Prepared for

Town of Georgina

Report for

Program Development and Recommendations Final Report

June 25, 2024

330 Rodinea Road, Unit 3
Vaughan, Ontario, Canada L6A 4P5

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June 25, 2024 **CIVICA Ref: GEO23-0004**

Town of Georgina
26557 Civic Centre Road
Keswick, ON
L4P 3G1

Attention: Camille Zeng, BASc, MEL, EIT.

Dear Ms. Zeng,

RE: Program Development and Recommendations – Final Report

Civica Infrastructure Inc. (Civica) is pleased to submit the final report for the Inflow and Infiltration (I/I) Study for the Town of Georgina (Town). We endeavour to meet the objectives of the final report, and in doing so, we feel this report meets and strives to exceed current best practices in the area of sanitary sewer I/I reduction studies to identify I/I sources. This report will help the Town to prioritize I/I source rehabilitation works in the sanitary sewer system and provide a framework for future I/I studies in the Town.

Do not hesitate to contact us for further clarification and/or comment.

Sincerely,

CIVICA INFRASTRUCTURE INC.

Matthew Malone, M.Sc., MBA
Project Manager

Encl. Program Development and Recommendations Final Report

Document History & QA/QC

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Revision History

Name	Date	Reason for Change	Version
Sarah Asrat	2024-06-07	Draft Submission	1
Sarah Asrat	2024-06-20	Submission After Town Comments	2
Sarah Asrat	2024-06-25	Final Submission	3

Table of Contents

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List of Figures

List of Tables

1.0 Introduction

In 2021 York Region (the Region) and its local municipal partners developed a Target Inflow and Infiltration (I/I) Framework for local municipalities to reduce I/I within their systems to help achieve the Region's overall goal of 40 Mega Litres per Day (MLD) reduction by 2031. The target I/I reduction for the Town of Georgina (the Town) was set at 0.27 MLD by 2026. Civica was retained by the Town to undertake an Inflow and Infiltration (I/I) study. The Final Report, which is the subject of this report, summarizes TM#1 Background Review and TM#2 Field Investigations completed and provides the projects key findings and I/I reduction rehabilitation recommendations.

1.1 Understanding Inflow and Infiltration

I/I is a commonly used term to define extraneous flow into a sanitary sewer. In general, sanitary sewers are designed to collect wastewater, which originates from domestic, commercial and industrial activities. Normally, wastewater flow is a bi-product of municipal (drinking) water use. Sanitary sewers are constructed to transport wastewater flow from urban areas to treatment facilities for treatment and ultimate disposal.

However, depending on weather conditions, sanitary sewers can also convey varying amounts of 'extraneous' flows. The amount of extraneous flow captured and carried in the sanitary sewers depends not only on the supply of water from rain, snowmelt and/or groundwater, which are comparatively easy to predict, but also the condition of the sewer system, which can be more onerous to predict. In relation to extraneous flows, the condition of the sewer system is impacted by the quantity and sizing of defects present. **Figure 1-1** below illustrates the most common I/I sources possible in a sanitary sewer system.

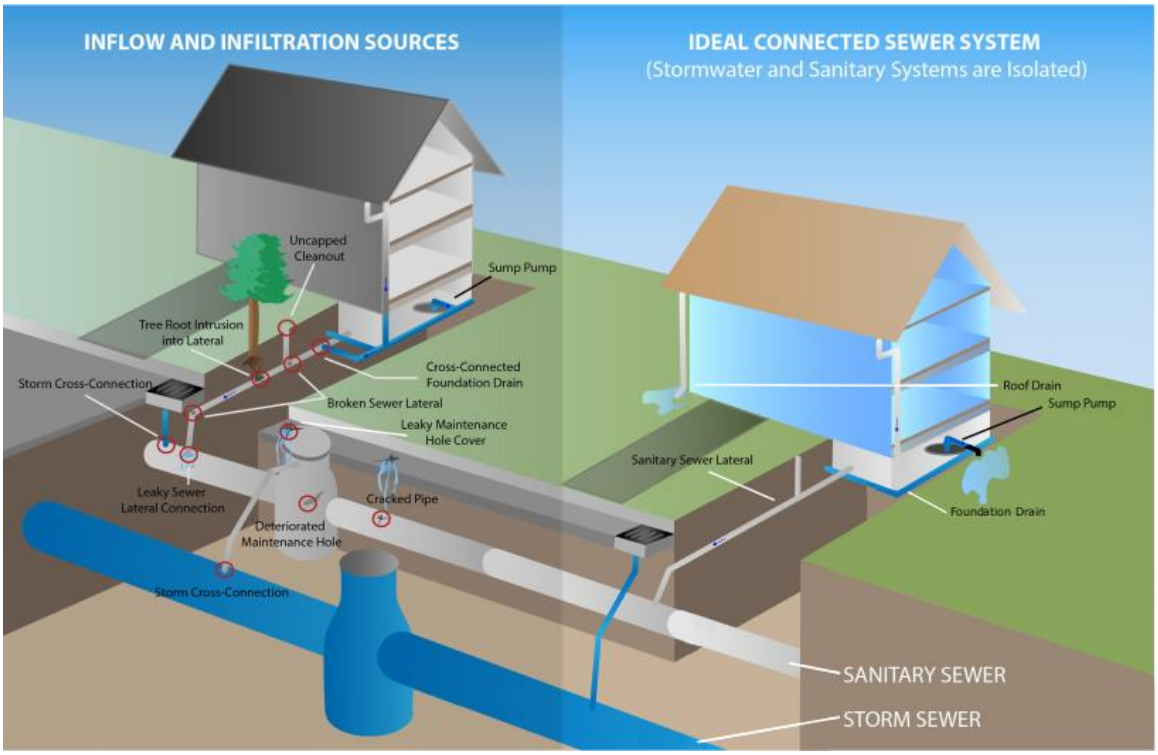

Figure 1-1: Types of I&I Defects

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What is Inflow – Inflow refers to engineered stormwater collection mechanisms that have been connected to a sanitary network. Types of inflow mechanisms can include residential downspouts, residential surface drains, catch basins, manhole pick holes, interconnections with storm sewers and foundation drain connections, referred to as defects. These inflow defects are often connected to the sanitary sewer due to a lack of a cost-effective or suitable stormwater outlet, historical regulatory practice or insufficient resources for standards enforcement.

What is Infiltration – Infiltration refers to the migration of water present in sub-surface soil into sanitary sewer infrastructure buried under the ground's surface. Two conditions need to be met for this to occur: 1) there must be water available above the pipe invert of the adjacent sanitary infrastructure, and 2) there must be defects present in the sewer infrastructure for the water to flow from outside to inside. Typical defects can include cracks, breaks, pipe joint offsets, root intrusions, and are caused by material deterioration, settlement of the adjacent sub-soils and/or poor installation practices.

1.2 Study Objectives

The two objectives for this project are to:

1. Identify quantifiable I/I sources and recommend mitigation and rehabilitation strategies to meet the 2026 reduction goal.
2. Develop a risk-based approach with remediation strategies and costing to proceed with the implementation of physical works to reduce the I/I found within the system.

There were four (4) catchment areas of interest in this project selected by the Town for the I/I investigation. Due to financial constraints, the fourth area was removed from the list of catchment areas. The background review was used to identify documented I/I concerns and to use the information to plan subsequent field investigations.

1.3 Study Area

The three (3) catchment areas analyzed for this study are shown in **Figure 1-2 - Figure 1-4**. **Table 1-1** below lists the attributes for the three (3) areas.

Table 1-1 : Study Area Attributes

Study Area Number	York Region ID	Area (ha)	Gravity Sewer Length (km)
Area 1	GE003a_10	207	10.9
Area 2	GE003a_20	122	8.5
Area 3	GE004b_20	53	5.8

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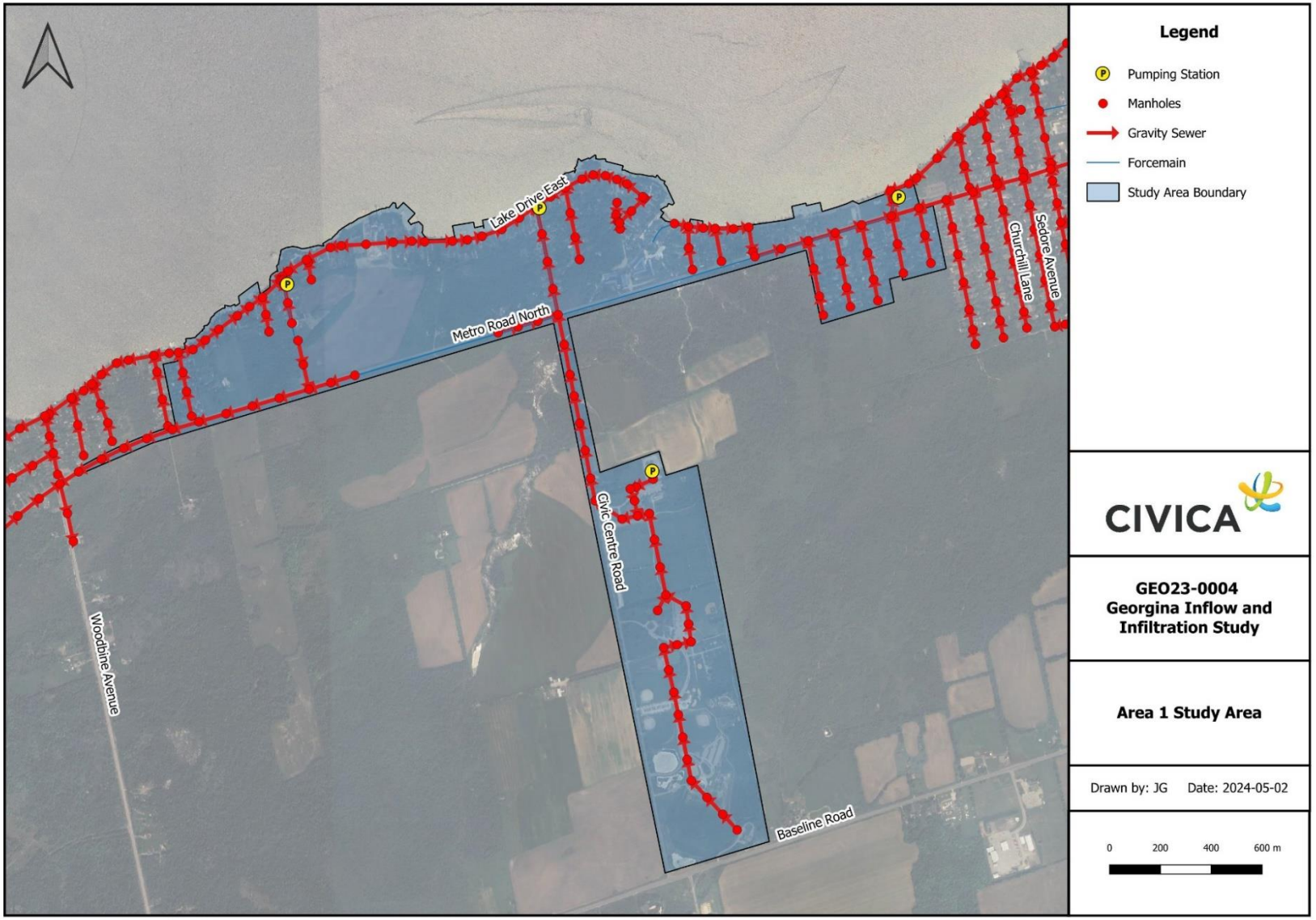

Figure 1-2: Area 1 Study Area

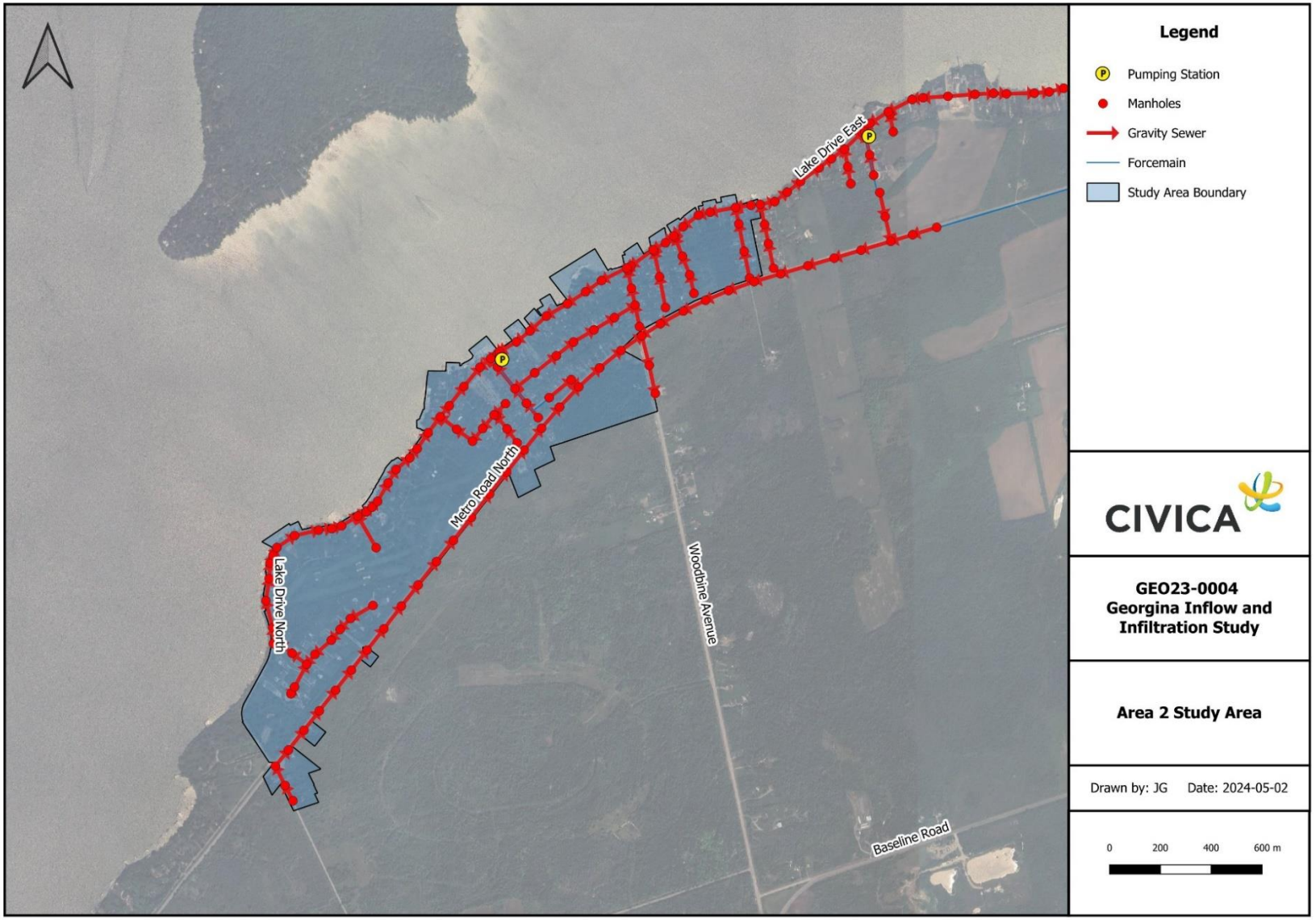

Figure 1-3: Area 2 Study Area

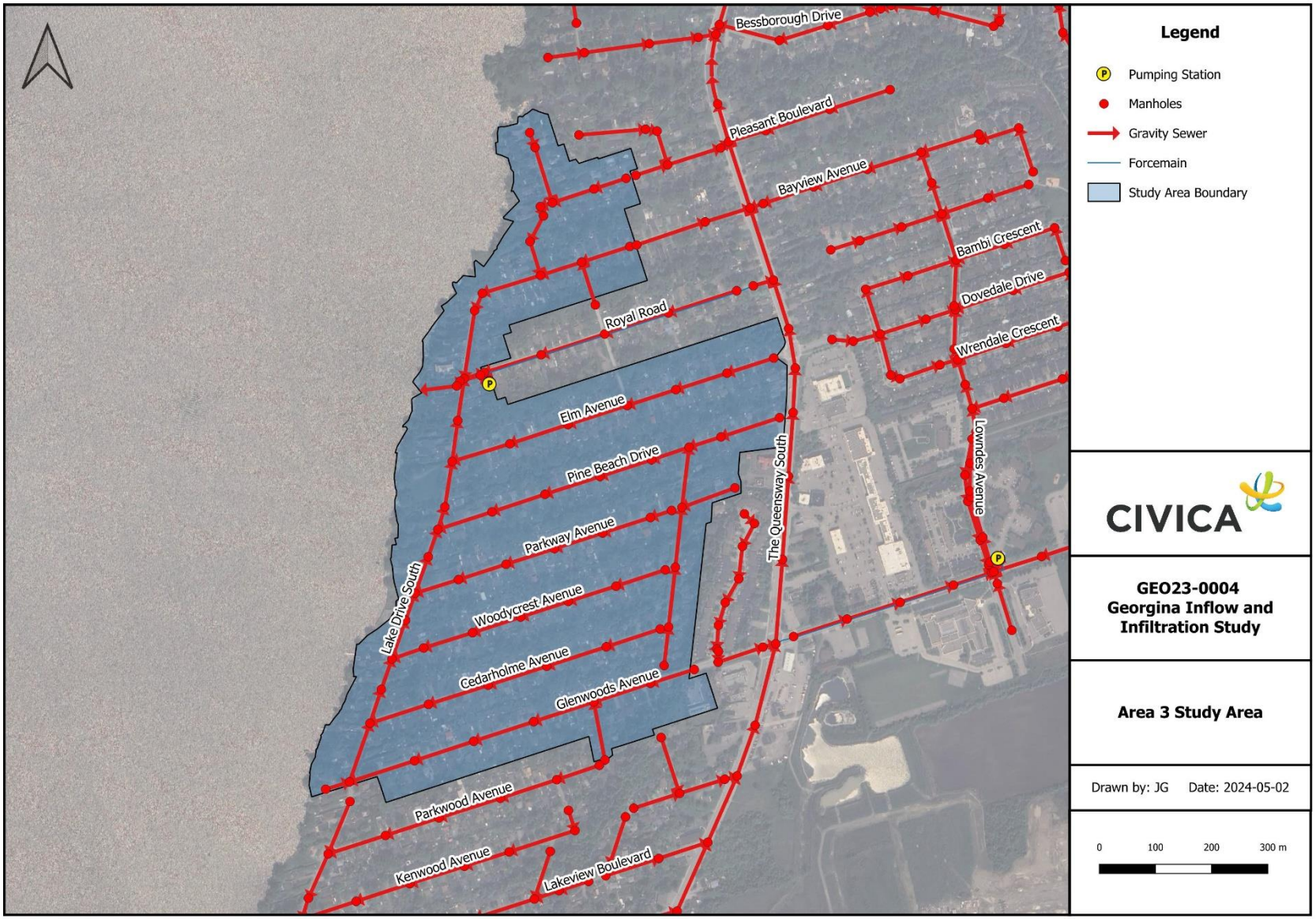

Figure 1-4: Area 3 Study Area

1.4 Outline of Study Approach

This study is structured to follow a linear track from establishing the existing conditions to providing recommendations of I/I rehabilitation programs that will benefit to meet and maintain the desired level of service in the sanitary sewer infrastructure. Starting with the review of available background records, an understanding of the existing conditions and I/I concerns were identified. The interim understanding of the subcatchment's conditions is then used to determine the appropriate field investigation tools to identify the I/I failure mechanisms. The investigation results are then used to inform suitable I/I reduction solutions. The following sequence of steps were followed in this study:

- Part 1 – Desktop Analysis
- Part 2 – Field Investigation
- Part 3 – Program Development and Recommendations

1.4.1 Part 1 – Desktop Analysis

The objective of the desktop analysis was to summarize the background information that was received by the Town. The following documents, reports and data were reviewed as part of the background review:

- Town of Georgina, Sanitary Sewer Master Plan, 2021
- York Region and Town of Georgina, Inflow and Infiltration Initiatives and Coordination, 2022
- York Region flow monitoring data (2019-2023)
- Flow monitoring data collected during the Town's Master Plan study (Mar-Jul, 2020)
- CCTV reports from 2018-2020
- Wastewater, stormwater, and planning GIS shapefiles
- Town of Georgina's Infoworks sanitary model

The desktop analysis was used to develop a general plan on how field investigations should be prioritized within the three (3) catchment areas. The background information was used to identify areas that exhibit to have I/I sources within the sanitary sewer system. This data helped to identify and plan which 3 catchments require priority for field investigations.

Recommendations from the desktop review included the following:

- Begin CCTV inspections in Areas 1 and 2.
- During dry weather conditions prioritize inspections of deeper sewers that are expected to have lower elevation than Lake Simcoe to look for sources of infiltration in those sewers.
- During wet weather conditions prioritize inspections of shallower sewers that are expected to have higher elevation than Lake Simcoe.
- Consider wet weather investigations in pipes that are known to have potential I/I sources.
- Joints between sewer pipes and manhole chambers were identified as sites likely to be prone to infiltration.
- Smoke testing was recommended for all catchment areas to identify any existing active inflow sources.
- Consideration of additional flow monitor installations.

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1.4.2 Part 2 - Field Investigation

The objectives of the field investigations were to identify the sources of I/I into the sanitary sewer. Field investigations carried out in this study included CCTV inspections and smoke testing. The results were also used to inform which areas that require further monitoring or additional investigations to help meet the Town's I/I reduction objectives.

Field investigations were intended to identify I/I sources. The goal of CCTV investigations was to identity I/I sources within the Town's sanitary sewer mainline. Smoke testing was conducted to identify sources of I/I on public property (e.g., catch basins). When the sanitary sewer was undergoing smoke testing, external lot inspections were completed to observe if any signs of smoke were present. This was assessed to confirm whether there are I/I source contributions received from private property into the Town's sanitary sewer. Verifying the potential inflow sources to the sanitary sewer is beneficial to identify I/I and plan preventative measures to reduce I/I into the sanitary sewer. Examples where private side I/I observations may be visible through smoke testing are downspouts, sump pumps, and cleanouts.

1.4.2.1 Sewer Inspection (PACP)

Pipeline Assessment Certification Program (PACP). PACP is a North American Standard for pipeline defect identification and assessment, providing standardization and consistency to the methods in which pipeline conditions are identified, evaluated and managed. Civica partnered together with Wessuc Inc. to complete CCTV and flushing of the specified sanitary mainlines within the study area. National Association of Sewer Service Companies (NASSCO) certified staff recorded comprehensive PACP databases inclusive of inspection details and assigned structural and operation and maintenance ratings for all inspected infrastructure. PACP inspection databases, pdf reports, defect images and geodatabases have been provided to the Town alongside this report.

1.4.2.2 Manhole Inspections (Level 2 MACP)

The Manhole Assessment and Certification Program (MACP) is the North American Standard for manhole (MH) inspections and provides condition assessment information to evaluate the general condition of a MH. MACP uses the established defect coding system found in PACP inspections.

1.4.3 Part 3 – Program Development and Recommendations

The objective of this report is to review the findings from the desktop analysis and field investigations to develop a risk-based prioritization of I/I sources and to develop rehabilitation strategies along with cost estimates to complete the work. This report provides supporting information on the recommended programs and other suggested measures to identify and to remediate I/I inflow sources. Recommendations for further field investigations, monitoring and asset maintenance will also be provided in **Section 4.0**. Class C cost estimates for the recommended rehabilitation measures are provided. The Town's risk model results as per the Town's Assets Management Plan (AMP) was used to prioritize the risk the asset imposes as very high risk, high, medium, low and very low risk. A ten (10) year capital plan was prepared to identify a timeline of when the rehabilitation works should be implemented.

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2.0 Findings and System Remediation Needs

2.1 Inflow and Infiltration Flow Reduction Target

To address the issues of I/I in the three catchment areas and to achieve the set targets, the approach needs to consider both localized impacts (e.g. mainline sewer I/I sources) and broader systemic impacts (e.g. inflow sources by connected downspouts).

An overall I/I reduction target of 40 MLD has been established for 2031 across all of York Region. The target I/I reduction for the Town was set at 0.27 MLD by 2026 (see **Table 2-1** below).

Table 2-1: York Region Recommended I/I Reduction Targets

Municipalities	Recommended five-year I&I reduction target (To be achieved by 2026) (MLD)
Town of Aurora	0.64
Town of East Gwillimbury	0.14
Town of Georgina	0.27
Township of King	0.12
City of Markham	1.61
Town of Newmarket	0.52
City of Richmond Hill	1.55
City of Vaughan	1.36
Town of Whitchurch-Stouffville	0.21
York Region	2.15
Total	**8.57**

2.2 Field Investigation Results

The following items listed below can be drawn from Part 1 and Part 2 results:

- The sanitary sewers in the three catchment areas were inspected through CCTV investigations. Sixteen active infiltration sources were observed in manholes and sewers. Seven additional defects were identified that were considered potential sources of infiltration that may become active if there is water present outside the pipe.
- The sanitary sewers in the three study areas were smoke tested alongside detailed lot inspections. The most common observation was defective cleanouts which are not likely to be significant sources of I/I but are relatively simple to fix. Two larger potential sources of I/I were identified through smoke testing: one downspout and one sump pump. All the identified potential inflow sources were observed on the private side.
- Estimates of I/I peak flows and volumes have been given to each confirmed and potential I/I source where an accurate estimate is feasible. It's estimated that a volume reduction of 50.9 m^3 (or 0.0509 MLD) can be reduced during a 1-25 yr storm event. Rehabilitation of the potential infiltration sources and the defective cleanouts may provide further reductions that cannot be accurately quantified at this time.

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- The Town has an objective of reducing I/I by 0.27 MLD by 2026. The estimated potential reduction of 0.0506 MLD represents approximately 19% of the Town's objective. Other Town initiatives, such as the ongoing Sewer and Manhole Condition Assessment program, will also aid the Town in achieving this objective. Any infiltration sources identified, quantified, and rehabilitated through that initiative will move the Town closer to achieving the 0.27 MLD reduction.
- In addition to the positive smoke tests, approximately 23% of the downspouts documented through the lot inspections were recorded as having no visible surface discharge and discharged into pipes going into the ground. These downspouts did not smoke during testing, but it is possible that they may discharge to a foundation drain and indirectly convey rainwater to the sanitary sewer system. It is also possible that debris or standing water within the downspout or gutter at the time of the smoke test could have prevented smoke from being visible during testing. These remain potential sources of I/I and could be confirmed through dye testing.
- Overall, the CCTV inspections indicate that the sewers within the three study areas are in good condition and according the PACP grading there were 8 identified structural defects of the 298 pipes inspected.
- Additional I/I sources may be present on the private side in the form of defective laterals or foundation drains either directly connected or connected through a sump pump to the sanitary system. None of the three study areas have storm sewer systems that would typically be accommodating foundation drain flows (i.e. storm ditches).

2.2.1 CCTV Inspection Results

CCTV inspections were carried out to identify potential and active sources of I/I within the sanitary sewer pipes. The conditions of the observed pipes and defects were documented using the PACP standard pipe coding system.

2.2.1.1 Active Infiltration Sources

A total of sixteen active infiltration sources were found across all three catchment areas. **Table 2-2** summarizes the active infiltration sources found based on area and identifies the different I/I sources observed.

Table 2-2: Active Infiltration Sources by Area

Area	Infiltration Gusher (Grade 5 Defect)	Infiltration Runner (Grade 4 Defect)	Infiltration Dripper (Grade 3 Defect)
Area 1	5	1	0
Area 2	3	1	1
Area 3	3	2	0
Total	**11**	**4**	**1**

2.2.1.2 Potential Infiltration Sources

The identified potential I/I sources may contribute flows to the sanitary sewer collection system if there is a positive hydraulic pressure from the surrounding trench acting upon the defect. During wet weather conditions, these transient sources may respond due to water rising within the sewer trench. Factors such

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as encrustations provide evidence that infiltration gradually enters the pipes which creates deposits of calcite on the interior walls of the pipe. **Table 2-3** summarizes the potential I/I sources found.

Table 2-3: Potential Infiltration Sources

Area	Holes	Fractures	Encrustations	Roots
Area 1	0	0	0	0
Area 2	1	1*	2	0
Area 3	0	0	2	1
Total	**1**	**1**	**4**	**1**

** There was a second fracture with an active infiltration source (gusher) already accounted for in **Error! Reference source not found.***

2.2.1.3 Non-I/I Related Structural Defects

During the CCTV investigations, Structural and Operational & Maintenance (O&M) defects in the pipes were documented. Structural defects such as fractures, holes and sags were observed. O&M defects such as deposits (encrustation and debris), obstructions and roots were observed. The structural and O&M conditions of a pipe were based on the defect grades which depend on the severity and the observations made. The most common observation made was the presence of encrustation and debris. There are code modifiers in the PACP reports that further differentiate these observations. The documented observations identified that four defects are encrustations and the rest are mainly debris or other solids found in the pipes. It is recommended to conduct a separate study to assess the existing conditions and complete a risk analysis to develop a strategy to mitigate the structural and O&M defects.

2.2.2 Lot Inspection and Smoke Testing Results

The desktop analysis that was completed in part 1 of this study was used to develop a strategy to plan field investigations based on a risk assessment. This was based on reviewing historical flow monitoring data and the catchment characteristics. Smoke testing was completed to identify potential sources of I/I sources into the sanitary sewer. **Table 2-4** summarize the smoke test results by area. About 23% of the homes documented through the lot inspections to have downspouts that do not visibly discharge to the surface and discharged into pipes that go into the ground. For downspouts that discharge into the ground but did not smoke, there is a possibility that flow may discharge to a sump pump or foundation drain which may indirectly convey rainwater into the sanitary sewer. During the time of the smoke tests, there is chance that debris or standing water maybe present within the downspout which would prevent smoke from being visible during testing. Therefore, these sources are considered as potential I/I.

Table 2-4: Types and Quantities of Positive Smoke Tests by Area

Area	Cleanout – Open Below Grade	Cleanout – Open Above Grade	Downspout	Sump Pump
Area 1	11	8	0	1
Area 2	26	7	1	0
Area 3	0	1	0	0

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Area	Cleanout – Open Below Grade	Cleanout – Open Above Grade	Downspout	Sump Pump
Total	37	16	1	1

2.3 Inflow and Infiltration Sources

Field investigations identified a number of sources of inflow and also quantified locations susceptible to increased infiltration. The number and distribution of I/I defects identified is as follows:

Public I/I Defects

- Mainline Pipes (16) active infiltration
- Mainline Pipes (7) potential infiltration

Private I/I Defects

- Residential Downspouts (1)
- Sump Pump (1)
- Cleanouts – Below Grade (36)

As described in TM#2, the flow contributions from each active infiltration source, the one residential downspout, and the one residential sump pump have been quantified. The estimated flow rates for each infiltration source are summarized in **Table 2-5**. The quantification of I/I sources found in this study are expected to be relatively constant with varying flows, where groundwater and trench water levels will fluctuate seasonally or during wet weather events.

Table 2-5: Estimated Peak Flows and Volumes from I/I Sources

Location	PACP Code	Infiltration Type	Estimated At-Source Peak Flow (L/s)	Estimated 24 hr Volume during 1-25 Yr Storm Event (m3)
G-WWM0166	IRC	Runner	0.01	0.9
G-WWM0166	IGC	Gusher	0.01	0.9
G-WWM0167	IGC	Gusher	0.06	5.2
G-WWM0173	IGC	Gusher	0.03	2.6
G-WWM0188	IRC	Runner	0.01	0.9
G-WWM02214	IDJ	Dripper	0.005	0.4
G-WWM02681	IRJ	Runner	0.005	0.4
G-WWM02697	IGJ	Gusher	0.05	4.3
G-WWM02698	IGJ	Gusher	0.06	5.2
G-WWM02699	IGJ	Gusher	0.03	2.6
G-WWM0620	IGJ	Gusher	0.12	10.4
G-WWM0621	IGB	Gusher	0.01	0.9
G-WWM0668	IRC	Runner	0.03	2.6
G-WWM0685	IGJ	Gusher	0.06	5.2

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Location	PACP Code	Infiltration Type	Estimated At-Source Peak Flow (L/s)	Estimated 24 hr Volume during 1-25 Yr Storm Event (m3)
G-WWM0720	IGC	Gusher	0.02	1.7
G-WWM0774	IG	Gusher	0.01	0.9
Private Property	n/a	Downspout	2.9	3.9
Private Property	n/a	Sump Pump	1.0	2.0
Total			**4.4**	**50.9**

I/I quantification for sump pump depends on many factors such as the lot grading, discharge location of downspouts, age of building, soil characteristics, season, and antecedent moisture conditions. Using information from the City of London weeping tile disconnection program (2012) and research paper that was published about quantifying I/I was used as a reference to determine a conservative estimate of 2.0m^3 volume reduction.

Cleanouts that are located at or below grade were considered to have low peak flow and volume contribution. Areas that are low-lying that have the potential to pond during high intensity rainfall or snowmelt events are considered to have higher peak flow rate and volume quantification. In order to accurately estimate the I/I quantification further assessment is required. Due to the large number of defective cleanouts and the relative ease and low cost to mitigate cleanouts, it is recommended for these cleanouts to be properly capped.

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3.0 Risk Management Strategy

A risk assessment for municipality-owned assets was completed for the I/I sources identified in the sections above. This information was used to prepare a priority list for the recommended rehabilitation measures. The following sections will describe the components of the risk assessment and rehabilitation prioritization.

3.1 Risk Assessment

The Town's Asset Management Plan (AMP) is meant to develop a financial and technical guide for managing the Town's infrastructure assets. This will allow for the Town to add value to their assets by determining cost effective measures that will maintain and improve infrastructure services to the Town's residents. A risk-based approach is used to prioritize projects for rehabilitation. Asset deficiencies that are identified to be of higher risk to system performance are prioritized for remediation. As per the Town's Core Asset Management Plan, risk is defined as the product of Consequence of Failure (CoF) and Probability of Failure (PoF).

For pipes with infiltration sources identified, the Likelihood of Failure (LoF) is drawn from the NASSCO numerical representation of the condition of an asset. LoF is an output of the PACP and MACP inspections with possible values from 1-6. To align with the Town's risk model, any assets with LoF values greater than 5 have been assigned a PoF value of 5. The CoF was provided from the Town and is derived from an assessment of the Economic, Social and Environmental impacts should an asset fail, and have been provided by the Town to Civica for each asset in the scope of work.

The evaluation of risk in this report has been completed in accordance with the risk model in the Town's Asset Management Plan (AMP) for Core Infrastructure. The risk exposure of an asset is determined by the PoF and CoF. The overall risk scores are visually presented in the 5x5 matrix shown in **Figure 3-1**. The risk score thresholds from the Town's AMP are defined below in **Table 3-1**.

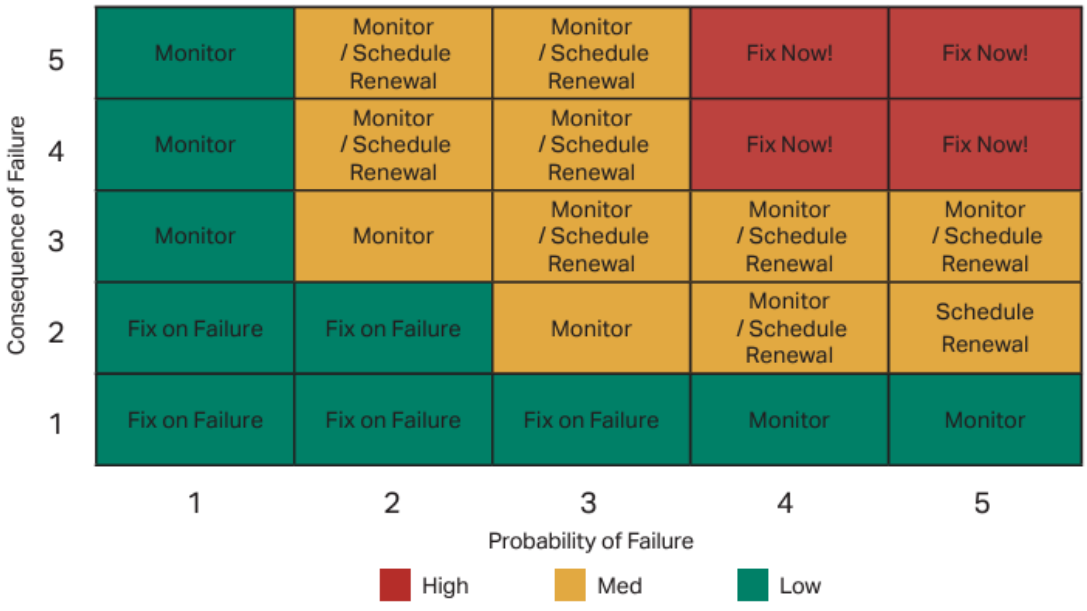

Figure 3-1: Risk Based Intervention Matrix from Town's AMP for Core Infrastructure

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Table 3-1: Risk Score Thresholds in Town's AMP for Core Infrastructure

Risk Score Thresholds		
Lower	**Upper**	**Score**
0	4	Very Low
4	7	Low
7	11	Medium
11	16	High
16	25	Very High

3.1.1 I/I Source Risk Assessment

A risk value for each I/I source was calculated and the defects have been classified into the five risk categories as identified in the table above. The number of assets that fall into each risk category is summarized below in **Table 3-2.**

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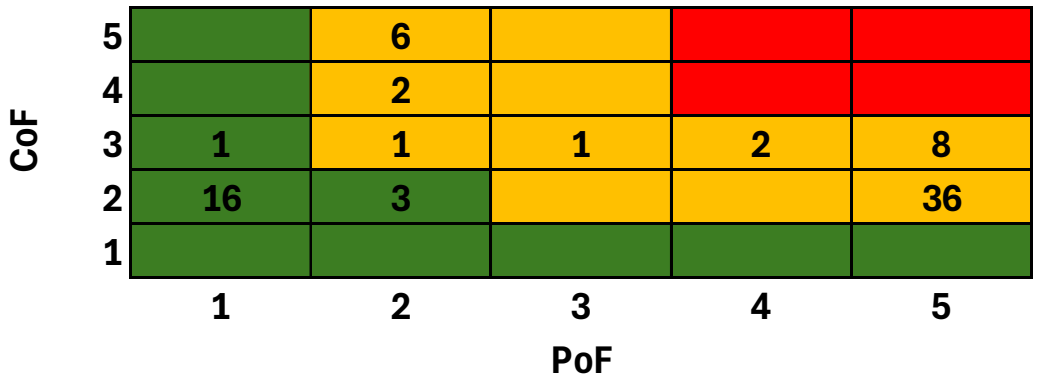
Table 3-2: Risk Rating of Inspected Sewers

Risk	Number of Assets
Very Low Risk	17
Low Risk	4
Medium Risk	45
High Risk	10
Very High Risk	0

The Town's intervention matrix can be used to prioritize asset intervention. The quantity of I/I sources that fall within each risk intervention category have been summarized below in **Figure 3-2.**



*Note that PoF values have one decimal place and quantities have been totaled such that, for example, a value greater than 1 and less than 2 is counted as a 1).

Figure 3-2: Quantity of I/I Sources in Each Section of the Town's Intervention Matrix

The cost associated with certain risks may in some cases be more expensive than the costs of dealing with the potential hazard should it occur. Therefore, acceptable levels of risk should be assessed as part of the risk management strategy using clearly defined criteria.

4.0 I/I Rehabilitation and Reassessment Recommendations

4.1 Recommended I/I Rehabilitation Methods

The program development and I/I rehabilitation recommendations provides remediation methods and/or renewal needs. I/I rehabilitation involves remediating identified active inflow sources into the sanitary sewer system and also providing methods to monitor potential inflow sources.

The I/I rehabilitation methods recommended for defects identified through CCTV investigations will involve mainline remediation repairs. Prioritization of recommended rehabilitation methods will be provided based on the Towns AMP risk model. This will then be used to develop the ten (10) year capital plan. Additional recommended investigations are provided to help, asses other I/I inflow sources and sanitary sewer condition under wet weather CCTV inspections.

Inflow sources identified on private side should be taken into consideration. One connected downspout to the sanitary sewer in isolation is rarely the cause of systems failure (e.g., basement flooding, overflows at treatments plants, etc.), however, many connected downspouts across a system can cause significant issues. Additionally, the benefits of eliminating these sources far outweigh the costs, particularly in the context of conveyance and treatment costs, and most inflow sources in general are recommended to be remediated in the short term.

The following sections detail the recommended I/I rehabilitation measures for mitigating active I/I sources.

4.1.1 Sanitary Sewer Mainline Repair

Cutting/Reaming – Cutting and reaming are two types of methodologies used to remove obstructions such as roots, encrustations, or intruding laterals from a sewer main. Reaming is a process that involves pulling a sewer flushing nozzle with specific attachments through a sewer main that break up obstructions in the pipe without causing damage to the pipe itself. It is a fast and effective methodology for removing a lot of obstructions in a pipe. Cutting is a process that uses a robot with a cutting attachment that can travel down the length of a sewer and precisely cut away encrustations, roots, or intruding laterals. Reaming and cutting can be a rehabilitation method on its own, or a first step in preparing sewers for further rehabilitation such as grouting or CIPP lining.

Grouting – Chemical injection grouting is a methodology for repairing infiltration sources in both manholes and sewers. In sewers the work is completed using remote inflatable packers. With the aid of CCTV cameras, the packers can travel down the length of a sewer and remotely inject grout at specific defect locations. The grout forms an impermeable barrier on the outside of the pipe that eliminates the infiltration. Within manholes, the work can be conducted through person-entry and similarly involves drilling and injecting grout at the location of observed infiltration sources to form an impermeable layer on the outside of the manhole. Grouting eliminates infiltration but does not provide structural support and is best used on pipes and manholes that are structurally sound. However, eliminating infiltration sources does provide structural benefits by limiting the amount of soil loss around sewers and manholes that lead to structural deterioration. Grouting is a relatively easy and inexpensive rehabilitation methodology that can be effective for eliminating infiltration.

4.1.2 Downspout Disconnection

The physical disconnection work will consist of the following steps**:**

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- Cut the identified downspout above grade.
- Cut the section of the downspout connected to the existing sewer line, capping with a PVC top and burying.
- Attach a flexible or 90-degree bent extension to the remaining downspout connected to the house and direct flow away from the house using a splash pad; where grade allows for positive drainage away from the house. Re-grading may be required in situations where positive drainage away from the house does not exist and will require a site-specific assessment. An additional extension that allows for the discharge of the storm water to the necessary distance from the house to allow for positive drainage, ideally greater than 2m from the foundation wall.

4.1.3 Cleanout Capping

As noted in **Section 2.2.2** there were 36 cleanouts below grade identified that were identified as positive I/I sources. These sources may be due to uncapped or defective sanitary cleanout. Since the openings are uncapped or defective, during rainfall or snow melt events there is a possibility that water can enter into the sanitary system through the open cleanouts.

4.1.4 Summary of Remediation Works

The recommended remediation works of identified through field investigations as contributing sources is summarized in **Table 4-1**.

Table 4-1: Summary of Remediation Works

I/I Source Type	Sources Found	Nature of Work
Sanitary Mainline	16	Apply grout and seal I/I sources in sixteen (16) pipe segments
Residential Downspout	1	Disconnect one (1) residential downspout
Sump Pump	1	Disconnect one (1) residential sump pump
Cleanout	36	Fix and cap thirty-six (36) sanitary cleanouts

4.2 Recommended Additional Inspections

The following sections detail the recommended additional inspections to confirm potential I/I sources.

4.2.1 Dye Testing

Dye testing consists of the pouring of a non-toxic dye solution (mixture of water and an inert tracer dye) into a drain inlet (such as a roof drain, downspout or catch basin) source previously identified through fog testing and visually confirming connectivity to the storm or sanitary sewer. A positive I/I source test occurs when the tracer dye confirms the hydraulic connectivity from the drain inlet source to the sanitary sewer.

'False-Positive' tests occur when fog testing shows a connection between the sanitary sewer and a drain inlet, but the dye solution follows a 'preferential' flow path into the storm sewer. False-negative dye test occurs when the preferential flow is to the storm sewer up to a rate where overflow into the sanitary sewer occurs (e.g. storm lead connection backs-up into the sanitary system). Seasonal positives occur when there is a hydraulic connection to the sanitary such as during periods of high groundwater levels saturating foundation storage. Without visual confirmation of drain system cross-connections, these I/I

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sources can only be verified through physical disconnection and verification monitoring. If further testing is warranted, CCTV testing may be conducted.

4.2.2 Wet Weather CCTV Inspection

Wet weather CCTV inspection occurs in the sanitary sewer mainline during rainfall and snowmelt events. When there is hydraulic pressure from the surrounding trench acting upon the defect, the potential I/I sources identified during dry weather may respond due to water rising within the sewer trench. The CCTV inspection will capture the I/I source in an active state and would allow to observe and document the severity of the I/I defect. Based on how the I/I source responds to wet weather and the type of defect found, strategies to rehabilitate can be determined.

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5.0 Risk Prioritization and Cost Estimates

The recommended rehabilitation measures have been prioritized following the Town's risk base approach. A list of the active and potential I/I sources have been prepared identifying the risk score and the relative cost estimate for rehabilitation as shown below in **Table 5-1** for public side assets. This table provides details of the pipe asset ID and risk classification. **Table 5-2** provides details for the private side potential I/I sources, suggestions for rehabilitation or reassessment, cost estimates and timeline. Note that the cost estimates provided are based on the combination of the average current industry prices, available public information (e.g., municipal subsidy programs to fund I/I rehabilitation), and recent rehabilitation works for other projects Civica has completed.

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Table 5-1: I/I Rehabilitation Risk Assessment and Cost Estimate for Public Repairs

Pipe Inspection	Date	Infiltration Type	US MH	DS MH	Survey Direction	Distance (m)	Comment	CoF Score	NASSCO LoF Score	PoF	Risk	Risk Group	Structural Repair Required	Cleaning	Parging	Grouting	Rehabilitation/ Reassessment	Timeline (Years)	Cost Estimates
Active Infiltration Sources																			
G-WWM0620	2024-01-04	Gusher	G-WWMH0681	G-WWMH0682	Upstream	54.6		3	5	5	15	High Risk	Y	Y		Y	Rehabilitation	1-5 Years	$3,000.00
G-WWM0621	2024-01-04	Gusher	G-WWMH0682	G-WWMH0683	Downstream	107.6		3	5	5	15	High Risk	Y	Y		Y	Rehabilitation	1-5 Years	$3,000.00
G-WWM0720	2023-08-30	Gusher	G-WWMH0707	G-WWMH0708	Downstream	4.4		3	5	5	15	High Risk	Y	Y		Y	Rehabilitation	1-5 Years	$3,000.00
G-WWM0166	2023-11-14	Gusher	G-WWMH0202	G-WWMH0203	Downstream	36.7		3	5	5	15	High Risk	Y	Y		Y	Rehabilitation	1-5 Years	$3,000.00
G-WWM0167	2023-11-14	Gusher	G-WWMH0203	G-WWMH0191	Upstream	19.3		3	5	5	15	High Risk	Y	Y		Y	Rehabilitation	1-5 Years	$3,000.00
G-WWM0173	2023-11-10	Gusher	G-WWMH0134	G-WWMH0135	Downstream	108.3		3	5	5	15	High Risk	Y	Y		Y	Rehabilitation	1-5 Years	$3,000.00
G-WWM0188	2024-01-30	Runner	G-WWMH0157	G-WWMH0158	Downstream	101.7		3	4	4.1	12	High Risk	Y	Y		Y	Rehabilitation	1-5 Years	$3,000.00
G-WWM0166	2023-11-14	Runner	G-WWMH0202	G-WWMH0203	Downstream	0.3		3	4	4	12	High Risk	Y	Y		Y	Rehabilitation	1-5 Years	$3,000.00
G-WWM02697	2024-04-24	Gusher	G-WWMH02414	G-WWMH02415	Upstream	0	*Defect at pipe joint within manhole G-WWMH02415*	2	5	5	10	Medium Risk	N	Y	Y	Y	Rehabilitation	1-5 Years	$5,500.00
G-WWM02698	2024-04-23	Gusher	G-WWMH02415	G-WWMH02416	Upstream	0.1	*Defect at pipe joint within manhole G-WWMH02416*	2	5	5	10	Medium Risk	N	Y	Y	Y	Rehabilitation	1-5 Years	$5,500.00
G-WWM02699	2024-04-23	Gusher	G-WWMH02416	G-WWMH02417	Downstream	87.5	*Defect at pipe joint within manhole G-WWMH02417*	2	5	5	10	Medium Risk	N	Y	Y	Y	Rehabilitation	1-5 Years	$5,500.00
G-WWM0685	2024-04-25	Gusher	G-WWMH0628	G-WWMH0629	Downstream	0	*Defect in manhole structure G-WWMH0628*	2	5	5	10	Medium Risk	N	Y	Y	Y	Rehabilitation	1-5 Years	$5,500.00
G-WWM0774	2024-01-16	Gusher	G-WWMH0756	G-WWMH0757	Downstream	0	*Defect in manhole structure G-WWMH0756*	2	5	2	10	Medium Risk	N	Y	Y	Y	Rehabilitation	1-5 Years	$5,500.00
G-WWM02214	2024-04-01	Dripper	G-WWMH02175	G-WWMH02176	Downstream	0	*Defect at pipe joint within manhole G-WWMH02175*	3	3	3.1	9	Medium Risk	N	Y	Y	Y	Rehabilitation	1-5 Years	$5,500.00
G-WWM02681	2024-04-23	Runner	G-WWMH02398	G-WWMH0729	Downstream	72		2	4	4.1	8	Medium Risk	N	Y		Y	Rehabilitation	1-5 Years	$3,000.00
G-WWM0668	2024-04-17	Runner	G-WWM0658	G-WWM0659	Upstream	62.5	*Defect in manhole structure G-WWMH0658*	2	4	4.1	8	Medium Risk	N	Y	Y	Y	Rehabilitation	1-5 Years	$5,500.00
Potential Infiltration Sources																			
G-WWM0168	2024-02-16	Pending	G-WWMH0136	G-WWMH0193	Upstream	41.5	*Encrustation within the pipe. Flush pipe and conduct CCTV Inspection*	2	5		10	Medium Risk	N				Reassessment	1-5 Years	$330.00
G-WWM0639	2024-04-23	Pending	G-WWMH0671	G-WWMH0672	Downstream	68.3	*Hole present in the pipe. Flush pipe and conduct CCTV Inspection*	2	5		10	Medium Risk	N				Reassessment	1-5 Years	$300.00
G-WWM0140	2024-01-22	Pending	G-WWMH0187	G-WWMH0188	Downstream	74	*Encrustation within the pipe. Flush pipe and conduct CCTV Inspection*	3	2.1		6.3	Low Risk	N				Reassessment	6-10 Years	$180.00
G-WWMH0658	2024-04-17	Pending	G-WWMH0662	G-WWMH0663	Upstream	70.09	*Encrustation within the pipe. Flush pipe and conduct CCTV Inspection*	2	2.1		4.2	Low Risk	N				Reassessment	6-10 Years	$300.00
G-WWM0672	2024-04-15	Pending	G-WWMH0615	G-WWMH0616	Upstream	57.6	*Encrustation within the pipe. Flush pipe and conduct CCTV Inspection*	2	2.1		4.2	Low Risk	N				Reassessment	6-10 Years	$310.00

Pipe Inspection	Date	Infiltration Type	US MH	DS MH	Survey Direction	Distance (m)	Comment	CoF Score	NASSCO LoF Score	PoF	Risk	Risk Group	Structural Repair Required	Cleaning	Parging	Grouting	Rehabilitation/ Reassessment	Timeline (Years)	Cost Estimates
G-WWM0191	2024-02-20	Pending	G-WWMH0159	G-WWMH0162	Upstream	67	*Roots present in the pipe. Flush pipe and conduct CCTV Inspection*	3	1.1		3.3	Low Risk	N				Reassessment	6-10 Years	$250.00

*Refer to TM#2 for locations of I/I sources

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Table 5-2: I/I Rehabilitation Risk Assessment and Cost Estimate for Private Repairs

Inspection Date	Address*	Type	Rehabilitation/Reassessment	Timeline (Years)	Cost Estimate
2023-10-31	115 LAKE DRIVE E	Cleanout - Below Grade	Rehabilitation	1-5 Years	$500.00
2023-10-31	125 LAKE DRIVE E	Cleanout - Below Grade	Rehabilitation	1-5 Years	$500.00
2023-10-31	125 LAKE DRIVE E	Cleanout - Below Grade	Rehabilitation	1-5 Years	$500.00
2023-11-01	15 RED ROBIN RD	Cleanout - Below Grade	Rehabilitation	1-5 Years	$500.00
2023-10-31	181 LAKE DRIVE E	Cleanout - Below Grade	Rehabilitation	1-5 Years	$500.00
2023-11-07	26 JOEL AVE	Cleanout - Below Grade	Rehabilitation	1-5 Years	$500.00
2023-11-01	27193 CIVIC CENTRE RD	Cleanout - Above Grade	Reassessment	6-10 Years	$200.00
2023-11-01	27193 CIVIC CENTRE RD	Cleanout - Above Grade	Reassessment	6-10 Years	$200.00
2023-11-07	28 JOEL AVE	Cleanout - Above Grade	Reassessment	6-10 Years	$200.00
2023-11-06	321 METRO ROAD N	Cleanout - Above Grade	Reassessment	6-10 Years	$200.00
2023-11-07	769 MCNEIL RD	Cleanout - Above Grade	Reassessment	6-10 Years	$200.00
2023-11-08	773 JACKSONVILLE RD	Cleanout - Below Grade	Rehabilitation	1-5 Years	$500.00
2023-11-08	775 WILLOWVIEW RD	Cleanout - Below Grade	Rehabilitation	1-5 Years	$500.00
2023-11-08	780 JACKSONVILLE RD	Cleanout - Above Grade	Reassessment	6-10 Years	$200.00
2023-11-08	784 WILLOWVIEW RD	Cleanout - Below Grade	Rehabilitation	1-5 Years	$500.00
2023-11-07	785 CAROL AVE	Cleanout - Above Grade	Reassessment	6-10 Years	$200.00
2023-11-06	819 PARADISE DR	Cleanout - Above Grade	Reassessment	6-10 Years	$200.00
2023-11-06	822 LAGOON DR	Sump Pump	Rehabilitation	1-5 Years	$2,500.00
2023-10-30	848 TRIVETTS RD	Cleanout - Below Grade	Rehabilitation	1-5 Years	$500.00
2023-11-01	852 CRESCENT BEACH RD	Cleanout - Below Grade	Rehabilitation	1-5 Years	$500.00
2023-10-27	1003 LAKE DRIVE N	Cleanout - Below Grade	Rehabilitation	1-5 Years	$500.00
2023-10-26	1007 BARTON AVE	Cleanout - Below Grade	Rehabilitation	1-5 Years	$500.00
2023-10-26	1010 BARTON AVE	Cleanout - Above Grade	Reassessment	6-10 Years	$200.00
2023-10-27	1022 METRO RD N	Cleanout - Below Grade	Rehabilitation	1-5 Years	$500.00
2023-10-27	1022 METRO RD N	Cleanout - Below Grade	Rehabilitation	1-5 Years	$500.00
2023-10-27	1028 METRO RD N	Cleanout - Below Grade	Rehabilitation	1-5 Years	$500.00
2023-10-18	11 WOLFORD CRT	Cleanout - Below Grade	Rehabilitation	1-5 Years	$500.00
2023-10-18	11 WOLFORD CRT	Cleanout - Below Grade	Rehabilitation	1-5 Years	$500.00
2023-10-18	14 WOLFORD CRT	Cleanout - Below Grade	Rehabilitation	1-5 Years	$500.00
2023-10-18	20 WOLFORD CRT	Cleanout - Below Grade	Rehabilitation	1-5 Years	$500.00
2023-10-18	24 EASTBOURNE DR	Cleanout - Above Grade	Reassessment	6-10 Years	$200.00
2023-10-18	24 WOLFORD CRT	Cleanout - Below Grade	Rehabilitation	1-5 Years	$500.00
2023-10-18	25 WOLFORD CRT	Cleanout - Below Grade	Rehabilitation	1-5 Years	$500.00
2023-10-27	27 LAKE DRIVE E	Downspout	Rehabilitation	1-5 Years	$750.00
2023-10-27	27166 WOODBINE AVE	Cleanout - Above Grade	Reassessment	6-10 Years	$200.00
2023-10-18	29 WOLFORD CRT	Cleanout - Below Grade	Rehabilitation	1-5 Years	$500.00
2023-10-18	30 WOLFORD CRT	Cleanout - Below Grade	Rehabilitation	1-5 Years	$500.00

Inspection Date	Address*	Type	Rehabilitation/Reassessment	Timeline (Years)	Cost Estimate
2023-10-18	31 LAKE DRIVE E	Cleanout - Above Grade	Reassessment	6-10 Years	$200.00
2023-10-27	31 WOLFORD CRT	Cleanout - Above Grade	Reassessment	6-10 Years	$200.00
2023-10-18	4 COTTAGE GRV	Cleanout - Below Grade	Rehabilitation	1-5 Years	$500.00
2023-10-27	41 LAKE DRIVE E	Cleanout - Below Grade	Rehabilitation	1-5 Years	$500.00
2023-10-27	769 SHEPPARD AVE	Cleanout - Below Grade	Rehabilitation	1-5 Years	$500.00
2023-10-20	775 LENNOX AVE	Cleanout - Below Grade	Rehabilitation	1-5 Years	$500.00
2023-10-19	777 SHEPPARD AVE	Cleanout - Below Grade	Rehabilitation	1-5 Years	$500.00
2023-10-20	782 SHEPPARD AVE	Cleanout - Below Grade	Rehabilitation	1-5 Years	$500.00
2023-10-20	794 CHARLES CRES	Cleanout - Above Grade	Reassessment	6-10 Years	$200.00
2023-10-19	853 LAKE DRIVE N	Cleanout - Above Grade	Reassessment	6-10 Years	$200.00
2023-10-18	899 LAKE DRIVE N	Cleanout - Below Grade	Rehabilitation	1-5 Years	$500.00
2023-10-18	936 LAKE DRIVE N	Cleanout - Below Grade	Rehabilitation	1-5 Years	$500.00
2023-10-19	961 WILLOUGHBY BLVD	Cleanout - Below Grade	Rehabilitation	1-5 Years	$500.00
2023-10-19	985 LAKE DRIVE N	Cleanout - Below Grade	Rehabilitation	1-5 Years	$500.00
2023-10-27	987 LAKE DRIVE N	Cleanout - Below Grade	Rehabilitation	1-5 Years	$500.00
2023-10-27	997 LAKE DRIVE N	Cleanout - Below Grade	Rehabilitation	1-5 Years	$500.00
2023-10-03	245 ELM AVE	Cleanout – Above Grade	Reassessment	6-10 Years	$ 200.00

*Refer to TM#2 for locations of I/I sources

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6.0 Implementation of Mitigation Measures on Private Property

I/I reduction work can take place in both private side and public side and the Town has existing programs in place to deal with I/I on public property (i.e., to fix sewer infiltration sources). However, depending on the type of I/I to be tackled and the scale of the rehabilitation program on private property, different strategies may be required. Therefore, it is recommended that the Town evaluate the different approaches to tackling I/I on private property.

6.1 Design-Bid-Build Programs

Under this type of program, once an I/I source is identified and confirmed as an I/I source through field investigations, the source is evaluated, and based on the results of the evaluation, is remediated immediately. It is recommended that the I/I source have a cost benefit analysis and risk assessment performed, and if certain criteria are met, remediation works should take place by the Town's contractor as soon as possible. This type of program will involve investigations, evaluations and remediation work taking place concurrently, with the goal of wrapping all phases of an I/I project into a single venture.

The advantages to this program are that it would wrap all phases of project into a single venture, leading to faster I/I reductions. However, there may be increased liability for remediation works that will fall onto the Town and its contractor.

6.2 Incentive Based Program for Private-Side Defects

This type of program would involve the Town providing funding and/or rebates to property owners as incentive to fix private-side I/I sources. The Town would need to create a subsidy program for private-side fixes in the study area and if desired for future I/I source disconnection needs.

6.2.1 Public-Private Partnership Programs

Offering incentives to municipal developers to undertake I/I programs that free up capacity in the sewer system can be undertaken as a step necessary for the approval of proposed developments. The works undertaken should be sufficient to demonstrate to the satisfaction of the Town - prior to construction of the proposed development– that the flow reduction works are implementable and will result in a net reduction in the peak flows in the sewer system even after the proposed development is fully occupied. This work must demonstrate a 'Net-Benefit' in the existing Town's sanitary sewer and should compensate for the additional peak sewage flows into the sanitary sewer system by using a recommended at least 2:1 offset. This program has been rolled out across York Region and has been implemented across several municipalities in the Region over the last 10-12 years.

6.3 By-Law Enforcement Program

This type of program involves the Town's by-law enforcement officers delivering written notices to property owners that currently have illegal cross-connections in order to mandate that owners disconnect the drainage features themselves. If property owners are not granted an exemption and do not comply with the by-law, fines can be imposed against the property owners until they are in compliance with the bylaw. The problem with this type of program is that property owners can be forced to spend thousands of dollars which can create high stakeholder negativity towards the program. The Town should review relevant by-laws to understand if a program such as this would be enforceable.

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6.4 Evaluation of Implementation Programs

In order to assess an implementation program for the study area, **Table 6-1** below describes the advantages/disadvantages of each of the implementation programs described in the sections above.

Table 6-1: Implementation Programs - Advantages and Disadvantages

Implementation Program	Advantages	Disadvantages
Design-Bid-Build	• Higher efficiency – tendering for similar type works rather than piecemeal • Increased Town control/oversight (costs, schedule, risk, etc.) • Tracking I/I reductions easier with more insight into remediation completion data • Property owner participation likely to be higher with no cost and shared liability • Large benefit in cost savings due to high uptake (O&M, conveyance and treatment, basement flooding, development, etc.)	• Increased liability for the Town (shared with contractor) • Increased cost for the Town compared to other implementation programs • Requires changes to accepted protocol to allow Town to fund private-side remediation works
Incentive Based	• Lower localized risk for Town – property owner assumes risk for remediation work • Property owner participation likely to be higher than by-law enforcement program	• Low participation if subsidy is not sufficient to cover most costs • Low participation if resident unaware of program/not effected by impacts of I/I (e.g., basement flooding) • Higher cost than some other implementation plans (public-private partnership, by-law enforcement)
Public-Private Partnership	• Lower cost for Town - developer assumes costs for investigation and remediation works • Lower risk for Town – developer assumes risk for remediation works • Property owner participation likely to be higher with no cost and reduced liability • Large benefit in cost savings due to high uptake (O&M, conveyance and treatment, basement flooding, development, etc.)	• Not available if new developments are not planned in study area • May cause negative feedback from residents if stakeholder engagement not properly managed

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Implementation Program	Advantages	Disadvantages
By-Law Enforcement	• Reduced liability for the Town - homeowner tasked with finding contractor and assuming risk • Lower cost for the Town	• May cause negative feedback from residents by forcing them to spend potentially $1,000's of dollars on remediation works • Resources needed for by-law enforcement department to enforce/inspect remediation works

Based on the advantages/disadvantages of each type of program, it is recommended that the Town move forward with an approach that is best suited to current and future I/I reduction needs.

A public-private partnership offers many advantages, however, it is unknown at this time if there are plans for development in the study areas and should be evaluated further.

6.5 Similar Experiences of I/I Reduction

A review of similar I/I reduction programs was completed to better understand different implementation strategies and the success rate of such programs. Several municipalities have implemented programs to reduce private property contributions with a variety of approaches taken to reduce I/I, including:

- Incentive-based approach:
  - Providing funding and/or rebates to property owners as incentive to fix private-side I/I sources
  - Financial assistance (low income/seniors/disability)
- Enforcement-based approach:
  - Municipality uses varying bylaw enforcement techniques (fines, termination of services, etc.) to ensure I/I fixes occur
- Agency-driven approach:
  - Municipality/agency undertakes investigation, evaluation and remediation program
  - Municipality/agency funds I/I disconnection work
  - Municipality/agency offers incentive to property developers/other private entities to fix I/I issues as part of a sustainable development plan

Varying techniques and incentives have been used to help achieve I/I reduction in municipalities across North America. The following sections outline case studies from nearby municipalities with a goal of I/I reduction through public and private property remediation works.

6.5.1 Basement Flooding Protection Subsidy Program, City of Toronto, Ontario

The City of Toronto is located in southern Ontario and has a population of over 2.7 million. The City has introduced various wet weather flow reduction strategies and a dedicated basement flooding protection program. The City offers an incentive-based approach for disconnecting drainage features on private

property, specifically for disconnecting foundation drains connected the sanitary sewer and to install sump pumps and backflow preventer valves to help mitigate I/I-induced basement flooding.

The City of Toronto employs a subsidy program for disconnection of foundation drains, as well as for the installation/replacement of sump pumps and backwater valves. Homeowners must select and employ a City-approved contractor to be eligible for the subsidy. A breakdown of the various subsidies can be found in **Table 6-2**.

Table 6-2: City of Toronto Subsidy Breakdown

Work Completed	Details	Subsidy
Foundation Drain Disconnection	Severing and Capping Connection	80% of cost to maximum $400
Sump Pump Installation	Installation/Replacement Installation of Alarm Installation of Back-Up Power	80% of cost to maximum $1,750
Installation of Backwater Valve	Installation/Replacement Installation of Alarm	80% of cost to maximum $1,250

6.5.2 I/I Reduction Program - Regional Municipality of Halton, Ontario,

Halton Region is located in southern Ontario, west of Toronto and east of Hamilton. This regional municipality has a population over 500,000 and services four municipalities. Halton Region has an I/I reduction program- Enhanced Basement Flooding Prevention Program, aimed at reducing the number of basement floods that occur during large rain events.

Halton Region offers an extensive incentive program for disconnection of downspouts and foundation drains, as well as for sanitary lateral lining and installation of a backwater valves. A breakdown of the various subsidies can be found in **Table 6-3**.

Table 6-3: Halton Region Subsidy Breakdown

Work Completed	Details	Subsidy
Downspout Disconnection	Within Target Areas	100% of cost
Downspout Disconnection	Outside Target Areas	100% of cost to maximum $500
Foundation Drain Disconnect and Sump Pump Installation	Arranged by Homeowner	100% of cost to maximum $5,000
Sewer Lateral Repair or Lining Work	Arranged by Homeowner	50% of cost to maximum $2,000
Installation of Backwater Valve	Arranged by Homeowner	50% of cost to maximum $675

This disconnection program is relatively new, and therefore I/I reduction results are not currently available.

6.5.3 Basement Flooding Protection Subsidy Program – City of Windsor, Ontario

The City of Windsor is located in southern Ontario. The City is offering a subsidy program to install a sump pump overflow and/or backwater valve. Services to disconnect the found drain from the floor drain is also offered in the subsidy program. The goal for the Basement Protection Subsidy Program is to reduce the risk of basement flooding by taking the initiative for mitigate risks on private property.

The City of Windsor is providing subsidies for eligible work based on the availability of funding (first come, first serve). Aside from the approved works, the subsidy program does not cover the replacement, upgrade, add an additional sump pump. A breakdown of the service offered through this subsidy program can be found in **Table 6-4**.

Table 6-4: City of Windsor Incentive Breakdown

Work Completed	Details	Subsidy
Sump Pump Installation	Installation with sump pump overflow Disconnect floor drains	100% of cost to maximum &$1,750
Sump Pump Installation	Overflow to discharge outside to surface	100% of cost to maximum $300
Backwater Valve Installation	Installation	100% of cost to maximum $1,000
Backwater Valve and Sump Pump with Overflow Installation	Installation	100% of cost to maximum $2,800
Foundation Drain Disconnection	Disconnect foundation drain from floor drain and/or dyes testing and camera work required	100% of cost to maximum $400

6.5.4 Sump Pump Disconnection and Backwater Valve Installation Grants – The Municipality of Lambton Shores

The Municipality of Lambton Shores is located is located on the southern shores of Lake Huron. This municipality has a population greater than 10,000 and services multiple communities within this municipality. The Municipality offers grants to residents to conduct sump pump disconnection and backwater valve installation. The objective is to provide residents with the leverage to participate in the disconnection program. The goal is to reduce the flows entering the sanitary sewer system during high intensity storm events to prevent sewage backups.

Table 6-5 provides a breakdown of the subsidies offered for the sump pump disconnection and backwater valve installation. This program is set to provide the benefits of reducing excess flow into the sanitary system, prevent sewage backups and to meet compliance with Municipal by-laws.

Table 6-5: The Municipality of Lambton Shores Subsidy Breakdown

Work Completed	Details	Subsidy
Sump Pump Disconnection	Disconnection	100% of cost to maximum $2,500
Backwater Valve Installation	Installation	100% of cost to maximum $2,500

7.0 Conclusions and Recommendations

Based on the results of this I/I reduction study, the following recommendations can be made:

1. Sixteen active infiltration sources should be rehabilitated to mitigate I/I into the sanitary sewer. Seven potential sources should be assessed during wet weather inspections as these potential I/I source may be active during rainfall or snowmelt events. These are defects located on the public side infrastructure.
2. Results from smoke testing and lot inspections indicated that the most common observation was defective cleanouts below grade. These are not necessarily significant sources of I/I, but are recommended to properly fix and cap those that are uncapped or defective. Positive smoke tests that have higher I/I potential observed are: one downspout and one sump pump. All identified potential inflow sources were observed on the private side. These I/I sources recommended to be reassessed through dye testing to confirm if there is a hydraulic connectivity to the sanitary sewer and then rehabilitate the confirmed I/I sources.
3. Estimates of I/I peak flows and volumes have been given to each confirmed and potential I/I source where an accurate estimate is feasible. It's estimated that a volume reduction of 50.9 m^3 (or 0.0509 MLD) can be reduced during a 1-25 yr storm event. Rehabilitation of the potential infiltration sources and the defective cleanouts may provide further reductions that cannot be accurately quantified at this time.
4. The Town has an objective of reducing I/I by 0.27 MLD by 2026. Other Town initiatives, such as the ongoing Sewer and Manhole Condition Assessment program, will also aid the Town in achieving this objective. In the Sanitary Sewer and Manhole Condition Assessment Study, the estimated flow reduction is 0.102 MLD assuming that all defects are active throughout the entire year. When the flow reductions from the Sanitary Sewer and Manhole Condition Assessment Study and this I/I study are combined a total of 0.1529 MLD is estimated to be the potential I/I reduction which represents approximately 57% of the Town's objective. Any infiltration sources identified, quantified, and rehabilitated through these initiatives will move the Town closer to achieving the 0.27 MLD reduction. The Town has set a 10-year capital plan in which it encompasses ongoing improvements to the sanitary collection system which will be recommended on an annual basis. The collective rehabilitation of I/I sources is anticipated to have a greater potential to reduce I/I. On an individual scale, remediating one I/I source may not achieve I/I reduction, but mitigating the sources in the sanitary pipes and I/I sources from private side can provide greater results.
5. The lot inspections also documented that about 23% of the downspouts were observed to have no visible surface discharge and discharged into pipes going into the ground. Since these downspouts did not smoke during the smoke test, there is a potential that it may discharge to the foundation drain and indirectly convey rainwater to the sanitary sewer system. The presence of debris or standing water can contribute to negative smoke tests. These potential sources of I/I are recommended to be confirmed through dye-testing.
6. None of the three study areas have storm sewer systems that would be accommodating foundation drain flows. These sources should be confirmed through dye testing and/or lateral CCTV inspection. If there are positive sources, sump pump disconnections and sanitary sewer grouting are recommended. I/I sources may be present on the private side in the form of defective laterals or foundation drains either directly connected or connected through a sump pump to the sanitary system. A single cross-connection to the sanitary sewer in isolation is rarely the cause of

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systems failure however, many cross-connections from private side to sanitary sewer across a system can cause significant issues. Therefore, it is beneficial to eliminate these sources.

7. Structural and Operation & Maintenance observations were made through CCTV inspections using NASSCO PACP grading. The documented observations indicated that deposits consisted of encrustation and debris was the most common defect observed. Other defects such as fractures, holes, sags, obstructions and roots were observed. It is recommended to conduct a separate study to analyze the risk associated with the structure performance and to develop a timeline for the pipes to be reassessed and rehabilitated.
8. The Town should evaluate which approach to take for disconnecting I/I sources on private property, which should take into consideration current needs and potential future I/I projects.

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