

April 30, 2024

City of Brantford
**Stormwater
Management System**

Annual Performance Report 2023
ECA No. 063-S701



Contents

System Owner

The Corporation of the City of Brantford

Reporting Period

January 1st, 2023 to December 31st, 2023

Report prepared by

The Corporation of the City of Brantford

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Glossary of Terms and Abbreviations

Contaminant: has the same meaning as defined in section 1 of the EPA.

CCTV: Closed Circuit Television

Conveyance Channel: Open channels that convey stormwater from one structure to another or directly to the water course

CCME: Canadian Council of Ministers of the Environment

Director: A person appointed by the Minister, pursuant to section 5 of the EPA for the purpose of Part II.1 of EPA (Environmental Compliance Approvals)

ECA: Environmental Compliance Approval issued by the Ministry of the Environment, Conservation, and Parks

Mainline Sewer: a pipe that collects wastewater from smaller laterals and conveys to a larger trunk sewer

Maintenance Hole (M/H): A structure that provides access to a sewer system for inspection, cleaning, maintenance, sampling, or flow monitoring

MECP: Ministry, of the Environment, Conservation and Parks

Ministry: The Ministry of the Minister and includes all employees or other persons acting on its behalf

OGS: Oil and Grit Separator

PWQO: Provincial Water Quality Objectives

pH: Measure of the alkalinity or acidity in water

SAC: Spills Action Centre

SDWT: Significant Drinking Water Threat

Spill: As defined in Part X of the Environmental Protection Act, is a discharge a) into the natural environment, b) from or out of a structure, vehicle or other container; or c) that is abnormal in quality or quantity in light of all of the circumstances of the discharge.

Stormwater: Rainwater runoff, water runoff from roofs, snowmelt, and surface runoff

STP: Sewage Treatment Plant, also known as Wastewater Treatment Plant ('WWTP')

SWMP: Stormwater Management Pond

Third Pipe Collection System: Sewage Works designed to collect and transmit foundation drainage and/or groundwater to a receiving watercourse

Total Ammonia Nitrogen (TAN): A measure of the amount of ammonia (nitrogen pollution) in water

Total Phosphorus (TP): An essential nutrient used by microorganisms for growth. Excess amounts can lead to environmental issues like algae over-growth

Total Suspended Solids (TSS): Suspended particles (organic and inorganic material) present in the water sample

Wastewater: Water that has been used and discharged by homes, businesses, and industries. Everything we flush down a toilet or pour down a drain, collectively

1.0 Introduction

This report has been prepared in accordance with the terms and requirements set out in the City of Brantford's Ministry of the Environment, Conservation and Parks (MECP) Environmental Compliance Approval (ECA) for a Municipal Stormwater Collection System #063-S701 issued on November 2nd, 2022.

This report covers the period from January 1st 2023 to December 31st 2023 and will be made available on the City of Brantford's website by June 1st 2024. Hard copies will be made available by request by contacting the City of Brantford's Environmental Services Department.

ECA #063-S701 outlines the terms and conditions for operating the Stormwater Collection System. Schedule E, Section 5.2 of the ECA mandates the submission of an Annual Performance Report to the Director. This report includes monitoring data, operational challenges, inspections, maintenance, repairs, calibration, spills, public complaints and other operational information in respect to the system.

For the reporting period, City Staff worked diligently completing several maintenance, rehabilitation renewal projects to ensure the adequacy of the City's Stormwater Collection System. No Ministry of the Environmental, Conservation and Parks inspections occurred during this time.

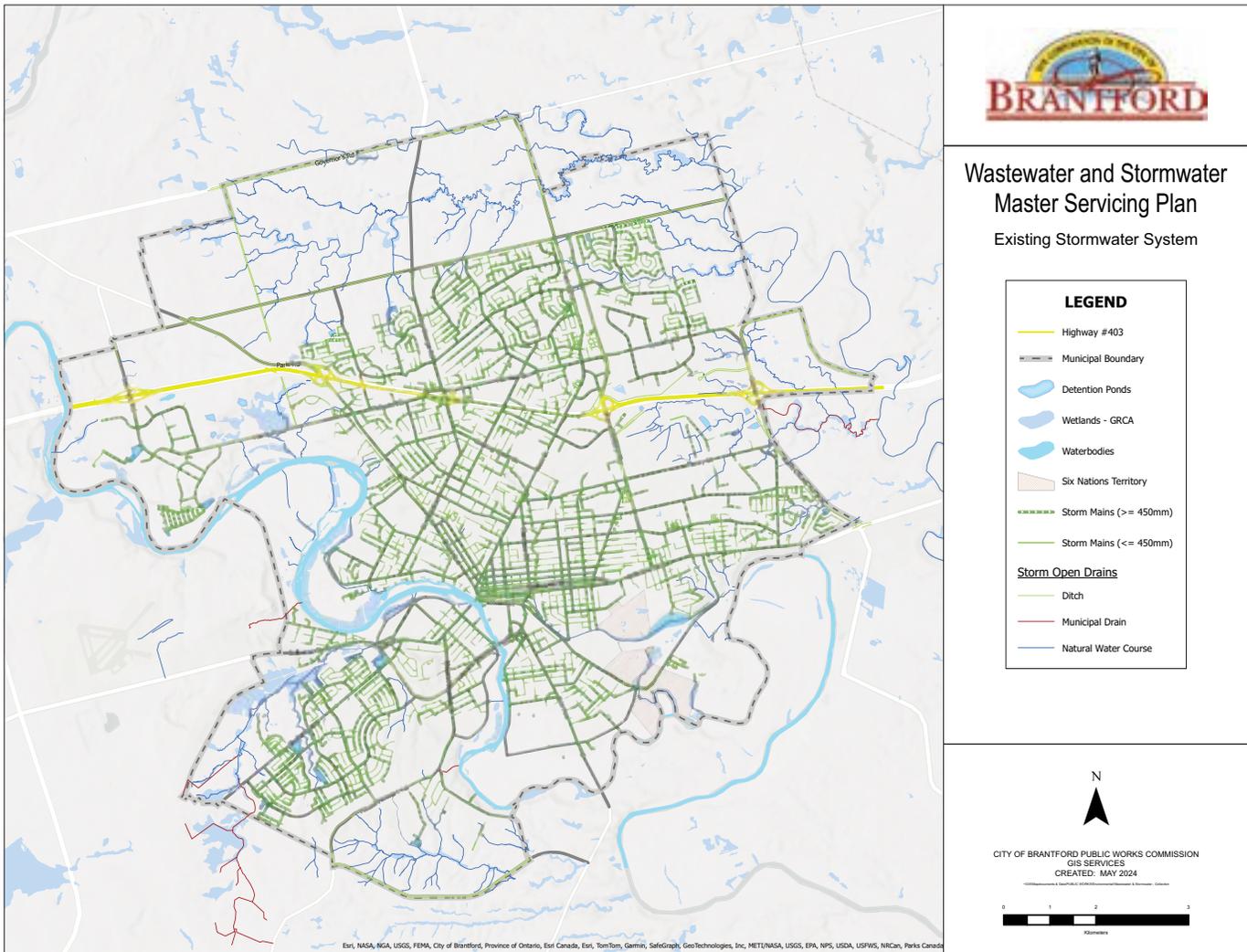
2.0 Stormwater Management System Overview

The Corporation of the City of Brantford ("The City") owns, maintains, and operates the Stormwater Collection System designed for the collections, transmission, and treatment of stormwater, consisting of approximately 430 kilometers of storm sewers, 228 kilometers of channels, ditches, culverts, 20 oil grit separator units (OGS), 23 stormwater management facilities, including catchbasins and other related infrastructure that transmits stormwater to the Grand River, or its tributaries.

The entirety of the City is located within the Grand River Watershed, regulated by the Grand River Conservation Authority (GRCA). The majority of the City's stormwater system drains directly to the Grand River or its tributaries; Mohawk Lake, D'Aubigny Creek and Fairchild Creek. A significant portion of the northeastern segment of the City discharges to local creeks along the City's north and east boundaries to Fairchild Creek. Within the Fairchild Creek catchment, there is a major ditch network along Hwy 403 and Wayne Gretzky Parkway that receives a large portion of Fairchild Creek catchment, conveying flows to the south east, and to the Garden Avenue Municipal Drain. The Mohawk Lake and canal is a receiving body for a substantial portion of the City's stormwater. Figure 1 provides an overview of the Stormwater Management System.

The Stormwater Management System operated under the authority of an Environmental Compliance Approval for a Municipal Stormwater Management System number 063-S701. Regulatory compliance, inspections and reporting are completed through the Ministry of Environment, Conservation, and Parks Guelph District Office.

Figure 1: An overview of the Stormwater Management System



3.0 Operational Performance

As per the ECA, this section's purpose is to provide a summary of significant operational problems encountered and any associated corrective actions that were implemented.

Stormwater management infrastructure is inspected on a routine basis to ensure it is performing as designed and operating effectively. Inspection and maintenance activities are recorded and retained for record retention purposes and the data is used to assess performance, compliance and identification of trends and anomalies that require further investigation and or remediation to maintain proper function of the system. Where issues are identified during inspections, work orders are generated for maintenance/repairs.

3.1 Operating Challenges and Corrective Actions

Following a gradual increase in quarterly nitrate sampling results that were over half of the Maximum Acceptable Concentration or MAC, (MAC-10 mg/L, half MAC-5mg/L), the City voluntarily increased Point of Entry (POE) to the distribution system sample collection frequency from quarterly to weekly starting in September 2022 and continued throughout 2023 to better understand the seasonal nitrate trends measured in the raw and treated water at the water treatment plant.

The 2023 weekly nitrate sampling data indicates that the nitrate concentration in the river exceeded half of the MAC for 18 weeks in 2023 most of which were between January and the end of March. The average nitrate concentration at the POE was 4.54 mg/L and the maximum was 8.38 mg/L.

- In 2022, an Industrial Fire on Henry Street impacted the newly-constructed Braneida SWMF (Asset ID 07F002DP) located off Adams Blvd.
 - Impacts to water quality in Fairchild Creek observed – City/Consultant monitored the impacted area throughout 2023 until remediation efforts were completed and surface water sampling indicated the event was no longer impacting the creek.
 - A Remediation Plan was prepared and undertaken for the remediation and restoration of the Braneida SWMF, including soil and surface water remediation activities – on-going, expected to be complete in Summer 2024
- TSS loading through Fairchild Creek subcatchment higher than historical averages – City to undertake further investigation during the 2024 monitoring year to identify potential contributors.
- The Grand River and Fairchild Creek subcatchments were mostly in exceedance of the CCME long-term exposure guideline for chloride and often above the short-term exposure guideline (640 mg/L) as well. – City to explore additional efforts to be made to limit at-source road salt use to lower chloride loading to the receiving watercourses.
- Total phosphorus throughout the City's Stormwater Monitoring locations was mostly high, indicative of a hyper-eutrophic environment (>0.100 mg/L) – continued efforts to increase the use of bioretention and vegetation within stormwater management treatment-train infrastructure to help remove phosphorus from runoff.

4.0 Monitoring Program Information

The City's Environmental Services Department was responsible for conducting stormwater monitoring within the Stormwater Management System during the reporting period.

Table 1 includes a summary of the monitoring program details.

Monitoring Details	
No. of Water Quality Monitoring Stations	28
Monitoring Level	Level 1
Key Receivers Monitored	D'Aubigny Creek, Grand River, Fairchild Creek
Name of Accredited Laboratories Used	E3 Laboratories Inc., 360 York Rd, Niagara-on-the-Lake, ON L0S 1J0

The City conducts a routine water quality monitoring program that uses creek and stormwater drainage monitoring locations. Every year, routine monitoring is completed monthly with a rotating four (4) week schedule, and targeted wet-weather sampling is completed on an event-based timeline.

There were a total of 28 locations strategically placed to encompass major waterways within the City's drainage network. Samples are taken from a combination of stormwater manholes, open watercourses, and outfalls. These results are used as a baseline to benchmark data collected during spills and wet weather events.

5.0 Monitoring Results Analysis

LGL Limited was retained by the City to develop the City's Stormwater Monitoring Plan in response to requirements of ECA No. 063-S701. LGL Limited completed the analysis of the City's previous 6 years of stormwater monitoring sample results to produce recommendations for future monitoring programs.

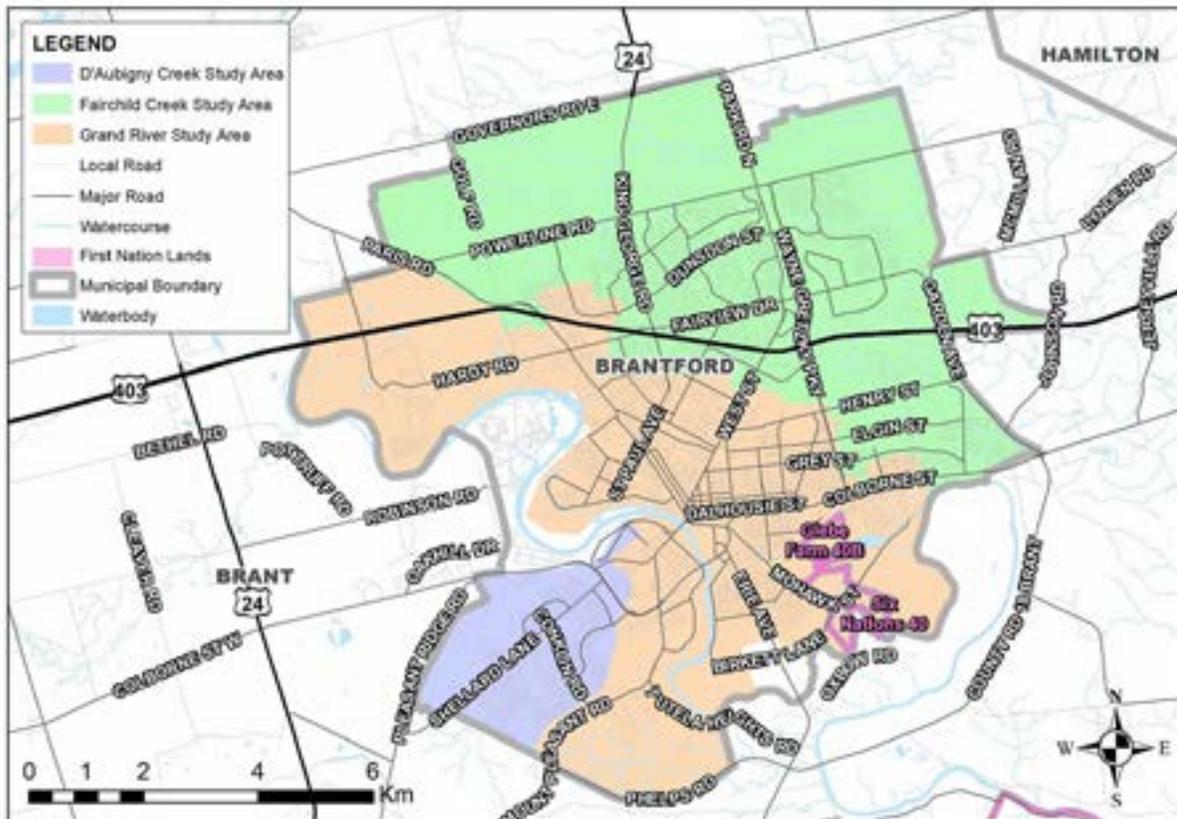
The City operated a wide-ranging monitoring and sampling program, and results were based on the measured criteria that are relevant to evaluate the performance of stormwater management infrastructure as well as health of receiving watercourses.

Throughout 2024, the City and LGL Limited will continue to develop the Stormwater Monitoring Plan to meet the requirements of the ECA. The City is awaiting the release of the Ministry's monitoring guidance documents to fulfil this obligation.

5.1 Catchment Areas being Monitored

Within the City of Brantford's municipal boundary there are three (3) Subwatersheds that have been identified, see Figure 2.

Figure 2: City of Brantford Subwatersheds



5.1.1 The Grand River

The Grand River is the largest Canadian watershed that flows into Lake Erie, with over 6,800 square kilometers of catchment area. It is one of the richest agricultural regions in Canada with approximately 70% of the watershed actively farmed (GRCA 2014). Large urban centres represent approximately 7% of the watershed and wetlands and forest cover approximately 20% of the watershed. For the reporting year, there were 4 SWMF and 5 OGS units that formed part of the Authorized System, each outlet into the Grand River.

The reach of the Grand River through Brantford is identified through the Land Information Ontario (Stations GU-3002-GRA and GU-3001-GRA) database as a warmwater thermal regime. Species at risk fish were identified in the reach throughout the monitoring area through LIO and DFO's species at risk mapping including threatened Black Redhorse (*Moxostoma duquesnei*), Silver Shiner (*Notropis photogenis*), and Eastern Sand Darter (*Ammocrypta pellucida*). Additionally, several species at risk mussels were identified through DFO mapping as within or potentially within this reach of the Grand River to include special concern Rainbow Mussel (*Villosa iris*), Wavy-rayed Lampmussel (*Lampsilis fasciola*), and Mapleleaf (*Quadrula quadrula*), and endangered Round Pigtoe (*Pleurobema sintoxia*).

Mohawk Lake is a waterbody that exists southeast of the downtown core and receives most of its drainage from downtown and the most heavily developed areas of central Brantford. The Mohawk Lake drainage area is characterized by East Ward Creek that conveys urban drainage east through Mohawk Lake and through the Beach Road Dam before flowing into the Grand River. The Mohawk Lake subcatchment has future restoration and drainage improvement plans including adding wetland vegetation to further improve water quality treatment of runoff from the downtown core.

5.1.2 D'Aubigny Creek

D'Aubigny Creek is a coldwater tributary originating in the D'Aubigny Swamp, a Provincially Significant Wetland that travels 8 km through swamp areas and finally D'Aubigny Creek Park before entering the Grand River approximately 700 m upstream of Grant Island (GRCA 2017). For the reporting year, there were 6 SWMF and 2 OGS units that are a part of the Authorized System, and each outlet into D'Aubigny Creek. Brown Trout (*Salmo trutta*), Brook Trout (*Salvelinus fontinalis*) and Rainbow Trout (*Oncorhynchus mykiss*) were all identified within the middle to upper reaches of D'Aubigny Creek during surveys completed in 1994 (Phillips Planning and Engineering Ltd. 1995). The presence of these species further supports D'Aubigny Creek's status as a coldwater tributary, though more recent records were not readily available.

5.1.3 Fairchild Creek

Fairchild Creek is a largely agricultural subwatershed with headwaters based in the Beverly Swamp Wetland Complex, a Provincially Significant Wetland. Fairchild Creek flows from this wetland complex south-southwest towards Brantford, where it eventually outflows into the Grand River near Onondaga. There are 14 SWMF and 6 OGS units that are a part of the Authorized System, each outlet into Fairchild Creek.

In 2016, the Grand River Conservation Authority (GRCA) completed a subwatershed characterization study on Fairchild Creek and found that winter average chloride, TSS, and phosphorus concentrations were all over the CCME long-term guidelines. Winter chloride concentrations were 129.3 mg/L, with other seasonal values recorded below 75 mg/L. TSS concentrations were above 25 mg/L in 83.3% of samples collected. Phosphorus concentrations were above the PWQO threshold of 0.03 mg/L in 98.1% of samples collected (MECP 1994). Fairchild Creek has been found to contribute more TSS and phosphorus to the Grand River per square kilometer than any other major tributary in the watershed (GRCA 2016). Only approximately 20% of Fairchild Creek has been evaluated for thermal regime by the Ontario Ministry of Natural Resources and Forestry (OMNRF), with a majority (87.8%) of the areas identified as warmwater habitat, 12.2% was identified as coldwater habitat, and <0.1% identified as coolwater habitat (GRCA 2016).

5.2 Supporting Information for Monitoring Results

The City's Stormwater Monitoring Program locations were analyzed to determine the closest upstream and downstream locations for each of the stormwater infrastructure to be monitored under the ECA requirements.

LGL Limited conducted the analysis of the stormwater sample results obtained during the previous 5 years of baseline monitoring and completed specific analysis of the 2023 monitoring period. The obtained stormwater monitoring results were compared to the Provincial Water Quality Objectives (PWQO) and Canadian Council of Ministers of the Environment (CCME) – Standards for the Protection of Aquatic Life.

The majority of Stormwater Management Facilities did not have monitoring stations directly upstream and downstream thus limiting the ability to allow for evaluation of the performance of individual facilities. Alternatively, to assess the overall performance of the Stormwater Management System, analysis of watercourse health was applied to the three subwatershed areas: D'Aubigny Creek, Grand River and Fairchild Creek.

Through 2024, the City along with LGL Limited will work to develop a Stormwater Monitoring Plan with the goal of improving the current monitoring programs to address ECA requirements more acutely and implement a monitoring framework that can be leveraged to take decisive action to improve water quality in the City of Brantford. This will be a collaborative process that will integrate feedback and concerns from a variety of stakeholders and community members, including the MECP.

5.3 Analysis of Overall Performance

Analysis of overall performance can be confirmed through the Stormwater Monitoring Program, visual inspections and formal Condition Assessments of Stormwater Management Infrastructure. The City completes inspections and formal Condition Assessments of Stormwater Management Infrastructure on a routine basis as identified in the Stormwater Operation & Maintenance (O&M) Manual.

Although the stormwater sampling program completed by the City does not have any direct inlet/outlet sampling locations relative to any of the stormwater infrastructure identified within the ECA, there are robust and detailed data available to assess the health of local watercourses and highlight specific stormwater events of concern for further investigation in the subsequent sections of this report. There are no major issues with the operation of the system; all stormwater infrastructure is working as designed or plans have been established to improve their condition, based on the condition assessments and water quality analysis within this report.

5.4 Analysis of Water Quality in Watershed

The analysis of water quality in the watershed included comparing the 2023 monitoring year to the previous 5 years of background trending data to determine if the 2023 monitoring year demonstrated different characteristics relative to the historical baselines and to contextualize historical watershed health indicators.

Water quality in watercourses within the City of Brantford is highly variable depending on the subwatershed. Many of the PWQO and CCME water quality guideline exceedances are likely independent of the performance of SWMPs and/or OGS units. Given the design intent of SWMF, their treatment capacity, health of local watercourses and the monitoring program completed by the City, the analysis focuses on the following water quality criteria:

- total suspended solids;
- chlorides;
- phosphorus;
- conductivity;
- dissolved oxygen; and
- pH.

Water quality criteria such as chloride, phosphorus, conductivity, dissolved oxygen and pH may not be directly indicative of the functional capacity of SWM infrastructure, however highlighting areas of potential concern will enable the City to improve water quality using holistic strategies that consider on-line SWMF's.

Stormwater management infrastructure is generally designed to control and remove total suspended solids (TSS), though it also can lower total phosphorus concentrations and have a buffering/dilution effect on chloride and pH. Generally, TSS loading through the City was consistent with the historical averages, except for the Fairchild Creek subcatchment. Further investigation is recommended for the 2024 monitoring program to identify the causes of higher sediment loading in the Fairchild Creek subcatchment specific to stormwater infrastructure and road drainage. Chloride concentrations within D'Aubigny Creek were generally low, though the 2023 downstream monitoring location identified the first exceedances of CCME guideline for long-term exposure (120 mg/L); this should be carefully monitored in future years to ensure that this cold-water tributary does not become overly inundated with chloride. The Grand River and Fairchild Creek subcatchments were mostly in exceedance of the CCME long-term exposure guideline for chloride and often above the short-term exposure guideline (640 mg/L) as well. Efforts should be made to limit at-source road salt use to lower chloride loading to the receiving watercourses. Total phosphorus throughout the City was mostly high, indicative of a hyper-eutrophic environment (>0.100 mg/L); continued efforts should be made to increase the use of bioretention and vegetation within stormwater management treatment-train infrastructure to help remove phosphorus from runoff.

5.4.1 Total Suspended Solids

The main purpose of Stormwater Management Facilities is to capture and retain suspended solids. Therefore, TSS concentrations represent the primary water quality indicator for the performance of stormwater management infrastructure.

Suspended solids within D'Aubigny Creek were at or below 23.5 mg/L throughout samples completed in 2023, reflecting a very low-turbidity watercourse without any sediment-loading events observed that may be indicative of poor stormwater infrastructure performance.

The subcatchment draining directly to the Grand River only had one monitoring location where increases greater than 25 mg/L compared to baseline were observed, both occurred at the Gilkison Creek outfall/confluence with the Grand River.

No major trends in sediment loading were identified that would require immediate remediation or urgent project maintenance works. SWM facility 07F002DP should be closely monitored as vegetation establishes along the banks to ensure that it will function in its full intended capacity for the 2024 monitoring season and into the future.

5.4.2 Chlorides

Chlorides in urban waterways are predominately caused by the application of road salts, and are not readily filtered by soil or plants (Haake and Knouft 2019). Stormwater management facilities, specifically wet ponds, can offer some buffering of peak chloride concentrations in runoff during the colder months through dilution within the volume of the pond, but this is not the design intent of the facilities. Stormwater ponds can also retain relatively high chloride concentrations into warmer months, causing higher chloride loading during months where road salts are not actively applied to the contributing catchment areas (Lam et al. 2020). The best way to limit chlorides from entering watercourses is to limit their use as much as possible or use an alternative solution to winter road conditions such as sand, where possible. Measures to reducing the use of road salts and educating the public to reduce their use of deicing salts should be applied throughout the City. Overall performance of the Stormwater Management System, analysis of watercourse health was applied to the three subwatershed areas: D'Aubigny Creek, Grand River and Fairchild Creek.

Chloride concentrations in D'Aubigny Creek were relatively low (<68 mg/L) at the natural/upstream sample station throughout the year, and the downstream location only exceeded the CCME long term value (120 mg/L) for the protection of aquatic life during the winter 2018-2023 average (127 mg/L) and in 2023 (217 mg/L). This is a concerning trend, especially as development to the southeast of D'Aubigny Creek continues to be built out and new stormwater infrastructure comes online within the subcatchment. D'Aubigny Creek represents a coldwater tributary to the Grand River, providing valuable habitat to biota that are limited to these coldwater areas of the watershed.

In the subcatchment draining directly to the Grand River high chloride concentrations were observed throughout the study area, except for Brant Park, where neither the 2018-2023 averages nor 2023 sample year exceeded CCME guidelines. Average chloride at all other monitoring stations and seasons exceeded the 120 mg/L long-term value for the protection of aquatic life, with many locations exceeding the CCME short-term threshold (640 mg/L) as well. The station contributing the lowest average concentration of chlorides to the Grand River in 2023 was Hardy Road in the fall (133 mg/L) and the highest was Gilkison Creek in the winter (1864 mg/L). These values are not atypical for a medium-sized urbanized city in southern Ontario, but efforts should continue to limit the use and application of road salts.

Like the Grand River subcatchment, the Fairchild Creek watershed consistently demonstrated average chloride concentrations exceeding the CCME long term guideline (120 mg/L) in 2023, with the only exceptions being the winter sampling at Garden Ave, and spring to fall monitoring at King George Road Creek and McMillan Road. The range of chloride concentrations in 2023 were between 35 mg/L (McMillan Road in spring) and 1296 mg/L (Sinclair Creek in winter). F-07 demonstrated a significant rise in chloride concentrations during wet weather sampling relative to baseline conditions, and further investigation should take place to determine what may be causing this trend. The lowest chloride concentrations occurred, predictably, in the northern headwaters of Fairchild Creek, areas with the lowest urbanization and development in their upstream catchment area.

5.4.3 pH

pH values outside of the PWQO for the protection of aquatic life (6.5 – 8.5) can reduce habitat quality and cause biological impairments to freshwater biota. There is little effect that stormwater management infrastructure can have on pH, aside from a buffering effect of potentially acidic or alkaline inflows into the ponds – like the interaction between chloride concentrations and stormwater management ponds. All values of pH measured (2018 – 2023 averages and 2023 averages) within each of the subcatchments were within the PWQO (6.5 – 8.5), with the exception of the Beach Road Dam location in summer 2023 (8.53).

5.4.4 Total Phosphorus

Although it is not always an explicit design intent, stormwater management ponds can reduce total phosphorus concentrations in water as it moves through the facility (Nayeb Yazdi et al. 2021). Stormwater management strategies that utilize treatment-train approaches and maximize vegetation in the facilities (in-facility wetland cells, bioretention) can increase the efficacy of phosphorus retention within the facility. Phosphorus is the limiting nutrient to primary productivity in southern Ontario, and excess phosphorus can result in eutrophication, hypoxic conditions and potentially algae blooms in slower moving watercourses or ponds.

Most sampling locations within the City's monitoring program demonstrated hyper-eutrophic concentrations of phosphorus in the 2018 – 2023 averages as well as during the 2023 monitoring period. Future stormwater management infrastructure development and rehabilitation projects should focus on designs that have capacity to filter and fix phosphorus from stormwater to help address the hyper-eutrophic concentrations of phosphorus observed in the City.

5.4.5 Dissolved Oxygen

Dissolved oxygen is an essential component of freshwater ecosystems required to support fish and other aquatic biota, and the capacity for water to sustain higher concentrations of dissolved oxygen is dependent on water temperature (Harvey et al. 2011). Stormwater management ponds can have a significant impact on water temperature, as the wet ponds are typically fully exposed to the sun and effluent is historically skimmed from the top of the pond, though more modern stormwater management designs have integrated bottom-draw outlets and cooling trenches to combat the thermal impacts of stormwater management ponds.

Dissolved oxygen concentrations throughout each subwatershed were consistent with historical averages as well as the historical thermal regimes of the watersheds, where data were available (GRCA 2016). D'Aubigny Creek continues to demonstrate a coldwater thermal regime, while the Grand River and Fairchild Creek watersheds demonstrate a thermal regime that can consistently support a warmwater fishery. Some reaches of the Grand River and Fairchild Creek subcatchments demonstrate DO concentrations required to support coldwater fish.

5.4.6 Conductivity

Conductivity is a measure of the inorganic dissolved solids in water and can be used as a proxy measurement to determine the overall loading of dissolved ionic elements in water. Typical ions that contribute to conductivity levels are chloride, nitrate, sulfate, and phosphate anions, as well as sodium, magnesium, calcium, iron, and aluminum cations.

Conductivity ranged from 554 – 1215 $\mu\text{S}/\text{cm}$ in D'Aubigny Creek, 639 – 3706 $\mu\text{S}/\text{cm}$ in the Grand River, and 286 – 5561 $\mu\text{S}/\text{cm}$ in the Fairchild Creek watershed in 2023. There were some notable areas that were well above the historical averages, and an investigatory response framework to monitoring activities will be recommended in the stormwater management program plan that is being developed for the City of Brantford.

6.0 Interpretation of Environmental Trends

LGL Limited was retained by the City to complete data analysis and interpretation of environmental trends based on previous stormwater monitoring information and data for the previous five (5) years (2018-2022), and specific analysis of the 2023 monitoring period in response to requirements of ECA No. 063-S701. LGL's detailed stormwater quality monitoring report is included as an appendix to this report, and high-level trends and recommendations have been integrated within this report.

City data was used to examine trends in chloride, total suspended solids, pH, phosphorus, conductivity and dissolved oxygen, where applicable. City monitoring locations focused on capturing drain and stream conditions near stormwater management infrastructure, with a watershed approach that involved monitoring confluence points along the watershed. Data was sorted by receiving watercourse to contextualize historical watershed health indicators. GRCA data was also accessed and used to examine trends in precipitation and air temperature in the Grand River.

7.0 Calibrations & Maintenance of Monitoring Equipment

This section provides a summary of calibrations and maintenance performed on all stormwater monitoring equipment used in the Environmental Services Lab. The City has a formal instrumentation calibration and maintenance program performed on all laboratory equipment to track the performance and accuracy of all instrumentation. Accuracy verification and calibration of monitoring devices are completed annually by a Third-Party Certified Contractor. Table 2 provides a summary of laboratory equipment and the calibration results. One analyzer was not calibrated during the reporting year and required calibration and maintenance in January 2024.

Table 2: Laboratory Equipment Calibration and Maintenance Schedule

Analyzer	Equipment Description	Date Calibrated	Results
DRB200 Reactor, 110V 30 X 16MM (14090C0424)	Digester for Hach Kit TP Analysis	July 27, 2023	Passed
Reactor 115V 12X13 + 8X20 (2 BLOCKS) (13110C0476)	Digester for Hach Kit TP Analysis	July 27, 2023	Passed
DR3900 Spectrophotometer with RFID (1591447)	Colour spectrophotometer for Hach kit TP Analysis	July 27, 2023	Passed
DR3900 Spectrophotometer with RFID (1419310)	Colour spectrophotometer for Hach kit TP Analysis	July 27, 2023	Passed
Hanna Multimeter 9829 (06270018101/9672BN)	Multimeter used for field analysis of conductivity DO and pH	July 27, 2023	Failed*
Denver AA-250 Balance (21861)	Balanced used to weigh filter papers for TSS analysis	Oct 10, 2023	Passed

*During the reporting period, the Multimeter failed the in-house calibration tests due to issues with the sensor and did not receive annual calibration by Third-Party Certified Contractor. In January 2024 the Multimeter received calibration by Third-Party Certified Contractor and the sensor was serviced.

8.0 Inspections, Maintenance and Repairs

The following section provides an overview of some of the inspection, major maintenance activities and capital upgrades carried out on the stormwater Management system for the reporting year.

8.1 Inspections

Inspections are critical for detecting and addressing issues promptly within the Stormwater Management System, preventing environmental contamination and ensuring regulatory compliance. The City maintains routine inspection programs to identify potential issues early, maintain integrity and performance of the system while minimizing risks to public health and the environment.

Table 3: Summary of Major Inspection Activities

Type of Activity	Inspection Frequency	Number Completed	Description
Storm CCTV Inspections	7-10 years	31.5 km	<ul style="list-style-type: none"> Completed under the CCTV Sewer Inspection Program, includes maintenance holes Storm sewers are flushed prior to CCTV Deficiencies identified from inspections will be prioritized and addressed by City or a Contractor.
Brick Manhole Inspections	1 per year	10	<ul style="list-style-type: none"> Visual inspection
Stormwater Management Pond Inspections	3 times per year	55	<ul style="list-style-type: none"> Visual inspection
Stormwater Outfall Inspections	1 per year	294	<ul style="list-style-type: none"> Visual inspection
Catchbasin Inspections	5-7 years	4203	<ul style="list-style-type: none"> CCTV / Zoom Camera inspection
OGS Inspections	3 times per year	65	<ul style="list-style-type: none"> Visual inspection and sediment measurements to determine cleanout frequency
Storm Inlet Inspections	2 times per year	1,690	<ul style="list-style-type: none"> Visual inspection

8.2 Maintenance and Repairs

The City uses preventative maintenance software to manage work orders for all scheduled and unscheduled maintenance activities. Scheduled maintenance work orders are derived from manufacturer operation and maintenance manuals, supplemented by Staff expertise. The work order system efficiently records non-routine and unplanned maintenance activities. Operations Staff document the actions taken, and then subsequent follow-up work is planned and executed to ensure comprehensive maintenance coverage.

Table 4 shows a summary of major maintenance and repair activities completed for the Stormwater Management System. Appendix A includes a table summarizing capital projects completed, on-going, and future for the reporting period.

Table 4: Summary of Major Maintenance and Repair Activities

Type of Activity	Inspection Frequency	Number Completed	Description
Storm Sewer Relining	As required	0.5 km	• Repairs part of road reconstruction projects
Ditch Slope Reinstatement	As required	9.6 km	• Repairs based on condition assessments
Maintenance Hole Repairs & Replacements	As required	44	• Includes new frame and cover installations, spray lining, parging to stop roots, fill voids and reduce infiltration
Storm Mainline Repairs	As required	9	• Completed based on CCTV Inspection Program
OGS Cleanouts	1 per year	5	• Cleanout frequency based on sediment design capacity
Catchbasin Cleanouts	5 to 7 years	4203	• Inspections completed after cleanout
Catchbasin Repairs & Replacements	As required	62	• Excavations, repairs, lead pipe repairs, and replacements
Cross Connection Repairs	As required	1	• Repaired one (1) sanitary cross connected with storm sewer
Storm Sewer Flushing / Cleaning	As required	31.5 km	• Flushing completed under the CCTV Inspection Program
SWMP Cleanouts and Repairs	10 years	1	• Sediment removal and cleanout along with repairing/rehabilitating deficiencies identified
Creek Maintenance	As required	26	• Tree and garbage removal
Culvert Replacements	As required	1	• Repairs based on condition assessments

9.0 Complaints & Responses

The City of Brantford receives customer complaints through the City's Customer Service Call Centre, or sometimes complaints are directed to individual Departments. During the reporting period, a total of 217 complaints were received in regards to both the storm sewer and sanitary collection systems. Table 5 provides a summary of complaints received during the reporting period and steps taken to address the complaints.

Table 5: Summary of Complaints and Actions Taken

Type of Complaint(s)	Complaints	Actions Taken
Stoppage/Back-ups	189	<ul style="list-style-type: none"> All complaints were investigated and addressed by City Staff Some incidents were identified as private plumbing issues (no issues identified on the City side), but the City performed the work to clear the stoppage/backup Some incidents identified issues on the City side, which resulted in maintenance / repairs
Odour Complaints	28	<ul style="list-style-type: none"> All complaints were investigated and addressed by City Staff Some incidents were identified as private plumbing issues (no issues identified on the City side) Some incidents identified stoppages/back-up issues, which resulted in maintenance / repairs
Catchbasin Complaints	11	<ul style="list-style-type: none"> All complaints were investigated and addressed by City Staff
Drainage System Complaints	163	<ul style="list-style-type: none"> All complaints were investigated and addressed by City Staff Types of complaints include: flooding, catchbasin and maintenance hole repairs/maintenance in ROW, fallen trees, garbage, creek/stream complaints related to the drainage system

10.0 Spill(s) or Abnormal Discharge Event(s)

10.1 Spills and Abnormal Discharges

All incoming spill incidents were managed by the Environmental Services Department, with the majority involving hydrocarbons or oil-based substances. Efforts to contain such spills were typically executed using absorbent materials and booms with the impact on the environment frequently reported to be minimal or non-existent. Industrial firewater spills were handled by installing booms and employing vacuum trucks to manage and remove/divert the firewater, resulting in minor or no reported environmental impacts were observed. The MECP's Spills Action Center (SAC) and/or MECP Environmental Officers assigned were regularly kept informed, as required. A complete summary of these spill incidents can be found in Table 6.

Table 6: Summary of Spills and Abnormal Discharge Events

Number	Date(s)	Location/Receiver	Description of Spill / Event	Estimated Duration (Hr)	Estimated Volume (L)	Actions Taken
1	1-04-23, 2-09-23, 3-17-23, 4-05-23	Outfall 03F001OF Open Drain that eventually discharges to Fairchild Creek	<ul style="list-style-type: none"> Industrial facility stormwater runoff found to be above stormwater by-law limits 	Unknown	Unknown	<ul style="list-style-type: none"> Warning Letter Issued. Industry responds indicating plans for warehouse expansion and grading changes to improve run-off. Stormwater treatment options and additional covered storage for prone areas are being considered as well. In process of improving site condition and increased source control measures.
2.	02-21-23	Outfall 02F084OF / Open Drain that eventually discharges to Fairchild Creek	<ul style="list-style-type: none"> Industrial fire caused minor impacts to stormwater outlet 	Unknown	Unknown	<ul style="list-style-type: none"> Oil absorbent booms installed at outfall Fire water diverted from storm sewer system to sanitary system

Number	Date(s)	Location/ Receiver	Description of Spill / Event	Estimated Duration (Hr)	Estimated Volume (L)	Actions Taken
3.	09-22-23	Outfall 03F001OF / Open Drain that eventually discharges to Fairchild Creek	<ul style="list-style-type: none"> Industrial Facility oil based material accidentally discharged to private storm-water collection system, resulting in the material entering the City's stormwater collection system Minor impacts to receiving stream 	Unknown	Unknown	<ul style="list-style-type: none"> Oil absorbent booms installed at outfall Remediation efforts undertaken
4.	6-26-23	Outfall 02F084OF / Open Drain that eventually discharges to Fairchild Creek	<ul style="list-style-type: none"> Abnormal stormwater discharge above stormwater by-law limits Rainfall intensity caused below grade stormwater collection vault to overflow and discharged untreated stormwater into City Storm Collection System 	Unknown	Unknown	<ul style="list-style-type: none"> Warning Letter issued. MECP issued Notice of Violation. Industry updated Emergency SOPs and installed stage plates for catch basins to reduce velocity of influent during heavy rain events.
5.	7-31-23	Outfall 02F124OF / Open Drain that eventually discharges to Fairchild Creek	<ul style="list-style-type: none"> Industrial fire caused impacts to stormwater outlet 	Unknown	Unknown	<ul style="list-style-type: none"> Industry In process of installing stormwater settling pond

Number	Date(s)	Location/Receiver	Description of Spill / Event	Estimated Duration (Hr)	Estimated Volume (L)	Actions Taken
6.	01-4-23, 02-9-23, 3-17-23, 4-05-23, 11-21-23	Outfall 03F590OF / Open Drain that eventually discharges to Fairchild Creek	<ul style="list-style-type: none"> Industrial facility stormwater runoff found to be above stormwater by-law limits 	Unknown	Unknown	<ul style="list-style-type: none"> Industry In process of installing stormwater settling pond
7.	1. 12-09-23	Outfall 02F105OF / Open Drain that eventually discharges to Fairchild Creek	<ul style="list-style-type: none"> Oil slick reported travelling through creek on Henry St Minimal impact to receiver 	Unknown	U<50 L	<ul style="list-style-type: none"> Oil absorbent booms installed at outfall Remediation contractor responded

10.2 Efforts Made to Reduce Spills or Abnormal Discharge Events

Activity	Description	Assessment of Effectiveness
Sewer Use By-law Program	<ul style="list-style-type: none"> Regulates the discharge of Stormwater entering the City's Stormwater Collection System Education and outreach program designed to inform dischargers about the City of Brantford's stormwater system and what they can do to help reduce impacts to the environment. Monitor, control and reduce the impact of spills 	<ul style="list-style-type: none"> Successfully contributed to the GRCA Children's Water Festival. 4th grade classes from schools in Brantford, Brant and Six Nations were educated on the different storm water and sanitary systems within Brantford. Education outreach fliers were distributed in areas of concern following spill events. 56 Industrial Inspections and 1 Restaurant Location successfully completed in 2023. All issues were immediately addressed and future inspection timelines based on inspection results. Two new Compliance Agreements and one new Compliance Agreement Amendment were created in 2023 to help bring industry discharge to within bylaw limits.
Stormwater Monitoring Program	<ul style="list-style-type: none"> Routine monitoring of stormwater at various locations in the City's drainage network, including targeted wet-weather sampling Results are used as baseline benchmark data 	Over 450 samples taken in 2023, providing valuable background stormwater quality trending data which allowed staff to identify areas of concern for investigation activities
CCTV Sewer Inspection Program	<ul style="list-style-type: none"> Employs the use of proactive closed-circuit television (CCTV) inspections to identify Cross Connections / Illegal Connections Reducing I&I by identifying sanitary sewers in poor condition requiring rehabilitation 	Effectively identified one (1) sanitary lateral cross connected to the storm sewer system, which was repaired
Private Sewer Lateral Replacement Grant Program & Sewer Lateral Rehabilitation and Repairs Program	<ul style="list-style-type: none"> The Private Sanitary Sewer Lateral Replacement Grant Program assists residents with the cost of replacing old sanitary sewer laterals on private property The Sewer Lateral Rehabilitation and Repairs Program covers the costs for replacing sanitary laterals (City side) identified in poor condition by the CCTV Inspection Program 	Reduces the number of leaky sanitary laterals allowing I&I into the sanitary collection system, and cross connections

Activity	Description	Assessment of Effectiveness
Sewermain Relining Program	<ul style="list-style-type: none"> Relining sanitary sewers identified during CCTV in need of repair Reducing I&I to improve the sewer collection system 	<ul style="list-style-type: none"> Successfully relined 31.5km of storm sewers, increasing the performance and extending the life of the storm sewer network
WWPS Capital Upgrades	<ul style="list-style-type: none"> Identified WWPS upgrades include construction of new Emergency Sanitary Overflow Storage Tanks to allow for diversion of sewage in an emergency event – eliminating the potential for CSO 	Unable to assess effectiveness since no CSO's or emergency situations requiring the Overflow Tanks has occurred
WWPS Contingency Plans	<ul style="list-style-type: none"> The City is currently in the progress of completing Contingency Plans for WWPS – 3 Plans complete thus far Outcome of assignment is delivery of a practical plan for maintaining station flows thereby mitigating risk when planned or unplanned station outages and disruptions occur 	Unable to assess effectiveness, Contingency Plan has not been required

11.0 Summary of Pre-Authorized Alterations to the System

During the reporting period there were no Director Notifications required.

Table 7 provides a summary of Stormwater Management System Alterations completed during the reporting period and alterations classified as Significant Drinking Water Threats. This includes components, Equipment, or Sewage Works that are being altered.

Table 7: Summary of Stormwater Management System Alterations

Alteration Type	No. of Alterations	No. of Alterations that Pose Significant Drinking Water Threat
Pre-Authorized Separate Sewers, Ditches, Culverts	3	0
Pre-Authorized Stormwater Management Facilities	1	1
Pre-Authorized Third Pipe Collection System	0	0
Previously Approved Works	0	0
Schedule C Works	0	0

11.1 Alterations that Pose Significant Drinking Water Threats

For the reporting period, one project was identified under the Stormwater Management System ECA as Significant Drinking Water Threats.

The Waterworks Park Parking Lot/Low Impact Development project (on-hold) is a planned reconstruction of the existing parking lot to pavement, including the installation of 5 bioretention cells for water quality and retention. Construction is on hold until Spring 2024. A Source Water Supplementary Report was submitted for this project, addressing concerns related to its location in the City of Brantford Intake Protection Zone 1 (IPZ-1) and outlining measures to mitigate risks associated with the construction or operation of the sewage works alteration.

Further details regarding projects identified as Significant Drinking Water Threats can be found in the Annual Significant Drinking Water Threat Assessment Report for Proposed Alterations prepared prior to October 21st each year.

11.2 Major/Significant Alterations

For the reporting period, one project was identified under the Stormwater Management System ECA as Significant Drinking Water Threats.

- Division, Seventh Street, Whitehead Street, Fifth Avenue storm sewer reconstruction (on-going), within the municipal right-of-way on several streets including Seventh Street, Whitehead Street, and Fifth Avenue.
- Drummond Street storm sewer reconstruction (complete) within the municipal right-of-way on Drummond Street between Dalhousie Street and Chatham Street.
- Dundas Street storm sewer reconstruction (on-going), along Dundas Street from Sydenham Street to High Street and Dundas Street East from High Street to West Street, within the municipal right-of-way.
- St. George Street storm sewer reconstruction (complete), within the municipal right-of-way of St. George Street from Orchard Avenue to north of Queensway Drive.

12.0 Other Relevant Documents

12.1 Stormwater Master Plan

The City of Brantford completed a Master Servicing Plan (MSP) Update to 2051 in November 2021. The objective of the MSP is to provide a comprehensive plan that incorporates all facets of the management, expansion and funding of the water, wastewater and stormwater systems for the entire City to the year 2051. This document reviewed in detail plans to 2051 and more broad implications beyond 2051.

12.2 10-Year capital Project Forecast – 2023

The City of Brantford maintains a 10-year capital forecast which incorporates upcoming projects for the period of 2023 – 2032. Within this capital forecast are projects that will assist in eliminating infrastructure that has reached the end of its lifecycle and upgrade compromised materials to the latest design standards.

Table 8 includes a summary of Capital Programs for the Stormwater Management System. Table 9 includes a summary of capital programs and upgrades for the Stormwater Management System. A full detailed overview of the City's 10-Year Capital Forecast can be found on the City's website.

Table 8: Summary of Capital Programs

Program Area	Program Name (ID)	Details	Status
Technical Studies	City-wide Stormwater Asset Inventory (002098)	<ul style="list-style-type: none"> Identified in the 2020 MSP- Stormwater, the need to improve and build upon the City's stormwater asset inventory. Work to include but not limited to updating data inputs to create a more accurate stormwater model, condition assessments and surveying/collecting minor storm related assets within the stormwater network. Program reoccurs every 3 years, began in 2022 completed in 2023 	Complete
Technical Studies	Inflow and Infiltration Source Investigation & Remediation Program (001474)	<ul style="list-style-type: none"> I/I investigation and remediation of key catchment areas. In-Field investigation to identify sources of I/I to include lateral CCTV surveys, smoke testing, dye testing and private side inspections. Results of the flow monitoring studies and in-field investigations started in 2023 will be incorporated into the remediation program to reduce the volume of I/I entering into the city's wastewater network. 	On-going
Technical Studies	City Stormwater all-pipe Model Validation (001541)	<ul style="list-style-type: none"> Field verification and storm sewer model update to support system analysis and improvements 	On-going
Technical Studies	Stormwater System Improvement Studies (001543)	<ul style="list-style-type: none"> Review of drainage area and stormwater management system, undertake minor and major system capacity analysis, identify system deficiencies and recommend improvements Improve older residential community neighborhood resilience for flooding problems to an acceptable level 	On-going
Technical Studies	Stormwater Flow Monitoring Program and Model Update (000826)	<ul style="list-style-type: none"> Identified through 2014 and 2020 Master Servicing Plan (MSP), the need for a continuous Stormwater Flow Monitoring Program to support sub-watershed studies, stormwater modelling as well as other stormwater initiatives such as flood mitigation. 	On-going

Program Area	Program Name (ID)	Details	Status
SOGR	Storm Water Management Pond Safety Program (002022)	<ul style="list-style-type: none"> Improve safety deficiencies included installing of SWMPs 	On-going
SOGR	Stormwater Retention Pond Condition Assessment	<ul style="list-style-type: none"> Stormwater retention ponds and stormceptor condition assessment to identify structural and operational performance. Program to include visual inspections and bathymetric survey/sediment loading work to prioritize capital work. 	On-going
SOGR	CCTV Sewer Inspection Program – Stormwater (001766)	<ul style="list-style-type: none"> Annual Program CCTV inspections for the City's stormwater collection systems for approximately 40km per year (10% of the network) within the City. Inspections will provide a condition assessment of the collection system which includes a database, videos and reports for each inspection. 	On-going
SOGR	Tutela Heights Slope Monitoring Program (001403)	<ul style="list-style-type: none"> Establish a network of horizontal/vertical benchmarks within the slope area, installation of inclinometers and potential ground water monitoring wells. Project was identified in Brant County's 2017 Municipal Class Environmental Assessment as a high priority. Data will be used for regular slope monitoring to establish timing of future works. 	On-going
SOGR	Operational Services Flood Control Capital Works (001579)	<ul style="list-style-type: none"> Improvements and upgrades related to flood control assets. Activities to include: repairs and maintenance to Wastop valves and Sluice gates, catch basins, storm inlets and outlets, bank stabilization, inspection technology, emergency response equipment, and signage. 	On-going
SOGR	Storm Ditching Program (001597)	<ul style="list-style-type: none"> This funding is used for the maintenance of the City's storm ditch network and work at storm outfalls and inlets. Storm assets are rehabilitated to meet Ontario best practices for stormwater. 	On-going

Program Area	Program Name (ID)	Details	Status
SOGR	Mohawk lake OGS Program	<ul style="list-style-type: none"> Includes the design and construction of three (3) OGSs as part of the recommendations of the Environmental Assessment of the Mohawk Lake Rehabilitation Project. The Preferred Management Strategy of the completed Environmental Assessment Report has identified around twelve (12) oil/grit separator retrofits that were considered high priority. The proposed OGSs will be selected from a high priority list as close as possible to Mohawk Lake. 	On-going
SOGR	Sewer Rehabilitation and Lining Program (000421)	<ul style="list-style-type: none"> Trenchless wastewater and stormwater lining (including lining of services to the property line) on multiple sewers across the City. The need for this project is driven by condition data, which indicates that the sewers are in poor condition. 	On-going
SOGR	Basement Flooding Prevention Grant Program	<ul style="list-style-type: none"> Subsidize the cost of investigations, installation of devices, drainage improvements to help protect basements from flooding as a result of stormwater overloading of the collection system. 	Future

Table 9: Summary of Capital Upgrades

Program Area	Program Name (ID)	Details	Status
SOGR	Storm Ditch Condition Assessment (001880)	<ul style="list-style-type: none"> Complete a condition assessment on the City's ditch network, and storm outlets 	Complete
SOGR	Reconstruction of Existing Braneida Industrial Park VII Stormwater Management Pond (001301)	<ul style="list-style-type: none"> To support further development in the Braneida Industrial Park Area (Henry Street east of Wayne Gretzky Parkway), the City must retrofit the existing dry SWMP pond located behind 76, 90, and 112 Adams Blvd. to a wet SWMP. In 2019, a new component has been added to address GRCA concerns regarding channel erosion remediation/restoration downstream of the pond. 	On-going
SOGR	D'Aubigny Forest Storm Pond Cleanout & Sediment Removal (002041)	<ul style="list-style-type: none"> SWMP due for sediment removal and cleanout along with repairing/rehabilitating several high risk deficiencies such as embankment erosion. 	On-going
SOGR	Powerline Road Storm Ditch Improvements (001891)	<ul style="list-style-type: none"> This project will contribute to the relief of drainage problems that caused flooding along Coulbeck / Arbor area. Based on updated network field investigations and modelling work, a new option is proposed to replace the existing orifice at the Powerline stormwater inlet close to Arbor Dr. with a larger one. 	On-going
SOGR	St. Patrick's Drive Storm Pond Improvements (001693)	<ul style="list-style-type: none"> Undertake stormwater facility condition assessment, preliminary and detail design to ensure compliance with the ECA/ Ministry of Environment and Conservation and Parks (MECP) Based on initial operating observations, the performance of the pond seems to significantly reduced and deteriorated with the need for major repairs and cleanout 	On-going

Program Area	Program Name (ID)	Details	Status
SOGR	Kraemer Way Storm Pond Outlet Repairs and Inlet Assessment (001647)	<ul style="list-style-type: none"> Based on initial operating observations, the performance of the pond is significantly reduced and deteriorated with the need for major repairs and cleanout. The scope is to undertake the construction of the proposed retrofitting works as per the recommendations of the current ongoing phase. 	On-going
SOGR	Colborne Street (East Slope) Stabilization – Mitigation Measures (000086)	<ul style="list-style-type: none"> This project will include mitigation measures including slope stabilization for the landslide area along Colborne Street. An annual monitoring program is currently in place for the area. Mitigation options will be identified and evaluated during the Environmental Assessment phase. The project also includes the design and construction of the preferred option. 	On-going
SOGR	Kedem Estates SWM Pond Sediment Removal and Clean Out (001185)	<ul style="list-style-type: none"> A 2015 Condition Assessment was completed to assess various SWMPs in the City. It identified, the pond needs a significant repair work to address the failing structure components of the ponds slopes, berms and outfall. Project will include a condition assessment, undertaking design and construction of the pond to function as per the original design with some enhancements. 	On-going
Technical Studies	Stormwater Rate/ Policy Review and Update (002099)	<ul style="list-style-type: none"> Prepare stormwater rate billing methodology and develop the incentive/rebate program. Identify resources and road map needed including upgrades to billing system and timeline for public consultation and implementation. 	Future

13.0 References

1. 2023 Annual Significant Drinking Water Threat Assessment Report for Proposed Alterations, written by Source Water Protection Department
2. 2023 Calibration Reports
3. Cartegraph Work Orders and Service Requests
4. Customer Relationship Management (CRM) System Requests
5. Stormwater Management Operation & Maintenance (O&M) Manual

Detailed summary reports that present information regarding maintenance, inspection, monitoring data, etc. are available upon request by contacting the Environmental Services Department.