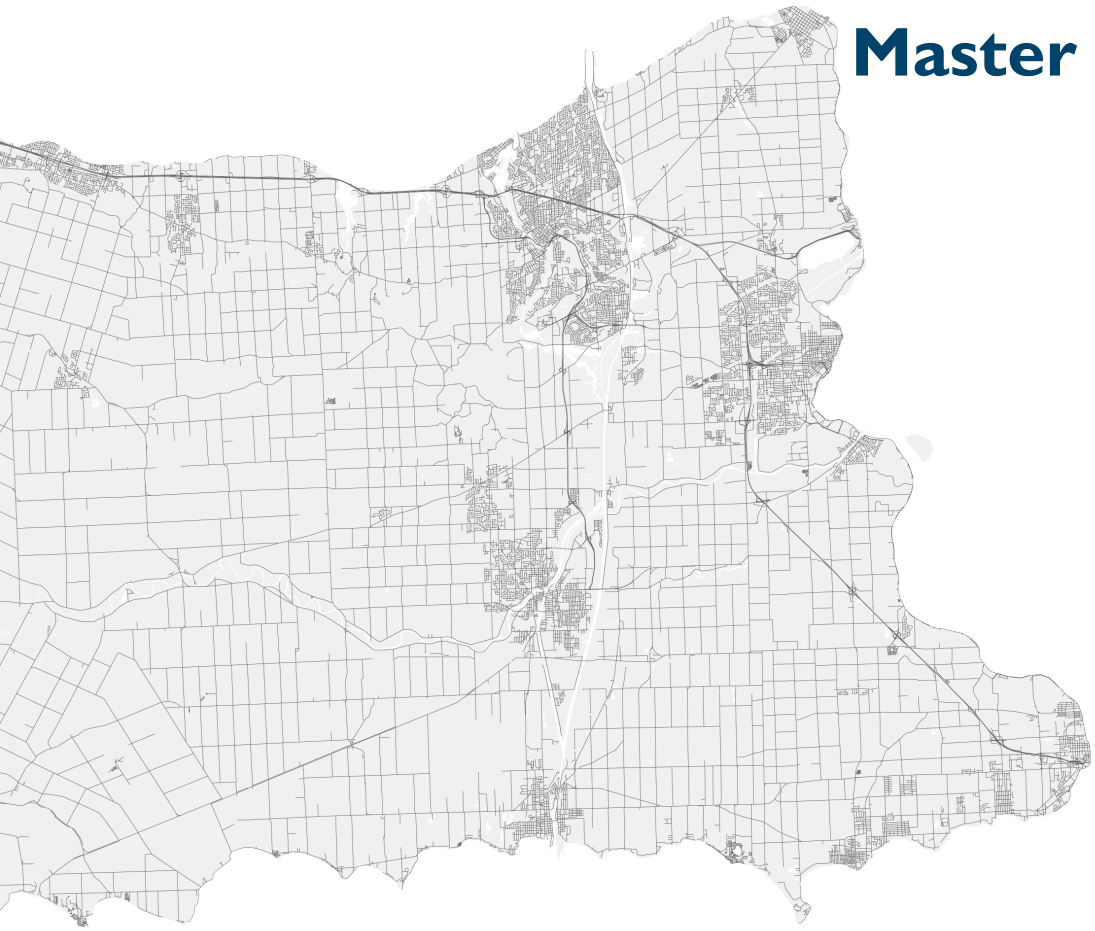
APPENDIX A2:
TM 2 – Sewer Use By-Law Review

Technical Memorandum 2
Sewer Use By-Law Review

2021 Biosolids Management Master Plan Update

December 2022



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QA/QC - SIGN OFF SHEET

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1.0 Introduction

1.1 Background and Purpose

In alignment with Niagara's Growth Management Strategy and under the legislative context of the Province's Place to Grow Plan and the Regional Policy Plan, growth in the Region of Niagara should occur in a sustainable manner addressing economic, social, and environmental considerations. The Region initiated the current Biosolids Management Master Plan (BMMP) Update to review the existing biosolids management strategy in light of these Provincial and Regional growth targets, to identify limitations, develop and evaluate alternative management strategies, and recommend a preferred strategy for implementation. The study will address Phases 1 and 2 of the Municipal Engineers Association Class Environmental Assessment Master Planning Process, while meeting the goals and objectives of the Region.

The quality of biosolids produced in the Region are impacted by what is discharged into the sewer system. Niagara Region has had a Sewer Use By-Law (SUB) in place since 1976, which regulates discharges into the sewer. In 2002, as part of the Sewer Use Program, the By-law was revised to reflect the Model Sewer Use By-Law from the Ontario Ministry of the Environment, now the Ministry of the Environment, Conservation and Parks (MECP). A review of the Region's SUB was completed as part of the 2010 Biosolids Management Master Plan (BMMP), and some of the BMMP's recommended updates were incorporated in the Region's 2014 Sewer Use By-law update.

The SUB is aimed at reducing the loading of contaminants originating from industrial, commercial, and institutional facilities that enter the municipal sewer system to reduce harmful contaminants that are difficult to treat at receiving wastewater treatment plants. Therefore, the SUB helps improve effluent quality from WWTPs, as well as biosolids quality. Improving biosolids quality will allow the Region to continue to meet biosolids regulations and guidelines with respect to treatment and end-uses, and to be prepared for potentially more stringent regulations in the future.

1.2 Technical Memorandum Outline

The purpose of this Technical Memorandum (TM) is to review and assess the Niagara's Existing Sewer Use By-Law and make recommendations for its potential improvement. It is organized into the following sections:

1. **Introduction:** This section describes the BMMP purpose and TM outline.
2. **Existing and Model Sewer Use By-laws:** This section reviews the Region of Niagara and lower tier municipalities' current SUBs and compares them to model sewer use by-laws.

3. **Review of the 2010 BMMP**: This section reviews the conclusions and recommendations for the Region's SUB made under the 2010 BMMP, and which of these recommendations were implemented under the 2014 SUB update.
4. **Current Sewer Discharges:** This section reviews current sewer discharge loadings from residential, commercial, institutional, and industrial sources, as well as Region-generated discharges, including liquid side streams from the Garner Road Biosolids Facility.
5. **Contaminants of Concern for Land Application of Biosolids:** This section describes the metals that are regulated through the Nutrient Management Act that dictates contaminant loading for land application of biosolids.
6. **Recommendations:** This section identifies recommended updates to the existing SUB to improve biosolids quality.
7. **Summary and Next Steps:** This section summarizes key findings and next steps in the assessment process.

2 Existing and Model Sewer Use By-laws

A Sewer Use By-law (SUB) regulates discharges to a municipality's sewer system through establishing limits for various common pollutants and detailing other requirements that must be met by users. This protects sewer workers, the sewer infrastructure and wastewater treatment processes, and improves the quality of treated effluent and biosolids, thus better protecting the natural environment. The underlying principle is that it is much more cost-effective to prevent pollution or treat it at the source than to remediate its resulting impacts. Niagara Region's current SUB, 27-2014, has evolved over time from its previous versions 47-2008 and 39-2002. The current version includes many aspects of the 2009 CCME Model SUB, as described below.

2.1 CCME Model Sewer Use By-Law

The Canadian Council of Ministers of the Environment (CCME) is comprised of the environment ministers from federal, provincial, and territorial governments who collaborate to focus on national environmental issues using working groups of experts to achieve specific directives in a variety of fields. In 2009, the CCME developed the Canada-wide Strategy for the Management of Municipal Wastewater Effluent which required all facilities that discharge to surface water to meet minimum national performance standards ($CBOD_5$, TSS, Total Residual Chlorine) and site-specific effluent discharge objectives for various pathogens, nutrients, and metals.

In addition, the CCME produced a Model SUB, a template to help municipalities implement source controls for contaminants discharged to sewer systems, as part of the national strategy to harmonize wastewater management. While this model serves as the current industry standard, it is generic in nature and intended for modification to best suit the objectives and

circumstances of individual communities. It covers a range of subjects such as sampling and monitoring requirements, grease and sediment interceptors, spill response, extra strength surcharges, compliance programs, and penalties. While it provides recommended concentration limits for numerous contaminants, these limits are intended to provide guidance and are not required by regulation.

2.2 Ministry of the Environment, Conservation and Parks Model Sewer Use By-law

In 1998, the Ontario Ministry of the Environment (now the Ministry of the Environment, Conservation and Parks, MECP) released a Draft Model SUB to serve as a reference for municipalities to develop their own local SUBs. The MOE had previously developed a draft 1988 model by-law which was used as a basis for many Ontario municipal SUBs at the time. After several revisions, the draft Model SUB concept was discontinued with the intention of instead producing a guidance manual for municipalities. The 2009 CCME Model SUB is now considered the most current reference model.

2.3 Niagara Region Sewer Use By-Law (No. 27-2014)

The current Niagara Region SUB 27-2014 covers most topics found in other municipalities' SUBs. Of particular interest to the BMMP, the restricted contaminant concentrations levels are found in "Section 4 Use of Sanitary and Combined Sewers". In Table 1, the limits are compared to those found in the CCME Model SUB where limits higher than those suggested in the CCME use red text. As mentioned earlier, the limits are not regulated but serve as guidance for municipalities to consider. As well, the limits from the previous SUB 47-2008 are included to show which were changed. Substances removed from the list include aluminum, barium, chloride, iron, sulphate, and sulphides while Dichlorobenzene (1,2-) was added to the list. Other elements that had their allowable concentration limits reduced include chromium, mercury, lead, selenium, nickel, zinc, 1,4-Dichlorobenzene, toluene, and trichloroethylene.

The CCME Model By-law also includes a supplemental list of substances from the Canadian Environmental Protection Act, 1999, Canada-Ontario Agreement (COA, 2002), and Canada-US Binational Toxics Strategy (1997) which may be added to a SUB depending on a municipality's objectives and risk assessment outcomes. Further details about the derivation of the CCME limits or choosing appropriate limits can be found in "Model Sewer Use Bylaw Guidance Document" (Marbek Resource Consultants Ltd., 2009).

Table 1: Restricted Contaminants Concentration Limits

Substance	Concentration Limit (mg/L)		
	Niagara Region By-law 47-2008	CCME Model By-law (mg/L)	Niagara Region By-law 27-2014 (mg/L)
Conventional Contaminants			
Biochemical Oxygen Demand	300	300	300
Chemical Oxygen Demand	-	600	-
Oil & Grease - animal & vegetable	100	150	150
Oil & Grease - mineral & synthetic/hydrocarbon	15	15	15
Total Suspended Solids	350	300	350
pH (unitless)		6.0 - 10.5	6.0 - 11
Temperature		60 deg C	60 deg C
Inorganic Contaminants			
Aluminum, Total	50	-	-
Antimony, Total	5	-	5
Arsenic, Total	1	1	1
Barium, Total	5	-	-
Cadmium, Total	0.7	0.7	0.7
Chromium, Total	5	2.8	3
Chloride	3,000		
Cobalt, Total	5	5.0	5
Copper, Total	3	2.0	3
Cyanide, Total	1	1.2	1
Fluoride	10	-	10
Iron, Total	50	-	-
Lead, Total	2	0.7	1
Mercury, Total	0.05	0.01	0.01
Molybdenum, Total	5	5.0	5
Nickel, Total	3	2.0	2
Nitrogen, Total Kjeldahl	100	50.0	100
Phosphorus, Total	10	10.0	10
Selenium, Total	5	0.8	1

Substance	Concentration Limit (mg/L)		
	Niagara Region By-law 47-2008	CCME Model By-law (mg/L)	Niagara Region By-law 27-2014 (mg/L)
Silver, Total	5	0.4	5
Sulphate	1,500	-	-
Sulphides, Total	1	1.0	-
Tin, Total	5	-	5
Zinc, Total	5	2.0	3
Organic Contaminants			
Benzene	0.01	0.01	0.01
Chloroform	0.04	0.04	0.04
Dichlorobenzene (1,2-)		0.05	0.05
1,4-Dichlorobenzene	0.47	0.08	0.08
Ethylbenzene	0.16	0.06	0.16
Hexachlorobenzene	-	0.0001	-
Methylene Chloride (Dichloromethane)	0.21	0.09	0.21
PCBs (chlorobiphenyls)	-	0.004	-
Phenolics (4AAP)	1	-	1
Phenols, Total (or Phenolic compounds)	-	0.1	-
Tetrachloroethylene	0.05	0.06	0.05
1,1,2,2-Tetrachloroethane	0.04	0.06	0.04
Toluene	0.27	0.02	0.2
Trichloroethylene	0.07	0.05	0.05
Xylenes, total	0.52	0.3	0.52
	Metals for which biosolids guidelines and/or regulations exist		
Text in red indicate limits in Niagara Region SUB that exceed the limits suggested in the CCME Model SUB			

2.4 Lower Tier Municipal Sewer Use By-Laws

Most of Niagara's lower-tier municipalities have their own SUB, with the exceptions of City of Niagara Falls, Town of Grimsby, Town of Pelham, and Township of Wainfleet (there are no sewer systems within Wainfleet). Of note, the 2011 BMMP indicated that the Township of West Lincoln has SUB 96-24; however, it is not available on their website and no response was

received to an email inquiry, so it is not known if this by-law is still in use or references the Region's SUB.

Niagara Falls, St. Catharines, and Welland have combined sewer systems whereas the other lower tier municipalities have separate sanitary and storm sewer systems. The lower-tier municipal SUBs generally have some similar sections to the Region's SUB but also include sections pertaining to connections and private-side infrastructure such as downspouts and foundation drains. In all cases, they refer to the Region's SUB, as summarized in Table 2, with the By-law section number listed where the references appear. Generally, the SUBs have a clause with intent similar to the following:

"The use of the Sewer Works and Sewage Discharge characteristics shall conform to the restrictions of the Regional Municipality of Niagara Sewer Use By-law No. 27-2014, as amended from time to time." (City of Welland By-law 2017-18, 7.2.4)

Table 2: Comparison of Niagara Region Municipal Sewer Use By-laws

Municipality	Population (2016)	Sewer System	Bylaw No.	Year Bylaw Passed	Reference to Region SUB
Niagara Region	447,888	Combined	27-2014	2014	-
City of Niagara Falls	88,071	Combined	none		
City of St. Catharines	133,113	Combined	91-364 (amended)	1991, Amended 92, 93, 97	Part 1.IV.6, IV.10, Part 2.I
Town of Fort Erie	30,710	Separate	68-06	2006	4.2.7, 4.3.5.b
Town of Grimsby	27,314	Separate	n/a		
Town of Lincoln	23,787	Separate	07-47	2008	4.8, 6.1
Town of Niagara-on-the-Lake	17,511	Separate	2758-94	1994	203.12, 203.14, 301.01
Town of Pelham	17,110	Separate	n/a		
City of Port Colborne	18,306	Separate	5228/134/08	2008	4.2.8, 6.1.4
City of Thorold	18,801	Separate	22-2011	2011	4.2.7, 4.2.8.c
Township of Wainfleet	6,372	No Sewers	n/a		
City of Welland	52,293	Combined	2017-18	2017	7.2.4. 7.2.5.c
Township of West Lincoln	14,500	Separate	96-24*	1996	?

n/a – Not Applicable
**This by-law not available on Township website; no response from Township to email inquiry*

The lower-tier SUBs do not specifically list any of the restricted contaminants but the Town of Fort Erie and City of Thorold both stipulate limits of 100 mg/L for Oil and Grease (animal and vegetable) which is lower than the Region's limit of 150 mg/L.

3 Review of the 2010 Biosolids Management Master Plan

The 2010 BMMP recommended various changes to the Region's SUB to improve biosolids quality, listed below, some of which were incorporated in the 2014 SUB update, as follows:

- *More stringent limits for cadmium, copper, mercury, selenium, zinc*

  The 2011 BMMP noted that reducing these element concentration limits to those of the CCME Model By-law would allow for biosolids land application at the maximum potential rate (22 dry tonnes per hectare). As noted in Table 1, only mercury was reduced to match the CCME rates. Copper remained at 3 mg/L. Selenium was reduced from 5 mg/L to 1 mg/L closer to the CCME limit of 0.8mg/L, and zinc was reduced from 5 mg/L to 3 mg/L closer to the CCME limit of 2 mg/L. These limit reductions introduced in 2014 allow for higher application rates and reduced program costs compared to the limits in the Region's 2008 SUB.

- *Add discharge limits for persistent toxic organics and conduct detailed sampling program for sewage and biosolids quality*

  It was anticipated that adopting the CCME limits for various toxic organics contaminants would be a proactive step to meet potential future regulations and sampling raw sewage and biosolids quality would identify which contaminants specific to the Region's system should be targeted. The maximum limits for several contaminants were reduced slightly or modified to match the CCME suggested limits (see Table 1) including limits for Dichlorobenzene (1,2-), Dichlorobenzene (1,4), Toluene, and Trichloroethylene (1,1,2,2-). As a requirement of the Environmental Compliance Approval (ECA) at Garner Road Biosolids Dewatering Facility the Region samples each sludge load received at Garner Road for pH, total solids and volatile solids. All supernatant and centrate that is pumped or hauled offsite is also sampled to ensure compliance with process requirements and limitations of the receiving wastewater treatment facilities (typically Port Weller WWTP or Niagara Falls WWTP). Furthermore, Thomas Nutrient Solutions, the third party contractor responsible for hauling liquid sludge from Garner Road for land application, samples all sludge transported offsite from Garner Road to ensure compliance with their Non-Agricultural Source Material (NASM) Plan in accordance with the Nutrient Management Act (O.Reg.267/03).

- *Requirements for dental amalgam waste separators at dental clinics to reduce mercury loading*

  Clause 5.4 was added to the 2014 SUB which requires installation of a dental waste amalgam separator where this substance is in use. This was already required under the *Dentistry Act, 1991*, S.O. 1991, c.24, but ensures the By-law is in alignment with this policy.

- *Submission of pollution prevention plans for industrial, commercial and institutional dischargers*

  Pollution prevention plans are suggested where municipalities have industrial or commercial sectors that may potentially release substances of concern that are toxic, bio-accumulative, or carcinogenic such as metal finishing/plating, chemical manufacturing, or others specific to the community. The identified sectors choose the methods most suitable to them to reduce or eliminate these substances to meet the requirements outlined in the by-law and the municipality reviews the plan. The CCME Model By-law highlights the 11 heavy metals for which biosolids regulations and/or guidelines exist, though a municipality may target whichever substances are a concern in their community. The 2014 SUB does not include a pollution plan requirement.

- *Identify sources of metals within specific sewersheds*

  The 2011 BMMP suggested that the sewersheds for the wastewater treatment facilities with biosolids which exceed the regulated limits or guidelines for metal concentrations be investigated to determine the discharge sources. The 2014 SUB updated metal concentration limits to be in line with the CCME Model By-Law as discussed above. Any concentrations over these limits are not permitted. In March 2022 Regional Council approved authorization of an additional staff member as an Environmental Enforcement Officer, for a total of six (6) Environmental Enforcement Officers. One role of the Environmental Enforcement Officers is to enforce 2014 SUB through examining the sewer catchments and identifying possible dischargers through land use and knowledge of local industry, reviewing flow sampling data and discussing with dischargers about substances in use, and potentially fining those who exceed the by-law concentrations limits.

- *Modify lower tier municipality sewer use by-laws to reference Region's SUB*

  The 2011 BMMP also suggested that the lower-tier municipal SUBs be changed to coordinate with the Region's SUB in terms of restricted metals discharges observed in high concentrations at the various wastewater treatment plants. As summarized in Table 2, for all the lower-tier municipalities with SUBs, the SUBs do refer to the Region's SUB and stipulate that discharges must adhere to it. It is presumed that those municipalities without SUBs follow the Region's SUB.

4 Sewer Discharge Streams

4.1 Residential, Commercial and Institutional Sewer Discharges

The Region does not monitor individual residential dischargers, and data was not available for commercial and institutional dischargers. It is expected that residential, commercial and institutional sewer dischargers in the Region generally adhere to the requirements of the sewer use by-law limits and would not require a Sewer Use By-Law Discharge Agreement that allows for by-law exceedances. It is noted that a portion of wastewater from residential septic tanks and holding tanks is hauled to select WWTPs in the Region, and this hauled waste is monitored by Region staff to ensure compliance with the Sewer Use By-Law.

4.2 Industrial Sewer Discharges

Industrial sewer dischargers within the Region primarily include wineries and food processing plants, with a few other miscellaneous sectors. There are 17 companies with Surcharge Agreements which allow discharges to exceed the SUB limits by an agreed upon threshold for Biochemical Oxygen Demand (BOD), Total Phosphorus (TP), or Total Suspended Solids (TSS). The companies pay a fee based on the extra loading which is intended to cover the additional costs associated with treating the overstrength contributions. Metals over the concentration limit are not permitted as any metals in the influent to the wastewater treatment plant will result in more toxic sludge, and if not adequately removed through the treatment process, may contribute to aquatic contamination which can enter the food chain. Metals are more efficiently removed through targeted processes at their source.

The average and maximum monthly BOD, TSS, and TP concentrations for the Surcharge Agreement holders from 2017 to 2021 are summarized in Table 3 in comparison to the allowable limits under the Region's Sewer Use By-law. Overall, the winery sector contributes more BOD loading and food processing produces greater TSS and TP loading.

Table 3: Average and Maximum Monthly Concentrations from Surcharge Agreement Holders

	Average Monthly (mg/L)			Maximum Monthly (mg/L)		
	BOD	TSS	TP	BOD	TSS	TP
SUB Limit	300	350	10	300	350	10
2017	8,294	729	23	100,000	12,465	127
2018	8,158	701	21	100,000	5,286	124
2019	8,051	595	19	100,000	3,945	120
2020	8,338	718	23	100,000	5,328	150
2021	8,242	605	21	100,000	4,683	193

Increased BOD loading to the downstream WWTPs from industrial dischargers will increase biosolids production at the plants. Future biosolids production estimated at the WWTPs as described in TM 4 incorporates loading from existing industrials dischargers and assumes this will not change in the future. If any additional SUB agreements are to be issued that would increase BOD loading to the downstream WWTP, impacts on plant performance and biosolids production should be reviewed.

Of the 17 companies with Surcharge Agreements, wastewater sample data was occasionally taken to test for various contaminants between 2017 – 2021. The eleven metals for which biosolids guidelines and/or regulations exist (see Table 2-1) were sampled at seven of the companies, and no metal exceedances were measured during this period. Sampling was also conducted at 14 other companies that do not have Surcharge Agreements, with some metal exceedances measured from manufacturing, metallurgy and waste management industries. Over 357 tests, there were 55 exceedances as summarized in Table 4.

Sampling for contaminants from eight landfills (67 samples) found no metal exceedances. Based on this review of all sampling data, metal exceedances tend to be isolated to specific industrial dischargers and are not widespread.

Table 4: Exceedances for Restricted Contaminants from All Monitored Industrial Dischargers (2017 to 2021)

Industry Sector	# of Samples	# of Exceedances	Contaminant
Surcharge Agreement			
Winery	11	0	--
Food Processing	3	0	--
Distillery	1	0	--
No Surcharge Agreement			
Brewery	2	0	--
Forge	13	0	--
Manufacturing	265	33	Copper (13 – all in Fort Erie), Cobalt (1 – Fort Erie) Chromium (1 - Lincoln), Lead (5 – all in Fort Erie), Selenium (13 – all in Fort Erie)
Metallurgy	10	7	Chromium (2), Molybdenum (1), Nickel (1), Zinc (3)
Waste Management	66	15	Zinc
Winery	1	0	--
Landfill	67	0	--
Total	439	55	--

Table 5 shows the average and maximum concentrations from available sample data from the Surcharge Agreement holders which were in compliance with the metal limits in the By-law from 2018 to 2020.

Table 5: Summary of Sample Metal Concentrations from Surcharge Agreement Holders

	By-law 27-2014	2018		2019		2020	
		Avg	Max	Avg	Max	Avg	Max
Arsenic	1	0.02	0.05	0.01	0.01	0.02	0.05
Cadmium	0.7	0.01	0.02	0.00	0.00	0.01	0.02
Chromium	3	0.02	0.05	0.01	0.01	0.02	0.05
Cobalt	5	0.01	0.02	0.00	0.00	0.01	0.02
Copper	3	0.08	0.16	0.07	0.09	0.06	0.09
Lead	1	0.02	0.05	0.01	0.01	0.02	0.05
Mercury	0.01	0.00010	0.00023	0.00005	0.00005	0.00017	0.00029
Molybdenum	5	0.03	0.11	0.00	0.00	0.01	0.01
Nickel	2	0.01	0.02	0.00	0.00	0.02	0.03
Selenium	1	0.02	0.05	0.01	0.01	0.02	0.05
Zinc	3	0.20	0.40	0.12	0.21	0.18	0.21

Error! Not a valid bookmark self-reference. summarizes the sample data for other industries which do not have discharge Agreements. There were exceedances of the By-law limits for several parameters, although the majority of exceedances were maximum concentrations only. Only Selenium showed an average concentration that exceeded the by-law limit over the period from 2017 to 2021, with the samples exceeding the limit occurring primarily in the manufacturing sector in an isolated geographical area in 2021 and does not indicate an long-term trend. The average level of selenium is still very close to the SUB limit (1.03mg/L compared to 1.00 mg/L)

For the 'other industries' without surcharge agreements, the most common industries with exceedances were manufacturing and metallurgy, with some exceedances from landfill sites as well.

Table 6: Summary of Sample Metal Concentrations from Other Industry

	By-law 27-2014	2017		2018		2019		2020		2021		OVERALL	
		Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	98th Perc.
Arsenic	1	0.02	0.71	0.01	0.04	0.02	0.50	0.01	0.05	0.02	0.50	0.017	0.0488
Cadmium	0.7	0.00	0.02	0.00	0.00	0.01	0.20	0.04	0.20	0.03	0.20	0.016	0.2
Chromium	3	0.08	0.97	0.25	12.00	0.15	5.86	0.09	1.67	2.69	246	0.876	0.8564
Cobalt	5	0.01	0.04	0.00	0.02	0.01	0.20	0.23	5.21	0.15	1.93	0.090	1.1116
Copper	3	0.03	0.32	0.04	0.64	0.04	0.21	7.28	156.00	2.54	72.0	1.97	42.16
Lead	1	0.02	0.35	0.02	0.10	0.02	0.60	0.04	0.28	0.11	2.22	0.063	0.39184
Mercury	0.01	0.00005	0.00010	0.00008	0.00059	0.00010	0.00253	0.00005	0.00018	0.00006	0.00090	0.00006	0.00016
Molyb-denum	5	0.08	1.31	0.12	3.82	0.12	1.75	0.15	1.44	0.45	24.2	0.182	1.1224
Nickel	2	0.14	5.59	0.10	2.02	0.07	0.78	0.05	0.76	0.34	29.1	0.181	0.9474
Selenium	1	0.01	0.05	0.01	0.03	0.02	0.50	0.12	1.24	3.56	148	1.03	4.9044
Zinc	3	0.64	45.60	0.09	0.72	0.24	2.76	0.52	22.60	1.14	11.6	0.648	8.1864
	Value exceeds current By-law limit												

4.3 Region-Generated Sewer Discharges

4.3.1 Garner Road Sewer Discharges and Hauled Wastewater to MH 13

Three liquid waste streams are currently generated at the Garner Road Biosolids Facility, supernatant from the lagoons, centrate from the centrifuges and storm water. These waste streams are normally pumped via a forcemain into the Niagara Falls WWTP sewershed. As a contingency when the pumps or forcemain are not available, the liquid waste streams are hauled by Thomas Nutrient Solutions, a third-party contractor, to MH 13 located at 2 Niagara Stone Road in Niagara-on-the-Lake within the Port Weller WWTP sewershed. Other waste streams that have been hauled to MH 13 based on data provided by Niagara Region include:

- Sludge and centrate from Niagara Falls WWTP (on-going, as needed)
- Raw sludge from Crystal Beach (during digester maintenance in 2021)
- Sludge from Queenston WWTP (on-going)
- Sludge from Niagara-on-the-Lake Lagoons (discontinued after new Niagara-on-the Lake WWTP was commissioned in 2020)
- Other loads from WWTPs as required

Table 7 summarizes monthly loading and concentrations of lagoon supernatant and centrifuge centrate originating from the Garner Road Biosolids Facility in 2021 that was pumped into the Niagara Falls WWTP sewershed. The metal concentration values are based on monthly averages calculated from weekly sampling data and monthly volume. The other loading parameters (BOD_5, TSS, NH3-N, TKN) were calculated using concentrations from the report "Feasibility Study for Centrate and Supernatant Pumping System at the Garner Road Biosolids Storage Facility" (Hydromantis, Inc., 2006) which were based on a sample from 2005 so may not be an accurate representation of current conditions.

The Region has noted that some hauling of side streams to MH13 has been done but is infrequent. The limited hauling to MH13 is mostly used as contingency during plant upsets/maintenance activities. It is unlikely this usage has a significant impact on the quality or quantity of biosolids at the Garner Road Biosolids Facility.

Table 7: Garner Rd Centrate and Supernatant Concentrations

Parameter	By-law 27-2014	Concentration (mg/L)	
		Average	Maximum
Centrate[1]			
Arsenic	1	0.013	0.050
Cadmium	0.7	0.004	0.020
Chromium	3	0.013	0.050
Cobalt	5	0.007	0.020
Copper	3	0.047	0.173
Lead	1	0.013	0.050
Mercury	0.01	0.00054	0.00110
Molybdenum	5	0.004	0.023
Nickel	2	0.017	0.037
Selenium	1	0.013	0.050
Zinc	3	0.088	0.250
BOD_5	300	106.00	106.00
TSS	350	173.44	173.44
TP	10	5.39	5.39
NH3-N	-	529.24	529.24
TKN	100	673.42	673.42
Supernatant[1]			
BOD_5	300	152.83	--
TSS	350	163.33	--
TP	10	9.02	--
NH3-N	-	352.83	--
TKN	100	403.83	--
	Value exceeds current By-law limit		

1. Centrate Concentrations are based on monthly values from 2021
2. Supernatant Quality Data is based on Feasibility Study for Centrate and Supernatant Pumping Station at Garner Road Biosolids Storage Facility (Hydromantis, 2006)

The data shows that ammonia (NH3-N) and Total Kjeldahl Nitrogen (TKN) levels of the centrate and supernatant are very high, with TKN being above the By-law limit in both the centrate and supernatant. From 2017 to 2021, the average total volume of supernatant was 217,000 m^3 while the centrate was 113,000 m^3. The majority of the nitrogen loading is soluble and as a result, the concentrations are higher in the centrate. It is also important to note that stormwater from Garner Road is also pumped with the supernate and centrate into the sanitary sewer which would reduce the TKN concentration in the discharge stream.

Table 8: Garner Road Forcemain Discharge Quality, July 2018 – Nov 2022

Parameter	By-law 27-2014	Concentration (mg/L)		
		Average	95th percentile	Maximum
BOD_5	300 mg/L	49*	224*	2565*
TSS	350 mg/L	210	468	1800
pH	6 to 11	8.04	8.3	8.4
	Value exceeds current By-law limit			

**Data value available was for COD, not BOD_5. A correlation factor of 3.8 (COD:BOD_5) was used to convert COD to BOD_5 based on typical correlation values seen at Niagara Falls WWTP in 2021.*

Table 8: Garner Road Forcemain Discharge Quality, July 2018 – Nov 2022above shows the quantity data measured for the blended discharge stream from Garner Road, including centrate, supernatant and stormwater. The data available for the blended wastewater stream that leaves Garner Road does not include metals or TKN, but does show average discharge concentrations for BOD5, TSS and pH comply with the by-law. It is expected that the wastewater discharged from Garner Road will have TKN concentrations lower than those shown in Table 7, as some dilution from stormwater will likely be present.

Overall, the nitrogen loading discharged from the Garner Road Facility may impact performance of the Niagara Falls WWTP. However, there are opportunities to reduce loading to the Niagara Falls sewershed by pre-treating the centrate and supernatant at the Garner Road Facility (e.g., nitrification, deammonification, etc.) before it is discharged to the sewer. Pre-treatment options and potential process changes that may improve upon Garner Road discharges are being reviewed in more detail as part of TM 7b, which includes an evaluation of upgrade options at the Garner Road Biosolids Facility. The quantity of supernatant and centrate will vary based on the preferred alternative for storage and disposal at the Garner Road Biosolid Facility, and this is being considered in the evaluation.

The Region currently has plans to upgrade the Niagara Falls WWTP. With this project there is an opportunity to provide additional treatment at the Niagara Falls WWTP to potentially avoid the need for additional pre-treatment of centrate and supernatant at Garner Road, at least in the short term. Although the Niagara Falls WWTP does not currently have an ammonia limit in their ECA, planned upgrades include a Moving Bed Biofilm Reactor (MBBR) that can be designed for nitrification, which would increase the ability of the Niagara Falls WWTP to handle TKN loading from the Garner Road Facility. This opportunity will also be reviewed with the Region as part of this 2021 BMMP Update.

4.3.2 Water Treatment Plant Residual Discharges

An assessment was also completed on residuals quality from WTPs with available data between 2017 and 2021 to determine impact of sending water residuals to the sewer, as shown in Table 9**Error! Reference source not found.**. It is noted that quality data was only available for WTPs that currently haul their waste to the Garner Road Biosolids Facility (i.e., DeCew Falls WTP, Grimsby WTP and Niagara Falls WTP), and not the WTPs that currently send their residuals to the sewer (i.e., Port Colborne WTP, Rosehill WTP and Welland WTP). The concentrations provided in the table below are based on a thickened residual, so those WTPs that discharge directly to the sewer would have a lower concentration than shown below.

Table 9: Residuals Quality from Region Water Treatment Plants with hauled residuals, 5 Year Average (2017 – 2021)

	DeCew Falls WTP (mg/L)	Grimsby WTP (mg/L)	Niagara Falls WTP (mg/L)	Niagara Region By-law 27-2014 (mg/L)
Arsenic	34.816	53.644	29.583	1.0
Cadmium	1.879	1.966	1.992	0.7
Cobalt	5.079	4.464	6.413	3.0
Chromium	12.891	7.740	20.967	5.0
Copper	60.224	46.336	56.500	3.0
Lead	11.179	10.675	9.558	1.0
Mercury	0.030	0.019	0.022	0.01
Molybdenum	8.037	8.473	5.967	5.0
Nickel	16.699	8.718	19.604	2.0
Selenium	2.039	1.535	3.467	1.0
Zinc	58.940	82.214	97.313	3.0

Based on the data in Table 9 above, WTP residuals from the listed plants that haul residuals would not currently meet the Region's SUB if they were to discharge to the sewer. However, residuals from these WTPs are thickened prior to hauling, which increases metals concentrations, so this is not necessarily a concern.

Per the Garner Road ECA, water treatment residuals must be mixed at a ratio of 1:20 with sewage biosolids, which results in a dilution effect. It is also noted that land application rate can be varied to ensure NMA loading limits are achieved. As such, it may not be necessary to increase treatment of WTP residuals before release into the sewer from a biosolids quality perspective. Source reduction of metals is preferred over treatment of residuals at the WTPs.

Referring to Table 10, two of the three WTPs that directly discharge to the sewer have intermittent exceedances of TSS, which are expected during cleaning operations when high solids concentrations are flushed into the sewer. Average TP and TKN are within the by-law limit. Metal data is not available for the three WTPs that directly discharge to the sewer.

Table 10: Residuals Quality from Region Water Treatment Plants Discharging to Sewer (2017-2022

	Welland WTP (mg/L)		Port Colborne WTP (mg/L)		Rosehill WTP (mg/L)		Niagara Region By-law 27-2014 (mg/L)
	Avg	95th Perc.	Avg	95th Perc.	Avg	95th Perc.	
TSS	1958	11,880	1566	4992	61.8	212	350 mg/L
TP	4.9	28	1.4	4.2	0.13	0.29	10 mg/L
TKN	21.6	130	7.0	22.5	0.83	3.3	100 mg/L
	Value exceeds current By-law limit						

Overall, the residuals that are discharged to the sewer are eventually blended with biosolids at the downstream WWTPs, and hauled to Garner Road. As long as the receiving WWTP can handle the intermittent TSS loading, the practice of discharging directly to the sewer will not negatively impact biosolids quality. Opportunities for managing WTP residuals is discussed further in TM8.

5 Contaminants of Concern for Land Application of Biosolids

As described in detail in Technical Memorandum 9 – Long Term Market Strategies, agricultural land application of non-agricultural source material (NASM) such as biosolids is regulated by the Province of Ontario's Nutrient Management Act (NMA), last amended December 13, 2021. This stipulates levels of plant-available phosphorus, plant-available potassium, regulated metals and pH. Pathogen levels (*E.coli* and *Salmonella*) are also regulated. The Canadian Food Inspection Agency (CFIA) administers the Fertilizers Act that regulates products land applied as a fertilizer, and stipulates limits for the same metals listed above, as well as Thallium and Vanadium. The Fertilizers Act also stipulates limits for polychlorinated dibenzo-p-dioxins, polychlorinated dibenzofurans, and pathogens.

The regulated metals present in the biosolids produced from wastewater can be managed through source quality control in the Sewer Use By-Law by adjusting discharge limits. Table 11 summarizes the metals that are regulated under the NMA.

Table 11: Regulated Metals, from O.Reg. 267/03, 98.01.12

Item	Column 1 — Regulated metal for NASM under NMA	Current SUB is at or below CCME Guideline limit
1.	Arsenic	Yes
2.	Cadmium	Yes
3.	Cobalt	Yes
4.	Chromium	**No**
5.	Copper	**No**
6.	Lead	**No**
7.	Mercury	Yes
8.	Molybdenum	Yes
9.	Nickel	Yes
10.	Selenium	**No**
11.	Zinc	**No**

Although it is difficult to equate the metal concentration discharged to the sewer with the resulting metal levels that will be captured in the final biosolids product, it is possible to target specific dischargers that have more frequent exceedances of metal concentrations as these contaminants could limit land applicability of the resulting biosolids. The potential to implement pollution prevention practices for contaminants of interest at companies with regular exceedances should be investigated.

6 Recommended Updates to Sewer Use By-Law

To reduce impacts of sewer discharge streams on biosolids quality now and in the future, the following updates to the Niagara Region's Sewer Use By-Law should be considered:

1. **Continue to Enforce By-Law**: Region should continue to track industrial users and enforce by-law limits to improve compliance with existing SUB.
2. **Continue to work with industrial discharger** to address more frequent exceedances, including those related to BOD, FOG and TSS.

No changes to Region's SUB limits are proposed at this time, as the current limits are close to the CCME limits. Lowering them further will likely result in more exceedances, as additional treatment for metals by industries is difficult given limitations in available technologies and is not cost effective. No changes to the lower-tier municipalities' SUBs are required as they all reference the Regional By-law.

7 Summary and Next Steps

Overall, this technical memorandum summarizes the Region's existing Sewer Use By-law, impacts to biosolids quality and recommended updates to improve biosolids quality. Biosolids quality may also be improved through side stream treatment at the Garner Road Biosolids Facility and the WTPs, to be discussed further in TM 5, TM 7 and TM 8, respectively. The recommendations described here will be incorporated into the overall biosolids management strategy to be detailed in the Biosolids Management Master Plan Report.