2
		Trimethoprim[6,7]		738-70-5
	Blood cholesterol/ lipids regulators	Atorvastatin[8,9]		134523-00-5
		Gemfibrozil[6,11]		25812-30-0
	Antihypertensive/angina medication	Metoprolol[6,8]		37350-58-6
	Hormonal contraceptives	Ethinylestradiol[5,6]	Synthetic estrogen	57-63-6
		Levonorgestrel[10]	Synthetic progesterone	797-63-7
	Antidepressants	Citalopram[6]		59729-33-8
		Fluoxetine[6,7]		59333-67-4
	Anti-epileptics	Carbamazepine[6,8,12]		298-46-4
Other CECs	Natural hormones	Estradiol[5,6]		50-28-2
		Estrone[5,6]		51-16-7
		Testosterone[5,6]		58-22-0

[1]N,N-diethyl-meta-toluamide; [2]Butylated hydroxyanisole; [3]Butylated hydroxytoluene; [4]Drewes, J., et al., 2009; [5]Jjemba, P., 2008; [6]The Merck Index, 1989; [7]Batt, A., et al., 2008; [8]EC1; [9]DB1; [10]DB2; [11]DB3; [12]A1; [13]DB4

2.0 CECs in Influent, Effluent and Surface Waters in Atlantic Canada and Elsewhere in Canada

The measurement of CECs in sewage is difficult to do because often the concentration of CECs are very low and close to the ability of the equipment to measure them (analytical detection limits). Also, many studies will measure only a few of the hundreds of chemicals that are known to be in sewage because several different chemical techniques are needed to measure the diverse range of CECs (e.g. see Stephenson and Oppenheimer 2007). For these reasons, studies that report CECs in sewage or receiving waters will report results for only a select few chemicals, making it difficult to know everything that is present in these wastewaters.

Table 2 shows the concentrations of some CECs in sewage influent, effluent and surface waters (both fresh and marine) from several studies in Atlantic Canada and elsewhere in the country. These results are from a variety of locations that have different types of sewage treatment (see Appendix B for details). The concentrations vary and can sometimes be higher in the effluent than influent because the influent values and the effluent values may come from different locations or times. It is well known that concentrations of CECs will change from one day to the next within an STP depending on water flows and operating conditions. In addition, in some reports both the influent and effluent of the same sewage treatment plant were not tested. For the CECs that have not been measured in Atlantic Canada, we show data from elsewhere in Canada. It was assumed that sewage in Atlantic Canada will have similar concentrations to other locations across the country.

Levels of CECs in untreated sewage vary considerably from one location to another and from one CEC to another. Some pharmaceuticals like pain killers or anti inflammatories (aspirin and naproxen) are widely used and very commonly found in sewage. Salicylic acid (a breakdown product of aspirin) and naproxen found at much higher concentrations than other drugs because of their high use (Table 2). STPs that service larger communities can have higher CECs in the influent than STPs that service a smaller population. Finally, the type of sewage system in a community can influence the concentrations of CECs in influent. If stormwater is also collected for treatment, then this will dilute the amount of CECs in sewage. Table 2 shows that there is a wide range of CEC concentrations in untreated sewage from low ppt (e.g. estradiol) to low ppm (salicylic acid) concentrations. For many CECs, data for Atlantic Canada are not available.

Conversion of Concentrations

1 mg/L = 1000 µg/L = 1,000,000 ng/L

mg/L = parts per million (ppm); µg/L = parts per billion (ppb); ng/L = parts per trillion (ppt)

Table 2: Influent, effluent and surface water concentrations of select CECs in Atlantic Canada or other regions of Canada (ND means non- detectable, means that the chemical was not measured). Bolded values are from studies outside of Canada (U.S. mainly). This table is a summary of Appendix B.

Category	Compound	Canada			Atlantic Canada[1,2]		
		Influent ranges (ng/L)	Effluent ranges (ng/L)	Surface water (ng/L)	Influent ranges (ng/L)	Effluent ranges (ng/L)	Surface water (ng/L)
Analgesics/anti-inflammatories	Naproxen	ND-611000[11,15]	ND-33900[11,15]	ND-2700[10, 16,19]	ND-110	ND-91000	ND-4500
	Salicylic acid	13700-874000[8,11,15]	ND-59600[11,15]	80[19]	36-56	ND-35000	ND-17000
Antibiotics	Amoxicillin	-	**4.7[13]**	8019	-	-	-
	Doxycycline	-	ND-102[16]	**ND-80[13]**	-	-	-
	Erythromycin	-	838[12]	590[19]	-	-	-
	Sulfacetamide	-	ND-151[12,16]	ND[16]	-	-	-
	Sulfamethoxazole	-	193-3278[16]	ND-510[16,19]	-	-	-
	Sulfapyridine	-	81-707[12,16]	ND-61[16]	-	-	-
	Trimethoprim	-	9-3528[10,16]	ND-150[16,19]	-	-	-
Antidepressants	Citalopram	-	-	**4.53-219[14]**	-	-	-
	Fluoxetine	-	ND-799[10,16]	ND-46[10]	-	-	-
Anti-epileptic	Carbamazepine	100-1900[11,15]	7-3287[10,16]	2-350[10,19]	-	ND-240	ND-170
Antihypertensive/ angina medication	Metoprolol		**10-2200[13]**	**30-2200[13]**	-	-	-
Antimicrobials	Triclocarban	**49-6750[5,17]**	**26-130[17]**	**33-5600[5]**	-	-	-
	Triclosan	1930[8]	108[8]	110[19]	-	-	-
Blood cholesterol/ lipids regulators	Atorvastatin	166[7]	ND-77[7,10]	ND-15[10]	-	-	-
	Gemfibrozil	ND-2100[11,15]	ND-1493[10,15]	ND-4200[10,19]	ND-8	ND-13000	ND-580
Fragrances	Galaxolide	2031[8]	751[8]	**77-794[3]**	-	-	-
	Vanillin	**1600-2100[17]**	**150-470[17]**		-	-	-
Hormonal contraceptives	Ethinylestradiol	75-90[18]	ND-8.5[16]	ND[16]	-	-	-
	Levonorgestrel	150-170[18]	30[18]	ND[16]	-	-	-
Insect repellent	DEET	**54-600[18]**	**100-260[18]**	490[20]	-	-	-
Natural hormones	Estradiol	2.5-125[11,15,18]	ND-90[16,18]	ND-9[16,18]	-	-	ND–1.8
	Estrone	19-80[11,15]	ND-100[11,15,16]	ND[16,18]	5.7-20.0	-	1.4-6.6
	Testosterone	**5.4-13.3[9]**	ND[16]	**ND-214[6,9]**	-	-	-
Plasticizers	Bisphenol A	**200-530[17]**	1.29-194.6[16]	ND-1527[16]	-	-	-
	Dibutyl-phthalate	**390-3100[17]**	16.1-1385[16]	ND-169[16]	-	-	-
Preservatives/antioxidants	BHA	**52-230[17]**	**ND-39[17]**	-	-	-	-
	BHT	**43-410[17]**	**ND-240[17]**	**178[4]**	-	-	-
	Propylparaben	**760-2000[17]**	**ND-3.7[17]**	**ND-207[20]**	-	-	-
Sunscreens	Camphor	**160-1800[17]**	**ND[17]**	-	-	-	-

[1] Data from Brun, G., et al., 2006; Comeau, F., et al., 2008; and Saravanabhavan, G., et al. 2009. [2] These results are from Halifax, NS; Springhill, NS; Fredericton, NB; Sussex, NB; Charlottetown, PE; Summerside, PE; Gander, NL; St. John's, NL; and Nova Scotia watersheds (Halifax, Pictou and Cocagne); [3] Chase, D., et al., 2012; [4] Fries, E. and W. Püttmann, 2004; [5] Halden, R. and Paull, D., 2004; [6] Kolpin, D., et al., 2002; [7] Lee, H-B., et al., 2009; [8] Lishman, L., et al., 2006; [9] Liu, S., et al., 2011; [10] Metcalfe, C., et al., 2003a; [11] Metcalfe, C., et al., 2003b; [12] Miao, X., et al., 2004; [13] Monterio, S. and Boxall A., 2010; [14] Schultz, M., et al., 2010; [15] Servos, M., et al., 2005; [16] Sosiak, A., 2005; [17] Trenholm, R., et al., 2008; [18] Viglino, L., et al., 2008; [19] Waiser, M., et al., 2011; and [20] Yamamoto, H. et al., 2011.

3.0 Types of Sewage Treatment in Atlantic Canada

The Bay of Fundy receives both treated and untreated sewage from the cities and towns in its watershed. Some of the sewage treatment plant effluents are discharged into rivers that drain into the Bay of Fundy (e.g. the Saint John River receives sewage from Edmundston, Woodstock, Fredericton, Gagetown and several other communities before the river discharges into the Saint John Harbour). Other discharges to the Bay of Fundy are into estuaries or coastal areas (e.g. treated and untreated sewage from the City of Saint John).

Table 3 summarizes the types of STPs that discharge into the Bay of Fundy in both Nova Scotia and New Brunswick (for more details see Appendix C). Between the two provinces there are 155 STPs discharging effluents either directly into the Bay or into waters that eventually flow into the Bay. In Nova Scotia, about half of the STPs use lagoons and half use secondary treatment. In contrast, STPs in New Brunswick use mainly lagoon treatment (71 of 88 STPs) and a much smaller number are secondary treatment. A small number of STPs in both provinces have tertiary treatment (10 and 1 % of plants in Nova Scotia and New Brunswick, respectively).

Nationally, 79% of STPs use lagoons or secondary treatment and smaller communities (<2000) tend to have lagoons whereas larger communities tend to use secondary treatment (Holton et al. 2011). Although municipal wastewater treatment has improved in Canada over the past decades, intentional and unintentional discharges of untreated sewage still occur in some communities due to a lack of treatment and when the capacity of treatment plants are exceeded during high storm events. These combined sewer overflows occur in communities where the stormwater and wastewater collection systems are not separated. CECs are also one of a number of water quality issues (i.e. excess nutrients, low dissolved oxygen, high ammonia, drinking water contamination, habitat loss) related to municipal wastewater discharges in Canadian waters (see Holton et al. 2011 for review).

Table 3: Numbers of STPs in New Brunswick and Nova Scotia that discharge directly into the Bay of Fundy or into rivers that flow into the Bay, the types of treatment used at these STPs, and the percent of total wastewater flow for each of these treatment types (data from Stefan Furey, Nova Scotia Environment (Water and Wastewater Branch) and Timothy LeBlanc, New Brunswick Department of Environment (Water and Wastewater Management Section), personal communication). Full table is available in Appendix C.

Province	Totals	Lagoon[1]	Primary[2]	Secondary[3]	Tertiary[4]
Nova Scotia – plant numbers	67	29	1	30	7
Flow (m^3/day)		35%	23%	34%	8%
New Brunswick – plant numbers	88	71	2	14	1
Flow (m^3/day)		48%	45%	3%	4%

[1] Aerated lagoon, facultative lagoon and aerated lagoon with sand filters.
[2] Primary, chemical assisted primary, and unknown.
[3] Rotating biological contactor (RBC), sequencing batch reactor (SBR), solar aquatics (operating as a SBR), contact stabilization, oxidation ditch, extended aeration, trickling filter, biogreen system and artificial wetland
[4] Activated biofilter, recirculating sand filters (RSF), dissolved air flotation (DAF), and DAF with activated sludge.

4.0 Removal of CECs by Sewage Treatment Plants

Even though STPs were not designed to remove CECs, levels of many of these chemicals are lower in the effluent than the influent because the processes used in wastewater treatment to remove nutrients, organics and bacteria can also remove some CECs (Stephenson and Oppenheimer 2007, Drewes et al. 2009). Also, other CECs will absorb to the solids (sludge) in the STP and not be discharged with the treated waters. Each STP is different in how well it removes these CECs and removal efficiencies will also vary within the same STP from one day to the next depending on the operating conditions. The influent and effluent levels of CECs from individual plants were used to calculate removal efficiencies and present the range in percent removal in Table 4 (for more details see Appendix D).

$$\% \text{ removal} = \frac{(\text{Concentration}_{\text{influent}} - \text{Concentration}_{\text{effluent}})}{(\text{Concentration influent})} \times 100$$

In general, the more treatment household sewage receives the higher the percent removal of CECs. STPs with tertiary treatment will typically have higher removal efficiencies than STPs with secondary or primary treatment. However, it is difficult to generalize because there are many different kinds of treatments used within each general category (see Table 3 for details), and this is why the removal

efficiencies can vary from “poor” to “excellent” within each of these general categories. For example, the removal of the antiepileptic carbamazepine ranges from 0 to 100% within STPs with tertiary treatment (Table 4). It is difficult to generalize about how well certain classes of CECs are removed during sewage treatment because of the operational differences from one plant to another and from one day to another (see for example Drewes et al. 2009, Stephenson and Oppenheimer 2007).

Table 4: Removal efficiencies of select CECs for lagoons, primary, secondary and tertiary sewage treatment (data compiled from Drewes et al. 2009, Lee, H-B., et al, 2009, Lishman, L., et al., 2006, Monterio, S. and Boxall, A., 2010, and Servos, M., et al., 2005). Chemicals within each of the general categories are those listed in Table 1. Data to generate this table are found in Appendix D.

Substance Category	**Lagoon**	**Primary Treatment**	**Secondary**	**Tertiary**	**Misc.**
Antimicrobials			Good	Moderate-Good	
Fragrances	Excellent		Poor	Poor-Good	
Analgesics			Poor-Excellent	Poor-Excellent	
Antibiotics		Poor-Moderate	Poor	Poor-Excellent	
Antiepileptics			Poor	Poor-Excellent	
Antihypertensive, angina medication					Moderate
Blood cholesterol/lipid regulators			Poor-Excellent	Poor-Excellent	
Antidepressants				Poor-Excellent	
Insect repellent				Moderate	
Natural hormones	Moderate-Excellent	Excellent	Poor-Excellent	Good-Excellent	
Plasticizers				Moderate-Good	
Preservatives/antioxidants				Moderate-Excellent	
Sunscreens				Excellent	

Legend for Table 4: Range in removal efficiencies of CECs for the different categories.

Rating	**% Removal**	**Rating**	**% Removal**
Poor	<50%	Moderate-Good	50-94%
Poor-Moderate	<50-74%	Poor-Excellent	<50%->95%
Poor-Good	<50-94%	Moderate-Excellent	50->95%
Moderate	50-74%	Good-Excellent	75->95%
Good	75-94%	Excellent	≥95%

5.0 Risks of CECs to Aquatic Organisms

The chemical properties of CECs are very different from one group to another, and it is these properties (e.g. easily dissolved in water versus not easily dissolved in water) that determine where CECs go in the environment and how long they persist once discharged in the wastewaters. When CECs are released into surface waters, they may stay dissolved in the water or bind to particles in the water column or

move into the sediments at the bottom of the river, lake or coastal area. The concentrations of CECs present in the water will depend on what is in the effluents and how quickly these effluents are diluted. Typically the highest levels of CECs are found closest to the wastewater outfall and then they rapidly decline downstream because of dilution or because they are degraded in the environment by sunlight or bacteria that are naturally present. Degradation can result in new chemicals in the environment which can be more or less toxic than the original ones. However, the CECs that stick to particles in the surface water and to the sediments tend to be more persistent in the environment and resistant to any degradation, and may also accumulate in the tissues of fish and other aquatic organisms. As examples, antidepressants, antimicrobials, antiepileptics, and fragrances have been found in the tissues of fish living downstream of STP discharges in other parts of Canada and in the United States (Metcalfe et al. 2010, Dann and Hontela 2011, Brooks et al. 2005, Ramirez et al. 2009).

Risks of chemicals to aquatic organisms depend on the concentrations and types of CECs to which they are exposed. Higher concentrations in the environment typically means higher risk to fish and other wildlife. Aquatic organisms are exposed to these chemicals directly from water or sediments, or through their food and both the level of exposure and route of exposure affects how toxic these chemicals are to an organism. Although fish and other organisms are exposed to complex mixtures of chemicals in effluents, the science is not advanced enough to be able to assess the total effects of these mixtures. For this reason, risks are examined using individual chemicals, maximum environmental exposures (worst-case scenarios), and lab toxicity experiments.

Very few surface water data for CECs exist for Atlantic Canada and these data are mainly from streams and not from the Bay of Fundy itself and for only a very small number of chemicals (Table 2). Only two out of eight sites are from marine environments in Atlantic Canada. The antiepileptic carbamazepine and the blood cholesterol regulator gemfibrozil were found at concentrations up to 170 and 580 ng/L, respectively. In contrast, anti-inflammatories and pain killers were found at much higher levels (naproxen 4,500 ng/L; salicylic acid 17,000 ng/L). Elsewhere in Canada, other CECs have been found in surface waters including plasticizers, antimicrobials, antibiotics, antidepressants and natural hormones (Table 2). It is likely that these CECs could also be found in surface waters in Atlantic Canada.

Because these CECs are very diverse in their properties and little is known about their effects on aquatic organisms, it is difficult to estimate the risk that they pose for species living in the Bay of Fundy or in waters flowing into the Bay. Some, like the natural and contraceptive hormones, are very similar to the hormones that are used by fish to control their reproduction and can be taken up from the water into the fish through their gills. Very low levels (~1 ng/L) of some hormones are enough to interfere with sexual development and reproduction in fish (Parrott and Blunt 2005). Other CECs like antibiotics can affect the growth of algae or the invertebrates (Daphnids or Daphnia) that fish eat.

Another issue of concern for municipal wastewaters is the discharge of antibiotics into surface waters (e.g. Waiser et al. 2011). Because antibiotics are effective against bacterial infections in humans and livestock, once they are released into surface waters they may also affect the abundance of naturally-occurring bacteria and also cause antibiotic resistance in these organisms. While several reviews on this subject have been written (Kummerer 2009, Taylor et al. 2011) and fecal bacteria that are resistant to antibiotics are found, albeit at low levels, downstream of municipal wastewater discharges or livestock production (e.g. Lanthier et al. 2011), little is known about the effects of antibiotics on natural bacterial communities in the Canadian environment.

A preliminary assessment of the risk of these CECs to aquatic organisms is shown in Table 5. The highest surface water concentration that was measured in Atlantic Canada (from Table 2) was compared to the lowest concentration of the CEC that affects algae, invertebrates or fish either over the short term (acute) or longer term (chronic) or a toxicity value that was calculated from the properties of the chemical (U.S. Environmental Protection Agency's PBT Profiler, www.epa.gov/oppt/sf/tools/pbtprofiler.htm; PBT – Persistence, Bioaccumulation, Toxicity). For a few chemicals, no toxicity data were available and these chemicals were not included in Table 5 (see Appendix E). These effects ranged from decreased survival of algae, zooplankton or fish (lethal concentrations (LC) or effective concentrations (EC)) organisms to changes in growth using chronic studies. If no surface water concentrations were available for Atlantic Canada, data from elsewhere in Canada or outside of Canada were used. A risk quotient (RQ) was calculated as follows:

$$RQ = \frac{\text{Maximum surface water concentration (mg/L)}}{\text{Toxicity value for most sensitive organism (mg/L)}}$$

RQs > 1 indicate that there is a potential risk for aquatic organisms.

RQs < 1 indicate little or no risk of these CECs in the environment.

Based on the results shown in Table 5, all RQs were well below 1 and suggest that the measured levels of these CECs do not threaten the health of aquatic organisms (see Appendix F for data used to generate RQs). However, there are many limitations to this approach. First, very few aquatic organisms have been studied and for those that have, most are freshwater and not marine. Lab studies examine individual chemicals but wild animals are exposed to mixtures of CECs and other chemicals in these effluents. It is not known how these mixes of chemicals affect aquatic organisms. Finally, some of these CECs will affect the hormone (endocrine) systems of fish at much lower concentrations than the toxicity data shown in Table 5 so the risks may be underestimated. More specifically, male fish living downstream of wastewater discharges in heavily populated watersheds, like the Grand River in Ontario, are feminized because of the presence of estrogen mimics in the effluents (e.g. Tetreault et al. 2011). These effects on male fish occur at much lower concentrations of estrogens than those that cause effects on survival and growth. In spite of the unknowns related to CECs, many studies have shown that increased treatment of sewage decreases the risks to aquatic life. For example, the major upgrade of the City of Boulder, Colorado, STP from trickling filter to activated sludge decreased the concentrations of estrogens in the effluents and their subsequent effects on male fish (Barber et al. 2012).

6.0 Unknowns for CECs in Atlantic Canada

Few studies have been done on CECs in Atlantic Canada and limited data exist on only a small number of CECs for this region. At present, it is not known how widespread CECs are in surface waters and almost no measurements have been done in marine waters. None were found for the Bay of Fundy proper. It is possible because of the low densities of people in the region that most CECs will not be present at detectable levels or concentrations of concern but currently this is not known. Some CECs will concentrate in sediments and into fish tissues. However, no studies have been done as yet in the more populated parts of the Bay of Fundy watershed that have measured concentrations of CECs in water, sediments and biota, or effects of these effluents on the health of fish or other aquatic life.

Recommended study sites include the Saint John Harbour and the Saint John River near large centres like Fredericton, NB.

Table 5: Risk quotients (RQs) of select CECs in surface waters (see text for explanation) (- means no data available for calculation). The maximum surface water concentrations (mg/L) are from Table 2. See Appendix E for all toxicity data and Appendix F for all RQs.

Compound	Max Surface Water (mg/L)	Toxicity Value (mg/L)	Surface Water RQs	Type of Toxicity Data	Toxicity Reference
Trimethoprim	0.00015	72.062	0.000002	Algae (Chronic)	1
Sulfapyridine	0.000061	3.5	0.00002	PBT Profiler	1
Amoxicillin	0.00008	2.2	0.00004	Algae (24h LC50)	2
Carbamazepine	0.00017	4.615	0.00004	Daphnid (Chronic)	1
Estradiol	0.0000018	0.044	0.00004	PBT Profiler	1
Citalopram	0.000219	3.9	0.00006	Daphnia (48th EC50)	3
DEET	0.00049	5.835	0.00008	Daphnid (Chronic)	1
Doxycycline	0.00008	0.86	0.00009	PBT Profiler	1
Estrone	0.0000066	0.074	0.00009	PBT Profiler	1
Erythromycin	0.000590	0.94	0.00011	Daphnia (48th EC50)	2
Fluoxetine	0.000046	0.398	0.00012	Fish (Chronic)	1
Testosterone	0.000214	1.34	0.00016	Daphnid (Chronic)	1
Metoprolol	0.0022	13.383	0.00016	Daphnid (Chronic)	1
Gemfibrozil	0.00058	0.889	0.00065	Fish (Chronic)	1
Triclosan	0.00011	0.13	0.00085	Daphnia (48th EC50)	2
Dibutyl phthalate	0.000169	0.11	0.00154	PBT Profiler	1
Naproxen	0.0045	2.6203	0.00172	Algae (96h EC50)	2
Propylparaben	0.000207	0.078	0.00265	PBT Profiler	1
Salicylic acid	0.017	1.3	0.01308	PBT Profiler	1
BHT	0.000178	0.012	0.01483	PBT Profiler	1
Galaxolide	0.000794	0.05	0.01588	PBT Profiler	1
Sulfamethoxazole	0.000510	0.03	0.01700	Algae (LC5)	2
Bisphenol A	0.001527	0.05	0.03054	PBT Profiler	1
Triclocarban	0.0056	0.09	0.06222	PBT Profiler	1
BHA	-	0.046	-	PBT Profiler	1
Camphor	-	1.8	-	PBT Profiler	1
Vanillin	-	0.48	-	PBT Profiler	1

[1]Diamond et al. 2011, [2]Waiser et al. 2011 and [3]Henry, T.B., et al., 2004

As mentioned earlier, municipal wastewaters contain a mix of hundreds of different chemicals and the types and concentrations of these mixtures varies from one location to another. Some of these individual chemicals affect aquatic life in a similar and additive way. Others may interfere with different processes in the same organism, thereby affecting the overall health of the animal. Because of the many unknowns about how CECs affect aquatic life, it is not yet possible to know the total toxicity or risk that CECs pose to freshwater and marine organisms. The understanding of mixture effects has been identified as a big knowledge gap by the scientific community.

Most of the lab studies to assess the toxicity of CECs have been done on freshwater species. While this is useful for organisms living in the rivers draining into the Bay of Fundy, the risks to the species living in the Bay of Fundy proper are very difficult to assess. No lab studies are done on marine mammals and few exist for marine algae, invertebrates and fish. If they are exposed to CECs at all, levels are likely to be very low given the large dilution in the Bay of Fundy. However, this is also an unknown.

Some CECs like antibiotics used in livestock production or hormones excreted by the livestock themselves can be found in surface waters in agricultural areas when storms create runoff of manure into waterways. This runoff could contain elevated concentrations of CECs in areas where there is intense livestock production but information on this potential risk is not understood for Atlantic Canada and for the Bay of Fundy.

7.0 Summary

- Based on the current but limited data available for Atlantic Canada, there does not appear to be a risk of toxicity from individual CECs for the Bay of Fundy watershed.
- However, these data are available for only a limited number of sites and for a small number of chemicals compared to the hundreds known to be in sewage. As a result, there may be some CECs that pose a risk to aquatic life but they have not yet been identified because information on environmental concentrations or toxicity are missing.
- Risks from CECs will be greatest in areas where there is little dilution of the effluent and human populations are highest. These sites are recommended as priorities for future studies.
- There large data gaps for Atlantic Canada for CECs in effluents, surface waters, sediments and biota. More studies on CECs concentrations in the Bay of Fundy watershed are recommended to better understand their levels and fate, and the risks to this environment.
- In addition, wastewaters are a mix of CECs as well as other chemical and physical stressors to surface waters. Understanding the total risk of chemicals in wastewater (including CECs) to aquatic life is an ongoing challenge. However, it is clear that improved wastewater treatment has many benefits for organisms living downstream.

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Appendix A: List of Chemicals of Emerging Concern (Kidd and Mercer, 2012, Chemicals of emerging concern in the Bay of Fundy watershed: What are the risks? Bay of Fundy Ecosystem Partnership Technical Report No. 7, Bay of Fundy Ecosystem Partnership, Wolfville, NS, 22 p.)

Drug[a]	Category	CAS#[a]	Hazard Values	Synonyms	Applications	Reference
triclocarban	Antimicrobials	101-20-2	6	1-(3',4'-dichlorophenyl)-3-(4'-chlorophenyl)urea; 3,4,4'-trichlorodiphenylurea; 3,4,4'-Trichlorocarbanilide; cusiter; cutisan; genoface; N-(3,4-dichlorophenyl)-N'-(4-chlorophenyl)urea; N-(4-chlorophenyl)-N'-(3,4-dichlorophenyl)urea; procutene; Solubacter; TCC; Trichlorocarbanilide; triclocarban	Antibacterial, soap, deodorant	Drewes, J., et al., 2009
triclosan	Antimicrobials	3380-34-5	NI	Triclosan; Phenol, 5-chloro-2-(2,4-dichlorophenoxy)-; Ether, 2'-hydroxy-2,4,4'-trichlorodiphenyl; 5-Chloro-2-(2,4-dichlorophenoxy)phenol; 2,4,4'-Trichloro-2'-hydroxy diphenyl ether	Antibacterial, soap, lotion	Drewes, J., et al., 2009
galaxolide	Fragrances	1222-05-5			Fragrances, Musk	[a]Jjemba, P., 2008
vanillin	Fragrances	121-33-5	6	p-Hydroxy-m-methoxybenzaldehyde; 4-Hydroxy-m-anisaldehyde; 4-Hydroxy-3-methoxybenzaldehyde; Benzaldehyde, 4-hydroxy-3-methoxy-; Vanillin [USAN]	Fragrance, cosmetics, various	Drewes, J., et al., 2009
naproxen	Human pharmaceuticals-analesics	22204-53-1		(S)-6-Methoxy-α-methyl-2-naphthaleneacetic acid; d-2-(6-methoxy-2-naphthyl)propionic acid; MNPA; RS-3540; Axer; Bonyl; Calosen; Diocodal; Dysmenalgit N; Equiproxen; Floginax; Laraflex; Laser; Naixan; Napren E, Naprium; Naprius; Naprosine; Naprosyn; Naprosyne; Naprux; Naxen; Prexan; Primeral; Proxen; Reuxen; Veradol; Xenar[c]	Analgesic[a,c]/anti-inflammatory[a,c], NSAID[b]	[c]Merck Index; [d]DB4
salicylic acid	Human pharmaceuticals-analesics	69-72-7[a,b]		2-Hydroxybenzoic acid; Keralyt; Verrugon[c]	Metabolite of acetylsalicylic acid (asprin)	[c]Merck Index

Drug[a]	Category	CAS#[a]	Hazard Values	Synonyms	Applications	Reference
amoxicillin	Human pharmaceuticals-antibiotics	26787-78-0[a]		[2S-[2α, 5α,6β(S*)]]-6-[[Amino(4-hydroxyphenyl)acetyl]amino]-3,3-dimethyl-7-oxo-4-thia-1-azabicyclo[3.2.0]heptane-2-carboxylic acid; (-)-6-[2-amino-2-(p-hydroxyphenyl)acetamido]3,3-dimethyl-7-oxo-4-thia-1-azabicyclo[3.2.0]heptane-2-carboxylic acid; 6-[D(-)-α-amino-p-hydroxyphenylacetamido]penicillanic acid; α-amino-p-hydroxybenzylpenicillin; 6-(p-hydroxy-α-aminophenylacetamido)peniillanic acid; p-hydroxyampicillin; amoxyxillin; AMPC; Alfomox; Almodan; Amocilline; Amolin; Amopenixin; Amoxi; Amoxipen; Anemolin; Aspenil; Betamox; Bristamox; cabermox; Cuxacillin; Delacillin; Efpenix; Grinsil; Ibiamox; Ospamox; Optium; Piramox; Simoxil; Sumox[a]	Antibiotics	[a]Merck Index
doxycycline	Human pharmaceuticals-antibiotics	17086-28-1[b]		4-(Dimethylamino)-1,4,4a,5,5a,6-11,12a-octahydro-3,5,10,12,12a-pentahydroxy-6-methyl-1,11,-dioxo-2-naphthacenecarboxamide monohydrate; α-6-deoxy-5-hydroxytetracycline monohydrate; α-6-deoxyoxytetracycline monohydrate; 5-hydroxy-α-6-deoxytetracycline monohydrate[b]	Antibiotics	[a]EC1, [b]Merck Index
erythromycin	Human pharmaceuticals-antibiotics	114-07-8[a]		Erythromycin A; Abomacetin; Ak-Mycin; Akinin; E-Base; EMU; E-Mycin; Eritrocina; Ery Derm; Erymax; Ery-Tab; Erythromast 36; Erythtomid; ERTC; Erycen; Erycin; Erycinum; Ermysin; Ilotycin; Retcin; Staticin; Stiemycin; Torlamicina[a]	Antibiotics[a]	[a]Merck Index
sulfacetamide	Human pharmaceuticals-antibiotics	144-80-9		N--[4-Aminophenyl)sulfonyl]-acetamide; N-sulfanilylacetamide; N^1-acetylsulfanilamide; p-aminobenzenesulfonoacetamide; Acetocid; Acetosulfamin; Albucid; Sulamyd; Sulfacet; Sulfacyl; Urosulfone	Antibiotics	[a]Merck Index
sulfamethoxazole	Human pharmaceuticals-antibiotics	723-46-6		4-Amino-N-(5-methyl-3-isoxazolyl)benzenesulfonamide; N^1(5-methyl-3-isoxazolyl)sulfanilamide; 5-methyl-3-sulfanilamidoisoxazole; 3-sulfanilamido-5-methylisoxazole; 3-(p-aminophenylsulfonamido)-5-methylisoxazole; sulfisomezole; sulfamethylisoxazole; sulfamethoxizole; Gantanol; Sinomin[b]	Antibiotics[b]	Drewes, J., et al., 2009; [b]Merck Index

Drug[a]	Category	CAS#[a]	Hazard Values	Synonyms	Applications	Reference
sulfapyridine	Human pharmaceuticals-antibiotics	144-83-2[a]		4-Amino-N-2-pyridinylbenzenesulfonamide; N^1-2-pyridysulfanilamide; 2-sulfanilamidopyridine; M & B 693; Dagenan; Eubasin; Pyriamid; Coccoclase; Piridazol; Septipulmon; Relbapiridina; Plurazol; Haptocil; Sulfidine[a]	Antibiotics[a]	[a]Merck Index
trimethoprim	Human pharmaceuticals-antibiotics	738-70-5		5-[(3,4,5-Trimethoxyphenyl)methyl]-2,4-pyrimidinediamine; 2,4-diamino-5-(3,4,5-trimethoxybenzyl)pyrimidine; Monotrim; Proloprim; Syraprim; Tiempe; Trimanyl; Trimogal; Trimopan; Trimpex; Uretrim; Wellcoprim[b]	Antibacterial[b]	[a]Batt, A., et al., 2008; [b]Merck Index
atorvastatin	Human pharmaceuticals-heart and blood pressure medications	134523-00-5[b]		Atorvastatin calcium	Cholesterol regulator	[a]EC1; [b]DB1
metoprolol	Human pharmaceuticals-heart and blood pressure medications	37350-58-6[b]		1-[4-(2-methoxyethyl)phenoxy]-3-[(1-methylethyl)amino]-2-propanol; (±)-1-(isopropylamino)-3-[p-(β-methoxyethyl)phenoxy]-2-propanol; CGP 2175[b]	Antihypertensive, anti-anginal	[a]EC1; [b]Merck Index
ethinylestradiol	Human pharmaceuticals-hormones	57-63-6		(17α)-19-Norpregna-1,3,5(10)-trien-20-yne-3,17-diol; 17α-thynyl-1,3,5(10)-estratriene-3,17β-diol; 17-ethinylestradiol; ethynyestradiol; Diogyn E; Dufaston; Dyloform; Esteed; Estigyn; Estinyl; Eston-E; Ethidol; Ethinyl-Oestradiol; Ethyl 11; Eticyclol; Eticyclin; Etinestrol; Etinestryl; Etinoestryl; Etivex; Feminine; Ginestrene; Gynolett; Kolpolyn; Linoral; Lynoral; Menolyn; Neo-Estrone; Norma-oestren; Novestrol; Oradiol; Orestralyn; Palonyl; Perovex; Primogyn; Primogyn C; Primogyn M; Progylut; Progynon C; Progynon M; Roldiol; Spanestrin; Y;estrol[b]	Synthetic Estrogens	[a]Jjemba, P., 2008; [b]Merck Index
levonorgestrel	Human pharmaceuticals-hormones	797-63-7		Levonorgestrelum [INN-Latin]; SOH-075	Synthetic Estrogens	DB2

Drug[a]	Category	CAS#[a]	Hazard Values	Synonyms	Applications	Reference
gemfibrozil	Human pharmaceuticals-lipid regulators	25812-30-0		5-(2,5-Dimethylphenoxy)-2,2-dimethylpentanoic acid; 2,2-dimethyl-5-(2,5-xylyloxy)valeric acid; CI-719; Decrelip; Gevilon; Lipozid; Lipur; Lopid[b]	Lipid regulator	[b]Merck Index; [c]DB3
citalopram	Human pharmaceuticals-SSRIs/antidepressants	59729-33-8[a]		1-[3-(Dimethylamino)propyl]-1-(4-fluorophenyl)-1,3-dihydro-5-isobenzofurancarbonitrile; 1-[3-(dimethylamino)propyl]-1(4-fluorophenyl)-5-phthalancarbonitrile; nitalapram[a]	Antidepressant[a]	[a]Merck Index
fluoxetine	Human pharmaceuticals-SSRIs/antidepressants	59333-67-4		(±)-N-Methyl-γ-[4-(trifluoromethyl)phenoxy]benzenepropanamine; (±)-N-Methyl-3-phenyl-3-[(α,α,α-trifluoro-p-tolyl)oxy]propylamine; N-methyl-3-(p-trifluoromethylphenoxy)-3-phenylpropylamine[b]	Antidepressant[b]	[a]Batt, A., et al., 2008; [b]Merck Index
DEET	Insect Repellant	134-62-3	4	N,N-Diethyl-meta-toluamide; DEET; Benzamide, N,N-diethyl-3-methyl-; N,NDiethyl-m-toluamide; m-Toluamide, N,N-diethylinsect	Insect repellant, industrial	Drewes
17β-estradiol	Natural Hormones	50-28-2		(17β)-Estra-1,2,5(10)-triene-3,17-diol; β-estradiol; cis-estradiol; 3,17-epidiculin; hydroxyestrin; dihydrofollicular hormone; dihydrofolloculin; dihydroxyestrin; dihydrotheelin; Compudose 365; Dihydromenformon; Dimenformon; Diogyn;Estrace; Estraderm; Estrovite; Femestral; Gynergon; Gynoestryl; Lamdiol; Macrodiol; Oestrogel; Oestergon; Ovahormon; ovasterol; Ovocyclin; Ovocylin; Perlatanil; Primofol; Profoliol; Progynon-DH[b]	Natural Estrogens	[a]Jjemba, P., 2008; [b]Merck Index
estrone	Natural hormones	51-16-7		3-Hydroxyestra-1,3,5(10)-trien-17-one; 1,2,5-estratrien-3-ol-17-one; oestrone; theelin; folliculin; follicular hormone; tokokin; theykinin; ketohydroxyestrin; Hiestrone; Menformon; Glandubolin; Cristallovar; Destrone; Endofolliculina; Estrol; Femidyn; Folikrin; Ovex; Oestroperos; Wynestron; Thelestrin; Kestrone; Estrusol; Estrugenone; Femestrone Inj.; Folipex; Follestrine; Follidrin (tablets); Follicunodis; Hormofollin; Oestrin; Oestroform; Ovifollin; Pertatan; Ketodestrin; Inden[a]	Natural Estrogens	[a]Jjemba, P., 2008; [b]Merck Index

Drug[a]	Category	CAS#[a]	Hazard Values	Synonyms	Applications	Reference
testosterone	Natural hormones	58-22-0		17β-Hydroxyandrost-4-en-3-one; Δ^4-androstene-17β-ol-3-one; trans-testosterone; Géno-cristaux Gremy; Malestrone (amps); Orquisteron; Percutacrine Androgénique; Primotest; Sustanon; Mertestate; Testobase; Virosterone; Testryl; Testrone; Homosteron; Oreton-F; Teslen[b]	Natural Estrogens	[a]Jjemba, P., 2008; [b]Merck Index
carbamazepine	Pharmaceuticals	298-46-4[a,b,c]		5H-Dibenz[b,f]azepine-5-carboxaminde; 5-carbamoyl-5H-dibenz[b,f]azepine; G 32883; Biston; Calepsin; Carbelan; Epitol; Finlespin; Sirtal; Strazepine; Tegretal; Tegretol; Telesmin; Timonil[d]	Analgesic; antiepileptic	[a]Metcalfe, C. et al., 2003b; [b]A1; [c]EC1; [d]Merck Index
bisphenol A	Plasticizers	80-05-7	5	Isopropylidenediphenol; Bisphenol A; Diphenylolpropane; Phenol, 4,4'-(1-methylethylidene)bis-; Phenol, 4,4'-isopropylidenedi-; 4,4' Isopropylidinediphenol	Plasticizer, epoxy, glue	Drewes, J., et al., 2009
dibutyl-phthalate	Plasticizers	84-74-2	6	2,6-Di-t-butyl-p-cresol; BHT; 2,6-Di-tert-butyl-p-cresol; Butylated hydroxytoluene; Butylhydroxytoluene; Di-t-butylcresol; Phenol, 2,6-bis(1,1-dimethylethyl)-4-methyl-; p-Cresol, 2,6-di-tert-butyl	Skin care, hobby supplies	Drewes, J., et al., 2009
BHA	Preservatives/antioxidants	25013-16-5	6	BHA; tert-Butyl-4-methoxyphenol; 3-tert-Butyl-4-hydroxyanisole; Anisole, butylated hydroxyl-; Phenol, (1,1-dimethylethyl)-4-methoxy	Anti-oxidant, various	Drewes, J., et al., 2009
BHT (2,6-Di-t-butyl-p-cresol)	Preservatives/antioxidants	128-37-0	6	2,6-Di-t-butyl-p-cresol; BHT; 2,6-Di-tert-butyl-p-cresol; Butylated hydroxytoluene; Butylhydroxytoluene; Di-t-butylcresol; Phenol, 2,6-bis(1,1-dimethylethyl)-4-methyl-; p-Cresol, 2,6-di-tert-butyl	Skin care, hobby supplies	Drewes, J., et al., 2009
propylparaben	Preservatives/antioxidants	94-13-3	NI	4-Hydroxybenzoic acid, propyl ester; Benzoic acid, 4-hydroxy-, propyl ester; Benzoic acid, p-hydroxy-, propyl ester; Propyl 4-hydroxybenzoate; Propyl parahydroxybenzoate; Propyl p-hydroxybenzoate; Propyl paraben	Preservative, various	Drewes, J., et al., 2009
3-benzylidene camphor	Sunscreens					

Drug[a]	Category	CAS#[a]	Hazard Values	Synonyms	Applications	Reference
4-Methylbenzylidene camphor	Sunscreens	36861-47-9			Organic UV filters	[a]Jjemba, P., 2008
camphor	Sunscreens	76-22-2[a]	n.i	2-one, 1,7,7-trimethyl-; Camphor; Spirit of camphor; Gum camphor; (+-)-Camphor; DL-Bornan-2-one	Fragrance, various	Drewes, J., et al., 2009
cyclic methyl siloxanes (D4, D5 and D6)	Sunscreens					

Hazard Values are from Drewes, J., et al., 2009

Appendix B: Concentrations of Chemicals of Emerging Concern Found in Influent, Effluent and Surface Waters (Kidd and Mercer, 2012, Chemicals of emerging concern in the Bay of Fundy watershed: What are the risks? Bay of Fundy Ecosystem Partnership Technical Report No. 7, Bay of Fundy Ecosystem Partnership, Wolfville, NS, 22 p.)

Sewage Treatment Plant	Location	Date of Sampling	Population Served	Average Daily Flow (m^3/day)	Highest Level of Treatment	Hydraulic Retention Time
Mill Cove	Halifax, NS	13-May-03	52500	18900	Secondary (aeration with pure O_2, UV, anaerobic sludge digestion)	4-7h
Mill Cove	Halifax, NS	10-Sep-03	52500	18900	Secondary (aeration with pure O_2, UV, anaerobic sludge digestion)	4-7h
Nashwaaksis	Fredericton, NB	12-May-03	34000	18200	Secondary (activated sludge)	n/a
Nashwaaksis	Fredericton, NB	08-Sep-03	34000	18200	Secondary (activated sludge)	n/a
Charlottetown	Charlottetown, PE	05-May-03	30000	21700	Primary (two-stage anaerobic digestion, Cl disinfection	3h
Charlottetown	Charlottetown, PE	09-Sep-03	30000	21700	Primary (two-stage anaerobic digestion, Cl disinfection	3h
Grand Falls- Windsor	Grand Falls, NL	20-May-03	15000	12900	Secondary (aerated lagoon/water stabilization pond)	9.7-16.5d
Grand Falls- Windsor	Grand Falls, NL	30-Sep-03	15000	12900	Secondary (aerated lagoon/water stabilization pond)	9.7-16.5d
Sussex	Sussex, NB	12-May-03	4293	1900	Secondary (aerated lagoon and polishing pond)	28d
Sussex	Sussex, NB	08-Sep-03	4293	1900	Secondary (aerated lagoon and polishing pond)	28d
Springhill	Springhill, NS	13-May-03	4250	2000	Tertiary (aerated lagoon and polishing pond, filtration/UV)	48d
Springhill	Springhill, NS	10-Sep-03	4250	2000	Tertiary (aerated lagoon and polishing pond, filtration/UV)	48d
Summerside (St. Eleanors)	Summerside, PE	05-May-03	1800	900	Secondary (aerated lagoon and polishing pond, UV)	40-45d

Sewage Treatment Plant	Location	Date of Sampling	Population Served	Average Daily Flow (m^3/day)	Highest Level of Treatment	Hydraulic Retention Time
Summerside (St. Eleanors)	Summerside, PE	09-Sep-03	1800	900	Secondary (aerated lagoon and polishing pond, UV)	40-45d
Gander (Beaverwood)	Gander, NL	20-May-03	6000	11400	Primary (hydrodynamic, separators, Cl disinfection)	2-16 h
Gander (Beaverwood)	Gander, NL	30-Sep-03	6000	11400	Primary (hydrodynamic, separators, Cl disinfection)	2-16 h
Halifax Harbour	Halifax, NS	2002	-	-	-	-
Saint John's Harbour	Saint John's NL	2002	-	-	-	-
Halifax watershed	Nova Scotia	various 2005	52500	-	Primary clarification, anaerobic sludge digestion, secondary clarification and UV disinfection.	-
Halifax watershed	Nova Scotia	various 2005	-	-	Untreated sewage pipe	-
Halifax watershed	Nova Scotia	various 2005	-	-	Untreated sewage pipe	-
Pictou Watershed	Nova Scotia	various 2005	46965	-	Secondary treatment , primary clarification, anaerobic sludge digestion, secondary clarification and chlorine disinfection.	-
Pictou Watershed	Nova Scotia	various 2005	-	-	Untreated sewage pipe	-
Cocagne Watershed	Nova Scotia	various 2005	6000	-	Personal septics with possibility of leaching	-
Peterborough	Peterborough, ON	2002	63000	55000	Secondary (activated sludge, chlorine seasonally)	12-18d
Burlington (Skyway)	Burlington, ON	2002	120000	93000	Secondary (activated sludge, chlorine seasonally)	12-20d
Little River	Windsor, ON	2002	79000	73000	Secondary (activated sludge, UV seasonally)	15-22d
West Windsor	Windsor, ON	2002	123000	155000	Secondary (clarifiers, chlorine seasonally)	8-12d

Sewage Treatment Plant	Location	Date of Sampling	Population Served	Average Daily Flow (m^3/day)	Highest Level of Treatment	Hydraulic Retention Time
12 wastewater plants	Southwestern, ON	Oct-Dec 2002	-	1200-105000	Various methods	Various
11 wastewater plants	Ontario	-	-	-	Various methods	Various
A	Canada	1998	68800	32872	Tertiary (aerated, activated sludge, nitrification, alum phosphorous removal, sand filtration and UV (low))	22h
B	Canada	1998	124000	68498	Secondary (aerated ferric chloride polymer, activated sludge polymer, partial nitrification, ferric chloride phosphorous removal, chlorination)	15h
C	Canada	1998	1226000	585667	Secondary (aerated, activated sludge, ferrous chloride phosphorous removal, chlorination)	14h
D	Canada	1998	46100	17364	Secondary (vortex grit removal, high activated sludge, partial nitrification, alum phosphorous removal, UV (med)seasonally)	11-12h
E	Canada	1998	24800	6243	Secondary (Alum grit removal, activated sludge, partial nitrification, primary phosphorous removal, UV (low) seasonal)	14h
F	Canada	1998	179300	125248	Secondary (aerated, activated sludge, partial nitrification, alum phosphorous removal, UV (med) seasonally)	13-14h
G	Canada	1998	3600	2400	Tertiary, grit removal, no primary treatment, extended aeration activated sludge, nitrification, alumn phosphorous removal, sand filtration and UV (high))	61h

Sewage Treatment Plant	Location	Date of Sampling	Population Served	Average Daily Flow (m^3/day)	Highest Level of Treatment	Hydraulic Retention Time
H	Canada	1998	29000	14600	Tertiary, grit removal, extended aeration activated sludge, nitrification, ferrous chloride phosphorous removal, granular anthracitefiltration and UV (high))	28h
I	Canada	1998	10000	5074	Secondary (grit removal, activated sludge, methanol and antifoam, nitrification, ferric chloride phosphorous removal and chlorination	27h
J	Canada	1998	2000	1171	Lagoon (aerated/facultative lagoon, seasonal discharge, alum phosphorous removal)	>150h
K	Canada	1998	2150	850	Lagoon (aerated/facultative lagoon, seasonal discharge, alum phosphorous removal, slow sand filtration)	>150h
L	Canada	1998	6475	2385	Lagoon (aerated/facultative lagoon, seasonal discharge, alum phosphorous removal when needed)	>150h
M	Canada	1998	1600	432	Lagoon (aerated/facultative lagoon, seasonal discharge, alum , polymer phosphorous removal)	>150h
N	Canada	1998	600000	366898	Secondary (aerated, biological nutrient removal (BNR), nitrification, alum phosphorous removal, UV)	23h
O	Canada	1998	382000	185000	Secondary (aerated, high rate oxygen activated sludge)	12h

Sewage Treatment Plant	Location	Date of Sampling	Population Served	Average Daily Flow (m^3/day)	Highest Level of Treatment	Hydraulic Retention Time
P	Canada	1998	157000	47860	Secondary (aerated, high rate oxygen activated sludge)	13h
Q	Canada	1998	900000	626000	Secondary (trickling filter solids contact, chlorination seasonally)	6-8h
R	Canada	1999	1799000	2366208	Primary (aerated alum phosphorous removal	3h
Mean of A-R	Canada	1998-1999	1600-1799000	432-2366208	Various methods	Various
City of Regina	Regina SK	2005-2007	-	86400	Primary (five cell lagoon, alum phosphorous removal, UV)	1 month
STP1	Whitby, ON	2001	-	-	-	-
STP2	Whitby, ON	2001	-	-	-	-
STP3	Peterborough, ON	2001	-	-	-	-
Various	Canada	various 2002	-	-	-	-
Capital Region WWTP	Edmonton, Alberta	2002	-	9936000	-	-
Gold Bar WWTP	Edmonton, Alberta	2002	-	9936000	-	-
Fish Creek WWTP	Calgary, Alberta	2003	-	6739200	-	-
Bonnybrook WWTP	Calgary, Alberta	2003	-	6739200	-	-
Lethbridge WWTP	Lethbridge, Alberta	2003	-	1745280	-	-
Medicine Hat WWTP	Medicine Hat, Alberta	2003	-	5581440	-	-

Sewage Treatment Plant	Location	Date of Sampling	Population Served	Average Daily Flow (m^3/day)	Highest Level of Treatment	Hydraulic Retention Time
Red Deer WWTP	Red Deer Alberta	2003	-	1365120	-	-
Montreal Urban Community Sewage Treatment Plant	Montreal, QC	2007	-	2500000	Primary	-
Various	Various Countries	Various	-	-	-	-
Facility 1	Western USA	-	-	-	-	-
Facility 2	Western USA	-	-	-	-	-
Facility 3	Western USA	-	-	-	-	-
-	Colorado, USA	2005	-	-	-	-
-	Iowa, USA	2005	-	-	-	-
-	Colorado, USA	2006	-	-	-	-
-	Iowa, USA	2006	-	-	-	-
North Fork of the Brazos River	Lubbock, TX Area USA	2010	-	-	Various methods	-
Oder River	Germany	2000-2001	Various	Var	Various methods	-
Greater Baltimore Area	Baltimore USA	-	-	-	-	-
Tokushima Japan Sites	Tokushima Japan	2010	-	-	-	-
Guangdong Province China	Guangdong Province China	2010	-	-	-	-
Various US streams	Various USA	1999-2000	-	-	-	-
Atlantic Canada	Min	Atlantic Canada				
	Max	Atlantic Canada				

Sewage Treatment Plant	Location	Date of Sampling	Population Served	Average Daily Flow (m^3/day)	Highest Level of Treatment	Hydraulic Retention Time
Canada (except Atlantic Canada)						
	Min	Canada				
	Max	Canada				
International	Min	International				
	Max	International				

Max and Min Bolded values were used in Table 2 of the report

Note: For min and max values only canadian data were used unless there was no canadian data. In these cases International data were used.

Legend for Rows 1 and 2

Influent Data
Effluent Data
Surface Water Data

Legend for all other rows

Atlantic Canada Data
Canadian (except Atlantic Canada)
International Values

Sewage Treatment Plant	Receiving Waters	Freshwater/ Marine	Influent Concentration in ng/L (ppt)											
			camphor	fluoxetine	trimethoprim	atorvastatin	gemfibrozil	naproxen	salicylic acid	carbamazepine	metoprolol	testosterone	17β-estradiol
Mill Cove	Bedford Bay	Marine	-	-	-	-	-	-	-	-	-	-	-
Mill Cove	Bedford Bay	Marine	-	-	-	-	-	-	-	-	-	-	-
Nashwaaksis	Saint John River	Freshwater	-	-	-	-	-	-	-	-	-	-	-
Nashwaaksis	Saint John River	Freshwater	-	-	-	-	-	-	-	-	-	-	-
Charlottetown	Hillsborough River	Marine	-	-	-	-	-	-	-	-	-	-	-
Charlottetown	Hillsborough River	Marine	-	-	-	-	-	-	-	-	-	-	-
Grand Falls- Windsor	Exploits River	Freshwater	-	-	-	-	-	-	-	-	-	-	-
Grand Falls- Windsor	Exploits River	Freshwater	-	-	-	-	-	-	-	-	-	-	-
Sussex	Kennebecasis River	Freshwater	-	-	-	-	-	-	-	-	-	-	-
Sussex	Kennebecasis River	Freshwater	-	-	-	-	-	-	-	-	-	-	-
Springhill	Coal mine Brook	Freshwater	-	-	-	-	-	-	-	-	-	-	-
Springhill	Coal mine Brook	Freshwater	-	-	-	-	-	-	-	-	-	-	-
Summerside (St. Eleanors)	Unnamed Brook	Freshwater	-	-	-	-	-	-	-	-	-	-	-

Sewage Treatment Plant	Receiving Waters	Freshwater/ Marine	Influent Concentration in ng/L (ppt)											
			camphor	fluoxetine	trimethoprim	atorvastatin	gemfibrozil	naproxen	salicylic acid	carbamazepine	metoprolol	testosterone	17β-estradiol
Summerside (St. Eleanors)	Unnamed Brook	Freshwater	-	-	-	-	-	-	-	-	-	-	-
Gander (Beaverwood)	Headwaters Soulis Pond	Freshwater	-	-	-	-	-	-	-	-	-	-	-
Gander (Beaverwood)	Headwaters Soulis Pond	Freshwater	-	-	-	-	-	-	-	-	-	-	-
Halifax Harbour	Halifax Harbour	-	-	-	-	-	-	-	-	-	-	-	-
Saint John's Harbour	Saint John's Harbour	-	-	-	-	-	-	-	-	-	-	-	-
Halifax watershed	-	-	-	-	-	-	-	-	-	-	-	-	-
Halifax watershed	-	-	-	-	-	-	8	110	52	-	-	-	-
Halifax watershed	-	-	-	-	-	-	ND	24	39	-	-	-	-
Pictou Watershed	-	-	-	-	-	-	-	-	-	-	-	-	-
Pictou Watershed	-	-	-	-	-	-	ND	8	56	-	-	-	-
Cocagne Watershed	-	-	-	-	-	-	ND	ND	36	-	-	-	-
Peterborough	Diffuser in Otonabee River	-	-	-	-	-	-	-	-	-	-	-	-
Burlington (Skyway)	Diffuser in Hamiltoon Harbour	-	-	-	-	-	-	-	-	-	-	-	-
Little River	Little River	-	-	-	-	-	-	-	-	-	-	-	-
West Windsor	Detroit River (Canada)	-	-	-	-	-	-	-	-	-	-	-	-

Sewage Treatment Plant	Receiving Waters	Freshwater/ Marine	Influent Concentration in ng/L (ppt)											
			camphor	fluoxetine	trimethoprim	atorvastatin	gemfibrozil	naproxen	salicylic acid	carbamazepine	metoprolol	testosterone	17β-estradiol
12 wastewater plants	Thames River, ON	-	-	-	-	-	453	5580	13700	-	-	-	8
11 wastewater plants	-	-	-	-	-	166	-	-	-	-	-	-	-
A	?	-	-	-	-	-	ND	15000	162000	1900	-	-	7.5
B	?	-	-	-	-	-	ND	30000	318000	700	-	-	21
C	?	-	-	-	-	-	ND	42000	178000	600	-	-	24
D	?	-	-	-	-	-	ND	611000	345000	1300	-	-	21
E	?	-	-	-	-	-	700	63000	468000	1000	-	-	26
F	?	-	-	-	-	-	ND	26000	150000	700	-	-	11
G	?	-	-	-	-	-	ND	22000	336000	200	-	-	2.5

Sewage Treatment Plant	Receiving Waters	Freshwater/ Marine	Influent Concentration in ng/L (ppt)											
			camphor	fluoxetine	trimethoprim	atorvastatin	gemfibrozil	naproxen	salicylic acid	carbamazepine	metoprolol	testosterone	17β-estradiol
H	?	-	-	-	-	-	ND	64000	606000	600	-	-	17.5
I	?	-	-	-	-	-	ND	59000	332000	1000	-	-	14.9
J	?	-	-	-	-	-	ND	67000	589000	200	-	-	14
K	?	-	-	-	-	-	ND	40000	402000	300	-	-	19
L	?	-	-	-	-	-	400	86000	874000	500	-	-	10
M	?	-	-	-	-	-	ND	32000	519000	100	-	-	15
N	?	-	-	-	-	-	ND	16000	29000	900	-	-	13
O	?	-	-	-	-	-	ND	ND	45000	1200	-	-	9

Sewage Treatment Plant	Receiving Waters	Freshwater/ Marine	Influent Concentration in ng/L (ppt)											
			camphor	fluoxetine	trimethoprim	atorvastatin	gemfibrozil	naproxen	salicylic acid	carbamazepine	metoprolol	testosterone	17β-estradiol
P	?	-	-	-	-	-	ND	ND	62000	1100	-	-	21
Q	?	-	-	-	-	-	ND	50000	202000	800	-	-	13
R	?	-	-	-	-	-	2100	13000	95000	500	-	-	10
Mean of A-R	?	-	-	-	-	-	-	-	-	-	-	-	15.6
City of Regina	Wascana Creek/Qu'Appelle River System	-	-	-	-	-	-	-	-	-	-	-	-
STP1	-	-	-	-	-	-	-	-	-	-	-	-	-
STP2	-	-	-	-	-	-	-	-	-	-	-	-	-
STP3	-	-	-	-	-	-	-	-	-	-	-	-	-
Various	-	-	-	-	-	-	-	-	-	-	-	-	-
Capital Region WWTP	North Saskatchewan River	-	-	-	-	-	-	-	-	-	-	-	-
Gold Bar WWTP	North Saskatchewan River	-	-	-	-	-	-	-	-	-	-	-	-
Fish Creek WWTP	Bow River	-	-	-	-	-	-	-	-	-	-	-	-
Bonnybrook WWTP	Bow River	-	-	-	-	-	-	-	-	-	-	-	-
Lethbridge WWTP	Oldman River	-	-	-	-	-	-	-	-	-	-	-	-
Medicine Hat WWTP	South Saskatchewan River	-	-	-	-	-	-	-	-	-	-	-	-

			Influent Concentration in ng/L (ppt)										
Sewage Treatment Plant	**Receiving Waters**	**Freshwater/ Marine**	camphor	fluoxetine	trimethoprim	atorvastatin	gemfibrozil	naproxen	salicylic acid	carbamazepine	metoprolol	testosterone	17β-estradiol
Red Deer WWTP	Red Deer River	-	-	-	-	-	-	-	-	-	-	-	-
Montreal Urban Community Sewage Treatment Plant	St. Lawerance River	Marine?	-	-	-	-	-	-	-	-	-	-	120-125
Various	-	-	-	-	-	-	-	-	-	-	-	-	-
Facility 1	-	-	160-1800	-	-	-	-	-	-	-	-	-	-
Facility 2	-	-	1700	-	-	-	-	-	-	-	-	-	-
Facility 3	-	-	-	-	-	-	-	-	-	-	-	-	-
-	Boulder Creek	Freshwater	-	-	-	-	-	-	-	-	-	-	-
-	Fourmile Creek	Freshwater	-	-	-	-	-	-	-	-	-	-	-
-	Boulder Creek	Freshwater	-	-	-	-	-	-	-	-	-	-	-
-	Fourmile Creek	Freshwater	-	-	-	-	-	-	-	-	-	-	-
North Fork of the Brazos River	-	-	-	-	-	-	-	-	-	-	-	-	-
Oder River	Oder River, Germany	-	-	-	-	-	-	-	-	-	-	-	-
Greater Baltimore Area	-	-	-	-	-	-	-	-	-	-	-	-	-
Tokushima Japan Sites	various rivers in Japan	-	-	-	-	-	-	-	-	-	-	-	-
Guangdong Province China	-	-	-	-	-	-	-	-	-	-	-	5.4-13.3	-
Various US streams	-	-	-	-	-	-	-	-	-	-	-	-	-
Atlantic Canada			-	-	-	-	**ND**	**ND**	**36**	-	-	-	-
			-	-	-	-	**8**	**110**	**56**	-	-	-	-

Sewage Treatment Plant	Receiving Waters	Freshwater/ Marine	Influent Concentration in ng/L (ppt)											
			camphor	fluoxetine	trimethoprim	atorvastatin	gemfibrozil	naproxen	salicylic acid	carbamazepine	metoprolol	testosterone	17β-estradiol
Canada (except Atlantic Canada)			-	-	-	**166**	**ND**	**ND**	**13700**	**100**	**-**	-	**2.5**
			-	-	-	**166**	**2100**	**611000**	**874000**	**1900**	**-**	-	**125**
International			**160**	-	-	-	-	-	-	-	-	**5.4**	-
			1800	-	-	-	-	-	-	-	-	**13.3**	-

Max and Min Bolded values were used in Table 2 of the report

Note: For min and max values only canadian data were used unless there was no canadian data. In these cases International data were used.

Legend for Rows 1 and 2

Influent Data

Effluent Data

Surface Water Data

Legend for all other rows

Atlantic Canada Data

Canadian (except Atlantic Canada)

International Values

Sewage Treatment Plant	estrone	levonorgestrel	ethinylestradiol	erythromycin	sulfacetamide	sulfapyridine	sulfamethazole	amoxicillin	doxycycline	citalopram	propylparaben	BHA	BHT	DEET	bisphenol A	dibutyl-phthalate
Mill Cove	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mill Cove	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nashwaaksis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nashwaaksis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Charlottetown	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Charlottetown	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Grand Falls- Windsor	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Grand Falls- Windsor	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sussex	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sussex	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Springhill	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Springhill	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Summerside (St. Eleanors)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Sewage Treatment Plant	estrone	levonorgestrel	ethinylestradiol	erythromycin	sulfacetamide	sulfapyridine	sulfamethazole	amoxicillin	doxycycline	citalopram	propylparaben	BHA	BHT	DEET	bisphenol A	dibutyl-phthalate
Summerside (St. Eleanors)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gander (Beaverwood)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gander (Beaverwood)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Halifax Harbour	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Saint John's Harbour	5.7-20.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Halifax watershed	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Halifax watershed	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Halifax watershed	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pictou Watershed	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pictou Watershed	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cocagne Watershed	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Peterborough	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Burlington (Skyway)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Little River	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
West Windsor	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Sewage Treatment Plant	estrone	levonorgestrel	ethinylestradiol	erythromycin	sulfacetamide	sulfapyridine	sulfamethazole	amoxicillin	doxycycline	citalopram	propylparaben	BHA	BHT	DEET	bisphenol A	dibutyl-phthalate
12 wastewater plants	30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11 wastewater plants	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A	40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B	45	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C	62	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D	70	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E	52	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
G	19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Sewage Treatment Plant	estrone	levonorgestrel	ethinylestradiol	erythromycin	sulfacetamide	sulfapyridine	sulfamethazole	amoxicillin	doxycycline	citalopram	propylparaben	BHA	BHT	DEET	bisphenol A	dibutyl-phthalate
H	80	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
I	60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
J	35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
K	30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L	45	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
M	35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N	80	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
O	42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Sewage Treatment Plant	estrone	levonorgestrel	ethinylestradiol	erythromycin	sulfacetamide	sulfapyridine	sulfamethazole	amoxicillin	doxycycline	citalopram	propylparaben	BHA	BHT	DEET	bisphenol A	dibutyl-phthalate
P	62	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Q	63	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R	40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mean of A-R	49	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
City of Regina	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
STP1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
STP2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
STP3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Various	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Capital Region WWTP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gold Bar WWTP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fish Creek WWTP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bonnybrook WWTP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lethbridge WWTP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Medicine Hat WWTP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Sewage Treatment Plant	estrone	levonorgestrel	ethinylestradiol	erythromycin	sulfacetamide	sulfapyridine	sulfamethazole	amoxicillin	doxycycline	citalopram	propylparaben	BHA	BHT	DEET	bisphenol A	dibutyl-phthalate
Red Deer WWTP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Montreal Urban Community Sewage Treatment Plant	-	150-170	75-90	-	-	-	-	-	-	-	-	-	-	-	-	-
Various	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Facility 1	-	-	-	-	-	-	-	-	-	-	760-2000	52-220	43-410	54-470	220-530	390-2400
Facility 2	-	-	-	-	-	-	-	-	-	-	1500	230	390	600	200	3100
Facility 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
North Fork of the Brazos River	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oder River	-	-	-	-	-	-	-	-	-	-	-	-	392	-	-	-
Greater Baltimore Area	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tokushima Japan Sites	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Guangdong Province China	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Various US streams	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Atlantic Canada	**5.7**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	20.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Sewage Treatment Plant	estrone	levonorgestrel	ethinylestradiol	erythromycin	sulfacetamide	sulfapyridine	sulfamethazole	amoxicillin	doxycycline	citalopram	propylparaben	BHA	BHT	DEET	bisphenol A	dibutyl-phthalate
Canada (except Atlantic Canada)	**19**	**150**	**75**	-	-	-	-	-	-	-	-	-	-	-	-	-
	80	**170**	**90**	-	-	-	-	-	-	-	-	-	-	-	-	-
International	-	-	-	-	-	-	-	-	-	-	**760**	**52**	**43**	**54**	**200**	**390**
	-	-	-	-	-	-	-	-	-	-	**2000**	**230**	**410**	**600**	**530**	**3100**

Max and Min Bolded values were used in Table 2 of the report

Note: For min and max values only canadian data were used unless there was no canadian data. In these cases International data were used.

Legend for Rows 1 and 2

Influent Data

Effluent Data

Surface Water Data

Legend for all other rows

Atlantic Canada Data

Canadian (except Atlantic Canada)

International Values

Sewage Treatment Plant	Effluent Concentration in ng/L (ppt)											
	triclosan	triclocarban	vanillin	galaxolide	campohr	fluoxetine	trimethoprim	atorvastatin	gemfibrozil	naproxen	salicylic acid	carbamazepine
Mill Cove	-	-	-	-	-	-	-	-	530	ND	100	45
Mill Cove	-	-	-	-	-	-	-	-	320	1700	ND	130
Nashwaaksis	-	-	-	-	-	-	-	-	940	5900	1900	97
Nashwaaksis	-	-	-	-	-	-	-	-	840	3300	53	83
Charlottetown	-	-	-	-	-	-	-	-	780	91000	20000	64
Charlottetown	-	-	-	-	-	-	-	-	1400	14000	35000	240
Grand Falls- Windsor	-	-	-	-	-	-	-	-	201	1200	170	ND
Grand Falls- Windsor	-	-	-	-	-	-	-	-	570	1700	190	75
Sussex	-	-	-	-	-	-	-	-	ND	850	110	41
Sussex	-	-	-	-	-	-	-	-	240	860	56	98
Springhill	-	-	-	-	-	-	-	-	180	650	70	88
Springhill	-	-	-	-	-	-	-	-	240	220	ND	180
Summerside (St. Eleanors)	-	-	-	-	-	-	-	-	590	800	750	24

Sewage Treatment Plant	triclosan	triclocarban	vanillin	galaxolide	Effluent Concentration in ng/L (ppt) campohr	fluoxetine	trimethoprim	atorvastatin	gemfibrozil	naproxen	salicylic acid	carbamazepine
Summerside (St. Eleanors)	-	-	-	-	-	-	-	-	13000	370	ND	66
Gander (Beaverwood)	-	-	-	-	-	-	-	-	370	1000	460	ND
Gander (Beaverwood)	-	-	-	-	-	-	-	-	600	1700	54	170
Halifax Harbour	-	-	-	-	-	-	-	-	-	-	-	-
Saint John's Harbour	-	-	-	-	-	-	-	-	-	-	-	-
Halifax watershed	-	-	-	-	-	-	-	-	300	5100	100	-
Halifax watershed	-	-	-	-	-	-	-	-	-	-	-	-
Halifax watershed	-	-	-	-	-	-	-	-	-	-	-	-
Pictou Watershed	-	-	-	-	-	-	-	-	190	380	280	-
Pictou Watershed	-	-	-	-	-	-	-	-	-	-	-	-
Cocagne Watershed	-	-	-	-	-	-	-	-	-	-	-	-
Peterborough	-	-	-	-	-	50	71	22	1493	-	524	126
Burlington (Skyway)	-	-	-	-	-	38	84	44	5	-	41	64
Little River	-	-	-	-	-	99	194	19	12	-	21	112
West Windsor	-	-	-	-	-	ND	9	ND	43	-	168	7

Sewage Treatment Plant	triclosan	triclocarban	vanillin	galaxolide	Effluent Concentration in ng/L (ppt) campohr	fluoxetine	trimethoprim	atorvastatin	gemfibrozil	naproxen	salicylic acid	carbamazepine
12 wastewater plants	1930	-	-	2031	-	-	-	-	246	452	106	-
11 wastewater plants	-	-	-	-	-	-	-	77	-	-	-	-
A	-	-	-	-	-	-	-	-	ND	ND	1800	2100
B	-	-	-	-	-	-	-	-	ND	ND	300	700
C	-	-	-	-	-	-	-	-	ND	ND	300	800
D	-	-	-	-	-	-	-	-	ND	7200	4300	800
E	-	-	-	-	-	-	-	-	ND	ND	4800	500
F	-	-	-	-	-	-	-	-	ND	ND	ND	800
G	-	-	-	-	-	-	-	-	ND	ND	ND	300

Sewage Treatment Plant	Effluent Concentration in ng/L (ppt)											
	triclosan	triclocarban	vanillin	galaxolide	campohr	fluoxetine	trimethoprim	atorvastatin	gemfibrozil	naproxen	salicylic acid	carbamazepine
H	-	-	-	-	-	-	-	-	ND	ND	ND	800
I	-	-	-	-	-	-	-	-	ND	ND	ND	900
J	-	-	-	-	-	-	-	-	ND	ND	ND	100
K	-	-	-	-	-	-	-	-	ND	ND	ND	300
L	-	-	-	-	-	-	-	-	ND	ND	ND	200
M	-	-	-	-	-	-	-	-	ND	ND	ND	100
N	-	-	-	-	-	-	-	-	ND	ND	ND	1700
O	-	-	-	-	-	-	-	-	ND	ND	ND	1700

Sewage Treatment Plant	Effluent Concentration in ng/L (ppt)											
	triclosan	triclocarban	vanillin	galaxolide	campohr	fluoxetine	trimethoprim	atorvastatin	gemfibrozil	naproxen	salicylic acid	carbamazepine
P	-	-	-	-	-	-	-	-	ND	ND	ND	2300
Q	-	-	-	-	-	-	-	-	1300	33900	2800	700
R	-	-	-	-	-	-	-	-	ND	9500	59600	400
Mean of A-R	-	-	-	-	-	-	-	-	-	-	-	-
City of Regina	-	-	-	-	-	-	-	-	-	-	-	-
STP1	-	-	-	-	-	-	-	-	-	20	-	-
STP2	-	-	-	-	-	-	-	-	-	20	-	-
STP3	-	-	-	-	-	-	-	-	-	310	-	-
Various	-	-	-	-	-	-	-	-	-	-	-	-
Capital Region WWTP	-	-	-	-	-	31	3528	-	619	ND	-	2641
Gold Bar WWTP	-	-	-	-	-	799	669	-	652	ND	-	1784
Fish Creek WWTP	-	-	-	-	-	ND	795	-	773	2668	-	702
Bonnybrook WWTP	-	-	-	-	-	ND	907	-	799	1785	-	925
Lethbridge WWTP	-	-	-	-	-	ND	887	-	410	ND	-	2785
Medicine Hat WWTP	-	-	-	-	-	ND	514	-	606	ND	-	1123

Sewage Treatment Plant	Effluent Concentration in ng/L (ppt)											
	triclosan	triclocarban	vanillin	galaxolide	campohr	fluoxetine	trimethoprim	atorvastatin	gemfibrozil	naproxen	salicylic acid	carbamazepine
Red Deer WWTP	-	-	-	-	-	ND	1404	-	813	ND	-	3287
Montreal Urban Community Sewage Treatment Plant	-	-	-	-	-	-	-	-	-	-	-	-
Various	-	-	-	-	-	ND-99	9-1760	ND-44	5-4760	ND-5220	ND-13000	32.5-6300
Facility 1	770-860	49-77	1600-2000	-	ND	-	-	-	-	-	-	-
Facility 2	1500	350	2100	-	ND	-	-	-	-	-	-	-
Facility 3	-	-	-	-	ND	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-
North Fork of the Brazos River	-	-	-	4772-13399	-	-	-	-	-	-	-	-
Oder River	-	-	-	-	-	-	-	-	-	-	-	-
Greater Baltimore Area	-	6650-6750	-	-	-	-	-	-	-	-	-	-
Tokushima Japan Sites	-	-	-	-	-	-	-	-	-	-	-	-
Guangdong Province China	-	-	-	-	-	-	-	-	-	-	-	-
Various US streams	-	-	-	-	-	-	-	-	-	-	-	-
Atlantic Canada	-	-	-	-	-	-	-	-	**ND**	**ND**	**ND**	**ND**
	-	-	-	-	-	-	-	-	**13000**	**91000**	**35000**	**240**

Sewage Treatment Plant	triclosan	triclocarban	vanillin	galaxolide	campohr	fluoxetine	trimethoprim	atorvastatin	gemfibrozil	naproxen	salicylic acid	carbamazepine
					Effluent Concentration in ng/L (ppt)							
Canada (except Atlantic Canada)	**1930**	-	-	**2031**	-	**ND**	**9**	**ND**	**ND**	**ND**	**ND**	**7**
	1930	-	-	**2031**	-	**799**	**3528**	**77**	**1493**	**33900**	**59600**	**3287**
International	770	**49**	**1600**	4772	**ND**	ND	9	ND	5	ND	ND	32.5
	1500	**6750**	**2100**	13399	**ND**	99	1760	44	4760	5220	13000	6300

Max and Min Bolded values were used in Table 2 of the report

Note: For min and max values only canadian data were used unless there was no canadian data. In these cases International data were used.

Legend for Rows 1 and 2

Influent Data

Effluent Data

Surface Water Data

Legend for all other rows

Atlantic Canada Data

Canadian (except Atlantic Canada)

International Values

Sewage Treatment Plant	metoprolol	testosterone	17β-estradiol	estrone	levonorgestrel	ethinylestradiol	erythromycin	sulfacetamide	sulfapyridine	sulfamethazole	amoxicillin	doxycycline	citalopram	propylparaben	BHA	BHT
Mill Cove	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mill Cove	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nashwaaksis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nashwaaksis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Charlottetown	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Charlottetown	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Grand Falls- Windsor	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Grand Falls- Windsor	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sussex	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sussex	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Springhill	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Springhill	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Summerside (St. Eleanors)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Sewage Treatment Plant	metoprolol	testosterone	17β-estradiol	estrone	levonorgestrel	ethinylestradiol	erythromycin	sulfacetamide	sulfapyridine	sulfamethazole	amoxicillin	doxycycline	citalopram	propylparaben	BHA	BHT
Summerside (St. Eleanors)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gander (Beaverwood)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gander (Beaverwood)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Halifax Harbour	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Saint John's Harbour	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Halifax watershed	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Halifax watershed	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Halifax watershed	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pictou Watershed	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pictou Watershed	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cocagne Watershed	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Peterborough	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Burlington (Skyway)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Little River	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
West Windsor	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Sewage Treatment Plant	metoprolol	testosterone	17β-estradiol	estrone	levonorgestrel	ethinylestradiol	erythromycin	sulfacetamide	sulfapyridine	sulfamethazole	amoxicillin	doxycycline	citalopram	propylparaben	BHA	BHT
12 wastewater plants	-	-	-	8	-	-	-	-	-	-	-	-	-	-	-	-
11 wastewater plants	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A	-	-	1.3	12	-	-	-	-	-	-	-	-	-	-	-	-
B	-	-	1	12	-	-	-	-	-	-	-	-	-	-	-	-
C	-	-	14	95	-	-	-	-	-	-	-	-	-	-	-	-
D	-	-	2	15	-	-	-	-	-	-	-	-	-	-	-	-
E	-	-	0.5	8	-	-	-	-	-	-	-	-	-	-	-	-
F	-	-	2.5	70	-	-	-	-	-	-	-	-	-	-	-	-
G	-	-	<0.5	<1	-	-	-	-	-	-	-	-	-	-	-	-

Sewage Treatment Plant	metoprolol	testosterone	17β-estradiol	estrone	levonorgestrel	ethinylestradiol	erythromycin	sulfacetamide	sulfapyridine	sulfamethazole	amoxicillin	doxycycline	citalopram	propylparaben	BHA	BHT
H	-	-	<0.5	1	-	-	-	-	-	-	-	-	-	-	-	-
I	-	-	<0.5	1	-	-	-	-	-	-	-	-	-	-	-	-
J	-	-	<0.5	1	-	-	-	-	-	-	-	-	-	-	-	-
K	-	-	4	15	-	-	-	-	-	-	-	-	-	-	-	-
L	-	-	0.5	1	-	-	-	-	-	-	-	-	-	-	-	-
M	-	-	<0.5	1	-	-	-	-	-	-	-	-	-	-	-	-
N	-	-	1	15	-	-	-	-	-	-	-	-	-	-	-	-
O	-	-	<0.5	10	-	-	-	-	-	-	-	-	-	-	-	-

Sewage Treatment Plant	metoprolol	testosterone	17β-estradiol	estrone	levonorgestrel	ethinylestradiol	erythromycin	sulfacetamide	sulfapyridine	sulfamethazole	amoxicillin	doxycycline	citalopram	propylparaben	BHA	BHT
P	-	-	1	2	-	-	-	-	-	-	-	-	-	-	-	-
Q	-	-	16	100	-	-	-	-	-	-	-	-	-	-	-	-
R	-	-	11	50	-	-	-	-	-	-	-	-	-	-	-	-
Mean of A-R	-	-	1.8	17	-	-	-	-	-	-	-	-	-	-	-	-
City of Regina	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
STP1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
STP2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
STP3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Various	-	-	-	-	-	-	80 (838)	64 (151)	81 (228)	243 (871)	-	38 (46)	-	-	-	-
Capital Region WWTP	-	ND	ND	3.34	-	ND	-	105	707	3278	-	ND	-	-	-	-
Gold Bar WWTP	-	ND	2.08	34.06	-	ND	-	44	182	1020	-	ND	-	-	-	-
Fish Creek WWTP	-	ND	ND	ND	-	ND	-	ND	223	415	-	ND	-	-	-	-
Bonnybrook WWTP	-	ND	1.48	2.56	-	8.47	-	68	323	931	-	ND	-	-	-	-
Lethbridge WWTP	-	ND	0.21	ND	-	ND	-	ND	167	886	-	102	-	-	-	-
Medicine Hat WWTP	-	ND	2.73	10.27	-	ND	-	ND	297	363	-	ND	-	-	-	-

Sewage Treatment Plant	metoprolol	testosterone	17β-estradiol	estrone	levonorgestrel	ethinylestradiol	erythromycin	sulfacetamide	sulfapyridine	sulfamethazole	amoxicillin	doxycycline	citalopram	propylparaben	BHA	BHT
Red Deer WWTP	-	ND	ND	9.93	-	ND	-	ND	117	193	-	ND	-	-	-	-
Montreal Urban Community Sewage Treatment Plant	-	-	90	-	30	ND	-	-	-	-	-	-	-	-	-	-
Various	10-2200	-	-	-	-	0.1-420	<10-6000	6.4-151	81-228	ND-2140	4.7	38-90	-	-	-	-
Facility 1	-	-	-	-	-	-	-	-	-	-	-	-	-	2.6-3.7	ND-39	35-43
Facility 2	-	-	-	-	-	-	-	-	-	-	-	-	-	ND	ND	ND
Facility 3	-	-	-	-	-	-	-	-	-	-	-	-	-	0.26	ND	240
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
North Fork of the Brazos River	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oder River	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	132
Greater Baltimore Area	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tokushima Japan Sites	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Guangdong Province China	-	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Various US streams	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Atlantic Canada	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Sewage Treatment Plant	metoprolol	testosterone	17β-estradiol	estrone	levonorgestrel	ethinylestradiol	erythromycin	sulfacetamide	sulfapyridine	sulfamethazole	amoxicillin	doxycycline	citalopram	propylparaben	BHA	BHT
Canada (except Atlantic Canada)	-	**ND**	**ND**	**ND**	**30**	**ND**	**838**	**ND**	**81**	**193**	-	**ND**	-	-	-	-
	-	**ND**	**90**	**100**	**30**	**8.47**	**838**	**151**	**707**	**3278**	-	**102**	-	-	-	-
International	**10**	ND	-	-	-	0	<10	6.4	81	ND	**4.7**	38	-	**ND**	**ND**	**ND**
	2200	ND	-	-	-	0	6000	151	228	2140	**4.7**	90	-	**3.7**	**39**	**240**

Max and Min Bolded values were used in Table 2 of the report

Note: For min and max values only canadian data were used unless there was no canadian data. In these cases International data were used.

Legend for Rows 1 and 2

Influent Data

Effluent Data

Surface Water Data

Legend for all other rows

Atlantic Canada Data

Canadian (except Atlantic Canada)

International Values

Sewage Treatment Plant	DEET	bisphenol A	dibutyl-phthalate	triclosan	triclocarban	vanillin	galaxolide	Surface Water in ng/L (ppt) fluoxetine	trimethoprim	atorvastatin	gemfibrozil	naproxen	salicylic acid
Mill Cove	-	-	-	-	-	-	-	-	-	-	ND	47	ND
Mill Cove	-	-	-	-	-	-	-	-	-	-	ND	51	ND
Nashwaaksis	-	-	-	-	-	-	-	-	-	-	ND	ND	ND
Nashwaaksis	-	-	-	-	-	-	-	-	-	-	ND	ND	ND
Charlottetown	-	-	-	-	-	-	-	-	-	-	ND	ND	ND
Charlottetown	-	-	-	-	-	-	-	-	-	-	ND	ND	ND
Grand Falls- Windsor	-	-	-	-	-	-	-	-	-	-	ND	36	ND
Grand Falls- Windsor	-	-	-	-	-	-	-	-	-	-	ND	53	ND
Sussex	-	-	-	-	-	-	-	-	-	-	ND	40	ND
Sussex	-	-	-	-	-	-	-	-	-	-	ND	ND	ND
Springhill	-	-	-	-	-	-	-	-	-	-	210	220	57
Springhill	-	-	-	-	-	-	-	-	-	-	310	250	ND
Summerside (St. Eleanors)	-	-	-	-	-	-	-	-	-	-	210	220	57

Sewage Treatment Plant	DEET	bisphenol A	dibutyl-phthalate	triclosan	triclocarban	vanillin	galaxolide	Surface Water in ng/L (ppt) fluoxetine	trimethoprim	atorvastatin	gemfibrozil	naproxen	salicylic acid
Summerside (St. Eleanors)	-	-	-	-	-	-	-	-	-	-	420	160	ND
Gander (Beaverwood)	-	-	-	-	-	-	-	-	-	-	47	4500	850
Gander (Beaverwood)	-	-	-	-	-	-	-	-	-	-	580	4300	17000
Halifax Harbour	-	-	-	-	-	-	-	-	-	-	-	-	-
Saint John's Harbour	-	-	-	-	-	-	-	-	-	-	-	-	-
Halifax watershed	-	-	-	-	-	-	-	-	-	-	ND	18	70
Halifax watershed	-	-	-	-	-	-	-	-	-	-	-	-	-
Halifax watershed	-	-	-	-	-	-	-	-	-	-	-	-	-
Pictou Watershed	-	-	-	-	-	-	-	-	-	-	6	12	51
Pictou Watershed	-	-	-	-	-	-	-	-	-	-	-	-	-
Cocagne Watershed	-	-	-	-	-	-	-	-	-	-	-	-	-
Peterborough	-	-	-	-	-	-	-	ND	ND	ND	ND	ND	-
Burlington (Skyway)	-	-	-	-	-	-	-	13	43	10	38	39	-
Little River	-	-	-	-	-	-	-	46	134	15	34	73	-
West Windsor	-	-	-	-	-	-	-	ND	ND	ND	2	ND	-

Sewage Treatment Plant	DEET	bisphenol A	dibutyl-phthalate	triclosan	triclocarban	vanillin	galaxolide	Surface Water in ng/L (ppt) fluoxetine	trimethoprim	atorvastatin	gemfibrozil	naproxen	salicylic acid
12 wastewater plants	-	-	-	108	-	-	751	-	-	-	-	-	-
11 wastewater plants	-	-	-	-	-	-	-	-	-	-	-	-	-
A	-	-	-	-	-	-	-	-	-	-	-	-	-
B	-	-	-	-	-	-	-	-	-	-	-	-	-
C	-	-	-	-	-	-	-	-	-	-	-	-	-
D	-	-	-	-	-	-	-	-	-	-	-	-	-
E	-	-	-	-	-	-	-	-	-	-	-	-	-
F	-	-	-	-	-	-	-	-	-	-	-	-	-
G	-	-	-	-	-	-	-	-	-	-	-	-	-

Sewage Treatment Plant	DEET	bisphenol A	dibutyl-phthalate	triclosan	triclocarban	vanillin	galaxolide	Surface Water in ng/L (ppt) fluoxetine	trimethoprim	atorvastatin	gemfibrozil	naproxen	salicylic acid
H	-	-	-	-	-	-	-	-	-	-	-	-	-
I	-	-	-	-	-	-	-	-	-	-	-	-	-
J	-	-	-	-	-	-	-	-	-	-	-	-	-
K	-	-	-	-	-	-	-	-	-	-	-	-	-
L	-	-	-	-	-	-	-	-	-	-	-	-	-
M	-	-	-	-	-	-	-	-	-	-	-	-	-
N	-	-	-	-	-	-	-	-	-	-	-	-	-
O	-	-	-	-	-	-	-	-	-	-	-	-	-

Sewage Treatment Plant	DEET	bisphenol A	dibutyl-phthalate	triclosan	triclocarban	vanillin	galaxolide	Surface Water in ng/L (ppt) fluoxetine	trimethoprim	atorvastatin	gemfibrozil	naproxen	salicylic acid
P	-	-	-	-	-	-	-	-	-	-	-	-	-
Q	-	-	-	-	-	-	-	-	-	-	-	-	-
R	-	-	-	-	-	-	-	-	-	-	-	-	-
Mean of A-R	-	-	-	-	-	-	-	-	-	-	-	-	-
City of Regina	-	-	-	-	-	-	-	-	150	-	4200	2700	80
STP1	-	-	-	-	-	-	-	-	-	-	-	-	-
STP2	-	-	-	-	-	-	-	-	-	-	-	-	-
STP3	-	-	-	-	-	-	-	-	-	-	-	-	-
Various	-	-	-	-	-	-	-	-	-	-	-	-	-
Capital Region WWTP	-	6.49	1385.4	-	-	-	-	ND	104	-	52	106	-
Gold Bar WWTP	-	115.93	57.2	-	-	-	-	ND	104	-	52	106	-
Fish Creek WWTP	-	194.55	246.8	-	-	-	-	ND	18	-	23	59	-
Bonnybrook WWTP	-	83.57	101.2	-	-	-	-	ND	18	-	23	59	-
Lethbridge WWTP	-	1.29	16.1	-	-	-	-	ND	39	-	17	ND	-
Medicine Hat WWTP	-	36.93	26.9	-	-	-	-	ND	76	-	67	ND	-

Sewage Treatment Plant	DEET	bisphenol A	dibutyl-phthalate	triclosan	triclocarban	vanillin	galaxolide	Surface Water in ng/L (ppt) fluoxetine	trimethoprim	atorvastatin	gemfibrozil	naproxen	salicylic acid
Red Deer WWTP	-	26.34	51.6	-	-	-	-	ND	ND	-	4	ND	-
Montreal Urban Community Sewage Treatment Plant	-	-	-	-	-	-	-	-	-	-	-	-	-
Various	-	-	-	-	-	-	-	ND-46	ND-710	ND-15	ND-1550	ND-2000	18-8800
Facility 1	120-190	1600-2600	150-180	43-110	99-110	190-470	-	-	-	-	-	-	-
Facility 2	100	1900	210	3.4	26	150	-	-	-	-	-	-	-
Facility 3	260	860	1300	18	130	290	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-
North Fork of the Brazos River	-	-	-	-	-	-	2928-10525	-	-	-	-	-	-
Oder River	-	-	-	-	-	-	-	-	-	-	-	-	-
Greater Baltimore Area	-	-	-	-	-	-	-	-	-	-	-	-	-
Tokushima Japan Sites	-	-	-	-	-	-	-	-	-	-	-	-	-
Guangdong Province China	-	-	-	-	-	-	-	-	-	-	-	-	-
Various US streams	-	-	-	-	-	-	-	-	-	-	-	-	-
Atlantic Canada	-	-	-	-	-	-	-	-	-	-	**ND**	**ND**	**ND**
	-	-	-	-	-	-	-	-	-	-	**580**	**4500**	**17000**

Sewage Treatment Plant	DEET	bisphenol A	dibutyl-phthalate	triclosan	triclocarban	vanillin	galaxolide	Surface Water in ng/L (ppt) fluoxetine	trimethoprim	atorvastatin	gemfibrozil	naproxen	salicylic acid
Canada (except Atlantic Canada)	-	**1.29**	**16.1**	**108**	-	-	**751**	**ND**	**ND**	**ND**	**ND**	**ND**	**80**
	-	**194.55**	**1385.4**	**108**	-	-	**751**	**46**	**150**	**15**	**4200**	**2700**	**80**
International	**100**	860	210	3.4	**26**	**150**	2928	ND	ND	ND	ND	ND	18
	260	2600	1300	110	**130**	**470**	10525	46	710	15	1550	2000	8800

Max and Min Bolded values were used in Table 2 of the report

Note: For min and max values only canadian data were used unless there was no canadian data. In these cases International data were used.

Legend for Rows 1 and 2

Influent Data

Effluent Data

Surface Water Data

Legend for all other rows

Atlantic Canada Data

Canadian (except Atlantic Canada)

International Values

Sewage Treatment Plant	carbamazepine	metoprolol	testosterone	17β-estradiol	estrone	levonorgestrel	ethinylestradiol	erythromycin	sulfacetamide	sulfapyridine	sulfamethazole	amoxicillin	doxycycline	citalopram	propylparaben
Mill Cove	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mill Cove	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nashwaaksis	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nashwaaksis	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Charlottetown	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Charlottetown	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Grand Falls- Windsor	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Grand Falls- Windsor	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sussex	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sussex	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Springhill	62	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Springhill	170	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Summerside (St. Eleanors)	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Sewage Treatment Plant	carbamazepine	metoprolol	testosterone	17β-estradiol	estrone	levonorgestrel	ethinylestradiol	erythromycin	sulfacetamide	sulfapyridine	sulfamethazole	amoxicillin	doxycycline	citalopram	propylparaben
Summerside (St. Eleanors)	40	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gander (Beaverwood)	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gander (Beaverwood)	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Halifax Harbour	-	-	-	-	4.0-6.6	-	-	-	-	-	-	-	-	-	-
Saint John's Harbour	-	-	-	-	1.4-1.5	-	-	-	-	-	-	-	-	-	-
Halifax watershed	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Halifax watershed	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Halifax watershed	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pictou Watershed	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pictou Watershed	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cocagne Watershed	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Peterborough	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Burlington (Skyway)	23	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Little River	80	-	-	-	-	-	-	-	-	-	-	-	-	-	-
West Windsor	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Sewage Treatment Plant	carbamazepine	metoprolol	testosterone	17β-estradiol	estrone	levonorgestrel	ethinylestradiol	erythromycin	sulfacetamide	sulfapyridine	sulfamethazole	amoxicillin	doxycycline	citalopram	propylparaben
12 wastewater plants	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11 wastewater plants	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
G	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Sewage Treatment Plant	carbamazepine	metoprolol	testosterone	17β-estradiol	estrone	levonorgestrel	ethinylestradiol	erythromycin	sulfacetamide	sulfapyridine	sulfamethazole	amoxicillin	doxycycline	citalopram	propylparaben
H	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
I	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
J	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
K	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
O	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Sewage Treatment Plant	carbamazepine	metoprolol	testosterone	17β-estradiol	estrone	levonorgestrel	ethinylestradiol	erythromycin	sulfacetamide	sulfapyridine	sulfamethazole	amoxicillin	doxycycline	citalopram	propylparaben
P	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Q	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mean of A-R	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
City of Regina	350	-	-	-	-	-	-	590	-	-	510	80	-	-	-
STP1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
STP2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
STP3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Various	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Capital Region WWTP	171	-	ND	ND	ND	-	ND	-	ND	35	286	-	ND	-	-
Gold Bar WWTP	171	-	ND	ND	ND	-	ND	-	ND	35	286	-	ND	-	-
Fish Creek WWTP	94	-	ND	ND	ND	-	ND	-	ND	15	48	-	ND	-	-
Bonnybrook WWTP	94	-	ND	ND	ND	-	ND	-	ND	15	48	-	ND	-	-
Lethbridge WWTP	139	-	ND	ND	ND	-	ND	-	ND	61	101	-	ND	-	-
Medicine Hat WWTP	206	-	ND	ND	ND	-	ND	-	ND	ND	25	-	ND	-	-

Sewage Treatment Plant	carbamazepine	metoprolol	testosterone	17β-estradiol	estrone	levonorgestrel	ethinylestradiol	erythromycin	sulfacetamide	sulfapyridine	sulfamethazole	amoxicillin	doxycycline	citalopram	propylparaben
Red Deer WWTP	95	-	ND	ND	ND	-	ND	-	ND	ND	ND	-	ND	-	-
Montreal Urban Community Sewage Treatment Plant	-	-	-	9	ND	ND	ND	-	-	-	-	-	-	-	-
Various	<1-7100	30-2200	116-214	-	-	-	0.1	3.2-1700	-	-	ND-1900	ND	ND-80	-	-
Facility 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Facility 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Facility 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	32.4-86.4	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.53-31.9	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	11.7-219	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.3-159	-
North Fork of the Brazos River	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oder River	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Greater Baltimore Area	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tokushima Japan Sites	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND-207
Guangdong Province China	-	-	ND-1.2	-	-	-	-	-	-	-	-	-	-	-	-
Various US streams	-	-	214	-	-	-	-	-	-	-	-	-	-	-	-
Atlantic Canada	**ND**	-	-	-	**1.4**	-	-	-	-	-	-	-	-	-	-
	170	-	-	-	**6.6**	-	-	-	-	-	-	-	-	-	-

Sewage Treatment Plant	carbamazepine	metoprolol	testosterone	17β-estradiol	estrone	levonorgestrel	ethinylestradiol	erythromycin	sulfacetamide	sulfapyridine	sulfamethazole	amoxicillin	doxycycline	citalopram	propylparaben
Canada (except Atlantic Canada)	**2**	-	ND	**ND**	**ND**	**ND**	**ND**	**590**	**ND**	**ND**	**ND**	**80**	ND	-	-
	350	-	ND	**9**	**ND**	**ND**	**ND**	**590**	**ND**	**61**	**510**	**80**	ND	-	-
International	<1	**30**	**ND**	-	-	-	0.1	3.2	-	-	ND	ND	**ND**	**4.53**	**ND**
	7100	**2200**	**214**	-	-	-	0.1	1700	-	-	1900	ND	**80**	**219**	**207**

Max and Min Bolded values were used in Table 2 of the report

Note: For min and max values only canadian data were used unless there was no canadian data. In these cases International data were used.

Legend for Rows 1 and 2

Influent Data

Effluent Data

Surface Water Data

Legend for all other rows

Atlantic Canada Data

Canadian (except Atlantic Canada)

International Values

Sewage Treatment Plant	BHT	DEET	bisphenol A	dibutyl-phthalate	triclosan	triclocarban	vanillin	galaxolide	References
Mill Cove	-	-	-	-	-	-	-	-	Brun, G., et al., 2006
Mill Cove	-	-	-	-	-	-	-	-	Brun, G., et al., 2006
Nashwaaksis	-	-	-	-	-	-	-	-	Brun, G., et al., 2006
Nashwaaksis	-	-	-	-	-	-	-	-	Brun, G., et al., 2006
Charlottetown	-	-	-	-	-	-	-	-	Brun, G., et al., 2006
Charlottetown	-	-	-	-	-	-	-	-	Brun, G., et al., 2006
Grand Falls- Windsor	-	-	-	-	-	-	-	-	Brun, G., et al., 2006
Grand Falls- Windsor	-	-	-	-	-	-	-	-	Brun, G., et al., 2006
Sussex	-	-	-	-	-	-	-	-	Brun, G., et al., 2006
Sussex	-	-	-	-	-	-	-	-	Brun, G., et al., 2006
Springhill	-	-	-	-	-	-	-	-	Brun, G., et al., 2006
Springhill	-	-	-	-	-	-	-	-	Brun, G., et al., 2006
Summerside (St. Eleanors)	-	-	-	-	-	-	-	-	Brun, G., et al., 2006

Sewage Treatment Plant	BHT	DEET	bisphenol A	dibutyl-phthalate	triclosan	triclocarban	vanillin	galaxolide	References
Summerside (St. Eleanors)	-	-	-	-	-	-	-	-	Brun, G., et al., 2006
Gander (Beaverwood)	-	-	-	-	-	-	-	-	Brun, G., et al., 2006
Gander (Beaverwood)	-	-	-	-	-	-	-	-	Brun, G., et al., 2006
Halifax Harbour	-	-	-	-	-	-	-	-	Saravanabhavan, G., et al., 2009
Saint John's Harbour	-	-	-	-	-	-	-	-	Saravanabhavan, G., et al., 2009
Halifax watershed	-	-	-	-	-	-	-	-	Comeau, F., et al., 2008
Halifax watershed	-	-	-	-	-	-	-	-	Comeau, F., et al., 2008
Halifax watershed	-	-	-	-	-	-	-	-	Comeau, F., et al., 2008
Pictou Watershed	-	-	-	-	-	-	-	-	Comeau, F., et al., 2008
Pictou Watershed	-	-	-	-	-	-	-	-	Comeau, F., et al., 2008
Cocagne Watershed	-	-	-	-	-	-	-	-	Comeau, F., et al., 2008
Peterborough	-	-	-	-	-	-	-	-	Metcalfe, C. et al., 2003a
Burlington (Skyway)	-	-	-	-	-	-	-	-	Metcalfe, C. et al., 2003a
Little River	-	-	-	-	-	-	-	-	Metcalfe, C. et al., 2003a
West Windsor	-	-	-	-	-	-	-	-	Metcalfe, C. et al., 2003a

Sewage Treatment Plant	BHT	DEET	bisphenol A	dibutyl-phthalate	triclosan	triclocarban	vanillin	galaxolide	References
12 wastewater plants	-	-	-	-	-	-	-	-	Lishman L., et al., 2006
11 wastewater plants	-	-	-	-	-	-	-	-	Lee, H-B., et al., 2009
A	-	-	-	-	-	-	-	-	Servos, M., et al., 2005, Metcalfe, C., et al., 2003b
B	-	-	-	-	-	-	-	-	Servos, M., et al., 2005, Metcalfe, C., et al., 2003b
C	-	-	-	-	-	-	-	-	Servos, M., et al., 2005, Metcalfe, C., et al., 2003b
D	-	-	-	-	-	-	-	-	Servos, M., et al., 2005, Metcalfe, C., et al., 2003b
E	-	-	-	-	-	-	-	-	Servos, M., et al., 2005, Metcalfe, C., et al., 2003b
F	-	-	-	-	-	-	-	-	Servos, M., et al., 2005, Metcalfe, C., et al., 2003b
G	-	-	-	-	-	-	-	-	Servos, M., et al., 2005, Metcalfe, C., et al., 2003b

Sewage Treatment Plant	BHT	DEET	bisphenol A	dibutyl-phthalate	triclosan	triclocarban	vanillin	galaxolide	References
H	-	-	-	-	-	-	-	-	Servos, M., et al., 2005, Metcalfe, C., et al., 2003b
I	-	-	-	-	-	-	-	-	Servos, M., et al., 2005, Metcalfe, C., et al., 2003b
J	-	-	-	-	-	-	-	-	Servos, M., et al., 2005, Metcalfe, C., et al., 2003b
K	-	-	-	-	-	-	-	-	Servos, M., et al., 2005, Metcalfe, C., et al., 2003b
L	-	-	-	-	-	-	-	-	Servos, M., et al., 2005, Metcalfe, C., et al., 2003b
M	-	-	-	-	-	-	-	-	Servos, M., et al., 2005, Metcalfe, C., et al., 2003b
N	-	-	-	-	-	-	-	-	Servos, M., et al., 2005, Metcalfe, C., et al., 2003b
O	-	-	-	-	-	-	-	-	Servos, M., et al., 2005, Metcalfe, C., et al., 2003b

Sewage Treatment Plant	BHT	DEET	bisphenol A	dibutyl-phthalate	triclosan	triclocarban	vanillin	galaxolide	References
P	-	-	-	-	-	-	-	-	Servos, M., et al., 2005, Metcalfe, C., et al., 2003b
Q	-	-	-	-	-	-	-	-	Servos, M., et al., 2005, Metcalfe, C., et al., 2003b
R	-	-	-	-	-	-	-	-	Servos, M., et al., 2005, Metcalfe, C., et al., 2003b
Mean of A-R	-	-	-	-	-	-	-	-	Servos, M., et al., 2005, Metcalfe, C., et al., 2003b
City of Regina	-	490	-	-	110	-	-	-	Waiser, M., et al., 2011
STP1	-	-	-	-	-	-	-	-	Miao, X., et al., 2002
STP2	-	-	-	-	-	-	-	-	Miao, X., et al., 2002
STP3	-	-	-	-	-	-	-	-	Miao, X., et al., 2002
Various	-	-	-	-	-	-	-	-	Miao, X., et al., 2004
Capital Region WWTP	-	-	ND	5.8	-	-	-	-	Sosiak, A., 2005
Gold Bar WWTP	-	-	ND	5.8	-	-	-	-	Sosiak, A., 2005
Fish Creek WWTP	-	-	1.8	169.4	-	-	-	-	Sosiak, A., 2005
Bonnybrook WWTP	-	-	1.8	169.4	-	-	-	-	Sosiak, A., 2005
Lethbridge WWTP	-	-	1527.35	41	-	-	-	-	Sosiak, A., 2005
Medicine Hat WWTP	-	-	ND	87.8	-	-	-	-	Sosiak, A., 2005

Sewage Treatment Plant	BHT	DEET	bisphenol A	dibutyl-phthalate	triclosan	triclocarban	vanillin	galaxolide	References
Red Deer WWTP	-	-	42.55	ND	-	-	-	-	Sosiak, A., 2005
Montreal Urban Community Sewage Treatment Plant	-	-	-	-	-	-	-	-	Viglino, L., et al 2008
Various	-	-	-	-	-	-	-	-	Monteiro, S., and Boxall, A., 2010
Facility 1	-	-	-	-	-	-	-	-	Trenholm et al., 2008
Facility 2	-	-	-	-	-	-	-	-	Trenholm et al., 2009
Facility 3	-	-	-	-	-	-	-	-	Trenholm et al., 2010
-	-	-	-	-	-	-	-	-	Schultz, M., et al., 2010
-	-	-	-	-	-	-	-	-	Schultz, M., et al., 2010
-	-	-	-	-	-	-	-	-	Schultz, M., et al., 2010
-	-	-	-	-	-	-	-	-	Schultz, M., et al., 2010
North Fork of the Brazos River	-	-	-	-	-	-	-	77-794	Chase, D., et al. 2012
Oder River	178	-	-	-	-	-	-	-	Fries, E.. and Püttmann, W. 2004
Greater Baltimore Area	-	-	-	-	-	33-5600	-	-	Halden,R. and Paull, D. 2004
Tokushima Japan Sites	-	-	-	-	-	-	-	-	Yamamoto, H., et al., 2011
Guangdong Province China	-	-	-	-	-	-	-	-	Liu, S., et al., 2011
Various US streams	-	-	-	-	-	-	-	-	Koplin, D., et al., 2004
Atlantic Canada	-	-	-	-	-	-	-	-	
	-	-	-	-	-	-	-	-	

Sewage Treatment Plant	BHT	DEET	bisphenol A	dibutyl-phthalate	triclosan	triclocarban	vanillin	galaxolide	References
Canada (except Atlantic Canada)	-	**490**	**ND**	**ND**	**110**	-	-	-	
	-	**490**	**1527.35**	**169.4**	**110**	-	-	-	
International	**178**	-	-	-	-	**33**	**-**	**77**	
	178	-	-	-	-	**5600**	**-**	**794**	

Max and Min Bolded values were used in Table 2 of the report

Note: For min and max values only canadian data were used unless there was no canadian data. In these cases International data were used.

Legend for Rows 1 and 2

Influent Data

Effluent Data

Surface Water Data

Legend for all other rows

Atlantic Canada Data

Canadian (except Atlantic Canada)

International Values

Appendix C: Types of Treatments, Numbers of Facilities and Flows for Sewage Treatment Plants in New Brunswick and Nova Scotia (Kidd and Mercer, 2012, Chemicals of emerging concern in the Bay of Fundy watershed: What are the risks? Bay of Fundy Ecosystem Partnership Technical Report No. 7, Bay of Fundy Ecosystem Partnership, Wolfville, NS, 22 p.)

Name of Municipality	LATITUDE	LONGITUDE	Treatment Type	Lagoon	Primary	Secondary	Tertiary	Type	Design Flow (m3/day)	Primary Total Flow/day	Secondary Total Flow/day	Tertiary Total Flow/day
ALMA	47.72222	67.01583	AERATED LAGOON	1	0	0	0	Lagoon	500	0	0	0
APOHAQUI	45.69278	65.59148	ROTATING BIOLOGICAL CONTACTOR (RBC)	0	0	1	0	Secondary	51	0	51	0
BAKER BROOK	47.30087	68.50323	LAGOON	1	0	0	0	Lagoon	273	0	0	0
BALMORAL	47.99049	66.38727	AERATED LAGOON	1	0	0	0	Lagoon	909	0	0	0
BATH	46.49957	67.57915	AERATED LAGOON	1	0	0	0	Lagoon	380	0	0	0
BLACKS HARBOUR	45.06928	66.77431	AERATED LAGOON	1	0	0	0	Lagoon	604	0	0	0
BRISTOL	46.49911	67.57861	AERATED LAGOON	1	0	0	0	Lagoon	362	0	0	0
CAP PELE	46.22005	64.27083	AERATED LAGOON	1	0	0	0	Lagoon	727	0	0	0
CARAQUET (Extended Aeration)	47.76788	65.06917	EXTENDED AERATION	0	0	1	0	Secondary	909	0	909	0
CARAQUET (Lagoon)	47.78129	64.92235	LAGOON	1	0	0	0	Lagoon	2273	0	0	0
CENTREVILLE	46.43099	67.72408	AERATED LAGOON	1	0	0	0	Lagoon	362	0	0	0
CHARLO	48.00387	66.35635	LAGOON	1	0	0	0	Lagoon	545	0	0	0
CHIPMAN	46.05094	65.88691	OXIDATION DITCH	0	0	1	0	Secondary	1137	0	1137	0
CLAIR	47.25937	68.59265	AERATED LAGOON	1	0	0	0	Lagoon	710	0	0	0
DALHOUSIE	47.73284	65.70663	AERATED LAGOON	1	0	0	0	Lagoon	7046	0	0	0
DOAKTOWN	46.55552	66.12307	AERATED LAGOON	1	0	0	0	Lagoon	~591	0	0	0
DORCHESTER	45.75604	64.52678	LAGOON	1	0	0	0	Lagoon	727	0	0	0
DRUMMOND	47.03711	67.74501	AERATED LAGOON	1	0	0	0	Lagoon		0	0	0
EDMUNDSTON - BOUCHER OFFICE	47.39421	68.35008	SEQUENTIAL BATCH REACTOR	0	0	1	0	Secondary	864	0	864	0
EDMUNDSTON - COTE LANE	47.39402	68.35086	AERATED LAGOON	1	0	0	0	Lagoon	9100	0	0	0
EDMUNDSTON - ST. BASIL	47.36299	68.28215	AERATED LAGOON	1	0	0	0	Lagoon	1000	0	0	0
EDMUNDSTON - ST. JACQUES #1	47.40976	68.36567	LAGOON	1	0	0	0	Lagoon	1182	0	0	0
EDMUNDSTON - ST. JACQUES #2	47.43057	68.38186	LAGOON	1	0	0	0	Lagoon	850	0	0	0
EDMUNDSTON - VERRET	47.34855	68.37645	LAGOON	1	0	0	0	Lagoon	518	0	0	0
FLORENCEVILLE	46.41668	67.60528	AERATED LAGOON	1	0	0	0	Lagoon	450	0	0	0
F'TON AREA POLLUTION CONTROL	45.95863	66.61694	CONVENTIONAL ACTIVATED SLUDGE	0	0	0	0		22730	0	0	0
FREDERICTON - GARDEN CREEK	45.96265	66.70699	AERATED LAGOON	1	0	0	0	Lagoon	2900	0	0	0
FREDERICTON - LINCOLN	45.90256	66.57944	AERATED LAGOON	1	0	0	0	Lagoon	2273	0	0	0
FREDERICTON JUNCTION	45.65861	66.59771	AERATED LAGOON	1	0	0	0	Lagoon	546	0	0	0
GAGETOWN	45.76997	66.14036	AERATED LAGOON	1	0	0	0	Lagoon	200	0	0	0
GRAND BAY-WESTFIELD (MacLean Sub)	45.36042	66.24492	TRICKLING FILTER	0	0	1	0	Secondary		0	0	0

Name of Municipality	LATITUDE	LONGITUDE	Treatment Type	Lagoon	Primary	Secondary	Tertiary	Type	Design Flow (m3/day)	Primary Total Flow/day	Secondary Total Flow/day	Tertiary Total Flow/day
GRAND BAY-WESTFIELD (Main)	45.30301	66.18964	AERATED LAGOON	1	0	0	0	Lagoon	1200	0	0	0
GRAND FALLS	47.03442	67.73978	AERATED LAGOON	1	0	0	0	Lagoon		0	0	0
GREATER MONCTON SEWAGE COMM	46.07983	64.76665	CHEMICALLY ASSISTED PRIMARY	0	1	0	0	Primary	115200	115200	0	0
GREATER SHEDIAC SC - SCOUDOUC	46.14533	64.56001	AERATED LAGOON	1	0	0	0	Lagoon	3636	0	0	0
GREATER SHEDIAC SC - SHEDIAC	46.22999	64.48281	AERATED LAGOON	1	0	0	0	Lagoon		0	0	0
HAMPTON	45.52289	65.83253	LAGOON	1	0	0	0	Lagoon	2000	0	0	0
HARTLAND	46.28853	67.51522	AERATED LAGOON	1	0	0	0	Lagoon	573	0	0	0
HARVEY	45.72592	67.00528	AERATED LAGOON	1	0	0	0	Lagoon	341	0	0	0
HILLSBOROUGH	45.92813	64.64131	LAGOON	1	0	0	0	Lagoon	727	0	0	0
MCADAM	45.59801	67.33334	OXIDATION DITCH	0	0	1	0	Secondary	990	0	990	0
MEMRAMCOOK - EST	45.98889	64.55491	FACULTATIVE LAGOON	1	0	0	0	Lagoon	2181	0	0	0
MEMRAMCOOK - LA MONTAIN	45.99353	64.56765	AERATED LAGOON	1	0	0	0	Lagoon	765	0	0	0
MEMRAMCOOK - ST. JOSEPH	45.98438	64.56015	LAGOON	1	0	0	0	Lagoon	682	0	0	0
MUSQUASH	45.19667	66.33058	LAGOON	1	0	0	0	Lagoon		0	0	0
NACKAWIC - EA	45.99708	67.23492	EXTENDED AERATION	0	0	1	0	Secondary	1137	0	1137	0
NACKAWIC TF	46.00422	67.23369	TRICKLING FILTER	0	0	1	0	Secondary		0	0	0
NEW MARYLAND - APPLEWOOD ACRES	45.90819	66.69179	AERATED LAGOON	1	0	0	0	Lagoon		0	0	0
NEW MARYLAND - MAIN	45.88912	66.65221	AERATED LAGOON WITH SAND FILTERS	1	0	0	0	Lagoon	1600	0	0	0
NORTON	45.63491	65.70539	LAGOON	1	0	0	0	Lagoon	546	0	0	0
OROMOCTO WEST	45.83239	66.52085	OXIDATION DITCH	0	0	1	0	Secondary	45	0	45	0
OROMOCTO RBC	45.45754	66.46601	ROTATING BIOLOGICAL CONTACTOR	0	0	1	0	Secondary	85	0	85	0
OROMOCTO TF	45.85629	66.45706	TRICKLING FILTER	0	0	1	0	Secondary	955	0	955	0
PAQUETVILLE	47.65728	65.09839	LAGOON	1	0	0	0	Lagoon	404	0	0	0
PERTH-ANDOVER	46.04981	64.07839	LAGOON	1	0	0	0	Lagoon	1420	0	0	0
PETITCODIAC	45.94182	65.17361	LAGOON	1	0	0	0	Lagoon	455	0	0	0
PLASTER ROCK #1 (NORTH)	46.91621	67.39064	AERATED LAGOON	1	0	0	0	Lagoon	91	0	0	0
PLASTER ROCK #2 (SOUTH EAST)	46.89436	67.38217	LAGOON	1	0	0	0	Lagoon		0	0	0
POINTE VERTE	47.86167	65.76531	AERATED LAGOON	1	0	0	0	Lagoon	727	0	0	0
PORT ELGIN	46.04918	64.08102	LAGOON	1	0	0	0	Lagoon	600	0	0	0
QUISPAMSIS	45.41289	65.98176	AERATED LAGOON	1	0	0	0	Lagoon	5400	0	0	0
RIVIERE-VERTE	47.30923	68.13938	LAGOON	1	0	0	0	Lagoon	295	0	0	0
ROTHESAY - FAIRVALE	45.39747	65.99794	AERATED LAGOON	1	0	0	0	Lagoon	3600	0	0	0
ROTHESAY - KENNEBECASIS PARK	45.39971	65.99592	LAGOON	1	0	0	0	Lagoon	546	0	0	0
ROTHESAY - RENFORTH	45.39848	65.99755	LAGOON	1	0	0	0	Lagoon	1818	0	0	0
SACKVILLE #1	45.88931	64.35097		0	1	0	0	Primary	818	818	0	0
SACKVILLE #2	45.91902	64.36028	TRICKLING FILTER	0	0	1	0	Secondary	818	0	818	0
SAINT JOHN - GREENWOOD	45.32366	65.95429	TRICKLING FILTER	0	0	1	0	Secondary	11	0	11	0

Name of Municipality	LATITUDE	LONGITUDE	Treatment Type	Lagoon	Primary	Secondary	Tertiary	Type	Design Flow (m3/day)	Primary Total Flow/day	Secondary Total Flow/day	Tertiary Total Flow/day
SAINT JOHN - LANCASTER	45.23928	66.11309	AERATED LAGOON	1	0	0	0	Lagoon	9464	0	0	0
SAINT JOHN - MILLIDGEVILLE	45.28742	66.11658	ACTIVATED BIOFILTER	0	0	0	1	Tertiary	10000	0	0	10000
SAINT JOHN - MORNA HEIGHTS	45.29184	66.16447	TRICKLING FILTER	0	0	1	0	Secondary	50	0	50	0
SAINTE ANNE-DE-MADAWASKA	47.24913	68.03612	LAGOON	1	0	0	0	Lagoon	680	0	0	0
SALISBURY	46.03198	65.01429	AERATED LAGOON	1	0	0	0	Lagoon	1750	0	0	0
SHIPPAGAN	47.62185	65.65782	LAGOON	1	0	0	0	Lagoon	3773	0	0	0
ST. ANDRÉ	47.09542	67.73778	LAGOON	1	0	0	0	Lagoon	273	0	0	0
ST. ANDREWS	45.07233	67.03883	AERATED LAGOON	1	0	0	0	Lagoon	1400	0	0	0
ST. ANTOINE #1	46.37389	64.76321	LAGOON	1	0	0	0	Lagoon	796	0	0	0
ST. ANTOINE #2	46.36832	64.74221	LAGOON	1	0	0	0	Lagoon	273	0	0	0
ST. FRANCOIS	47.24067	68.70939	LAGOON	1	0	0	0	Lagoon	344	0	0	0
ST. GEORGE	45.12021	66.83078	AERATED LAGOON	1	0	0	0	Lagoon	1341	0	0	0
ST. HILAIRE	47.29762	68.38265	LAGOON	1	0	0	0	Lagoon	182	0	0	0
ST. LEONARD	47.17581	67.93549	LAGOON	1	0	0	0	Lagoon	1050	0	0	0
ST. LOUIS-DE-KENT	46.73662	64.97983	AERATED LAGOON	1	0	0	0	Lagoon	1063	0	0	0
ST. STEPHEN	45.19111	67.26251	AERATED LAGOON	1	0	0	0	Lagoon	2800	0	0	0
STANLEY	46.28072	66.73543	LAGOON	1	0	0	0	Lagoon	250	0	0	0
SUSSEX	45.72311	65.54125	AERATED LAGOON	1	0	0	0	Lagoon	5680	0	0	0
TRACADIE-SHEILA #1(rue de la Cote)	47.52567	64.90043	AERATED LAGOON	1	0	0	0	Lagoon	2273	0	0	0
TRACADIE-SHEILA #2 (rue Pointe-A-Bouleau)	47.49281	64.90797	AERATED LAGOON	1	0	0	0	Lagoon	728	0	0	0
WOODSTOCK	46.13104	67.58324	AERATED LAGOON	1	0	0	0	Lagoon	3600	0	0	0
				71	2	14	1			116018	7052	10000

Province	Totals	Lagoon	Primary	Secondary	Tertiary
NS	67	29	1	30	7
NSFlow/day (m3/day)	113801	40006	26367	38312	9116
NB	88	71	2	14	1
NBFlow/day (m3/day)	257564	124494	116018	7052	10000

Province	Totals	Lagoon	Primary	Secondary	Tertiary
NS	67	29	1	30	7
NSFlow/day (m3/day)	100%	35%	23%	34%	8%
NB	88	71	2	14	1
NBFlow/day (m3/day)	100%	48%	45%	3%	4%

Appendix D: Sewage Treatment Plant Efficiencies Master Table (Kidd and Mercer, 2012, Chemicals of emerging concern in the Bay of Fundy watershed: What are the risks? Bay of Fundy Ecosystem Partnership Technical Report No. 7, Bay of Fundy Ecosystem Partnership, Wolfville, NS, 22 p.)

Treatment Type	Category of Treatment	Caffeine	Cotinine	Fluoxetine	Norfluoxetine	Trimethoprim	Atrovastatin	Benzafibrate	Clofibric acid	Diclofenac	Fenoprofen	Gemfibrozil
Lagoon	Lagoon	-	-	-	-	-	-	-	-	-	-	-
Lagoon (aerated/facultative lagoon, seasonal discharge, alum , polymer phosphorous removal)	Lagoon	-	-	-	-	-	-	-	-	-	-	-
Lagoon (aerated/facultative lagoon, seasonal discharge, alum phosphorous removal when needed)	Lagoon	-	-	-	-	-	-	-	-	-	-	-
Lagoon (aerated/facultative lagoon, seasonal discharge, alum phosphorous removal)	Lagoon	-	-	-	-	-	-	-	-	-	-	-
Lagoon (aerated/facultative lagoon, seasonal discharge, alum phosphorous removal, slow sand filtration)	Lagoon	-	-	-	-	-	-	-	-	-	-	-
Various types (mean)	Misc	-	-	-	-	-	66	-	-	-	-	-
Primary (aeration, alum phosphorous removal)	Primary	-	-	-	-	-	-	-	-	-	-	-

Treatment Type	Category of Treatment	Caffeine	Cotinine	Fluoxetine	Norfluoxetine	Trimethoprim	Atrovastatin	Benzafibrate	Clofibric acid	Diclofenac	Fenoprofen	Gemfibrozil
Sand filtration, aluminum treatment-coagulation	Primary	0	-	-	-	60	-	-	-	-	-	-
Activated sludge	Secondary	85-99.7	-	-	-	0-69	-	50-97	26-52	18-75	-	46-75
Conventional Activated Sludge	Secondary	-	-	-	-	-	-	-	-	neg	-	66
Membrane bioractor	Secondary	-	-	-	-	-	-	-	54	58	-	-
Secondary (trickling filter solids contact, chlorination seasonally)	Secondary	-	-	-	-	-	-	-	-	-	-	-
Secondary (aerated ferric chloride polymer, acitivated sludge polymer, partial nitrification, ferric chloride phosphorous removal, chlorination)	Secondary	-	-	-	-	-	-	-	-	-	-	-
Secondary (aerated, activated sludge, ferrous chloride phosphorous removal, chlorination)	Secondary	-	-	-	-	-	-	-	-	-	-	-
Secondary (aerated, activated sludge, partial nitrification, alum phosphorous removal, UV (med) seasonally)	Secondary	-	-	-	-	-	-	-	-	-	-	-

Treatment Type	Category of Treatment	Caffeine	Cotinine	Fluoxetine	Norfluoxetine	Trimethoprim	Atrovastatin	Benzafibrate	Clofibric acid	Diclofenac	Fenoprofen	Gemfibrozil
Secondary (aerated, biological nutrient removal (BNR), nitrification, alum phosphorous removal, UV)	Secondary	-	-	-	-	-	-	-	-	-	-	-
Secondary (aerated, high rate oxygen activated sludge)	Secondary	-	-	-	-	-	-	-	-	-	-	-
Secondary (aerated, high rate oxygen activated sludge)	Secondary	-	-	-	-	-	-	-	-	-	-	-
Secondary (alum grit removal, activaed sludge, partial nitrification, primary phosphorous removal, UV (low) seasonal)	Secondary	-	-	-	-	-	-	-	-	-	-	-
Secondary (grit removal, activated sludge, methanol and antifoam, nitrification, ferric chloride phosphorous removal and chlorination)	Secondary	-	-	-	-	-	-	-	-	-	-	-
Secondary (vortex grit removal, high activated sludge, partial nitrification, alum phosphorous removal, UV (med) seasonally)	Secondary	-	-	-	-	-	-	-	-	-	-	-
Activated carbon (12 mg/L)	Tertiary	-	-	-	-	-	-	-	-	-	-	-
Activated carbon (5 mg/L)	Tertiary	70	-	92	-	83	-	-	-	39	-	37

Treatment Type	Category of Treatment	Caffeine	Cotinine	Fluoxetine	Norfluoxetine	Trimethoprim	Atrovastatin	Benzafibrate	Clofibric acid	Diclofenac	Fenoprofen	Gemfibrozil
Activated sludge/UV biological filter	Tertiary	99.9	-	-	-	-	-	17	15	9	-	16
Aeration of groundwater → filtration (Fe and Mn)	Tertiary	-	-	-	-	-	-	-	-	-	-	-
Chlorination (1.2 mg/L free Cl)	Tertiary	0	-	15	-	100	-	-	-	-	-	-
Conventional activated sludge + filtration	Tertiary	-	-	-	-	-	-	-	-	-	-	-
Fullscale conventional wastewater	Tertiary	-	-	-	-	-	-	-	-	-	-	-
Ozone medium dose (1-5mg/L cont.)	Tertiary	-	>93	-	-	>85->99	-	-	-	-	-	>94
Ozone pre-treatment for sludge anaerobic digestion	Tertiary	-	-	-	-	-	-	-	-	60-80	-	-
Ozone/H_2O_2: high (>7.1/3.5 mg/L)	Tertiary	>68	-	>91	-	>99	-	-	-	>98	-	>99

Treatment Type	Category of Treatment	Caffeine	Cotinine	Fluoxetine	Norfluoxetine	Trimethoprim	Atrovastatin	Benzafibrate	Clofibric acid	Diclofenac	Fenoprofen	Gemfibrozil
Ozone/H_2O_2: low (2.1/1.0 mg/L)	Tertiary	-	-	81	-	95	-	-	-	98	-	74
Ozone/H_2O_2: medium (3.6/2.5 mg/L)	Tertiary	-	-	>91	-	>99	-	-	-	-	-	>99
Ozone/H_2O_2: medium (3.6/2.5 mg/L; cont.)	Tertiary	65	-	-	-	-	-	-	-	>98	-	-
Ozone/UV (15 mg/L)	Tertiary	-	-	-	-	-	-	-	-	-	-	-
Ozone: high dose (>5-7.1 mg/L)	Tertiary	>63	-	>99	-	97	-	-	-	>98	-	>99
Ozone: low dose (0.2-0.3 mg/L; cont.)	Tertiary	91	-	91	-	98	-	-	-	95	-	98
Ozone: medium dose (1-5 mg/L)	Tertiary	34->53	-	-	-	-	-	-	50	>96->99	-	-
Ozone: very high dose (10-15 mg/L)	Tertiary	>87	-	-	-	-	-	-	>59	-	-	-

Treatment Type	Category of Treatment	Caffeine	Cotinine	Fluoxetine	Norfluoxetine	Trimethoprim	Atrovastatin	Benzafibrate	Clofibric acid	Diclofenac	Fenoprofen	Gemfibrozil
Tertiary (aerated, activated sludge, nitrification, alum phosphorous removal, sand filtration and UV (low))	Tertiary	-	-	-	-	-	-	-	-	-	-	-
Tertiary, grit removal, extended aeration activated sludge, nitrification, ferrous chloride phosphorous removal, granular anthracitefiltration and UV (high))	Tertiary	-	-	-	-	-	-	-	-	-	-	-
Tertiary, grit removal, no primary treatment, extended aeration activated sludge, nitrification, alumn phosphorous removal, sand filtration and UV (high))	Tertiary	-	-	-	-	-	-	-	-	-	-	-

Treatment Type	Ibuprofen	Indomethacin	Ketoprofen	Naproxen	Salicylic acid	Acetaminophen
Lagoon	-	-	-	-	-	-
Lagoon (aerated/facultative lagoon, seasonal discharge, alum , polymer phosphorous removal)	-	-	-	-	-	-
Lagoon (aerated/facultative lagoon, seasonal discharge, alum phosphorous removal when needed)	-	-	-	-	-	-
Lagoon (aerated/facultative lagoon, seasonal discharge, alum phosphorous removal)	-	-	-	-	-	-
Lagoon (aerated/facultative lagoon, seasonal discharge, alum phosphorous removal, slow sand filtration)	-	-	-	-	-	-
Various types (mean)	-	-	-	-	-	-
Primary (aeration alum phosphorous removal)	-	-	-	-	-	-

Treatment Type	Ibuprofen	Indomethacin	Ketoprofen	Naproxen	Salicylic acid	Acetaminophen
Sand filtration Aluminum treatment-coagulation	-	-	-	-	-	-
Activated sludge	75-97	75-83	65-77	66-3	>99	92-99
Conventional Activated Sludge	95	23	44	93	-	-
Membrane bioractor	99	-	-	-	-	-
Secondary (trickling filter solids contact, chlorination seasonally)	-	-	-	-	-	-
Secondary (aerated ferric chloride polymer, acitivated sludge polymer, partial nitrification, ferric chloride phosphorous removal, chlorination)	-	-	-	-	-	-
Secondary (aerated, activated sludge, ferrous chloride phosphorous removal, chlorination)	-	-	-	-	-	-
Secondary (aerated, activated sludge, partial nitrification, alum phosphorous removal, UV (med) seasonally)	-	-	-	-	-	-

Treatment Type	Ibuprofen	Indomethacin	Ketoprofen	Naproxen	Salicylic acid	Acetaminophen
Secondary (aerated, biological nutrient removal (BNR), nitrification, alum phosphorous removal, UV)	-	-	-	-	-	-
Secondary (aerated, high rate oxygen activated sludge)	-	-	-	-	-	-
Secondary (aerated, high rate oxygen activated sludge)	-	-	-	-	-	-
Secondary (Alum grit removal, activaed sludge, partial nitrification, primary phosphorous removal, UV (low) seasonal)	-	-	-	-	-	-
Secondary (grit removal, activated sludge, methanol and antifoam, nitrification, ferric chloride phosphorous removal and chlorination	-	-	-	-	-	-
Secondary (vortex grit removal, high activated sludge, partial nitrification, alum phosphorous removal, UV (med)seasonally)	-	-	-	-	-	-
Activated carbon (12 mg/L)	99	-	-	-	-	-
Activated carbon (5 mg/L)	16-90	-	-	52	-	72

Treatment Type	Ibuprofen	Indomethacin	Ketoprofen	Naproxen	Salicylic acid	Acetaminophen
Activated sludge/UV Biological Filter	22	71	48	15	-	-
Aeration of groundwater → filtration (Fe and Mn)	-	-	-	-	-	-
Chlorination (1.2 mg/L free Cl)	-	-	-	-	-	100
Conventional Activated Sludge + Filtration	-	-	-	-	-	-
Fullscale Conventional Wastewater	-	-	-	-	-	-
Ozone medium dose (1-5mg/L cont.)	-	90-99	-	>50-99	-	-
Ozone pre-treatment for sludge anaerobic digestion	20-50	-	-	-	-	-
Ozone/H_2O_2: high (>7.1/3.5 mg/L)	>93	-	-	>98	-	-

Treatment Type	Ibuprofen	Indomethacin	Ketoprofen	Naproxen	Salicylic acid	Acetaminophen
Ozone/H_2O_2: low (2.1/1.0 mg/L)	<1	-	-	96	-	-
Ozone/H_2O_2: medium (3.6/2.5 mg/L)	-	-	-	>98	-	-
Ozone/H_2O_2: medium (3.6/2.5 mg/L; cont.)	<1	-	-	-	-	-
Ozone/UV (15 mg/L)	-	-	-	-	-	-
Ozone: high dose (>5-7.1 mg/L)	>24	>50	-	>66	-	-
Ozone: low dose (0.2-0.3 mg/L; cont.)	80	-	-	91	-	94
Ozone: medium dose (1-5 mg/L)	48->82	-	-	-	-	-
Ozone: very high dose (10-15 mg/L)	>62	-	-	-	-	-

Treatment Type	Ibuprofen	Indomethacin	Ketoprofen	Naproxen	Salicylic acid	Acetaminophen
Tertiary (aerated, activated sludge, nitrification, alum phosphorous removal, sand filtration and UV (low))	-	-	-	-	-	-
Tertiary, grit removal, extended aeration activated sludge, nitrification, ferrous chloride phosphorous removal, granular anthracitefiltration and UV (high))	-	-	-	-	-	-
Tertiary, grit removal, no primary treatment, extended aeration activated sludge, nitrification, alumn phosphorous removal, sand filtration and UV (high))	-	-	-	-	-	-

Treatment Type	Carbamazepine	Cyclophosphamide	Pentoxifyline	Phenazone	Metoprolol	Testosterone	17β-estradiol	Estrone	Levonorgestrel	Ethinylestradiol	Erythromycin	Sulfacetamide	Sulfapyridine	Sulfamethozazole
Lagoon	-	-	-	-	-	-	86	-	-	-	-	-	-	-
Lagoon (aerated/facultative lagoon, seasonal discharge, alum , polymer phosphorous removal)	-	-	-	-	-	-	98.1	96.1	-	-	-	-	-	-
Lagoon (aerated/facultative lagoon, seasonal discharge, alum phosphorous removal when needed)	-	-	-	-	-	-	95.9	95.3	-	-	-	-	-	-
Lagoon (aerated/facultative lagoon, seasonal discharge, alum phosphorous removal)	-	-	-	-	-	-	98.4	93.3	-	-	-	-	-	-
Lagoon (aerated/facultative lagoon, seasonal discharge, alum phosphorous removal, slow sand filtration)	-	-	-	-	-	-	80.5	46.4	-	-	-	-	-	-
Various types (mean)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Primary (aeration alum phosphorous removal)	-	-	-	-	-	-	-1.0	-28.6	-	-	-	-	-	-

Treatment Type	Carbamazepine	Cyclophosphamide	Pentoxifyline	Phenazone	Metoprolol	Testosterone	17β-estradiol	Estrone	Levonorgestrel	Ethinylestradiol	Erythromycin	Sulfacetamide	Sulfapyridine	Sulfamethozazole
Sand filtration Aluminum treatment-coagulation	-	-	-	-	-	-	-	-	-	-	33	-	-	-
Activated sludge	0-30	-	-	33	-	-	0.->98	-	-	-	25	-	-	0-55
Conventional Activated Sludge	-	-	-	-	-	-	80	-	-	-	-	-	-	-
Membrane bioractor	13	-	-	-	-	-	-	-	-	-	-	-	-	-
Secondary (trickling filter solids contact, chlorination seasonally)	-	-	-	-	-	-	-18.5	-62.4	-	-	-	-	-	-
Secondary (aerated ferric chloride polymer, acitivated sludge polymer, partial nitrification, ferric chloride phosphorous removal, chlorination)	-	-	-	-	-	-	96.8	72.7	-	-	-	-	-	-
Secondary (aerated, activated sludge, ferrous chloride phosphorous removal, chlorination)	-	-	-	-	-	-	39.5	-54.8	-	-	-	-	-	-
Secondary (aerated, activated sludge, partial nitrification, alum phosphorous removal, UV (med) seasonally)	-	-	-	-	-	-	75.9	-45.8	-	-	-	-	-	-

Treatment Type	Carbamazepine	Cyclophosphamide	Pentoxifyline	Phenazone	Metoprolol	Testosterone	17β-estradiol	Estrone	Levonorgestrel	Ethinylestradiol	Erythromycin	Sulfacetamide	Sulfapyridine	Sulfamethozazole
Secondary (aerated, biological nutrient removal (BNR), nitrification, alum phosphorous removal, UV)	-	-	-	-	-	-	94.7	82.1	-	-	-	-	-	-
Secondary (aerated, high rate oxygen activated sludge)	-	-	-	-	-	-	96.1	80.6	-	-	-	-	-	-
Secondary (aerated, high rate oxygen activated sludge)	-	-	-	-	-	-	97.1	95.1	-	-	-	-	-	-
Secondary (Alum grit removal, activaed sludge, partial nitrification, primary phosphorous removal, UV (low) seasonal)	-	-	-	-	-	-	98.3	85.4	-	-	-	-	-	-
Secondary (grit removal, activated sludge, methanol and antifoam, nitrification, ferric chloride phosphorous removal and chlorination	-	-	-	-	-	-	98.2	95.1	-	-	-	-	-	-
Secondary (vortex grit removal, high activated sludge, partial nitrification, alum phosphorous removal, UV (med)seasonally)	-	-	-	-	-	-	92.7	76.7	-	-	-	-	-	-
Activated carbon (12 mg/L)	99	-	-	-	-	-	-	-	-	-	-	-	-	99
Activated carbon (5 mg/L)	74	-	-	-	-	-	-	-	-	-	54	-	-	36-90

Treatment Type	Carbamazepine	Cyclophosphamide	Pentoxifyline	Phenazone	Metoprolol	Testosterone	17β-estradiol	Estrone	Levonorgestrel	Ethinylestradiol	Erythromycin	Sulfacetamide	Sulfapyridine	Sulfamethozazole
Activated sludge/UV Biological Filter	29	-	-	-	-	-	-	-	-	-	-	-	-	-
Aeration of groundwater → filtration (Fe and Mn)	-	-	-	90	-	-	-	-	-	-	-	-	-	-
Chlorination (1.2 mg/L free Cl)	0	-	-	-	-	-	-	-	-	-	0	-	-	100
Conventional Activated Sludge + Filtration	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fullscale Conventional Wastewater	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ozone medium dose (1-5mg/L cont.)	-	-	-	-	-	-	-	-	-	-	90-99	-	90-99	90->99
Ozone pre-treatment for sludge anaerobic digestion	60	-	-	-	-	-	-	-	-	-	-	-	-	>80
Ozone/H_2O_2: high (>7.1/3.5 mg/L)	>99	-	-	-	-	-	-	-	-	-	>99	-	-	>99

Treatment Type	Carbamazepine	Cyclophosphamide	Pentoxifyline	Phenazone	Metoprolol	Testosterone	17β-estradiol	Estrone	Levonorgestrel	Ethinylestradiol	Erythromycin	Sulfacetamide	Sulfapyridine	Sulfamethozazole
Ozone/H_2O_2: low (2.1/1.0 mg/L)	98	-	-	-	-	-	-	-	-	-	79	-	-	83
Ozone/H_2O_2: medium (3.6/2.5 mg/L)	-	-	-	-	-	-	-	-	-	-	-	-	-	97
Ozone/H_2O_2: medium (3.6/2.5 mg/L; cont.)	>99	-	-	-	-	-	-	-	-	-	>99	-	-	-
Ozone/UV (15 mg/L)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ozone: high dose (>5-7.1 mg/L)	>99	-	-	-	-	-	-	-	-	-	>99	-	-	>99
Ozone: low dose (0.2-0.3 mg/L; cont.)	99	-	-	-	-	-	-	-	-	-	97	-	-	91
Ozone: medium dose (1-5 mg/L)	>98-100	-	-	-	-	-	-	-	-	-	-	-	-	-
Ozone: very high dose (10-15 mg/L)	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Treatment Type	Carbamazepine	Cyclophosphamide	Pentoxifyline	Phenazone	Metoprolol	Testosterone	17β-estradiol	Estrone	Levonorgestrel	Ethinylestradiol	Erythromycin	Sulfacetamide	Sulfapyridine	Sulfamethozazole
Tertiary (aerated, activated sludge, nitrification, alum phosphorous removal, sand filtration and UV (low))	-	-	-	-	-	-	82.9	66.7	-	-	-	-	-	-
Tertiary, grit removal, extended aeration activated sludge, nitrification, ferrous chloride phosphorous removal, granular anthracitefiltration and UV (high))	-	-	-	-	-	-	98.8	97.8	-	-	-	-	-	-
Tertiary, grit removal, no primary treatment, extended aeration activated sludge, nitrification, alumn phosphorous removal, sand filtration and UV (high))	-	-	-	-	-	-	93.3	96.5	-	-	-	-	-	-

Treatment Type	Amoxicillin	Trimethyoprim	Doxycycline	Citalopram	3-benzylidene camphor	4-methylbenzylidene camphor	Cyclic methyl siloxanes	Propylparaben
Lagoon	-	-	-	-	-	-	-	-
Lagoon (aerated/facultative lagoon, seasonal discharge, alum , polymer phosphorous removal)	-	-	-	-	-	-	-	-
Lagoon (aerated/facultative lagoon, seasonal discharge, alum phosphorous removal when needed)	-	-	-	-	-	-	-	-
Lagoon (aerated/facultative lagoon, seasonal discharge, alum phosphorous removal)	-	-	-	-	-	-	-	-
Lagoon (aerated/facultative lagoon, seasonal discharge, alum phosphorous removal, slow sand filtration)	-	-	-	-	-	-	-	-
Various types (mean)	-	-	-	-	-	-	-	-
Primary (aeration alum phosphorous removal)	-	-	-	-	-	-	-	-

Treatment Type	Amoxicillin	Trimethyoprim	Doxycycline	Citalopram	3-benzylidene camphor	4-methylbenzylidene camphor	Cyclic methyl siloxanes	Propylparaben
Sand filtration Aluminum treatment-coagulation	-	-	-	-	-	-	-	-
Activated sludge	-	-	-	-	-	-	-	-
Conventional Activated Sludge	-	-	-	-	-	-	-	-
Membrane bioractor	-	-	-	-	-	-	-	-
Secondary (trickling filter solids contact, chlorination seasonally)	-	-	-	-	-	-	-	-
Secondary (aerated ferric chloride polymer, acitivated sludge polymer, partial nitrification, ferric chloride phosphorous removal, chlorination)	-	-	-	-	-	-	-	-
Secondary (aerated, activated sludge, ferrous chloride phosphorous removal, chlorination)	-	-	-	-	-	-	-	-
Secondary (aerated, activated sludge, partial nitrification, alum phosphorous removal, UV (med) seasonally)	-	-	-	-	-	-	-	-

Treatment Type	Amoxicillin	Trimethyoprim	Doxycycline	Citalopram	3-benzylidene camphor	4-methylbenzylidene camphor	Cyclic methyl siloxanes	Propylparaben
Secondary (aerated, biological nutrient removal (BNR), nitrification, alum phosphorous removal, UV)	-	-	-	-	-	-	-	-
Secondary (aerated, high rate oxygen activated sludge)	-	-	-	-	-	-	-	-
Secondary (aerated, high rate oxygen activated sludge)	-	-	-	-	-	-	-	-
Secondary (Alum grit removal, activaed sludge, partial nitrification, primary phosphorous removal, UV (low) seasonal)	-	-	-	-	-	-	-	-
Secondary (grit removal, activated sludge, methanol and antifoam, nitrification, ferric chloride phosphorous removal and chlorination	-	-	-	-	-	-	-	-
Secondary (vortex grit removal, high activated sludge, partial nitrification, alum phosphorous removal, UV (med)seasonally)	-	-	-	-	-	-	-	-
Activated carbon (12 mg/L)	-	-	-	-	-	-	-	-
Activated carbon (5 mg/L)	-	-	-	-	-	-	-	-

Treatment Type	Amoxicillin	Trimethyoprim	Doxycycline	Citalopram	3-benzylidene camphor	4-methylbenzylidene camphor	Cyclic methyl siloxanes	Propylparaben
Activated sludge/UV Biological Filter	-	-	-	-	-	-	-	-
Aeration of groundwater → filtration (Fe and Mn)	-	-	-	-	-	-	-	-
Chlorination (1.2 mg/L free Cl)	-	-	-	-	-	-	-	-
Conventional Activated Sludge + Filtration	-	-	-	-	-	-	-	-
Fullscale Conventional Wastewater	-	-	-	-	~100	~100	-	~100
Ozone medium dose (1-5mg/L cont.)	-	-	-	-	-	-	-	-
Ozone pre-treatment for sludge anaerobic digestion	-	-	-	-	-	-	-	-
Ozone/H_2O_2: high (>7.1/3.5 mg/L)	-	-	-	-	-	-	-	-

Treatment Type	Amoxicillin	Trimethyoprim	Doxycycline	Citalopram	3-benzylidene camphor	4-methylbenzylidene camphor	Cyclic methyl siloxanes	Propylparaben
Ozone/H_2O_2: low (2.1/1.0 mg/L)	-	-	-	-	-	-	-	-
Ozone/H_2O_2: medium (3.6/2.5 mg/L)	-	-	-	-	-	-	-	-
Ozone/H_2O_2: medium (3.6/2.5 mg/L; cont.)	-	-	-	-	-	-	-	-
Ozone/UV (15 mg/L)	-	-	-	-	-	-	-	-
Ozone: high dose (>5-7.1 mg/L)	-	-	-	-	-	-	-	-
Ozone: low dose (0.2-0.3 mg/L; cont.)	-	-	-	-	-	-	-	-
Ozone: medium dose (1-5 mg/L)	-	-	-	-	-	-	-	-
Ozone: very high dose (10-15 mg/L)	-	-	-	-	-	-	-	-

Treatment Type	Amoxicillin	Trimethyoprim	Doxycycline	Citalopram	3-benzylidene camphor	4-methylbenzylidene camphor	Cyclic methyl siloxanes	Propylparaben
Tertiary (aerated, activated sludge, nitrification, alum phosphorous removal, sand filtration and UV (low))	-	-	-	-	-	-	-	-
Tertiary, grit removal, extended aeration activated sludge, nitrification, ferrous chloride phosphorous removal, granular anthracitefiltration and UV (high))	-	-	-	-	-	-	-	-
Tertiary, grit removal, no primary treatment, extended aeration activated sludge, nitrification, alumn phosphorous removal, sand filtration and UV (high))	-	-	-	-	-	-	-	-

Treatment Type	BHT	DEET	Bisphenol A	Dibutyl-phthalate	Triclosan	Triclocarban	Vanailin	Galaxolide	References
Lagoon	-	-	-	-	-	-	-	99	Lishman L., et al., 2006
Lagoon (aerated/facultative lagoon, seasonal discharge, alum , polymer phosphorous removal)	-	-	-	-	-	-	-	-	Servos, M., et al. 2005
Lagoon (aerated/facultative lagoon, seasonal discharge, alum phosphorous removal when needed)	-	-	-	-	-	-	-	-	Servos, M., et al. 2005
Lagoon (aerated/facultative lagoon, seasonal discharge, alum phosphorous removal)	-	-	-	-	-	-	-	-	Servos, M., et al. 2005
Lagoon (aerated/facultative lagoon, seasonal discharge, alum phosphorous removal, slow sand filtration)	-	-	-	-	-	-	-	-	Servos, M., et al. 2005
Various types (mean)	-	-	-	-	-	-	-	-	Lee, H-B., et al., 2009
Primary (aeration alum phosphorous removal)	-	-	-	-	-	-	-	-	Servos, M., et al. 2005

Treatment Type	BHT	DEET	Bisphenol A	Dibutyl-phthalate	Triclosan	Triclocarban	Vanailin	Galaxolide	References
Sand filtration Aluminum treatment-coagulation	-	-	-	-	-	-	-	-	Monteiro, S., and Boxall, A., 2010
Activated sludge	-	-	-	-	-	-	-	-	Monteiro, S., and Boxall, A., 2010
Conventional Activated Sludge	-	-	-	-	93	-	-	43	Lishman L., et al., 2006
Membrane bioractor	-	-	-	-	-	-	-	-	Monteiro, S., and Boxall, A., 2010
Secondary (trickling filter solids contact, chlorination seasonally)	-	-	-	-	-	-	-	-	Servos, M., et al. 2005
Secondary (aerated ferric chloride polymer, acitivated sludge polymer, partial nitrification, ferric chloride phosphorous removal, chlorination)	-	-	-	-	-	-	-	-	Servos, M., et al. 2005
Secondary (aerated, activated sludge, ferrous chloride phosphorous removal, chlorination)	-	-	-	-	-	-	-	-	Servos, M., et al. 2005
Secondary (aerated, activated sludge, partial nitrification, alum phosphorous removal, UV (med) seasonally)	-	-	-	-	-	-	-	-	Servos, M., et al. 2005

Treatment Type	BHT	DEET	Bisphenol A	Dibutyl-phthalate	Triclosan	Triclocarban	Vanailin	Galaxolide	References
Secondary (aerated, biological nutrient removal (BNR), nitrification, alum phosphorous removal, UV)	-	-	-	-	-	-	-	-	Servos, M., et al. 2005
Secondary (aerated, high rate oxygen activated sludge)	-	-	-	-	-	-	-	-	Servos, M., et al. 2005
Secondary (aerated, high rate oxygen activated sludge)	-	-	-	-	-	-	-	-	Servos, M., et al. 2005
Secondary (Alum grit removal, activaed sludge, partial nitrification, primary phosphorous removal, UV (low) seasonal)	-	-	-	-	-	-	-	-	Servos, M., et al. 2005
Secondary (grit removal, activated sludge, methanol and antifoam, nitrification, ferric chloride phosphorous removal and chlorination	-	-	-	-	-	-	-	-	Servos, M., et al. 2005
Secondary (vortex grit removal, high activated sludge, partial nitrification, alum phosphorous removal, UV (med)seasonally)	-	-	-	-	-	-	-	-	Servos, M., et al. 2005
Activated carbon (12 mg/L)	-	-	-	-	-	-	-	-	Monteiro, S., and Boxall, A., 2010
Activated carbon (5 mg/L)	-	-	-	-	-	-	-	-	Monteiro, S., and Boxall, A., 2010

Treatment Type	BHT	DEET	Bisphenol A	Dibutyl-phthalate	Triclosan	Triclocarban	Vanailin	Galaxolide	References
Activated sludge/UV Biological Filter	-	-	-	-	-	-	-	-	Monteiro, S., and Boxall, A., 2010
Aeration of groundwater → filtration (Fe and Mn)	-	-	-	-	-	-	-	-	Monteiro, S., and Boxall, A., 2010
Chlorination (1.2 mg/L free Cl)	-	-	-	-	-	-	-	-	Monteiro, S., and Boxall, A., 2010
Conventional Activated Sludge + Filtration	-	-	-	-	95	-	-	19	Lishman L., et al., 2006
Fullscale Conventional Wastewater	~68	~69	~65	~80	~84	~64	~89	-	Drewes, J., et al., 2009
Ozone medium dose (1-5mg/L cont.)	-	-	-	-	-	-	-	-	Monteiro, S., and Boxall, A., 2010
Ozone pre-treatment for sludge anaerobic digestion	-	-	-	-	-	-	-	-	Monteiro, S., and Boxall, A., 2010
Ozone/H_2O_2: high (>7.1/3.5 mg/L)	-	-	-	-	-	-	-	-	Monteiro, S., and Boxall, A., 2010

Treatment Type	BHT	DEET	Bisphenol A	Dibutyl-phthalate	Triclosan	Triclocarban	Vanailin	Galaxolide	References
Ozone/H_2O_2: low (2.1/1.0 mg/L)	-	-	-	-	-	-	-	-	Monteiro, S., and Boxall, A., 2010
Ozone/H_2O_2: medium (3.6/2.5 mg/L)	-	-	-	-	-	-	-	-	Monteiro, S., and Boxall, A., 2010
Ozone/H_2O_2: medium (3.6/2.5 mg/L; cont.)	-	-	-	-	-	-	-	-	Monteiro, S., and Boxall, A., 2010
Ozone/UV (15 mg/L)	-	-	-	-	-	-	-	-	Monteiro, S., and Boxall, A., 2010
Ozone: high dose (>5-7.1 mg/L)	-	-	-	-	-	-	-	-	Monteiro, S., and Boxall, A., 2010
Ozone: low dose (0.2-0.3 mg/L; cont.)	-	-	-	-	-	-	-	-	Monteiro, S., and Boxall, A., 2010
Ozone: medium dose (1-5 mg/L)	-	-	-	-	-	-	-	-	Monteiro, S., and Boxall, A., 2010
Ozone: very high dose (10-15 mg/L)	-	-	-	-	-	-	-	-	Monteiro, S., and Boxall, A., 2010

Treatment Type	BHT	DEET	Bisphenol A	Dibutyl-phthalate	Triclosan	Triclocarban	Vanailin	Galaxolide	References
Tertiary (aerated, activated sludge, nitrification, alum phosphorous removal, sand filtration and UV (low))	-	-	-	-	-	-	-	-	Servos, M., et al. 2005
Tertiary, grit removal, extended aeration activated sludge, nitrification, ferrous chloride phosphorous removal, granular anthracitefiltration and UV (high))	-	-	-	-	-	-	-	-	Servos, M., et al. 2005
Tertiary, grit removal, no primary treatment, extended aeration activated sludge, nitrification, alumn phosphorous removal, sand filtration and UV (high))	-	-	-	-	-	-	-	-	Servos, M., et al. 2005

Appendix E: Known Toxicity Values for Select Emerging Chemicals of Concern (Kidd and Mercer, 2012, Chemicals of emerging concern in the Bay of Fundy watershed: What are the risks? Bay of Fundy Ecosystem Partnership Technical Report No. 7, Bay of Fundy Ecosystem Partnership, Wolfville, NS, 22 p.)

Compound	Organisim	Test	Toxicity (mg/L)	Reference
17β-estradiol	**PBT Profiler**	**-**	**0.044**	**Diamond et al., 2011**
3-benzylidene camphor	-	-	-	-
4-methylbenzylidene camphor	-	-	-	-
Acetaminophen	*Daphnia*	48h EC50	9.2	Waiser, M., et al., 2011
Acetaminophen	Algae	24h LC50	134	Waiser, M., et al., 2011
Acetaminophen	Fish	<96h LC50	378	Waiser, M., et al., 2011
Acetaminophen	PBT Profiler	-	1.1	Diamond et al., 2011
Amoxicillin	**Algae**	**24h LC50**	**2.2**	**Waiser, M., et al., 2011**
Atorvastatin	-	-	-	-
Benzafibrate	ChV Value Fish	-	0.314	Diamond et al., 2011
BHT	**PBT Profiler**	**-**	**0.012**	**Diamond et al., 2011**
Bisphenol A	**PBT Profiler**	**-**	**0.046**	**Diamond et al., 2011**
Caffeine	*Daphnia*	48h LC50	182	Waiser, M., et al., 2011
Caffeine	*Lemna gibba*	EC50	>1.0	Waiser, M., et al., 2011
Caffeine	Fish	<96h LC50	87	Waiser, M., et al., 2011
Caffeine	ChV Value Algae	-	173.488	Diamond et al., 2011
Carbamazepine	Cladoceran	LC50	13.8	Waiser, M., et al., 2011
Carbamazepine	Algae	24h LC50	33.6	Waiser, M., et al., 2011
Carbamazepine	*Hydra*	96h EC50	15.52	Waiser, M., et al., 2011
Carbamazepine	**ChV Value Daphnid**	**-**	**4.615**	**Diamond et al., 2011**
Camphor	**PBT Profiler**	**-**	**1.8**	**Diamond et al., 2011**
Citalopram	***Ceriodaphnia dubia***	**48LC50**	**3.9**	**Henry, T et al., 2004**
Clofibric Acid	PBT Profiler	-	38	Diamond et al., 2011
Cotinine	*Lemna gibba*	EC50	>1.0	Waiser, M., et al., 2011
Cotinine	*ChV Value Algae*	-	132.44	Diamond et al., 2011
Cyclic methyl siloxanes	-	-	-	-
Cyclophosphamide	ChV Value Daphnid	-	58.347	Diamond et al., 2011
DEET	*D. magna*	96h LC50	108	Waiser, M., et al., 2011
DEET	*Gammarus faciatis*	96h EC50	100	Waiser, M., et al., 2011
DEET	*Gambusia affinis*	48h EC50	235	Waiser, M., et al., 2011
DEET	**ChV Value Daphnid**	**-**	**5.835**	**Diamond et al., 2011**
Dibutyl-phthalate	***PBT Profiler***	**-**	**0.11**	**Diamond et al., 2011**
Diclofenac	Fish	LC50	532	Waiser, M., et al., 2011
Diclofenac	*Daphnia*	48h LC50	22.4	Waiser, M., et al., 2011
Diclofenac	Algae	LC50	14.5	Waiser, M., et al., 2011
Diclofenac	PBT Profiler	-	530	Diamond et al., 2011
Doxycycline	**PBT Profiler**	**-**	**0.86**	**Diamond et al., 2011**
Erythromycin	***Daphnia***	**48h EC50**	**0.94**	**Waiser, M., et al., 2011**
Erythromycin	Algae	24h LC50	0.02	Waiser, M., et al., 2011
Erythromycin	Fish	<96h LC50	80	Waiser, M., et al., 2011
Erythromycin	ChV Value Daphnid	-	5.238	Diamond et al., 2011

Compound	Organisim	Test	Toxicity (mg/L)	Reference
Estrone	**PBT Profiler**	**-**	**0.074**	**Diamond et al., 2011**
Ethinylestradiol	**-**	**-**	**-**	**-**
Fenoprofen	ChV Value Fish	-	0.000671	Diamond et al., 2011
Fluoxetine	**ChV Value Fish**	**-**	**0.398**	**Diamond et al., 2011**
Galaxolide	**PBT Profiler**	**-**	**0.05**	**Diamond et al., 2011**
Gemfibrozil	Fish	LC50	0.9	Waiser, M., et al., 2011
Gemfibrozil	*Daphnia*	LC50	10.4	Waiser, M., et al., 2011
Gemfibrozil	*Hydra*	96h EC50	1.18	Waiser, M., et al., 2011
Gemfibrozil	Algae	LC50	4	Waiser, M., et al., 2011
Gemfibrozil	**ChV Value Fish**	**-**	**0.889**	**Diamond et al., 2011**
Ibuprofen	ChV Value Fish	-	3.492	Diamond et al., 2011
Indomethacin	Fish	LC50	5	Waiser, M., et al., 2011
Indomethacin	*Daphnia*	LC50	9.02	Waiser, M., et al., 2011
Indomethacin	*Hydra*	96h EC50	1.65	Waiser, M., et al., 2011
Indomethacin	Algae	EC50	4	Waiser, M., et al., 2011
Indomethacin	ChV Value Fish	-	0.299	Diamond et al., 2011
Ketoprofen	ChV Value Daphnid	-	18.688	Diamond et al., 2011
Levonorgestrel	**-**	**-**	**-**	**-**
Metoprolol	**ChV Value Daphnid**	**-**	**13.383**	**Diamond et al., 2011**
Naproxen	Fish	EC50	34	Waiser, M., et al., 2011
Naproxen	*Daphnia*	LC50	22	Waiser, M., et al., 2011
Naproxen	*Hydra*	LC50	21	Waiser, M., et al., 2011
Naproxen	**Algae**	**96h EC50**	**2.62**	**Waiser, M., et al., 2011**
Naproxen	ChV Value Daphnid		15.247	Diamond et al., 2011
Norfluoxetine	-	-	-	Diamond et al., 2011
Pentoxifylline	ChV Value Algae	-	159.417	Diamond et al., 2011
Phenazone	PBT Profiler	-	0.31	Diamond et al., 2011
Propylparaben	**PBT Profiler**	**-**	**0.078**	**Diamond et al., 2011**
Salicyclic acid	Fish	LC50	1.29	Waiser, M., et al., 2011
Salicyclic acid	*Daphnia*	LC50	59	Waiser, M., et al., 2011
Salicyclic acid	Algae	LC50	48	Waiser, M., et al., 2011
Salicyclic acid	**PBT Profiler**		**1.3**	**Diamond et al., 2011**
Sulfacetamide	**-**	**-**	**-**	**-**
Sulfamethoxazole	Fish	LC50	562.5	Waiser, M., et al., 2011
Sulfamethoxazole	*Daphnia*	LC50	25.2	Waiser, M., et al., 2011
Sulfamethoxazole	Algae	LC5	0.03	Waiser, M., et al., 2011
Sulfamethoxazole	PBT Profiler	-	3.9	Diamond et al., 2011
Sulfapyridine	**PBT Profiler**	**-**	**3.5**	**Diamond et al., 2011**
Testosterone	**ChV Value Daphnid**	**-**	**1.34**	**Diamond et al., 2011**
Triclocarban	**PBT Profiler**	**-**	**0.09**	**Diamond et al., 2011**
Triclosan	***Daphnia***	**48h EC50**	**0.13**	**Waiser, M., et al., 2011**
Triclosan	Algae	24h LC50	0.005	Waiser, M., et al., 2011
Triclosan	Fish	<96h LC50	0.26	Waiser, M., et al., 2011
Triclosan	PBT Profiler	-	0.22	Diamond et al., 2011
Trimethoprim	Fish	EC50	-	Waiser, M., et al., 2011
Trimethoprim	Cladoceran	LC50	-	Waiser, M., et al., 2011

Compound	Organisim	Test	Toxicity (mg/L)	Reference
Trimethoprim	Algae	LC50	-	Waiser, M., et al., 2011
Trimethoprim	**ChV Value Algae**	**-**	**72.062**	**Diamond et al., 2011**
Vanillin	**PBT Profiler**	**-**	**0.48**	**Diamond et al., 2011**

Bolded values were used for RQ Calculations.

Compound	Original Source	Notes
17-β-estradiol	**-**	**Min Toxicity Value**
3-benzylidene camphor	-	-
4-methylbenzylidene camphor	-	-
Acetaminophen	Quinn, B., et al., 2008	-
Acetaminophen	Solomon, K., et al., 1996	-
Acetaminophen	Solomon, K., et al., 1996	-
Acetaminophen	-	Min Toxicity Value
Amoxicillin	**Solomon, K., et al., 1996**	**-**
Atorvastatin	-	-
Benzafibrate	-	Min Toxicity Value
BHT	**-**	**Min Toxicity Value**
Bisphenol A	**-**	**Min Toxicity Value**
Caffeine	Solomon, K., et al., 1996	-
Caffeine	Brun, G., et al., 2006	-
Caffeine	Solomon, K., et al., 1996	-
Caffeine	-	Min Toxicity Value
Carbamazepine	Kim, Y., et al., 2007	-
Carbamazepine	Solomon, K., et al., 1996	-
Carbamazepine	Han, G., et al., 2006	-
Carbamazepine	**-**	**Min Toxicity Value**
Camphor	**-**	**Min Toxicity Value**
Citalopram	**-**	**Min Toxicity Value**
Clofibric Acid	-	Min Toxicity Value
Cotinine	Brun, G., et al., 2006	-
Cotinine	-	Min Toxicity Value
Cyclic methyl siloxanes	-	-
Cyclophosphamide	-	Min Toxicity Value
DEET	Costanzo, A., et al., 2005	-
DEET	Costanzo, A., et al., 2005	-
DEET	Costanzo, A., et al., 2005	-
DEET	**-**	**Min Toxicity Value**
Dibutyl-phthalate	**-**	**Min Toxicity Value**
Diclofenac	European Commission, 2003	-
Diclofenac	Solomon, K., et al., 1996	-
Diclofenac	Calow, P., 1997	-
Diclofenac	-	Min Toxicity Value
doxycycline	**-**	**Min Toxicity Value**
Erythromycin	**Solomon, K., et al., 1996**	**-**
Erythromycin	Solomon, K., et al., 1996	-
Erythromycin	Solomon, K., et al., 1996	-
Erythromycin	-	Min Toxicity Value

Compound	Original Source	Notes
Estrone	**-**	**Min Toxicity Value**
Ethinylestradiol	**-**	**-**
Fenoprofen	-	Min Toxicity Value
Fluoxetine	**-**	**Min Toxicity Value**
Galaxolide	**-**	**Min Toxicity Value**
Gemfibrozil	European Commission, 2003	-
Gemfibrozil	Sanderson, H. and Thomsen, M., 2009	-
Gemfibrozil	Han, G., et al., 2006	-
Gemfibrozil	European Commission, 2003	-
Gemfibrozil	**-**	**Min Toxicity Value**
Ibuprofen	-	Min Toxicity Value
Indomethacin	European Commission, 2003	-
Indomethacin	European Commission, 2003	-
Indomethacin	Han, G., et al., 2006	-
Indomethacin	European Commission, 2003	-
Indomethacin	-	Min Toxicity Value
Ketoprofen	-	Min Toxicity Value
Levonorgestrel	**-**	**-**
Metoprolol	**-**	**Min Toxicity Value**
Naproxen	European Commission, 2003	-
Naproxen	European Commission, 2003	-
Naproxen	Solomon, K., et al., 1996	-
Naproxen	**Han, G., et al., 2006**	**-**
Naproxen	-	Min Toxicity Value
Norfluoxetine	-	Min Toxicity Value
Pentoxifylline	-	Min Toxicity Value
Phenazone	-	Min Toxicity Value
Propylparaben	**-**	**Min Toxicity Value**
Salicyclic acid	European Commission, 2003	-
Salicyclic acid	European Commission, 2003	-
Salicyclic acid	European Commission, 2003	-
Salicyclic acid	**-**	**Min Toxicity Value**
Sulfacetamide	**-**	**-**
Sulfamethoxazole	European Commission, 2003	-
Sulfamethoxazole	European Commission, 2003	-
Sulfamethoxazole	Kim, Y., et al., 2007	-
Sulfamethoxazole	-	Min Toxicity Value
Sulfapyridine	**-**	**Min Toxicity Value**
Testosterone	**-**	**Min Toxicity Value**
Triclocarban	**-**	**Min Toxicity Value**
Triclosan	**Solomon, K., et al., 1996**	**-**
Triclosan	Solomon, K., et al., 1996	-
Triclosan	Solomon, K., et al., 1996	-
Triclosan	-	Min Toxicity Value
Trimethoprim	European Commission, 2003	-
Trimethoprim	Calow, P., 1997	-

Compound	Original Source	Notes
Trimethoprim	European Commission, 2003	-
Trimethyoprim	**-**	**Min Toxicity Value**
Vanillin	**-**	**Min Toxicity Value**

Bolded values were used for RQ Calculations.

Appendix F: Risk Quotients (RQ)for Influent, Effluent and Surface Waters, Concentrations Measured in Effluents and Surface Waters, and Toxicity Values used for RQs (Kidd and Mercer, 2012, Chemicals of emerging concern in the Bay of Fundy watershed: What are the risks? Bay of Fundy Ecosystem Partnership Technical Report No. 7, Bay of Fundy Ecosystem Partnership, Wolfville, NS, 22 p.)

Compound	Category	Influent RQs	Effluent RQs	Surface Water RQs	Influent ranges (ng/L)	Effluent ranges (ng/L)	Surface Water ranges (ng/L)	Influent Max (mg/L)	Max Effluent (mg/L)	Max Surface Water (mg/L)	Toxicity Value (mg/L)	Toxicity Reference
17β-estradiol	Natural hormones	0.00284	0.00205	0.00004	2.5-125	ND-90	ND-1.8	0.000125	0.00009	0.0000018	0.044	Diammond et al., 2011
3-benzylidene camphor	Sunscreens	-	-	-	-	-	-	-	-	-	-	-
4-methylbenzylidene camphor	Sunscreens	-	-	-	-	-	-	-	-	-	-	-
amoxicillin	Human pharmaceuticals-antibiotics	-	0.00000	0.00004	-	4.7	ND-80	-	0.0000047	0.00008	2.200	Waiser, M., et al., 2011
atorvastatin	Human pharmaceuticals-heart and blood pressure medications	-	-	-	166	ND-77	ND-15	0.000166	0.000077	0.000015	-	Diammond et al., 2011
BHA	Preservatives/antioxidants	0.01917	0.00325	-	52-230	ND-39	-	0.00023	0.000039	-	0.012	Diammond et al., 2011
BHT	Preservatives/antioxidants	0.00891	0.00522	0.00387	43-410	ND-240	178	0.00041	0.00024	0.000178	0.046	Diammond et al., 2011
bisphenol A	Plasticizers	0.01060	0.00389	0.03054	200-530	1.29-194.6	ND-1527	0.00053	0.0001946	0.001527	0.050	Diammond et al., 2011
carbamazepine	Human pharmaceuticals-antiepileptics	0.00041	0.00071	0.00008	100-1900	ND-3287	ND-350	0.0019	0.003287	0.00035	4.615	Diammond et al., 2011
camphor	Sunscreens	0.00100	-	-	160-1800	ND	-	0.0018	-	-	1.800	Diammond et al., 2011
citalopram	Human pharmaceuticals-SSRIs/antidepressants	-	-	0.00006	-	-	4.53-219	-	-	0.000219	3.900	Henry, T et al., 2004
cyclic methyl siloxanes	Sunscreens	-	-	-	-	-	-	-	-	-	-	-
DEET	Insect Repellant	0.00010	0.00004	0.00008	54-600	100-260	490	0.0006	0.00026	0.00049	5.835	Diammond et al., 2011
dibutyl-phthalate	Plasticizers	0.02818	0.01235	0.00154	390-3100	16.1-1358	ND-169	0.0031	0.001358	0.000169	0.110	Diammond et al., 2011
doxycycline	Human pharmaceuticals-antibiotics	-	0.00012	0.00009	-	ND-102	ND-80	-	0.000102	0.00008	0.860	Diammond et al., 2011
erythromycin	Human pharmaceuticals-antibiotics	-	0.00016	0.00011	-	838	590	-	0.000838	0.00059	5.238	Waiser, M., et al., 2011
estrone	Natural hormones	0.00108	0.00135	-	19-80	ND-100	ND	0.00008	0.0001	-	0.074	Diammond et al., 2011
ethinylestradiol	Human pharmaceuticals-hormones	-	-	-	75-90	ND-8.5	ND	**0.00009**	**0.0000085**	**-**	-	-
fluoxetine	Human pharmaceuticals-SSRIs/antidepressants	-	0.00201	0.00012	-	ND-799	ND-46	-	0.000799	0.000046	0.398	Diammond et al., 2011
galaxolide	Fragrances	0.04062	0.01502	0.01588	2031	751	74-794	0.002031	0.000751	0.000794	0.050	Diammond et al., 2011
gemfibrozil	Human pharmaceuticals-lipid regulators	0.00001	0.01462	0.00065	ND-8	ND-1493	ND-580	0.000008	0.013	0.00058	0.889	Diammond et al., 2011
levonorgestrel	Human pharmaceuticals-hormones	-	-	-	150-170	30.00000	ND	-	-	-	-	-
metoprolol	Human pharmaceuticals-heart and blood pressure medications	-	0.00016	0.00016	-	10-2200	30-2200	-	0.0022	0.0022	13.383	Diammond et al., 2011
naproxen	Human pharmaceuticals-analesics	0.04007	0.00597	0.00030	ND-611000	ND-91000	ND-4500	0.611	0.091	0.0045	15.247	Waiser, M., et al., 2011
propylparaben	Preservatives/antioxidants	-	-	-	-	-	-	-	-	-	0.078	Diammond et al., 2011
salicyclic acid	Human pharmaceuticals-analesics	0.00008	0.07000	0.00346	ND-110	ND-91000	ND-4500	0.00011	0.091	0.0045	1.300	Diammond et al., 2011
sulfacetamide	Human pharmaceuticals-antibiotics	-	-	-	-	ND-151	ND	-	0.000151	-	-	-
sulfamethoxazole	Human pharmaceuticals-antibiotics	-	0.00084	0.00013	-	193-3278	ND-510	-	0.003278	0.00051	3.900	Waiser, M., et al., 2011
sulfapyridine	Human pharmaceuticals-antibiotics	-	0.00020	0.00002	-	81-707	ND-61	-	0.000707	0.00006	3.500	Diammond et al., 2011
testosterone	Natural hormones	0.00001	-	0.00016	5.4-13.3	ND	ND-214	0.0000133	-	0.000214	1.340	Diammond et al., 2011
triclocarban	Antimicrobials	0.07500	0.00144	0.06222	49-6750	26-130	33-5600	0.00675	0.00013	0.0056	0.090	Diammond et al., 2011
triclosan	Antimicrobials	0.00877	0.00049	0.00050	1930	108	110	0.00193	0.000108	0.00011	0.220	Waiser, M., et al., 2011
trimethoprim	Human pharmaceuticals-antibiotics	-	0.00005	0.00000	-	9-3528	ND-150	-	0.003528	0.00015	72.062	Diammond et al., 2011
vanillin	Fragrances	0.00877	0.00049	-	1600-2100	150-470	-	0.0021	0.00047	-	0.480	Diammond et al., 2011

ND-No Detect

Notes

Limited Bay of Fundy data

Limited Canadian data

Diamond J, Thornton K, Munkittrick K, Kidd K, Bartell S. 2011. Diagnostic tools to evaluate impacts of trace organic compounds Final Report. CEC5R08. Water Environment Research Foundation, Alexandria, VA, USA.