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April 9, 2024

VIA EMAIL (crystal.henwood@novascotia.ca)
Ms. Crystal Henwood, Regulatory Affairs Officer/Clerk of the Board
N.S. Utility and Review Board
3rd Floor, Summit Place, 1601 Lower Water Street
P. O. Box 1692, Postal Unit M
Halifax, NS B3J 3S3

Re: M10524 - Future Regulatory Scenarios Study

Dear Ms. Henwood:

Further to Matter M10524 and the Board directive in its letter dated October 27, 2021, in Matter M10312 (2021 RDC Annual Report), attached is the final draft of the Future Regulatory Scenarios Study.

Planning for compliance with updated wastewater regulations and increasingly stringent drinking water quality guidelines remains a priority for Halifax Water. The Future Regulatory Scenarios Study highlighted areas to monitor across all three lines of service, confirmed that no new legislation is expected in the near term, and confirmed that there is no additional regulatory guidance beyond current requirements.

The study also outlined emerging conversations in the Canadian regulatory environment including, but not limited to, PFAs in both water and wastewater, disinfection byproducts in drinking water, combined sewer overflows, and GHG emissions from wastewater treatment processes.

Staff are available for consultation with the Board and its consultants once they have had time to review the study.

Please contact the undersigned if you have any questions.

Respectfully submitted,

DocuSigned by:
Kenda MacKenzie
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Kenda MacKenzie, P.Eng.
A/General Manager

Attachment
Future Regulatory Scenarios Study, Final Draft

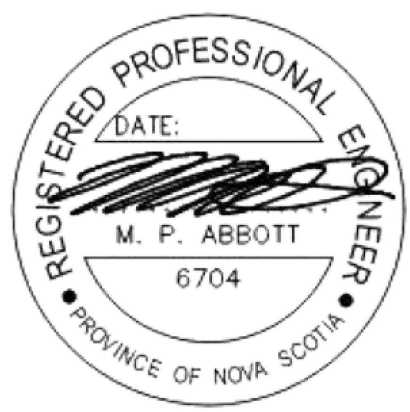
Halifax Water Future Regulatory Scenarios Study

DRAFT FINAL

CBCL

Project #220823.01 • April 2024

E	DRAFT FINAL	M. Abbott	05-Apr-2024	M. Fraser
D	DRAFT FINAL	M. Abbott	18-Mar-2024	M. Fraser
C	DRAFT FINAL	M. Abbott	15-Dec-2023	M. Fraser
B	DRAFT Rev B	M. Fraser	14-Dec–2023	M. Fraser
A	DRAFT	M. Fraser	27-Oct-2023	M. Fraser
Rev.	Issue	Reviewed By:	Date	Issued By:



Project No. 220823.01

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April 5, 2024

Marcia Chapman, P.Eng.
Project Manager
Asset Management and Capital Planning
Halifax Water
450 Cowie Hill Rd,
PO Box 8388 RPO CSC
Halifax, NS B3K 5M1

Dear Ms. Chapman:

RE: ***Potential Future Regulatory Scenarios Study – Draft Final***

CBCL is pleased to submit this draft report for your review, which presents the results of the Future Regulatory Scenarios Review completed for Halifax Water.

Yours very truly,

CBCL Limited

Prepared by:
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VP Water Treatment

Project No.: 220823.01

Contents

Appendices

1 Introduction

CBCL Limited was retained by Halifax Water in 2023 to perform a Potential Future Regulatory Scenario Study in preparation for the development of the next Halifax Water Compliance Plan and subsequently, the next iteration of the Integrated Resource Plan (IRP).

This study was completed to provide Halifax Water with an updated review of emerging regulations and guidelines in the water, wastewater, and stormwater sectors based on the regulatory environment in other jurisdictions and insight from industry organizations.

Research for this study was performed through consulting with governing bodies and industry associations and supplemented with desktop investigations of the most recent legislation and guidelines in various jurisdictions. Where additional or more stringent regulations existed, they were documented as potential future regulations for Halifax Water facilities.

The objectives of this report include:

- Document the current regulatory environment as it pertains to Halifax Water facilities and systems.
- Summarize regulatory trends in the Water, Wastewater and Stormwater sectors at the provincial and federal levels.
- Identify potential future regulations and/or guidelines that may need to be considered in capital project planning and implementation.

2 Drinking Water Regulations

2.1 Halifax Water Drinking Water Supply Plants

Halifax Water currently owns and operates eight water supply plants (WSPs) with varying levels of treatment and daily flow capacities that serve a mixture of residential and industrial/commercial/institutional customers. A brief overview of the Halifax Water WSPs is provided in Table 2.1.

Table 2.1: Overview of Halifax Water WSPs

Facility	Treatment Type
Bennery Lake	Surface water, conventional filtration, disinfection
Bomont	Surface water, membrane filtration (ultra), ion exchange, disinfection
Collins Park	Surface water, membrane filtration (ultra, and nanofiltration), disinfection
Five Island Lake	Groundwater, disinfection
Lake Major	Surface water, conventional treatment (sedimentation with multimedia filtration), disinfection
Middle Musq.	Surface water, membrane filtration (ultra and nanofiltration), disinfection
J.D. Kline (Pockwock)	Surface water, direct filtration (dual media), disinfection
Silver Sands	Groundwater, greensand filtration (iron/magananese removal), disinfection

To investigate potential future regulations applicable to Halifax Water WSPs, an analysis was conducted on existing drinking water quality guidelines in Canada and worldwide. This study examined regulatory patterns and trends, with a specific focus on federal and provincial levels, aiming to anticipate forthcoming regulations.

2.2 Current Regulatory Environment

Drinking water supplies in Nova Scotia are categorized as either private (residential) supplies, municipal (approved) supplies, or registered public supplies. A Public Drinking Water Supply refers to a system with 15 or more service connections (i.e. households) or serves more than 25 people more than 60 days per year. These are either Municipal or Registered supplies. If the supply does not meet these threshold criteria, it is considered a private (residential) supply.

All provincial regulations on drinking water originate with *The Water and Wastewater Facilities and Public Drinking Water Supplies Regulations*, under the *Environment Act* and are enforced by Nova Scotia Department of Environment and Climate Change (NSECC). Treatment standards for municipal supplies are outlined in the *Treatment Standards for Municipal Drinking Water Supplies*. The *Guidelines for Monitoring Public Drinking Water Supplies* outline the current NSECC regulatory framework covering owner's responsibilities, water quality objectives, monitoring and reporting requirements and corrective actions for both municipal and registered supplies.

Health Canada develops the *Guidelines for Canadian Drinking Water Quality (GCDWQ*). The *GCDWQ* was initially developed in the 1960s, to provide national framework for assessing and managing the quality of drinking water in Canada. The guidelines serve as a scientific and technical reference to ensure that drinking water is safe and meets health-based standards. Over the years, the *GCDWQ* have undergone several revisions and updates to reflect the most current scientific knowledge, emerging concerns, and international best practices. The *GCDWQ* are issued by Health Canada and encompass recommended thresholds for microbiological, chemical, and radiological components present in drinking water. Maintaining substance levels at or below these recommended thresholds ensures that human health remains unaffected over a person's lifetime. Health Canada collaborates closely with provinces, territories, and other federal departments to develop these guidelines. The guidelines are built around MACs, Aesthetic Objectives (AOs) and Operational Guidance (OG) values. NSECC has representatives that sit on the Health Canada *GCDWQ* committee and are involved in the process reviewing and updating the guidelines.

NSECC adopts the *GCDWQ* Maximum Allowable Concentrations (MACs) when developing and implementing drinking water regulations and guidelines in the province and are enforceable under *The Water and Wastewater Facilities and Public Drinking Water Supplies*. They consider the recommendations and standards outlined in the *GCDWQ* to ensure that drinking water in Nova Scotia meets appropriate health and safety standards. AO and OG values are acknowledged by NSECC, however are not directly adopted through regulation and are not enforceable.

The most recent revision of the *GCDWQ* summary was published in September 2022 and a summary is provided in Table 2.2, Table 2.3 and Table 2.4. Since this revision, Boron and Malathion were updated in 2023. In recent years, several new or amended parameters (and accompanying guidance documents) have been added to the *GCDWQ*. These include pathogen guidance (e.g*., E. coli*), organic parameters (e.g. NOM), and inorganic parameters (e.g. manganese, aluminum, lead). Several of the parameters that have recently been adopted (ie new objective for Perfluroalkylated Substances – PFAS) have not historically been detected in source waters in the region or at concentrations exceeding the new guidelines. Additional sampling may be required to determine the source water concentrations and to determine if existing treatment processes at the WSP can be used to meet the guidelines. Other parameters, such as manganese, are present and at levels requiring optimization of existing processes or additional treatment to meet new MACs and AOs.

Table 2.2: Microbiological Parameters as Adopted from Health Canada's *Guidelines for Canadian Drinking Water Quality* (Sept 2022)

Parameter	Guideline
Enteric protozoa: *Giardia* and *Cryptosporidium* (2019)	Treatment goal: Minimum 3 log removal and/or inactivation of cysts and oocysts
Enteric viruses (2019)	Treatment goal: Minimum 4 log reduction (removal and/or inactivation) of enteric viruses
Escherichia coli (E. coli) (2020)	MAC: None detectable per 100 mL
Total Coliforms (2020)	MAC: None detectable/100 mL in water leaving a treatment plant and in non-disinfected groundwater leaving the well
Turbidity (2012)	Treatment limits for individual filters or units: -Conventional and direct filtration: ≤ 0.3 NTU. -Slow sand and diatomaceous earth filtration: ≤ 1.0 NTU. -Membrane filtration: ≤0.1 NTU.

Table 2.3: Radiological Parameters Adopted from Health Canada's *Guidelines for Canadian Drinking Water Quality* (Sept 2022)

Parameter	MAC (Bq/L)
Cesium-137 (2009)	10
Iodine-121 (2009)	6
Lead-210 (2009)	0.2
Radium-226 (2009)	0.5
Radon (2009)	n/a
Strontium-90 (2009)	5

Parameter	MAC (Bq/L)
Tritium (2009)	7000
Uranium (1999)	n/a

Table 2.4: Chemical and Physical Parameters Adopted from Health Canada's *Guidelines for Canadian Drinking Water Quality* (Sept 2022)

Parameter	MAC (mg/L)	Other Value (mg/L)	Parameter	MAC (mg/L)	Other Value (mg/L)	Parameter	MAC (mg/L)	Other Value (mg/L)
Aluminum (2021)	2.9	OG: 0.1	2,4-Dichlorophenoxy acetic acid (2,4-D) (2022)	0.1		Strontium (2019)	7	
Antimony (1997)	0.006		Dimethoate and omethoate (2022)	0.02		Sulphate (1994)	None	AO: ≤ 500
Arsenic (2006)	0.01		Diquat (2022)	0.05		Sulphide (1992)	None	AO: ≤ 0.05
Atrazine (1993)	0.005		1,4-Dioxane (2021)	0.050		Tetrachloroethylene (2015)	0.01	
Barium (2020)	2		Ethylbenzene (2014)	0.14	AO: 0.0016	Toluene (2014)	0.06	AO: 0.024
Benzene (2009)	0.005		Fluoride (2010)	1.5		Total dissolved solids (TDS) (1991)	None	AO: ≤ 500
Benzo[a]pyrene (2016)	0.00004		Glyphosate (1987, 2005)	0.28		Trichloroethylene (2005)	0.005	
Boron (2023)	5		Haloacetic acids - Total (HAAs) (2008)	0.08		2,4,6-Trichlorophenol (1987, 2005)	0.005	AO: ≤ 0.002
Bromate (2018)	0.01		Iron (1978, 2005)	None	AO: ≤ 0.3	Trihalomethanes (THMs) (2006)	0.1	
Bromoxynil (2022)	0.03		Lead (2019)	0.005 ALARA		Uranium (2019)	0.02	
Cadmium (2020)	0.007		Malathion (1986,2005, 2023)	0.29		Vinyl chloride (2013)	0.002 ALARA	
Carbon tetrachloride (2010)	0.002		Manganese (2019)	0.12	AO: ≤ 0.02	Xylenes (total) (2014)	0.09	AO: 0.02
Chlorate (2008)	1		Mercury (1986)	0.001		Zinc (1979, 2005)	None	AO: ≤ 5.0
Chloride (1979, 2005)	None	AO: ≤ 250	2-Methyl-4-chlorophenoxyacetic acid (MCPA) (2022)	0.35				
Chlorite (2008)	1		Methyl tertiary-butyl ether (MTBE) (2006)	None	AO: ≤ 0.015	Ammonia (2013)*	None required	
Chlorpyrifos (1986)	0.09		Metribuzin (2021)	0.08		Asbestos (1989, 2005)*	None required	
Chromium (2018)	0.05		Nitrate (2013)	45 as nitrate; 10 as nitrate-nitrogen		Calcium(1987,2005)*	None required	
Colour (1979, 2005)	None	AO: ≤ 15 TCU	Nitrilotriacetic acid (NTA) (1990)	0.4		Chloramines (2020)*	None required	
Copper (2019)	2	AO: 1	Nitrite (2013)	3 as nitrite; 1 as nitrite-nitrogen		Chlorine (2009)*	None required	
Cyanide (1979, 1991)	0.2		N-Nitroso dimethylamine (NDMA) (2010)	0.000 04		Chlorine dioxide (2008)*	None required	
Cyanobacterial toxins (2018)	0.0015		Pentachlorophenol (1987, 2005)	0.06	AO: ≤ 0.03	Formaldehyde (1997)*	None required	
Dicamba (2022)	0.11		Perfluorooctane Sulfonate (PFOS) (2018)	0.0006		Hardness (1979)8	None required	
1,4-Dichlorobenzene (1987)	0.005	AO: ≤ 0.001	Perfluorooactanoic Acid (PFOA) (2018)	0.0002		Magnesium (1978)*	None required	
1,2-Dichloroethane (2014)	0.005		pH (2015)	None	7.0-10.5	Odour (1979, 2005)*		Inoffensive
1,1-Dichloroethylene (1994)	0.014		Selenium (2014)	0.05		Silver (1986,2005)*	None required	
Dichloromethane (2011)	0.05		Sodium (1979)	None	AO: ≤ 200	Taste (1979,2005)		Inoffensive

MAC: Maximum Acceptable Concentration
OG: Operational Guideline
AO: Aesthetic Objective
*Parameters that are listed in GCDWQ but are not assigned a numerical value

Under the *Environment Act*, Halifax Water WSPs are required to obtain an Approval to Operate from NSECC. These approvals ensure that the facilities meet environmental standards, comply with regulations, and have appropriate measures in place to protect water quality and the environment. Table 2.5 summarizes the treatment standards for drinking water quality for Halifax Water's WSPs included in the Approval to Operates. The Approval to Operate also includes minimum requirements for monitoring and sampling the WSPs and distribution systems (Schedule A of the specific WSP Approval to Operate documents, not included in this report) which is reported to NSECC during annual reporting.

Table 2.5: Halifax Water's Approval Limits

Facility	Turbidity (NTU)		Aluminum Residual (mg/L)		Free Chlorine Residual (mg/L)		Treatment Backwash (mg/L)				
	Individual Filter	Distribution	Conventional	Other	Min	Max	pH	TSS	TDS	Chlorine Residual	Total Aluminum
Bennery Lake	≤ 0.2 (95%), ≤ 1 (100%)	5	0.1	0.2	0.2	4	6.5-9	5	-	0.02	For pH < 6.5*: 0.005** For pH > 6.5*: 0.1**
Bomont	-	5	-	-	0.2	4	6.5-9.0	25	-	0.02	0.1
Collins Park	≤ 0.1 (95%), ≤ 0.3 (100%)	5	-	-	0.2	4	6.5-9.0	14	-	0.02	0.151**
Five Island Lake	≤ 1 (95%)	5	-	-	0.2	4	-	-	-	-	-
Lake Major	≤ 0.2 (95%), ≤ 1 (100%)	5	0.1	0.2	0.2	4	6.5-9	20	-	0.02	**
Middle Musq.	≤ 0.1 (99%), ≤ 0.3 (100%)	5	-	-	0.2	4	6.5-9.0	25	-	0.02	0.385**
J.D. Kline	≤ 0.15 (95%), ≤ 1 (100%)	5	0.1	0.2	0.2	4	6.5-9.0	5	-	0.02	0.184**
Silver Sands	≤ 1 (95%)	5	-	-	0.2	4	-	-	-	-	-

* Note: pH of the receiving watercourse not the backwash water

**Total Aluminum discharge limits are under review pending completion of the receiving water monitoring studies (pending approval of monitoring plan submitted to NSECC).

2.3 Potential Future Regulations Review

A review of drinking water quality guidelines in the Canadian provinces and in countries with similar drinking water treatment regulations indicated that drinking water quality guidelines are growing a tendency towards stricter limits for several heavy metals (arsenic, manganese, copper), microbiological contaminants (*E. Coli*, *Legionella,*), emerging contaminants (PFAS, cyanotoxins), and other chemical and physical parameters (fluoride). The countries included in the review of drinking water quality guidelines and regulations were the European Union (EU), the United Kingdom (UK), Japan, the United States (US), and Australia. Health Canada creates an initial list of chemical contaminants by following a prioritization process that considers factors like emerging scientific data, international assessments, and revisions to drinking water quality standards and guidelines in other countries, including those from organizations like the World Health Organization. The regions selected for this study often have stricter guidelines for chemical contaminants than in Canada and are included in the review by Health Canada.

Table 2.6 provides a summary of parameters for drinking water that were reviewed, along with those that are listed as Health Canada's current and future priorities for the next 5-year period and from the United States Environmental Protection Agency (USEPA) contaminant candidate list. Parameters in bold italics are current priorities being considered by Health Canada. Parameters in italics are on Health Canada's list for consideration in the next five years. The current limit range for these parameters represents the regulations implemented by the countries reviewed for this study. For a detailed overview of the drinking water quality guidelines and regulations reviewed for specific provinces and countries, refer to Appendix A.

A parameter may be considered a priority for several reasons including new scientific data, public interest or the time elapsed since the document was previously updated. Once a parameter has been identified as a priority, a risk assessment is undertaken by Health Canada evaluators which evaluates the health risk to the public along with considerations for treatment and analytical measurement. Following the risk assessment, the initial document undergoes a peer review by internal and external experts. It is then presented to the provincial and territorial stakeholders to review and endorse prior to publication to the public as a draft guideline document. A public consultation period is held, and Health Canada collects comments for review. The comments are then reviewed by the provincial, territorial and other key government stakeholders and the documents are updated as required. Final approval is completed by Health Canada and the provincial/territorial stakeholders, and the final documents are published. There is no set timeframe for the review process, but generally is completed in a 3–5-year time period.

Some of the parameters under consideration are based on the time elapsed since the previous review and are updated based on more relevant scientific data available. Some parameters may be reconfirmed, while others could see more stringent limits applied, or the limit concentration increased.

Table 2.6. Summary of Drinking Water Quality Guidelines Ranges

Parameter	Current (*GCDWQ*)	Industry Regulatory Limit Range
Chemical and Physical (mg/L)		
Acephate	-	0.008
Acrylamide	***-***	***0 – 0.1***
Aluminum	2.9, OG: 0.1	0.1 – 9.5
Antimony*	***0.006***	***0.003 – 0.01***
Arsenic	***0.01***	***0 – 0.01***
Asbestos	***-***	***0***
Atrazine	0.005	0.003 – 3.5
Boron	5	1 – 5
Bromoxynil	0.03	0.0035 – 0.005
Carbaryl	-	0.007 – 0.03
Carbendazium	-	0.09
Chlorate	*1*	*0.25 – 1*
Chlorite	*1*	*0.25 – 1*
Chloropicrin	-	0
Chlorpyrifos	0.09	0.01 – 70
Cobalt	-	0.001
Cyanide	*0.2*	*0.01 – 0.05*
Diazinon	-	0.004
1,4-Dichlorobenzene	***0.005***	***0.0003 – 0.04***
1,1-Dichloroethylene	***0.014***	***0 – 0.05***
Dieldrin	-	0.03
Dimethoate and omethoate	0.02	0.0006 – 0.0014
1, 4-dioxane	-	0.05
Diuron	-	0.02 – 0.11
Estriol/Estrone	-	
Fipronil	-	0.0007
Fluometuron	-	0.07
Fluoride*	***1.5***	***0.8 – 4***
Formaldehyde	*-*	*0.08 – 0.5*
Haloacetic acids - Total (HAAs)	***0.08***	***0.06 – 0.08***
Hydroxyatrazine	-	0.2
Iodide	-	0.5
Iprodione	-	0.1

Parameter	Current (*GCDWQ*)	Industry Regulatory Limit Range
Chemical and Physical (mg/L)		
Iron	***AO: ≤ 0.3***	***0.2 – 0.3***
Malathion	0.19	0.07 – 0.19
Manganese	0.12; AO: ≤ 0.02	0.02 – 0.5
Methomyl	-	0.02
Methyl tertiary-butyl ether (MTBE)	AO: ≤ 0.015	0.015
Metolachlor	-	0.01 – 35
Microcystin (Total)	0.0015	0.001-0.0015
Molybdenum	-	0.05 – 0.088
Nitrilotriacetic acid (NTA)	*0.4*	*0.2 – 0.28*
Permethrin	-	0.2
Phorate	-	0.002 – 1.4
Polycyclic aromatic hydrocarbons	-	0.1
Pentachlorophenol	*0.06; AO: ≤ 0.03*	*0 – 0.06*
PFAS*	***-***	***0.0001 – 0.5***
di(2-ethylhexyl) phthalate	-	0.01
Profenofos	-	0.0003
Propachlor	-	0.07
Propanil	-	0.7
Propargite	-	0.007
Propazine	-	0.05
Sodium	AO: ≤ 200	50 – 300
Styrene	-	*0.004 – 0.1*
Terbufos	-	0.0009 – 0.5
2,4,6-Trichlorophenol	***-***	***5***
Trihalomethanes (THMs)	0.1	0.1 – 1
Zinc	AO: ≤ 5	1 – 5
Microbiological		
E. coli (ND/100 mL)	ND/100 mL	0 – 10
Legionella (CFU/mL)		**< 1000 CFU**
Turbidity (NTU)	0.1-1	0.1-5

Radiological (Bq/L)		
Beryllium-7		
Bismuth-210		
Cesium-137	10	
Iodine-131	6	
Lead-210	0.2	
Polonium		
Radium-226	0.5	
Radium-224		
Radium-228		
Radon	None required	
Molybdenum-99		
Strontium-90	5	
Thorium-232		
Tritium	7000	
Uranium	N/A	
Additional Areas of Review		
Corrosion Control*		
Cyanotoxins/ Cyanobacteria		

*indicates draft technical guidelines/documents have been released by Health Canada in past year and final documents are forthcoming

2.3.1 Historically Relevant Parameters

Health Canada has recently updated the MAC for aluminum at 2.9 mg/L. However, this varies across different provinces as British Columbia sets the MAC at 9.5 mg/L and Newfoundland does not have one. The OG set by Health Canada is 0.1 mg/L. Japan, the UK and EU have a health guideline of 0.2 mg/L and Australia has an AO of 0.2 mg/L. Based on the varying guidelines in other countries, it could be possible that Canada decreases its MAC for aluminum from current limits to coincide with limits elsewhere.

Regulated disinfection byproducts, HAAs and THMs, have MACs set by Health Canada of 0.08 mg/L and 0.1 mg/L, respectively. The limits set by the USEPA are slightly lower than Canada's MACs for these parameters, with a limit of 0.08 mg/L for THMs and 0.06 mg/L for HAAs. The EU has a guideline of 0.06 mg/L for HAAs. THM regulations across the other countries from this study show similar values, except for Australia which has a health guideline of 0.25 mg/L. HAAs and THMs have been identified as a priority for Health Canada in the next review period. In addition to the regulated DBPs, the US EPA has identified 23 unregulated DBPs on the current contaminant candidate list which includes additional haloacetic acids (HAA9) and nitrogenous DBPs (N-DBPs) for future consideration.

Iron concentrations in the drinking water supply mostly stem from aesthetic, taste, and odor related concerns. Nova Scotia has adopted the *GCDWQ* aesthetic objective of 0.3 mg/L which is consistent with Australia's AO. Japan shares this value of 0.2 mg/L but as their standard value. The UK and EU have a more stringent maximum value of 0.2 mg/L in their drinking water. Health Canada has recently entered the consultation stage (as of Fall 2023) on reducing the AO limit to 0.1 mg/L for the *GCDWQ*.

Canadian municipal systems are required to have the capacity to meet the MAC of non-detectable levels per 100 mL for E. coli in drinking water. This MAC aligns with the drinking water guidelines set by various countries and international organizations. The WHO, EU, USEPA, the Japanese Ministry of Health, Labor and Welfare and the Australian National Health and Medical Research Council have all established a limit of zero E. coli per 100 mL. An overview of the microbiological documentation has been identified as a priority for Health Canada in the next 5 years.

Heavy metals, such as antimony and arsenic, have been identified for review on the short term by Health Canada. Part of the regular review process for Health Canada for the guidelines is to review parameters on rotating basis, which is likely the case for these two parameters. The current limits for both are in line with other jurisdictions. Health Canada recently completed the review period for the draft technical document for Antimony (March 2023).

Fluoride has had the current health-based limit of 1.5 mg/L since 2010. Health Canada has identified it as a high priority for review based on new information on the health risk and has established an expert panel to review current science and prepare a review. It is anticipated following this review that an updated guideline technical document will be released. The current fluoride limit is in line with Australia, the UK and EU, however Japan has a lower limit of 0.8 mg/L.

In 2023, Health Canada release a new guideline document on sampling and mitigation measures for controlling corrosion in drinking water supplies. It followed the reduction of the MAC for lead to 0.005 mg/L in 2019. The guidance document mainly focuses on how to sample for lead at the tap and has significant gaps compared to current industry knowledge. It is anticipated that that guidance around corrosion control will continue to evolve to match the current industry knowledge and standards, however it is unclear the timeline for implementation.

The USEPA in November 2023 announced the proposed Lead and Copper Rule Improvements (LCRI). The program includes several key provisions including achieving 100% lead pipe replacement within 10 years, locating legacy lead pipes and developing inventories and service line replacement plans, lowering the USEPA lead action level concentration from 15 μg/L to 10 μg/L and adjustments to tap sampling for lead at sites with lead service lines. If implemented, the LCRI would represent significant effort and cost to local governments and utilities to maintain compliance.

Current regulations generally rely on finished water quality leaving the water treatment plant as compliance points, with the main exceptions of chlorine residual, turbidity and microbiological parameters sampled from consumers taps. In recent years there has been a shift in the industry to put more emphasis around the tap water quality for other parameters of concern including manganese, lead and cadmium. This shift moves the sampling point from the utilities' infrastructure to the end user's premise plumbing. This can represent a significant risk to utilities efforts to meet regulatory limits as there are many factors within premise plumbing that can negatively impact the tap water quality outside the utilities' control (such as lead fixtures etc.), and currently remains a grey-area under existing regulations.

2.3.2 Emerging Parameters of Concern

In recent years, asbestos in drinking water was reported on in the news and became of public interest. The main source of asbestos in drinking water is from asbestos-cement pipes, which have been largely discontinued since the 1970's. Currently, Health Canada and WHO have concluded that there is no consistent evidence of a health risk from ingesting asbestos through drinking water, however it is on the current list of parameters to review.

The provinces, territories, and federal departments have worked with Health Canada to put forth a proposal for an objective of 30 ng/L as the combined total of all PFAS detected in drinking water with the goal to have PFAS concentrations as low as reasonably achievable (ALARA). This objective was established with a precautionary approach to minimize exposure to PFAS through the consumption of drinking water. From a regulatory standpoint, there is some uncertainty on how the objective set out by Health Canada is to be used compared to "formal" guidelines and the implications for provincial jurisdictions that adopt the *GCDWQ*. The EU has limits of 100 ng/L for the sum of 20 PFAS and 500 ng/L for the sum of all PFAS in drinking water. The US EPA is proposing Maximum Contaminant Levels (MCLs) of 4 ng/L for PFOA and PFOS as individual contaminants along with Maximum Contaminant Level Goals (MCLGs) of zero. Four other identified compounds (PFNA, PFHxS, PFBS and HFPO-DA) are proposed to have a hazard index applied with a value of 1. In addition to the proposed federal regulations, there are 10 states that have interim or final enforceable limits for PFAS. As the guideline decreases in the US, it could be expected that the limits will follow suit in Canada.

Legionella is one of a group of opportunistic pathogens that have become an emerging parameter of concern in municipal water systems. It is a naturally occurring bacteria, that can rapidly regrow at high concentrations when favorable conditions are present, which more often occurs in premise plumbing. The occurrence of Legionella in distribution systems is less understood. Across regions, the safe limit of exposure to legionella is still being determined and regulations are evolving. The directive (EU) 2020/2184 of the European Parliament and of the Council from 2020 on the quality of water intended for human consumption included Legionella as a parameter relevant for the risk assessment of domestic distribution systems. It states that actions could still be considered when Total Legionella sampling values are below 1000 CFU/L.

Cyanotoxins and cyanobacteria, often referred to as harmful algal blooms (HABs) in the drinking water context, have been identified as an emerging parameter of concern. Currently cyanotoxins are regulated based on a limit of 0.0015 mg/L for total microcystin, however there are other jurisdictions (Quebec, WHO, USEPA) that have developed limits for anatoxin-a (3.7 µg/L in Quebec) and cylindrospermopsin (US EPA limits of 3 µg/L for adults and 0.7µg/L for bottle-fed infants and pre-school children) that could be implemented in the future. As the industry understanding of HABs evolves, it is anticipated that additional guidelines will be implemented.

2.4 Drinking Water Regulations Summary

The drinking water quality guidelines applicable to Halifax Water WSPs are anticipated to become more stringent over time. Health Canada appears to have higher MACs than the US, EU, UK, Australia, and Japan in most cases. As aluminum, HAAs, THMs and manganese have health guidelines that appear to be lower elsewhere due to potential health risks, it is expected that Canada will adopt more similar values for health-based concentrations. The emerging contaminant of concerns, PFAS, has had health guidelines decreasing in other jurisdictions as a precautionary approach to reduce exposure of PFAS through drinking water. It could be expected that Canada will follow suit. Canada appears to have concentration values on the higher end of the aesthetic objectives as well. Evolving guidance around corrosion control and HABs will likely have the greatest change on the current WSP regulations. Shifts in focus on tap water quality over distribution or finished water sampling from the treatment plant will implication on compliance for parameters such as lead, DBPs and Legionella.

3 Wastewater Regulations

3.1 Halifax Water Wastewater Treatment Facilities

Halifax Water currently owns and operates fourteen wastewater treatment facilities (WWTFs) within Halifax Regional Municipality (HRM) with varying levels of treatment and daily flow capacities that serve a mixture of residential, industrial, commercial, and institutional customers. A brief overview of the Halifax Water WWTFs is provided in Table 3.1.

Table 3.1: Overview of Halifax Water Wastewater Treatment Facilities

Facility	Treatment Level	Type of Receiving Water
Aerotech	Advanced Treatment	Fresh Water
Dartmouth	Enhanced Primary	Marine
Eastern Passage	Secondary	Marine
Fall River	Advanced Treatment	Fresh Water
Frame	Advanced Treatment	Fresh Water
Halifax	Enhanced Primary	Marine
Herring Cove	Enhanced Primary	Marine
Middle Musquodoboit	Secondary	Fresh Water
Mill Cove	Secondary	Marine
North Preston	Advanced Treatment	Fresh Water
Springfield	Secondary	Fresh Water
Timberlea (BLT)	Secondary	Fresh Water
Uplands Park	Secondary	Fresh Water
Wellington	Advanced Treatment	Fresh Water

For the purposes of this study, current wastewater regulations within Canada and across the globe were reviewed to determine regulatory trends, to anticipate possible future regulations at the federal or provincial level that could be applicable to Halifax Water WWTFs.

3.2 Current Regulatory Environment

Wastewater effluent requirements in Canada are governed federally and provincially. The parties that are involved in the regulation of wastewater effluent in Nova Scotia include:

1. Environment and Climate Change Canada (ECCC).
2. Nova Scotia Environment and Climate Change (NSECC).

3.2.1 ECCC Regulations

The Wastewater System Effluent Regulations (WSER) are federal regulations under the *Fisheries Act* for wastewater effluent in Canada. These regulations apply to all wastewater treatment facilities (WWTFs) owned and operated by Halifax Water that collect an average daily flow of 100 m^3/d or more. The WSER limits summarized in Table 3.2 were issued in 2012 and came into effect in 2015; however, owners/operators were able to register for a Transitional Authorization if a WWTF was not designed to meet WSER limits.

Table 3.2: Wastewater System Effluent Regulation Limits

Parameter	Concentration (mg/L)
Carbonaceous Biological Oxygen Demand (CBOD)	25
Total Suspended Solids (TSS)	25
Un-ionized Ammonia (UIA)	1.25
Total Residual Chlorine (TRC)	0.02

The Halifax and Dartmouth WWTFs obtained Transitional Authorizations which are applicable from January 1, 2015, to December 31, 2040. Transitional Authorizations were not obtained for the remaining 12 facilities. Once the Transitional Authorizations for Halifax and Dartmouth facilities expire, effluent from these facilities will be required to meet the WSER limits. The effluent requirements outlined by the WSER Transitional Authorization for the Halifax and Dartmouth WWTFs are summarized in Table 3.3.

Table 3.3: WSER Transitional Authorization Effluent Limits until December 31, 2040

Parameter	Halifax Water WWTF	
	Halifax	Dartmouth
Carbonaceous Biological Oxygen Demand (CBOD) (mg/L)	67	39
Total Suspended Solids (TSS) (mg/L)	50	48
Un-ionized Ammonia (mg/L)	1.25	1.25

ECC is proposing amendments to Transitional Authorizations which is expected to come into effect in 2024. The amendments would provide eligible owners/operators of wastewater systems another opportunity to receive a TA to the end of 2030 or 2040 as the previous application deadline was June 30, 2014. The new application process is proposed to be based on the existing eligibility criteria stated in the WSER and will continue to utilize the existing points system to evaluate the risk associated with the system.

Prior to the WSER becoming law, the Canadian Council of Ministers of the Environment (CCME) implemented the Canada-wide Strategy for the Management of Municipal Wastewater Effluent in 2009. The Strategy provides a regulatory framework for managing municipal wastewater effluent and requires that all facilities achieve minimum National Performance Standards (NPS) as well as develop and manage site-specific Effluent Discharge Objectives (EDOs). The NPS address the most common pollutants in municipal wastewater effluent and are identical to current WSER regulations; however, the NPS do not include a limit for un-ionized ammonia. EDOs address specific substances of concern for a particular receiving environment such as nutrients, metals, and pathogens identified through an Environmental Risk Assessment (ERA). A summary of all substances of potential concern that could be considered in an ERA is provided in Appendix B.

The CCME developed a Standard Method for performing an ERA to determine EDOs that would not negatively impact the quality of the receiving water (i.e., change trophic status, increase CBOD or TSS concentrations, etc.). In determining EDOs, the ERA process considers factors such as the existing ambient water quality, recreational uses of the waterbody, dilution factors within a specified mixing zone (typically 100 m from the outfall), as well as Environmental Quality Objectives (EQOs) based on established guidelines including WSER, Canadian Environmental Quality Guidelines and other guidelines specific to the jurisdiction.

Although the Standard Method for ERAs is set Canada-wide, ERAs are dealt with at the provincial level with departments such as NSECC using the results of an ERA to help inform the effluent requirements set in the Approval to Operate for WWTFs in Nova Scotia.

3.2.2 NSECC Regulations

Each WWTF in Nova Scotia is required to obtain an Approval to Operate from NSECC which defines the specific effluent requirements for the facility. Prior to the CCME Canada-Wide Strategy, the *Atlantic Canada Wastewater Guidelines Manual for Collection, Treatment and Disposal 2006* provided a procedure for determining effluent quality requirements for new or upgraded wastewater treatment plants. Effluent limits for Halifax Water owned and operated WWTFs based on the Approvals to Operate issued by NSECC are summarized in Table 3.4.

Table 3.4: NSECC Effluent Compliance Requirements

Facility	CBOD (mg/L)	TSS (mg/L)	pH	*E. coli* (MPN/100mL)	Ammonia (mg/L)	Phosphorus (mg/L)	TRC (mg/L)	DO (mg/L)
Aerotech	5	5	6-9	200	1.2[a] 5.7[c]	0.13	N/A	6.5
Dartmouth	50	40	6-9	5,000[a]	N/A	N/A	N/A	N/A
Eastern Passage	25	25	6-9	200	N/A	N/A	N/A	N/A
Fall River	20	20	6.5-9	200	8.0[a]	1.2[a]	N/A	N/A
Frame	20	20	6-9	200	N/A	N/A	N/A	N/A
Halifax	50	40	6-9	5,000[a]	N/A	N/A	N/A	N/A
Herring Cove	50	40	6-9	5,000[ab]	N/A	N/A	N/A	N/A
Middle Musquodoboit	20	20	6-9	200	N/A	N/A	N/A	N/A
Mill Cove	25	25	6-9	200	N/A	N/A	N/A	N/A
North Preston	10	10	6-9	200	3.0	1.5	N/A	N/A
Springfield	20	20	6-9	200	N/A	N/A	N/A	N/A
Timberlea (BLT)	15	20	6-9	200	3.0[a] 5.0[c]	1.0[a] 3.0[c]	0.02	N/A
Uplands	20	20	6-9	200	N/A	N/A	N/A	N/A
Wellington	20	20	6-9	200	14.4[a]	1.0[a]	N/A	N/A

[a]May 31 to Oct 30; [b]December 25 to Jan 2; [c]Oct 31-May 30
N/A = no requirement stated.

As shown in Table 3.4, the CBOD and TSS limits set by NSECC in the current operating permits for the Halifax and Dartmouth WWTFs vary from the limits set in the WSER Transitional Authorizations for the WWTFs (Table 3.3). Preliminary discussions with NSECC regulators have indicated a willingness to adjust limits to match the WSER Transitional Authorization standards should Halifax Water apply for a renewal of the existing operating permits.

Four Halifax Water WWTFs (Halifax, Dartmouth, Mill Cove & Eastern Passage) were designed and issued approvals based on the Atlantic Canada guidelines prior to the CCME Canada-Wide Strategy; however, ERAs have since been performed for these WWTFs and others as follows:

- 2009: Eastern Passage WWTF.
- 2011: Timberlea WWTF.
- 2013: Wellington, Fall River, Frame, and Aerotech WWTFs.
- 2015: Halifax, Dartmouth, and Herring Cove WWTFs.
- 2019: Mill Cove WWTF.

Upon completing the ERAs, the NPS and site-specific EDOs were determined for these Halifax Water WWTFs based on the CCME Canada-wide Strategy for the Management of Municipal Wastewater Effluent. In performing the ERAs, the substances of potential concern provided in Appendix A were assessed; therefore, it is unlikely that any of the additional substances of potential concern listed will become a concern for compliance in the near future. In addition to these NPS and EDOs, the effluent cannot be acutely lethal.

3.3 Potential Future Regulations Review

A review of wastewater regulations in the Canadian provinces and in countries with similar wastewater treatment regulations indicated that wastewater effluent regulations are trending towards more stringent nutrient limits (nitrogen and phosphorus), lower bacterial limits and increasing public health data gathering. Countries or jurisdictions for which wastewater effluent guidelines and regulations were reviewed include the European Union, United Kingdom, Japan, United States, and Australia.

The identified ranges of typical regulated wastewater effluent parameters are summarized in Table 3.5. A more in-depth summary of wastewater effluent guidelines and regulations reviewed for individual provinces and countries is provided in Appendix B.

Table 3.5: Summary of Typical Effluent Requirement ranges

Parameter	Current Limit Range
Carbonaceous Biological Oxygen Demand (CBOD) (mg/L)	25
Total Suspended Solids (TSS) (mg/L)	25 - 45
Total Phosphorus (mg/L)	1 - 16
Total Nitrogen (mg/L)	10 - 15
Total Coliforms (MPN/100mL)	1,000 - 3,000
Total *E. coli* (MPN/100mL)	200
pH	6.0 - 9.0
Total Residual Chlorine (TRC)*	0.02
Un-Ionized Ammonia (UIA) (mg/L)	1.25

*Only applicable for WWTFs that use chlorine for disinfection.

3.3.1 Nutrients

Bodies of water that become enriched with nutrients experience eutrophication; therefore, managing the levels of nutrients discharged into receiving waters should be monitored. Nutrient limits are currently assessed through the ERAs performed by the standard CCME method; however, there are no national limits put in place. National limits for total nitrogen are set for the European Union, United Kingdom, and Japan with the most common limit set at 15 mg/L. Similar to how nitrogen limits are set at the provincial level in Nova Scotia using the ERA process, total nitrogen limits for WWTFs in the United States are regulated at the state level on a site-specific basis through a process similar to an ERA.

As part of the 2014 Regional Plan, HRM adopted water quality objectives which aimed to “achieve public health standards for body contact regulation” and “maintain the trophic status of lakes and waterways to the extent possible”. The municipal strategies are focused on limiting phosphorus from stormwater runoff or discharge from onsite sewage disposal systems from large developments and are not expected to affect Halifax Water WWTFs in the future. Phosphorus limits are already covered under the ERA process which sets phosphorus limits at concentrations that would not increase the trophic status of the receiving water.

Manitoba was the only province found to have a province-wide limit of 15 mg/L for total nitrogen. Alberta, British Columbia, and Ontario all noted that nitrogen and/or ammonia were determined on site-specific basis through performing an ERA.

British Columbia, Manitoba, and Alberta were the only provinces identified to set province-wide effluent regulations for phosphorus. Total phosphorus limits only applied to tertiary WWTFs in Alberta and supplemented by phosphate limits in British Columbia. Across the globe, Japan and Australia were found to have set total phosphorus limits while the United States assesses phosphorus limits on a site-specific basis, through a process similar to an ERA.

Setting blanket nutrient limits at the federal level is difficult as there are many factors to consider when setting these limits that are specific to the site and receiving water. Blanket nutrient limits would need to be achievable by most WWTFs and would likely be in the range of 10 -15 mg/L, if consistent with limits in other jurisdictions. Limits in this range would be higher, for the most part, than those currently required by several Halifax Water WWTFs through EDOs or NSECC Effluent Compliance Requirements. For this reason, potential future federal nutrient limits are not anticipated to significantly impact Halifax Water WWTFs which currently have a nutrient limit. However, nutrient limits are an important consideration during future planning for facilities that do not have an existing limit for nitrogen and/or phosphorus.

More stringent regulations for nitrogen and phosphorus would impact the WWTFs owned and operated by Halifax Water that do not currently have nutrient regulations. With regards to provincial limits, this risk is mitigated by the ERAs that have been performed for all these facilities, which would identify if the receiving water sensitivity warranted more stringent limits so that Halifax Water could proactively plan for these, if required. More stringent limits could require capital upgrades to several WWTFs to include nutrient removal in order to meet requirements.

3.3.2 Sanitary Sewer Overflows

Sanitary Sewer Overflows (SSOs) may occur within a sanitary system due to blockages, lines breaks, power failures, among other reasons. SSOs result in the release of raw sewage which can contaminate waterways and pose public health concerns as well as cause property damage. In 2009, the CCME provided a guideline for managing overflow events from sanitary sewers through the Canada-wide Strategy for the Management of Municipal Wastewater Effluent which included:

- Sanitary sewer overflow frequencies will not increase due to development or redevelopment.
- Sanitary sewer overflows will not occur during dry weather, except during spring thaw and emergencies.

These guidelines were not carried over to the WSER and are not considered regulations for SSOs. Currently, SSOs do not have specific regulations at the federal, provincial, or municipal level; however, wastewater released from an SSO is likely to meet the definition of a deleterious substance and release of a deleterious substance is prohibited under the Fisheries Act.

3.3.3 Other Emerging Parameters

3.3.3.1 Air Emissions

Airborne emissions at WWTF's are typically addressed within their operating permits. Historically, clauses within these permits have focused on the requirement to reduce odours with some variation based on the sensitivity of the receptors in the area specific to a given facility. This is not expected to change and therefore Halifax Water should not be impacted by future regulatory change in this area. More recently, climate change concerns have resulted in a heightened awareness of greenhouse gases produced at wastewater treatment facilities including methane (CH_4) and Nitrous Oxide (N_2O). Methane is produced during the anaerobic digestion of wastewater residuals and its generation is well understood and specifically regulated by the digester gas code. Nitrous oxide emissions vary substantially between plants primarily due to differing designs and operational conditions; however, the detailed mechanisms remain to be fully delineated reducing the likelihood of regulation in the near future.

3.3.3.2 Public Health Monitoring

During the SARS-CoV-2 pandemic, many governments realized the potential for and benefits of collecting public health data through wastewater systems. For example, an amendment to the *Urban Wastewater Treatment Directive 1991* made in 2022 states that all EU Member States must establish a national urban wastewater monitoring system to monitor relevant public health parameters in urban wastewater. By January 1, 2025, Member States will have to set up a coordination structure between public health authorities and urban wastewater treatment which will determine the parameters to be monitored, testing frequency and method to be applied. The amendment also states that until public health authorities establish that the SARS-CoV-2 pandemic is not a risk for the population, urban wastewaters from at least 70% of the national population will be monitored.

The World Health Organization (WHO) has declared antimicrobial resistance (AMR) as one of the top 10 global public health threats facing humanity. AMR occurs naturally overtime but has been accelerated by the overuse and misuse of antibiotics leading to humans and animals becoming infected with pathogens that cannot be treated with antibiotics currently on the market. Antimicrobial resistance markers can be monitored in wastewater and source tracked to determine their origins whether it be hospitals or farms in order to understand risk to human, animal and environmental health. In the EU, an amendment has stated that all WWTFs servicing at least 100,000 people, Member States will also have to regularly monitor antimicrobial resistance markers in the outlets of urban wastewater treatment plants.

Although wastewater-based epidemiology is gaining traction across the globe, based on the current use of wastewater as a source of public health data in Nova Scotia and across Canada, it is unlikely that it will become federally or provincially regulated in the near future. If regulations were to come into place for wastewater-based epidemiology, it would likely be focused on data collection and reporting in order to gain public health data and would not likely require changes to wastewater treatment processes.

Industry knowledge on emerging parameters such as pharmaceuticals and microplastics in wastewater effluent is expanding; however, at this time there is limited guidance or regulation on these parameters in wastewater as they are still very much in the academic and research realm. Until these parameters are better understood, including the extent of their presence in wastewater, risk to the environment and human health, and effective removal processes, they will likely not be regulated.

3.3.3.3 Biosolids

Biosolids are currently hauled from Halifax Water WWTFs for beneficial reuse. The biosolids are processed into a fertilizer product using a lime stabilisation process at the Aerotech Biosolids Facility. The final fertilizer product currently meets the USEPA Class A standards for biosolids products which specifies heavy metal and other pollutant limits for land application use, as well as the Canadian Food Inspection Agency (CFIA) Requirements under the Canadian Fertilizer Act for labelling as a fertilizer product for sale in Canada.

Per- and Polyfluroalkylated Substances (PFAS) are emerging parameters of concern within biosolids as they are thermally and chemically stable chemicals used in a variety of industries such as cosmetics, food packaging and pharmaceuticals. PFAS accumulate in soil with fertilizer applications over time and can be harmful to humans, animals, and environment; however, research on the impact of PFAs on soil and human health is still in the early stages. Currently, these “forever chemicals” are best dealt with through source control and limiting the concentration of PFAS permitted in biosolids that will be used for land application.

In May 2023, the CFIA announced a proposed interim standard for PFAS in biosolids imported or sold in Canada as fertilizers as there is currently no standard for PFAS in biosolids in Canda. This would require that "biosolids contain less than 50 ppb (µg/kg) of perfluorooctane sulfonate (PFOS) as an indicator before they can be imported or sold in Canada” (CFIA, 2023). The CFIA noted that “90% of all Canadian produced biosolids contain less than 50 ppb of PFOS"; therefore, this interim standard is not anticipated to negatively impact the majority of domestic biosolids waste diversion efforts across Canada. The goal of this interim standard is to prevent the importing or selling of biosolids products that are heavily impacted by industrial inputs from being imported for use as fertilizes in Canada and is not expected to negatively impact the Aerotech biosolids facility.

3.4 Wastewater Regulations Summary

In summary, existing regulations and guidelines applicable to Halifax Water WWTF's are well aligned with those in other jurisdictions and no significant changes are anticipated for currently regulated parameters in wastewater effluent or biosolids. Regulations for emerging parameters such as air emissions or microplastics are not anticipated to be implemented in the near future, as research and guidance on how best to manage these parameters is still in its infancy.

Additional regulated parameters identified in other jurisdictions such as the European Union and Australia, indicated the potential for effluent nutrient limits (nitrogen and phosphorus) at the federal level. Nutrient limits are put in place as a means of protecting the environment and preventing eutrophication. As is the case in Nova Scotia, there are several areas such as Manitoba, Alberta, and the United States where nutrient limits are currently set on a site-specific basis through Environmental Risk Assessments, and as long as this approach is continued, the risk of tightening nutrient-related effluent criteria is expected to be relatively low.

4 Stormwater Regulations

4.1 Halifax Water Stormwater Management

Stormwater is the water from rain, melted snow or ice that runs off impervious surfaces such as roofs, sidewalks, and parking lots and pervious surfaces when rainfall intensity is high.

Urbanization increases the amount of surface runoff due to an increased number of impervious surfaces and loss of trees and natural ground cover which allow stormwater to slowly infiltrate. Stormwater from urban areas like Halifax can significantly impact downstream watersheds as it can carry a variety of pollutants including oil, grease, fertilizer, nutrients, and pathogens.

Halifax Water manages stormwater through assets including dry ponds, wet ponds, separated sewer systems and combined sewer systems. Separated sewer systems include sanitary sewers which carry sewage to WWTFs and storm sewers which carry stormwater directly to nearby waterway outfalls. Combined sewer systems (CSS) use a single system to take both sewage and stormwater directly to a wastewater treatment facility and include Combined Sewer Overflow (CSO) points where overflow is screened and discharged into waterways.

4.2 Current Regulatory Environment

Currently, there are limited regulations surrounding stormwater in Canada and it is typically managed at the provincial and/or municipality level. The following section will discuss the regulations surrounding stormwater in terms of infrastructure and source management as well as CSOs, as overflows typically occur due to high stormwater flows within a CSS.

4.2.1 Stormwater Infrastructure Regulations

There are currently limited regulations for stormwater infrastructure in Canada. Many provinces including Alberta, British Columbia, Ontario, and Manitoba implement Stormwater Best Management Practices (BMP) and low impact development strategies in order to mange stormwater rather than regulations. Within these BMPs, source control is a preferred method for managing stormwater as it retains stormwater at the site on which it falls using low impact development strategies such as green infrastructure (green roofs, rain gardens, dry ponds, constructed wetlands, etc.).

The Province of Nova Scotia does not set stormwater discharge quality standards in the same manner as it does for wastewater effluent. In HRM, there are stormwater By-Laws (G-200 and L-400) as well as the *Halifax Stormwater Management Standards for Development Activities* for managing stormwater. These documents are focused on what enters stormwater systems however, these by-laws do not pertain to what can be discharged at end-of-pipe. As is the case in many other Canadian cities, these By-Laws are centered around land development practices as the municipality is responsible for regulating land development activities. Since land development can lead to increased surface runoff, these regulations set volumetric targets for retaining a specified amount of stormwater onsite, reducing total suspended solids (TSS) load prior to discharging from the site to a sewer system, and submittal of erosion control plans.

The *Halifax Stormwater Management Standards for Development Activities* document recommends that a hierarchy approach be taken for stormwater management and infrastructure. The top priority is to control sources of stormwater where it reaches a site (i.e., retain water where it falls). Following implementation of source control, conveyance control measures are recommended to be implemented, such as vegetation swales or infiltration systems with the goal of limiting stormwater flow across the site. The last stormwater management opportunity is to consider end-of-pipe control which involves implementing treatment before the stormwater leaves a site. These standards are applicable to management of stormwater before it is discharged to Halifax Water's infrastructure.

4.2.2 Combined Sewer Overflows Regulations

CSOs are a concern to public health and the environment as the stormwater and its pollutants are also mixed with sanitary wastewater. CSO points are regulated federally through the WSER and are applicable to Halifax Water. The federal regulations currently required for each CSO point include recording of the following:

- The date of each day on which effluent was deposited via the overflow point.
- For each of those days, the duration or estimated duration, expressed in hours, of the deposit, along with an indication of whether it is the duration or an estimated duration and
- The daily volume of the effluent deposited, expressed in m^3, if that volume is yielded by a continuous measure.
- The estimated daily volume of the effluent deposited, expressed in m^3, in any other case.
- The volume or estimated volume, expressed in m^3, of effluent for each month during which effluent was deposited via the overflow point.
- The number of days in each of those months during which effluent was deposited via the overflow point.

- For each month of the calendar year during which effluent was not deposited via a combined sewer overflow point, a statement indicating that no effluent was deposited via an overflow point during the month.

Prior to the WSER, the CCME provided a guideline for managing overflow events from combined sanitary sewers in 2009 through the Canada-wide Strategy for the Management of Municipal Wastewater Effluent. The strategy states that no Canadian jurisdiction currently allows the construction of new combined sewers, although existing ones may be replaced or rehabilitated. Similar to National Performance Standards (NPS) developed by the CCME for wastewater effluent, NPS were developed for CSOs and included:

- No increase in combined sewer overflow frequency due to development or redevelopment, unless it occurs as part of an approved combined sewer overflow management plan.
- No combined sewer overflow discharge during dry weather, except during spring thaw and emergencies.
- Removal of floatable materials where feasible.

However, these guidelines were not carried into WSER and are not CSO regulations but rather best practices guidelines.

4.3 Potential Future Regulations Review

Following a review of federal regulations surrounding stormwater in other countries including the United States, Australia, and the United Kingdom, it was found that, like Canada, there are minimal federal stormwater regulations in place and stormwater is typically managed at the city level. Regulations surrounding stormwater management and system design have not changed in many of these countries since the early 2000's; however, the UK's Department for Environment, Food & Rural Affairs submitted the Storm Overflows Reduction Plan in 2022. The Plan will push water companies in the UK to reduce stormwater overflows and remove existing connections of stormwater to combined sewers. The Plan will only allow water companies to discharge from a storm overflow where they can demonstrate that there is no local adverse ecological impact. Other requirements of the Plan include water companies apply disinfection to storm overflows discharging into or near designated bathing waters to significantly reduce harmful pathogens or reduce the frequency of discharges to meet Environment Agency spill standards by 2035. A more in-depth summary of the Canadian federal regulations and the UK's Storm Overflows Reduction Plan are provided in Appendix C.

4.3.1 Potential Stormwater Infrastructure Management

In 2021, the Nova Scotia Government passed the Environmental Goals and Climate Change Reduction Act, which contains 28 goals to address the current climate emergency. Included in the Act is the Government's goal to develop provincial water quality objectives to guide activities that affect water quality by 2026. The focus of this goal is to "establish science-based water quality targets for Nova Scotia lakes and groundwater quality". In addition to developing the water quality targets, government departments have the initiative to develop policy recommendations for how to implement and reach the targets. As of 2023, this includes identifying opportunities to update municipal engineering specifications for stormwater infrastructure, updating planning requirements related to stormwater management plans and potential areas of risk. Future guidelines that may arise from the water quality objectives are anticipated to align with specifications or best practices for stormwater infrastructure rather than numerical value limits on parameters in stormwater effluent.

4.3.2 Potential Combined Sewer Overflow Management

As previously discussed, there are limited regulations surrounding CSO effluent water quality. The City of Winnipeg was found to have the most extensive requirements for CSOs. The terms and conditions of the City's license to operate a CSS include developing an internet-based public notification system for all discharges from CSO points, reducing CSO events to 4 events per year or less and ensuring CSO effluent quality is equivalent to that specified for primary treatment (Table 4.1) to 85% or more of the wastewater collected in the CSS during wet weather periods.

Table 4.1: Primary Treatment Effluent Quality Limits (City of Winnipeg, 2013)

Parameter	Limit
Biochemical Oxygen Demand (BOD) (mg/L)	50
Total Suspended Solids (TSS) (mg/L)	50
Total phosphorus (mg/L)	1
E. coli (MPN/100 mL)	1000

The City of Toronto implemented the Wet Weather Flow Master Plan in 2017 which is a 25-year plan focusing on stormwater management in the city. Significant progress has already been made on many projects to reduce CSOs and upgrade system technology and infrastructure to capture, transport and treat water collected in the CSS. This is an example of the direction in which CSO management is headed and how major cities are planning significant infrastructure upgrades to minimize environmental impacts.

Enforcing specific effluent discharge limits for stormwater and CSOs would be difficult, particularly in a city like Halifax, as it would require some form of treatment prior to discharge, which would require significant changes to infrastructure in addition to effluent quality monitoring at the CSOs. Based on the current regulatory environment, initiatives working towards reducing or eliminating CSOs from a system are more likely to occur than regulations surrounding CSO discharge water quality.

4.4 Stormwater Regulations Summary

Overall, there is an increased awareness towards better stormwater management, particularly in the case of combined sewer systems and the implementation of best management practices to mitigate impacts to quantity and quality of stormwater runoff due to development.

Potential monitored parameters for stormwater discharges or CSOs are anticipated to be the commonly monitored parameters of wastewater effluent (BOD, TSS and *E. coli*). As the City of Winnipeg was the only jurisdiction identified to have CSO effluent quality limits, it is difficult to gather a sense for trends in CSO effluent quality limits.

Based on current trends in the sector, it is difficult to gauge how stringent stormwater or CSO regulations will become in the future; however, plans to minimize or eliminate CSO events were identified across several jurisdictions as well as the consideration for source control and green infrastructure to manage stormwater at the source.

5 References

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APPENDIX A

Drinking Water Regulations Summary Table

Chemical and Physical	GCDWQ Health Canada		Nova Scotia		Ontario	British Columbia		Alberta		Manitoba		Quebec	Saskatchewan			PEI		New Brunswick		Newfoundland		USEPA		WHO	Japan	Australia		UK	Europe
	MAC (mg/L)	Other value (mg/L)	MAC (mg/L)	Other value (mg/L)	MAC (mg/L)	MAC (mg/L)	AO (mg/L)	MAC (mg/L)	Other value (mg/L)	SW (mg/L)	GW/GUDI (mg/L)	Max Conc (mg/L)	MAC (mg/L)	IMAC (mg/L)	AO (mg/L)	MAC (mg/L)	AO (mg/L)	MAC (mg/L)	AO (mg/L)	MAC (mg/L)	Other Value (mg/L)	MCLG (mg/L)	MCL or TT (mg/L)	Max Value (mg/L)	Max Value (mg/L)	Health (mg/L)	Aesthetic (mg/L)	Max Value (mg/L)	Max Value (mg/L)
Acephate																										0.008			
Acrylamide																						0	dosed at 1 mg/L	0.0005		0.0002		0.0001	0.0001
Aluminum	2.9	OG: 0.1	2.9	OG: 0.1		9.5		2.9	OG: 0.1											None	OG <0.1				0.2		0.2	0.2	0.2
Amentryn																										0.07			
Amitraz																										0.009			
Ammonia	None required	None	None required	None				None required	None																		0.5		0.5
Antimony	0.006	None	0.006	None	0.006	0.006		0.006	None			0.006				0.006		0.006		0.006		0.006	0.006	0.02		0.003		0.005	0.01
Arsenic	0.01	None	0.01	None	0.01	0.01		0.01	None		0.01	0.01	0.01			0.01		0.01		0.01		0	0.01	0.01	0.01	0.01		0.01	0.01
Alachlor					0.005																	0	0.002	0.02					
Aldicarb												7												0.01		0.004			
Aldrin												0.7												0.00003		0.0003		0.00003	
Alkalinity (as CaCO3)															500	None													
Asbestos	None required	None	None required	None				None required	None													7 MFL	7 MFL			-			
Asulam																										0.07			
Atrazine	0.005	None	0.005	None	0.005			0.005	None			3.5		0.005								0.003	0.003	0.1		0.02			
Azinphos-methyl					0.02							0.017														0.03			
Barium	2	None	2	None	1			2	None			1	1			2		1		2		2	2	1.3		0.09			
Beryllium																						0.004	0.004			0.06			
Benomyl																										0.09			
Bentazone																										0.4			
Benzene	0.005	None	0.005	None	0.001	0.005		0.005	None			0.0005	0.005					0.005				0	0.005	0.01	0.01	0.001		0.001	0.001
Benzo(a)pyrene	0.000 04	None	0.000 04	None	0.00001			0.000 04	None			0.00001	0.00001					0.00001				0	0.0002	0.0007				0.00001	0.00001
Bisphenol A																													0.0025
Bioresmethrin																										0.1			
Boron	5	None	5	None	5	5		5	None			5		5				5		5				2.4	1	4		1	1.5
Bromacil																										0.4			
Bromate	0.01	None	0.01	None	0.01			0.01	None	0.01	0.01	0.01	0.01									0	0.01	0.01	0.01	0.02		0.01	0.01
Bromodichloromethane																								0.06	0.03				
Bromophos-ethyl																										0.01			
Bromoform																		Not established						0.1	0.09				
Bromoxynil	0.03	None	0.03	None	0.005			0.03	None			0.0035		0.005												0.01			
Cadmium	0.007	None	0.007	None	0.005	0.005		0.007	None			0.005	0.005			0.0007		0.005		0.007		0.005	0.005	0.003	0.003	0.002		0.005	0.005
Calcium	None required	None	None required	None				None required	None							None									300				
Captan																										0.4			
Carbaryl					0.09							0.07														0.03			
Carbofuran					0.09							0.07	0.09									0.04	0.04	0.007					
Carbendazium																										0.09			
Carfentrazone-ethyl																										0.1			
Carbon tetrachloride	0.002	None	0.002	None	0.002	0.002		0.002	None			0.005	0.005					0.005				0	0.005	0.004	0.002	0.003			
Carbophenothion																										0.0005			
Carboxin																										0.3			
Chloramines	None required	None	None required	None	3			None required	None			3										4	4						
Chlorantraniliprole																										6			
Chlorate	1	None	1	None	1	1		1	None	1	1	0.8	1											0.7	0.6				0.25
Chlordane																						0	0.002	0.0002		0.002			
Chlorfenvinphos																										0.002			
Chloride	None	AO: ≤ 250	None	AO: ≤ 250			250	None	AO: ≤ 250						250		250		250		AO: <=250				200		250		250
Chloroacetic acid																									0.02	0.15			
Chlorobenzene																										0.3	0.01		
Chloroketones																													
Chlorophenol, 2																										0.3	0.0001		
Chlorophenol, 2,3,4,6-TTCP						0.1	0.001																						
Chlorophenol, 2,4-DCP						0.9	0.003																			0.2	0.0003		
Chlorophenol, 2,4,6-TCP						0.005	0.002																			0.02	0.002		
Chlorophenol, DCP							0.0003																						
Chlorophenol, MCP							0.0001																						
Chlorophenol, PCP						0.06	0.03																						
Chlorophenol, TCP							0.002																						
Chlorophenol, TTCP							0.001																						
4-chloro-2-methylphenoxy) acetic												0.03																	
acid also referred to as MCPA																													
Chlorinated furanones (MX)																													
Chlorine	None required	None	None required	None				None required	None													4	4	5		5	0.6		
Chlorine dioxide	None required	None	None required	None				None required	None													0.8	0.8				0.4		
Chlorite	1	None	1	None	1	1		1	None	1	1	0.8	1									0.8	1	0.7		0.8			0.25
Chlorobenzene																						0.1	0.1						
Chloroform																		not established						0.3	0.06				
Chlorotoluron																								0.03					
Chloroxuron																										0.01			
Chloropicrin																													
Chlorpyrifos	0.09	None	0.09	None	0.09			0.09	None			0.07	0.09											0.03		0.01			
Chlorsulfuron																										0.2			
Chlorothalonil																										0.05			
Chromium	0.05	None	0.05	None	0.05	0.05		0.05	None			0.05	0.05			0.05		0.05		0.05		0.1	0.1	0.05	0.05	0.05		0.05	0.025
Clostridium perfringens including spores																													0
Clopyralid																										2			
Cobalt						0.001																							
Conductivity																													2500 uS/cm
Colour	None	AO: ≤ 15 TCU	None	AO: ≤ 15 TCU			15	None	AO: ≤ 15 TCU						15 TCU						AO: <= 15 TCU				5 degree		15 HU	20	
Copper	2	AO: 1	2	AO: 1			1	2	AO: 1			1			1	2	1		1	2	AO: <=0.3	1.3	1.3	2	1	2	1	2	2
Cyanazine												0.009												0.0006					
Cyanide	0.2	None	0.2	None	0.2	0.2		0.2	None			0.2	0.2									0.2	0.2		0.01	0.08		0.05	0.05
Cyanogen chloride																										0.08			
Cylindrospermopsins (Cyanobacterial toxin)																								0.0007					
																								0.003 *short term					
Cyflutherin																										0.05			
Cypermethrin isomers																										0.2			
Cyprodinil																										0.09			
Cyanobacterial toxins	0.0015	None	0.0015	None		0.0015		0.0015	None																				
Dalapon																						0.2	0.2						
Deltamethrin																										0.04			
Diazinon					0.02							0.014														0.004			
1,2-Dibromo-3-chloropropane (DBCP)																						0	0.0002	0.001					

Chemical and Physical	GCDWQ Health Canada		Nova Scotia		Ontario	British Columbia		Alberta		Manitoba		Quebec	Saskatchewan			PEI		New Brunswick		Newfoundland		USEPA		WHO	Japan	Australia		UK	Europe
	MAC (mg/L)	Other value (mg/L)	MAC (mg/L)	Other value (mg/L)	MAC (mg/L)	MAC (mg/L)	AO (mg/L)	MAC (mg/L)	Other value (mg/L)	SW (mg/L)	GW/GUDI (mg/L)	Max Conc (mg/L)	MAC (mg/L)	IMAC (mg/L)	AO (mg/L)	MAC (mg/L)	AO (mg/L)	MAC (mg/L)	AO (mg/L)	MAC (mg/L)	Other Value (mg/L)	MCLG (mg/L)	MCL or TT (mg/L)	Max Value (mg/L)	Max Value (mg/L)	Health (mg/L)	Aesthetic (mg/L)	Max Value (mg/L)	Max Value (mg/L)
Dibromoacetonitrile																								0.1					
1,2-Dibromoethane																								0.0004					
Dichloroacetate																								0.05					
Dichloroacetic acid																									0.03	0.1			
Dichloroacetonitrile																								0.02					
Dibromochloromethane																		not established						0.001	0.1				
Dicamba	0.11	None	0.11	None	0.12			0.11	None			0.085	0.12													0.1			
Dichlobenil																										0.01			
1,2-Dichlorobenzene					0.2	0.2	0.003					0.15	0.2					0.2						1		1.5	0.001		
1,3-Dichlorobenzene																											0.02		
1,4-Dichlorobenzene	0.005	AO: ≤ 0.001	0.005	AO: ≤ 0.001	0.005	0.005	0.001	0.005	AO: ≤ 0.001			0.005	0.005					0.005						0.3		0.04	0.0003		
o-Dichlorobenzene																						0.6	0.6						
p-Dichlorobenzene																						0.075	0.075						
1,2-Dichloroethane	0.005	None	0.005	None	0.005	0.005		0.005	None			0.005		0.005				0.005				0	0.005	0.03		0.003		0.003	0.003
1,2-Dichloroethene																								0.05		0.06			
1,1-Dichloroethylene	0.014	None	0.014	None	0.014	0.014		0.014	None			0.01	0.014									0	0.005						
cis-1,2-Dichloroethylene																						0.07	0.07		0.04				
trans-1,2-Dichloroethylene																						0.1	0.1		0.04				
Dichloromethane	0.05	None	0.05	None	0.05	0.05		0.05	None			0.05	0.05					0.05				0	0.005	0.02	0.02	0.004			
Dichlorophenol					0.9							0.7	0.9																
2,4-Dichlorophenoxy acetic acid (2,4-D)	0.1	None	0.1	None	0.1			0.1	None			0.07		0.1								0.07	0.07	0.03		0.03			
2,4-DB																								0.09					
DDT and metabolites																								0.001		0.009			
1,2-Dichloropropane																						0	0.005	0.04					
1,2-Dichloropropene																								0.02					
1,3-Dichloropropene																										0.1			
Dichlorprop																								0.1		0.1			
Dichlorvos																										0.005			
Diclofop-methyl					0.02							0.007	0.009													0.005			
Dicofol																										0.004			
Dieldrin																												0.00003	
Difenzoquat																										0.1			
Diflubenzuron																										0.07			
Di(2-ethylhexyl) adipate																						0.4	0.4						
Di(2-ethylhexyl) phthalate																						0	0.006	0.008					
Dinoseb												0.007										0.007	0.007						
Dimethoate and omethoate	0.02	None	0.02	None	0.02			0.02	None			0.014		0.02										0.0006		0.007			
Diphenamid																										0.3			
1, 4-dioxane																									0.05				
Diquat	0.05		0.05		0.000000015			0.05				0.05										0	0.00000003	0.05		0.007			
Disulfoton	0.05	None	0.05	None	0.07			0.05	None													0.02	0.02			0.004			
Diisopropanolamine						3.5																				0.5			
Diuron					0.15							0.11														0.02			
Edetic acid																								0.6					
EDB																										0.001			
Endosulfan																										0.02			
Endothall																						0.1	0.1			0.1			
Endrin																						0.002	0.002	0.0006					
Epichlorohydrin																						0	TT8	0.0004		0.0005		0.0001	0.0001
EPTC																										0.3			
Esfenvalerate																										0.03			
Ethion																										0.004			
Ethoprophos																										0.001			
Ethylbenzene	0.14	AO: 0.0016	0.14	AO: 0.0016	0.14	0.14	0.0016	0.14	AO: 0.0016		0.14				0.0016				0.0024			0.7	0.7	0.3		0.3	0.003		
Ethylene dibromide																						0	0.00005						
Etridiazole																										0.1			
Fenamiphos																										0.0005			
Fenarimol																										0.04			
Fenchlorphos																													
Fenitrothion																										0.007			
Fenoprop																								0.009		0.01			
Fensulfothion																										0.01			
Fenthion																										0.007			
Fenvalerate																										0.06			
Fipronil																										0.0007			
Flamprop-methyl																										0.004			
Fluometuron																										0.07			
Fluoride	1.5	None	1.5	None	1.5	1.5		1.5	None		1.5	1.5	1.5					1.5		1.5		4	4	1.5	0.8	1.5		1.5	1.5
Fluproponate																										0.009			
Formaldehyde	None required	None	None required	None				None required	None																0.08	0.5			
Formothion																										0.05			
Fosamine																										0.03			
Glyphosate	0.28	None	0.28	None	0.28			0.28	None			0.21										0	0.7			1			
Haloacetic acids - Total (HAAs)	0.08	None	0.08	None	0.08			0.08	None	0.08	0.08	0.06	0.08							80 ug/L		N/A	0.06						0.06
Haloxyfop																										0.001			
Heptachlor																						0	0.0004			0.0003		0.00003	
Heptachlor epoxide																						0	0.0002					0.00003	
Hexachlorobenzene																						0	0.001						
Hexachlorobutadiene																								0.0006		0.0007			
Hexaflurate																										0.03			
Hexachlorocyclopentadiene	ALARA		ALARA					ALARA														0.05	0.05						
Hexazinone																										0.4			
Hydrogen ion concentration																													≥ 6,5 and ≤ 9,5
Hydrogen sulfide																											0.05		
Hydroxyatrazine																								0.2					
Hardness	None required	None	None required	None				None required	None						800		200										200		
Imazapyr																										9			
Iodide																										0.5			
Iprodione																										0.1			
Isoproturon																								0.009					
Iron	None	AO: ≤ 0.3	None	AO: ≤ 0.3			0.3	None	AO: ≤ 0.3						0.3		0.3		0.3		AO: 0.3				0.3		0.3	0.2	0.2
Lanthanum																										0.002			
Lead	0.005 ALARA	None	0.005 ALARA	None	0.01	0.005		0.005 ALARA	None	0.005	0.005	0.005	0.01			0.005		0.01		0.005		0	0.015	0.01	0.01	0.01		0.01	0.005

Chemical and Physical	GCDWQ Health Canada		Nova Scotia		Ontario	British Columbia		Alberta		Manitoba		Quebec	Saskatchewan			PEI		New Brunswick		Newfoundland		USEPA		WHO	Japan	Australia		UK	Europe
	MAC (mg/L)	Other value (mg/L)	MAC (mg/L)	Other value (mg/L)	MAC (mg/L)	MAC (mg/L)	AO (mg/L)	MAC (mg/L)	Other value (mg/L)	SW (mg/L)	GW/GUDI (mg/L)	Max Conc (mg/L)	MAC (mg/L)	IMAC (mg/L)	AO (mg/L)	MAC (mg/L)	AO (mg/L)	MAC (mg/L)	AO (mg/L)	MAC (mg/L)	Other Value (mg/L)	MCLG (mg/L)	MCL or TT (mg/L)	Max Value (mg/L)	Max Value (mg/L)	Health (mg/L)	Aesthetic (mg/L)	Max Value (mg/L)	Max Value (mg/L)
Lindane																						0.0002	0.0002	0.002		0.01			
Magnesium	None required	None	None required	None				None required	None						200	None									300				
Malathion	0.19	None	0.19	None	0.19			0.19	None			0.14	0.19													0.07			
Mancozeb																										0.009			
Manganese	0.12	AO: ≤ 0.02	0.12	AO: ≤ 0.02			0.02	0.12	AO: ≤ 0.02	0.12	0.12				0.05	0.12	0.02		0.05	0.12	AO: 0.02			80	0.05	0.5	0.1	0.05	0.05
Mercury	0.001	None	0.001	None	0.001	0.001		0.001	None			0.001	0.001					0.001		0.001		0.002	0.002	0.006	0.0005	0.001		0.001	0.001
Mecoprop																								0.01					
Metaldehyde																										0.02			
Metham																										0.001			
Methidathion																										0.006			
Methiocarb																										0.007			
Methomyl																										0.02			
2-Methyl-4-chlorophenoxyacetic acid (MCPA)	0.35	None	0.35	None	0.1			0.35	None				0.1													0.04			
Methyl tertiary-butyl ether (MTBE)	None	AO: ≤ 0.015	None	AO: ≤ 0.015			0.015	None	AO: ≤ 0.015																				
Methyloxychlor												0.7										0.04	0.04	0.02		0.3			
Methyl bromide																										0.001			
Metiram																										0.009			
Metolachlor					0.05							0.035												0.01		0.3			
Microcystins (cyanobacterial toxin)					0.0015					0.0015		0.0015	0.0015											0.001		1.3 ug/L			0.001
																								0.012 *short term					
Metribuzin	0.08	None	0.08	None	0.08			0.08	None			0.06														0.07			
Metsulfuron-methyl																										0.04			
Mevinphos																										0.005			
Molybdenum						0.088																				0.05			
Monochloramine																								3		3			
Monochloroacetate																								0.02					
Monochlorobenzene					0.08	0.08	0.03					0.06	0.08																
Monocrotophos																										0.002			
Molinate																								0.006		0.004			
Napropamide																										0.4			
Nicarbazin																										1			
Nickel						0.08																		0.07		0.02		0.02	0.02
Nitralin																										0.5			
Nitrate	45 as nitrate; 10 as nitrate-nitrogen	None	45 as nitrate; 10 as nitrate-nitrogen	None	10	10-45		rate; 10 as nitrate-nitrogen	None		nitrate 45, as nitrogen 10	10	45			10		10-45		10		10	10	50	10	50		50	50
Nitrilotriacetic acid (NTA)	0.4	None	0.4	None	0.4	0.4		0.4	None			0.28												0.2		0.2			
Nitrite	ite; 1 as nitrite-nitrogen	None	nitrite-nitrogen	None	1	1-3		itrite; 1 as nitrite-nitrogen	None		as nitrite 3, as nitrogen 1	10								10		1	1	3	0.04-10	3		0.5	0.5
N-Nitroso dimethylamine (NDMA)	0.000 04	None	0.000 04	None	0.000009			0.000 04	None		0.00004	0.00004												0.0001		0.0001			
Odour	None	Inoffensive	None	Inoffensive				None	Inoffensive						Inoffensive										Not abnormal	-			
Omethoate																										0.001			
tributyltin oxide																										0.001			
Organic Carbon						4																							
Oryzalin																										0.4			
Oxamyl																						0.2	0.2			0.007			
Oxidisability																													5
Paraquat					0.01							0.007														0.02			
Parathion																										0.02			
Parathion-methyl																										0.0007			
Pebulate																										0.03			
Permethrin																										0.2			
Phenols																									0.005				
Phorate					0.002							0.0014																	
Phosphorus							10 ug/L									None													
Picloram					0.19							0.14		0.19								0.5	0.5			0.3			
Piperonyl butoxide																										0.6			
Pirimicarb																										0.007			
Pirimiphos-ethyl																										0.0005			
Pirimiphos methyl																										0.09			
Polycyclic aromatic hydrocarbons (vii)																												0.0001	0.0001
Polychlorinated biphenyls (PCBs)					0.003																	0	0.0005						
Pendimethalin																								0.02		0.04			
Pentachlorophenol	0.06	AO: ≤ 0.03	0.06	AO: ≤ 0.03	0.06			0.06	AO: ≤ 0.03			0.042	0.06					0.06				0	0.001	0.0009		0.01			
PFAS total																													0.0005
Sum of PFAS																													0.0001
Perfluorooctane Sulfonate (PFOS)	0.0006		0.0006			0.0006		0.0006																		0.07 ug/L			
Perfluorooactanoic Acid (PFOA)	0.0002		0.0002			0.0002		0.0002																		0.56 ng/L			
Pesticides																												0.0001	0.0001
Pesticides total																												0.0005	0.0005
pH	None	le 2 footnote4	None	able 2 footnote4				None	le 2 footnote4						7-10.5		7-10.5				6.5-8.5				5.8-8.6		6.5-8.5		
di(2-ethylhexyl) phthalate																										0.01			
Polihexanide																										0.7			
Polycyclic aromatic hydrocarbons (PAHs) benzo-a-pyrene																										0.00001			
Profenofos																										0.0003			
Propachlor																										0.07			
Propanil																										0.7			
Propargite																										0.007			
Propazine																										0.05			
Propiconazole																										0.1			
Propyzamide																										0.07			
Pyrasulfotole																										0.04			
Pyrazophos																										0.02			
Pyroxsulam																										4			
Potassium																None													
Prometryne					0.001																								
Quintozene																										0.03			
Saxitoxins (cyanobacterial toxin)																								0.003					
Selenium	0.05	None	0.05	None		0.01		0.05	None			0.01	0.01			0.05		0.01		0.05		0.05	0.05	0.04	0.01	0.01		0.01	0.02
Silver	None required	None	None required	None				None required	None																	0.1			
Silica																											80		
Simazine					0.01							0.009										0.004	0.004	0.002		0.02			
Sodium	None	AO: ≤ 200	None	AO: ≤ 200				None	AO: ≤ 200						300		200		200		AO: 200			50	200\		180	200	200

Chemical and Physical	GCDWQ Health Canada		Nova Scotia		Ontario	British Columbia		Alberta		Manitoba		Quebec	Saskatchewan			PEI		New Brunswick		Newfoundland		USEPA		WHO	Japan	Australia		UK	Europe
	MAC	Other value	MAC	Other value	MAC	MAC	AO	MAC	Other value	SW	GW/GUDI	Max Conc	MAC	IMAC	AO	MAC	AO	MAC	AO	MAC	Other Value	MCLG	MCL or TT	Max Value	Max Value	Health	Aesthetic	Max Value	Max Value
	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
Spirotetramat																										0.2			
Strontium	7		7			7		7												7									
Styrene																						0.1	0.1	0.02		0.03	0.004		
Sulprofos																										0.01			
Sulfolane						0.09																							
Sulphate	None	AO: ≤ 500	None	AO: ≤ 500			500	None	AO: ≤ 500						500		500		500		AO: 500						250		250
Sulphide	None	AO: ≤ 0.05	None	AO: ≤ 0.05				None	AO: ≤ 0.05						0.05														
2,4,5-T																													
Taste	None	Inoffensive	None	Inoffensive				None	Inoffensive						Inoffensive										Not abnormal	-			
Temephos																										0.4			
Temperature	None	AO: ≤ 15°C	None	AO: ≤ 15°C			15	None	AO: ≤ 15°C						<15 °C											-			
Thallium																						0.0005	0.002						
Terbacil																										0.2			
Terbufos					0.001							0.0005														0.0009			
Terbuthylazine																								0.007		0.01			
Terbutryn																										0.4			
Tetrachloroethene																										0.05		0.01	0.01
Tetrachloromethane																												0.003	
Tetrachlorvinphos																										0.1			
Tetrachloroethylene	0.01	None	0.01	None	0.01	0.01		0.01	None		0.01	0.005										0	0.005	0.1	0.01				
2,3,4,6-Tetrachlorophenol					0.1							0.07	0.1																
2,4,6-Trichlorophenol												0.005																	
Thiobencarb																										0.04			
Thiometon																										0.004			
Thiophanate																										0.005			
Thiram																										0.007			
Toltrazuril																										0.004			
Toluene	0.06	AO: 0.024	0.06	AO: 0.024	0.06	0.06	0.024	0.06	AO: 0.024		0.06				0.024				0.024			1	1	0.7		0.8			
Trichloroacetate																								0.2					
Trichloroethene																								0.008				0.01	0.01
Total dissolved solids (TDS)	None	AO: ≤ 500	None	AO: ≤ 500				None	AO: ≤ 500						1500						AO: <= 500						600		
Total organic carbon																									3				
Toxaphene																						0	0.003						
2,4,5-TP (Silvex)																						0.05	0.05	0.0009					
Triadimefon																										0.09			
Trichlorfon																										0.007			
Trichloroacetic acid																									0.03	0.1			
Trichloroacetaldehyde																										0.1			
1,2,4-Trichlorobenzene																						0.07	0.07			0.03	0.005		
1,1,1-Trichloroethane																						0.2	0.2						
1,1,2-Trichloroethane																						0.003	0.005						
Trichloroethylene	0.005	None	0.005	None	0.005			0.005	None		0.005		0.05					0.005				0	0.005		0.01				
2,4,6-Trichlorophenol	0.005	AO: ≤ 0.002	0.005	AO: ≤ 0.002	0.005			0.005	AO: ≤ 0.002				0.005											0.2					
Triclopyr																										0.02			
Trifluralin					0.045							0.035		0.045										0.02		0.09			
Trihalomethanes (THMs)	0.1	None	0.1	None	0.1			0.1	None	0.1	0.1	0.08	0.1					0.1		100 ug/L		N/A	0.08	ld not exceed 1	0.1	0.25		0.1	0.1
Uranium	0.02	None	0.02	None	0.02	0.02		0.02	None		0.02	0.02	0.02			0.02		0.02		0.02				0.03		0.02			0.03
Vernolate																										0.04			
Vinyl chloride	0.002 ALARA	None	0.002 ALARA	None	0.001	0.002		0.002 ALARA	None			0.002	0.002					0.002				0	0.002	0.0003		0.0003		0.0005	0.0005
Xylenes (total)	0.09	AO: 0.02	0.09	AO: 0.02	0.09	0.09	0.02	0.09	AO: 0.02		0.09				0.02				0.3			10	10	0.5		0.6	0.02		
Zinc		AO: ≤ 5.0		AO: ≤ 5.0		3	5		AO: ≤ 5.0						5		5				AO: <=5				1		3		
Total residue																									500				
Anionic surface active agent																									0.2				
Geosmin																									0.00001				
2-Methylisobolneol																									0.00001				
Nonionic surface active agent																									0.02				
Microbiological	MAC		MAC					MAC																					
Enteric protozoa: Giardia and Cryptosporidium		nd/or inactivation of cysts and oocysts		inactivation of cysts and oocysts					nt goal: Minimum 3 log removal and/or inactivation of cysts and oocysts													0							
Enterococci																												0	0
Enteric viruses	ation) of enteric viruses		inactivation) of enteric viruses					: Minimum 4 log reduction (removal and/or inactivation) of enteric viruses														0							
Escherichia coli (E. coli)	ND/100 mL		ND/100 mL		ND	0 CFU/100 mL		ND/100 mL								0		ND/100 mL				0			Not to be detected	Not detected		0	0
Total coliforms	dwater leaving the well		d groundwater leaving the well		ND			disinfected groundwater leaving the well								0		ND				0						0	0
Common bacteria																									100 per 1 mL				
HPC																		-				0							
Legionella																						0							<1000
Turbidity	dividual filters or units:		its for individual filters or units:					Treatment limits for individual filters or units:				1.0 (5)						1 private wells			1 NTU	N/A			2 degree	5		4 NTU	
Conventional and direct filtration: ≤ 0.3	NTUTable 1 footnote1		on: ≤ 0.3 NTUTable 1 footnote1					Conventional and direct filtration: ≤ 0.3 NTUTable 1 footnote1				3						.0 chemically assisted											
slow sand and diatomaceous earth filtration: ≤ 1.0	NTUTable 1 footnote2		on: ≤ 1.0 NTUTable 1 footnote2					slow sand and diatomaceous earth filtration: ≤ 1.0 NTUTable 1 footnote2				0.2						1											
membrane filtration: ≤ 0.1	NTUTable 1 footnote3		on: ≤ 0.1 NTUTable 1 footnote3					membrane filtration: ≤ 0.1 NTUTable 1 footnote3										0.1											
																		1 unfiltered SW/GUDI											
Radiological	MAC (Bq/L)		MAC (Bq/L)		Page 3/4			MAC (Bq/L)																Table A6.1 Pg 558		an 1 mSv other than potassium			
Beryllium-7					4000																								
Bismuth-210					70																								
Cesium-137	10		10		10			10				10								10				10					
Iodine-131	6		6		6			6				6								6				10					
Lead-210	0.2		0.2		0.1			0.2				0.2								0.2				0.1					
Polonium					0.2																								
Radium-226	0.5		0.5		0.6			0.5				0.5								0.5		0	5 pCi/L	1					
Radium-224																				2									
Radium-228																				0.2									
Radon	None required		None required					None required																					
Molybdenum-99																				200									
Strontium-90	5		5		5			5				5								5				10					
Thorium-232					0.1															0.6									
Tritium	7000		7000		7000			7000				7000								7000									
Uranium	N/A		N/A		4			N/A												3		0	30 ug/L	1-1000					

APPENDIX B

Wastewater Regulations Summary Table

Parameter		WSER	Alberta (secondary)	Abt (Tertiary)	B.C.	Man.	Ont. (secondary)	Que.	Sask.	P.E.I		EU	UK	Japan	US EPA
BOD	mg/L				45	25	25-30 mg/L		30			25	25	120-160	30
CBOD	mg/L	25	25	20		25		25	25	25					25
COD	mg/L											125	125	120-160	
TSS	mg/L	25	25	20	45	25	25-40	25	25	25		35		200	30
TP	mg/L			1	1	1						1 to 2	1 to 2	16	Site-specific basis
Phosphate (PO43-)	mg/L				0.5										
Total Nitrogen	mg/L					15						10 to 15	10 to 15	60-120	Site-specific basis
Ammonia	mg/L			Site-specific basis		Site-specific basis									
Total residual chlorine	mg/L	0.02							0.02	0.02					
Unionizied Ammonia	mg/L	1.25							1.24	1.25					
Total Coliform (MPN/100mL)			1,000											3,000	
Fecal coliforms					14 - 200										
Total E. coli (MPN/100mL)			200			200									
pH					6.0 - 9.0			6.0 - 9.5						5.8-9.0	6.0 - 9.0
Acute lethality		Y	Y	Y	Y			Y							

effluent crieteria & design objectives based on technology

*other susbtances

Table 1: Summary of wastewater effluent requirements literature review

Jurisdiction	Legal Framework	Effluent Limits

Canada (Federal)	• Government of Canada, Environment and Climate Change Canada (ECCC)
	  ○ Wastewater Systems Effluent Regulations (WSER)
	
	• Canadian Council of Ministers of the Environment (CCME)
	  ○ Canada-wide Strategy for the Management of Municipal Wastewater Effluent (2009)
		• Monitoring requirements at the final discharge point:
		  ○ Average daily volume
		  ○ Composition of the effluent
		  ○ Toxicity of the effluent (for systems depositing >2,500 m^3/d)
		• Effluent Composition Limits:
		  ○ CBOD – 25 mg/L
		  ○ TSS – 25 mg/L
		  ○ TRC – 0.02 mg/L
		  ○ UIA – 1.25 mg/L
		
		• National Performance Standards (NPS)
		  ○ CBOD – 25 mg/L
		  ○ TSS – 25 mg/L
		  ○ TRC – 0.02 mg/L
		• Categorizes WWTP by daily flow:
		  ○ Very Small: ≤ 500 m^3/d
		  ○ Small: > 500 – 2,500 m^3/d
		  ○ Medium: > 2,500 – 17,500 m^3/d
		  ○ Large: > 17,500 – 50,000 m^3/d
		  ○ Very Large: > 50,000 m^3/d

Nova Scotia	• Nova Scotia Environment and Climate Change (NSECC) Environmental Act	• Effluent requirements are site specific and based on Environmental Risk Assessment following CCME ERA Standard Method ○ Full list of possible substances considered in ERA provided in following table.

Alberta	• Standards and guidelines for municipal waterworks, wastewater, and storm drainage systems, 2012	• Based on treatment technology. Tertiary Treatment limits include:
		  ○ CBOD – 20 mg/L
		  ○ TSS – 20 mg/L
		  ○ TP – 1 mg/L
		  ○ Total coliforms – 1000 MPN/100 mL
		  ○ Fecal coliform – 200 MPN/100 mL
		  ○ NH3-N limits set on site specific basis.

British Columbia	• Environmental Management Act
	  ○ Municipal Wastewater Regulation
		• Site specific permits based on receiving water and dilution ration of effluent:
		  ○ BOD & TSS: 10 to 45 mg/L
		  ○ TP: ≤ 1 mg/L
		  ○ Ortho phosphate: ≤ 0.5 mg/L
		  ○ Fecal coliforms: < 200 MPN/100 mL
		    ▪ < 14 MPN/ 100 mL if discharging to shellfish bearing waters

Manitoba	• Manitoba Water Stewardship – Manitoba Water Quality Standards, Objectives, and Guidelines (2011)	• Effluent Composition Limits: ○ CBOD – 25 mg/L ○ TSS – 25 mg/L ○ TP – 1 mg/L ○ TN – 15 mg/L
New Brunswick	• No provincial guidelines or regulations found.	• No provincial guidelines or regulations found.
Newfoundland & Labrador	• Water Resources Act, *Environmental Control Water and Sewage Regulations*, 2003 ○ Schedule A	• Effluent Composition Limits: ○ BOD – 20 mg/L ○ TSS – 25 mg/L ○ Fecal coliforms – 1000 MPN/100 mL ○ Total coliforms – 5000 MPN/100 mL ○ Full list of limits provided in following table.
Ontario	• Ministry of the Environment, Conservation and Parks ○ Guideline F-5 Requirements for treatment of municipal and private sewage discharge in surface waters.	• Effluent Composition Limits are based on treatment process used: ○ Conventional activated sludge system: ▪ CBOD – 25 mg/L ▪ TSS – 25 mg/L ○ Advanced treatment (activated sludge with TP removal and/or nitrification) ▪ CBOD & TSS – 5 to 15 mg/L
Prince Edward Island	• Water Act Water Supply System and Wastewater Treatment System Regulations	• Effluent Composition Limits: ○ BOD – 25 mg/L ○ TSS – 30 mg/L ○ UIA – 1.25 mg/L ○ TRC – 0.02 mg/L
Québec	• Environmental Quality Act	• Effluent Composition Limits: ○ CBOD – 25 mg/L ○ TSS – 25 mg/L ○ pH – 6.0 to 9.0
Saskatchewan	• Water Security Agency, The Waterworks and Sewage Works Regulations (2015)	• Effluent Composition Limits: ○ BOD – 30 mg/L ○ CBOD – 25 mg/L ○ TSS – 30 mg/L ○ UIA – 1.24 mg/L ○ TRC – 0.02 mg/L
International		
United States	• US Environmental Protection Agency (US EPA) National Pollutant Discharge Elimination System (NPDES) ○ Under the Clean Water Act	• Effluent Composition Limits: ○ BOD – 30 mg/L ○ TSS – 30 mg/L ○ Additional site-specific requirements are determined through the NPDES permit process. ○ Most WW effluent guidelines pertain to industrial ww effluent discharge.

European Union	• European Commission Urban Wastewater Treatment Directive Requirements for Urban Wastewater, 1991	• Effluent Composition Limits: ○ BOD – 25 mg/L ○ TSS – 35 mg/L ○ TP – 1 to 2 mg/L ○ TN – 10 to 15 mg/L
United Kingdom	• The Urban Waste Water Treatment (England and Wales) Regulations 1994	• Effluent Composition Limits: ○ BOD – 25 mg/L ○ COD – 125 mg/L ○ TSS – 125 mg/L (unfiltered sample) ○ TP – 1 to 2 mg/L ○ TN – 10 to 15 mg/L
Japan	• Ministry of the Environment ○ Environmental Quality Standards for water Pollution	• Includes National Effluent Standards for: ○ Protecting human health. ○ Protecting the living environment. ○ Full list of effluent standards provided in following table.
Australia	• National Water Quality Management Strategy	• Effluent Composition Limits: ○ BOD – 30 mg/L ○ TSS – 30 mg/L ○ *E. coli* – 30 cfu/100mL ○ TN – 15 mg/L ○ TP – 2 mg/L
Other		
UN Water	• UN World Water Development Report 2017 ○ Wastewater – The Untapped Resource	• Emerging pollutants identified in water systems: ○ Pharmaceuticals (antibiotics, analgesics, anti-inflammatory drugs, psychiatric drugs) ○ Steroids and hormones (contraceptive drugs) ○ Personal care products (fragrances, sunscreen agents, insect repellents, microbeads, and antiseptics) ○ Pesticides and herbicides ○ Surfactants and surfactant metabolites ○ Flame retardants ○ Industrial additives ○ Chemicals and plasticizers ○ Gasoline additives

Table 2: CCME list of substances of potential concern considered in an Environmental Risk Assessment for medium, large & very large WWTPs

Test Group	Substances
General Chemistry/Nutrients	Fluoride Nitrate Nitrate + Nitrite Total Ammonia Nitrogen Total Kjeldahl Nitrogen (TKN) Total Phosphorus (TP) Total Suspended Solids (TSS) Carbonaceous BOD Total Residual Chlorine (TRC) COD Cyanide (total) pH Temperature
Metals	Aluminum, barium, beryllium, boron, cadmium, chromium, cobalt, copper, iron, lead, manganese, molybdenum, nickel, silver, strontium, thallium, tin, titanium, uranium, vanadium, zinc as well as arsenic, antimony, selenium and mercury
Pathogens	*E. coli* (or other pathogen, as directed by the jurisdiction)
Organochlorine Pesticides	Alpha-BHC, endosulfan (I and II), endrin, heptachlor epoxide, lindane (gamme-BHC), mirex, DDT, methoxychlor, aldrin, dieldrin, heptachlor, a-chlordane and g-chlordane, toxaphene
Polychlorinated Biphenyls (PCBs)	Total PCBs
Polycyclic Aromatic Hydrocarbons (PAHs)	Acenaphthene, acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i,)perylene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, methylnaphthalene, naphthalene, phenanthrene, pyrene
Volatile Organic Compounds (VOCs)	Benzene, bromodichloromethane, bromoform, carbon tetrachloride, chlorobenzene, chlorodibromomethane, chloroform, 1,2-dichlorobenzene, 1,4-dichlorobenzene, 1,2-dichloroethane, 1,1-dichloroethene, dichloromethane, ethylbenzene, 1,1,1,2-tetrachloroethane, 1,1,2,2- tetrachloroethane, tetrachloroethene, toluene, trichloroethene, vinyl chloride m/p-xylene, o-xylene
Phenolic compounds	2,3,4,6–tetrachlorophenol, 2,4,6-trichlorophenol, 2,4-dichlorophenol, pentachlorophenol
Surfactants	Non-ionic surfactants and anionic surfactants (others may be added by the jurisdiction)

Table 3: Newfoundland & Labrador - Schedule A, Wastewater Effluent Discharge Requirements

Parameter	Limit
Biological Oxygen Demand	20 mg/L
Fecal coliforms	1000 MPN/100 mL
Total coliforms	5000 MPN/ 100 mL
Dissolved solids	1000 mg/L
Suspended solids	30 mg/L
Oils	15 mg/L
Arsenic	0.5 mg/L
Barium	5.0 mg/L
Boron	5.0 mg/L
Cadmium	0.05 mg/L
Chlorine	1.0 mg/L
Chromium (hexavalent)	0.05 mg/L
Chromium (trivalent)	1.0 mg/L
Copper	0.3 mg/L
Cyanide	0.025 mg/L
Iron (total)	10 mg/L
Lead	0.2 mg/L
Mercury	0.005 mg/L
Nickel	0.5 mg/L
Nitrates	10 mg/L
Nitrogen (ammoniacal)	2.0 mg/L
Phenol	0.1 mg/L
Phosphates (total as P_2O_5)	1.0 mg/L
Phosphorus (elemental)	0.0005 mg/L
Selenium	0.01 mg/L
Sulfides	0.5 mg/L
Silver	0.05 mg/L
Zinc	0.5 mg/L

Table 4: Japan Ministry of the Environment - National Effluent Standards

Chemical	Permissible Limit
Related to the protection of human health	
Cadmium and its compounds	0.03mg Cd/L
Cyanide compounds	1mg CN/L
Organic phosphorus compounds (Parathion, Methyl Parathion, Methyl Demeton and EPN only)	1mg/L
Lead and its compounds	0.1mg Pb/L
Hexavalent Chromium	0.5mg CR(VI)/L
Arsenic and its compounds	0.1mg As/L
Mercury and its compounds	0.005 mgHg/L
Alkyl mercury compounds	Not detectable
PCBs	0.003 mg/L
Trichloroethylene	0.1 mg/L
Tetrachloroethylene	0.1 mg/L
Dichloromethane	0.2mg/L
Carbon Tetrachloride	0.02mg/L
1,2-Dichloro ethylene	0.04mg/L
1,1-Dichloro ethylene	1mg/L
Cis-1,2-Dichloro ethylene	0.4mg/L
1,1,1-Trichloro ethane	3mg/L
1,1,2-Trichloro ethane	0.06mg/L
1,3-Dichlororpropene	0.02mg/L
Thiram	0.06mg/L
Simazine	0.03mg/L
Thiobencarb	0.2mg/L
Benzene	0.1mg/L
Selenium and its compounds	0.1 mg Se/L
Boron and its compounds	Non-coastal areas: 10 mg/L Coastal areas: 230 mg/L
Fluorine and its compounds	Non-coastal areas: 8mg/L Coastal areas: 15mg/L
Ammonia, Ammonium compounds, Nitrate and Nitrite Compounds	100mg/L
1,4-Dioxane	0.5mg/L
Related to the protection of the environment:	
pH	Non-coastal areas: 5.8 - 8.6 Coastal areas: 5.0 - 9.0
BOD	160 mg/L (daily average 120 mg/L)
COD	160 mg/L (daily average 120 mg/L)
TSS	200 mg/L (daily average 150 mg/L)
N-hexane Extracts (mineral oil)	5 mg/L
N-hexane Extracts (animal and vegetable fats)	30 mg/L
Phenols	5 mg/L
Copper	3 mg/L
Zinc	2 mg/L
Dissolved iron	10 mg/L
Dissolved Manganese	10 mg/L
Chromium	2 mg/L
Coliform groups	Daily Average 3000/cm^3
Nitrogen	120 mg/L (daily average 60 mg/L)
Phosphorus	16 mg/L (daily average 8 mg/L)

APPENDIX C

Stormwater Regulations Summary Table

Table 1: Summary of Stormwater Regulations Literature Review

Jurisdiction	Framework	Notes

Canada (Federal)	• Wastewater System Effluent Regulations (WSER)	• CSO reporting requirements include:
		  ○ Date of each day effluent was deposited via the overflow point.
		  ○ For each of those days, the duration or estimated duration (hrs) of the deposit.
		  ○ Volume or estimated volume of deposit (m^3).
		  ○ The volume or estimated volume (m^3) of effluent for each month during which effluent was deposited via the overflow point.
		  ○ The number of days in each of those months during which effluent was deposited via the overflow point.

	• Canada Wide Strategy for the Management of Municipal Wastewater Effluent (CCME)	• No Canadian jurisdiction allows the construction of new combined sewers, although existing ones may be replaced or rehabilitated.
		• National standards for CSOs
		  ○ No increase in CSO frequency due to development or redevelopment unless part of an approved CSO management plan.
		  ○ No CSOs discharge during dry weather, except during spring thaw and emergencies.
		  ○ Removal of floatable materials where feasible.
		• Jurisdictions may determine site-specific objectives.

Alberta	• Stormwater Management Guidelines for the Province of Alberta, 1999	• No stormwater monitoring requirements found.
		• Guidelines suggest monitoring flow and runoff quality from strategic locations within the catchment area but are not regulations. The contaminants listed include:
		  ○ TSS
		  ○ Total dissolved solids
		  ○ BOD
		  ○ TP
		  ○ TN
		  ○ Nitrate
		  ○ Chloride
		  ○ Lead
		  ○ Zinc
		  ○ Total coliforms
		  ○ *E. coli*

Ontario	• Stormwater Management Plan and Design manual
	
	• City of Toronto Wet Weather Flow Master Plan
		• No stormwater monitoring requirements found.
		• Stormwater Management Plan covers the design of stormwater management facilities (catch basins, effective vegetation, wet ponds, constructed wetlands, etc.)
		
		• No stormwater monitoring requirements found.
		• Plan objectives for CSOs include:
		    ○ Eliminate CSOs
		    ○ Reduce inflow & infiltration to sanitary sewers and
		    ○ Reduce basement flooding.

Manitoba	• City of Winnipeg General Terms & Conditions of Combined Sewer System Operating License	• Combined sewer system and wastewater collection system should be operated such that there are no CSOs except during wet weather periods.
		• No increase in frequency or volume of CSOs in any sewer shed due to new and upgraded land development activities.
		• Green technology and innovative practices shall be used in the design and operation of all new and upgraded storm and wastewater infrastructures.
		• Public notification system development and implementation plan submission required by December 31, 2015
		    ○ Internet-based public notification system for all discharges from CSO points, including assessment of making notifications available on a real-time basis.
		
		• CSO Effluent Quality Limits:
		    ○ CSO effluent will be equivalent to that specified for primary treatment to 85% or more of the WW collected in the CSO during wet weather periods. The following effluent quality limits summarize what is expected for primary treatment:
		        ▪ $BOD_5 < 50$ mg/L
		        ▪ TSS < 50 mg/L
		        ▪ Total phosphorus < 1 mg/L
		        ▪ *E. coli* not to exceed 1000 MPN/100 mL

United Kingdom	• Department for Environmental Food & Rural Affairs
	  ○ Storm Overflows Discharge Reduction Plan, Aug 26, 2022
	
	• Environmental Act, 2021
		• The reduction plan includes headline targets for:
		  ○ Environment: Water companies will only be permitted to discharge from a storm overflow where they can demonstrate there is no local adverse ecological impacts.
		  ○ Human Health: Water companies must significantly reduce harmful pathogens from storm overflows discharging into and near designated bathing waters, either by applying disinfection or reducing the frequency of discharges to meet Environment Agency spill standards by 2035.
		• Storm overflows will not be permitted to discharge above an average of 10 rainfall events per year by 2050.
		• Water companies will be required to ensure all storm overflows have screening controls.
		
		• Water quality upstream and downstream from an asset (storm overflow or outfall) must be monitored for DO, pH, turbidity, ammonia and any other specified regulations by the Secretary of State.

Baltic Sea Region Countries (Estonia, Finland, Latvia, Sweden)	• iWATER project ○ Integrated Storm Water Management System Guidelines	• No stormwater monitoring requirements found. • Guidelines suggest possible biological (*E.coli*, fish), physical (flow, TSS, streambank stability), and chemical monitoring (phosphorus, heavy metals, etc.) of stormwater in order to monitor project's success however is not required in the region.

United States	• US EPA National Pollutant Discharge Elimination System (NPDES)
	  ○ CSO Control Policy
		• CSOs are subject to the NPDES permitting program and communities with CSOs must have a permit to discharge.
		• Policy prohibits significantly increased overflows in sensitive areas (national resource waters, waters with threatened or endangered species, waters with primary contact recreation, etc.)
		• The long-term control plans for CSOs in such areas must include eliminating or relocating overflows that discharge to sensitive areas where physically possible.
		• A CSO that meets the following criteria would be presumed to provide adequate control of CSOs to meet water-quality based requirements of the Clean Water Act:
		  ○ No more than an average of 4 overflow events per year.

<table>
<tr><td></td><td></td><td>The elimination or the capture for treatment of no less than 85% by volume of the combined sewage.
Elimination or removal of no less than the mass pollutants identified as causing water quality impairment through the sewer system characterization monitoring.
If CSOs do not meet theses criteria, the CSOs should receive a minimum of primary clarification, solids and floatable disposal and disinfection of effluent.
US EPA regulates stormwater discharges from three potential sources:
Municipal separate storm sewer systems
Construction activities
Industrial activities.</td></tr>
<tr><td>Australia</td><td>Natural Resource Management Ministerial Council Guidelines for Sewage System Overflows</td><td>Criteria for meeting an adequate treatment of CSOs:
Presumption approach:
No more than a prescribed number of wet weather overflow events per year
Elimination or capture for treatment of a specified percentage of the volume of sewage collected from a wet weather overflow.
The elimination of no less than the mass load of the pollutants that have a negative impact on water quality objectives or receiving waters.
Demonstration approach:
Overflow must not affect environmental values.
Must meet water quality objectives.
Must allow cost effective expansion or modification of infrastructure.
The elimination of no less than the mass load of the pollutants that have a negative impact on water quality objectives or receiving waters.</td></tr>
</table>

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