

City of Regina

Semi-Annual Sewer Source Control Report (Jan - Jun 2022)

Environmental Services
Water, Waste & Environment
Citizen Service
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EXECUTIVE SUMMARY

The City of Regina (City) treats wastewater from residential, commercial and industrial properties. The quality of wastewater entering the sewage collection system is regulated by *The Wastewater and Storm Water Bylaw, 2016* (Bylaw). The Bylaw sets allowances for various parameters that have been determined by weighing the needs of the wastewater treatment and collection system against realistic industrial, commercial and institutional wastewater quality.

Source control is the practice of tracking and managing what enters the sewer system. Source control programs use the Bylaw to ensure the wastewater quality is met so it can effectively and efficiently be treated by the wastewater treatment plant (WWTP). The City's various sewer source control programs are in place to allocate costs fairly, protect the sewer infrastructure from harmful materials that can damage the collection and/or treatment system and to prevent detrimental releases to the environment as a result. The program functions through site inspections, sampling and education campaigns and when appropriate enforcement and compliance actions.

This report outlines the various sewer source control programs, their main function, goals and costs. It does not present information on releases to the environment, that information can be found in the Annual Discharge and Release Report.

The next step in the program will be to continue to increase inspections on ICI (industrial, commercial and institutional) customers to further help prevent issues and increase effective wastewater treatment and consistency in compliance activities including surcharges to businesses.

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DEFINITIONS

Regulatory Release is a spill or discharge that meets federal or provincial regulatory limits and is required to be reported as per the Saskatchewan Ministry of Environment *Discharge and Discovery Reporting Standard*. Information on these releases is in the annual *Discharge and Release Report*.

Non-Regulatory Release is a spill or discharge that does not meet the Saskatchewan Ministry of Environment *Discharge and Discovery Reporting Standard*. It has the potential to cause minor harm to the environment but is not serious enough to be reportable to regulatory agencies. Information on these releases is in the annual *Discharge and Release Report*.

Sewer Release is a spill or discharge into the either the wastewater or storm water system that could cause an adverse impact to the sewer system but does not have a negative impact on the environment and is not reportable as per the *Discharge and Discovery Reporting Standard*.

1.0 INTRODUCTION

The City of Regina (City) treats wastewater from residential, commercial and industrial properties. The City's *Permit to Operate a Sewage Works* (Permit) and *Wastewater and Storm Water Bylaw, 2016* (Bylaw) regulate the treatment and collection of the wastewater. The Bylaw and Permit include stipulations around what is and is not allowed in the City's infrastructure, and at what concentrations, to protect the sewer collection and treatment system from any adverse effects. Except in very rare situations, commercial and industrial clients are required to pre-treat any wastewater, where the wastewater's quality is outside the Bylaw's parameters, before it enters the wastewater sewer system.

Source control is the practice of tracking and managing what enters the sewer systems. The City's various sewer source control programs are in place to allocate costs fairly, protect the sewer infrastructure from harmful materials that can damage the collection and/or treatment system and to prevent detrimental releases to the environment as a result. The program functions through site inspections, sampling and education campaigns and when appropriate enforcement and compliance actions.

The programs were developed with consideration to *The Wastewater Master Plan (WWMP)* which provides a comprehensive wastewater overview designed to support the *Official Community City Plan (OCP) Community Priorities*. The WWMP defines source control and how the initiatives help to reduce parameters of concern that industrial, commercial and industrial (ICI) and residents discharge into the wastewater sewer system. The WWMP sets out standards to ensure work is completed in a sustainable and cost-effective way to provide reliable and affordable wastewater services to citizens.

This summary report will include (but is not limited) to the following information:

- Sewer Releases into the City wastewater sewer system with the potential to cause adverse effects that are contained within the wastewater system;
- offending parties and the associated costs;
- summarized wastewater quality;
- mitigation strategies to help prevent, reduce, control and assist in the recovery of compensation resulting from harmful material entering to the wastewater system; and
- Initiatives and metrics to assess the effectiveness of the municipal wastewater systems and their associated costs and overall effectiveness.

Information on the municipal sewer systems, including associated infrastructure for the collection, treatment and hauling of wastewater; Sewer Releases; and strategies implemented to address the issues is included. Regulatory and Non-Regulatory Releases to the environment are reported in the annual *Environmental Discharge and Release Report*.

2.0 BACKGROUND

The City operates two separate sewer systems (Appendix A). The storm water sewer system collects runoff from precipitation events and directs the untreated water to Wascana Lake or Creek. The wastewater sewer system collects wastewater (i.e., sewage) from residents, commercial business, institutions and industries across the city. Wastewater enters the collection system and travels into one of four wastewater sewer trunks. From there it enters McCarthy Boulevard Pumping Station (MBPS) on the west side of the city where it is pumped through a forcemain to the Wastewater Treatment Plant (WWTP). At the WWTP the wastewater undergoes treatment before it is discharged into Wascana Creek west of Regina.

Storm Sewer:

- 20 lift stations
- Approximately 20,700 storm drains
- Approximately 10,321 storm maintenance holes,
- More than 1,1320 kilometers (km) of storm mains

Wastewater Sewer:

- Wastewater Treatment Plant (WWTP)
- McCarthy Boulevard Pump Station (MBPS)
- Hauled Wastewater Station (HWS)
- 19 lift stations
- more than 960 km of pipes and 704 km of building service connections
- more than 10,580 maintenance holes

3.0 SEWER SOURCE CONTROL

Sewer source control exists to track, control and reduce the occurrence of potentially damaging substances in the wastewater and storm water sewer systems from industries, businesses, institutions and households. The primary role of the program is to reduce, through education, inspections and other preventative measures, the occurrence of harmful substances entering one of the sewer systems. In the event a harmful substance does enter the system, processes are in place to help mitigate damage, track back the substance to the source and recover costs. Due to the size and nature of the sewer system a varied approach to source control needs to be taken.

For wastewater source control EPCOR currently operates and maintains the City owned WWTP and hauled wastewater station. The City and EPCOR both conduct extensive sampling within the wastewater system and the WWTP as part of the source control program:

- to monitor the wastewater sewer system for potentially harmful compounds that could adversely impact the WWTP or the collection system.
- to gather information to help the City and EPCOR effectively operate collection and treatment systems.

Other information that the City and EPCOR gather is used internally to help make informed decisions on technical adjustments to the WWTP's operations. This reduces the impact on the environment and on the City's sewer systems and helps improve the efficiency of the City's wastewater related processes.

For stormwater source control the focus to date has been on educating residents about the two sewer systems and to only put "rain down the drain." However a number of other programs also exist.

- The City requires industrial business with stormwater ponds to submit the analytical results for review before approval to discharge to the storm sewer is given.
- "Adopt a Drain" communication campaign.
- Requiring businesses using a hydrant carts to submit a "Water Discharge Plan" to prevent discharges into natural waterways.
- Sampling of stormwater during spring runoff to better understand the effects city runoff has on Wascana Creek water quality.

3.1 WASTEWATER AND STORM WATER BYLAW

All the sewer source control programs are governed by the Bylaw. In 2016, the City repealed *The Sewer Service Bylaw*, Bylaw No. 5601 and replaced it with the new Bylaw. The bylaw changes were made based on the City's new biological nutrient removal WWTP requirements, through comparison to other municipalities, and industry best practice (Canadian Council of Ministers of the Environment – Canada-wide Strategy for the Management of Municipal Wastewater Effluent). The new Bylaw is more restrictive in terms of allowed substances and concentrations of those substances into the wastewater sewer system, but still takes into consideration realistic ICI wastewater quality. When the new Bylaw came into effect in 2016, the City, with Council approval, implemented a two-year phase in approach to allow businesses time to introduce the necessary changes to meet the new Bylaw.

If an infraction has been discovered, depending on the severity, the City will issue a remedial order letter with respect to the Bylaw subsection(s) that has been violated to inform the offending party of the violation details and to request a remedial action be completed within a practical timeframe. In more severe cases, costs and expenses that will be charged to the offending party are also included. In the event the corrective action is not completed in a practical timeframe the City may perform the work and include those costs as well. For minor infractions the City will work with the individual or business to ensure they understand the Bylaw and the requirements they need to meet to discharge into the wastewater sewer system.

When a letter is issued, the offending party must respond in writing to the City outlining the remedial plan and timeframe and pay any fees back to the City. If fees are not paid and/or no improvements occur after a reasonable timeframe, the City may then enter into litigation to recoup costs and/or fine under the Bylaw.

In the event of a Sewer Release into the wastewater sewer system where damage to the WWTP or the collection system occurs, additional sampling would be completed within the treatment and collection system to prove where the Sewer Release originated and the sections of the Bylaw that were in violation. The City would then use this information to recoup costs from the offending party. To date, this form of enforcement has been successful in educating users about the Bylaw and their non-compliance, as well as obtaining compliance and cost recovery.

3.2 WASTEWATER QUALITY MONITORING

To effectively run the collection and treatment systems and track back any Sewer Releases, appropriate monitoring programs must be in place. The City and EPCOR work seamlessly together to monitor and understand Regina's wastewater quality.

EPCOR performs approximately 15,000 analysis per year on routine laboratory testing. The testing includes a combination of regulatory, quality control, process control, and downstream creek samples. Approximately half of the samples are required by the City's contract or regulators, the remaining samples are related to source control initiatives and process control. Additional testing is also conducted when the WWTP experiences influent contamination.

Significant improvements and progress have been made over the years to the City's wastewater quality monitoring. In addition to the samples ECPOR completes, a City wastewater quality program was implemented following the completion of the WWTP upgrades to better understand Regina's wastewater and to monitor the system for potentially harmful substances.

Since inception the program has evolved from discrete manual sampling to automated sampling at six key locations within the wastewater sewer system, with the added ability to sample at additional locations as required. The permanent locations allow the system to be divided to determine if differences exist between the areas and if those differences need to be further investigated. Sampling at the six permanent locations is completed routinely. Sampling frequency is determined based on the need for the information to make informed decisions, and/or in the event of a Sewer Release to determine the source and potential damage.



Figure 1. Wastewater Sewer Trunks and Associated Sampling Locations

3.2.1 McCarthy Boulevard Pump Station (MBPS)

McCarthy Boulevard Pumping Station receives approximately 95 per cent of the wastewater that enters the WWTP. It is therefore an ideal location to monitor the wastewater before it enters the WWTP to help prevent harmful substances from entering the WWTP. It takes approximately three hours for wastewater from MBPS to reach the valve chamber at the WWTP that is upstream of the treatment process. This delay provides the City with an opportunity to warn EPCOR in the event a harmful substance has been identified at MBPS.

In addition to visual observation completed by the operators at MBPS, the City has implemented a sampling and real time monitoring location at MBPS to help identify unwanted and harmful substances before they reach the WWTP.

From January-June, no harmful events were identified by the monitoring system. Within that time period one minor event was identified at the WWTP and tracked back to its source. The substance that was identified as the cause cannot be tested for in commercial labs or by the monitoring system, which is why it was not caught before entering the WWTP.

3.2.2 Hauled Wastewater Station (HWS)

The HWS is a disposal location for commercially-hauled wastewater by permitted haulers. Accepted wastewater comes from construction and excavation sites, septic and holding tanks, portable toilet and other wastewater holding structures. Users are from both inside and outside Regina city limits. Users and generators must ensure that any ICI wastewater has City approval before it is disposed at the Hauled Wastewater Station. Sampling can be conducted on the disposed wastewater to help identify loads that have resulted in contamination. Haulers are

monitored using Radio Frequency Identification Device (RFID) Tag, which provides site usage information for billing purposes.

In 2022, between January and June, administration communicated with the haulers and generators approximately 70 times to discuss onsite rules, wastewater quality allowances and testing requirements.

3.2.3 Parameters of Concern

There were no parameters of concern documented in 2022 for the HWS.

The only identified parameter of concern for the WWTP and collection system in 2022 from Jan-June was diglycolamine,

Appendix 'A' includes the maximum, minimum and average values of parameters in the wastewater that enters the WWTP. As diglycolamine cannot be tested for in commercial laboratories results for that parameter are not included.

3.2.4 Industrial/Commercial/Institutional (ICI) Engagement

In an effort to ensure business are aware of their requirements under the Bylaw, and under what conditions surcharges are required, the City conducted an Industrial, Commercial, Institutional (ICI) questionnaire in 2020 and 2021. The questionnaire focused on high water users that were more likely to have an impact on the overall wastewater quality and businesses that may be contributing to metal levels within the wastewater sewer system. Metals were identified through the wastewater quality monitoring program as a potential parameter of concern in previous years. Seventy-two businesses were contacted and provided answers to the questionnaire through multiple conversations with administration. Results identified no major concerns. From the questionnaire three additional businesses were identified to inspect. No inspections occurred in the first half of 2022, however they are scheduled for the second half of 2022.

The objective of the questionnaire and inspections are to:

- better understand ICI wastewater within Regina;
- help make informed decisions from a wastewater treatment perspective and to better understand the impacts those decisions can have on businesses within Regina;
- further educate businesses as to what is acceptable to put in the wastewater sewer system based on the Bylaw, and how the businesses wastewater can impact the wastewater collection and treatment system;
- increase City presence within ICI businesses through conversations, questions and inspections;
- increase the effectiveness of the WWTP processes and support regulatory compliance for wastewater; and
- prevent the release of harmful substances into the wastewater sewer system.

The ICI engagement program works in collaboration with the wastewater sampling results to identify parameters of concern and corresponding businesses that may be the cause. Through public engagement activities such as this questionnaire, businesses become more aware of what type of wastewater they produce and how their wastewater should properly be disposed of or pre-treated so as to not increase costs to the City and the public as a whole.

When a new ICI business comes through Servicing & Infrastructure Approval, compliance with all bylaws is investigated, including wastewater. Businesses that are flagged as potentially having wastewater that could be detrimental to the wastewater sewer system are required to pre-treat their wastewater and, if necessary, enter into an agreement with the City. The wastewater is then tested by either the City and/or business in question to guarantee the Bylaw is being met. Businesses that have wastewater that is not detrimental to the Public Sewer System, but discharge wastewater that costs more to treat are required to pay surcharges based on the heightened parameter and the volume of water.

3.2.5 Wastewater Quality Monitoring Total Costs

Wastewater that was causing issues at the WWTP was identified in one instance in the first half of 2022. The City’s investigation concluded that the Co-op Refinery Complex (CRC) was releasing the wastewater. The City advised CRC, and CRC put in mitigating measures to prevent a similar occurrence from occurring and reimbursed the City for the event. Costs associated with harmful wastewater and the amounts the City recouped can be found in Table 1. All Relief Claims issued by EPCOR, including the costs and cause can be found in Table 3.

The 2022 Jan-Jun total costs for the wastewater quality monitoring activities were approximately \$150,000. Table 2 provides a cost breakdown for wastewater quality monitoring.

No fines were issued by the Court in 2021.

Table 1. Costs associated with harmful wastewater events.

Source	Cost	Amount Recouped	Remaining
2022 Wastewater testing directly downstream of CRC	\$2,175	Not yet invoiced.	\$2,175
2022 Costs Associated with Harmful Wastewater Events from CRC	\$69,943	\$69,943	\$0
Total 2022 Sewer Sampling Costs Associated with Harmful Wastewater Events (Jan-Jun)	\$72,117	\$69,943	\$2,175
Total 2021 Sewer Sampling Costs Associated with Harmful Wastewater Events	\$142,060	\$142,060	\$0

*This table does not include costs associated with sampling within the environment. Those can be found in the Discharge & Release Report. Does include costs associated with claims from EPCOR.

Table 2. Costs associated with the Wastewater Quality program.

Source	2021 Cost	Jan-June 2022
Wastewater Source Control Quality Labour Costs	\$202,420	\$103,234
Wastewater Source Control Quality Analytical Costs	\$53,618	\$19,580
Wastewater Source Control Quality Other Costs	\$60,495	\$21,103
Total Sewer Sampling Costs	\$316,532	\$143,917

*This table does not include costs associated with harmful wastewater events.

Table 3. List of Claims submitted by EPCOR.

Relief Claim	Year	Costs (GST excluded)	Cost Recouped	Cause	Comments	
Relief Claim 1	2015	\$ -	N/A	Unknown	Issue during construction. Epcor requested permit relief.	
Relief Claim 2	2015	\$ -	N/A	Unknown	Issue during construction. Epcor requested permit relief.	
Relief Claim 3	2015	\$ -	N/A	Unknown	Issue during construction. Epcor requested permit relief.	
Relief Claim 4	2018	\$ -	N/A	High Zinc Level	Issue during construction. Epcor requested permit relief. Die off of bacteria, missed permit levels, addition of chemical to treat.	
Relief Claim 5	2019	\$ -	N/A	CRC	Elevated PAHs in wastewater causing WWTP issues. Epcor requested permit relief.	
Relief Claim 7	2020	\$ 71,789.74	Yes	PROCOR	Feb 2020 hydrocarbon event.	
Relief Claim 6	2019	\$ 144,892.15	The City recouped payment of \$4,974,826.41 from CRC. This total payment is comprised of invoices paid by CRC and a global settlement payment provided by CRC in court action QBG-RG-01132-2022.	CRC	Elevated PAHs in wastewater causing WWTP issues.	
Relief Claim 8	2020	\$ 246,586.03		CRC	May 2020 Oil Event, elevated hydrocarbons, PAHs released the environment.	
Relief Claim 9	2020	\$ 196,543.31		CRC	PAHs	
Relief Claim 10	2020	\$ 523,545.06		CRC	May 2020 Oil Event - Lagoon clean up	
Relief Claim 11	2020	\$ 282,479.42		CRC	May 2020 Oil Event - Lagoon clean up	
Relief Claim 12	2020	\$ -		CRC	May 2020 Oil Event. Requested contract relief.	
Relief Claim 13	2020	\$ -		CRC	May 2020 Oil Event. Epcor requested contract	
Change Order 12	2020	\$ 3,546,147.44		CRC	May 2020 Oil Event - Lagoon Clean up	
Relief Claim 14	2021	\$ 69,196.85		Yes	CRC	CRC had issues with their wastewater treatment process.
Relief Claim 15	2021	\$ 106,451.26		Yes	CRC	Elevated benzo(a)pyrene in WWTP final effluent, on and off Aug-Sept. Ongoing issues at WWTP until the end of 2021.
Relief Claim 16	2022	\$ 68,852.86	Yes	CRC	Leak into wastewater caused a contamination event at the WWTP.	

3.3 FATS, OILS AND GREASE SOURCE CONTROL

The primary objective of the Fats, Oils and Greases (FOG) Source Control Program is to reduce sewer overflows and blockages and protect public health and the environment by minimizing public exposure to unsanitary conditions. FOG released to the wastewater sewer system can accumulate along pipe walls, coating pipes until wastewater flow through the line is restricted, causing backups, and blockages. By controlling FOG to the wastewater collection system, sewer surcharge occurrences are reduced, and the system operating efficiency is increased. In

addition, an effective FOG Source Control Program can reduce financial liabilities and revenue losses associated with enforcement actions and the associated impacts.

The City has two main approaches to reduce FOG in the system 1) education & awareness communications and 2) inspecting restaurants grease traps.

Over the past few years, the City has increased emphasis on sewer blockage prevention through FOG initiatives including public campaigns to educate the relevant stakeholders on how FOG causes blockages in wastewater collection systems and how to properly dispose of FOG. The campaigns target the relevant stakeholder groups including residents, restaurants, and other industry associations.

The City campaign objectives in 2022 focused on public education related to what substances are acceptable to put into the sewer system. The “Prevent the Plug” campaign message was that only the 3P’s (pee, poo and toilet paper) are allowed to be entering the City wastewater system.

The campaigns were successful through social media performance metrics such as the increased number of website visitors, opinion feedbacks, and click rates in 2021 in comparison to previous years. The increase in number of public participants for the campaigns indicate that the campaign was a success and that funding allotted to educational campaigns are a good use of public funding.

In 2022, the City was able to participate the Regina Spring Home Show. The City set up a booth with displays that spoke to Prevent the Plug and other City water, wastewater and waste diversion programs. Over 2,400 residents had interactions with City staff and received information on how to better sort their waste and prevent plugging in their wastewater system.

In addition to the public education campaigns the City also performs regular inspections of restaurants grease traps to ensure restaurant owners are cleaning grease traps effectively and frequently. When it becomes evident that the business is non-compliant an official letter is written and after three such letters the City would take the business to court. To date the City has not prosecuted generators because the City has been able to achieve compliance with the Bylaw through education and follow up inspections.

Although the campaigns are starting to reach a wider audience, more work has to be done as the City has not seen a reduction in the number of lift station cleanings required due to grease accumulation and also the ongoing disposal of non-dispersible wipes and rags. Municipalities across Canada are advocating that companies do not label baby or facial wipes as flushable. The wipes may be flushable but they are not dispersible; they do not break down in the sewer system and the City has had instances where wipes and/or rags shutdown pumps as they get entangled on the pump impellers.

3.4 STORM WATER SOURCE CONTROL PROGRAMS

3.4.1 Adopt a Storm Drain Educational Campaign

In addition to all the source control programs that exist for the wastewater system, the City has also recently started an educational campaign for the storm system. The City campaign objectives in 2021 focused on public education to encourage citizen participation to adopt and name a storm drain (Adopt a Storm Drain), and to determine the most effective marketing media to educate and engage citizens. The campaign significantly exceeded its objective and over 700 storm drain were adopted. The City also determined that direct and organic marketing was the most effective marketing strategy. Partial success of the program was seen during the spring melt as storm drains that were cleared reduced the risk of street and property flooding.

The total cost to fund the campaign in 2021 was \$20K.

3.4.2 Industrial and Commercial Storm Source Control

The City has a few main storm sewer source control programs for industrial and commercial businesses.

1. Testing of industrial stormwater ponds before release into the City's storm sewer. Industries with stormwater ponds are required to test the pond water for specific parameters that have the potential to be elevated based on the specific industry. The City reviews the submitted analytical information against provincial guidelines and regulations for surface water and approves discharge if they're met.
2. Businesses that use hydrant carts are required to inform the City what the cart will be used for, how water will be discharged and if the water will be dechlorinated before discharge. This information is required to help reduce the occurrence of chlorinated water from entering surrounding water bodies and having potentially negative effects.
3. Businesses are not allowed to discharge potentially contaminated standing water from construction sites into the storm sewer. They must use the Hauled Wastewater Site if there is a potential for elevated levels of parameters of concern.

3.4.3 Spring Runoff Sampling

Each spring the City samples within the creek and the storm sewer system to better understand the effects city winter runoff and the snow storage site has on Wascana Creek water quality. The results of this work help make decisions on the running of the snow storage site and the roadways salting program.

4.0 SUCCESSES AND CHALLENGES

Since the inception of the wastewater sewer source control program there have been many successes. The major ones are listed below

- The return of the Regina Spring Home Show allowed City staff to interact with 2,462 individuals during the event and provide information on the sewer system, including

how to prevent plugging wastewater pipes, recycling and waste collection and the potable water system.

- New refrigerated autosamplers that are used to take samples within the wastewater collection system and improved quality control and quality assurance programs further the City's ability to track the wastewaters quality and recoup costs when needed.
- The line of communication in regard to wastewater between the City and its businesses improved through increased communication and more routine meetings.
- ICI businesses achieved a greater understanding of the wastewater bylaw, their wastewater and the impacts it can have on the wastewater sewer system.
- The MBPS analyzer was functioning well for the Jan-Jun 2022 period.
- The City is in a good position to not only identify, but also track down Sewer Releases and recoup costs. Multiple Sewer Release have been identified and the source confirmed. Before the program, when issues at the WWTP occurred there was no means to identify why the issues were occurring or what may be causing them. This process has led to increased efficiency at the WWTP and the ability to recoup costs.
- The City's FOG source control program has become a regular name within the food service establishments and an improved working relationship with property management companies, and maintenance personnel in hospitals, has occurred.
- Educational campaigns have reached a large portion of Regina and have helped educate residents on what can and can't go down the drain.

Although the programs have seen many successes there are still challenges within the program. The wastewater sewer and the treatment of wastewater is a large, complex system that is constantly changing and is different for each municipality. The main limitations to the programs are listed below.

- Workforce Optimization - allow staff to specialize and streamline source control operations. By enabling teams of staff to focus resources on similar issues, we will be able to better monitor and control our levels of service. This includes increased funding to add on more staff to be trained to conduct inspections and to do checkups on a regular basis for compliance.
 - The 2022 budget allowed for the hiring an additional FOG Inspector and two support staff. This additional staff will allow the program to start garage sump inspections in addition to restaurant inspections.
- There has not been a reduction in cleanings that need to be performed to remove FOG from the wastewater sewer system following the "Don't Abuse the Sewers" communication campaign and restaurant inspections. The "Don't Abuse the Sewers" was an educational campaign that told residents what not to put down the drain. Discussions on next steps are currently underway to help improve the situation and determine if more targeted communication tactics and other enforcement options may result in increased results.

- Technology. Real time analyzers for all parameters of concern do not exist. Correlations and trends must be reviewed by trained staff to understand much of the information. Further, test results from external laboratories takes up to two weeks to receive, limiting the ability to quickly act in specific situations.

Although the source control programs have challenges, the improvements and successes over the last years highlight the importance of the programs and the need for them to continue to grow and reach more industrial, commercial and institutional businesses and individual residents to improve overall wastewater, while maintaining economic development.

Appendix A



Figure A. Water, Wastewater & Drainage System

Table A. Summary of parameters tested in the primary effluent entering the WWTP.

Category	Parameter	Average	Minimum	Maximum
Hydrocarbons (PAHs)	1-MethylNaphthalene	0.000743	0.000020	0.006050
	2-MethylNaphthalene	0.000666	0.000020	0.007440
	Acenaphthene	0.000065	0.000010	0.000290
	Acenaphthylene	0.000011	0.000010	0.000020
	Acridine	0.000189	0.000020	0.000860
	Anthracene	0.000076	0.000010	0.000220
	Benzo(a)anthracene	0.000035	0.000010	0.000130
	Benzo(a)pyrene	0.0000204	0.0000000	0.0009400
	Benzo(b&j)fluoranthene	0.000022	0.000010	0.000090
	Benzo(b,j,k)fluoranthene	0.000029	0.000020	0.000100
	Benzo(e)pyrene	0.000019	0.000010	0.000060
	Benzo(g,h,i)perylene	0.000015	0.000010	0.000100
	Benzo(k)fluoranthene	0.000012	0.000010	0.000030
	Carbazole	0.000624	0.000020	0.005180
	Chrysene	0.000049	0.000010	0.000140
	Dibenzo(a,h)anthracene	0.0000060	0.0000000	0.0000500
	Dibenzofuran	0.000054	0.000050	0.000100
	Fluoranthene	0.000060	0.000010	0.000190
	Fluorene	0.000113	0.000020	0.000360
	Indeno(1,2,3-c,d)pyrene	0.000054	0.000010	0.000180
	Methyl anthracenes	0.000484	0.000020	0.004260
	methylnaphthalenes, 1+2-	0.001407	0.000030	0.012400
	Naphthalene	0.000838	0.000050	0.010300
	Perylene	0.000010	0.000010	0.000010
	Phenanthrene	0.000146	0.000040	0.000520
	Pyrene	0.000090	0.000010	0.000310
Quinoline	0.000928	0.000050	0.009320	
Retene	0.000013	0.000010	0.000050	
Hydrocarbons (others)	Benzene	0.00886	0.00050	0.07620
	EthylBenzene	0.00135	0.00050	0.01340
	F1	0.11	0.10	0.30
	F2	0.34	0.10	1.72
	F3	6.68	0.25	39.50
	F4	2.40	0.25	7.72
	m+p-Xylene	0.00532	0.00050	0.04310
	o-Xylene	0.00340	0.00050	0.03070
	Phenols	0.0852	0.0248	0.3680
	Toluene	0.01116	0.00050	0.11000
	Xylenes	0.00856	0.00075	0.07380

Total Metals	Aluminum	0.2968	0.0137	2.1300	
	Antimony	0.00099	0.00020	0.00392	
	Arsenic	0.00151	0.00068	0.00282	
	Barium	0.08062	0.04530	0.13900	
	Beryllium	0.00004	0.00004	0.00010	
	Bismuth	0.002333	0.000100	0.022100	
	Boron	0.309	0.156	0.725	
	Cadmium	0.0001204	0.0000100	0.0003400	
	Calcium	137.123	56.900	307.000	
	Cesium	0.000125	0.000050	0.000320	
	Chromium	0.00268	0.00082	0.00741	
	Cobalt	0.00100	0.00036	0.00302	
	Copper	0.06698	0.00815	0.15100	
	Iron	1.515	0.273	4.800	
	Lead	0.001939	0.000100	0.005770	
	Lithium	0.0704	0.0236	0.1700	
	Magnesium	59.9063	28.5000	134.0000	
	Manganese	0.61404	0.04410	2.60000	
	Mercury	0.0000506	0.0000500	0.0000700	
	Molybdenum	0.031428	0.002280	0.172000	
	Nickel	0.00968	0.00338	0.03120	
	Potassium	16.635	7.410	25.600	
	Rubidium	0.00918	0.00232	0.01420	
	Selenium	0.024827	0.000730	0.114000	
	Silicon	6.12	2.15	14.40	
	Silver	0.000468	0.000020	0.007520	
	Sodium	207.417	129.000	345.000	
	Strontium	0.82258	0.37100	1.85000	
	Sulphur (S Total)	214.17	54.00	576.00	
	Tellurium	0.00043	0.00040	0.00100	
	Thallium	0.000022	0.000020	0.000050	
	Thorium	0.00021	0.00020	0.00050	
	Tin	0.00121	0.00020	0.00286	
	Titanium	0.00866	0.00060	0.04370	
	Tungsten	0.00046	0.00020	0.00205	
	Uranium	0.002627	0.000430	0.006740	
	Vanadium	0.01823	0.00100	0.21800	
	Zinc	0.0842	0.0060	0.2390	
	Zirconium	0.001300	0.000400	0.003350	
	Dissolved metals	Dissolved Calcium	137.790	56.500	304.000
		Dissolved Iron	0.184	0.031	0.538
Dissolved Magnesium		60.1686	30.8000	135.0000	
Dissolved Manganese		0.59944	0.03260	2.57000	

	Dissolved Potassium	16.553	7.500	24.600
	Dissolved Sodium	208.020	147.000	353.000
Surchargeables	Biochemical Oxygen Demand	127	7	303
	Chemical Oxygen Demand	333	64	968
	Mineral Oil & Grease	7.0	5.0	34.1
	Oil & Grease	25.2	5.0	131.0
	Total Kjeldahl Nitrogen	32.9	1.2	64.6
	Total Phosphorus	4.36	0.68	9.74
	Total Suspended Solids	119.0	7.1	274.0
	General Chemistry and Nutrients	Alkalinity as CaCO ₃	244.4	54.0
Anion sum		22.48	13.40	41.70
Bicarbonate (HCO ₃)		298.3	65.9	458.0
carbonate (CO ₃)		1.0	1.0	1.0
Cation sum		21.32	12.80	42.10
Chloride		185.0	82.9	326.0
Conductivity (us/cm)		2051.4	1480.0	3250.0
Fluoride		0.261	0.100	0.687
Hardness as CaCO ₃		592	268	1320
Hydroxide		1.0	1.0	1.0
Nitrate		0.72	0.10	4.56
Nitrite		0.111	0.050	0.315
pH		7.58	7.16	7.84
Sulphate		591.9	126.0	1700.0
Sulphide (as H ₂ S)		1.04	0.03	4.97
Sulphide (as S)		0.98	0.03	4.67
Total Dissolved Solids		1365.2	749.0	2760.0
Total Nitrogen		45.9	42.9	52.0
Total Organic Carbon		99	66	144
Others		Cyanide, Total	0.0069	0.0050