Core Infrastructure Asset Management Report

2021

TORONTO

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Core Infrastructure Asset Management Plan

Summary

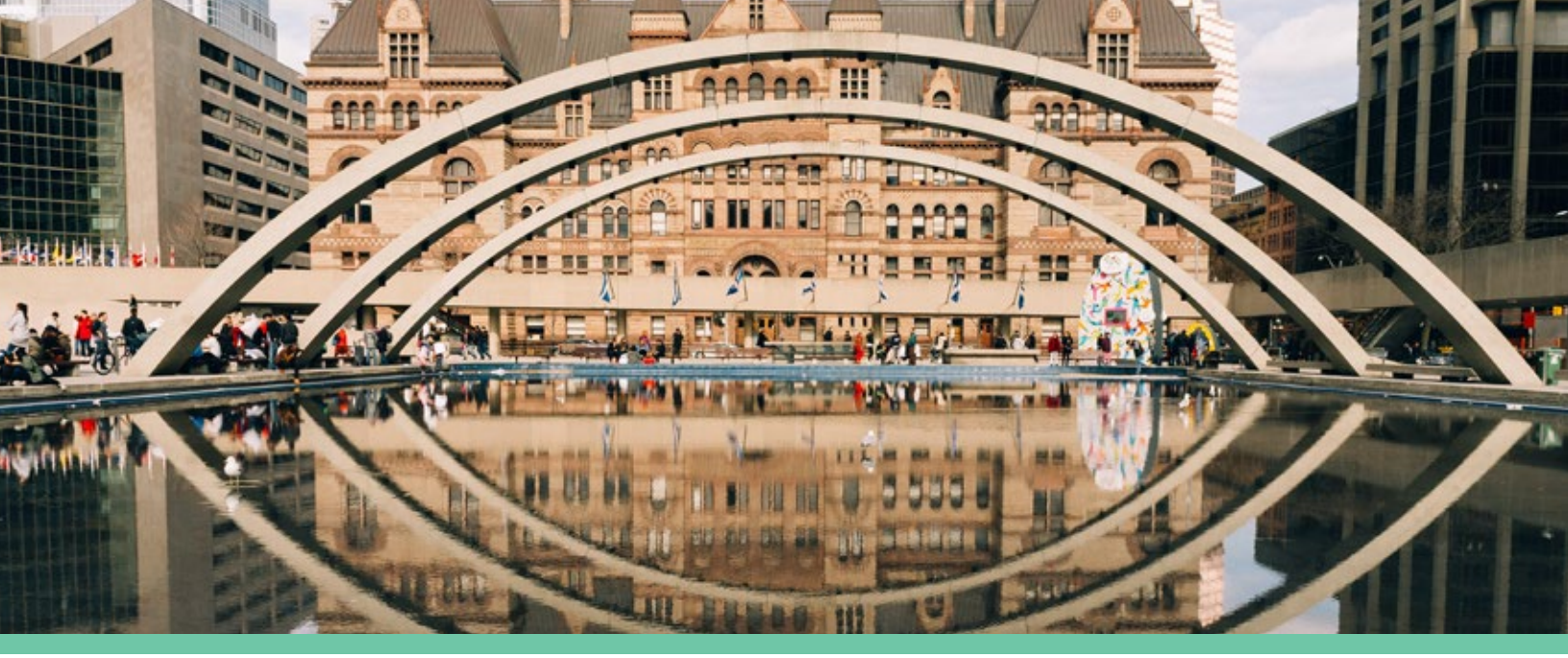
This report presents the City of Toronto's Core Infrastructure Asset Management Plan for City Council's approval, in accordance with *Ontario Regulation 588/17: Asset Management Planning for Municipal Infrastructure* (the "Regulation").

The regulations were subsequently amended in March of 2021 under *Ontario Regulation 193/21* to change the timing of reporting requirements under the Act. The report will address the infrastructure elements as outlined in the regulation and include water, wastewater, stormwater, roads, bridges and culvert asset groups.

The Core Infrastructure Asset Management Plan is aligned with Corporate Asset Management Policy approved by Council in 2019 and incorporates key principles and strategic directions that enhance asset management practices and ensure that asset management activities are continuously improved and integrated across the organization. The asset management plans in this report are based on the work used to develop the annual Capital Budget and Plan for the core infrastructure asset groups managed by Toronto Water and Transportation Services Divisions.

Asset management integrates planning, finance,engineering and operations to realize value from assets, reduce risks and provide expected levels of service to the community in a socially, environmentally and economically sustainable manner. Effective asset management requires an overarching framework to establish and guide its practice so that asset management becomes central to strategic, financial and operational decision-making at all levels of the organization.

The Core Infrastructure Asset Management Plan attached as **APPENDIX 1** and **2** of this report, provides the foundation that will support an integrated approach at the City as it develops and matures its asset management practice and ensure the sustainability of assets and related services; optimize infrastructure investment decisions; and support reliable service delivery. The Asset Management Plans provide an inventory by asset category, asset conditions, service levels and asset life cycle activities and costs required to maintain current service levels. The Plan also identifies the impacts of growth including costs to accommodate demand and the operating costs required to maintain current service levels in accordance with the first-phase requirements of Ontario Regulation 588/17.



Decision History

At its final wrap-up meeting on February 20, 2019, Budget Committee requested that the Chief Financial Officer and Treasurer continue efforts to update and improve the City's asset management policies, standards and practices and report back together with the City's asset management policy for Council's consideration and approval by July 1, 2019, as required by Provincial legislation.

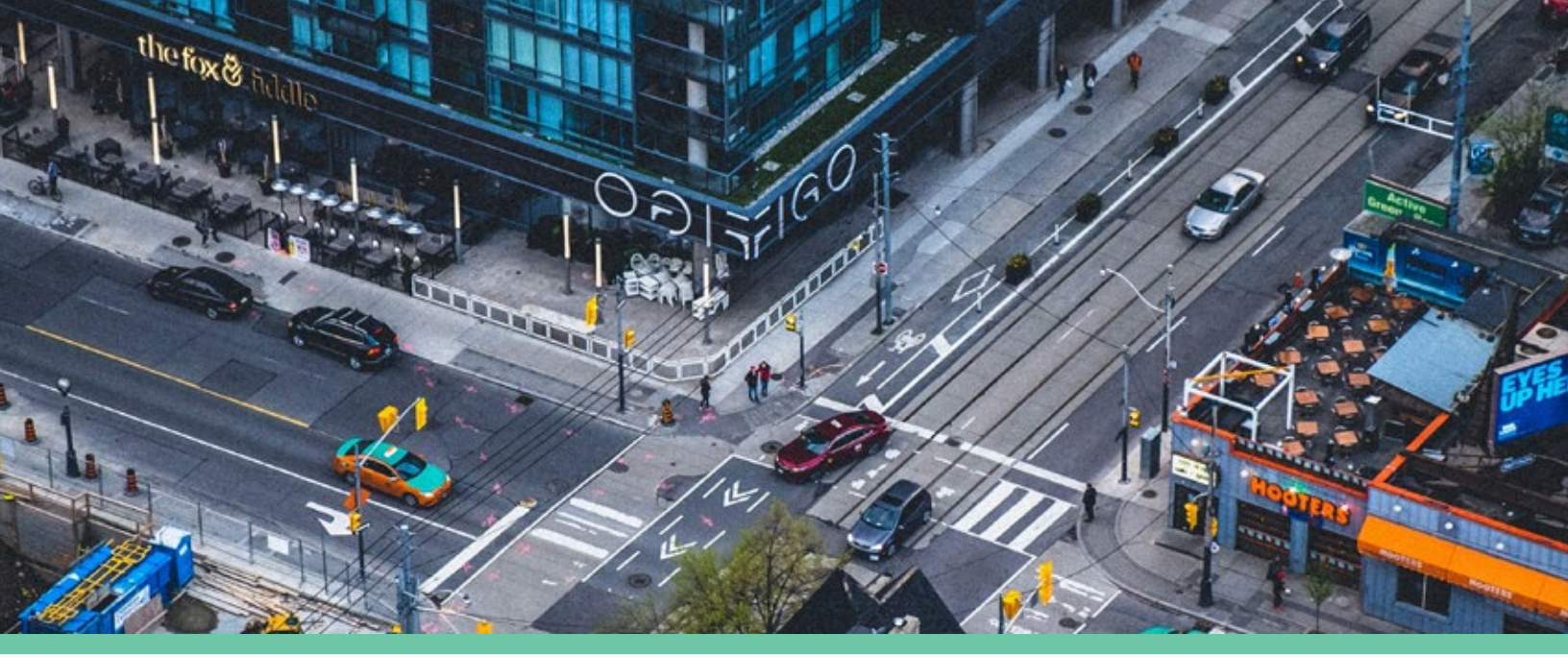
At its meeting on June 18, 2019, City Council adopted the Corporate Asset Management Policy. The purpose of this policy is to guide the development and implementation of the City of Toronto's asset management framework and asset management plans and applies to the lifecycle management activities of municipal infrastructure assets that are owned and/or controlled by the City of Toronto for the provision of services. app.toronto.ca/tmmis/viewAgendaItemHistory.do?item=2019.EX6.11

This policy was developed in response and in accordance with *Ontario Regulation 588/17: Asset Management Planning for Municipal Infrastructure* and it is used to guide the development of the Core Infrastructure Asset Plan presented in this report.

Background

In 2017 the Province of Ontario enacted *Ontario Regulation 588/17: Asset Management Planning for Municipal Infrastructure* (O. Reg. 588/17), under the *Infrastructure for Jobs and Prosperity Act*, to support improvements in municipal asset management.

Ontario Regulation 588/17 which came into effect in January 2018 provides the authority for the Province to regulate municipal asset management planning. It reflects the province's commitment to guide investments in public infrastructure that was first initiated in 2011 (and subsequently reconfirmed in 2017), when the Province of Ontario released *'Building Together'* as its long-term infrastructure plan and strategic framework. It also builds on consultations with the municipal sector, including the City of Toronto, which were conducted in 2016. The regulatory timelines were subsequently amended effective March 15th, 2021.



The Regulation facilitates asset management best practices throughout the municipal sector, provides a degree of consistency to asset management plans, and leverages asset management planning to optimize infrastructure investment decisions. **The requirements of the Regulation were phased in as follows with amendments (as filed under O.Reg 193/21 on March 15, 2021):**

1. **July 1, 2019**: Every municipality in Ontario must have a **strategic asset management policy** approved by Council. The policy is to be reviewed, and if necessary updated, at least every five years.

2. **July 1, 2022**: Every municipality in Ontario must have approved asset management plans for **core infrastructure assets** (water, wastewater, storm water, roads, bridges and culverts) at the current levels of service.

3. **July 1, 2024**: Every Municipality in Ontario must have approved asset management plans for **all infrastructure assets** at the current levels of service.

4. **July 1, 2025**: Every asset management plan-must include **proposed levels of service for each category** of infrastructure assets.

The Regulation defines detailed information requirements for each phase. These requirements are outlined throughout this report as applicable.

Additionally, the Regulation requires that the strategic asset management policy and asset management plans be approved by a resolution passed by Council and made available to the public via the city's website and to persons who request a copy.

Current Status

The strategic asset management policy requirement of the Regulation was met through the City Council's adoption of the Corporate Asset Management Policy Report in June of 2019. This report addresses the asset management plans for the core infrastructure assets and the requirements as defined by the Regulation for water, wastewater, stormwater **(APPENDIX 2)** and roads, bridges and culvert **(APPENDIX 2)** asset groups, and it is required to be approved by Council no later than July 1, 2022 (extended from July 1, 2021).

Comments

Corporate Asset Management

The City of Toronto has a large, complex and diverse range of infrastructure assets with an estimated asset value of $101.5 billion, on which it relies to deliver essential services. The scale and criticality of the City's asset portfolio requires an approach to asset management that integrates planning, finance, engineering and operations to ensure that value from assets is realized, risks reduced and expected levels of service to the community provided in a socially, environmentally and economically sustainable manner.

The application of asset management principles and practices at a corporate level is intended to ensure a coordinated, consistent, effective and sustainable Corporate Asset Management approach across diverse asset groups. These principles and practices need to be systematically developed, embedded and integrated across the organization, and be continuously improved. Effective asset management requires an overarching framework to establish and guide its practice so that asset management becomes central to strategic, financial and operational decision-making at all levels of the organization. This framework has been established by the Corporate Asset Management Policy adopted by Council in 2019.

In 2021 and 2022, work will continue to develop a corporate wide reporting standard across all City asset groups that is systematic, repeatable and that will feed into the annual Capital Budget and Planning process as well as meet the future reporting requirements in Ontario Regulation 588/17. The work currently underway in financial modernization initiatives including Financial Systems Transformation and Capital Modernization will inform and guide the corporate wide asset reporting standards.

Corporate Asset Management Policy

The Corporate Asset Management Policy presents the framework that is intended to promote a consistent and integrated approach to asset management of municipal infrastructure assets that are owned and/or controlled by the City of Toronto; facilitate logical and evidence-based decision-making for the management of infrastructure assets, and support the delivery of sustainable community services now and in the future, through the adoption of appropriate asset management practices.

The Corporate Asset Management Framework, as illustrated in **Figure 1** Corporate Asset Management Framework, represents the integrated relationship between elements of an effective asset management system, and provides a structure for standardization and consistency of asset management practices and plans across the organization.

It integrates land use, service and master planning to ensure that multi-year service plans account for the capital assets required to support existing service levels/delivery, increased service demand and to address projected growth. The Corporate Asset Management Framework also illustrates the interaction of key strategies of asset management planning that include all stages of the asset lifecycle, levels of service, risk and financial management.

Figure 1: Corporate Asset Management Framework

This framework is used to guide development and implementation of the Core Infrastructure Asset Management Plans included in this report and it is intended to ensure long-term core asset sustainability; demonstrate a commitment to good stewardship and support improved accountability and transparency to the community.

The Corporate Management Policy is presented in **APPENDIX 3** of this report.

The Asset Planning and Capital Budget Review Process

Asset planning is a key component of the capital planning and budgeting decision making process and identifies areas of investment in operational, maintenance, and renewal activities to ensure the reliability of the assets based on an understanding of the lifecycle costs. Each year through the budget process Divisions and Agencies ensure that the assets supporting services are managed in a way that balances service levels, risks, and affordability – all elements that form part of the asset management plans as prescribed by Ontario Regulation 588/17.

The Capital Budget process seeks to achieve a balance between maintaining existing City assets and growth; focusing on investment in health and safety, legislative compliance, state of good repair while addressing service gaps and priorities on a citywide basis for service improvements and growth related projects responsive to Council directions. Focus and priority is given to projects that maintain existing assets in a state of good repair (SOGR) and, in particular, those that reduce/address SOGR backlog.

Other considerations influencing the Capital Budget and timing of projects can include but are not limited to funding availability, market capability of delivering on capital works, coordination required with 3rd parties or other orders of government and design constraints.

The budget process also helps identify areas of under investment in assets where affordability impacts Divisions and Agencies ability to continue maintaining the existing asset base at prescribed service level standards while also addressing the growth needs of the City. City Programs and Agencies include the insurance and/or the replacement costs of capital assets along with the best estimates of the SOGR backlog in the capital budget submission. Expressing the SOGR backlog as a percent of related asset values both at the City Program / Agency level, and at the corporate level, provides the information which is crucial to effective management of the City's assets by ensuring that limited resources are allocated in a manner that optimizes utility of those assets.

The Core Infrastructure Plans although not specifically required under the legislation will include the state of good repair backlog that aligns with current service level standards of assets to provide context as to investment required to maintain City assets as well as inform future funding models and requests for investment by other orders of government.

Core Infrastructure Asset Management Plans

The legislation requires the City to provide to the Province asset management plans by July 1, 2022 (extended from July 1, 2021) for the City's Core Infrastructure Assets. The Core Infrastructure Assets addressed in this report include water, wastewater, stormwater, roads, bridges and culverts asset groups. This phase of reporting requirements will focus on core assets managed by Toronto Water and Transportation Services. There are similar ancillary asset types managed by other Divisions and Agencies, for example bridges and roadways in City parks and they will be included in future asset management plans as part of the Provincial requirements to provide the balance of the asset management plans under City management in July of 2024.

Core Infrastructure Asset Management Plans presented in this report are aligned with Corporate Asset Management Policy and incorporate key principles and strategic directions that enhance asset management practices and ensure that asset management activities are continuously improved and integrated across the organization.

The long-term outcome is to ensure the sustainability of assets and related services; optimize infrastructure investment decisions; and support reliable service delivery while fulfilling the first-phase requirements of meeting Ontario Regulation 588/17.

This report seeks to inform Council and residents on the current condition of assets and asset categories, the service levels, identify the average estimated useful life of assets, quantify the current replacement value of the core infrastructure group of tangible capital assets guided by the principles of City's Corporate Asset Management Policy. It also provides the 10-year forecast of lifecycle activities and costs to maintain current service levels and addresses impact of growth on the current service levels.

The Asset Management Plans in APPENDIX 1 and 2 are comprised of 9 sections presented in a standardized format for each Division/Core Infrastructure Asset Category and aligned to specific Regulation requirements (presented in APPENDIX 4) for easier reference and include:

1. **Introduction** - Overview including asset information, network extent, definition and basic history.

2. **Asset Inventory** - Categorization assets in further detail including asset inventory by each category that aligns to the requirements in Regulation *5 (2) 3.i*.

3. **Asset Valuations** - Valuation of assets at replacement that aligns to the requirements in Regulation *5 (2) 3.ii*.

4. **Average Asset Age** - Information on average asset age by category that aligns to the requirements in Regulation *5 (2) 3.iii.*

5. **Asset Conditions** - Examines the asset condition based on the information currently available and details approaches used for condition assessments by asset category that aligns to the requirements in Regulation *5 (2) 3.iv* and *5 (2) 3.v*.

6. **Levels of Service** - Provides qualitative descriptions in terms of scope and/or reliability and quality of current community levels of service, as well as technical metrics for current technical levels of service, by asset category, based on the past 2 years of historical data in order to fulfill specific Regulation requirements for water, wastewater and stormwater assets (tables 1, 2 and 3), and roads, bridges and culverts (tables 4 and 5). Also provides the current performance by asset category based on the past 2 years of historical data, in accordance with the performance measures established by the City of Toronto, including those that measure energy usage and operating efficiency of water, wastewater and stormwater assets and aligns to the requirements in Regulation *5.(2) 1.i* and *5.(2) 2*.

7. **Lifecycle Activities and Risk** - Describes lifecycle of assets and provides a future outlook by assessing lifecycle activities and options to maintain the current levels of service for the assets by category over the 10 year time frame and aligns to the requirements in Regulation *5.(2) 4.i, 5.(2) 4.ii, and 5.(2) 4iii*.

8. **Life Cycle Costs and Risks** - Provides lifecycle costs for activities that can be undertaken at lowest cost to maintain the assets at current levels of service over the 10 year time frame, and also highlights the risks associated with assets failing to meet current levels of service and aligns to the requirements in Regulation *5.(2) 4.iv Costs* and *5.(2) 4.iii*.

9. **Impact and Response to Growth** - Identifies the impact and response to growing population and employment forecast for the City of Toronto included in the Greater Golden Horseshoe 2017 Growth Plan, including the estimated 10 year capital expenditures and significant operating costs related to new construction or to upgrading of existing City of Toronto infrastructure assets required to accommodate projected increases in demand caused by growth, while maintaining the current levels of service and aligns to the requirements in Regulation 5.(2) 6i and 5.(2) 6.vi.

Next Steps

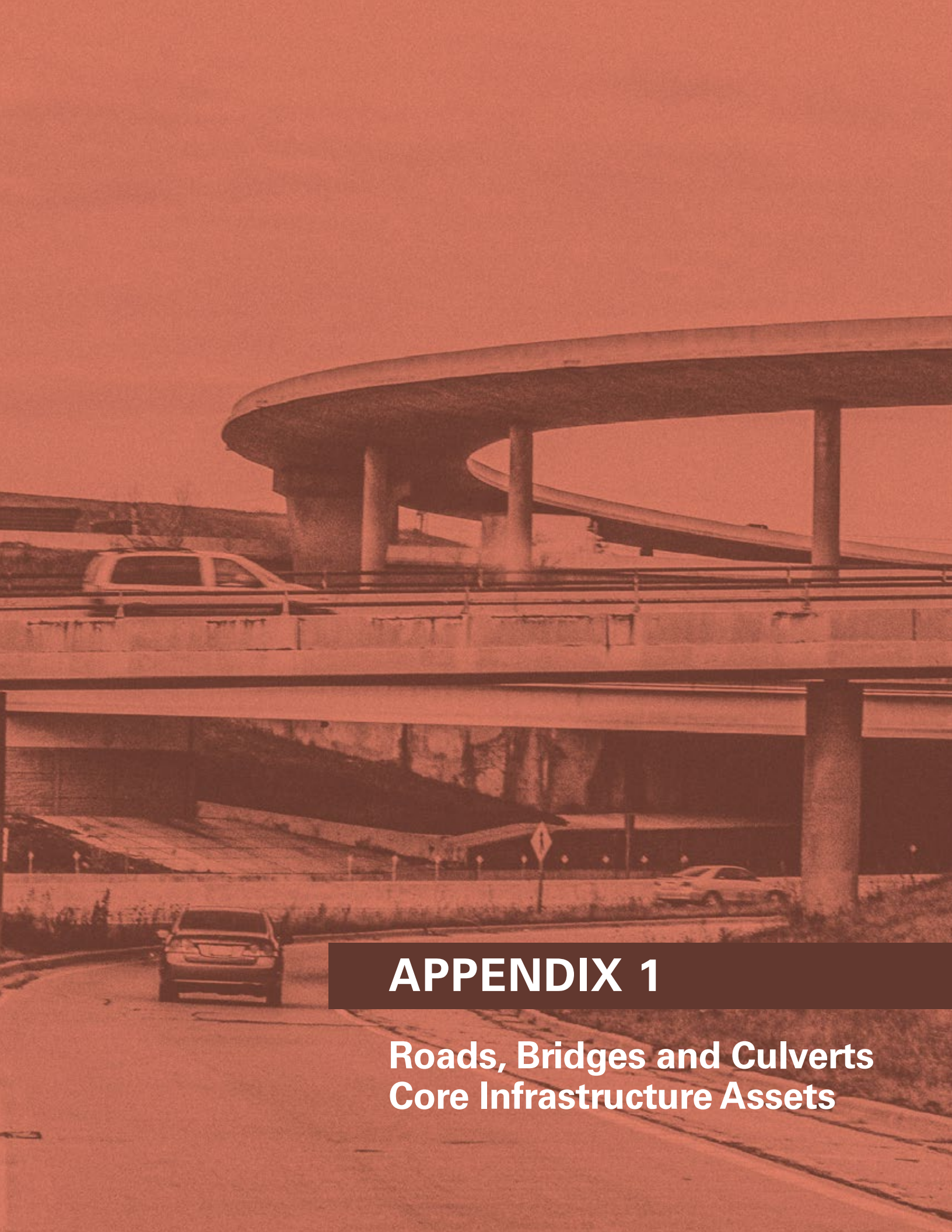
The City is currently in the process of transforming its capital financial management practices and is undertaking a series of modernization initiatives that will address governance, asset management, capital planning, and program delivery to allow for a single view of assets across City divisions and agencies and better inform long-term investment strategies.

Initiatives that are in progress include; conducting asset inventories; standardizing language on asset classes that will enable portfolio integration; aligning service based outcomes to capital investments; development of a capital budget governance and prioritization framework and standardization of condition needs assessments on similar asset groups. These initiatives are the foundation for the City developing an organization-wide practice of integrated asset management that will support asset management reporting to meet PSAB tangible capital asset reporting requirements, Ontario Regulation 588/17 asset reporting requirements and the capital budget process.

Future reporting on asset management to Council includes:

- July 2024, all other City Programs, Agencies (except Toronto Parking Authority) and the TCHC will be required to submit their respective asset management plans to City Council for approval.

- July 2025 (revised from July 2024), it will be expected that all City Programs, Agencies and the TCHC will be able to also identify the proposed service levels and asset performance that will result in asset investments as well as the financial strategies required to fund those asset investments.



APPENDIX 1

Roads, Bridges and Culverts Core Infrastructure Assets

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1.0.

EXECUTIVE SUMMARY

This is the first asset management report from the City of Toronto's Transportation Services Division that has been prepared in accordance with the requirements of Province of Ontario Regulation 588/17: Asset Management Planning for Municipal Infrastructure (O. Reg. 588/17), under the Infrastructure for Jobs and Prosperity Act, to support improvements in municipal asset management, and the City's Corporate Asset Management Policy. The requirements have a phased in approach noting the timelines were modified by Province of Ontario Regulation 193/21 as a result of impacts from the COVID-19 pandemic.

Transportation Services' mission statement is to "Build and maintain a resilient transportation network so people can connect with the places, activities and communities they value" that is further reflected in the principles, as stewards of transportation assets, that include: access for everyone, quality service, resilient solutions, and, safe, healthy communities.

This report specifically provides details for the core infrastructure categories of roads and bridges that fall under the stewardship of Transportation Services and fulfills O.Reg. 588/17 and 193/21 July 1, 2022 reporting requirements. Details include the extent and type of assets, replacement costs, average age, assessment of and asset condition, current levels of service, performance measures and metrics, the life-cycle maintenance and rehabilitation activities along with associated costs over the next ten years, and, the impact and response to growth.

Asset Inventory

The transportation network consists of about 5,600 centreline-kilometres of public roads and 879 bridges, including 131 structural culverts (>3 metres). The City's Road Classification System designates streets within the road network into different groups or classes according to the type of service each group is intended to provide.

The City's road classifications, in descending order by traffic volume, include about 2% expressways, 33% major and minor arterial roads, 62% collector and local roads, and, 3% laneways.

The bridge network includes road, rail and pedestrian carrying structures. The vast majority of structures, by deck area, carry road related traffic. The F.G. Gardiner Expressway has an elevated section that is about 6.5 kilometres in length and is made up of 323 bridge spans, accounting for about one-third of bridge structures.

Asset Valuation

Replacement values are based on the City's capital cost data. The estimated total replacement value for roads and bridges is $27.9 billion and consists of the road network at about $17.8 billion, followed by bridges at $9.0 billion and structural culverts accounting for $853 million. It is anticipated that the costs that comprise these values will continue to trend upwards with the implementation of new construction standards, inflationary pressures, and increased function and use of these assets.

Asset Age

The age of assets varies widely by type and classification. Some transportation infrastructure has existed in the City for well over one hundred years and continues to be maintained and provide service to the public. More than half the growth of the City's road and bridge infrastructure occurred with the building of many neighbourhoods in a thirty year period from the 1950s through to the 1980s.

This period also included the construction of major highways including the Don Valley Parkway and FG Gardiner Expressway in the 1960s.

Asset Condition Assessment

The City uses condition assessment indexes and procedures that are used broadly throughout the province and beyond including the Pavement Quality Index (PQI) for roads as described in American Standard Testing System (ASTM) Standard D6433 "Standard Practice for Roads and Parking Lots Pavement Condition Index Surveys" and the Bridge Condition Index (BCI) for bridges following the procedures of the Ontario Structural Inspection Manual. These indexes allow for the performance evaluation of individual assets over time, and also against the general condition of the overall assets within the network. They provide the ability to highlight areas of need, and distribute resources accordingly.

Community and Technical Levels of Service

Community levels of service include descriptions and images of the condition of roads and bridges and technical levels of service provide metrics including average overall conditions values and distribution.

Pavement conditions, PQI, is defined into three levels of service including good, fair and poor. The condition levels have different triggers based on the City's Road Classification System, recognizing that higher order roads (i.e., expressways. arterials) where there are higher vehicular operating speeds are affected more adversely by pavement distresses than lower order roads (i.e., collectors and locals).

Bridge conditions, BCI, determines the current economic worth of the structure compared to when it was brand new, or in 'excellent' condition. While there are a number of factors associated with prioritizing needs, the BCI is used to reflect the general condition of the bridges and structural culverts.

The figures below provides the level of service distribution of qualitative conditions for roads and bridges, that is the amount of the network rated as good, fair and poor.

Figure 1.0-1 PQI Condition for All Roads

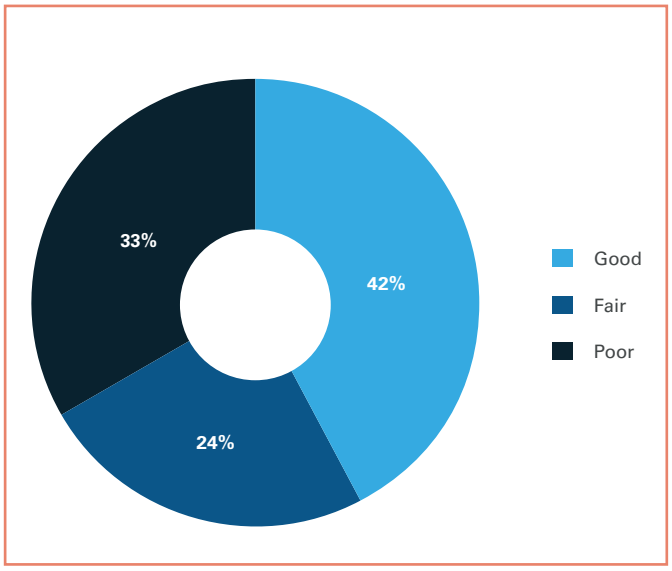
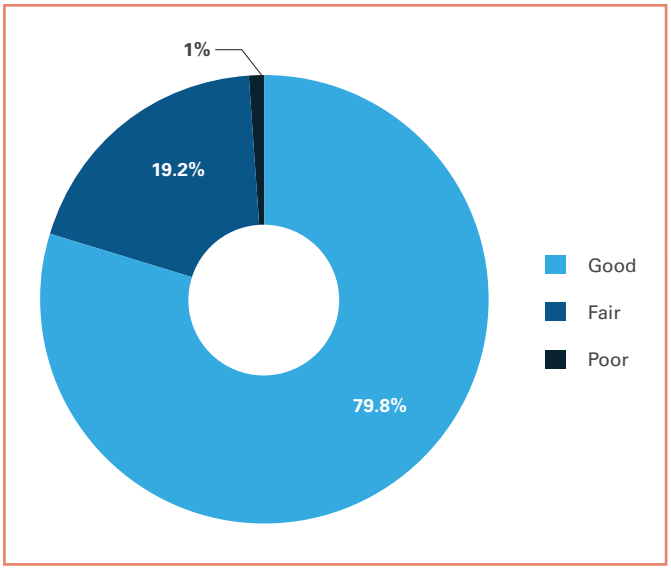


Figure 1.0-2 BCI Condition for All Structures (Bridges and Structural Culverts)



Lifecycle Activities

The key to long term, cost effective asset performance is to apply appropriate maintenance and rehabilitation activities at the right time throughout the service life of the asset to ensure both cost efficiency and adequate serviceability.

City pavements generally will provide about 75 to 100 years of service when maintenance and repair work is performed as required. Road lifecycle activities consist of maintenance and rehabilitation including work such as pothole repair, drainage maintenance, crack filling, surface sealing, patching, resurfacing and reconstruction to maintain a State of Good Repair that is safe, and enables the road to continue to operate in its intended use and function.

City bridges and culverts have an anticipated design life of 75 years. For the rehabilitation of bridges and culverts, the City also deploys a typical three-phased lifecycle activity rehabilitation approach with progressively more significant rehabilitation work required over time, to maintain the intended level of service noting as prescribed in the Ministry of Transportation's "Structural Rehabilitation Manual".

Life Cycle Costs and Risk

An expenditure forecast to maintain and repair roads and bridges is based on the City's 2021 Approved Operating Budget and 2021-2030 Approved Capital Budget and Plan for Transportation Services.

About $79.0 million of the $441.7 million 2021 Operating Budget is attributed towards road and bridge repair and maintenance. This would amount to over $800 million of Operating Budget costs over a 10 year period, assuming 2% annual inflation.

The 10-year forecasted capital costs needed to maintain current service levels for roads and bridges totals $8.6 billion with $3.9 billion funded and $4.7 billion unfunded by the end of 2030. During this period, a little more than half the approved capital funding, totaling about $2 billion, is being directed to the City's approved Strategic Rehabilitation Plan of the FG Gardiner Expressway.

The road network presents significant risk to the City given the extensive use and reliance by the public each day for the transportation of people and goods through multi-modal means (i.e., walking, cycling, transit, emergency services, freight and personal vehicles). There is a significant and growing backlog of repairs for arterial, collector and local roads which increases the City's liability, accelerates premature deterioration and exponentially increases the cost of repairs over the asset lifecycle.

To mitigate risks there are several current strategies in place to reduce risk, improve cost efficiency and reduce disruption including delivery of works through large "mega" or multi- year contracts and bundling of works. In the case of bundling of work this may be across different needs such as road repairs, safety and service improvements or across different types of assets such as roads, bridges, watermains and sewers, or, a combination of both approaches may be employed where possible.

Impact and Response to Growth

As the City continues to grow, new infrastructure is needed in order to maintain service levels. In response to the growth, most municipalities in Ontario, including Toronto, use Development Charges (DCs) to ensure that the cost of providing infrastructure to service growth is not borne by existing residents and businesses in the form of higher property taxes and utility rates. The projected costs for the anticipated road and bridge growth projects over the next 10 years is $1.5 billion, with 32% ($472.5 million) of these costs currently funded in the 2021-2030 Capital Plan. The majority of projects are to support transit needs, including Metrolinx Infrastructure and Go Transit Expansion projects. Given the complexity of some projects, several funding tools and strategies are used to funds these projects.

Next Steps

Future asset management reporting updates, in accordance with the Provincial Regulations and the City's Asset Management Policy, will build on this report by providing proposed levels of service details and strategies for roads and bridges along with information for other Transportation Services asset categories such as traffic signals, signs and sidewalks.

1.1.

INTRODUCTION

The City of Toronto's May 29, 2019 Corporate Asset Management Policy[i], approved by City Council, establishes the framework and an approach to asset management for assets owned that are managed by City Programs and other city controlled entities. As documented in the Policy report:

> ***"In 2017 the Province enacted Ontario Regulation 588/17: Asset Management Planning for Municipal Infrastructure (O. Reg. 588/17), under the Infrastructure for Jobs and Prosperity Act, to support improvements in municipal asset management.***
>
> ***Ontario Regulation 588/17 (O.Reg. 588/17) came into effect January 2018 and provides the authority for the Province to regulate municipal asset management planning. The Regulation facilitates asset management best practices throughout the municipal sector, provides a degree of consistency to asset management plans, and leverages asset management planning to optimize infrastructure investment decisions."***

The Corporate Asset Management Policy incorporates key principles and strategic directions that will enhance asset management practices and ensure that asset management activities are continuously improved and integrated across the organization. The long term outcome is to ensure the sustainability of assets and related services; optimize infrastructure investment decisions; and support reliable service delivery.

1.1.1. Provincial Reporting Requirements for Core Infrastructure

This report provides has been prepared in accordance with the requirements of O.Reg. 588/17 and O.Reg. 193/21 to meet July 1, 2022 reporting requirements for core infrastructure including roads and bridges.

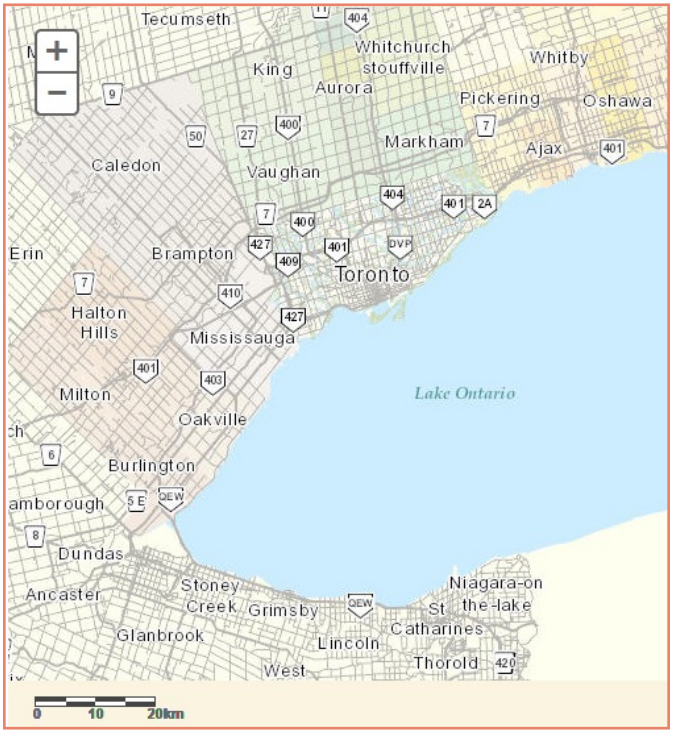
The reporting requirements for the July 1, 2022 deadline, as defined in the Province's Completeness Questionnaire, include:

1. Summary of core assets in each category;
2. Replacement cost of core assets in each category;
3. Average age of core assets in each category;
4. Condition of core assets in each category;
5. Description of municipality's approach to assessing condition of core assets in each category;
6. Current levels of service (qualitative descriptions and technical metrics as per Tables 1-5 in regulation) for core assets in each category;
7. Current performance measures of core assets in each category based on metrics established by the municipality (e.g. measures for energy usage, operating efficiency, etc.);
8. Lifecycle activities needed to maintain current levels of service for core assets in each category for 10 years;
9. Costs of providing lifecycle activities needed to maintain current levels of service for core assets in each category for 10 years;
10. Impacts of growth on lifecycle activities required to maintain current levels of service

1.1.2. City of Toronto Quick Facts

The City of Toronto is located on the northwest shore of Lake Ontario as shown in **Figure 1.1-1** and within the core area of the Province of Ontario's Golden Horseshoe, as shown on the inset map. The horseshoe part of the region's name is derived from the characteristic horseshoe shape of the west end of Lake Ontario. The golden part is historically attributed to the region's wealth and prosperity. Toronto's name is derived from the Huron word for "fishing weir".

Figure 1.1-1: Location of the City of Toronto



The red area defines the Core Area and the green area defines the Greater Golden Horseshoe.

Toronto is home to approximately 2.96 million people. The City covers 641 square kilometres and stretches 43 km from east to west and 21 km from north to south at its longest points. The perimeter is approximately 180 km. The outer boundaries of the City are defined as follows:

- Most northerly point is the intersection of Steeles Ave East and Pickering Town Line
- Most southerly point is Lake Ontario's shoreline at the border between Toronto and Mississauga
- Most easterly point is the meeting of the Rouge River and shoreline of Lake Ontario
- Most westerly point is the intersection of Steeles Ave West and Albion Road

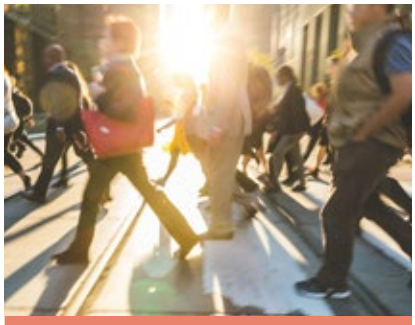
1.1.3. Transportation Services Division

The City of Toronto's Transportation Services Division (TSD) is responsible for the planning, engineering, design, maintenance and operations of infrastructure associated with the Public Road Right-of-Ways. TSD strives to build and maintain Toronto's transportation network to align to our mission, vision and principles, described in **Figure 1.1-2**.

Figure 1.1-2: Mission, vision and principles of Transportation Services Division

MISSION

Build and maintain a resilient transportation network so that people connect with the places, activities and communities they value



VISION

To keep people moving safely in our diverse and changing city

PRINCIPLES

Safe, healthy communities
Access for everyone
Quality service
Resilient solution

The core infrastructure of roads and bridges located on the City's Public Road Right-of-Ways through the City typically fall under the jurisdiction of TSD. This report provides the details related to the roads and bridges under TSD's ownership within the City. These roads and bridges are located on Public Road and Laneway Right-of-Ways (ROWs).

For clarification it is noted that there are many other infrastructure owners within the City that own and operate roads and bridges and in some cases their own corridors (i.e, ROWs). Some examples include the Ontario Ministry of Transportation (i.e., 400 Series Highway System), federally regulated parks (e.g. Downsview Park, Rouge Valley Park), railway companies (e.g., CN Railway, CP Railway, Metrolinx (GO Transit)), and, other City Agencies, Boards, Commissions and Divisions (e.g., Parks, Toronto Transit Commission, Exhibition Place, etc.). Infrastructure owned by these entities are not included in this report, except for situations where ownership is shared with TSD (e.g., bridges with shared ownership between the City and railway companies).

1.1.4. Future Reporting

Future reporting updates will build on this report by providing proposed levels of service details and strategies for roads and bridges along with information for other Transportation Services asset categories such as traffic signals, signs and sidewalks.

Further, reporting may be refined based on corporate wide guidance and reporting standards as described in the Corporate Asset Management Policy.

1.2.

ASSET INVENTORY

Municipal asset inventories are maintained by TSD for road and bridges using the computer programs RoadMatrix and Bridge Management System, (BMS), respectively, that were developed by and with program support from Stantec Consulting Limited. The databases contain asset attributes ranging from location definition to construction history, materials and condition. The following subsections detail road and bridge asset inventory information.

1.2.1. Road Asset Inventory

The City's roads have been constructed, maintained, rehabilitated and enhanced for over one hundred years. Road pavement structures have been constructed using a variety of structural designs depending on the location within the City, soil conditions, material availability, traffic characteristics and construction practices.

The City's Road Classification System designates streets into different groups or classes according to the type of service each group is intended to provide and is based on various criteria such as traffic volume, vehicular speed, access, etc. The road network in the City consists of several different classes of roads and laneways, as shown in the map on **Figure 1.2-1** and defined as follows:

- Expressways, generally four or more lanes wide, operate at higher speeds (i.e., 80-100 km/h), provide for longer distance movement and are limited access for motorized vehicles only.
- Major and Minor Arterial Roads (known as Major roads) cover about one-third of the road network and are typically four or more lanes wide, carry significant vehicular traffic, operate at moderate speeds (i.e., 40-60 km/h) and provide network connectivity for people, transit and goods.
- Collector and Local Roads (known as Local roads) cover about two-thirds of the road network and are typically two lanes wide, operate at lower speeds (i.e., 30-40 km/h) and primarily provide access to property along with pedestrian and cycle movement.
- Laneways, provide local, secondary access to residential and commercial buildings and tend to be narrow in width with low operating speeds.

The road network can also be categorized by pavement structure type. The two predominant categories are flexible, consisting of asphalt layers over granular base, and composite pavement, consisting of asphalt surface over concrete base over granular subbase. There is a small percentage of rigid pavements, consisting of concrete surface over granular base, and these types of pavement structures are common for the City's laneways. The last category called 'Other' captures a variety of less common pavement structures including those with concrete paver or brick surfaces, asphalt over bricks and other mixed paving materials.

Figure 1.2-1: City of Toronto Road Classification System Map

Table 1.2-1 and **Table 1.2-2** provide the inventory statistics of the road network by the City's Road Classification and by Pavement Structure Types, respectively, with **Figure 1.2-2** and **Figure 1.2-3** providing illustrations of the percentages of each type in pie charts.

Table 1.2-1. Road Asset Statistics by Road Classification (as per 2019 Road Survey Data)

Road Classification	Centreline-km	Lane-km	Pavement Area (m^2)
Laneways	320	393	1,433,229
Local & Collector Roads	4,032	9,408	36,057,305
Minor & Major Arterial Roads	1146	4631	18,593,291
Expressways	105	311	1,135,407
Total	**5,602**	**14,743**	**57,219,231**

Notes:

1. Expressways exclude 'Bridge' & 'Elevated Expressway' sections.
2. Lane-km based on 3.65 m wide lanes.

Figure 1.2-2: Road Asset Statistics by Functional Classification

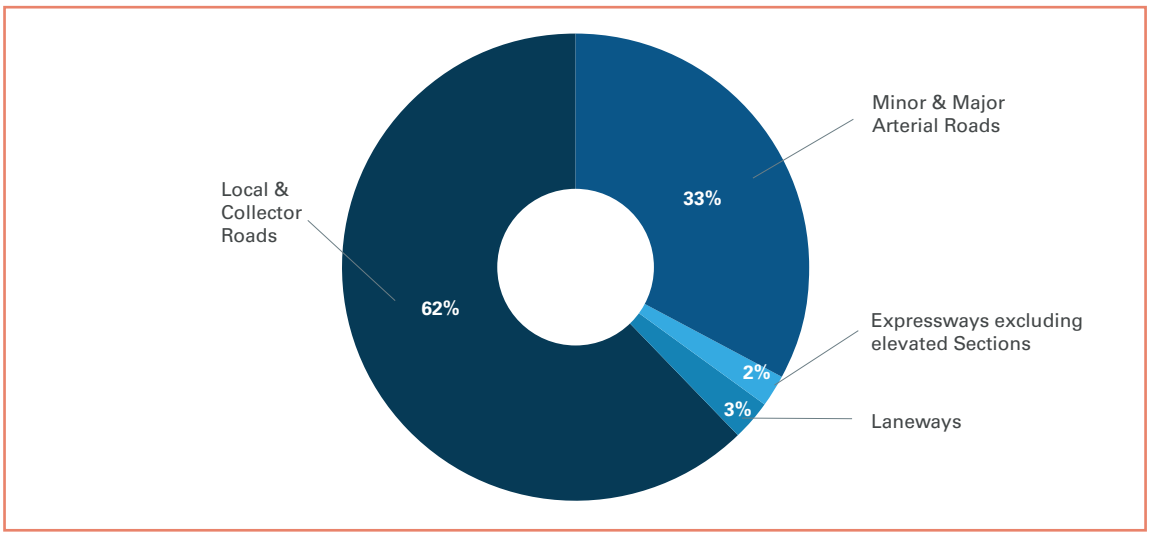
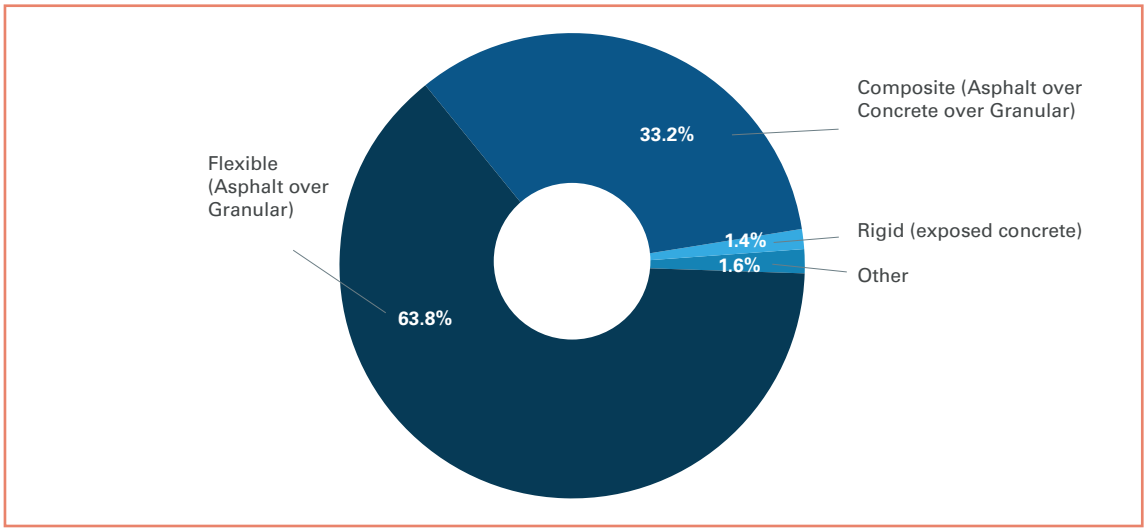


Table 1.2-2: Road Asset Statistics by Pavement Structure Type

Pavement Type	Centreline (km)	Lane (km)	Pavement Area (m^2)	% of Total
Flexible (Asphalt over Granular)	3,731	9,412	36,350,682	63.8%
Composite (Asphalt over Concrete over Granular)	1,609	4,900	19,248,882	33.2%
Rigid (exposed concrete)	156	199	730,289	1.4%
Other	106	232	889,378	1.6%
Total	**5,602**	**14,743**	**57,219,231**	**100.0%**

Figure 1.2-3: Road Asset Statistics by Pavement Type



1.2.2. Bridge Asset Inventory

The City maintains 425 bridges, as well as 6.5 km of elevated expressways associated with the F.G. Gardiner Expressway. For the management of assets, the elevated expressway is further subdivided into 323 separate spans resulting in a total of 748 bridge structures. In addition, 131 structural culverts (spanning 3.0m or greater) are also maintained within or crossing the City's ROWs. **Table 1.2-3** provides the inventory of structures categorized by carrying types.

Table 1.2-3: Distribution of Structures by Category

Structures Carrying	Description	Number of Structures	Total Deck Area (m^2)	% of Total
Road	Structures carrying all classification of City's road network, capable of carrying vehicles loading in accordance with the Canadian Highway Bridge Design Code. Includes bridges required to carry both motor vehicles and light rail vehicles (i.e., TTC Streetcars)	312	504,813	61.8%
Rail	Structures with the intended use of carrying only trains and other rail type vehicles crossing City's Transportation ROW.	66	53,001	6.5%
Pedestrians	Structures with the intended use of carrying pedestrians, and/or cyclists across City's Transportation ROW.	47	11,676	1.4%
Elevated Expressway	Elevated portion of the F.G. Gardiner Expressway, including all on and off ramps.	6.5 km (323 Spans)	247,436	30.3%
Bridge Total	**Total of all Road, Rail, Pedestrian, and Elevated Expressway.**	**748**	**816,926**	**100%**
Structural Culverts	Structures carrying road, rail, or pedestrian loads within or across the City's Transportation ROW which form an opening through soil 3.0m or greater	131	46,438	100.0%

1.3.

ASSET VALUATIONS

The core assets of roads and bridges are the most valuable assets under the stewardship of TSD. The values presented herein are replacement values. The estimated replacement value for roads and bridges totals $27 billion. It is anticipated that the costs that comprise these values will continue to trend upwards with the implementation of new construction standards, inflationary pressures, and increased function and use of the asset.

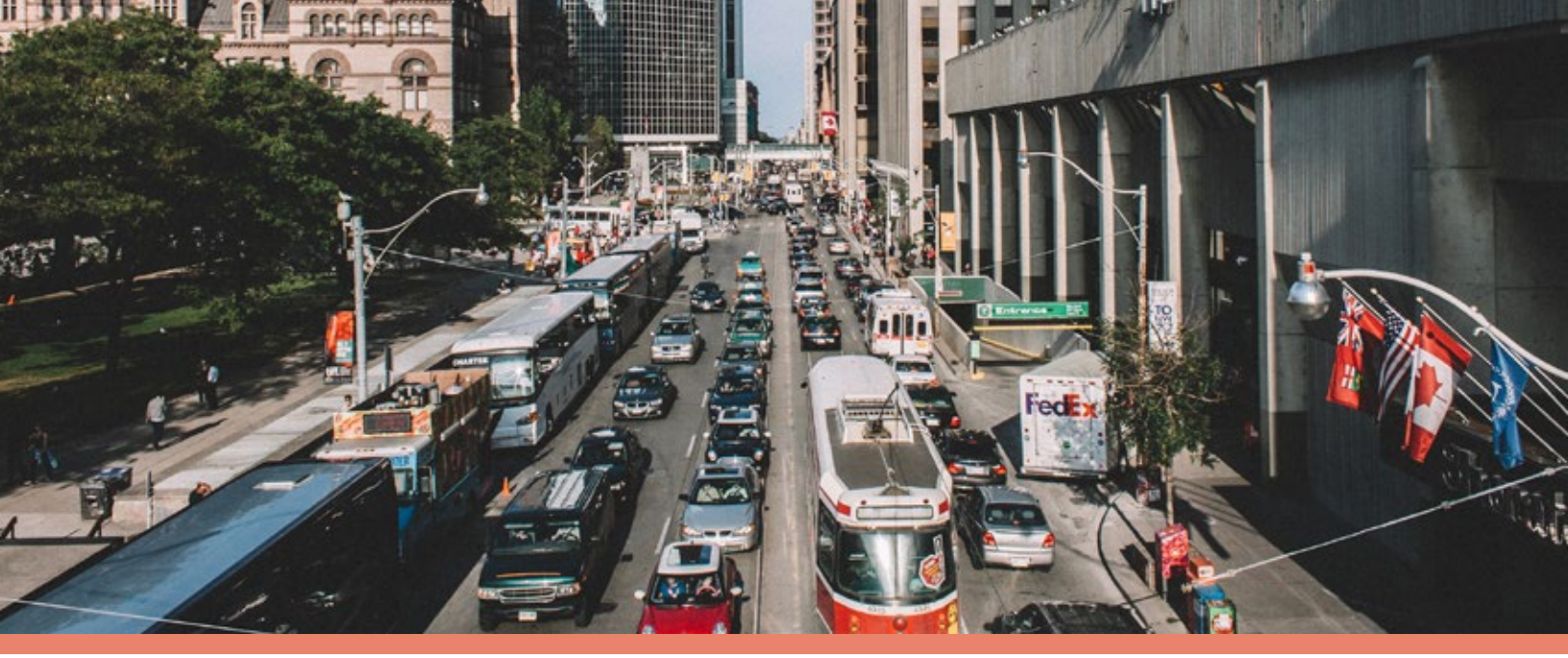
1.3.1. Road Asset Value

The replacement values of roads is based on historical trends in reconstruction costs and totals about $17.8 billion with approximately $692.8 million for laneways, $9.5 billion for local and collector roads, $6.1 billion for minor and major arterial roads, and, $1.5 billion for expressways. **Table 1.3-1** also provides a summary of road asset replacement values. The amount for expressways excludes the elevated section of the F.G. Gardiner Expressway that is included with the bridge asset value.

These reconstruction costs values do not account for items such as storm sewer drainage systems (owned and managed by Toronto Water), traffic signs and signals, street furniture and streetscape elements (e.g. paved boulevards, tree trenches, cycling bollards, etc.) and separated cycling facilities.

Table 1.3-1: Road Asset Value

Road Classification	Centreline-km	Lane-km	Adjusted Area (m^2)	Asset Replacement Value (Millions)	% Replacement Costs
Laneways	320	393	1,433,229	$692.8	3.89%
Local & Collector Roads	4,032	9,408	36,057,305	$9,507.7	53.34%
Minor & Major Arterial Roads	1146	4631	18,593,291	$6,128.4	34.38%
Expressways excluding elevated sections	105	311	1,135,407	$1,496.9	8.40%
Total	**5,602**	**14,743**	**57,219,231**	**$17,825.9**	**100.00%**



1.3.2. Bridge Asset Value

The replacement values of bridges totals $9.0 billion and structural culverts account for $853 million. **Table 1.3-2** also provides a summary of bridge asset replacement values. The replacement value of the bridge asset is assessed based on historical costs of deck and superstructure replacements of similar kinds. As replacement of the substructure is not common, estimates are based on assumed factors.

Certain bridges, most notably rail structures, have shared responsibilities with stakeholders. The bridge asset values shown here only reflect the City's portion of structure.

Table 1.3-2: Bridge Asset Value

Structures Carrying	Asset Replacement Value (Millions)
Road	$4,560
Rail	$322
Pedestrians	$138
Elevated Expressway	$4,000
Bridge Total	**$9,020**
Structural Culverts	$853
Combined Total	**$9,873**

1.4.

AVERAGE ASSET AGE

The age of assets varies widely by type and classification. Some transportation infrastructure has existed in the City for well over one hundred years and continues to be maintained and provide service to the public. More than half the growth of the City's road and bridge infrastructure occurred with the building of many neighbourhoods in a thirty year period from the 1950s through to the 1980s. This period also included the construction of major highways including the Don Valley Parkway and FG Gardiner Expressway in the 1960s.

The age of assets is based on the most recent replacement for the type of infrastructure as described in each section below.

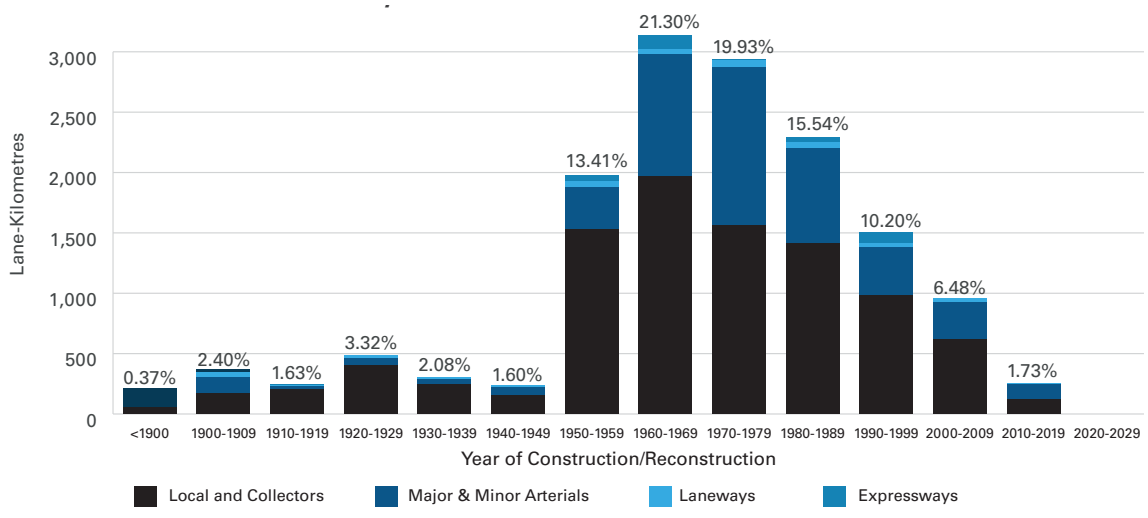
1.4.1. Road Age

The age of road pavement structures is based on the most recent construction activity, either the original construction or the reconstruction of the pavement structure. Typical pavements in the City are expected to provide about seventy-five to one hundred years of service between reconstruction with regular maintenance and rehabilitation.

The age of assets varies widely by classification with the building of many neighbourhoods in the 1950s through to the 1980s and the construction of major highways in the 1960s.

The average age is 62 years for laneways, 53 years for locals and collectors, 48 years for arterials and 47 years for expressways. A histogram of road age by decade of construction and road classification is presented in **Figure 1.4-1**.

Figure 1.4-1: Construction History of Roads

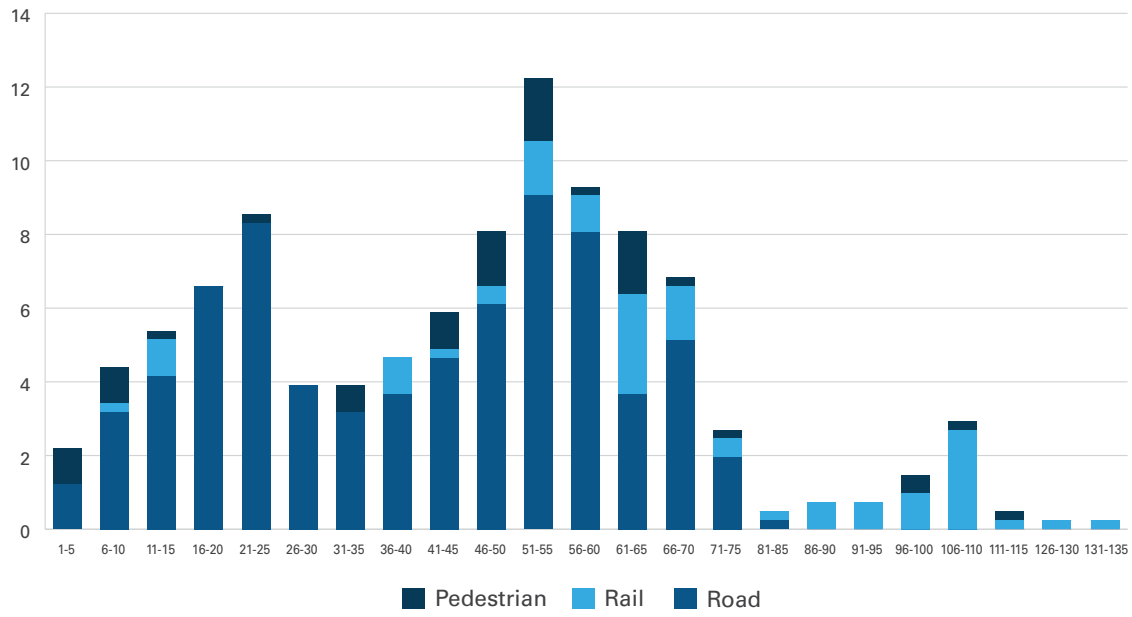


1.4.2. Bridge Age

In accordance with the governing design code the average anticipated design life of a bridge or culvert structure is 75 years. Consistently, the age of the bridge deck and its resulting condition, has the greatest impact on its rehabilitation cycle, and maintenance needs. Once a bridge deck has been replaced the rehabilitation cycle, as described in Section 1.7.2, begins again.

The average age of bridge decks within the City's network is 45 years, with 25 percent falling between 35-55 years. A histogram of bridge deck age is shown in **Figure 1.4-2.**

Figure 1.4-2: Age Distribution of Bridge Decks



Notes:

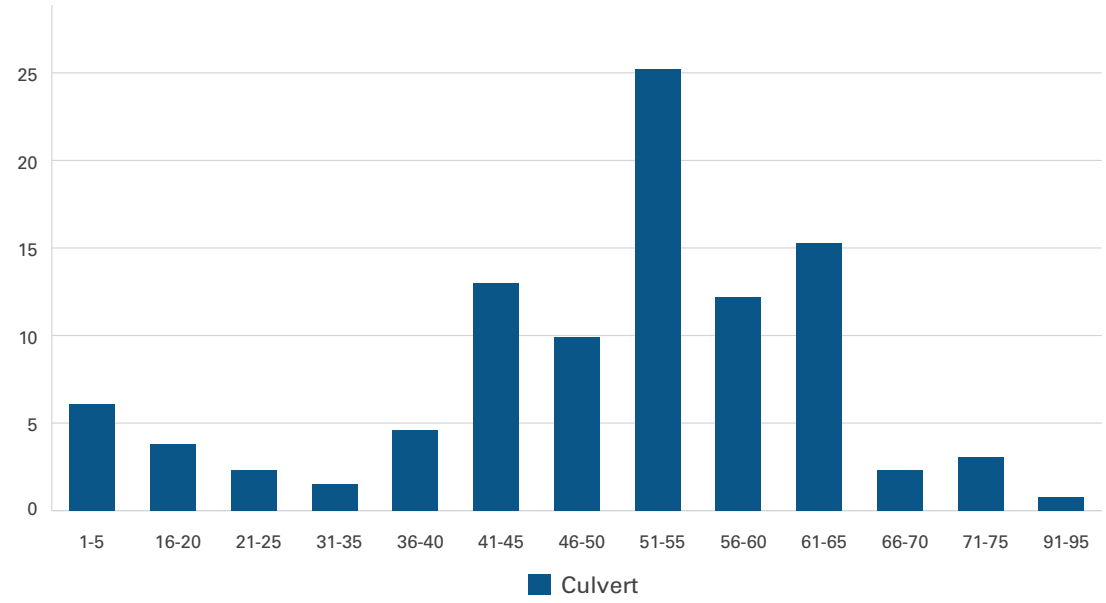
1. Due to less corrosive environments decks of rail carrying structures tend to have longer lifespans.

2. FG Gardiner, built circa 1965, is not depicted in the chart above, as it would skew the chart towards structures with age between 50 to 60 years old.

The average age of structural culverts within the City's network is 49 years, with 41 percent falling between 39-59 years. A histogram of culvert age is shown in **Figure 1.4-3.**

Current climate conditions and increases in the frequency and severity of storm events results in many culverts being deemed under capacity for today's water flow rates. This often leads to the need for upsizing of a culvert in advance of realizing its design life and at increased capital cost.

Figure 1.4-3: Age Distribution of Structural Culverts

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1.5.

ASSESSING ASSET CONDITIONS

TSD uses quality indexes developed specifically for road or bridge asset types, and used broadly throughout jurisdictions within the province. These indexes allow TSD to evaluate the performance of individual assets over time, and also against the general condition of the overall asset network. They provide the ability to highlight areas of need, and distribute resources accordingly.

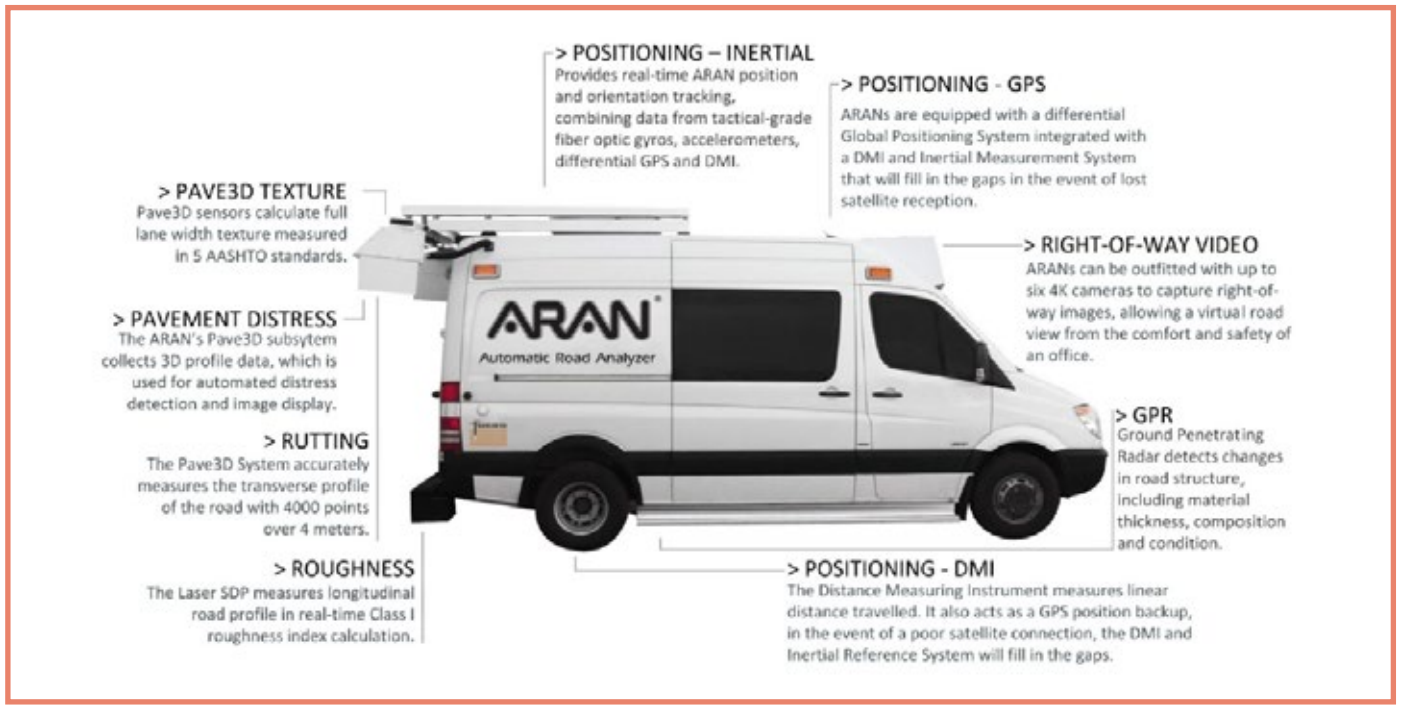
1.5.1. Road Condition Assessment

TSD assesses their pavement conditions using a Pavement Quality Index (PQI) rating system with a scale from 0 for a failed pavement to 100 for a pavement in excellent condition. The PQI is directly based on visual inspections of roads and laneways following the procedures described in American Standard Testing System (ASTM) Standard D6433 "Standard Practice for Roads and Parking Lots Pavement Condition Index Surveys". The ASTM standard is used to calculate a Pavement Condition Index (PCI) value calculated for each road section and the City equates PQI to PCI.

Other pavement assessments such as pavement roughness, typically determined through the International Roughness Index (IRI), and Structural Adequacy Index (SAI), typically determined through Falling Weight Deflectometer, can be used and calculated as part of an overall PQI (i.e., the formula: PQI = aPCI +bIRI + cSAI, where a, b and c are coefficients that sum to 100%). However, these additional assessments are not typically undertaken for network level assessments but may be used for project level investigations. Further, while IRI is automatically collected, these values are not always useful in a municipal context where many factors such as maintenance chambers, speed humps, temporary utility cuts, and, frequent stop and start conditions can produce roughness data that is unreliable for the purpose of determining physical asset condition or as in input to decision making.

The City also employs a third party vendor (e.g., Fugro-Roadware) to collect pavement condition data using an Automatic Road Analyzer (ARAN) as illustrated in **Figure 1.5-1**. The ARAN collects pavement condition data, including cracks and ruts, using downward facing cameras and laser-based measurements.

Figure 1.5-1: Automatic Road Analyzer (ARAN)



TSD inventories road condition data in its pavement management application, Roadmatrix. The frequency of assessment varies based on the road classification identified in **Table 1.5-1**.

Table 1.5-1: Road Condition Assessment Frequency

Road Classification	Inspection Frequency
Laneways	25% per year, four (4) year cycle
Local Roads	25% per year, four (4) year cycle
Collector Roads	50% per year, two (2) year cycle
Minor & Major Arterial Roads	100% per year, annually
Expressways	100% per year, annually

1.5.2. Bridge Condition Assessment

As required by Ontario Regulation 472/10: Standard for Bridges, the City completes visual inspections of their Transportation bridge and structural culvert inventory following the procedures of the Ontario Structural Inspection Manual. The findings of the inspection are used to develop the condition rating, known as the Bridge Condition Index (BCI). The BCI determines the current economic worth of the structure compared to when it was brand new, or in 'excellent' condition. While there are a number of factors associated with prioritizing needs, the BCI is used to reflect the general condition of the bridges and structural culverts.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1.6.

CURRENT LEVELS OF SERVICE

Qualitative descriptions of the community levels of service and technical metrics representing technical levels of service are provided in this section described in Tables 1-5 of O.Reg. 588/17.

Additional community and technical levels of service are provided for City services that include the operational activity of pothole filling. This information is included under the sections for roads although it should be noted that potholes can form on both roads and bridges.

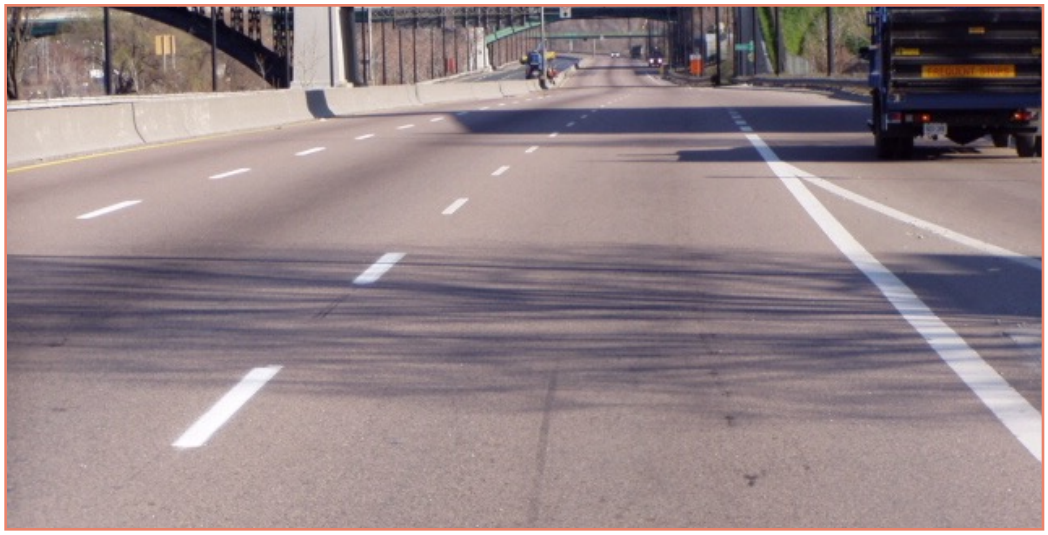
1.6.1. Community Levels of Service for Roads

The PQI value is defined for three levels of service, good, fair and poor. The triggers to select pavement condition are adjusted for road classification, recognizing that higher order roads (e.g., expressways, arterials) where higher vehicular operating speeds are affected more adversely by pavement distresses than lower order roads (e.g., collectors and locals). The PQI descriptions and ranges are listed in **Table 1.6-1** with photographic examples of each category provided in **Figure 1.6-1**.

Table 1.6-1: PQI Condition Descriptions and Ranges

	Level of Service		
	Poor	**Fair**	**Good**
Visual Description	Exhibits extensive cracking, settlements and distortions. Cracks width is medium to large. Surface may be very uneven or rough.	Exhibits frequent narrow and medium size cracks. May have some settlements, distortions and patches.	May have been recently constructed or rehabilitated. Typically exhibits a few to intermittent narrow width cracks and could have a few patches.
Road Classification			
Expressway	< 65	Between 65 and 75	> 75
Minor & Major Arterial	< 55	Between 55 and 75	> 75
Collector	< 50	Between 50 and 70	> 70
Local & Laneway	< 45	Between 45 and 65	> 65

Figure 1.6-1 Photographic Images of Road Conditions



Example of Expressway in Good Condition

Description:
Road surface recently repaved and there are no cracks or surface deformations.

Example of Expressway in Fair Condition

Description:
Presence of intermittent to frequent narrow and medium size cracks.

Example of Expressway in Poor Condition

Description:
Presence of intermittent to frequent cracks, rutting and distortions. Road surface is uneven and rough to drive.

Example of an Arterial Road in Good Condition

Description:
Road is recently reconstructed and there are no cracks or surface distresses.

Example of an Arterial Road in Fair Condition

Description:
Presence of intermittent to frequent narrow and medium size cracks, presence of intermittent wheel path cracks, moderate rutting.

Example of an Arterial Road in Poor Condition

Description:
Presence of frequent to extensive alligator cracks, settlements and distortions. Road surface is very uneven and rough to drive.

Example of a Local Road in Good Condition

Description:
Road is recently resurfaced and there are no cracks or surface distresses.

Example of a Local Road in Fair Condition

Description:
Presence of intermittent to frequent medium to large size transverse and longitudinal cracks, uneven road surface.

Example of a Local Road in Poor Condition—potential reconstruction candidate as overall pavement structurally failed

Description:
Presence of extensive alligator cracks, settlements and distortions. Road surface is very uneven and rough to drive.

Example of a Local Road in Poor Condition—potential resurfacing candidate as overall pavement surface failed but granular subbase layers are still functional

Description:
Presence of extensive cracks, settlements and distortions.
Road surface is very uneven and rough to drive.

1.6.2. Technical Levels of Service for Roads

The condition for each road classification overall along with the proportion of roads falling in the good, fair and poor categories is provided in **Table 1.6-2** with **Figures 1.6-2a-e** illustrating the distribution as defined in **Table 1.6-1** using a histogram with 5-point PQI increments. Further, **Figure 1.6-3** summarizes the conditions in pie charts. It should be noted that some PQIs are actual values, from the most recent survey (See **Table 1.5-1**), while others are predicted based on the average deterioration rates developed for "groupings" of roads based on the Road Classification System, pavement type, etc.

Table 1.6-2 Road Conditions

Road Classification	Average	Pavement Quality index, PQI		
		Good (% lane-km)	Fair (%lane-km)	Poor (% lane-km)
Laneways (% of Total Laneways)	69.15 (Good)	49.03%	19.27%	13.53%
Local & Collector Roads (% of Total Local Roads)	62.60 (Fair)	52.07%	23.53%	24.12%
Minor & Major Arterial Roads (% of Total Major Roads)	56.68 (Fair)	25.00%	25.51%	48.77%
Expressways	65.85 (Fair)	14.31%	16.14%	66.87%
Overall % of Total Lane-km	60.88	42.43%	23.91%	32.74%

Note <1% data is unreported

Figure 1.6-2a: Distribution of Road Condition for All Roads

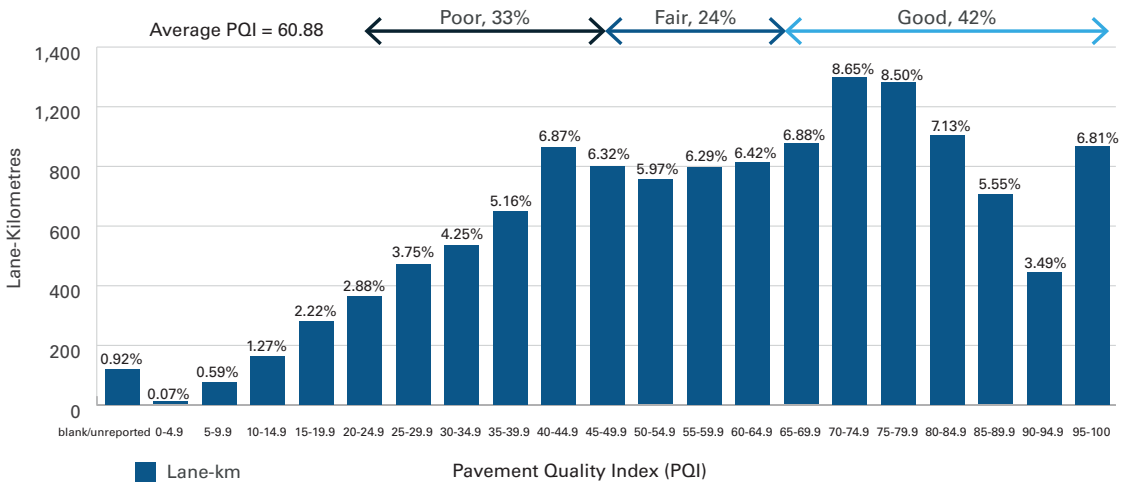


Figure 1.6-2b: Distribution of Road Condition for Expressways

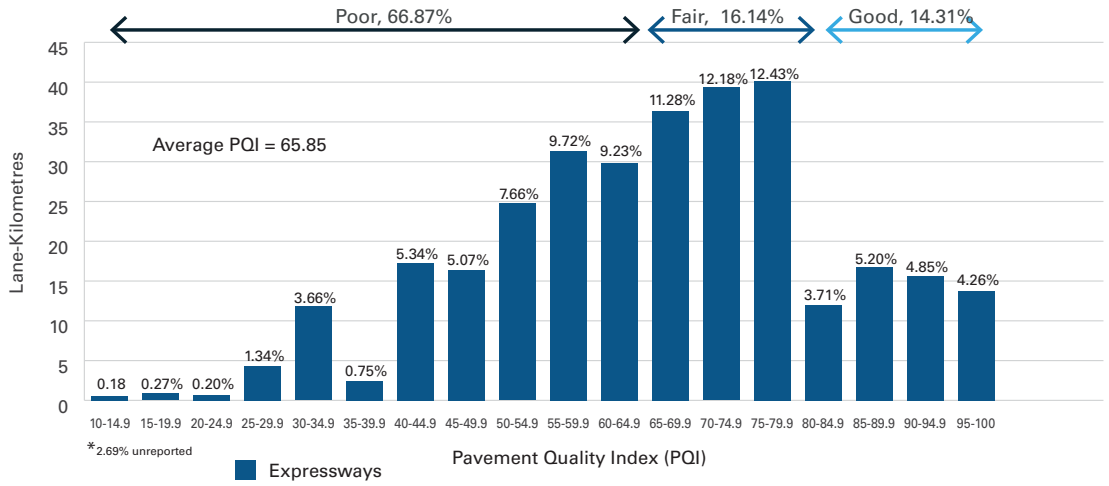


Figure 1.6-2c: Distribution of Road Condition for Major and Minor Arterial Roads

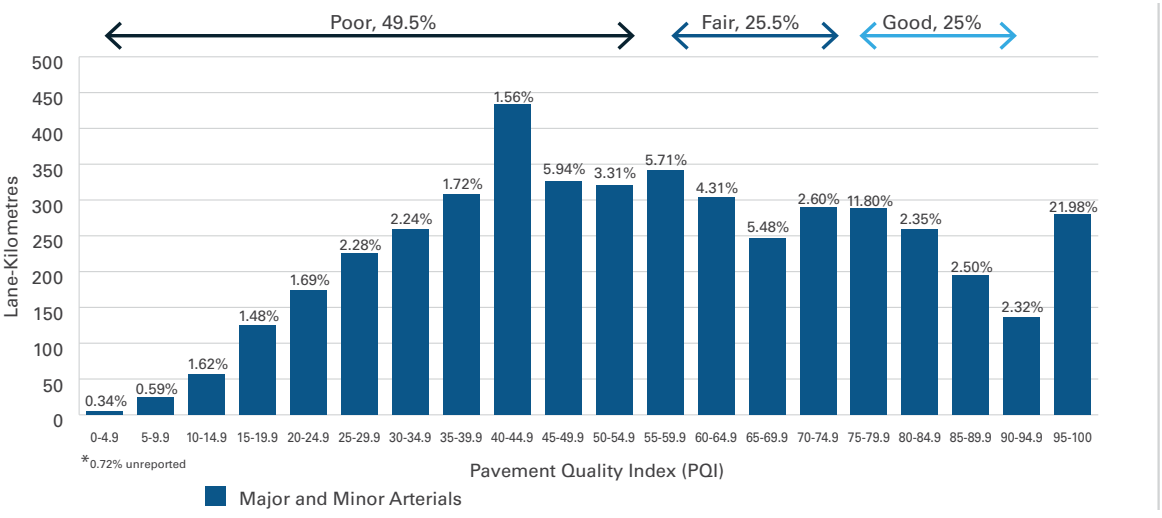


Figure 1.6-2d: Distribution of Road Condition for Local and Collector Roads

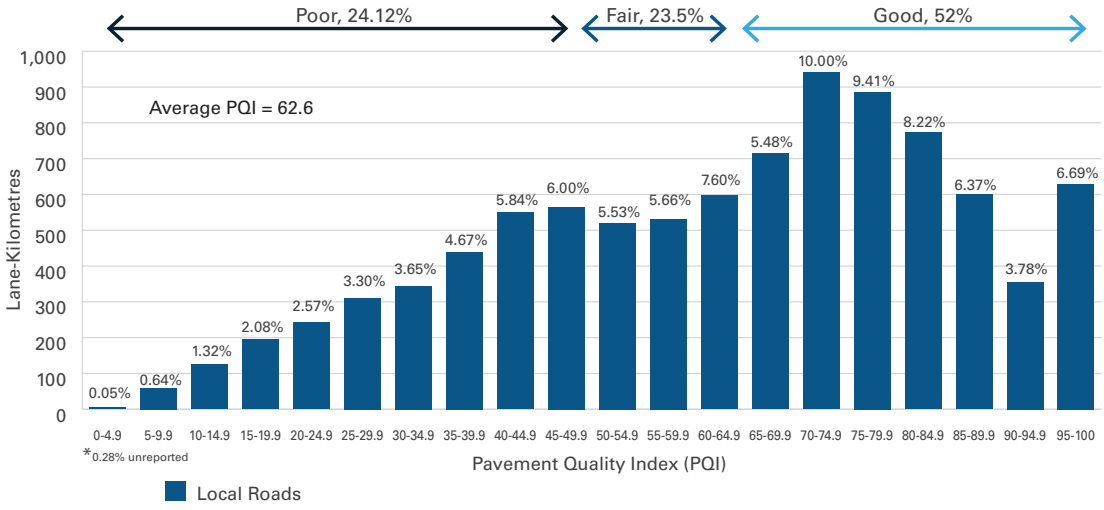


Figure 1.6-2e:. Distribution of Road Condition for Laneways

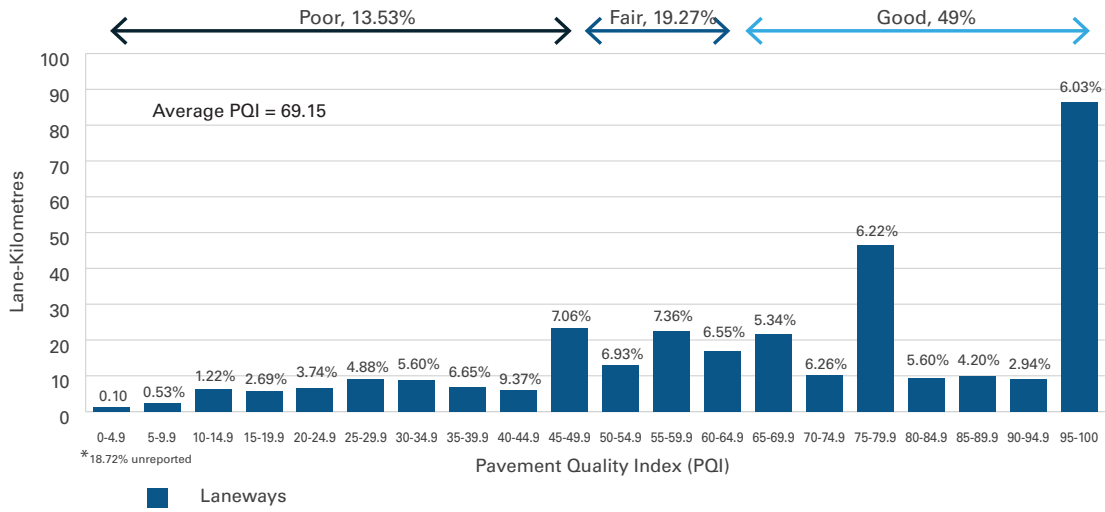
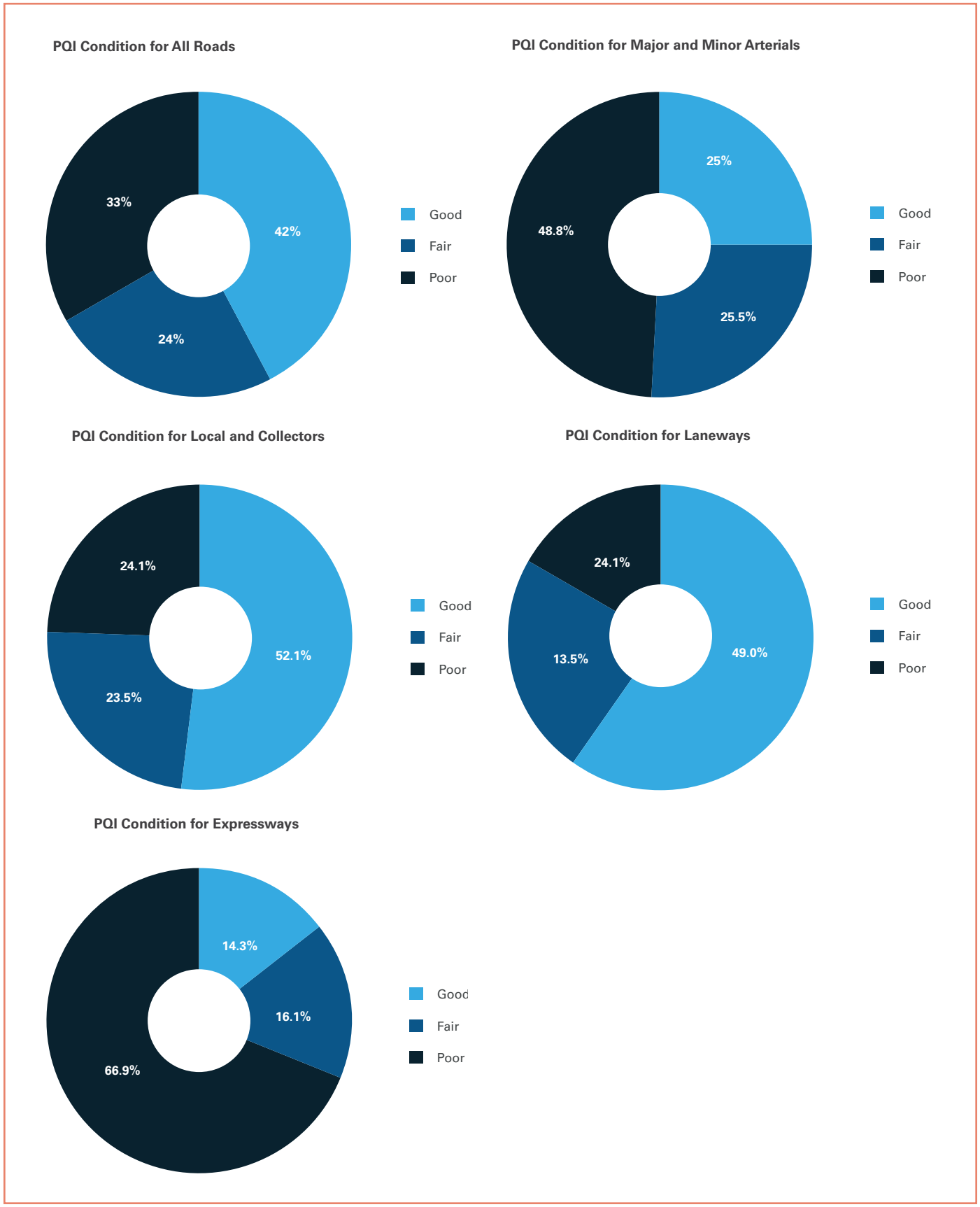
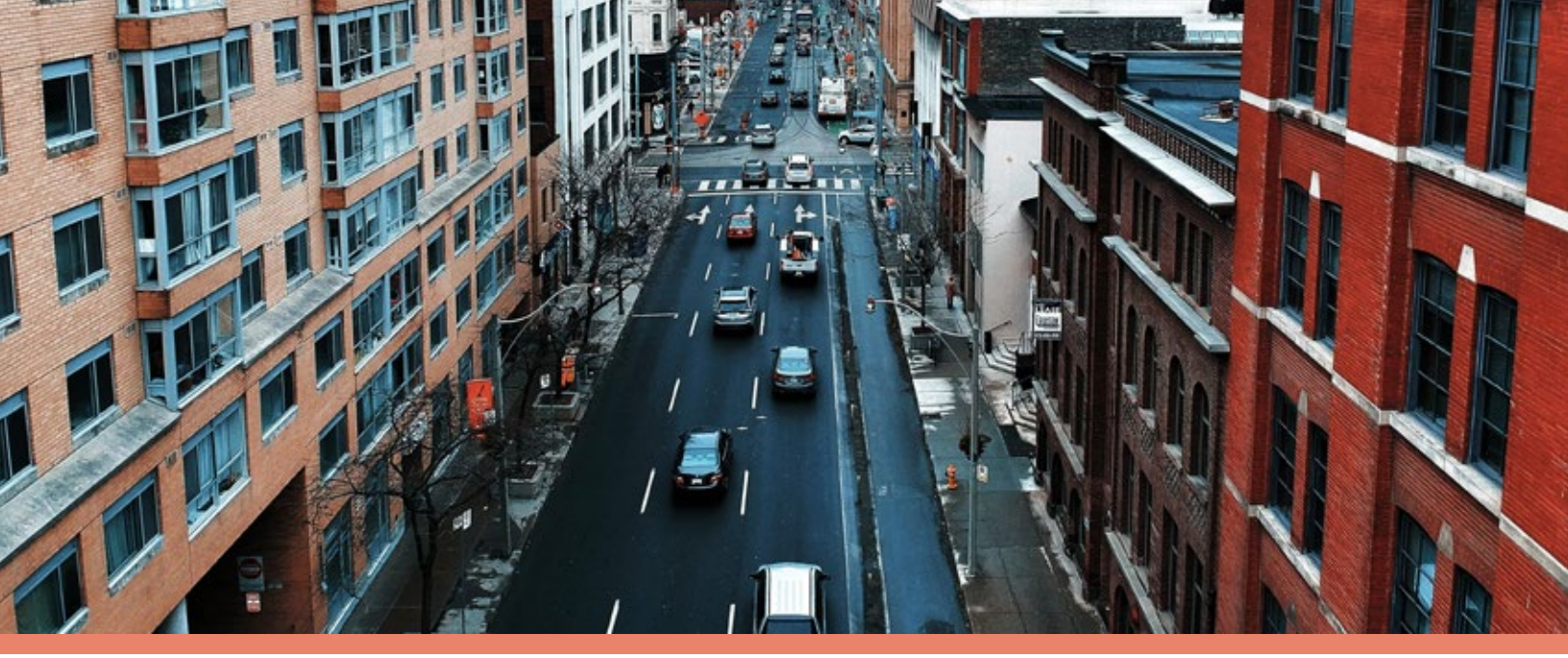


Figure 1.6-3: Summarized PQI Conditions for Roads





Repairing potholes is a significant maintenance activity. Throughout the life of a road, and also applicable to road bridges (see **Table 1.2-3**), ongoing wear and deterioration occurs that may result in the formation of potholes. When water penetrates the top layer of an asphalt surface through cracks and other deficiencies (e.g., curb-pavement edge, temporary utility cut repairs, etc.) in the road it can lead to the formation of potholes through various means after the moisture freezes and expands and/or when the weight of vehicles going over the road breaks the pavement and the asphalt is forced out.

City Council has approved service levels for pothole maintenance work. The approved and actual service levels are identified in **Table 1.6-3** and the total number of potholes filled annually are shown in **Table 1.6-4**. Regular updates are reported on the City's Potholes website.

These values provide insights on trends in the road performance noting that the number of potholes can vary as they are affected by weather with their frequency increasing in the spring, after the freeze/thaw action following winter.

Table 1.6-3: Approved and Actual Service Levels for Pothole Repairs

Service (Attribute)	Measure	2018 Actual	2019 Actual	2020 Target	2020 Projection	2021 Target	2022 Target	Status
Service Level Measures								
"Road & Sidewalk Management (Reliable, Resilient)"	% of roadway potholes made safe within 4 days of receiving a service request	94%	87%	90%	89%	90%	90%	●
"Road & Sidewalk Management (Reliable, Resilient)"	% of arterials de-iced within 2-4 hours and collectors de-iced within 4-6 hours after becoming aware roadway is icy	100%	100%	100%	100%	100%	100%	●

Table 1.6-4: Pothole Repair 5-Year Summary, 2016-2020

Year	Number of Potholes Filled
2020	188,653
2019	197,549
2018	244,425
2017	214,177
2016	185,116

1.6.3. Community Levels of Service for Bridges

To assess bridge condition, a rating system is used where a number from 0 to 100 is assigned to the BCI, with zero correlating to the worst condition. The triggers to select BCI ranges is defined in three levels of service including good, fair and poor as defined in **Table 1.6-5** with photographic examples of each category provided in **Figure 1.6-4**

Table 1.6-5: BCI Condition Ranges

BCI	Condition State	General timelines to address needs
70 or greater	Good	Usually not required in next 5 years
60 to 70	Fair	May be required within 5 years
Below 60	Poor	Likely required within 1-2 years

Figure 1.6-4: Photographic Images of Bridge and Structural Culvert Conditions

Example of a bridge in Good Condition – ID 250 Leslie under Old Leslie Hospital Ramp

Example of a bridge in fair condition – ID 336 Steels Ave over Rouge River

Example of a bridge in Poor Condition – ID 758 Don River Blvd over Don River

Example of a Culvert in Good Condition – ID 284 Lawrence Ave over Wilket Creek

Example of a Culvert in Fair Condition – ID 091 Jane St over Black Creek

Example of a Culvert in Poor Condition – ID 267 Albion Rd over Albion Creek

1.6.4. Technical Levels of Service for Bridges

Table 1.6-6 provides the BCI conditions along with the proportion of bridges and structural culverts falling in the good, fair and poor categories and **Figures 1.6-5** and **1.6-6** illustrate the proportion of and distribution of bridges and structural culverts, respectively, by poor, fair and good condition as defined in **Table 1.6-5**. **Figure 1.6-7** summarizes the conditions in pie charts.

Table 1.6-6 Bridge and Structural Culvert Conditions

Bridge Grouping	Bridge Condition Index, BCI			
	Average	Good (# / %)	Fair (# / %)	Poor (# / %)
Bridges (421 total)	74.1	361 / 86%	59 / 14%	1 / <1%
Elevated Expressway (FG Gardiner. 323)	72.2	234 / 72.4%	89 / 27.6%	0 / 0%
Bridge Total/Average	73.3	595 / 80.0%	148 / 19.9%	1 / 0.1%
Structural Culvert (135)	73.5	106 / 78.5%	21 / 15.6%	8 / 5.9%
Overall	73.3	701 / 79.8%	169 / 19.2%	9 / 1.0%

Figure 1.6-5: Distribution of Bridges Condition

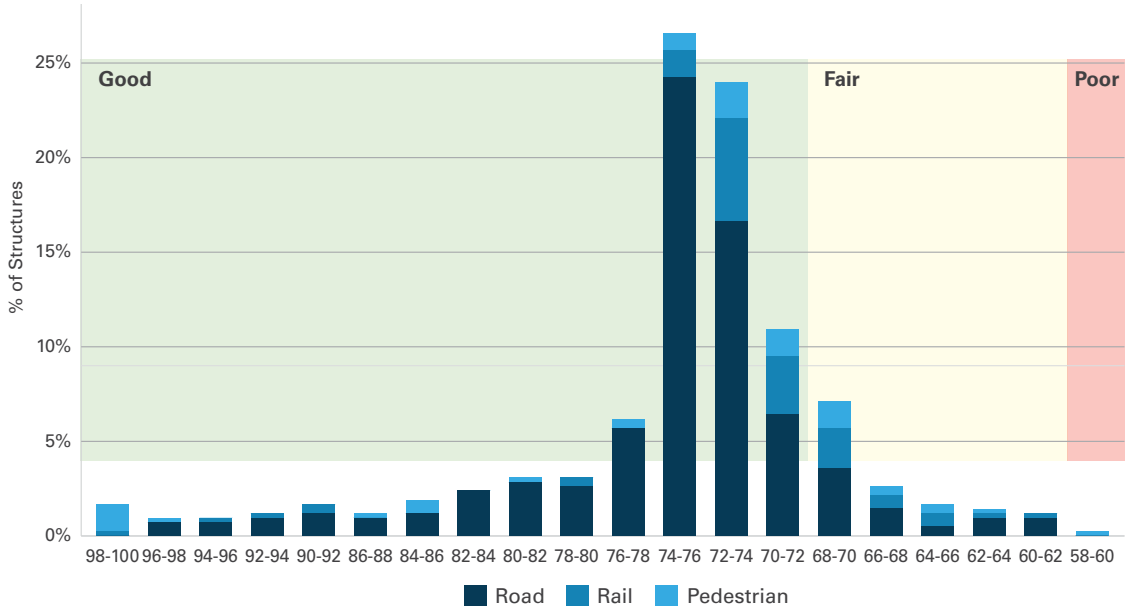


Figure 1.6-6: Distribution of Structural Culvert Condition

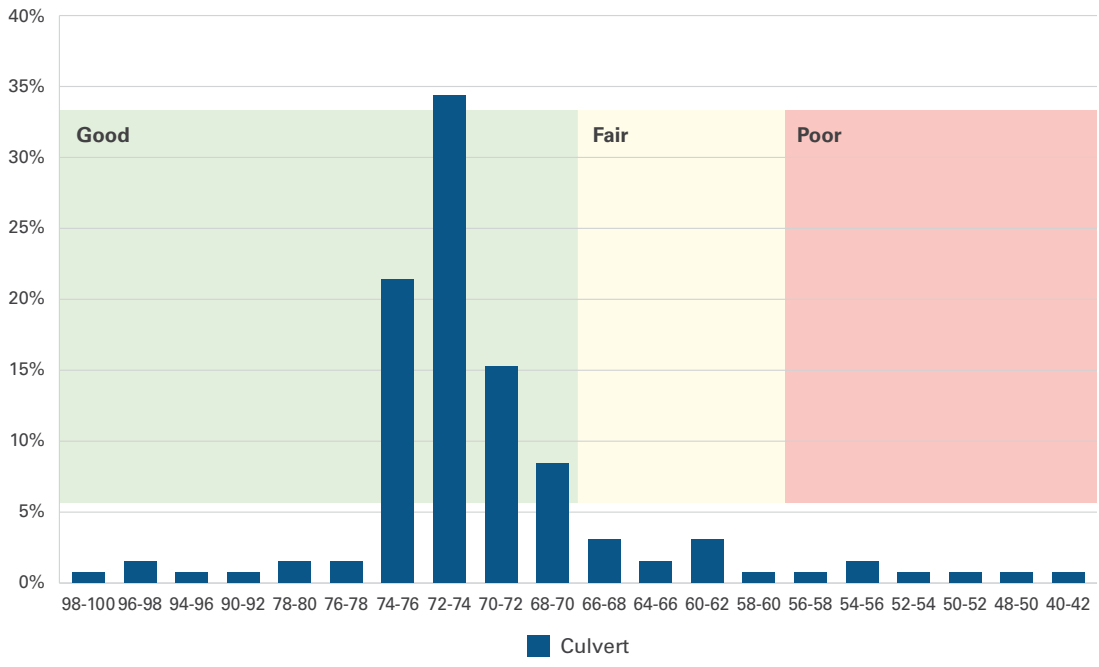
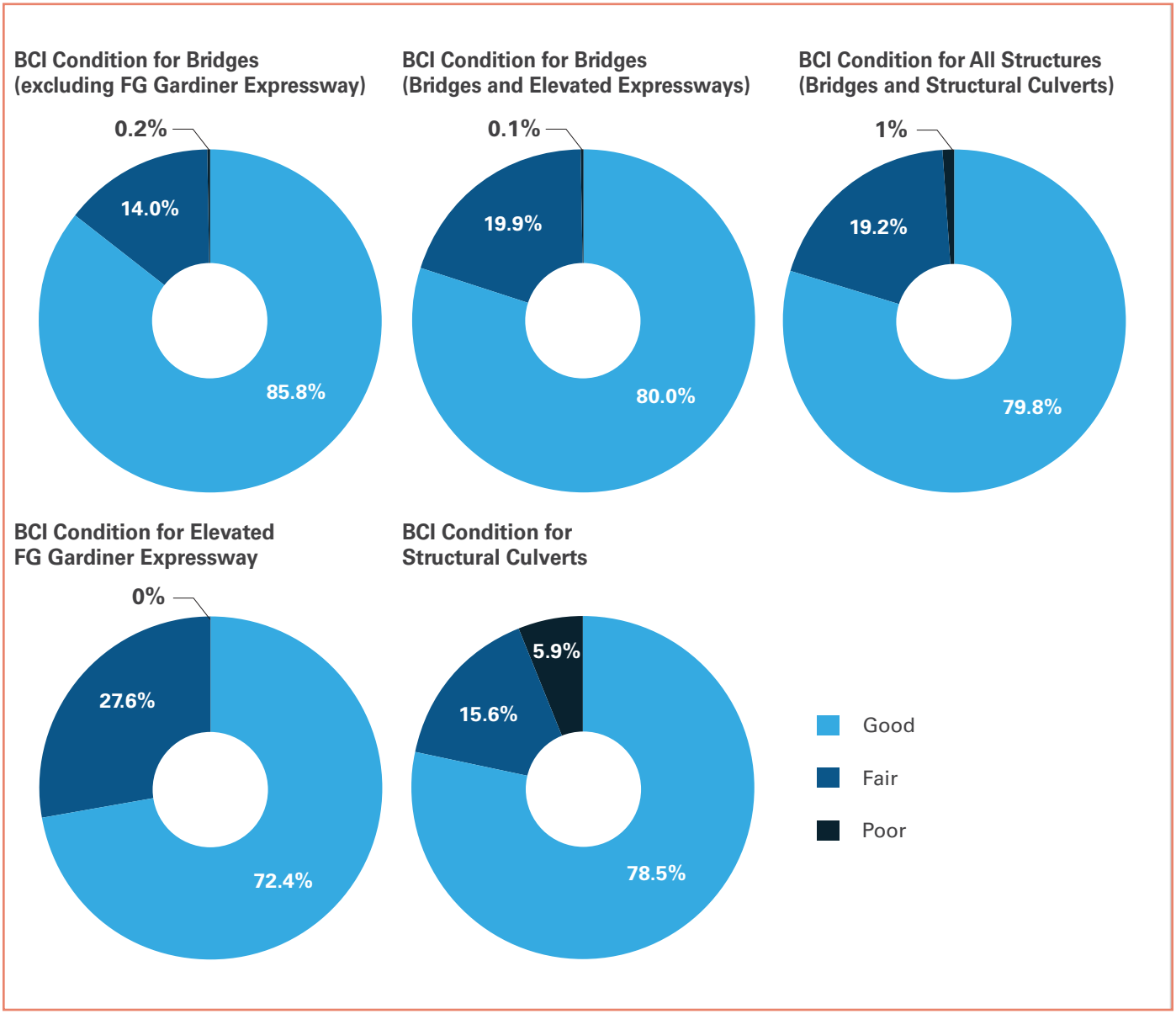
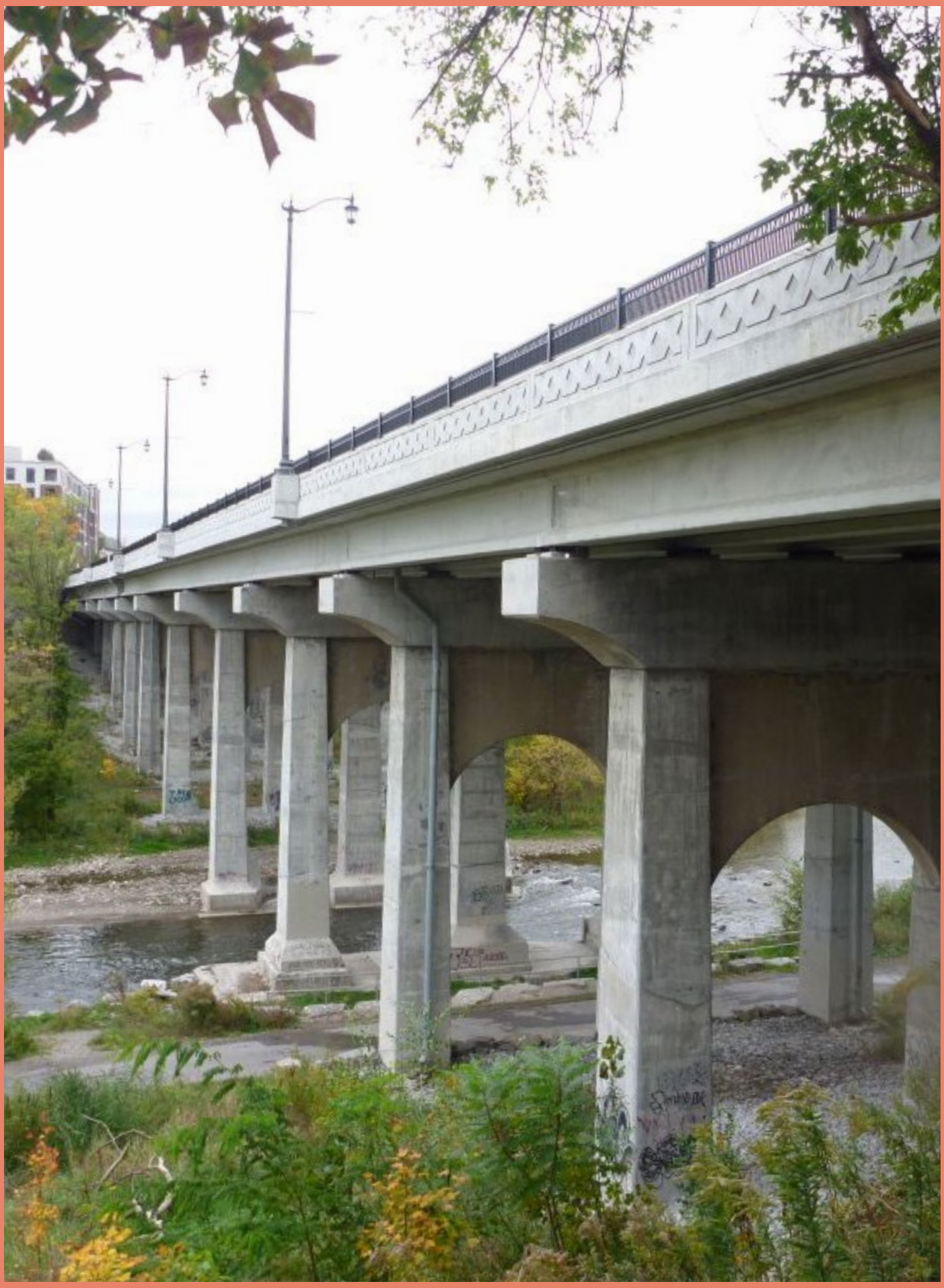


Figure 1.6-7: Summarized Conditions for Bridges and Structural Culverts



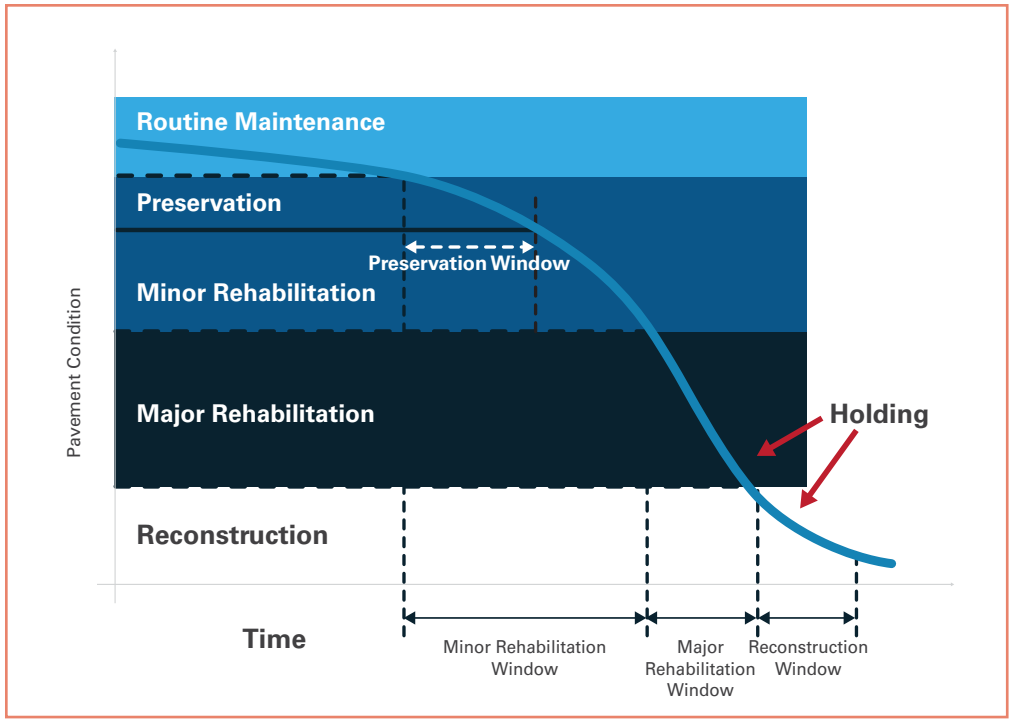


1.7.

LIFECYCLE ACTIVITIES

The key to long term, cost effective asset performance is to apply appropriate maintenance and rehabilitation activities at the right time throughout the service life of the asset as illustrated in Figure 1.7-1. The benefits of timely maintenance and rehabilitation are important to ensure both cost efficiency and adequate serviceability. That means performing the right fix, at the right time.

Figure 1.7-1: Typical Pavement Performance Curve



1.7.1. Road Lifecycle Activities

Lifecycle strategies for roads vary and are affected by many factors including road classification, pavement structure type, traffic volume and distribution, construction materials, practices and workmanship, and, the ability of the owner to perform maintenance and rehabilitation as needs emerge. Performance can also be impacted by utility work and private development activities. Generally, experience indicates that properly maintained and rehabilitated City pavements will provide about 75 to 100 years of service when maintenance and repair work is performed as required.

Throughout the life of a road, ongoing wear and deterioration occurs. Road maintenance and rehabilitation activities include work such as pothole repair, drainage maintenance, crack filling, surface sealing, patching, resurfacing and reconstruction to maintain a State of Good Repair that is safe, and enables the road to continue to operate in its intended use and function. **Table 1.7-1** provides details of various maintenance and rehabilitation activities employed by the City with **Figures 1.7-2** and **1.7-3** illustrating typical lifecycle curves and rehabilitation activities for major and local roads, respectively.

While maintenance work may be viewed as more reactive (e.g., pothole filling, utility cut repairs, etc.) there are also preventative maintenance activities (e.g., sealing pavement cracks, targeted patch repairs, ditch cleanout, adjusting catch basin frames, etc.). Performing both types of maintenance are critical to preserving and achieving or even extending the service life of the pavement structure.

Table 1.7-1: Typical Road Maintenance and Rehabilitation Activities

Activity Category	Activity Name	Activity Description	Estimated Service Life
Construction	Reconstruction	Rebuild entire pavement structure, improve drainage	70–100 years to next reconstruction, 25–30 years to major rehabilitation
Construction	Partial Pavement Reconstruction	Rebuild flexible/rigid pavement layers	20–30 years
Rehabilitation	Cold Recycling (Flexible Pavements)	Recycle in-place asphalt layers (full depth)	20–30 years
Rehabilitation	Resurfacing	Replace 2 lifts asphalt and base repairs	20–30 years
Rehabilitation	'Mill and Pave' (2 lifts)	Replace 2 lifts of asphalt	18–25 years
Rehabilitation	'Mill and Pave' (1 lift)	Replace 1 lift of asphalt	15–25 years, 10–15 years
Rehabilitation	Hot-In-Place Recycling	Recycle in-place surface course (50mm)	10–15 years
Rehabilitation	Overlay (1 lift)	Place asphalt over existing surface	10–15 years
Maintenance	Emulsion Seal (eg., slurry seal, chip seal, microsurfacing, etc.)	Seal oxidized asphalt surface with mixture of aggregate and emulsion	5–7 years
Maintenance	Crack Seal	Fill cracks insurface with rubberized sealant	5–10 years
Maintenance	Fill Potholes	Fill potholes with hot or cold mix asphalt	< 24 hours–5 years
Maintenance	Selective Patch = 'Mill and Pave'	Replace 1 lift of asphalt	3–8 years

Note: the Estimated Service Life is base on City of Toronto experience and varies with Road Classification, pavement structure and traffic.

Beside the road maintenance works, the City's Capital Program has two main categories of rehabilitation work:

- Resurfacing: the replacement of old asphalt surface with new asphalt surface, including repairs of any damaged sidewalks and curbs.
- Reconstruction: the replacement of the partial or entire road pavement structure, including the asphalt and underlying support materials, and the repair, improvement, or replacement of road drainage, curbs, boulevards and sidewalks.

Figure 1.7-2: Typical Major Road Lifecycle Curve and Activities

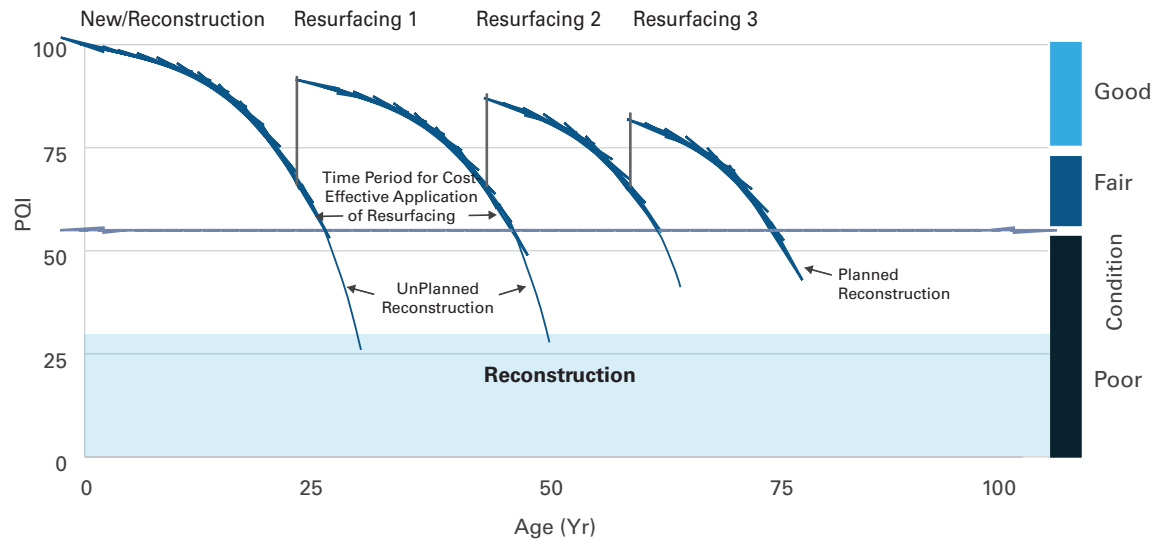
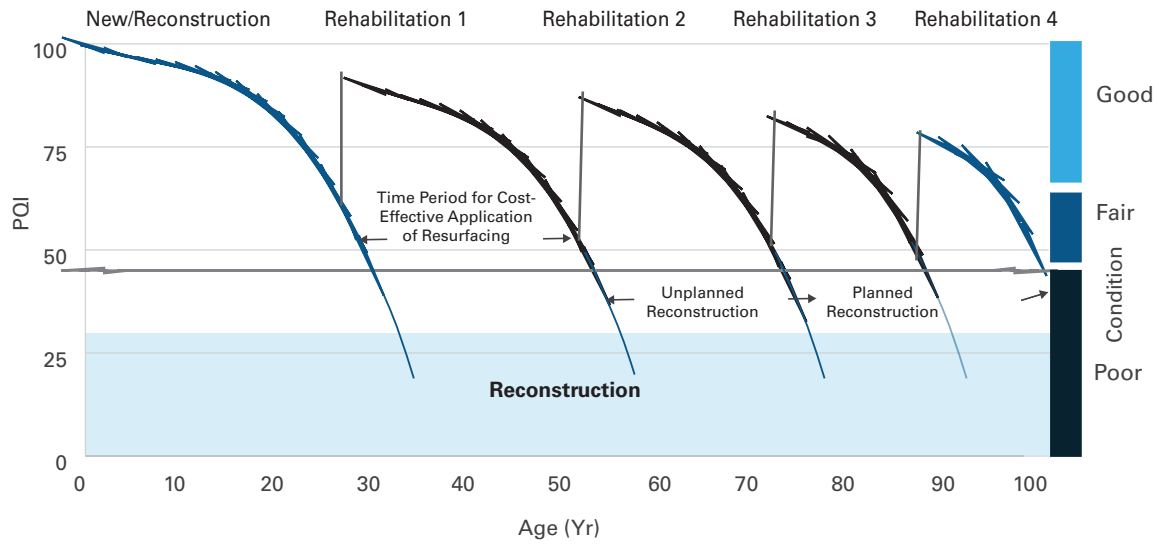


Figure 1.7-3: Typical Local Road Lifecycle Curve and Activities



The actual type of maintenance and rehabilitation work undertaken is dependent on the extent and severity of pavement defects combined with the cost effectiveness of the required repairs. Cost effectiveness can affect the timing of the work. For example, there are roads in poor condition that may require reconstruction at a future date while, in the interim, they will continue to deteriorate and be maintained through reactive activities such as critical interim repairs, localized pothole filling and patching.

As the City and associated infrastructure ages, the need for maintenance, repairs, servicing, upgrades and replacement of utilities continues to grow. The timing and frequency of these various events fluctuates significantly. Consequently, pavements are disturbed at all times of the year and sometimes different utilities may need access to their infrastructure over short-term periods–less than 5 years–resulting in pavements that have been cut into and repaired many times. Cuts made during winter months can exacerbate pavement damage because of infiltration of moisture and the resulting freeze/thaw action.

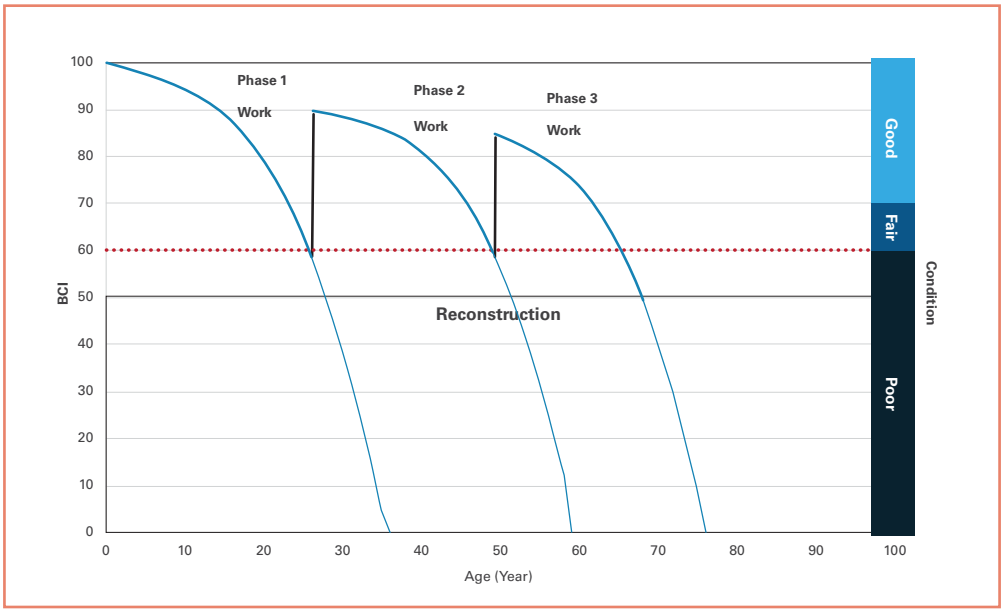
1.7.2. Bridges Lifecycle Activities

The level of service for bridges and culverts require the structures to be maintained in a state of good repair that is safe, and continues to operate in its intended use and function. The City deploys a phased rehabilitation approach to maintain the intended level of service. The method by which each phase of rehabilitation of bridge and culvert assets follows that prescribed in the Ministry of Transportation's "Structural Rehabilitation Manual". It is generally anticipated that a bridge structure will encounter several rehabilitations before requiring replacement. The focus of most rehabilitations and the major associated costs pertain to the maintenance of the deck structure. The scheduling of each phase of rehabilitation generally follows the timing and methodology, with the percentages of the inventory in each phase as defined in **Table 1.7-2** and would follow the life-cycle curve as illustrated in **Figure 1.7-4**.

Table 1.7-2: Typical Bridge Rehabilitation Activities and Distribution

			Bridges		Elevated FG Gardiner		Culverts	
Age of Structure	**Scope of Work**	**Cost Compared to Renewal**	**No. total**	**% of**	**No. total**	**% of**	**No. total**	**% of**
15-30 years	Phase 1 - Patching of concrete components, replacement of deck waterproofing and repaving of asphalt. Substructure work as required	Low	129	38.7%	38	11.8%	10	7.4%
20-55	Phase 2 - Application of concrete overlay to the existing deck, replacement of the waterproofing system, and repaving of the deck. Substructure work as required	Moderate	83	24.9%	0	0.0%	34	25.2%
50+	Phase 3 - Deck replacement. Substructure work as required	Equal	121	36.3%	285	88.2%	91	67.4%

Figure 1.7-4: Typical Bridge Lifecycle Curve and Activities

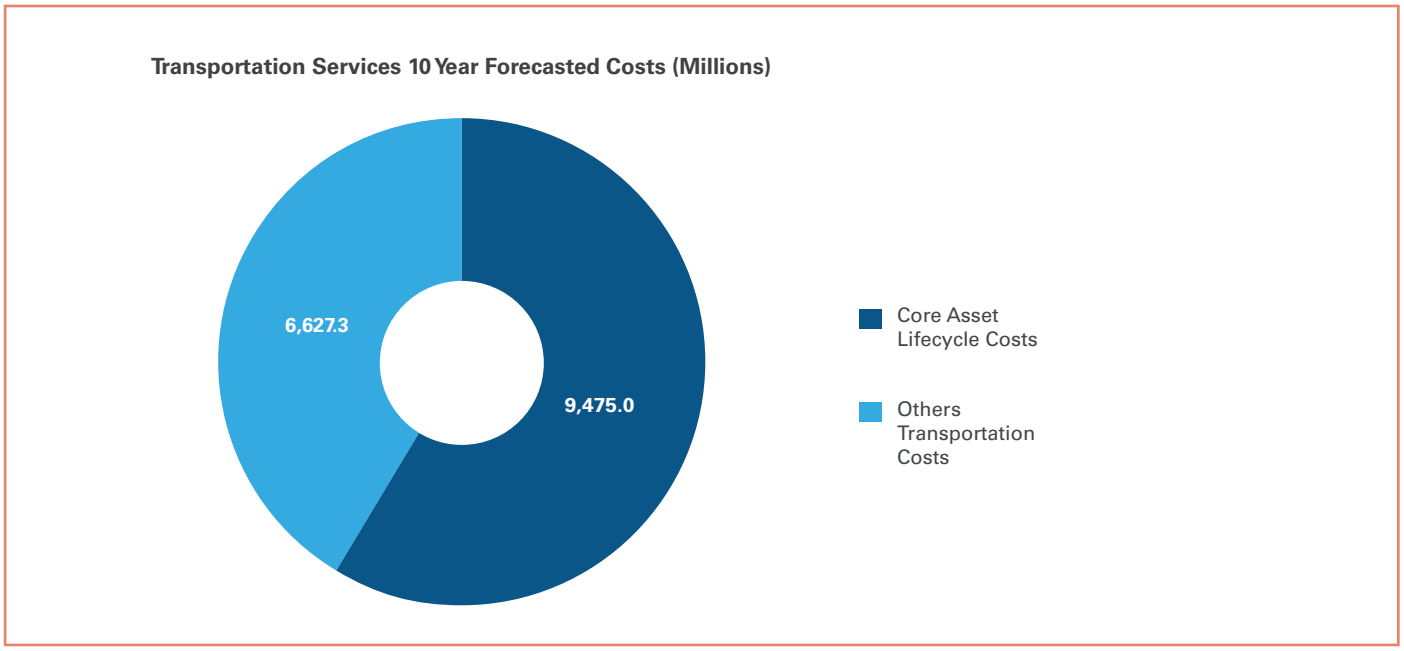


1.8.

LIFECYCLE COSTS & RISKS

The lifecycle activities described in the section titled Lifecycle Activities seek to maintain the City's roads, bridges and culverts in a state-of-good repair (SOGR). These lifecycle activities have costs that are distributed between the TSD Capital and Operating budgets as documented in the City's 2021 Budget. The chart shown in Figure 1.8-1 below illustrates the forecasted share of core asset lifecycle costs overall as part of the entire budget as presented in the City's 10-Year (2021 to 2030) Tax-Supported Capital Budget.

Figure1.8-1: 2021-2030 Year Capital Budget Core Asset Amount of Total



The capital costs to maintain existing core assets over the next 10 years is expected to be over 50% of the budgeted capital costs for Transportation Services at nearly $9.5 billion. Overall, SOGR for both core and non-core assets is about 75% of all capital costs, with 34% ($3.9 billion) being funded and 41% ($4.7 billion) being unfunded costs as shown in **Figure 1.8-2**. From an Operating perspective, 18% ($79.0 million of $441.7 million) of the 2021 budget is attributed towards repair and maintenance, as shown in **Figure 1.8-3**, which over a 10 year forecast would total about $865.0 million.

Figure 1.8-2: 2021-2030 Capital Budget Needs for Core and Non-Core Assets

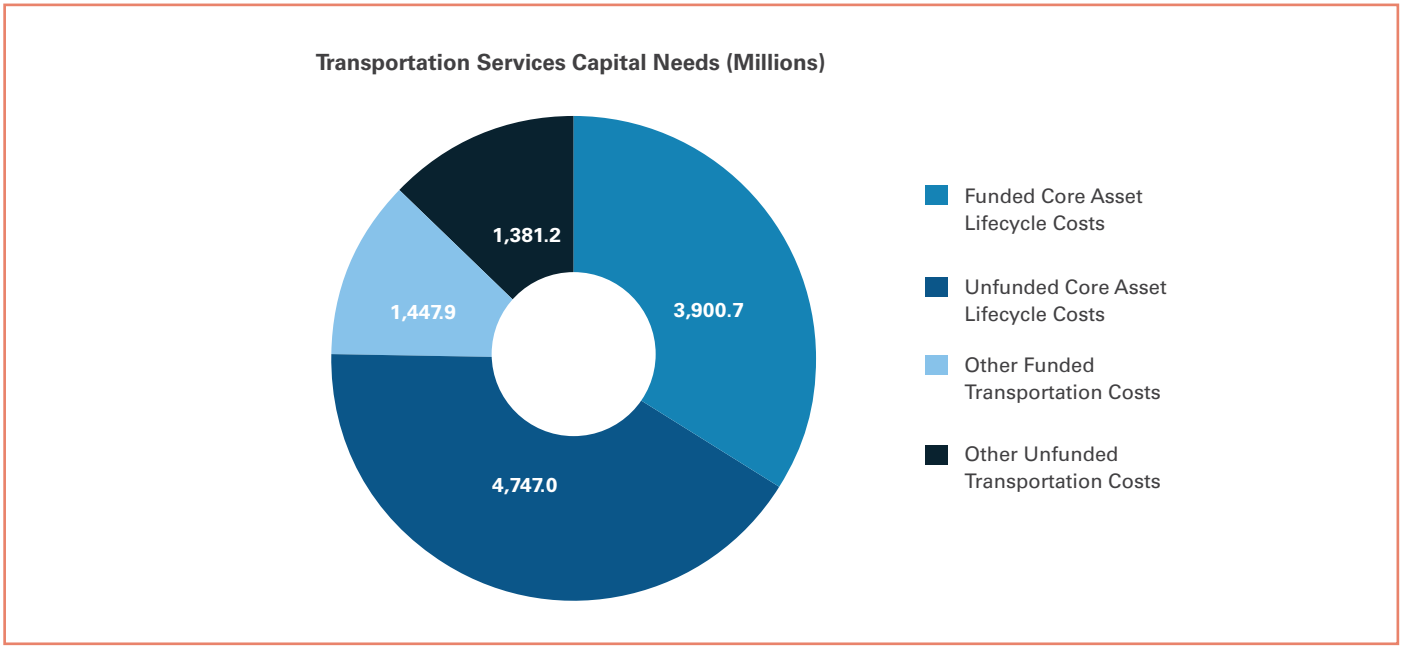
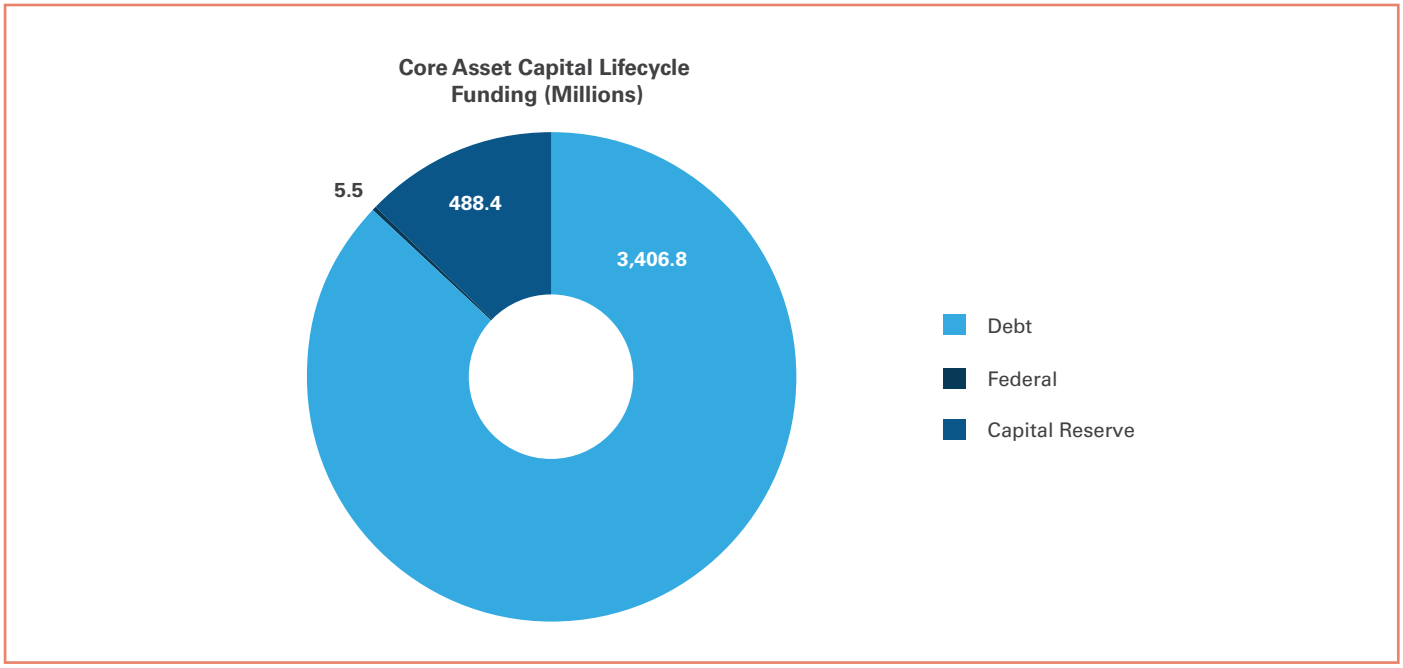


Figure 1.8-3: 2021 Operating Budget Core Asset Amount of Total



Despite using a variety of funding sources to address these costs, the City has been unable to undertake all the activities necessary to maintain TSD roads, bridges and culverts in a state of good repair, and as a result there is a growing backlog of repair work, much of which is unfunded. This section of the report outlines the lifecycle costs, funding details, and risks associated with these assets.

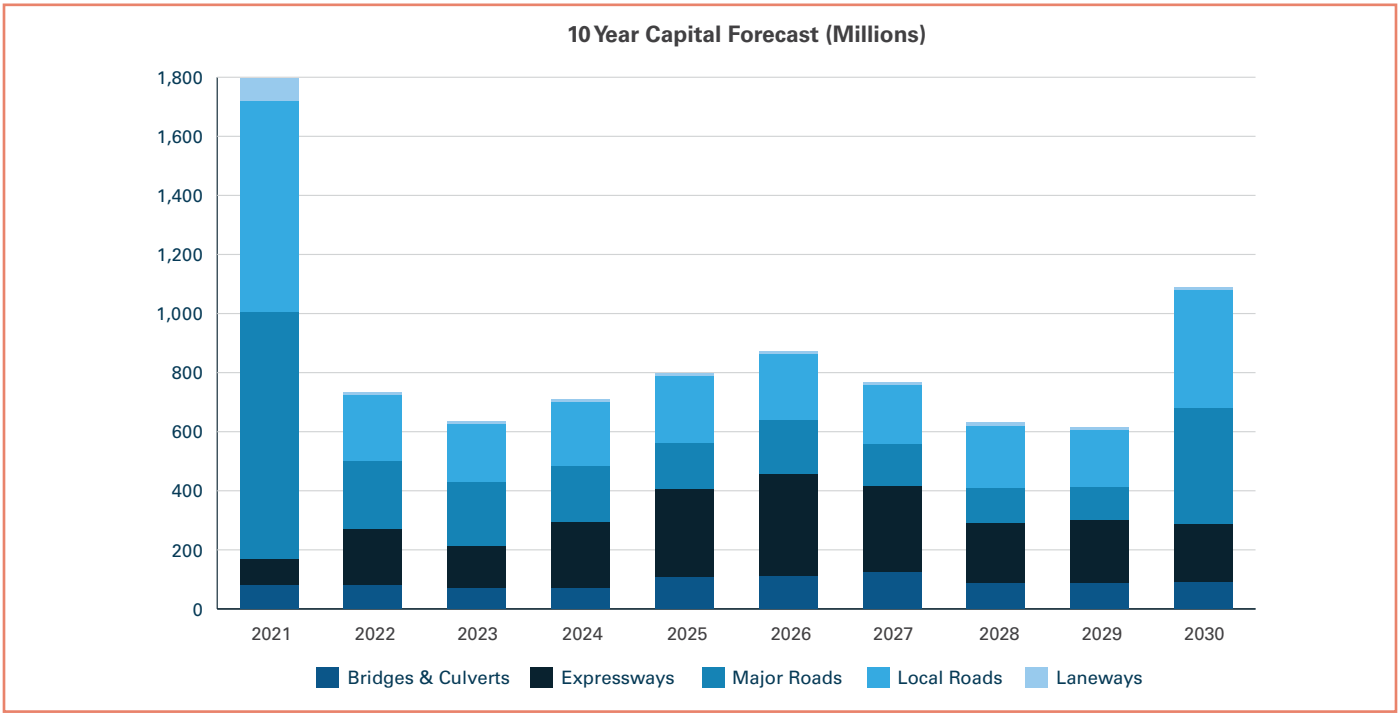
1.8.1. Expenditure Forecast

The expenditure forecast is based on the 2021 Approved Operating Budget and 2021-2030 Approved Capital Budget and Plan for Transportation Service. Further details can be found in the 2021 Program Summary for Transportation Services as provided below:
toronto.ca/wp-content/uploads/2021/04/9031-TP-2021-Public-Book.pdf

1.8.1.1. Capital Costs

The 10-year forecasted capital costs needed to maintain current service levels totals $8.648 billion and it is detailed by asset category in the **Figure 1.8-4** below.

Figure 1.8-4: 2021-2030 Capital Budget Needs for Core Assets



Bridge rehabilitation costs represent approximately 10% ($0.9 billion) of core asset capital SOGR costs.

A significant number of bridge and culvert structures, which were built in the 1960's and 1970's are now coming due for rehabilitation as they move to Phase 2. As a result, bridge rehabilitation costs are expected to increase from $80 million in 2021, to $124 million in 2027. All costs until 2024 are fully funded in the 10 Year Capital Plan. Costs beyond 2024 are partially funded and require further funding strategies to address all rehabilitation needs. The unfunded bridge related capital costs contribute to the growing state of good repair backlog.

Road rehabilitation costs (including laneways) represent 65% ($5.6 billion) of forecasted core asset capital costs for Transportation Services. Projects that are identified for resurfacing work that cannot be completed in a timely manner will deteriorate to a point where reconstruction is required and this ultimately costs the City more as the full benefit (optimization) of the asset service life is not achieved. Despite best efforts to address rehabilitation in a timely manner, funding and project delivery constraints have resulted in a backlog of local and major road rehabilitation work in 2021 which can be observed in **Figure 1.8-1** as an accumulated need in the first year (2021) of the 10 Year Capital Forecast.

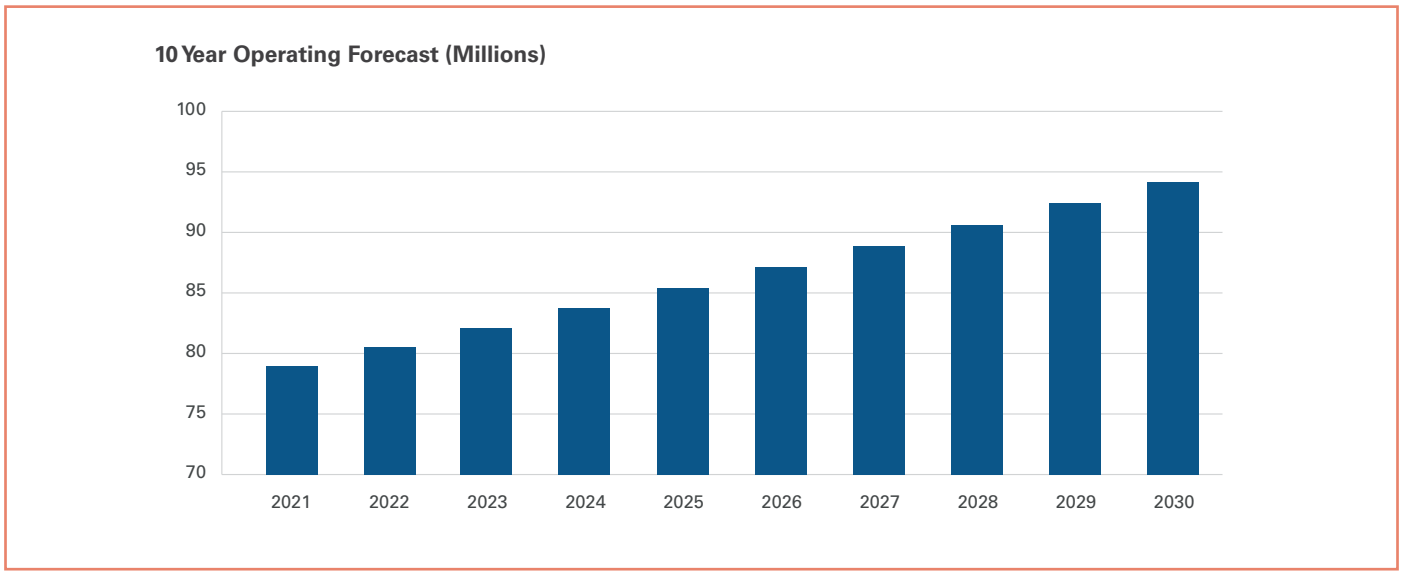
Rehabilitation of expressways represent the remainder 25% ($2.2 billion) of forecasted core asset capital SOGR costs for Transportation Services. The City manages three expressways: the F. G. Gardiner Expressway, the Don Valley Parkway, and the Allen Road Expressway. Of these, the Gardiner Expressway is the oldest (built in the 1950s) and requires significant rehabilitation. In 2017 the City approved the Strategic Rehabilitation Plan of the Gardiner to address the significant state of good repair backlog and safety concerns around expressway. The Plan's Phase 1 costs are approximately $2.3 billion and are fully funded, while the second Phase, which is estimated to start in 2026, is currently unfunded.

1.8.1.2. Operating Costs

Operating costs result from stop gap measures such as increased maintenance (e.g. pothole filling) and interim repairs (i.e., machine patching) that are needed in the interim period in order to ensure the safety of road and bridge users. Additionally, these costs are a strategic investment as routine reactive and preventative maintenance activities prolong the service life of the assets and thereby extend the periods between when more costly rehabilitation work is required.

The costs associated with the interim repair and maintenance repairs will vary depending on factors such as type of the road, traffic type and volume, and extent and type of pavement deterioration. These costs amounted to roughly $79 million in the 2021 Operating Budget. This would amount to over $800 million over a 10 year period, assuming 2% annual inflation, as shown in **Figure 1.8-5**.

Figure 1.8-5: 2021-2030 Operating Budget Funding Forecast for Core Assets



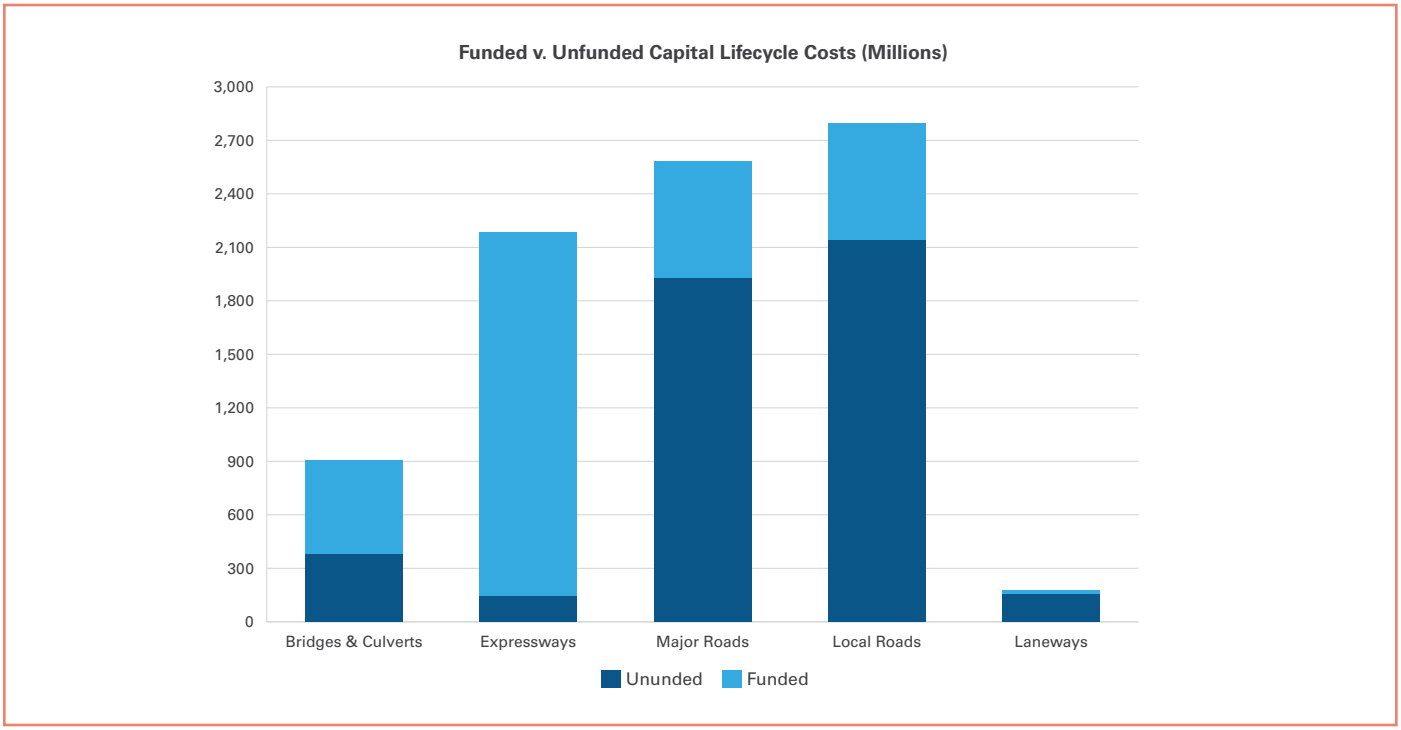
Although road and bridge maintenance costs are substantial, they represent less than 20% of the overall Operating Budget as the Program provides a variety of services such as winter maintenance, automated speed enforcement, school crossing guard program, etc.

1.8.2. Funding Lifecycle Costs

1.8.2.1. Capital Funding and SOGR Backlog

The capital costs identified in section 1.8.1.1 are not fully funded in the 2021-2030 Capital Plan. **Figure 1.8-6** illustrates the split of funded and unfunded costs for each asset type.

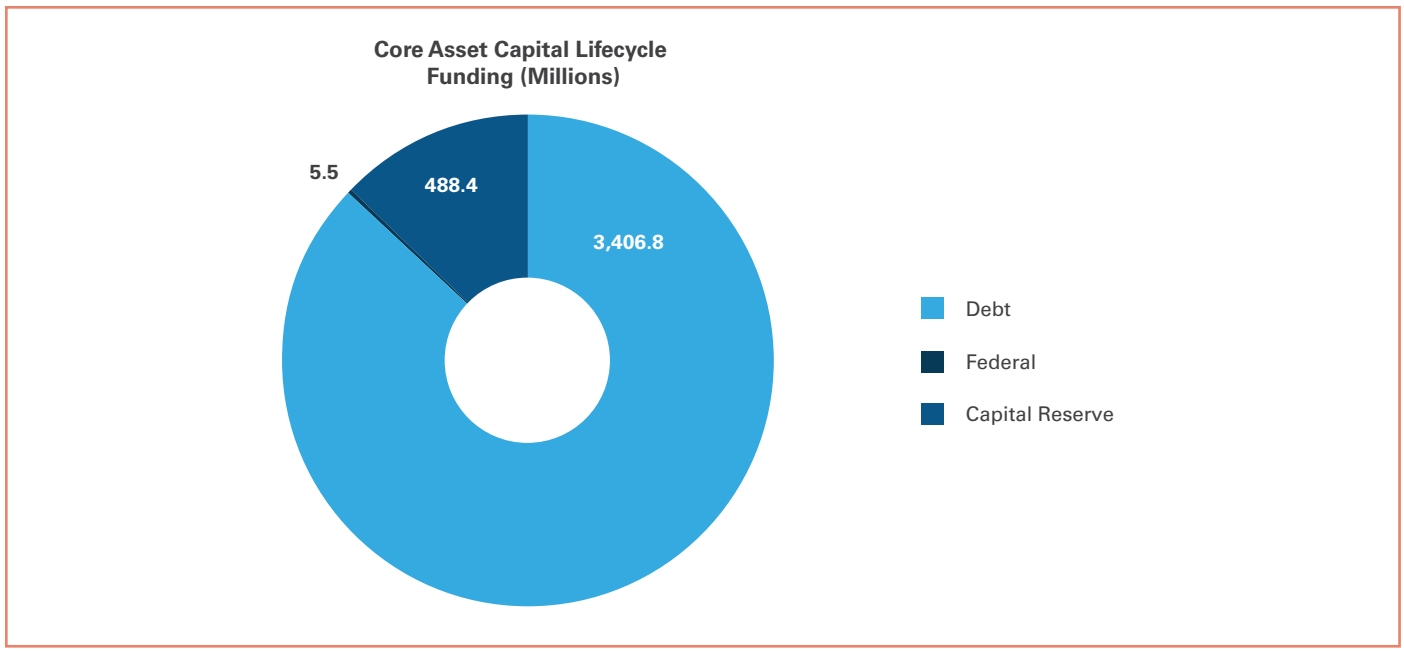
Figure 1.8-6: 2021-2030 SOGR Capital Funding Split by Asset Type



Of the $8.648 billion capital SOGR costs, $3.901 billion is funded in the 2021-2030 Capital Plan from three planned sources of funding; debt, reserves, and federal funding as illustrated in **Figure 1.8-7** and described as follows:

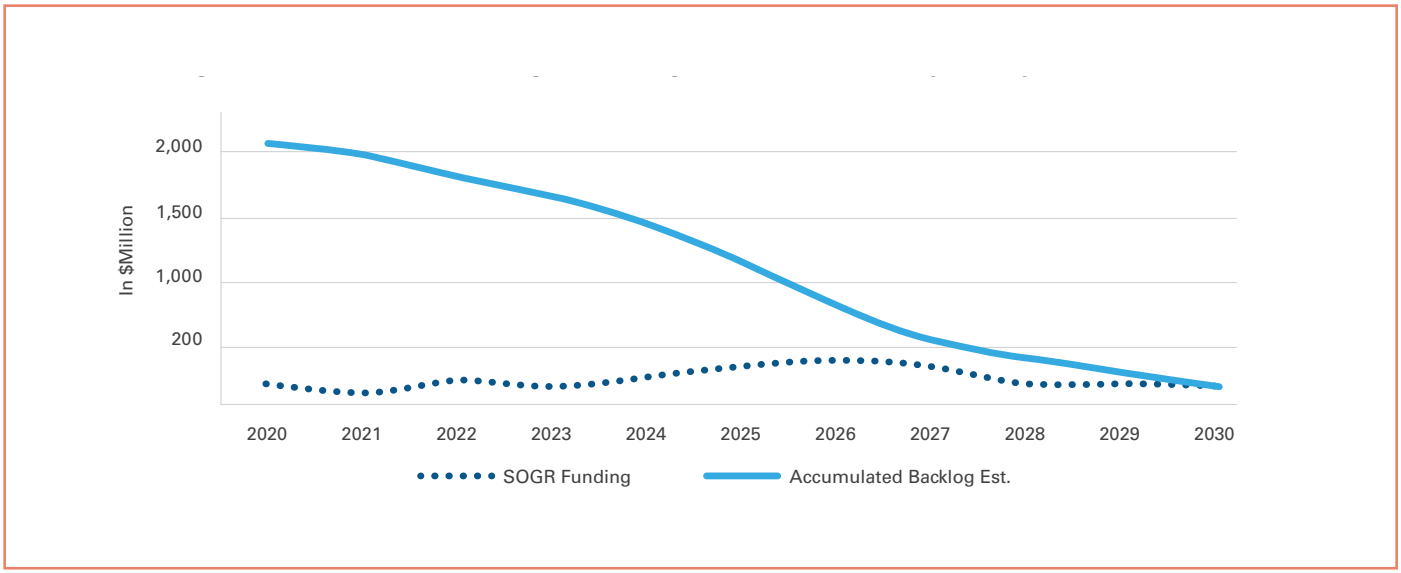
- Debt represents the largest share of funding (87% or $3.407 billion) with Laneways and Local Road Rehabilitation being fully funded from debt.
- The Bridge Rehabilitation Program is 99% funded from debt, but also receives $5.5 million in federal funding through the Disaster Mitigation and Adaptation Fund (DMAF) Program.
- The City has made strategic investments through the Capital Financing Reserve to fund Major Road Rehabilitation work ($180 million) and the FG Gardiner Rehabilitation project ($308 million) to maintain these assets.

Figure 1.8-7: 2021-2030 SOGR Capital Sources of Funds for Funded Work



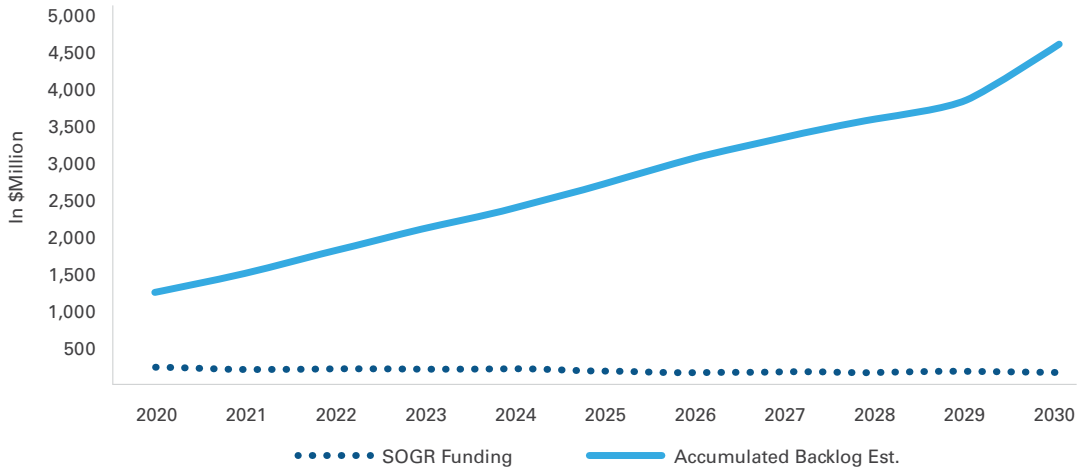
Despite these investments, there is a significant amount of state of good repair work that is unfunded, with the exception of expressways. As previously noted, in 2017 the City approved the Strategic Rehabilitation Plan of the FG Gardiner Expressway to address the significant state of good repair backlog with the first phase being fully funded. **Figure 1.8-8** demonstrates how the state of good repair backlog will decrease over the next 10 years with investments being made in the FG Gardiner Expressway.

Figure 1.8-8: 2021-2030 SOGR Funding and Backlog for the FG Gardiner Expressway



With the exception of Expressways, all other asset categories will see their SOGR backlog increase. To illustrate, **Figure 1.8-9** removes expressway data and depicts the SOGR funding and accumulated backlog estimates for major and local road rehabilitation, bridge rehabilitation and laneways.

Figure 1.8-9: 2021-2030 SOGR Funding and Backlog excluding the FG Gardiner Expressway



Based on current proposed ten year capital funding in the 2021 budget, the percentage of major roads in poor condition is expected to increase from 43 per cent to 54 per cent by 2030 while the percentage of local roads in poor condition is expected to increase from 24 per cent to 47 per cent by 2030.

The backlog of rehabilitation needs for both programs are expected to increase over the next 10 years as follows:

- The backlog for major roads will increase from $774.7 million at the end of 2021 to $1.9 billion by 2030; and,
- The backlog for local roads will increase from $634.6 million at the end of 2021 to $2.1 billion by 2030.

The backlog for laneways and bridges also increases:

- The backlog for laneways will increase from $77.8 million at the end of 2021 to $156.6 million by 2030
- The backlog for bridges will increase from $71.9 million at the end of 2025 to $353.8 million by 2030.

Table 1.8-1 provides the 10 year SOGR funding and accumulated backlog estimates for major and local road rehabilitation, bridge rehabilitation and laneways. In order to maintain core assets at the current level of service (i.e., PQI and BCI) no change in the identified 2021 starting backlog value would need to be achieved. There are two ways to achieve this:

1. Fund all incoming rehabilitation needs each year; for example, as shown in **Table 1.8-1** for Local Roads Rehabilitation funding needs of $213.5 million would be required in 2022, $186.6 million in 2023 and so on to maintain the current level of service, noting if the funding was possible there could be other challenges based on resource availability (e.g., staff, consultants, contractors) and coordination with other works across the City; or,

2. Modified strategies where capital and operating activities and funding are undertaken to maintain the level of service noting that with a network as large and complex as Toronto's a significant change in strategy (e.g., a road reconstruction only strategy) could have undesired outcomes and consequences such as missed opportunities to perform cost-effective maintenance and repairs as outlined in the Lifecycle Activities section.

Given the challenges with either of these strategies the City will continue to investigate various lifecycle management strategies and medium and long-term (i.e., beyond ten-years) approaches to determine the most appropriate, efficient and effective ways to address the growing SOGR backlog. This work will form part of future asset management planning activities including determining proposed service levels as documented in the City Asset Management Policy.

Table 1.8-1: 2021-2030 SOGR Funding and Backlog ($ Million)

Major Road Rehabilitation	2021	2022	2023	2024	2025	2026-2030	Total
Approved Funding	58.6	59.8	58.4	59.5	60.7	322.3	**619.4**
SOGR Backlog	774.7	169.6	154.6	129.1	92.9	606.1	**1,927.0**
Total Need	833.3	229.4	213.0	188.6	153.6	928.5	**2,546.4**
Local Road Rehabilitation							
Approved Funding	70.0	67.2	58.4	59.5	60.7	287.3	**603.2**
SOGR Backlog	634.6	146.2	128.3	146.4	157.0	891.6	**2,104.1**
Total Need	704.6	213.5	186.6	205.9	217.7	1,178.9	**2,707.3**
Bridge Rehabilitation							
Approved Funding	71.8	70.0	70.0	70.0	36.2	189.3	**507.3**
SOGR Backlog	-	-	-	-	71.9	282.0	**353.8**
Total Need	71.8	70.0	70.0	70.0	108.1	471.2	**861.1**
Laneways							
Approved Funding	1.9	1.9	1.9	1.9	2.0	9.6	**19.2**
SOGR Backlog	77.8	8.2	8.4	8.5	8.6	45.1	**156.6**
Total Need	79.7	10.1	10.3	10.4	10.6	54.7	**175.8**
F.G.Gardiner Expressway							
Approved Funding	80.4	181.9	136.0	216.0	293.0	1,095.1	2,002.5
SOGR Backlog	1,922.1	-181.9	-136.0	-216.0	-293.0	-952.4	142.7
Total Need	2,002.5	-	-	-	-	142.7	2,145.2

The increase in backlog reflects the history of when the infrastructure was built, when rehabilitation is required, and the type of rehabilitation required to maintain the assets in a technically desired condition where the Pavement Quality Index (PQI) would typically be in "Good" (i.e., 70-75). This technically desired condition may exceed proposed level of service that the City may ultimately target that will be further defined in future reporting as per O.Reg. 588/17 (i.e., Section 6(1), 1 (i-ii)).

1.8.2.2. Operating Funding

Routine maintenance and repair lifecycle costs that are funded through the operating budget do not have a dedicated revenue tool, such as user fees, to recover their cost. Therefore, all operating lifecycle costs for core transportation assets are funded through the property tax base.

1.8.3. Risks

The road network presents significant risk to the City given the extensive use and reliance by the public each day for the transportation of people and goods through multi-modal means (i.e., walking, cycling, transit, emergency services, freight and personal vehicles). An increasing road rehabilitation backlog can cause several risks including:

- Increased maintenance needs (i.e., increase in potholes);
- Likelihood that missed opportunities to perform minor maintenance and rehabilitation will result in a greater volume of major rehabilitation needs along with higher cost repairs;
- Certainty that more costly interventions are also more disruptive to the public in terms of time required for construction;
- Potential for greater liability as the overall condition of the network worsens coupled with the increasing multi-modal splits (i.e., increase in vulnerable road users); and,
- Situations where state of good repair issues become health and safety issues.

- Missed opportunities to align with and negative impacts on other City and Divisional priorities such as the Vision Zero Safety Plan, Cycling Plan and Resilience Strategy

To mitigate these risks several current strategies are in place as follows:

- Planning of work and resources to accomplish more projects faster to address needs, including:
  - ◊ Consideration of, through planning and bundling of work in, City contracts for cost efficiency and to reduce future disruption, including projects:
    - » Within the Division, including road and bridge SOGR with safety (e.g., Vision Zero Safety Plan) and service improvements (e.g., Cycling Plan); and,
    - » Across other City Divisions, Agencies, Boards and Commissions, including Toronto Water, City Planning, TTC, etc.
  - ◊ Delivering works through large "mega" and or multi-year contracts to increase cost efficiency and reduce resource demands (i.e., support staff in PMMD, Legal, etc.);
  - ◊ Third-party project delivery by others where there is shared asset ownership or work that can be bundled with work by others (e.g., CP or CN Railway for road-railway bridge rehabilitation work, Metrolinx on transit improvement projects, Ontario Ministry of Transportation 400 series highway improvement projects, etc.), noting the reciprocal project delivery by the City is also performed; and,
- Recognition of project complexity vs deliverability (i.e., stage gating approach).

Further, the road network is also susceptible to other vulnerabilities and the impact of climate change so adaptation and mitigation actions also include implementing revised standards and specifications for pavement materials and the design methodology so that investment in road and bridge improvements are more resilient.

1.9.

IMPACT AND RESPONSE TO GROWTH

This section is based on the population and employment forecasts for Toronto as set out in Schedule 3 or 7 to the 2017 Growth Plan. With respect to municipalities in the Greater Golden Horseshoe growth plan area.

The projections adhere to the population and employment forecasts presented in Schedule 3 of the Growth Plan for the Greater Golden Horseshoe. Population projections for the City of Toronto are summarized in **Table 1.9-1** below.

Table 1.9-1: City of Toronto Population and Employment Forecasts

Year	Population ('000s)	Employment ('000s)
2031*	3,190	1,660
2041*	3,400	1,720
2051**	3,650	1,980

Reference:
* 2017 Growth Plan for the Greater Golden Horseshoe, May 2017
** A Place to Grow Growth Plan for the Greater Golden Horseshoe Office Consolidation, August 2020 (ontario.ca)

As the City continues to grow, new infrastructure is needed in order to maintain service levels. Most municipalities in Ontario, including Toronto, use Development Charges (DCs) to ensure that the cost of providing infrastructure to service growth is not borne by existing residents and businesses in the form of higher property taxes and utility rates. Development charges (DCs) are fees collected from land developers at the time a building permit is issued. DCs help pay for the cost of new infrastructure to accommodate growth, such as roads, transit, water and sewer infrastructure, community centres and fire and police facilities.

The City of Toronto conducts a review of its Development Charges (DC) bylaw every 5 years as required by the Provincial Development Charges Act (DCA).

- As part of the review process, the City completes a comprehensive development charges background Study that sets out the City's future residential and non-residential growth forecast, identifies the related growth-related infrastructure needs and costs, and establishes the maximum calculated development charges rates that can be imposed under the DC Act.

- Council, after considering the input from public at the community meeting and consultation sessions, as well as the DC Study and proposed bylaw, determines the DC it wishes to establish for residential, industrial, office, institutional and retail development.

- Tax levy, user rate (in case of water and, wastewater and stormwater infrastructure) or other funding will be required to fund any portion of growth-related costs not funded by DCs.

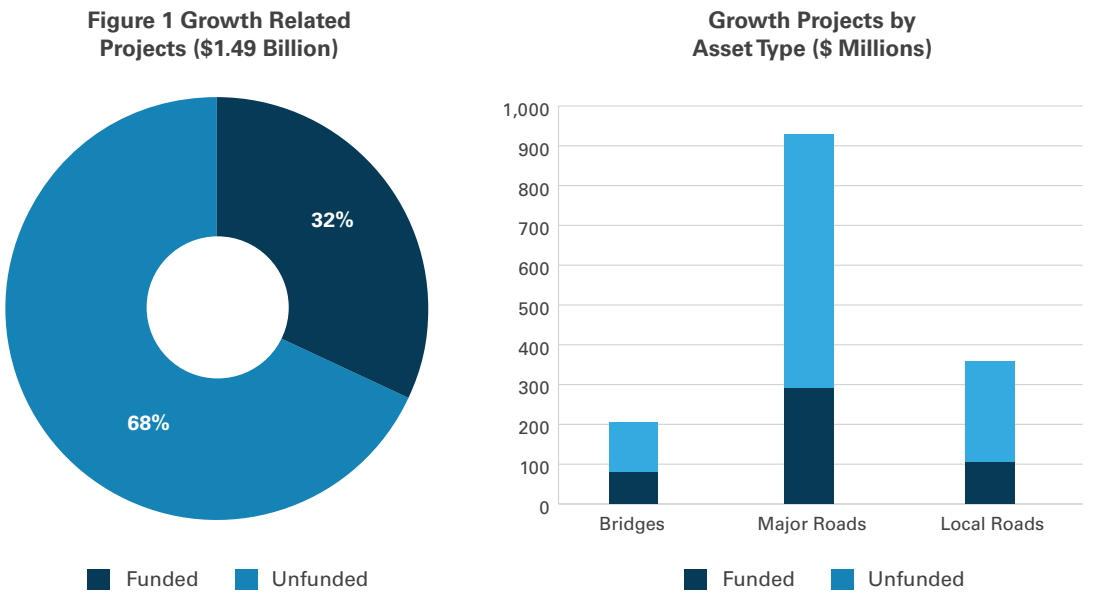
- The most recent review of the development charge by-law was conducted in 2017 and the Development Charges bylaw enacted on April 27, 2018. Changes to the City's administrative processes were adopted by City Council at its December 17, 2019, January 29, 2020 and February 5, 2021 meetings to ensure orderly transition and revenue neutrality related to subsequent Development Charges Act changes under Bill 108 and Bill 138.

The road and bridge growth projects identified in the following sections are based on the City's 2018-2022 DC Bylaw Review noting this planning was aligned the Province's 2017 Growth Plan for the Greater Golden Horseshoe. Asset Management Reporting updates will continue to reflect the most recent City DC Bylaw, recognizing the at the 2023-2027 DC Bylaw will be aligned with the Province's 2020 Growth Plan for the Greater Golden Horseshoe.

1.9.1. Expenditure Forecast

To accommodate the projected growth noted above, several road and bridge projects need to be undertaken over the next several years in the City of Toronto. These projects include new constructions, extensions of existing roads, reconfigurations, grade separations, and, widening roads to accommodate a greater capacity. The overall projected costs for the anticipated road and bridge projects over the next 10 years is $1.5 billion with $472.5 million or approximately 32% of these costs currently funded in the 2021-2030 Capital Plan for Transportation Services as shown in **Figure 1.9-1**.

Figure 1.9-1: 2021-2030 Growth Projects Funding Splits



The total growth needs for bridges is $205.5 million with $78.8 million funded in the current 10 Year Capital Plan. The majority of these needs are for bridge structures to support transit needs, including Metrolinx Infrastructure and Go Transit Expansion projects which total $160.7 million (of which $33.9 million is funded). In addition, other bridge requirements include $1.0 million for the completion of a Cycling Pedestrian Bridge to accommodate growth in the King Liberty area and $42.2 million for the Scarlett Road Bridge widening.

The total growth needs for major roads is $928.8 million with $290.2 million funded in the current 10 Year Capital Plan.

Notable major road growth related projects include:

- $229.9 million for Keele St. to Old Weston Rd. as part of the St. Clair Transportation Master Plan
- $207.9 million for the extension of Broadview Ave.
- Several projects along Yonge St. such as:
  - $101.4 million for Lower Yonge (waterfront area precinct)
  - $47.1 million for YongeTOmorrow (College St. to Queen St.)
  - $111.0 million for Yonge Street and Highway 401 Interchange
  - $63.8 million for Re-Imagine Yonge (Sheppard Ave. to Finch Ave.)

The total growth needs for local roads is $358.6 million with $103.6 million funded in the current 10 Year Capital Plan. The majority of these needs are unfunded as they are in the preliminary stage of the stage-gating process. Notable local road growth related projects include:

- $75.4 million for New Street in Liberty Village
- $66.0 million for Ingram Drive Extension
- $48.8 million for Legion Road Extension
- $46.4 million for John Street Revitalization

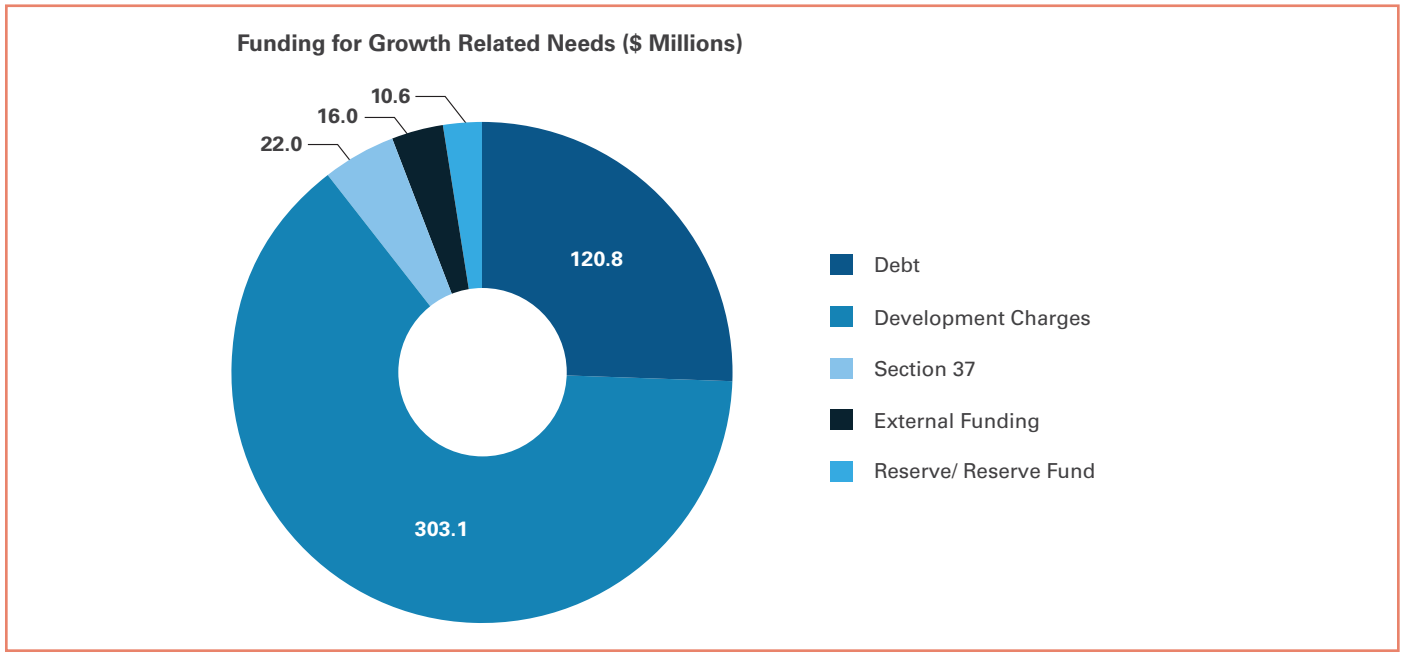
The majority of the road and bridge needs are unfunded as they are in the preliminary stage of the stage-gating process, requiring further studies and/or cost refinement, including for some the completion of a Municipal Class Environmental Assessment which is required to proceed to the design and construction. It is expected that as design progresses and costs and timelines become clearer that these needs will be accommodated (funded) within the Capital Plan.

1.9.2. Funding Sources

As previously noted, projected costs for the anticipated road and bridge projects over the next 10 years is $1.5 billion, with 32% ($472.5 million) of these costs currently funded in the 2021-2030 Capital Plan. Given the complexity of some of the projects, several funding tools and strategies are used to funds these projects including: debt, development charges, reserves, Section 37 funding, and external third-party funding as shown in **Figure 1.9-2** and described as follows:

- $303.1 million of anticipated road and bridge growth related work is planned to be funded from Development charges based on the Development Charges bylaw enacted on April 27, 2018.
- $120.8 million of road and bridge work is planned to be funded through the issuance of debt in order to cover off costs that cannot be recovered from growth funding tools or external sources.
- $22.0 million of growth related work in the 10 Year Capital Plan is currently funded from Section 37 funding which is secured through the Planning Act.
- $10.6 million will be funded through internal reserve funding
- $16.0 million is planned to be recovered from transit agencies for transit related projects

Figure 1.9-2: Growth Projects Funding Sources ($ Million)



1.9.3. Service Improvement

Transportation Services has $71.3 million in capital costs associated with service improvement for the Rockcliffe Flood Mitigation project. This project requires further study and cost refinement work through the Municipal Class Environmental Assessment (EA) process and in coordination with several other groups including Toronto Regional Conservation Authority (TRCA) and Toronto Water.

APPENDIX 2

Water, Wastewater and Stormwater Core Infrastructure Assets

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Continued next page

2.1.

INTRODUCTION

This document is Toronto Water's first publicly reported Asset Management Plan (AMP) developed as per the requirements set out by Provincial Regulations O.Reg. 588/17 and O.Reg. 193/21. In 2017, the Province of Ontario enacted Ontario Regulation 588/17: Asset Management Planning for Municipal Infrastructure (O. Reg. 588/17), under the Infrastructure for Jobs and Prosperity Act, to support improvements in municipal asset management. This Provincial legislation aims to standardize the way 444 Ontario municipalities plan their infrastructure, share best practices and enable the collection of comparable data for long-term planning and budgeting. The legislation requires the City to provide to the Province asset management plans on July 1, 2022 (extended from July 1, 2021) for the City's Core Infrastructure Assets (water, wastewater, stormwater, roads, bridges and culverts asset groups). The City of Toronto's "Core Infrastructure Asset Management Plan" is also aligned with the Corporate Asset Management Policy approved by Toronto City Council in 2019 and incorporates key principles and strategic directions that enhance asset management practices and ensures that asset management activities are continuously improved and integrated both in Toronto Water and across the organization.

Toronto Water service overview

- Supplies 435 billion litres of safe drinking water to more than 3.6 million from people (residents, businesses, visitors and the Industrial, Commercial, Institutional sector in Toronto and York Region) in a safe and reliable manner to protect public health.
- Collects and treats approximately 400 billion litres of wastewater in a safe and environmentally sustainable way to protect public health (residents, businesses and the Industrial, Commercial, Institutional sector in Toronto and Peel Region).
- Continuous conveyance of stormwater (rainwater and melted snow) through +4,900 km of storm sewers that is collected or diverted to help prevent the risk of property flooding, control erosion and improve water quality to protect public health and Toronto's waterways.

Toronto Water history

Toronto Water has a long and important history. The first public water system was in place in Toronto as early as 1872. Based on this information, as described in Toronto Public Health's "125 Years of Public Health in Toronto", Toronto's public water system will be 150 years old in 2022. The water system evolved through a combination of efforts involving Toronto Public Health staff, city engineers and skilled tradespeople who developed and built a clean water supply and wastewater disposal system for the city. By the early 1900s, most of this work was completed, greatly improving the living conditions for many people. In 1907, a report was written recommending a new modern water filtration plant be built on Toronto Island.

Toronto Bay (now Toronto Harbour) was a cesspool of city runoff, industrial pollution and human waste. When the pipe that brought cleaner water from south of Toronto Island through the bay cracked or broke, as it did several times in the 1890s and 1900s, the entire municipal water supply became contaminated. Residents had to boil water, or find an alternate supply for drinking and cooking.

In 1912, the Island Filtration Plant, located at the west end of Toronto Island, was in operation. The plant housed equipment that drew water from Lake Ontario and added chlorine which destroyed E. coli (Escherichia coli) bacteria. As a result of the filtration plant and other public health measures, the death rate from typhoid fell by 95 per cent between 1910 and 1915. During the same period of time, the Ashbridges Bay Treatment Plant was opened and began collecting and treating sewage.

Toronto Water is the result of nearly 150 years of extreme physical labour and hard work by thousands of dedicated people who work to provide safe drinking water, wastewater collection and treatment and stormwater management including: labourers; unionized workers; administrative staff, public health workers, water and wastewater operators; teams of skilled trades doing various types of work, including maintaining water and wastewater treatment plants, pumping stations, stormwater management facilities, watermains and sewer systems; engineers; scientists; supervisors; managers; contractors; staff responsible for daily emergency response; and, staff who are responsible for asset management and long-term planning for infrastructure replacement and rehabilitation projects. This work also requires research, utility management, industrial practices, regulatory requirements, engineering, consultants and manufacturers.

In 2021, Toronto Water now has more than 1,600 staff managing one of the largest water, wastewater and stormwater systems in North America, 24 hours a day, seven days a week. Toronto Water is strictly regulated by municipal, provincial and federal legislation and ensures over 3.6 million residents and businesses in Toronto, and portions of York and Peel, have access to safe drinking water, safely treated wastewater and stormwater management. These are critical services that protect public health and property and support customers in the City's residential and business communities making possible the future vision of Toronto.

Toronto Water and the importance of asset management planning

Asset management is a critical factor in achieving the effective and sustainable operation of Toronto Water. Asset Management principles, processes, practices and data have matured over time to support the Division's objective of delivering levels of service while minimizing the costs and risks associated with asset ownership.

Toronto Water has a rigorous annual capital delivery and 10-year capital program that is approved by Toronto City Council annually. Capital planning and asset management are inextricably linked. Utility asset planning helps to identify the critical investments required in operational, maintenance and renewal activities to ensure the reliability of the water utility assets and are based on a clear understanding of the lifecycle costs (life-cycle costs are important measurables such as energy consumption, equipment life and capital costs as well as preventative maintenance programs). Asset management planning helps to minimize the total cost of owning and operating the assets while delivering the service levels Toronto Water customer's desire. This balancing act weighs factors such as asset performance and condition, costs and risk and provides decision-makers with the tools and analysis in order to choose the most appropriate and optimized asset investments.

As a result of this history and experience Toronto Water's capabilities within the field of asset management continue to expand resulting in improved processes that include the implementation of new technology and innovative ways to assess condition and performance, and preserve and extend the useful life of infrastructure thereby protecting the City's original investment. Now a regular reporting tool, this Asset Management Plan will evolve and will help to inform and support the existing asset management practices within Toronto Water.

Toronto Water's asset management efforts and achievements

- A progressive long-term financial strategy to secure the required lifecycle activity investments to improve the condition and performance of the City's water, wastewater, and storm water systems
    - 2006 to 2014, annual rate increases of 9%;
    - 2015 and 2016, annual rate increases of 8%;
    - 2017 and 2018, annual rate increases of 5%; and
    - Then ongoing annual rate increases of 3% (1.5% in 2021).
- Capital programming process that has resulted in a 2021 10-year capital program of $6.8 billion in state-of-good-repair for underground assets, water/wastewater treatment plants and facilities and eliminating all but $132.304 million of the backlog by 2030.
- 2021 expected capital delivery rate of 92%.
- Construction on multiple significant Wet Weather Flow Master Plan projects including basement flooding work and the Don River and Central Waterfront & Connected Projects to reduce combined sewer overflow discharges in streams, rivers and Lake Ontario.

- Implementation of corrosion control at the four water treatment plants to reduce lead in drinking water.
- Development, management and automation of hundreds of key performance indicators.
- Launch of the Transmission Operational Optimizer for a total savings of more than 16 million kWh. The objective of this project is to minimize operating costs associated with water pumping and transmission through the use of software designed to optimize energy consumption while continuing to ensure water quantity and quality objectives are maintained.
- Installation of 470,000 residential, industrial, commercial and institutional water meters with operating savings of $5 million annually.
- Joint Optimization Study completed to determine infrastructure requirements to meet projected water demands in Toronto and York Region.
- Regularly exceeds legislative and regulatory water and wastewater standards.
- Manages the ongoing requirements of city growth.
- The development of a preventative and predictive maintenance program that proactively manages activities to maximize performance, minimize risks associated with asset failure, and protecting the City's asset investments.
- Investments in developing the data and technology required to support asset management processes and practices.

This Asset Management Plan has been developed in alignment with the following guiding documents:

- Toronto Water 10-year Capital Plan (2021-2030)
- Toronto Water (2020-2030) Strategic Plan
- Toronto Water Wet Weather Flow Master Plan
- City of Toronto Strategic Plan
- City of Toronto Official Plan
- City of Toronto Climate Mitigation Strategy
- City of Toronto Resilience Strategy

2.2.

ASSET INVENTORY

The following table provides an aggregate of the assets within the City's water, wastewater and stormwater asset inventory. This data was gathered in 2020.

Table 2.2-1: Toronto Water Core Asset Inventory

Assets within Each Asset Category	Inventory
Water: assets related to the collection, production, treatment, storage, supply or distribution of water	
Treatment Plants	4
Reservoirs & Storage Tanks	15
Pumping Stations	18
Distribution Watermains	6093 km
Transmission Watermains	627 km
Wastewater: assets related to the collection, transmission, treatment or disposal of wastewater, including any wastewater asset that from time to time manages stormwater	
Treatment Plants	4
Pumping Stations	75
Storage tanks	8
Local Sewers (<450mm)	4234 km
Local & Trunk Sewers (>450mm)	1337 km
Forcemains	59 km
Stormwater: assets related to the collection, transmission, treatment, retention, infiltration, control or disposal of stormwater	
Pumping Stations	12
Storm Ponds	27
Local Sewers (<450mm)	1,717 km
Local & Trunk Sewers (> or equal to 450mm)	3,174 km

Ownership and Cross-boundary Agreements

The City of Toronto linear water and sewage assets predominately serve its own residents, however, the City does have servicing agreements with neighbouring municipalities.

The City supplies water to the Region of York and is supplied water on Finch Avenue East by the Region of Durham.

The City receives sewage from the Region of Peel at the northwest corner of the City (Disco Road and Highway 427 to North Mimico Sub-Trunk Sewer (STS)), and conveys sewage from the Long Branch STS, crossing the municipal boundary to the Region of Peel on Lake Shore Boulevard West, to the G.E. Booth (Lakeview) Wastewater Treatment Plant. There is also a local sanitary sewer near Rakely Court and Eglinton Avenue West that is ultimately conveyed to the Region of Peel's Lakeview plant.

These cross boundary services are provided under agreements for which the municipality supplying the service is required to ensure the assets are maintained in a state of good repair.

2.3.

ASSET VALUATIONS

Toronto Water's core assets are valuated at $9.2 billion for water infrastructure, $12.6 billion for wastewater infrastructure and $6.2 billion for stormwater infrastructure for a total estimated value of $28 billion.

A breakdown of the replacement cost of this infrastructure is provided in **Table 2.3-1**. This asset valuation has been based both on the historical cost of the constructed asset inflated to estimate its replacement as well as appraisal valuations. This approach was utilized in response to guidance from the Public Sector Account Board (PSAB) for tangible capital assets introduced in 2006.

Table 2.3-1: Replacement Value

Asset Category	Replacement Cost ($)
Water	**9,224,453,245**
Treatment Plants	2,355,120,600
Reservoirs & Storage Tanks	461,738,194
Pumping Stations	314,944,452
Watermains	6,092,650,000
Wastewater	**12,669,640,246**
Treatment Plants	3,181,000,000
Pumping Stations	231,896,552
Storage tanks	89,015,133
Sewers	9,167,728,561
Stormwater	**6,272,870,778**
Pumping Stations	37,103,448
Storm Ponds	64,215,890
Sewers	6,171,551,439

For the purpose of this asset management plan the asset replacement valuation has been updated taking into consideration recent appraisal reports for a number of facilities as well as averaged unit rates for pipe installation based on bid pricing. A breakdown is provided in **Table 2.3-2**. These estimated replacement costs will continue to be evaluated and updated as costs can vary significantly based on site constraints and conditions, project delivery approach, project bundling, market conditions and material price fluctuations. The updated replacement cost of Toronto Water's infrastructure is $83 billion.

Table 2.3-2: Replacement Value - Updated

Core Asset	Replacement Cost ($)
Water	**24,894,673,252**
Treatment Plants	3,367,982,027
Reservoirs & Storage Tanks	756,431,005
Pumping Stations	534,230,419
Watermains	20,236,029,802
Wastewater	**35,608,655,711**
Treatment Plants	4,425,045,449
Pumping Stations	494,618,709
Storage tanks	189,862,893
Sewers	30,499,128,660
Stormwater	**22,663,757,218**
Pumping Stations	79,138,993
Storm Ponds	43,507,446
Sewers	22,541,110,779

2.4.

AVERAGE ASSET AGE

The average age of core assets within each asset category were calculated based on the components within each core asset. The age of linear plant is based on a weighted average according to pipe length, while the age of facility infrastructure is based on a sum of its components.

Table 2.4-1: Average Age of Toronto Water Core Asset Inventory

Core Asset	Average Age
Water	
Treatment Plants	33
Reservoirs & Storage Tanks	50
Pumping Stations	29
Distribution Watermains	62
Transmission Watermains	54
Wastewater	
Treatment Plants	33
Wastewater Pumping Stations	39
Wastewater storage tanks	24
Local Sewers (<450mm)	64
Local & Trunk Sewers (>450mm)	79
Sanitary Forcemains	38
Stormwater	
Pumping Stations	40
Storm Ponds	25
Local Sewers (<450mm)	55
Local & Trunk Sewers (> or equal to 450mm)	50

2.5.

ASSET CONDITIONS

2.5.1. General

Water, wastewater, and stormwater assets have a design or useful service life ranging from 15 to 100+ years. This wide range represents the diversity of Toronto Waters' asset inventory. The life expectancy of infrastructure can be impacted by a number of influencing factors including quality of materials, location, use, and environment. The useful life of infrastructure can be preserved or extended through regular maintenance, timely repair or rehabilitation. While infrastructure deteriorates over an expected useful life, different assessment approaches are utilized across asset classes to determine the condition of infrastructure over their theoretical design life.

2.5.2. Asset Condition Rating

Asset condition is rated using a five point scale ranging from very good to very poor. The following table provides a description of the condition rating assigned to water, wastewater and stormwater assets.

Table 2.5-1: Asset Condition Grade Summary

Numerical Rating	Descriptive Rating	Description
1	Very Good	The asset is fit for the future. It is well maintained, in good condition, new or recently rehabilitated.
2	Good	The asset is adequate. It is acceptable and generally within the mid-stage of its expected service life.
3	Fair	The asset requires attention. The asset shows signs of deterioration and some elements exhibit deficiencies.
4	Poor	There is an increasing potential for its condition to affect the service it provides. The asset is approaching the end of their service life, the condition is below the standard and a large portion of the system exhibits significant deterioration.
5	Very Poor	The asset is unfit for sustained service. It is near or beyond its expected service life and shows widespread signs of advanced deterioration.
	Unknown	Not enough data exists to respond.

2.5.3. Asset Condition Rating Methodology

The aggregate condition of infrastructure across the water, wastewater and stormwater categories of infrastructure are detailed in Table 2.5-2.

Table 2.5-2: Toronto Water Asset Condition Assessment

Core Asset Condition	Very good	Good	Fair	Poor	Very poor	Do not know
Water						
Treatment Plants	15%	42%	41%	1%	1%	
Reservoirs & Storage Tanks	70%	0%	27%	3%	0%	
Pumping Stations	36%	32%	31%	0%	1%	
Watermains - Local (diameter less than 416 mm)	20%	35%	33%	1%	11%	
Watermains - Transmission	11%	2%	87%			
Watermains - Diameter unknown	23%	5%	71%	1%		
Wastewater						
Treatment Plants	8%	17%	44%	22%	10%	
Wastewater Pumping Stations	13%	17%	41%	29%	0%	
Wastewater storage tanks	17%	50%	33%			
Sewer pipes (diameter <450 mm)	25%	5%	8%	4%	0%	58%
Sewer pipes (diameter >450 mm and <1500 mm)	45%	14%	11%	3%	0%	27%
Sewer pipes (diameter > or equal to 1500 mm)	45%	24%	6%	1%	1%	23%
Stormwater						
Pumping Stations	74%	0%	26%	0%	0%	
Stormwater Management Ponds	15%	7%	15%	37%		26 %
Stormwater pipes (diameter <450mm)	12%	9%	11%	3%	1%	65%
Stormwater pipes (diameter > or equal to 450mm and <1500mm)	45%	14%	11%	3%	0%	27%
Stormwater pipes (diameter > or equal to 1500 mm)	45%	24%	6%	1%	1%	23%

2.5.3.1. Water, Wastewater & Stormwater Facilities

Water, wastewater and stormwater treatment plants, pumping stations, and tanks are assessed periodically through condition assessment studies that rely on detailed visual inspections to identify deficiencies related to age, wear and deterioration of infrastructure. Key elements to inspections include:

- Assessment of structural condition
- Compliance to current standards, codes and regulations
- Assessment of supporting systems such as electrical, control and instrumentation systems
- Assessment of existing process equipment performance against design capacity
- Review of historical operating problems as identified by operations staff

The findings and recommendations of condition assessment studies are either addressed through emergency work (operating or capital budget) or prioritized through the capital planning process.

The condition assessment studies, while detailed in their assessment and recommendations, do not consistently apply a condition rating for infrastructure. As such, for overall asset management planning purposes, the condition of water, wastewater and stormwater facility infrastructure is based on overall condition of the facility and aligns with Toronto Water's capital plans for state of good repair. A breakdown of condition based on the useful life of components aggregated by their replacement cost taking into consideration asset design life and amended to reflect refurbishments and operational history is being developed and will be used to update the overall condition of facilities. The condition ranking scale detailed in **Table 2.5-1** will be applied in future condition assessment studies.

2.5.3.2. Sewer Pipe Condition Rating Methodology

The condition assessment of sewer pipes is conducted through the use of Closed Circuit Television (CCTV) inspection following the well-defined National Association of Sewer Service Companies (NASSCO) industry standards. This approach assigns both a condition and performance grade to the sewers.

Sewer inspection is scheduled in advance of the planned Transportation Capital Program to identify deficiencies for renewal in coordination with the transportation program to minimize disruption to the public. Sewer inspection is targeted to be conducted on at least a ten year cycle for trunk sewers and at least a 25 year cycle for local collection pipes.

2.5.3.3. Watermain Condition Rating Methodology

Watermain condition assessment is primarily undertaken through tracking watermain break history, correlated against asset size, pipe material, and soil conditions.

The City tracks watermain breaks recording available details such as location (district, coordinates, and street number), date of the break, type of break (blowout, bell shear, circumferential/round, through hole, longitudinal/ long, split bell, spiral break, unknown), cause of break, ambient air temperature, frost depth, anode installation, pipe diameter and material.

The watermain break studies have shown that some of the oldest watermains are still in good condition and are not in need of replacement; and for 150mm diameter watermains, it is more cost effective to replace the pipe if its break rate is greater than 3.0 breaks/km/year than to continue to repair the pipe. A reduced threshold may be considered when an opportunity exists to coordinate multiple infrastructure works within the roadway to reduce impact to businesses and the public.

An investigative report into the failure of cast iron transmission watermains recommended the systemic replacement of all cast iron transmission watermains as a risk management approach to avoid any failure of these watermains due to the significant impact one failure can have on surrounding properties. A condition assessment of a riveted steel watermain is scheduled to determine whether any deterioration has occurred to transmission watermains constructed of this material. Currently these watermains are assessed as being in Good to Fair condition pending the outcome of the assessment.

As required by the asset management regulation, qualitative descriptions of the community levels of service and technical metrics representing technical levels of service are detailed in **Sections 2.6.1 - 2.6.3**.

2.6.

COMMUNITY LEVELS OF SERVICE AND TECHNICAL LEVELS OF SERVICE

2.6.1. Water Assets

The extent of water servicing available within the City, as well as the reliability of service as represented by the occurrence of boil water advisories and overall service interruptions, as well as the associated technical levels of services over a 2 year timeframe are provided within this section.

2.6.1.1. Community Level of Service

The City of Toronto ensures that residents, businesses and visitors have access to clean, safe drinking water. This is done through a complex water treatment process and continuous testing so that water always meets or exceeds the requirements under the Safe Drinking Water Act set by the Ministry of the Environment, Conservation and Parks.

Toronto Water's accredited lab tests drinking water every six hours, conducts more than 20,000 tests at the water treatment plants annually, and conducts 15,000 bacteriological tests on samples collected from the water distribution system annually.

The drinking water system is monitored and maintained by both planned and unplanned maintenance. Monitoring is conducted to assess system performance for both regulatory compliance and asset planning. Drinking Water Quality and System Reports are made available for public viewing on the City's website. toronto.ca/services-payments/water-environment/tap-water-in-toronto/tap-water-quality-system-reports/

Description of user groups or areas that are connected to the water system

Nearly the entire City is connected to the municipal water system and has access to fire flow. Fire flow access is defined as properties that are in close proximity to a fire hydrant. Primarily vacant properties, and parks and ravine properties do not have service as well as the northeast corner of the City. It is in these areas where most of the active wells are located. It is also the area of the City where properties do not have access to fire flow.

The maps entitled 'Water Servicing in Toronto' and 'Hydrant Servicing Toronto' for fire flow access show the areas of water servicing in Toronto and are included as **Figures 2.6-1** and **2.6-2**.

Figure 2.6-1: Water Servicing in Toronto

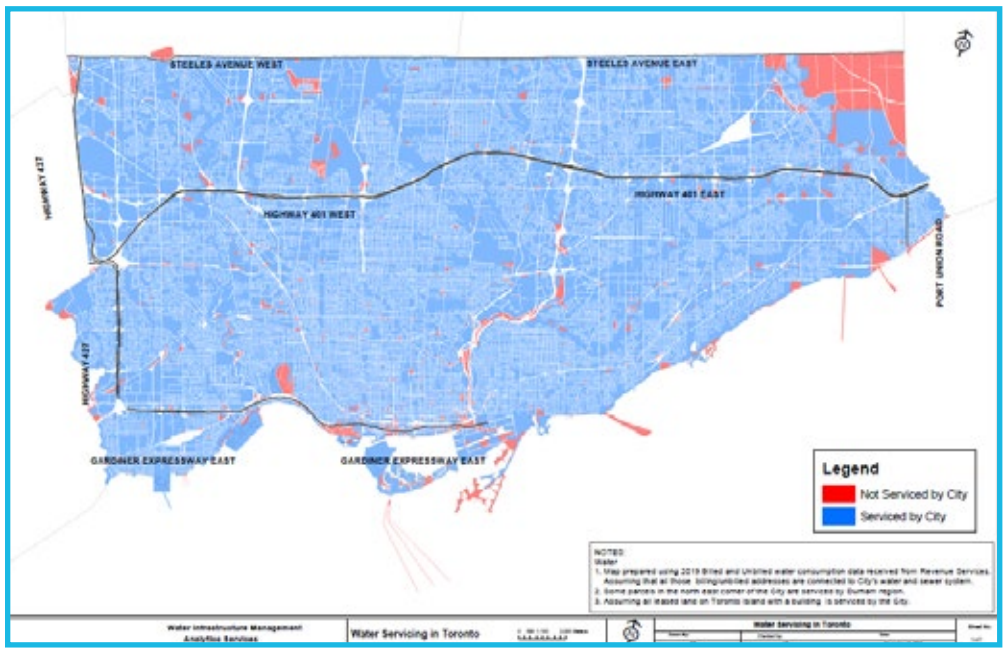
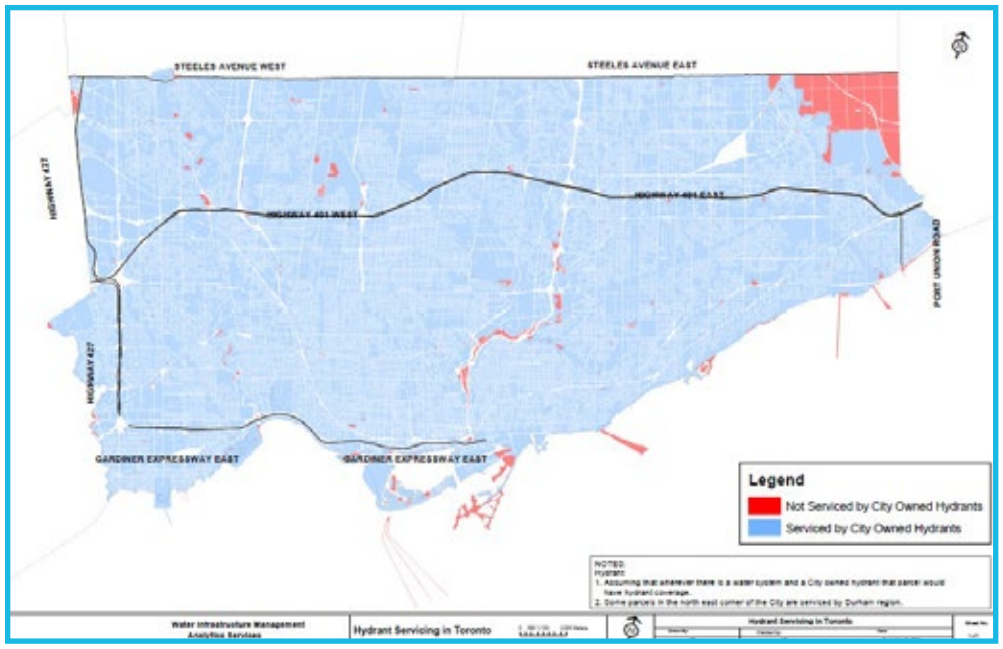


Figure 2.6-2: Fire Flow Servicing in Toronto



Description of boil water advisories and service interruptions

The City of Toronto has not had any Boil Water Advisories (as confirmed since the time of amalgamation in 1998). Toronto Water does have a Quality Management System (QMS) procedure entitled 'Adverse Notification Procedure – Drinking Water Treatment Plants' that complies with Ontario Regulation 170/03. The procedure includes; 'Duty to Report Adverse Test Results and Other Observations' for which a verbal notification is provided to City of Toronto Public Health, and to the MECP Spill Action Centre. A follow-up written notification is given to Public Health and to the MECP Spill Action Centre as soon as possible and no later than 24 hours after the verbal report. Public Health determines whether a boil water advisory is required.

The City of Toronto has not had any Service Interruptions that would affect a large area that could be represented as a 'Community Level of Service' in 2019 or 2020 such as an outage at a water treatment plant. Service Interruptions have occurred that affect a local area of services related to watermain breaks. Toronto Water minimizes water service interruptions by ensuring proactive communication with customers. Planned service interruptions and Capital works projects provide advanced written communication to all impacted customers that describe the project and the anticipated service interruptions, together with contact information for any concerns. Emergency driven service interruptions are minimized by isolating the impacted area, and providing both verbal and written notification to impacted customers. Written notification is in the form of a door hanger that provides a description of the emergency outage and contact information. Wherever possible, service interruptions are performed to accommodate the customer's needs, during weekends or after business hours. Toronto Water provides updates on service interruptions to 311 Toronto to assist with any inquiries. The City posts a 'No Water Map' to advise the public of locations of current locations where there is no water service due to a watermain break or planned maintenance work. The map is interactive and can be searched based on location or address. toronto.ca/services-payments/water-environment/no-water-map/#location=&lat=&lng=

2.6.1.2. Technical Level of Service

The percentage of properties connected to the municipal water system is based on the total number of parcels of land (497,403) and compared to the total number of properties serviced by the City (489,260). From the difference in amounts (8,143); the percentage (98.4%) can be calculated. Similarly, fire flow is available where properties have access to the municipal water system.

The percentage of connection-days per year due to the watermain breaks compared to the total number of properties connected to the municipal water system was determined based on work orders for which there was no water for a period greater than twenty-four (24) hours. This occurred 42 times in 2018, 43 times in 2019, and 28 times in 2020. The affected number of services are 381 in 2018, 728 in 2019 and 364 in 2020. Based on 2020 numbers and assuming 475,000 billing accounts, the percentage is 0.08%.

Table 2.6-1: Water Assets Technical Levels of Service

Technical Levels of Service (technical metrics)	2019	2020
Percentage of properties connected to the municipal water system	98.4%	98.4%
Percentage of properties where fire flow is available	98.4%	98.4%
Percentage of connection-days per year where a boil water advisory notice is in place compared to the total number of properties connected to the municipal water system	0%	0%
Percentage of connection-days per year due to the watermain breaks compared to the total number of properties connected to the municipal water system	0.15%	0.08%

2.6.2. Wastewater Assets

The extent of wastewater servicing available within the City, the reliability of service as represented by the occurrence of overflows, sewer backups, the number of effluent violations, and effluent discharge quality, as well as the associated technical levels of services over a 2 year timeframe are provided within this section.

2.6.2.1. Community Level of Service (qualitative descriptions)

The City of Toronto wastewater system is a major contributor to residents, businesses and visitors having a clean, healthy City. Toronto's wastewater treatment process operates under strict regulations and meets or exceeds standards set by the province and federal government to protect public health.

Wastewater is collected and treated 24 hours a day, 7 days a week. Annual reports for each of four wastewater treatment plants are submitted to the Ministry of the Environment, Conservation and Parks which are made available for viewing on the City's website. toronto.ca/services-payments/water-environment/managing-sewage-in-toronto/wastewater-treatment-plants-and-reports/
The reports provide a summary of plant operations and performance on an annual basis including a discussion of effluent quality and summaries of process operations, maintenance, chemical and utility consumption, capital projects, operational costs and human resources.

Description of user groups or areas connected to the wastewater system

Nearly the entire City is connected to the municipal sewage system. Property connectivity is based on water billing data. The wastewater system is comprised of four main sewersheds that flow into 4 wastewater treatment plants as shown in **Figure 2.6-3**. Primarily vacant properties, and parks and ravine properties do not have service as well as the northeast corner of the City as shown in **Figure 2.6-4**. There are small pockets where properties have septic systems.

Figure 2.6-3: Sewage Treatment in Toronto

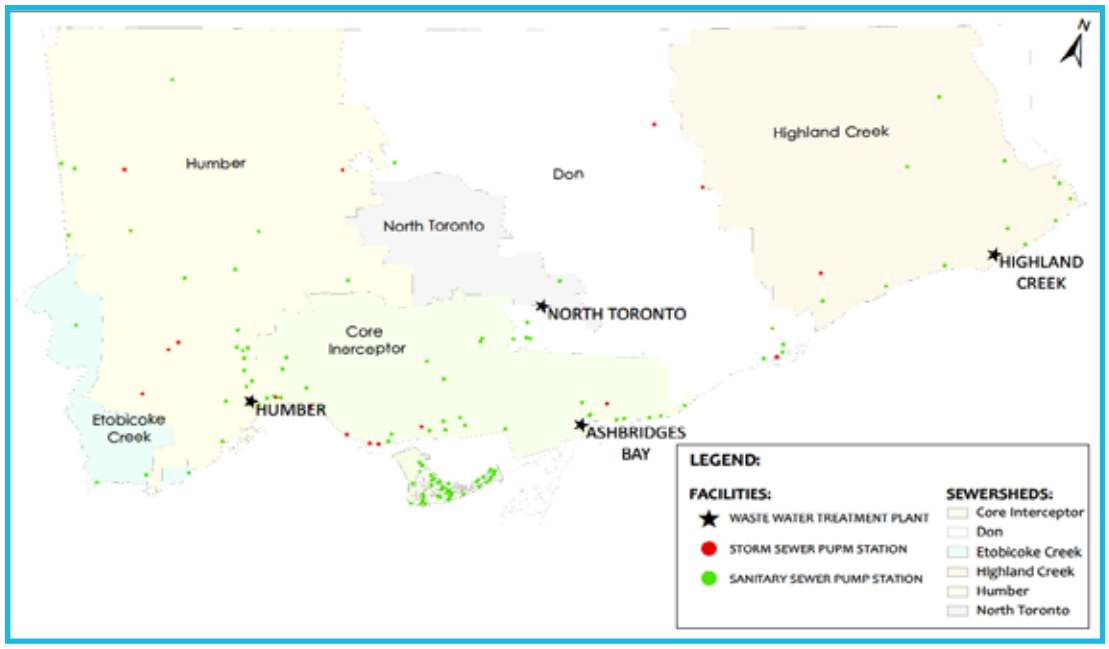
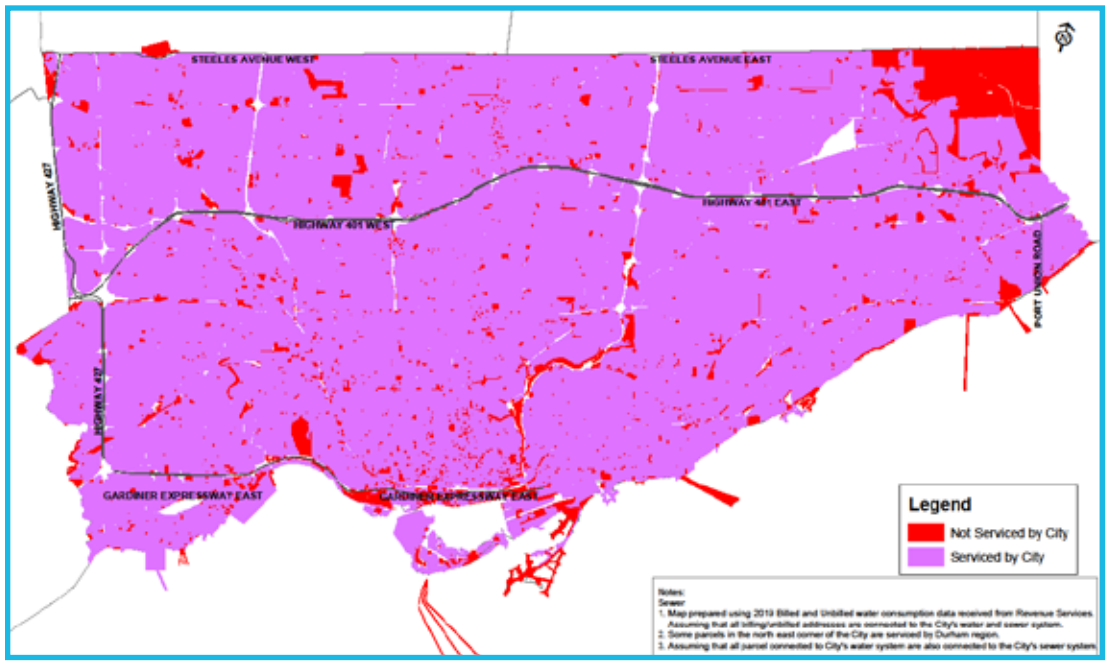


Figure 2.6-4: Sewer Servicing in Toronto



Description of the design of the overflow structures to prevent backups into homes

About a quarter of the City's drainage area (16,552 ha of 63,020 ha), located in the former City of Toronto, the southwest portion of the former City of Scarborough, the City of York, and the Borough of East York, is serviced by combined or partially separated sewage systems. No new combined sewer systems will be approved, however, rehabilitation of existing combined sewers to maintain a state-of-good-repair is permitted under MECP Procedure F-5-5. Existing combined sewers were designed with overflow structures and outfall pipes to watercourses. Generally, the overflow structure is positioned at the downstream end of the local sewer system (which receive service connections) and upstream of the pipe connection to the trunk sewer system. The weir is set at an elevation corresponding to 2.5 times the design dry weather flow (although this can vary from 2 times up to 4 times average dry weather flow). This design ensures there is a release elevation to limit surcharge in the local system and minimizes the possibility of sewage backing up into basements. To comply with MECP Procedure F-5-5, the City has and continues to construct end-of-pipe CSO controls as part of its pollution prevention program. These are large scale multi-year projects, designed to capture wet weather flow in large tanks or deep tunnels for subsequent treatment that would otherwise overflow to natural watercourses.

The design capacity of each segment of the combined system can vary based on each downstream weir setting. The Toronto Water InfoWorks hydraulic model includes pipe parameters of the combined sewer system. Limitations in design capacity of particular segments of the combined system are identified by inputting the hydrograph for various design storm events. The model then predicts where pipe segments are surcharged. Flow monitoring stations are also used to validate the modelling results.

The City has two (2) offline sanitary tanks; the Maryport 2100mm tunnel constructed in1993 (that will ultimately be part of the future Keele Trunk Relief sewer) and the Woodbine Park sanitary storage detention tank constructed in 1997. It has five (5) offline CSO tanks that include the Eastern Beaches tanks at Kenilworth approved in 1988 and Maclean Ave approved in 1993, Western Beaches storage tunnel approved 1997, Hyde Avenue tank constructed in 1969, North Toronto CSO tank constructed in 2009, and the Charles Caccia combined sewer tank constructed in 2013 (which is not designed to overflow).

There are CSO events that will result in a capacity exceedance at a CSO point, but a CSO event rarely causes a spill at a CSO tank facility. These facilities have a design capacity, above which the combined sewer system will bypass the flow around the tank to a downstream sewer which has an overflow point.

The City of Toronto has 309 Combined Sewer Overflow (CSO) points and 84 Outfall points in the Combined Sewer Area. Annual reporting is required as per Federal Wastewater Systems Effluent Regulations (SOR/2012-139, Fisheries Act). laws-lois.justice.gc.ca/eng/regulations/SOR-2012-139/index.html

The regulation requires mandatory minimum effluent quality standards to be met through secondary wastewater treatment and includes requirements for monitoring, record-keeping, reporting and toxicity testing. The City must report occurrence, duration, and volume of CSOs at all overflow regulators (locations) from the previous year before February 15th. CSO (duration, occurrence and volume) depend on rainfall and thus can vary significantly from year to year.

Description of frequency and volume of overflows

Modelling is the primary approach used to calculate the frequency and volume of overflows and is based on the 'Flow Control Structure NASSCO MACP Survey Assessment Report' conducted by CIMA in 2018 along with some as-built drawings.

The City has three (3) drainage systems where there is potential for CSO. They are served by Ashbridges Bay Treatment Plant (ABTP), Humber Treatment Plant (HTP), and North Toronto Treatment Plant (NTTP). The InfoWorks ICM 10.0 model is used to simulate CSO volume, duration and frequency for each drainage area. From these simulations, the flows are estimated and reported.

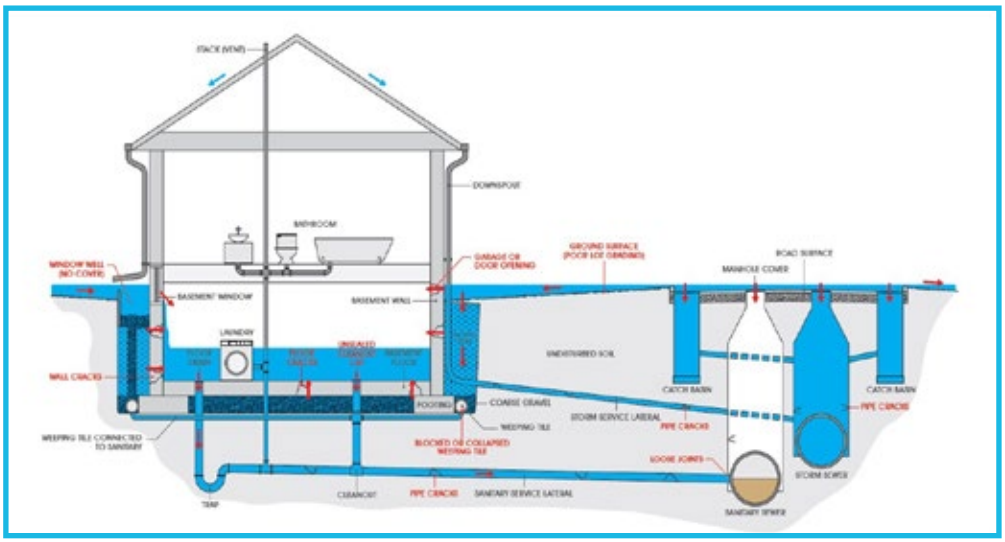
The City notes that annual CSO reporting does not provide an insight to the City's progress in managing CSOs, as the frequency and volume of CSOs is weather dependent. Of the CSO points, the Western Beaches Tunnel overflow at the Parkside outlet has the largest volume followed by the Hillary Combined Trunk Sewer at maintenance hole No.360-005-1, east of Rockcliffe Boulevard on the south bank of the Black Creek.

The distribution of CSO locations in terms of overflow days and CSO volume that was reported to Environment Canada was used to calculate the number of events per year where combined sewer flow in the municipal wastewater system exceeds system capacity.

Description of how stormwater can enter sanitary sewers

Stormwater can enter the wastewater system through a number of ways causing sewage to overflow into streets or back up into homes as shown in **Figure 2.6-5**. Cracks within the storm sewers and waste water system can lead to seepage of stormwater into sewers and properties. Poor lot drainage or the lack of overland flow routes can lead to ponding and flooding of roadways and properties.

Figure 2.6-5: Stormwater Overflow into Streets and Homes



Description of how sanitary sewers are designed to be resilient to avoid overflow into streets or homes

Stormwater can get into sanitary sewers in the municipal wastewater system by surface ponding at low points. The City seals these maintenance hole covers to reduce the amount of inflow. Similarly, infiltration is reduced by the elimination of cross-connections and relining sewers that have been identified by CCTV inspection as having a high amount of infiltration. Sewage overflow into streets or backup into homes is addressed through the City's Basement Flooding Protection program. Major drainage areas are studied under environmental assessments and detailed design to improve both the storm and sanitary sewage systems to lower the hydraulic grade line in the sewers during wet weather flow events.

New sanitary sewers are designed to be resilient such that there will be no overflow into streets or backup into homes by adhering to the City's sanitary sewer design criteria to convey both a peaked sanitary flow and an infiltration allowance. Existing sanitary sewers which have been identified as needing to be replaced, are hydraulically modelled, and if required, are upsized to lower the hydraulic grade line such that it is located at least 1.8m below grade.

Description of effluent discharged from sewage treatment plants

Effluent discharged from sewage treatment plants in the municipal wastewater system has been treated to meet final effluent parameters under the sewage treatment plant's environmental compliance approval. The parameters include Carbonaceous Biological Oxygen Demand (cBOD5), Total Suspended Solids, Total Phosphorus, Total Residual Chlorine, E-Coli and pH, along with eleven (11) selected heavy metals.

2.6.2.2. Technical Level of Service (technical metrics)

The technical levels of services as defined in the asset management regulation for sewer assets over a 2-year timeframe are provided within this section.

Table 2.6-2: Sewer Assets Technical Levels of Service

Technical Levels of Service (technical metrics)	2019	2020
Percentage of properties connected to the municipal wastewater system	99.91%	99.91%
Percentage of events per year where combined sewer flow in the municipal wastewater system exceeds system capacity compared to the total number of properties connected to the municipal wastewater system.	0.11%	0.06%
Percentage of connection-days per year due to wastewater backups compared to the total number of properties connected to the municipal wastewater system.	0.02%	0.01%
Percentage of effluent violations per year due to wastewater discharge compared to the total number of properties connected to the municipal wastewater system.	0.14%	0.12%

Notes:

1. The bypass events at the sewage treatment plants (designed for average daily flow as opposed to peak flow) is based on the annual reports for the Wastewater Treatment Plants.

2. All bypass events complied with the conditions on the plant ECA.

3. The reliability values shown for wastewater backup is in the linear system and is based on records from the Hansen works management system.

The number of wastewater treatment plant by-passes is provided in **Table 2.6-3**. In all cases, the reason for the bypass is excessive stormwater flow. The bypass reports are updated monthly, within 30 days of the end of each month. During a bypass, wastewater is diverted around the biological process (secondary treatment process) to protect the plant and its wastewater treatment processes. The bypassed wastewater continues to go through screening, grit removal, primary treatment, phosphorous removal and full disinfection to ensure the treated water always meets federal and provincial regulations.

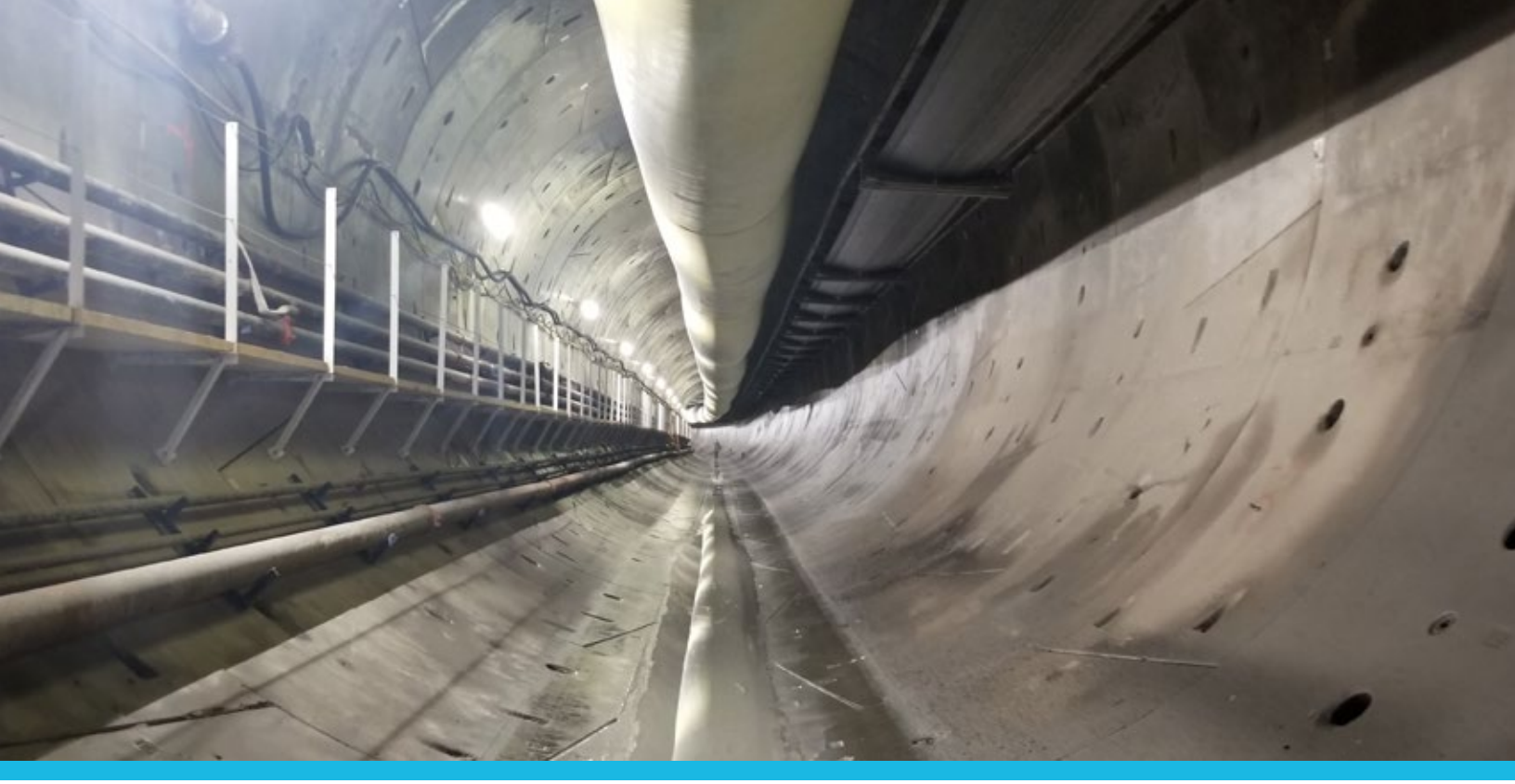


Table 2.6-3: Wastewater Treatment Plant Bypasses

Wastewater Treatment Plant	No. Events in 2019	No. Events in 2020
Ashbridges Bay	22	6
Humber	19	3

Notes:

- Highland Creek Treatment Plant serves a separated sewage system and historically does not need to bypass during wet weather. There were no bypasses during 2019 or 2020.
- North Toronto Treatment Plant is not configured for bypasses. The inflow to the plant is controlled, with excess flow routed upstream of the screens to a CSO tank and chemical treatment facility that has an outlet to the trunk sewer system to ABTP and an overflow to the Don River.

A summary of the City's CSO Tank Bypasses is included in **Table 2.6-4**. Listed are the major facilities with significant offline storage capacity. The number of events per year where combined sewer flow in the municipal wastewater system exceeds system capacity is the sum of CSO point events, CSO tank bypasses, and the wastewater treatment plant secondary bypasses.

Table 2.6-4: Summary of 2020 Events where Combined Sewer Flow Exceeds Municipal Wastewater System Capacity

CSO Point Location	Total Number of CSO Events (based on Volumetric Modelling[1])	Total Number of Offline CSO Control Facility Bypasses	Wastewater Treatment Plant Secondary Bypasses	Total Wastewater System Capacity Exceedances
Linear System CSO Points (excludes CSO facilities listed below & any CSO upstream of the facilities)	By sewershed 68 (ABTP) 45 (NTTP) 62 (HTP)	N/A	N/A	175
North Toronto CSO Tank	9	0	N/A	9
Eastern Beaches Tank at Kenilworth Avenue (2,250 m^3)	0	0	N/A	0
Eastern Beaches Tank at MacLean Avenue (4,000 m^3)	1	0	N/A	1
Hyde Avenue CSO tank (7,410 m^3)	33	0	N/A	33
Western Beaches Storage Tunnel (85,000 m^3)	68	0	N/A	68
Ashbridges Bay TP			0	0
Humber TP			0	
Sum	**286**			**286**

Notes:

The City has other offline combined sewage tanks such as the tank located in Charles Caccia Park which has a capacity of 6,000 m^3. However, these tanks are not tracked for CSO or bypass occurrence because they operate as temporary sewage storage facilities, designed to attenuate peak flow, for which there is no overflow at the tank location. Once sufficient capacity in the combined system is reached, the stored sewage either drains or is pumped back into the combined system. Once the tank reaches capacity, sewage continues through the system and may reach a CSO point.

Secondary Bypasses at ABTP and HTP are shown as zero because all bypasses met the conditions of the plant ECA.

MECP Spills Action Centre reporting is done within 24 hours after NTTP CSO tank overflowing into storm tank, which has a weir control prior to an outfall to the Don River.

Column 1 Volumetric Modelling[1]:

1. The number of CSO events provided in Column 1 of the table are modelled to demonstrate compliance with 'MECP F-5-5, Determination of Treatment Requirements for Municipal and Private Combined and Partially Separated Sewer Systems'. This procedure requires model simulations during a seven-month period commencing within 15 days of April 1. The remaining 5 months of the year are reported as zero. The City's CSO reporting is based on a calibrated model using the recorded rainfall data for a particular reporting year from April 1 to October 31. The model was developed and calibrated during the Don River and Central Waterfront Wet Weather Flow Control EA study completed in 2011.

2. The CSO event numbers provided in Column 1 of the table above are calendar days which means if more than one spill events happened within one day, then just 1 day is reported. If the spill duration crosses the midnight, then 2 days are reported.

3. Linear CSO events exclude all the CSO tank facilities listed in the table and any CSOs immediately above the tank facilities. The Total Number of CSO Events indicated in the table is the highest quantity of spill events (in terms of calendar days) of a CSO location in each of the sewersheds.

4. Each CSO tank was constructed subsequent to the linear combined sewer system. These tanks intercept CSO that was previously discharging from the linear system to the natural environment.

    - The final CSO numbers reported reflect the consideration of the effects of the storage facilities, including the NTTP Tank, Eastern Beaches Kenilworth Tank, Eastern Beaches Maclean Tank, Hyde Avenue Tank, and Western Beach Storage Tunnel (WBT). These facilities store not only CSO but also stormwater from separated or partially separated storm sewers. Based on the modelling results, further analysis was conducted to estimate the CSO from these facilities as follows.

        - If overflow from the facility = 0, then no CSO is reported;

        - If overflow from the facility > 0 and CSO to the facility = 0, then no CSO is reported; and

        - If overflow from the facility > 0 and CSO to the facility > 0, then CSO is reported. The reported CSO is the lesser of the CSO to the facility or the overflow from the facility. The overflow frequency is reported as the CSO frequency.

    - For each CSO tank, the Total Number of CSO Events indicated in the table is the highest quantity of spill events (in terms of calendar days) for the modelled upstream CSO points associated with the storage.

These 286 CSO events in 2020 are compared to the total number of properties connected to the municipal wastewater system of 475,000 based on water service records and billing data. Using this technical metric, the percentage of events per year where the combined sewer flow in the municipal wastewater system exceeds system capacity is 0.06%.

As summarized in **Table 2.6-2** the percentage of wastewater backups is based on 113 occurrences in 2019 and 43 occurrences in 2020 where backups exceeded a 24 hour period. These incidences are tied to individual locations and assumes that the receiving main sewer is also tied to an individual location. The connection-days per year due to wastewater backups compared to the total number of properties connected to the municipal wastewater system can be calculated based on the number of water service records and billing data (475,000). Using this technical metric the wastewater backup percentage is 0.02% for 2019. For 2020 the percentage is 0.01%.

Toronto Water, Environment and Administration, Environmental Monitoring and Protection unit is responsible for administrative compliance and enforcement of the City of Toronto's Municipal Code Chapter 681 ("Sewer-Use By-Law") and Municipal Code Chapter 851 ("Water Supply By-Law"). The link to the Council Report entitled 'Sewers and Water Supply By-laws 2019 Compliance and Enforcement Annual Report app.toronto.ca/tmmis/viewAgendaItemHistory.do?item=2021.IE24.12

The number of identified notices of violations due to wastewater discharge was 654 in 2019 and 538 in 2020. As a percentage of the total number of properties to the municipal wastewater system, there were 0.14% and 0.12% violations in 2019 and 2020 respectively.

2.6.3. Stormwater Assets

The qualitative levels of service describing the extent of stormwater servicing available within the City as well as the resilience within the system are provided.

2.6.3.1. Community Level of Service (qualitative descriptions)

The City of Toronto stormwater management system provides properties with protection from wet weather events, flooding, and the effects of erosion. Toronto Water has developed Wet Weather Flow Management Guidelines to augment the Ministry of the Environment, Conservation and Parks Stormwater Management Planning and Design manual. The City makes available for viewing its stormwater management standards and guidelines on its website, along with information on major projects to alleviate basement flooding. https://www.toronto.ca/services-payments/water-environment/managing-rain-melted-snow/what-the-city-is-doing-stormwater-management-projects/other-stormwater-management-projects/

The stormwater collection system is comprised of pipes and overland flow routes which were designed according to the standards of the day and the respective pre-amalgamation local area municipalities' standards. In 2006, the Basement Flooding Protection Program (BFPP) was created to raise the level of service in Toronto's stormwater collection system to the 100 year standard where financially feasible.

The City considered two types of flooding risks to comply with the Technical Levels of Service (technical metrics) requirement: 1) Riverine and 2) Urban.

Riverine

The floodplains in Toronto are regulated by the Toronto and Region Conservation Authority (TRCA) in accordance with Provincial floodplain management policies to manage flood risk. The TRCA uses Hurricane Hazel as the standard for delineating the regulatory floodplain. Over 99% of properties in the City of Toronto are outside of the regulated floodplain.

Urban

Properties are at risk from urban flooding due to overland flow or sewer backup. The intention of the City's Basement Flooding Protection Program (BFPP) is to raise the level of service of the storm drainage system to the 100-year standard where feasible based upon the cost per benefitting property. The Council Decision IE17.5, 2020 Basement Flooding Protection Program Update adopted without amendment on November 25, 2020 can be referred to for additional information. Agenda Item History - 2020.IE17.5 (toronto.ca)

The following maps provide an overview of the stormwater management system, the basement flooding study areas including those that have been completed.

Figure 2.6-6: Stormwater Outfalls in Toronto

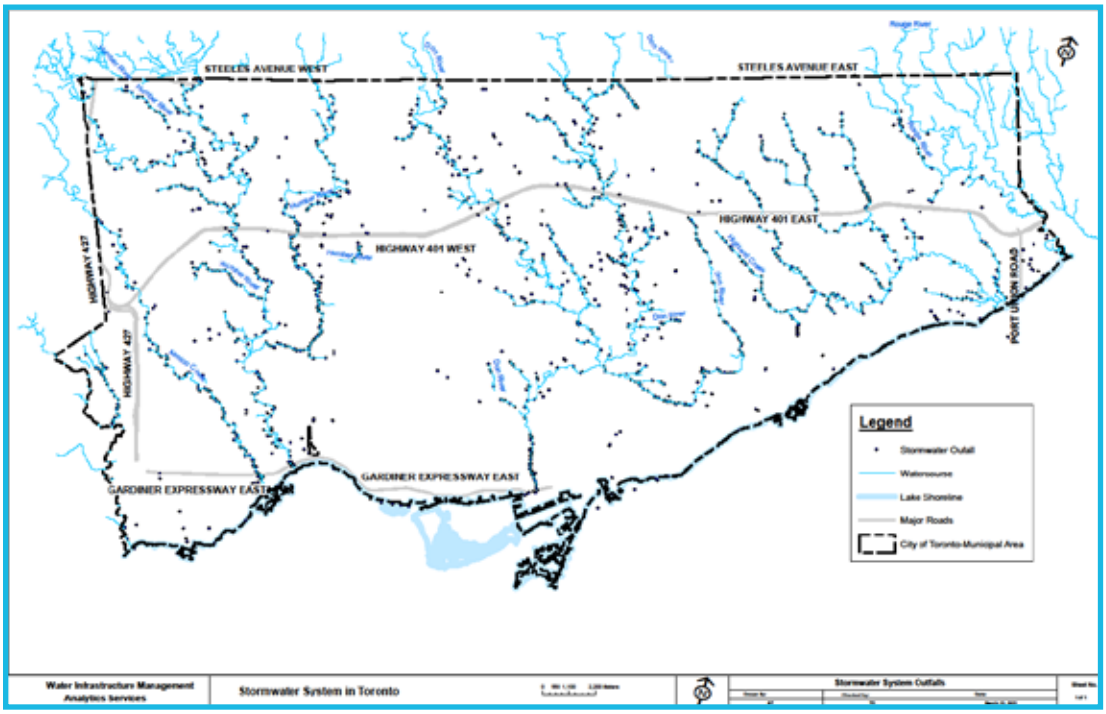
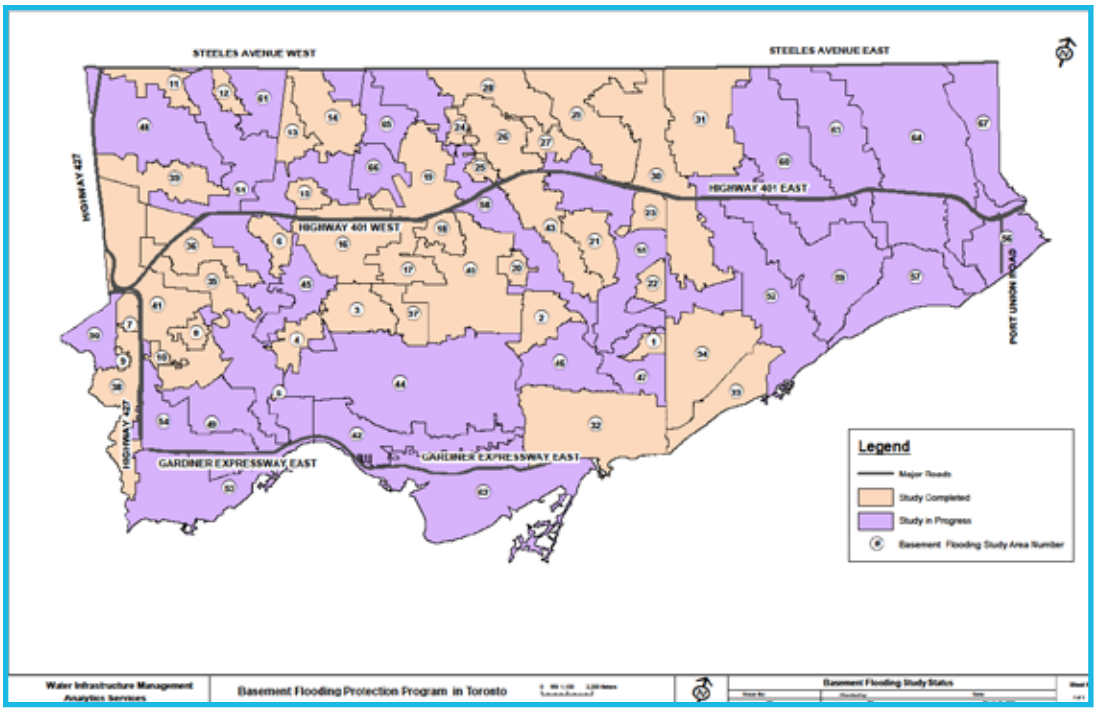


Figure 2.6-7: Basement Flooding Protection Program Study Areas



2.6.3.2. Technical Level of Service (technical metrics)

The associated technical levels of services related to the 5-year storm event and the 100-year storm event are provided within this section. The information presented is specific to separated storm sewer systems and does not include the combined or sanitary sewer systems.

The BFPP has modelled approximately 44% of the City of Toronto to-date. The results show that approximately 63% of properties are resilient to the 100-year storm; conversely, approximately 37% of properties, do not meet the 100-year storm resiliency criteria, but will if the recommended projects for improvement are constructed.

Toronto Water analyzed a representative sample of the City and determined approximately 80% of the storm sewer system is resilient to the 5-year storm.

2.6.4. Current Performance Measures of Core Assets

The following performance measures are tracked by Toronto Water to measure the Division's performance and progress towards several operational service objectives. These performance measures are reported through the annual budget submission as well as annual reports. Other measures of performance include complaint resolution, and energy management.

Table 2.6-5: Performance Measures across Asset Category

Asset Category / Service Area	Service Measure	2018 Actual	2019 Actual	2020 Target	2020 Actual
	Outcome Measures				
Water Treatment & Supply	Watermain Breaks per 100 km of Water Distribution Pipe	16.8 per 100km	16.5 per 100km	22.0 per 100km	10.7 per 100km
Water Treatment & Supply	Drinking Water Non-Compliance	0	0	0	1
Water Treatment & Supply	Percent Time Operating Within 276 kPA to 793 kPA Requirements	97.20%	97.00%	99.50%	95.00%
Wastewater Collection & Treatment	Wastewater Treatment Non-Compliance Events	0	1	0	0
Wastewater Collection & Treatment	Mainline Backups per 100 KM of Pipe	3.3	3.6	4	3.6
Stormwater Management	ML of Dedicated (designed) Stormwater Storage Capacity	1,248 ML	1,248 ML	1,248 ML	1,248 ML
	Service Level Measures				
Water Treatment & Supply	Water Treatment Non-Compliance Events	0	0	0	0
Water Treatment & Supply	Target Pressure Limits (Pressure Maintenance)	97.20%	97.00%	99.50%	99.1%
Wastewater Collection & Treatment	Pumping Station Outages	0	0	0	0
Wastewater Collection & Treatment	Non-Compliance Events (WWT)	0	1	0	0
Stormwater Management	Number stormwater ponds inspected / maintained	970	1069	990	1116
	Other Measures				
Water Treatment & Supply	Electrical kWH per ML of Water Pumped	342 kWH per ML	344 kWH per ML	330 kWH per ML	309 kWH per ML
Wastewater Collection & Treatment	Percent Biosolids Beneficially Used (ABTB)	100%	100%	100%	100%
Stormwater Management	Watercourse Inlet/ Outlet Inspections	3526	4025	3000	6175

Complaint Resolution

Toronto Water has a dedicated Customer Care Centre operating under the guiding principle of 'Continuous Service Delivery Improvement'. The business unit is a central point from which all customer contacts are managed. Functions include answering calls, scheduling field work, providing program support and investigating/ resolving escalated complaints.

Table 2.6-6: Customer Care Centre: Complaints

Metric	Count (2019)	Count (2020)
Customer Touch Points	226,000	246,628
Work Orders Issued	1028	550
Customer Service Requests handled (CCC and CFS)	62,000	81,604
Complaints Reduced to in Last Quarter of the year	9 (Normally 200 CFS)	1% complaint rate, 125 complaints for Q4

Toronto Water also maintains a record of complaints received due to odour and noise. All complaints are recorded, investigated, and reported to the MECP, and when possible, followed up with the complainant. The following table provides a summary of complaints received.

Table 2.6-7: Odour and Noise Complaints

Year	System Location	Nature of Complaint	Number	Notes
2019	ABTP	Noise	1	
2019	ABTP	Odour	11	Only 3 related to plant operations. Plant related complaints due to temporary maintenance shut-downs
2019	Humber	Noise	2	Exhaust Fan needed replacement
2019	Humber	Odour	6	
2019	North Toronto			There were no odour or noise complaints received in 2019

Energy Optimization

The Energy Optimization Plan (EOP) focuses on three strategic areas: energy optimization, revenue generation and innovation in energy. Energy optimization is being driven by a primary goal to reduce greenhouse gas (GHG) emissions by 20% per capita by 2035 from 2014 levels. Optimization is achieved through a number of revenue generation initiatives such as demand management through peak shaving, leveraging grants and incentives to implement energy efficient upgrades, reduction of energy purchases through on-site generation and the optimization of operations to minimize consumption. Innovation is achieved through partnerships with universities and industry research organization to pilot new approaches and technologies in the provision of water, wastewater and stormwater services.

Annual Utility Consumption

Toronto Water is organized to have specific work sections responsible for the safe and reliable operation of its facilities. These sections liaise with other sections to ensure environmental compliance, efficient asset utilization, demand forecasting, and planning redundancies in the system to address emergency situations.

The development of the operating plan includes examining trends and defining operating strategies and methods to meet the required service levels.

Utility consumption is monitored at the plants, including water usage, hydro usage, and natural gas usage. The following tables provides a summary for total annual consumption at major plant facilities.

Table 2.6-8: Annual Utility Consumption, Water Treatment and Supply

Asset Location	Consumption (kWh), 2019	Consumption (kWh), 2020	Hydro Cost ($), 2019	Hydro Cost ($), 2020
FJ Horgan	36,288,143	39,242,083	2,112,678	2,282,976
RC Harris	43,719,203	47,412,424	4,679,312	4,471,091
RL Clark	58,634,750	54,871,822	5,991,502	5,600,615
Island	7,879,306	7,098,169	1,004,365	876,598
High Level PS	10,374,648	11,628,970	1,002,212	1,122,164
Water Supply	140,003,114	146,949,465	18,898,689	19,077,875

Reference: 2020 Hydro Billing (PW) – Per E-Cap Billings

Table 2.6-9: Annual Utility Consumption, Wastewater (Water, Hydro, Gas)

Year	Asset Location	Water Usage (m^3)	Hydro Usage (kWh)	Natural Gas Usage (Mscm)
2019	ABTP	383,478	132,222,694	7.5
2020	ABTP	459,553	135,432,259	7.0
2019	Humber	287,036	49,843,462	2.5
2020	Humber	316,914	49,051,543	2.0
2019	Highland Creek	332,519	36,542,620	9.1
2020	Highland Creek	99,077	33,729,078	9.8
2019	North Toronto	61,167	2,771,179	Nil
2020	North Toronto	65,323	2,780,068	Nil

Reference: Wastewater Treatment Plants & Reports – City of Toronto

Energy Saving Programs

Toronto Water has implemented many programs to reduce energy consumption.

In Toronto, it is mandatory for all property owners to have a water meter installed on any pipe that delivers water into the building. In 2015, Toronto Water completed a capital project to install automated water meters in every home and business. The new meters send water use information directly to the City for billing and administration, eliminate the need for property owners or City staff to take manual readings, and provide a more accurate, fair and efficient way to administer water use in Toronto.

The financial benefits to the City of approximately $32.8 million per year (i.e. $27.8 million in revenue recovery and $5 million in operating savings) were achieved by 2016. A benefit associated with being able to monitor consumption levels on a property-by-property basis is that it will assist in leak detection to assist in asset management.

Toronto Water treatment plants are utilizing solar panels and battery energy storage to reduce plant operating costs. City Council Decision IE14.3 on July 9, 2020; 'Amendment to Purchase Order No. 6047271 for Engineering Design Services at the Island Water Treatment Plant' is one example. Agenda Item History - 2020.IE14.3 (toronto.ca)

This system is integrated with the Plant's electrical supply, to reduce overall energy costs by about 50%. This is expected to reduce electricity costs by an estimated $480,000 per year, representing a payback period of 13 years.

Toronto Water has a custom made application to track its Key Performance Indicators (KPIs) called "Performance Analytics and Information Reporting System" (PAIRS). This application tracks three (3) KPIs related to electrical energy consumption.

Overall electrical consumption for Toronto Water is measured against volume of water produced and volume of water treated. Based on historical trends the target for this KPI is 645 kWh/ML and any results below this rate means Toronto Water has met or exceeded the efficiency target, whereas values above 645 kWh/ML mean the target has not been met.

Table 2.6-10: Toronto Water Overall Electrical Energy Consumption

Key Performance Indicator (KPI)	2019	2020
kWh/ ML	614.65	640.84
kWh	506,638,173	517,620,795
Volume of Water produced (ML)	438,487	438,376
Volume of Wastewater treated (ML)	385,789	369,352
Total Volume (ML)	824,276	807,728
Reference: Toronto Water Process and Billing Data		

Toronto Water provides annual energy consumption data to the City's Environment and Energy Division who in turn report to the Ontario Ministry of Energy as required by the Ontario *Green Energy Act* (GEA), Regulation 397/11.

2.6.5. Climate Change Adaptation and Mitigation Strategies

Addressing vulnerabilities caused by climate change is integral to City Asset Management Policy. This includes incorporating climate change adaptation and mitigation strategies in infrastructure projects. This has been accomplished by building partnerships with the private sector and other levels of government, reducing emissions to the environment, energy conservation and demand management, promoting energy security and supply, and increasing resilience to extreme weather. **Actions include:**

- Facility energy efficiency initiatives (lighting, HVAC)
- Utilization of plant methane to produce energy that achieves natural gas offset
- A Wastewater Energy Transfer project (Agenda Item History - 2020.MM24.20 (toronto.ca)) which will capture thermal energy emanating from sewer infrastructure to displace natural gas use in buildings and therefore significantly reduce Greenhouse Gas emissions. The City's main role is to provide access to the sewer infrastructure with the private energy company designing, financing, constructing, owning and operating the energy system, largely at its own risk. The City will realize net-new revenue in the form of an energy transfer fee from 2022 to 2052.
- Peak flow management initiatives at the Humber and Ashbridges Bay wastewater treatment plants.
- The Basement Flooding Protection Program to address flooding up to 100-year storm event.
- Factoring the variable level of Lake Ontario into the design of pumping stations.
- Setting design of sewers infrastructure to reduce basement flooding during extreme wet weather events, when warranted.

The climate variables of concern in managing water infrastructure include i) extreme precipitation, ii) extreme heat, iii) extreme cold (freezing temperatures), iv) drought, v) snowfall, vi) freeze-thaw cycles, and vii) high winds. Seasonality is a concern, along with combinational effects such as extreme rainfall coinciding with the winter season, extreme rainfall followed by freeze-thaw conditions, and heavy snowfall followed by above zero temperatures.

Toronto Water has engaged the services of a consultant to undertake a pilot project with 4 other municipalities and regions within the Greater Toronto Area to study the impact of climate on its sewage and water infrastructure and to recommend further mitigation strategies. The recommendations will be available in 2021.

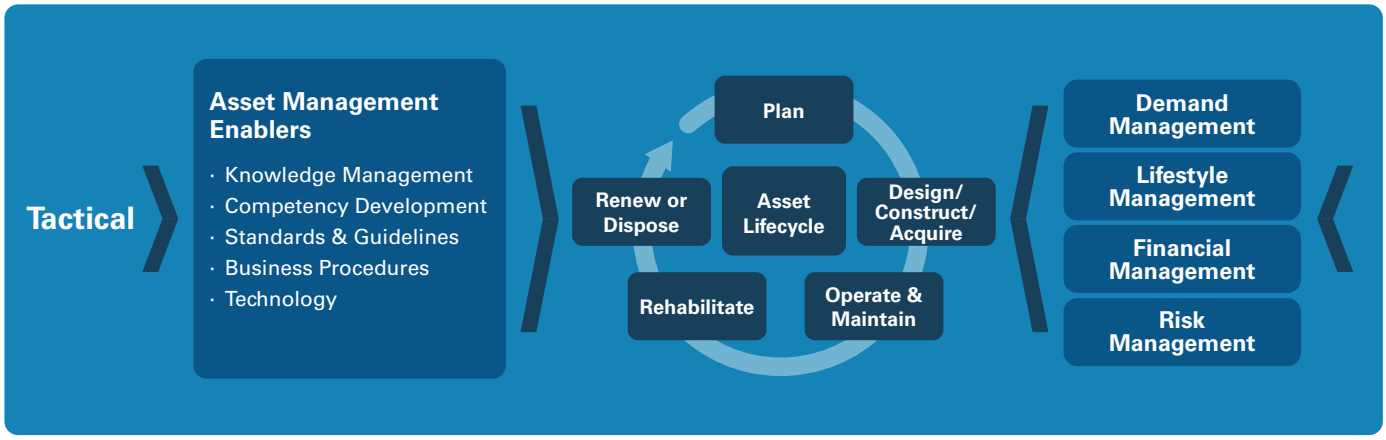
2.7.

LIFECYCLE ACTIVITIES AND RISK

2.7.1. Lifecycle Activities

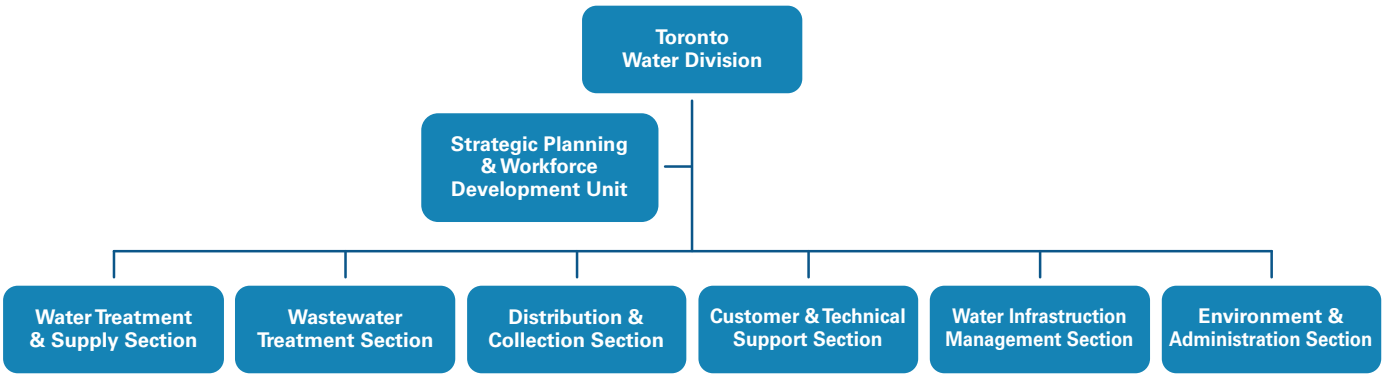
Toronto Water is organizationally structured to undertake asset management activities in accordance with the City's asset management framework of tactical elements to target and sustain defined levels of service, mitigate risk, achieve the lowest cost of asset ownership in compliance to regulatory requirements.

Figure 2.7-1: City of Toronto Asset Management Policy Framework – Tactical Element



While a number of key tactical elements span across multiple sections of Toronto Water, knowledge management is overseen by Water Infrastructure Management, competency development is overseen by Strategic Planning and Workforce Development, standards and guidelines are overseen by Environment & Administration and technology is overseen by Customer and Technical Support. Three sections oversee operations: Water Treatment & Supply, Wastewater Treatment, and Distribution and Collection.

Figure 2.7-2: Toronto Water Organizational Structure



The key phases of asset lifecycle management include:

- Planning
- Designing/Construction/Acquisition
- Operations and Maintenance
- Rehabilitation
- Renewal or Disposal

During the planning phase, infrastructure requirements are determined based on an evaluation of existing assets and services provided. These on-going evaluations, undertaken through modelling, studies and data analysis takes into consideration growth forecasts, service demands including climate resilience, and regulatory compliance, health and safety, and asset condition and performance. The output of these evaluations range from recommendations to adjust operations and maintenance to capital improvement projects that are further evaluated for cost-effectiveness, prioritized and coordinated as part of the capital planning process.

The design, construction and acquisition phase is guided by government and industry standards for water, wastewater and stormwater infrastructure services such as the Ministry of the Environment, Conservation and Parks (MECP) Design Guidelines for Drinking Water Systems and for Sewage Works and the City has developed a design criteria for sewers and watermains to augment those guidelines. Project schedules and impact are communicated directly to the public and as part of the annual budget planning process. The delivery of capital projects proceed through a competitive bidding process, are inspected for compliance throughout construction, are assessed for approval at completion and typically include a two-year warranty period.

Once commissioned, infrastructure moves to the operations and maintenance phase. Toronto Water's infrastructure operates 24 hours a day, seven days a week. Maintenance encompasses both planned maintenance and repairs in response to breakdowns. Maintenance activities are incurred under the operating budget and tracked within a works management system, they can be preventive and predictive activities to avoid failures or corrective activities that repair failures over the lifespan of an asset. Generally, preventive maintenance activities are the lowest cost alternative undertaken to reduce downtime, minimize emergency repair costs and prolong the life expectancy of infrastructure.

Infrastructure rehabilitation is undertaken as a preventive measure to extend the useful life of infrastructure as its condition or performance starts to deteriorate over time. Rehabilitation activities can encompass refurbishment (e.g. tunnel refurbishment) or lining of infrastructure to maintain or extend its life cycle and are funded through the capital budget. The purpose of rehabilitation is to cost-effectively improve the condition of infrastructure thereby extending its useful life. This option is more cost effective that running an asset to failure and replacing it.

The last phase of the asset lifecycle is the renewal or disposal of infrastructure. Typically, renewal encompasses the replacement of infrastructure like for like, but can include updates for efficiency or to meeting higher service levels. Costs for asset replacement can exceed original construction costs due to site constraints or conflicts, and market conditions.

Details of maintenance activities are listed within the Appendix. The following summarizes life cycle activities across the major components of each asset category.

Water Assets

1. Linear, Distribution Watermains

The City has 6093 km of distribution watermain. The full lifecycle activities include repairing watermain breaks, flow and pressure tests, cathodic protection, leak detection studies, and condition-based maintenance (CBM). Condition assessments are prioritized based on material, design, age of pipe, and history of failure. Scheduled preventative maintenance programs include i) air valve maintenance, ii) scheduled inspection programs for leak detection, iii) 24-hour emergency response capability, iv) reactive maintenance in response to public phone, email, and internet reports and complaints, and v) SCADA diagnostic monitoring. This work is conducted under the operating budget, a detailed breakdown of applicable maintenance activities is provided in **Appendices 2A-1** and **2A-2**.

KANEW Analysis is a macro model tool Toronto Water uses to develop a long range pipe rehabilitation and replacement strategy. KANEW utilizes the City's historical inventory of watermain and estimated life span data and predicts the length of pipe in different categories needed to be rehabilitated or replaced on an annual basis. The most important criteria for defining the types of watermains are break history, age, material, diameter, and bedding quality. The City prioritizes the rehabilitation and/ or replacement of cast iron pipe.

2. Linear, Transmission Watermains

The City has 627 km of transmission watermain. The full lifecycle activities rely on leak detection studies, exercising valves, undertaking condition assessments and rehabilitation of pipes. Condition assessments utilizing different technologies are prioritized based on material, design, age of pipe, and history of failure.

The risks associated with lifecycle activities include meeting contractual obligations with the Region of York, and customer service obligations to provide safe drinking water and process water for commercial uses and for the public.

Consultants are retained to perform hydraulic studies to identify and prioritize the design and construction of future transmission watermains to meet obligations under the Joint Optimization Study with the Region of York.

Leaks on the continuously welded steel concrete encased watermains can occur at valve chambers. These valves are inspected, cleaned, exercised, lubricated, and have scheduled repairs, for which part of the system will need to be temporarily taken out of service. This work is conducted under the operating budget.

3. Facility - Water Treatment Plants

The City of Toronto operates four (4) water treatment plants; R.C. Harris (in service 1941), R.L. Clark (in service 1968), Island (current plant in service 1977), and F.J. Horgan (in service 1979).

Water treatment plants consist of many processes required to treat water. The maintenance approach for the components of each are one of: 1) Reactive Maintenance that allows assets to run to failure (breakdown), 2) Preventative Maintenance or planned maintenance that provides for continuous operation and 3) Predictive Maintenance that predicts problems to increase asset reliability. A detailed breakdown of applicable maintenance activities is provided in **Appendix 2A-6**.

The full lifecycle activities are based on inspections to confirm regulatory compliance and individual assessments based on different components of the plant. Condition assessments are prioritized based on criticality of infrastructure, age of infrastructure, and history of failure. Risk assessment is based on a risk matrix developed by Toronto Water staff. Investment into the water treatment plants is also guided by the Energy Optimization Plan as well as a Water Quality Master Plan that has assessed the risk to water from a regulatory, operational, quality and growth perspective.

Additional risks considered include meeting contractual obligations with the Region of York and Enwave for its Deep Lake Water Cooling project, fire protection obligations (pressure and flow), and customer service obligations in order to collect revenue under the water rate.

Consultants are retained to perform hydraulic studies (which may include the expansion of a water treatment plant such as for the Horgan WTP completed in 2009), and to complete condition assessment reports.

4. Facility – Water Storage Facilities - Reservoirs and Elevated Tanks

Toronto Water maintains fifteen (15) water storage facilities. The full lifecycle activities follow a 5 to 10 year cycle of draining, cleaning and inspection, and then are supported by being a Facility Condition Assessment Program (FCAP) project. The process is driven by AWWA standards.

The risks associated with the lifecycle activities include meeting contractual obligations with the Region of York, and customer service obligations.

Maintenance activities include reactive, preventative, and predictive approaches because each facility includes mechanical subcomponents to pump, store, and drain the water based on demand. A detailed breakdown of applicable maintenance activities is provided in **Appendix 2A-6**.

Proper inspection and periodic maintenance of reservoirs and tanks is required to ensure the storage facility's water quality integrity. This includes inspection for structural, mechanical and cleanliness condition of the storage facility, noting all the maintenance and repairs requiring attention. Maintenance includes cleaning the basin, inlet/outlet pits and pipes, test sample lines and all other required repairs. Reservoirs must be isolated, dewatered, cleaned, repaired if necessary and disinfected before returning to service.

5. Facility - Pumping Stations

Toronto Water maintains eighteen (18) water pumping stations. The stations are inspected regularly to ensure adequate operational performance. A detailed breakdown of applicable maintenance activities is provided in **Appendix A-6**.

For each pumping station performance and efficiency reports are generated annually. Recommendations of these reports are used to determine whether refurbishment or replacement of the pumping station component are required. The electrical system (including switch gear and transformers) is assessed independently through separate studies. System sustainability studies are now completed as an outcome of the 2003 blackout event, which resulted in the installation of additional generators to improve system reliability.

Wastewater Assets

6. Linear - Local Sanitary Sewers

The City has about 5,000 km of local sanitary and combined sewers including sanitary, storm and combined sewers. Every year the City conducts over 700 km of sewer CCTV survey and condition assessment following the NASSCO industrial standard. CCTV survey planning is primarily based on coordination with other capital programs (such as road and watermain) as well as sewer criticality.

There are two CCTV inspection programs; On-Demand and Planned.

On-Demand CCTV inspection operates on an as-needed basis to address Operation and Maintenance issues such as sewer blockages, sewer collapses, etc. On average, approximately 50 km of sewers are inspected annually.

Planned CCTV inspection is used to determine sewer structural condition to develop capital relining or replacement programs. About 700 km of local sewers are CCTV inspected annually. This inspection rate is sufficient to CCTV local sewers at least once every 25 years. When developing multi-year renewal programs, CCTV inspections used must be within 7 years.

The timeframe to identify and complete sewer replacements in the state of good repair approach requires 5-6 years involving design, scheduling and tendering of projects. Sewer rehabilitation (such as lining) usually takes 3-4 years. If CCTV inspection reveals that a sewer requires emergency repair or replacement, it will be dealt with through an emergency replacement approach rather than the State-of-Good-Repair planning process.

The risks associated with the full lifecycle activities include, asset management risks in not performing the necessary maintenance needed to meet the minimum level of service during the lifespan of the asset includes i) optimizing and prioritizing repairs and refurbishments, ii) delays and budget constraints, iii) service interruptions, iv) inspection of sewer watercourse crossings for which stream erosion can expose the sewer pipe over time, and v) not identifying sewage capacity issues in advance, which could lead to spills and sewer backups.

In 2016, Toronto Water implemented an Acoustic Pipe Inspection program, which pre-determines whether a particular portion of the sewer needs to be flushed. This process has reduced the number of unnecessary cleanings and has redirected resources elsewhere for proactive system maintenance. This work is conducted under the operating budget. A detailed breakdown of applicable maintenance activities is provided in **Appendices 2A-1**, **2A-3**, **2A-4**.

7. Linear - Trunk Sewers

The City has about 400 km of trunk sewers including sanitary, storm and combined trunk sewers. Every year the City conducts over 40 km of sewer CCTV survey and condition assessment following the NASSCO industrial standard.

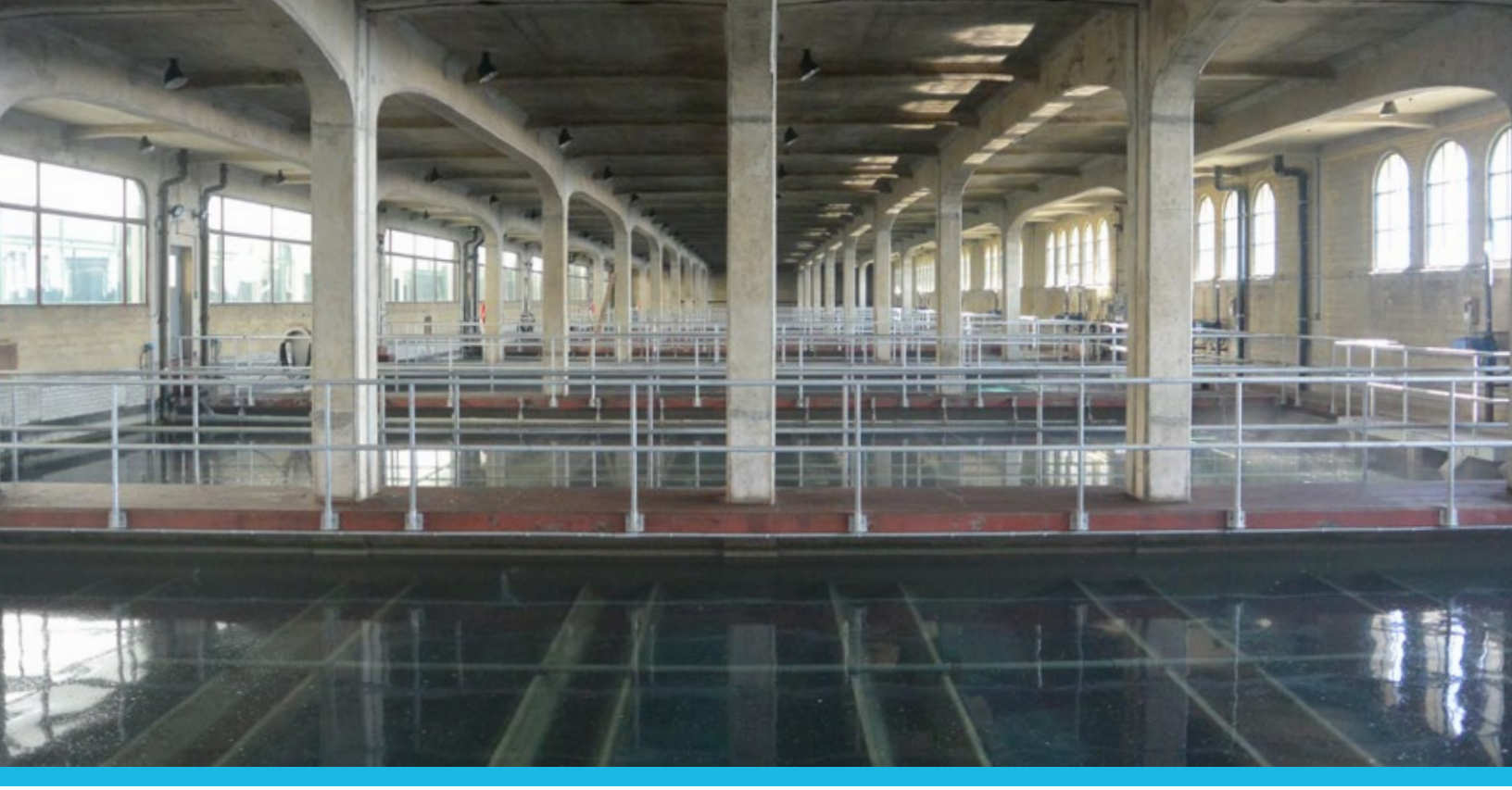
Trunk sewers are inspected every ten (10) years or less, depending on the condition of the last inspection. If a specific trunk sewer is rated as being in poor condition, it will be inspected more frequently until work to improve the condition is completed. Access chambers are inspected on an 18 month cycle, for health and safety purposes and operational access requirements. Gates and weirs are mechanically operated devices and are inspected at least quarterly, or more frequently for operational readiness, health and safety concerns, and to address structural issues.

Inspections and preventative maintenance activities include; the removal of blockages such as fallen brick using grappling hooks and/ or flushing the sewer. Sewer cleaning is done prior to bypassing, cleaning and lining. It has been found that there is no grease build-ups in the trunk sewer system but there can be grease in the connecting sewers that discharge to the trunk. There have been only a few emergency repairs associated with the trunk sewer system. A detailed breakdown of applicable maintenance activities is provided in **Appendices 2A-1**, **2A-3**, **2A-4**.

Spot repairs of cracked or damaged sewer pipe may include parging, sleeve methods, and installing short sections of liner. Spot excavation can also be employed to seal joints from the outside of the pipe using injection grouting.

All trunk sewers are modelled to identify whether there are any pinch points in the wastewater collection system. In addition, flow monitoring is done using smart cover monitors.

The risks associated with lifecycle activities include not performing the necessary maintenance needed to meet the minimum level of service during the lifespan of the asset including i) optimizing and prioritizing repairs and refurbishments, ii) delays and budget constraints, iii) service interruptions, iv) inspection of sewer watercourse crossings for which stream erosion can expose the sewer pipe over time, and v) not identifying sewage capacity issues in advance, which could lead to spills and sewer backups.



8. Facilities - Wastewater Treatment Plants

The City of Toronto operates four (4) wastewater treatment plants; ABTP (in service 1917), NTTP (in service 1929), HCTP (in service 1956) and HTP (in service 1960). These assets have multiple processes and components based on the operation of each plant. The maintenance activities undertaken are summarized in annual reports and within **Appendix 2A-6**.

Maintenance approaches include; 1) Reactive Maintenance that allows assets to run to failure (breakdown), 2) Preventative Maintenance or planned maintenance that supports continuous operation and 3) Predictive Maintenance that predicts problems to increase asset reliability.

Condition assessments are prioritized based on criticality of infrastructure, age of infrastructure, and history of failure. Risk assessment is based on a risk matrix developed by Toronto Water staff. Rehabilitation at wastewater treatment plants typically encompasses repairs to structures within the facility and replacement of parts within large equipment.

9. Facilities - Sanitary Pumping Stations

Toronto Water maintains seventy-five (75) sanitary or combined sewer pumping stations. The full lifecycle activities for these sanitary pumping stations rely on condition-based maintenance (CBM). The condition of the asset is monitored to determine when maintenance needs to be done. Pump tests are performed at each station at a frequency commensurate with the criticality of the station, based on population served. The pump test performance is compared with the manufacturer's design system-head curve and is used to determine when a pump needs to be refurbished or replaced. The lifecycle activities include regular inspection and summarizing the findings in associated reports. From the recommendations of these reports, improvements are made to the pumping stations funded by both the capital and operating budget. Maintenance activities include cleaning, exercising pumps, lubrication, and scheduled breakdown repairs. A detailed breakdown of applicable maintenance activities is provided in **Appendix 2A-6**.

10. Linear - Sanitary Forcemains

Toronto Water maintains approximately 60km of sanitary forcemains. Maintenance activities for a forcemain are almost entirely based on complaints received, through the City's 311 call centre system. Toronto Water work crews inspect i) the upstream pumping station and ii) the downstream maintenance hole at the point of discharge to the gravity system. Should a forcemain have an air valve at a high point, this will also be inspected and maintained. This inspection verifies that there is no blockage and there is a free-flowing condition.

Should there be a break in the pipe, a temporary bypass is installed and the forcemain is repaired. Toronto Water does have a program to twin forcemains based on a risk assessment, to provide redundancy in the system while simultaneously reducing risk to operations if there is a failure in the forcemain. The forcemain twinning program is captured within the capital budget.

Forcemain modelling can be done in conjunction with larger system-wide hydraulic studies. The break frequency will determine when there is a need to replace a forcemain. The maintenance activities are done in conjunction with pumping station inspections, checking the pipe at the station exit and discharge point.

11. Facilities - CSO Detention Facilities, WWF Projects

The City has eight (8) offline wastewater facilities designed to provide additional system capacity during periods of wet weather flow. The design capacity can vary from the Woodbine Park sanitary storage detention tank, designed to shave the peak flow in the Lakefront Interceptor, to the Western Beaches Storage Tunnel that is designed to serve a very large drainage area.

For the smaller facilities, the lifecycle activities include inspection and cleaning of sediment. For the larger facilities, lifecycle activities include the same, but also require much more rigorous inspection and maintenance requirements to comply with the terms and conditions on the Environmental Compliance Approval.

The risks associated with these lifecycle activities to maintain the current level of service is an increase of CSO, basement flooding, degradation of fish habitat, and not meeting the legislative requirements on the Environmental Compliance Approval.

Stormwater Assets

12. Linear - Local Storm Sewers

The City has about 5,000 km of storm sewers. Every year the City conducts over 700 km of sewer CCTV survey and condition assessment following NASSCO industrial standard. CCTV survey planning is primarily based on coordination with other capital programs (such as road and watermain) as well as sewer criticality.

The full lifecycle activities rely on a CCTV inspection program, where sewers are inspected as part of the local sewer inspection program. A detailed breakdown of applicable maintenance activities is provided in **Appendices 2A-1**, **2A-4**.

Inspections and preventative maintenance activities include; the removal of blockages such as fallen bricks located beneath a maintenance hole top, built-up debris that did not settle out at catch basins and/or flushing sewers.

The risks associated with the full lifecycle activities include: 1) health and safety risks during construction which include confined space and fall protection, and 2) asset management risks in not performing the necessary maintenance needed to meet the minimum level of service during the lifespan of the asset. The latter category includes: i) optimizing and prioritizing repairs and refurbishments, and ii) not identifying sewage capacity issues in advance, which could lead to surface ponding that could affect private property.

13. Linear - Trunk Storm Sewers

The City has about 400 km of trunk sewers including sanitary, storm and combined trunk sewers. Every year the City conducts over 40 km of sewer CCTV survey and condition assessment following the NASSCO industrial standard.

Trunk sewers are inspected every ten (10) years or less, depending on the condition of the last inspection. If a specific trunk sewer is rated as being in poor condition, it will be inspected more frequently until work to improve the condition is completed. Access chambers are inspected on an 18 month cycle, for health and safety purposes and operational access requirements. Gates and weirs are mechanically operated devices and are inspected at least quarterly, or more frequency for operational readiness, health and safety concerns, and to address structural issues.

Inspections and preventative maintenance activities include; the removal of blockages such as fallen brick using grappling hooks and/ or flushing the sewer. Sewer cleaning is done prior to bypassing, cleaning and lining. It has been found that there is no grease build-ups in the trunk sewer system but there can be grease in the connecting sewers that discharge to the trunk. There have been only a few emergency repairs associated with the trunk sewer system. A detailed breakdown of applicable maintenance activities is provided in **Appendices A-1**, **A-3**, **A-4**.

Spot repairs of cracked or damaged sewer pipe may include parging, sleeve methods, and installing short sections of liner. Spot excavation can also be employed to seal joints from the outside of the pipe using injection grouting.

All trunk sewers are modelled to identify whether there are any pinch points in the wastewater collection system. In addition, flow monitoring is done using smart cover monitors.

The risks associated with lifecycle activities include not performing the necessary maintenance needed to meet the minimum level of service during the lifespan of the asset including i) optimizing and prioritizing repairs and refurbishments, ii) delays and budget constraints, iii) service interruptions, iv) inspection of sewer watercourse crossings for which stream erosion can expose the sewer pipe over time, and v) not identifying sewage capacity issues in advance, which could lead to spills and sewer backups.

Storm trunk sewers crossing watercourses, have outfalls, intake and outlet screens. The Toronto and Region Conservation Authority (TRCA) carries-out inspections of pipe crossing valleys. There is a quarterly inspection for priority outfalls. There is also an annual inspection program, a monthly inspection program, and a program for after rainfall events. Inlets and outlets are checked to prevent back-up and flooding.

In its entirety, the program provides inspection for 1800 pipes. Hydraulic modelling is performed to identify pinch points in the system.

Toronto Water has a separate inspection program for corrugated steel pipe which have a shorter life span; these pipes are inspected at a greater frequency.

14. Facilities - Stormwater Management (SWM) Ponds

There are twenty-seven (27) SWM ponds that are considered to be Toronto Water core services.

The lifecycle activities include inspection, cleaning of sediment, and repair or replacement of any flow control equipment. The City has hired consultants to assist in prioritizing the work at stormwater management ponds. Condition assessment parameters include quantifying the remaining volume prior to cleaning, servicing the inlet, outlet, ponded area, and ponded block, the capacity of the receiving water body, aquatic biology, terrestrial fauna, erosion control, and structural condition of appurtenances.

The risks associated with the lifecycle activities include providing less protection against flooding during wet weather events, degrading of water quality at receiving water bodies, not protecting fish habitat, and erosion at receiving water courses.

15. Facilities - Pumping Stations

Toronto Water maintains twelve (12) stormwater pumping stations. The full lifecycle activities for these stormwater pumping stations are the same as that for sanitary pumping stations and rely on condition-based maintenance (CBM). The pumping stations typically include a detention storage chamber which requires inspection to ensure there is no build-up of sediment. These stations are inspected after every significant wet weather event. A detailed breakdown of applicable maintenance activities is provided in **Appendix A-6**.

The actual condition of the asset is monitored to determine when maintenance needs to be done. Pump tests are performed at each station at a frequency that commensurates with the criticality of the station, based on drainage area served. The pump test performance is compared with the manufacturer's design system-head curve. This is part of the risk assessment, and is used to determine when a pump needs to be replaced. Refurbishments are captured in condition assessment reports, for which a consultant is retained. In situations where there is a redesign of the road network and the pumping station requires a complete overhaul, a consultant is retained to perform a hydraulic study, do the pumping station design, and secure any necessary approvals for the project.

2.7.2. Risks Associated with Legislative Compliance

The requirement to maintain and keep assets in a state of good repair is based in provincial legislation (Sewage assets; Section 61 of the Ontario Water Resources, Drinking Water Assets; Section 11, Safe Drinking Water Act, MECP Procedure F-5-1 – Determination of Treatment Requirements for Municipal and Private

Sewage Works and MECP Procedure F-5-5 – Determination of Treatment Requirements for Municipal and Private Combined and Partially Separated Sewer Systems).

The Ashbridges Bay, Humber, and North Toronto Sewage Treatment Plants receive combined sewage. The Environmental Compliance Approvals issued by the MECP include conditions to control the frequency and volume of CSO discharges and plant bypass events. The City is currently implementing its Wet Weather Flow Master Plan (WWFMP) as a service improvement measure, which aims to reduce and eliminate the adverse impacts of storm water runoff and CSO discharges associated with wet weather events. It is expected that the on-going implementation of capital projects related to the City's WWFMP will eliminate CSO discharges and ultimately improve plant effluent.

New developments must comply with City by-laws and the Toronto Municipal Code. toronto.ca/legdocs/bylaws/lawmcode.htm?1600370916927

Toronto Water reviews and coordinates a range of development approvals pertaining to water and sewer servicing, and Toronto Water related by-law and regulatory approvals. These reviews assess the existing service potential, the risk to existing sewer and watermain infrastructure, and the need to upgrade municipal sewer and watermain servicing and capacity.

By-law related approvals include assessing the risks for granting Storm Connection Exemptions and accepting Reverse Slope Driveway applications.

Below-grade garages for residential buildings are prohibited by Zoning By-law 569-2013. Exemption applications can be submitted through Minor Variance or Re-zoning applications. A Toronto Water technical review is required, if:

1. The Committee of Adjustment's Notice of Decision or an Ontario Municipal Board decision requires a technical review and approval by Toronto Water.

2. A technical review is requested through a re-zoning application approval process.

3. The application proposes a storm connection to the City's sewer system to discharge water from the reverse slope driveway's trench drain.

The review would identify whether i) there is a risk of surface flooding under extreme storm events, ii) all measures to minimize surface flows on the driveway have been implemented, iii) the reverse slope cannot begin before the street line, and iv) back flow from the storm sewer system has been prevented.

Sewer Use By-law 681-11 Sewer Connections (Toronto Municipal Code, Chapter 681 Sewers, Section 681-11R (2) and (3)) prohibits direct connections of private storm sewers to the storm sewer unless there is no practical alternative means of drainage available. toronto.ca/legdocs/municode/1184_681.pdf

When an exemption is granted, the location is recorded. The information is considered when assessing of the resiliency of the municipal stormwater management system and impact on lifecycle costs, specifically for projects in areas where improvements have-been-made and will-be-made, to guard against basement flooding as part of Toronto Water asset management planning.

2.7.3. Risks Associated with Health and Safety Compliance

Toronto Water has an Environmental, Health, and Safety (EHS) Emergency Preparedness team that conducts an annual Risk Assessment for the division and focuses on risk identification. The elements of the Ontario Drinking Water Quality Management Standard (DWQMS) applies to Toronto Water assets and sets out a province-wide framework for the operating authority and the owner of a drinking water system to develop a QMS that is relevant and appropriate for the system. Compliance with the DWQMS is a requirement for Toronto Water to maintain its Municipal Drinking Water Licence (N0. 010-101). Risk assessment is addressed in Element No. 7 of this document. Element No. 8 addresses Risk assessment and outcomes. Element No. 14 is for the review and provision of infrastructure.
ontario.ca/page/ontarios-drinking-water-quality-management-standard-pocket-guide

2.7.4. Risks Associated with Lifecycle Management

Lifecycle Management considers both the consequences of an asset not meeting its required Level of Service and the likelihood of asset failure. It also includes ensuring there is a factor of safety by providing a level of redundancy in the system as a contingency plan.

ISO: 31000 is an international standard published in 2009 that provides principles and guidelines for effective risk management. The Canadian Standards Association (CSA) published a guide for 'CAN/CSA-ISO 31000, Risk management – Principles and guidelines' in 2011. In 2012, the Ministry of Solicitor General posted 'Hazard Identification and Risk Assessment (HIRA) for the Province of Ontario'. The procedure includes, 1) Identifying risks, problems, strengths, 2) Determining treatment options, 3) Collaborative planning, 4) Implementing care, and 5) a Monitor and review approach. This process has been adopted by the City for its Asset Management Plan.

The consequences of failure as per HIRA have four levels (C1 – Insignificant, C2 – Minor, C3 – Moderate, and C4 – Major) and four corresponding measures (Economic, Social, Environmental, and Service Delivery).

The City retains consultants to complete Facility Condition Assessment programs for its major vertical (Facility) infrastructure. This includes wastewater treatment plants, water treatment plants and reservoirs. These assignments require the review of specific asset components, a comparison of the asset age

with typical service life, an assessment of the assets' current condition, providing recommendations for improvements, and prioritizing the recommended improvements.

Non-destructive concrete testing activities include i) Striking Hammer test on concrete surfaces, ii) Chemical Indicator test on concrete at various depths, iii) Schmidt Hammer test to measure concrete hardness, iv) Cover test to detect the depth of concrete over underlying reinforcement, and v) Ultrasonic Pundit test to ultrasonically detect the depth of a crack within a concrete member.

Video Camera Inspection is used to inspect piping and perform leak detection tests. Acoustical noise signals, are conducted on yard piping to pinpoint possible leaks along a pipeline.

Dive vessel and dive crew inspections are conducted at water treatment plant intakes; from the intake, along the pipeline all the way to the shore. The assessment includes checking the condition of butterfly valves and debris built-up at the valve, verification of chlorine mixing, the amount of live mussel growth and bio-growth on pipeline walls.

2.7.5. Lifecycle Management Risks – Redundancy and Condition Assessment

Water Supply Assets

The watermain distribution and transmission systems are designed with redundancy in order to lessen risk and provide the necessary Community Level of Service. Small diameter watermains are looped to minimize stagnation, transmission mains are twinned where feasible to provide an additional factor of safety. Multiple elevated tanks and reservoirs buffer the transmission system, multiple treatment plants supply the system and pressure districts are designed to permit flow across boundaries when required. This planned redundancy provides a backup to reduce the consequences of a system failure and also permits offline condition assessments to be performed.

The Toronto-York "Joint Optimization Study" identified future water supply infrastructure requirements for Toronto and York Region to amend the 1998 Water Supply Agreement. Phase I of the study was completed in 2004 and identified the need to replace and twin parts of the transmission watermain system, and expand the capacity of reservoirs and treatment plants. The study was updated in 2012 and most recently in 2016. In addition, a Toronto-only Optimization Study (TOS) was completed in 2020 which had limited York Region participation.

The Transmission Operations Optimizer Study (March 2005) was a joint study completed for the City of Toronto and York Region to investigate the development and implementation of an Optimizer/Simulator that would automatically determine control strategies for the water trunk transmission system. The assets recommended by this study were put in service in November 2015 and it has been found that they have successfully reduced energy costs.

The System Sustainability Study – During a City and Region Wide Area Power Failure (September 2008) was conducted to identify the emergency preparedness for a similar situation as the August 2003 blackout.

The goal was to map-out a high level emergency preparedness plan to be implemented in the event of a major power failure. During the 2003 blackout, it was found that the system encountered difficulty in maintaining average day demand during a power outage.

Water Treatment Plants

The City has four (4) Water Treatment Plants which allows system flexibility for a plant to be taken off-line for inspections, maintenance, rehabilitation or upgrades during non-peak periods of the year for water demand. Each plant is designed such that it can be operated while taking pre-treatment modules (mixing, flocculation, and sedimentation tanks), granular media filters, backwash pumps and major pumping units out of service. This design permits regular and routine maintenance as well as rehabilitation and upgrades without affecting treatment plant operations. There is also emergency backup power supply at two of the four facilities, with further stand-by power to be implemented as part of the System Sustainability Program.

Process equipment must also meet a level of redundancy to meet legislative requirements, operating objectives, and the functionality of the associated equipment. Firm capacity is provided for major processes and equipment whereby a minimum of one process unit can be offline for maintenance or repair, while meeting plant rated capacity and complying with the Drinking Water Works Permit, as well as other regulations and water quality objectives.

Linear Wastewater Assets

Redundancy for wastewater assets is considered when addressing the management of wet weather flows. Wastewater systems are retrofitted with detention tanks to shave the peak flow to an amount that can be accommodated in the conveyance system. They also provide additional capacity for excess infiltration and inflow.

The asset condition is assessed based on its physical condition, the ability to achieve the design objectives, risk of asset failure, and the consequences of that failure. An asset shows signs of deterioration when it performs at a lower level than that for what it was originally designed. This deterioration may only require repair or replacement to individual components. However, when these maintenance costs exceed acceptable amounts, the entire asset may require replacement.

Linear Stormwater Assets

Stormwater works are designed to follow the principle of maintaining the natural hydrologic cycle to the greatest possible extent with 1) lot level controls, 2) conveyance controls, and 3) end-of-pipe facilities. Non-structural solutions are always preferred to structural solutions when possible, which will reduce lifecycle maintenance costs of the City's stormwater management system. These facilities provide a benefit to both water quality and water quantity.

Redundancy for stormwater assets is more appropriately described in terms of a level of protection to guard against flooding. When flooding occurs, the consequences will affect both people and property. There will

be a degradation to the physical structures and to water quality, erosion, a risk of not meeting regulatory requirements and the required community level of service. All of which could create an unsafe environment.

The asset condition is assessed based on its physical condition, the ability to achieve the design objectives, risk of asset failure, and the consequences of that failure; similar to wastewater assets.

Pumping Stations and Forcemains

Wastewater pumping stations are continuously monitored to measure performance. Condition assessments are done based on historical data and maintenance records, which includes tracking the frequency of failure for all equipment components.

Scheduled preventative maintenance and condition-based maintenance is performed by both internal and external personnel. This work includes vibration monitoring, infrared imagery to measure equipment surface temperature, oil level analysis, etc. The risks associated with lifecycle activities are documented in Reliability-Centered Maintenance studies. Toronto Water pumping stations are designed with appropriate standby assets to mitigate the risk of equipment failure and power outages. This includes standby pumps and back-up generators.

Lifecycle activities to maintain the current level of service are scheduled based on the type of asset. This can vary between five (5) and twenty-five (25) years for equipment, instrumentation and plant at pumping stations. As an example, a pump impeller will need replacement more frequently than a pump, and structural repairs to the station will need to be performed far less frequently.

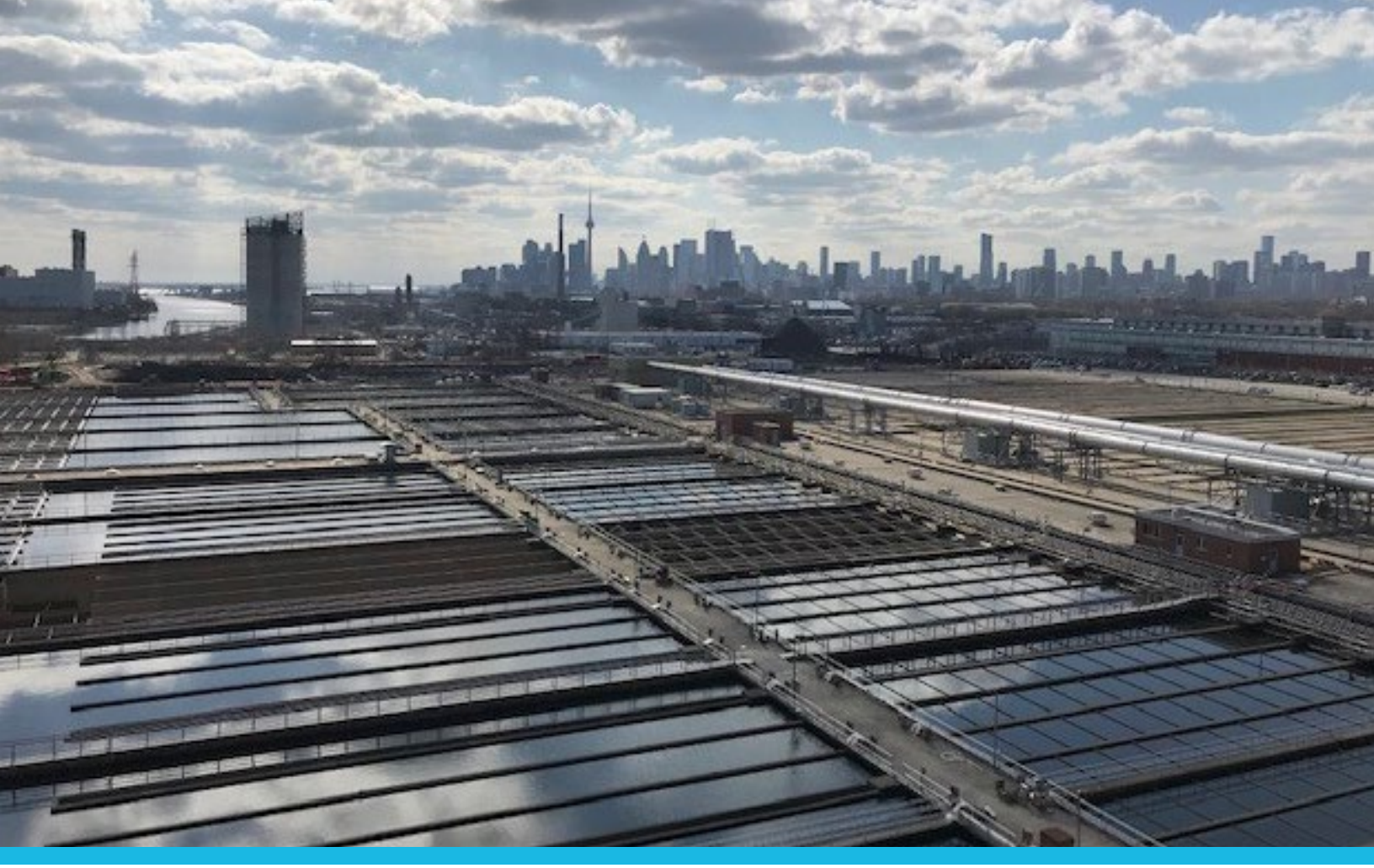
Forcemains will have a design service life exceeding fifty (50) years. Functionality is monitored based on the number of failures as well as an increase in the pipe's roughness as indicated in the forcemain's computed C-valve. A process and controls system (PCS) - SCADA system provides continuous monitoring of asset performance. Twinning of forcemains; one operating and one standby, provides redundancy in the system to mitigate risk for critical infrastructure.

Lifecycle activities to maintain the current level of service for forcemains and their appurtenances can range from five (5) to twenty-five (25 years). As an example, an air release valve or a check valve will have a shorter lifecycle than the forcemain itself. Continuous monitoring of the asset performance determines the end of the lifecycle, which is documented in the Toronto Water work management system. There is limited scheduled-preventative maintenance for forcemains due to the pipes being buried, having long lengths and typically not having intermediate access points. Maintenance activities are scheduled for valve chambers where available to inspect the equipment within the chamber.

Stormwater pumping stations follow the same lifecycle maintenance activities as for wastewater pumping stations. These facilities are typically lift stations and do not have forcemains of any significant length.

Wastewater Treatment Plants

Wastewater Treatment Plants are built with redundancy in their design to ensure that wastewater coming in to the facility can always be treated.



The facilities are designed with equipment to support a firm capacity for each process train, which is the number of units required to maintain the maximum rated flow through the facility at all times. Additionally, there will be spare units to cover equipment or process failures.

For example, at Ashbridges Bay Treatment Plant, there are eleven (11) aeration tanks; nine (9) to cover the firm capacity demand of 818 MLD secondary treatment flow, which is the capacity specified in the plant's Environmental Compliance Approval (ECA). The plant can have one (1) aeration tank down for major renovations, while another one can be down for shorter term breakdowns, and still have nine (9) tanks in service. To provide electrical distribution redundancy, the plant's electrical power distribution system has dual power feeds supplying power to each switchgear and motor control centre (MCC).

Wastewater Treatment Plant maintenance follows a condition-based approach that monitors the real-time condition of the asset to determine what maintenance needs to be performed. The maintenance procedures are obtained from manufacturer's recommendations, regulatory requirements, and condition-based strategies. Some of the condition-based technologies include oil sample analysis, vibration monitoring, infrared scanning, ultrasonic testing and observations.

For equipment replacement or repair, the particular asset condition is assessed and decisions are made based on when certain indicators show signs of decreasing performance or upcoming failure. This may include non-invasive measurements, visual inspection, reviewing performance data and scheduled test results. Equipment is replaced both at the individual asset level and also as part of larger capital projects; where a process is updated along with its equipment.

2.8.

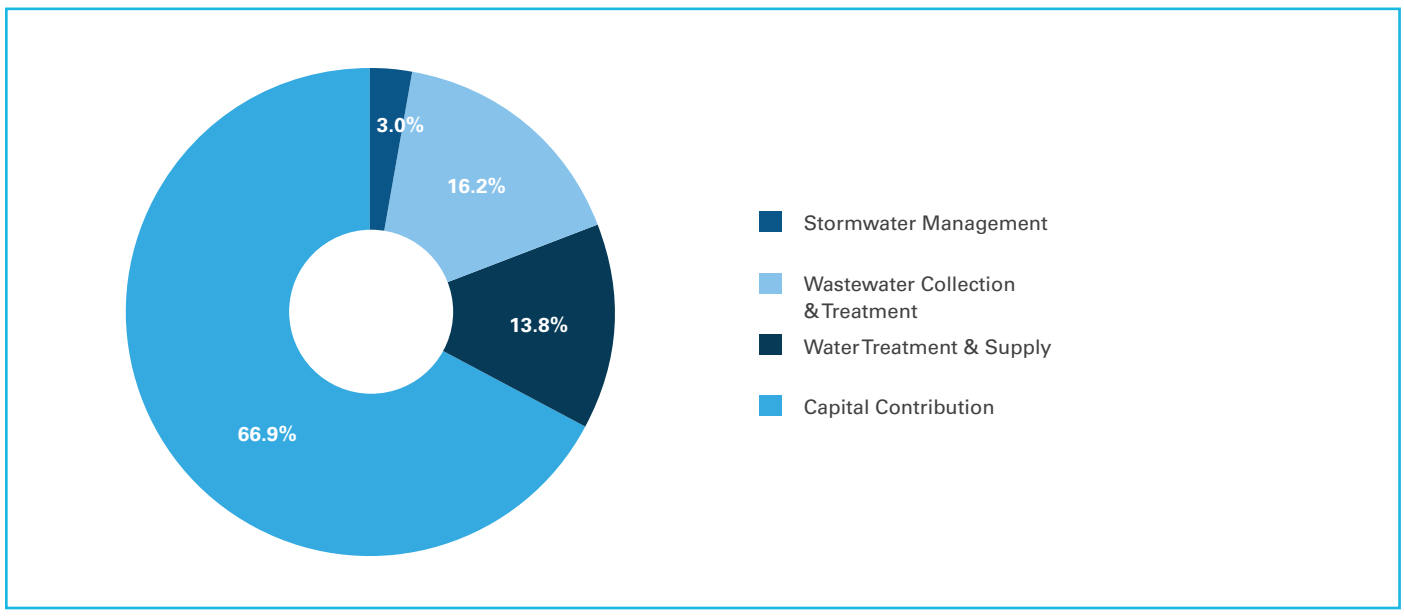
LIFECYCLE COSTS & RISKS

The budgeting process for the water, wastewater and stormwater program (the "Program") is a distinctly separate process from other tax supported public assets. The Program, which involves one the largest utilities in North America, is managed by Toronto Water Division and it operates 24 hours a day, seven days a week.

The 10-year Program is currently fully funded on a "pay-as-you-go" basis predominantly through a combined water and wastewater rate without any reliance on property taxes or borrowing/debenture financing, outlining the City's commitment of achieving sustainable water, wastewater and storm water systems by means of a rate strategy.

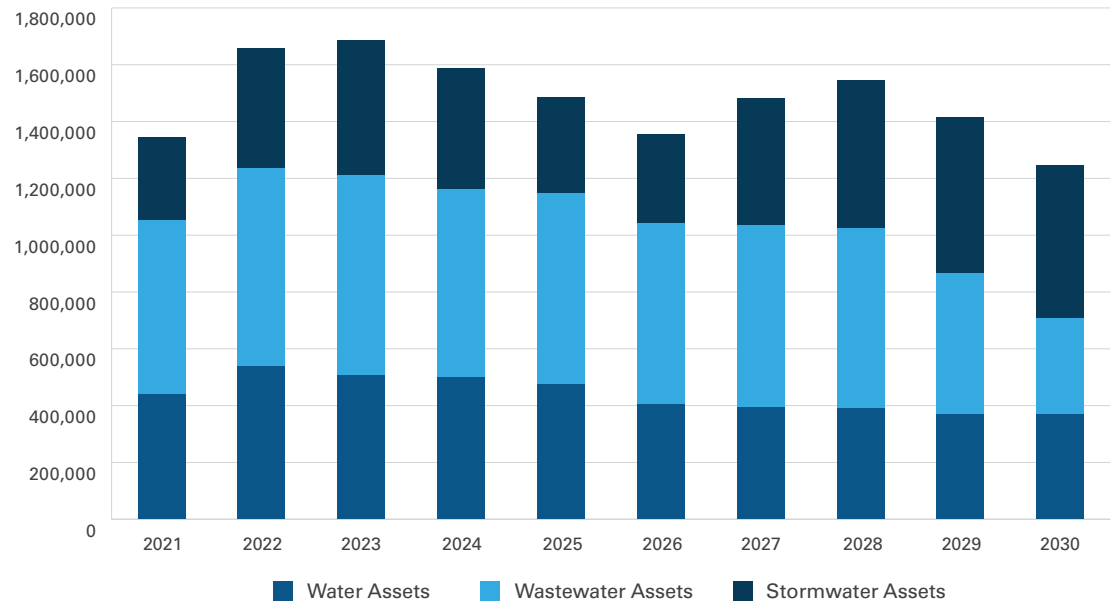
The chart shown in Figure 2.8-1 below illustrates Program's total 2021 budget of $1.415 billion. Of the total, $468.824 million are operating costs allocated between 3 services, Water Treatment and Supply, Wastewater Collection and Treatment, and Stormwater Management. The remaining $946.512 represents a contribution to capital financing reserves ("capital-from-current"), used to fund the current needs of Toronto Water's capital program.

Figure 2.8-1: 2021 Total Operating Budget by Service



The 10-Year Capital Plan (2021-2030) investment shown in **Figure 2.8-2** is estimated at $14.785 billion.

Figure 2.8-2: 2021-2030 Total Program Capital Budget By Core Asset Class

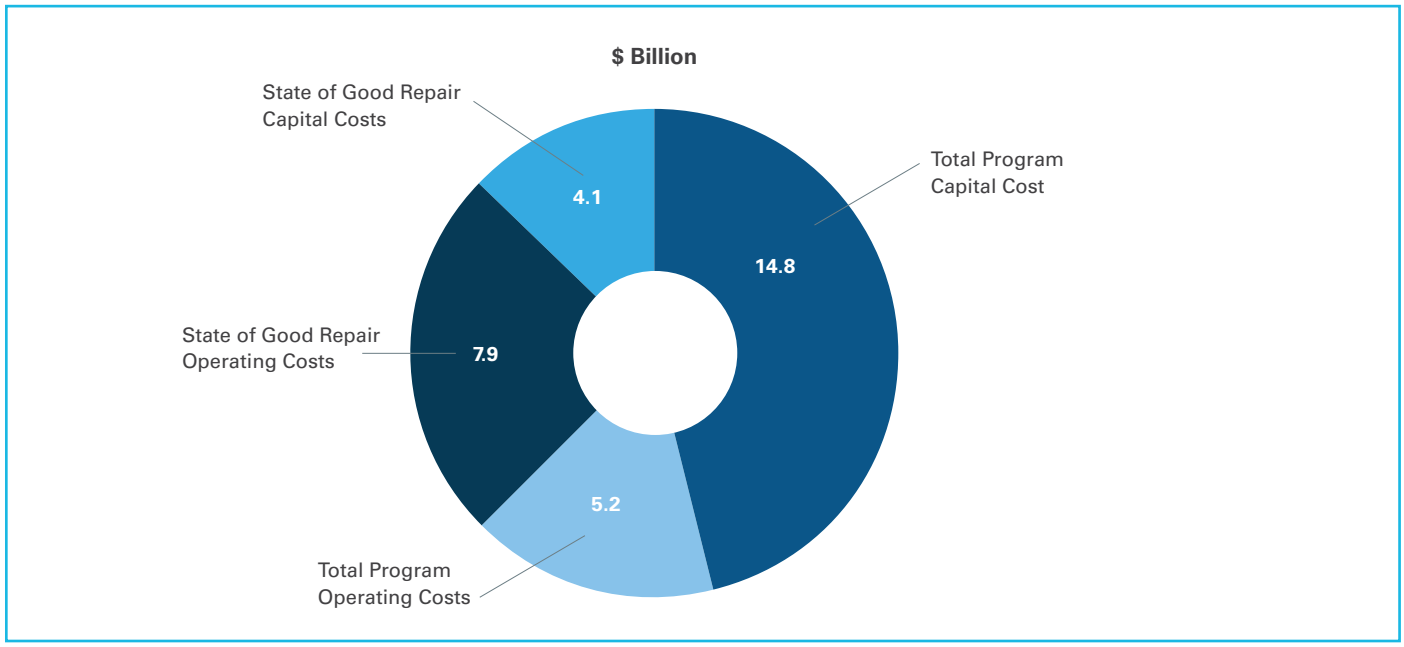


Approximately $7.905 billion is dedicated to maintain assets in the state-of-good-repair (SOGR) while addressing health and safety and legislated requirements needed to meet the current levels of service as described in **Section 2.6**. The lifecycle costs associated with those assets are further detailed in this section.

The remaining $6.880 billion consists of investments in (a) growth related capital projects over the next 10 years ($1.673 billion) that will address current service needs for the future increase in demand (detailed in **Section 2.9**), and (b) capital costs of the improved service levels ($5.207 billion) with a number of projects currently in the Environmental Impact Assessment phase, which will be the subject of the next reporting phase (July 2025) of the asset management regulation, requiring municipalities to report on assets needed to meet proposed/improved levels of service.

The lifecycle operating and capital costs to maintain existing core assets in the state-of-good repair over the next 10 years are estimated at $11.988 billion, compared to the Program's total lifecycle operating and capital costs of $19.984 billion as presented in **Figure 2.8-3**.

Figure 2.8-3: 2021-2030 Lifecycle Costs to Maintain Current Assets of Total Program Lifecycle Costs



2.8.1. Expenditure Forecast

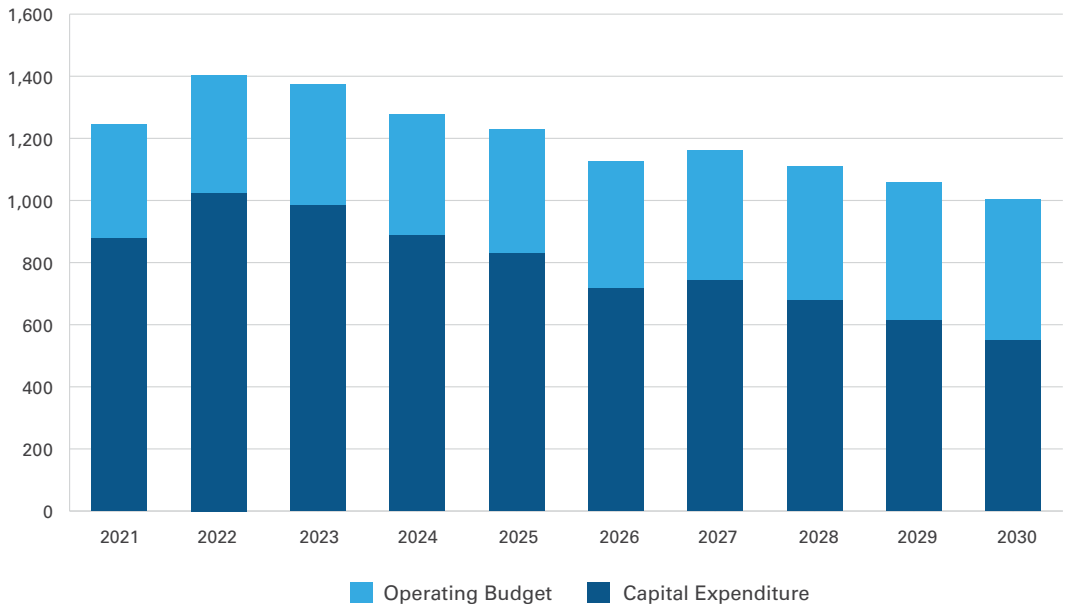
The expenditure forecast is based on the 2021 Approved Operating Budget and 2021-2030 Approved Capital Budget and Plan for Toronto Water. Further details can be found in the 2021 Program Summary for Toronto Water as provided below:
https://www.toronto.ca/wp-content/uploads/2021/04/96f5-TW-2021-Public-Book.pdf

Over the 2021-2030 period capital expenditures dedicated to maintain assets in the state of good repair while addressing health and safety and legislated requirements required to meet the current service levels are estimated at $7.905 billion.

Associated operating expenditures estimated at $369.111 million in 2021, are forecasted to increase beyond 2021 on average by approximately 2.5% annually, reflecting a continued commitment to try to identify additional savings and efficiencies.

The 10-year forecasted lifecycle costs for all core water, wastewater and stormwater assets required to support current service levels are shown in the **Figure 2.8-4**.

Figure 2.8-4: 2021-2030 Lifecycle Costs to Maintain Current Service Levels



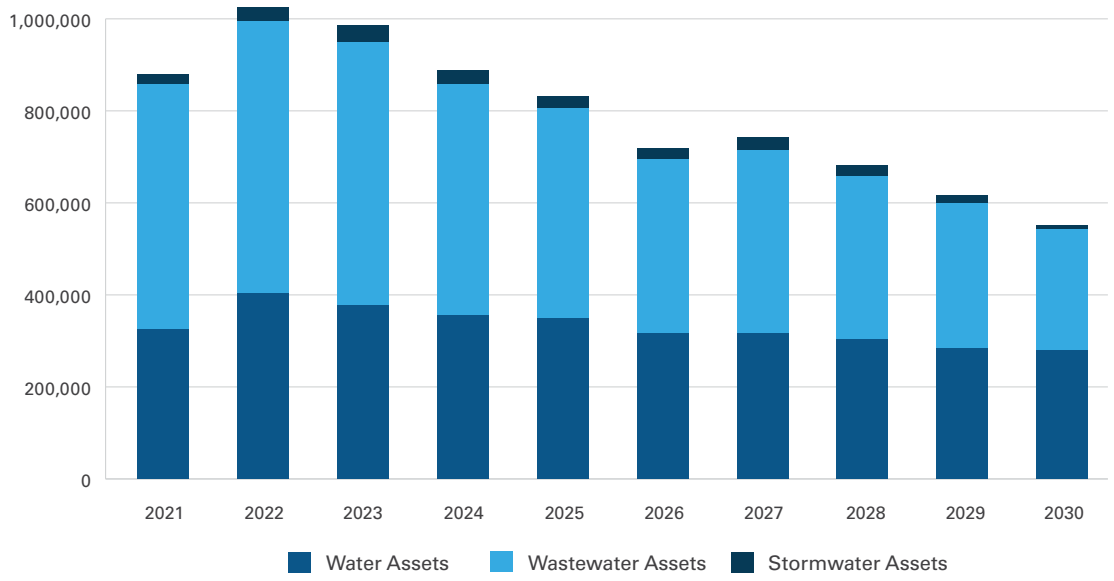
2.8.1.1. Capital Cost by Core Asset Category

The 10-year capital costs planned to maintain current service levels total $7.905 billion as detailed by core asset category in theTable **2.8-1** (**Figure 2.8-5**).

Table 2.8-1: 10-Year Capital Cost by Core Asset Category

$000	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Total
Water Assets	322,706	400,210	374,862	352,426	345,899	313,232	315,045	300,289	280,641	276,095	3,281,403
Wastewater Assets	534,155	591,606	573,782	502,662	457,823	379,058	396,494	355,724	315,453	263,786	4,370,541
Stormwater Assets	20,406	32,215	36,213	31,643	25,296	25,083	29,833	23,291	18,941	10,383	253,304
Total	**877,267**	**1,024,031**	**984,856**	**886,730**	**829,017**	**717,373**	**741,372**	**679,303**	**615,034**	**550,264**	**7,905,247**

Figure 2.8-5: 2021-2030 Capital Costs by Core Asset Category



Water infrastructure capital expenditure will require $3.281 billion or 42% of the total, mostly for watermain and water service replacement and rehabilitation.

Wastewater infrastructure spending is forecasted at $4.371 billion or 55% of the total expenditures, predominantly due to significant planned investments in the waste water treatment plants, as well as expenditures associated with rehabilitation and replacement of deteriorated sewers.

Total investment in stormwater infrastructure accounts for only 3% of the budget since the majority of stormwater projects represent service improvement projects which will be reported at a later date.

SOGR Backlog

Toronto Water's infrastructure is aging with an accumulated SOGR backlog estimated at $1.473 billion at the end of 2020, which includes both linear (watermains and sewers) and facility/plant infrastructure (water treatment plants, wastewater treatment plants, and pumping stations). This represents 5.1 % of the total replacement value of Toronto Water's assets, which at the end of 2020 are estimated to be $28.670 billion.

- Approximately 57 % or $0.842 billion of Toronto Water's infrastructure backlog is associated with aging linear watermain and sewer infrastructure. The 2021-2030 Budget and Capital Plan allocates a total of $4.429 billion to address deteriorated linear infrastructure.

- Approximately 43% or $0.630 billion of Toronto Water's infrastructure backlog is associated with the facilities backlog. The 2021-2030 Capital Budget and Plan allocates a further $2.421 billion for infrastructure renewal projects at water and wastewater treatment facilities. SOGR works at the water and wastewater facilities may include renewal of existing buildings, and process equipment and machinery, etc.

- The significant investment into Toronto Water's infrastructure included in the 10-Year Capital Plan will ensure continued and reliable service to residents, businesses and visitors, reducing the SOGR backlog to $132.304 million in 2030, effectively eliminating the backlog.

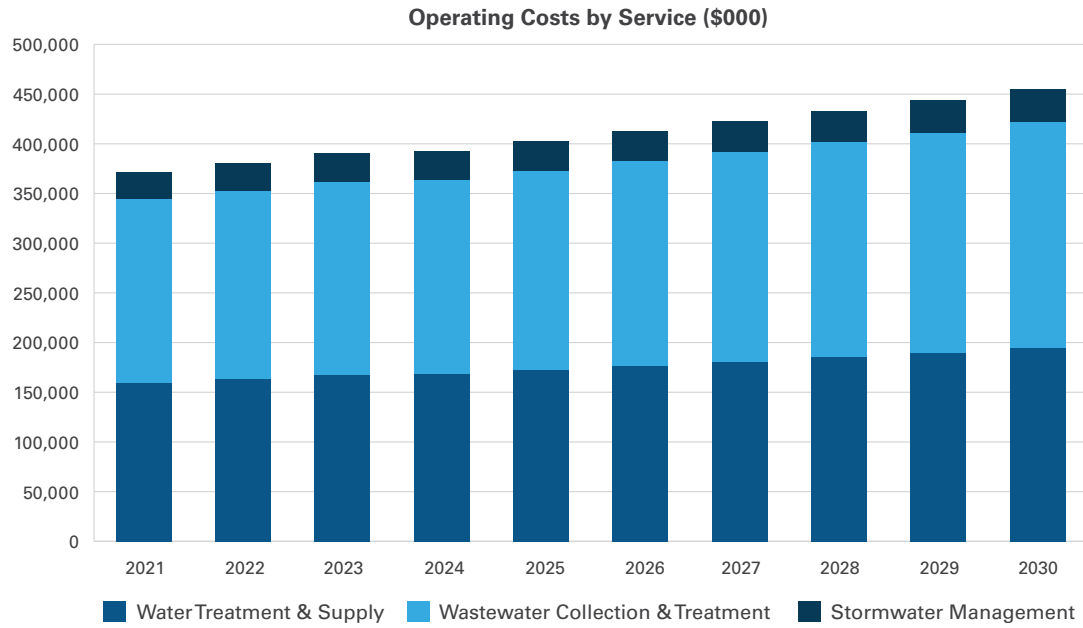
2.8.1.2. Operating Costs

Forecasted annual operating and maintenance costs by service are shown in the **Table 2.8-2** (**Figure 2.8-6**) below:

Table 2.8-2: Operating Costs by Service

$000	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Total
Water Treatment & Supply	156,897	160,819	164,840	165,956	170,105	174,358	178,717	183,185	187,764	192,458	3,281,403
Wastewater Collection & Treatment	185,309	189,942	194,690	195,575	200,465	205,476	210,613	215,878	221,275	226,807	4,370,541
Stormwater Management	26,905	27,578	28,268	28,974	29,699	30,441	31,202	31,982	32,782	33,601	253,304
Total	**369,111**	**378,339**	**387,798**	**390,506**	**400,268**	**410,275**	**420,532**	**431,045**	**441,821**	**452,867**	**7,905,247**

Figure 2.8-6: 2021-2030 Operating Costs by Service



- Costs presented above reflect costs of services provided by each group of core assets as included in Toronto Water's operating budget approved annually by Council, and projected in the financial Rate Model used for the rate setting purposes.

- Beyond the 2021 Approved Operating Budget, program operating expenditures are forecasted to increase on average by approximately 2.5% annually.

- In 2021, the Wastewater Collection and Treatment budget is the largest operating maintenance budget with 50% of the total, followed by the Water Treatment & Supply budget that accounts for 42%, and Stormwater Management budget allocation of about 8% of the total. The same relative trend will continue throughout the 10-Year period.

- Costs include direct costs of operating and maintaining assets (labour, materials, contracted services and equipment) based on the best available information from the existing financial systems. These costs represent approximately 79% of the total.

- The City of Toronto is presently going through a financial sustainability transformation program including budget and capital modernization, as well as financial systems transformation, intended to improve long-term capital investment strategies and provide a single source of financial information through streamlined processes and systems, including asset tracking, management and reporting data.

- The resulting information will be used to further inform asset management plans and to update maintenance costs for water, wastewater and stormwater assets.

2.8.2. Funding Lifecycle Costs

2.8.2.1 Revenues

Water and wastewater consumption rates and service fees are approved annually, based on the 10-year financial model (the "Rate Model") which considers projected water consumption, and it is premised upon the objective that the Program remains financially stable, with both operating and capital needs being met without excessive year-over year fluctuations in pricing over the long term. Further details are available in the 2021 Water and Wastewater Consumption Rates and Service Fees Report as referenced by the link below. toronto.ca/legdocs/mmis/2020/ex/bgrd/backgroundfile-158985.pdf

Total annual revenues in 2021 are expected to reach $1.415 billion and are forecasted to increase in the next 10 years as shown in the **Table 2.8.3**. Currently, the City of Toronto has approximately 489,260 (497,656 for 2020, 501,997 for 2019 – data from Revenue Services) metered water accounts. Customers are charged a combined water and wastewater service rate, which can be Block 1 rate (for the first 5,000 cubic meters consumed) or Block 2 rate (for rate customers that use over 5,000 m^3 per year). Most residential properties pay the Block 1 rate. Block 1 rate consumers account for 94% of consumption.

Revenues from the sale of water represent 91% of Toronto Water's annual revenues. The remaining 9% consists of other revenues including revenues from sale of water to the Region of York, treatment of waste from industrial clients, fees for new service connections and variety other services including private water discharge agreements.

Forecast shown in the **Table 2.8-3** is based on a planned 1.5% annual increase in combined water and waste water rate in 2021, followed by 3% annual increase from 2022-2030, while other revenues are forecasted to increase on average by approximately 2.5% annually.

Table 2.8-3: Operating Revenues

(In $000s)	2021 Budget	2022 Outlook	2023 Outlook	2024 Outlook	2025 Outlook	2026 Outlook	2027 Outlook	2028 Outlook	2029 Outlook	2030 Outlook
Sale of Water	1289,494	1,321,219	1,353,769	1,395,192	1,429,526	1,464,709	1,500,708	1,546,640	1,584,708	1,623,707
Other Revenues	125,842	128,989	132,213	128,532	131,745	135,039	138,414	141,875	145,422	149,057
Region of York Revenue	32,592	33,406	34,242	35,098	35,975	36,874	37,796	38,741	39,710	40,702
Watermain Connection Fees	36,000	36,900	37,823	38,768	39,737	40,731	41,749	42,793	43,863	44,959
Industrial Waste Agreements	9,791	10,036	10,287	10,544	10,808	11,078	11,355	11,639	11,930	12,228
Other Toronto Water Revenue	47,460	48,646	49,862	44,122	45,225	46,355	47,514	48,702	49,920	51,168
Total	**1,415,336**	**1,450,207**	**1,485,982**	**1,523,723**	**1,561,271**	**1,599,748**	**1,639,122**	**1,688,515**	**1,730,130**	**1,772,764**

Another trend that will continue to have an effect on actual revenues is the decline in water consumption. Over the last decade, despite the increase in population, there has been a trend of reduced consumption. Toronto's water consumption projected to 2021 year-end is estimated at 319 million cubic metres, which represents a substantial drop from 353 million cubic meters in 2010. The declining consumption reflects ongoing conservation efforts associated with use of more efficient fixtures and appliances, and changing consumer habits. An estimated further average decline of 0.5% annually is anticipated over the next 10-year period.

Combined with a number of various strategies intended to provide responsiveness to changing market and other conditions in order to maximize capital funding effectiveness, forecasted revenues presented above provide sufficient annual contribution ("capital-from-current") to the Water and Wastewater Capital Reserve Funds, for the current capital needs of the program and also to ensure through annual operating budget replenishment that an adequate balance is maintained in these reserve funds. Approximately 67% of total annual revenues are contributed to Capital Reserve Funds.

However, uncertainty surrounding growth/decline of consumption and maintenance of adequate reserve balances remains to present a challenge for Toronto Water.

2.8.2.2. Funding Capital Costs

The vast majority of capital spending (97%) will be directly supported from capital financing reserves (contribution from operating).The remaining 3% consists of external revenues, mostly development charges for work required to satisfy certain growth requirements that could not be specifically isolated within the state-of-good repair projects, and contribution from the Region of York for shared water and wastewater projects. **Figure 2.8-7** illustrates sources used to fund capital costs over the 10-year period, while **Table 2.8-4** shows further break down by each core asset category.

Figure 2.8-7: 2021-2030 Capital Costs Funding Sources

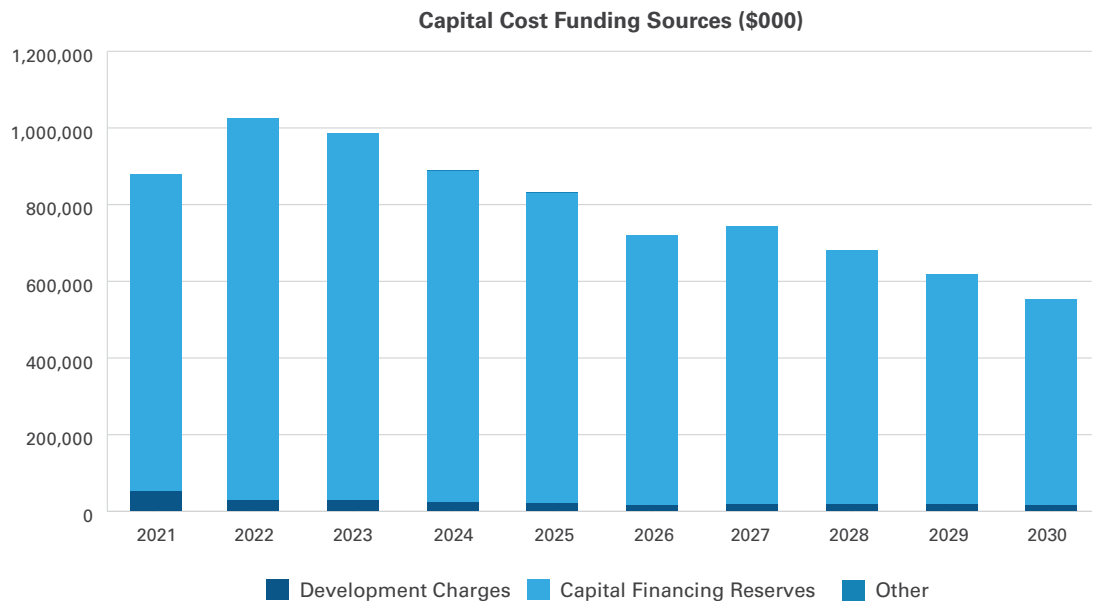


Table 2.8-4: 2021-2030 Capital Cost Funding Sources by Asset Category

($000)	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Total
Water Assets	**322,706**	**400,210**	**374,862**	**352,426**	**345,899**	**313,232**	**315,045**	**300,289**	**280,641**	**276,095**	**3,281,403**
Development Charges	7,799	6,835	6,239	6,399	6,377	4,811	4,511	4,482	4,380	4,403	56,235
Capital Financing Reserves	314,255	391,958	368,033	345,772	339,258	308,187	310,369	295,807	276,261	271,692	3,221,590
Other	653	1,418	590	255	264	235	166	0	0	0	3,578
Wastewater Assets	**534,155**	**591,606**	**573,782**	**502,662**	**457,823**	**379,058**	**396,494**	**355,724**	**315,453**	**263,786**	**4,370,541**
Development Charges	41,838	19,635	18,421	14,433	12,957	9,566	12,433	12,418	12,916	9,982	164,598
Capital Financing Reserves	491,845	571,054	554,771	487,974	444,602	369,258	383,896	343,306	302,537	253,804	4,203,045
Other	473	918	590	255	264	235	166	0	0	0	2,898
Stormwater Assets	**20,406**	**32,215**	**36,213**	**31,643**	**25,296**	**25,083**	**29,833**	**23,291**	**18,941**	**10,383**	**253,304**
Development Charges	1,197	1,422	1,577	485	175	79	4	0	0	0	4,939
Capital Financing Reserves	19,209	30,793	34,636	31,158	25,121	25,004	29,829	23,291	18,941	10,383	248,365
Total	**877,267**	**1,024,031**	**984,856**	**886,730**	**829,017**	**717,373**	**741,372**	**679,303**	**615,034**	**550,264**	**7,905,247**

The following trends should be noted:

- Toronto Water's Capital Program that addresses state of good repair of the core capital assets required to maintain its current service levels continues to be 100% self-sustaining, through water revenues.
- A need to maintain adequate capital reserves to fund the state of good repair 10-year capital program is critical. 10-Year Capital Plan relies primarily on 3 per cent (1.5 percent in 2021) water rate increases with a relatively low reliance on other funding sources.
- The 2021 financial Rate Model also assumes that 85% of the net Capital Budget (after capital contributions from other sources) will be drawn from Toronto Water's Capital Reserve, based on the current capital completion level experienced by the Program, so as not to overstate actual projected funding requirements.
- There is no dedicated funding source for stormwater so investment in these assets remains dependent on the water and wastewater consumption rate and capital financing reserves as shown in the **Table 2.8-5** below.

Table 2.8-5: Total Capital Cost Funding Sources by Asset Category

	Water Assets	Wastewater Assets	Stormwater Assets
Development Charges	1.7%	3.8%	1.9%
Capital Financing Reserves	98.2%	96.2%	98.1%
Other	0.1%	0.1%	

- It should be noted that due to the fact that investments in the state of good repair of existing assets result in newer and better equipment that leads to efficiency gains benefiting future growth, a portion of DC revenues is also used to fund SOGR projects

2.8.3. Risks

There are several risks associated with reaching/maintaining levels of service for water, wastewater, and stormwater assets:

- Managing Reserve Balances: Critical need to maintain adequate capital reserves to fund the state of good repair since the 10-Year Capital Plan relies primarily on 3% water rate increases. Uncertainty surrounding growth/decline of consumption also impacts maintenance of adequate reserve balances. Failing to secure required funding can result in a further asset deterioration.

- Aging Infrastructure: Ongoing significant capital investment is required to address and effectively eliminate the current SOGR for underground assets/water and wastewater treatment plants and facilities by 2030. Any potential delays and missed opportunities to perform maintenance can lead to more costly treatments and increase in SOGR backlog.

- Modernization: An aging suite of information technology tools and databases require considerable investment as there is a critical need to keep pace with upgraded technology requirements such as Geographic Information Systems, enhanced data management tools and artificial intelligence including Enterprise Work Management System.

- Climate resilience: Extreme weather events result in increased maintenance needs and more costly interventions that may also be more disruptive to the public. A significant investment is required to ensure climate resiliency and to manage basement flooding and other stormwater issues across the city. This aspect will be addressed in details in the next reporting phase (July 2025).

- Planning for growth: Rapid growth in the city core and mid-town are putting pressure on existing linear infrastructure. Long-term strategies are needed to keep up with growth. Significant groundwater issues have occurred over the past three years as deeper parking structures are being built. In addition, as a result of City Council development charge exemptions, $295 million is drawn from Toronto Water's capital reserves to accommodate development growth over the next 10 years. These issues are described further in the **Section 2.9** of this report.

To mitigate these risks several current strategies are in place including the following:

- Planning of work and resources to accomplish more projects faster to address needs, including:
    - Consideration of, and bundling of work in, City contracts for cost efficiency and to reduce future disruption, including projects with other City Divisions and ABCs, including Transportation Services, City Planning, TTC, etc.
    - Delivering works through large "mega" and or multi-year contracts to increase cost efficiency and reduce resource demands (i.e., support staff in PMMD, Legal, etc.).
    - Third-party project delivery by others where there is shared asset ownership or work that can be bundled with work by others such as Metrolinx on transit improvement projects, noting the reciprocal project delivery by the City is also performed.
- Recognition of project complexity vs deliverability (i.e., stage gating approach).
    - A 'Stage Gate' process is a technique in which a project's lifecycle is divided into major segments that are delineated by decision points, or 'gates'.
    - At each gate, information relevant to the project's current stage, such as the business case, risk analysis, cost estimates, milestone scheduled, etc., is provided to the governing body responsible.
    - The governance body, typically a project steering committee, can then make informed decisions to proceed, correct course, or discontinue the project based on information available at the time (including which stages to fund in the Capital Plan).

2.9.

IMPACT AND RESPONSE TO GROWTH

This section is based on the population and employment forecasts for Toronto as set out in Schedule 3 or 7 to the 2017 Growth Plan with respect to municipalities in the Greater Golden Horseshoe growth plan area.
files.ontario.ca/appendix_-_growth_plan_2017_-_oc-10242017.pdf
A Place to Grow Growth Plan for the Greater Golden Horseshoe Office Consolidation 2020 (ontario.ca)

The projections adhere to the population and employment forecasts presented in Schedule 3 of the Growth Plan for the Greater Golden Horseshoe. Population projections for the City of Toronto are summarized in **Table 2.9-1** below.

Table 2.9-1: City of Toronto Population and Employment Forecasts

Year	Population ('000s)	Employment ('000s)
2031*	3,190	1,660
2041*	3,400	1,720
2051**	3,650	1,980

Reference:
* 2017 Growth Plan for the Greater Golden Horseshoe, May 2017
** A Place to Grow Growth Plan for the Greater Golden Horseshoe Office Consolidation, August 2020 (ontario.ca)

As the City continues to grow, new infrastructure is needed in order to maintain service levels. Most municipalities in Ontario, including Toronto, use Development Charges (DCs) to ensure that the cost of providing infrastructure to service growth is not borne by existing residents and businesses in the form of higher property taxes and utility rates. Development charges (DCs) are fees collected from land developers at the time a building permit is issued. DCs help pay for the cost of new infrastructure to accommodate growth, such as roads, transit, water and sewer infrastructure, community centres and fire and police facilities.

The City of Toronto conducts a review of its Development Charges (DC) bylaw every 5 years as required by the Provincial Development Charges Act (DCA).

- As part of the review process, the City completes a comprehensive development charges background Study that sets out the City's future residential and non-residential growth forecast, identifies the related growth-related infrastructure needs and costs, and establishes the maximum calculated development charges rates that can be imposed under the DC Act.

- Council, after considering the input from public at the community meeting and consultation sessions, as well as the DC Study and proposed bylaw, determines the DC it wishes to establish for residential, industrial, office, institutional and retail development.

- Tax levy, user rate (in case of water and, wastewater and stormwater infrastructure) or other funding will be required to fund any portion of growth-related costs not funded by DCs.

- The most recent review of the development charge by-law was conducted in 2017 and the Development Charges bylaw enacted on April 27, 2018. Changes to the City's administrative processes were adopted by City Council at its December 17, 2019, January 29, 2020 and February 5, 2021 meetings to ensure orderly transition and revenue neutrality related to subsequent Development Charges Act changes under Bill 108 and Bill 138. toronto.ca/legdocs/bylaws/2018/law0515.pdf

The water, wastewater and stormwater growth projects identified in the following sections are based on the City's 2018-2022 DC Bylaw Review noting that this planning was aligned with the Province's 2017 Growth Plan for the Greater Golden Horseshoe. Asset Management Reporting updates will continue to reflect the most recent City DC Bylaw, recognizing that the 2023-2027 DC Bylaw will be aligned with the Province's 2020 Growth Plan for the Greater Golden Horseshoe.

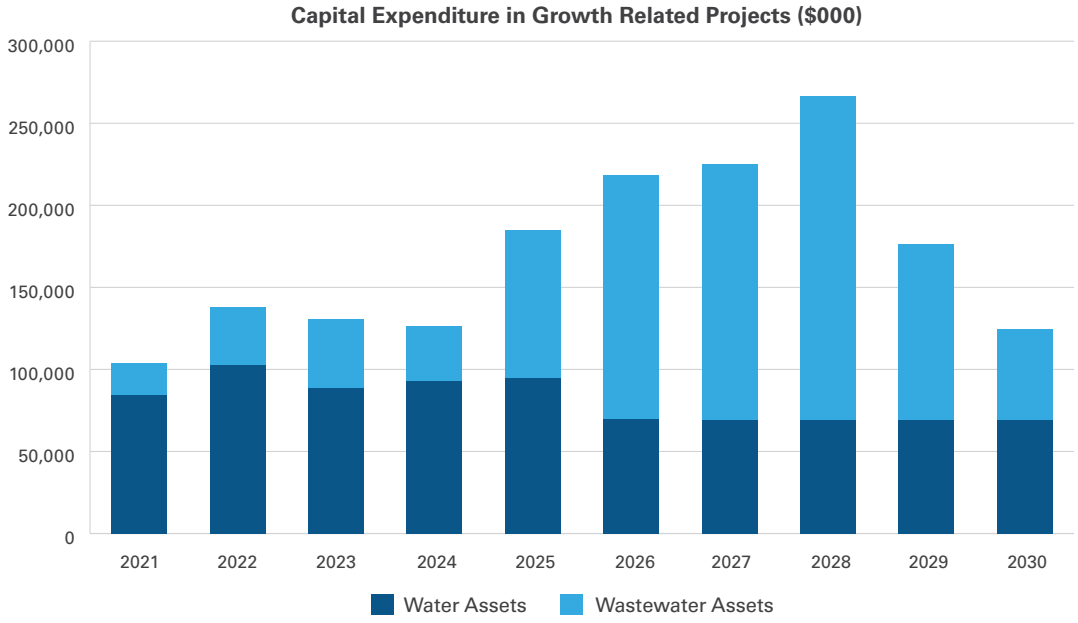
2.9.1. Capital Expenditure Forecast

The 2021-2030 Approved Capital Budget & Plan allocates $1.673 billion or 11.3% of the overall Capital Plan to the growth related water and waste water projects intended to maintain the current levels of service, as presented in **Table 2.9-2** and **Figure 2.9-1** below.

Table 2.9-2: Capital Expenditures in Growth Related Projects

($000s)	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Total
Water Assets	82,454	100,569	86,630	90,568	92,682	67,566	67,257	67,258	67,258	67,258	789,500
Wastewater Assets	19,360	35,045	41,879	33,572	90,225	148,770	155,740	196,875	106,698	55,211	883,375
Total	**101,814**	**135,614**	**128,509**	**124,140**	**182,907**	**216,336**	**222,997**	**264,133**	**173,956**	**122,469**	**1,672,875**

Figure 2.9-1: Capital Expenditures in Growth Related Projects



Approximately 47% of the growth related capital investment is for water asset related projects. In addition to the New Connection Program, the largest water asset projects in this category are the Local and Transmission Watermain Upgrade projects that will increase the hydraulic capacity in the Toronto Water supply system. Many of the Transmission Watermain projects are cost shared with the Region of York.

Wastewater asset projects account for the remaining 53%. The most significant funding is allocated to Trunk Sewers including the Black Creek and Keele Sanitary Trunk Sewers to provide the necessary servicing capacity based on projected population growth, and for the installation of service connections for new homes and developments. The Budget also allocates funding to construct 2 new aeration tanks at Ashbridges Bay Treatment Plant.

It should be noted that due to the fact that investments in the state of good repair of existing assets result in newer and better equipment that leads to efficiency gains benefiting future growth, a portion of DC revenues is also used to fund SOGR projects.

The majority of stormwater projects are service improvement projects and therefore not shown in the **Table 2.9-2** and **Figure 2.9-1** above. They will be addressed in the next reporting phase (July 2025).

2.9.2. Funding Sources

Capital spending in this category is supported mostly from capital financing reserves (69.8%) and development charges (30.0%), with a small portion funded by contributions from the Region of York for shared trunk watermain projects. **Figure 2.9-2** below illustrates sources used to fund growth related projects over the 10-year period, while **Table 2.9-3** shows further break down by each asset category.

Figure 2.9-2: Growth Projects Funding Sources

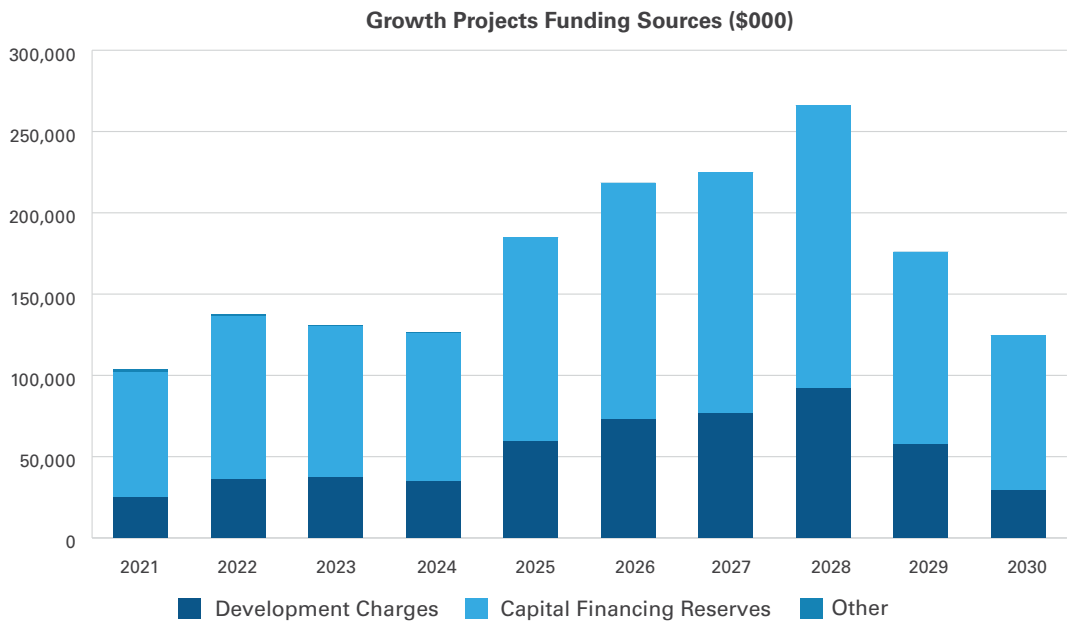


Table 2.9-3: Growth Projects Funding Sources by Asset Category

($000)	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Total
Water Assets	**82,454**	**100,569**	**86,630**	**90,568**	**92,682**	**67,566**	**67,257**	**67,258**	**67,258**	**67,258**	**789,500**
Development Charges	14,258	19,565	17,390	19,367	19,092	6,185	6,193	6,194	6,194	6,194	120,631
Capital Financing Reserves	66,500	80,030	69,102	71,126	73,590	61,381	61,064	61,064	61,064	61,064	665,985
Other	1,697	974	139	75	0	0	0	0	0	0	2,884
Wastewater Assets	**19,360**	**35,045**	**41,879**	**33,572**	**90,225**	**148,770**	**155,740**	**196,875**	**106,698**	**55,211**	**883,375**
Development Charges	9,037	14,430	17,726	13,468	38,387	64,919	68,382	83,728	49,740	20,911	380,727
Capital Financing Reserves	10,211	20,390	24,016	20,029	51,838	83,851	87,358	113,147	56,958	34,300	502,098
Other	113	225	138	75	0	0	0	0	0	0	550
Total	**101,814**	**135,614**	**128,509**	**124,140**	**182,907**	**216,336**	**222,997**	**264,133**	**173,956**	**122,469**	**1,672,875**

The 2021-2030 Capital Budget and Plan is based on the current City's 2018-2022 Development Charge by-law and development charge revenue projections at the time of the 10-Year Capital Budget and Plan approval. The following should be noted:

- Toronto Water is facing significant challenges in planning for growth of its core assets since rapid growth in the city core and mid-town are putting pressure on existing linear infrastructure. Long-term strategies are needed to keep up with growth. Significant groundwater issues have occurred over the past three years as deeper parking structures are being built. Toronto Water is developing a groundwater policy to minimize the amount of flow from these structures and associated envelopes and weeping tile systems that are being drained to the City's wastewater system.

- In addition, as approved by City Council, most non-residential development is exempt from development charge payments, resulting in projected revenues that are lower than they would have been based on the approved project eligibility criteria.

- Due to insufficient funding collected from Development Charges, Toronto Water will not be able to fully offset the costs of the growth related share for projects that are eligible for development charge funding incorporated in its 10-Year Capital Plan.

- Approximately $295 million in project costs related to the growth component in this category of projects will be funded from Toronto Water's capital financing reserves, thus reducing Toronto Water's ability to address its overall capital program at a faster rate.

2.9.3. Operating Costs

The approved 2021 Operating Budget and the 10-year financial model does not anticipate any significant costs associated with the future growth related projects. These costs are reviewed on an annual basis and included in operating budgets as appropriate, based an assumption that continuous efficiencies will be sought to reduce potential impacts of any additional operating costs.

2.9.4. Service Improvement

Specific details of Service Improvement projects are not provided at this time because these projects can be undertakings that must meet the requirements of the Environmental Assessment Act and normally require the completion of a Municipal Class Environmental Assessment prior to proceeding to design and construction. A typical example is basement flooding prevention projects which improve the level of protection from wet weather flow from 2 to 5 year storm events to 100 year storm events. As required by the Regulation, these projects will be addressed in the next reporting phase (July 2025).

GLOSSARY

Amortization	An accounting term describing the process for allocating the cost less the residual value of a tangible capital asset over its service life
CBM	Condition Based Maintenance
CCTV	Closed Circuit Television – used to determine the condition of an asset
Core Assets	As per the definition under Ontario Regulation 588/17 which includes i) Buildings and building improvements, ii) Machinery and equipment, iii) Water, waterwater and stormwater linear, iv) Roads linear, v) Transit, and vi) Land and improvements
CSO	Combined Sewer Overflow
DMAF	Government of Canada Disaster Mitigation and Adaptation Fund
Decommission	The process describing taking an asset out of service
FCAP	Facility Condition Assessment Program
HIRA	Hazard Identification and Risk Assessment
KPI	Key Performance Indicator
Lifecycle Cost	The total cost of ownership of an asset, over its expected life using approve accounting principles
Linear Assets	Assets constructed parallel to the ground service,
LOS	Level of Service
MECP	Ministry of Environment, Conservation and Parks
PSAB	Public Sector Accounting Board
Replacement Cost	The cost to replace an asset based on present dollars
Replacement Cost End of Life (future replacement cost)	The estimated cost of replacing an asset at the end of its service life based on the estimated rate of inflation
SCADA	Supervisory control and data acquisition
SOGR	State-of-Good-Repair
TRCA	Toronto and Region Conservation Authority

APPENDIX

Appendix 2A-1 Maintenance Activities Common to Multiple Linear Assets

PRACTICE NAME	SUMMARY
A. Water, Storm, Sanitary	
1. Sewers, Sewer Services, Watermains and Water Services - Locate	**Sewers, Sewer Services, Watermains and Water Services – Locate (Stakeouts)** Use locate equipment to mark utility with blue paint as this is requested by an excavator. Hand-dig if unable to locate pipe. **Emergency Locates** In addition to the above, includes the provision for specifications on safety measures to be taken and procedures for emergency notifications and repairs in the case of any damage to an adjacent facility. Benefits of this practice area are it ensures excavation will not damage underground utilities which will cause service disruption and extra cost.
2. Water and Sewer Service Lines – New Installations	**Water and Sewer Service – New Installations** Contractors carry out the installations. City Staff provide information to property owners on a new service line installation, process the application, and carry out contract administration and inspection functions. Benefits of this practice area are to ensure new installations are as per the regulations and City standards.

3. Restoration

Sod Restoration for excavation within the portion of a road allowance where ground was covered by topsoil and sod. All grassed areas are restored by City Staff during the spring, fall or weather permitting throughout the year. Roll the sod using the roller as needed and sweep hard surfaces of any dirt or debris.

Hard Surface Restoration for concrete, asphalt, and interlocking pavers.

Temporary Restoration includes restoring original permanent brick, if possible. Use plate/hand tamper and vibratory roller to allow for a smooth finish. Estimate asphalt amount based on cut. Temporary asphalt is used on all boulevards, arterial and local roads and marked with blue plastic plate.

Landscape and Hardscape Restoration includes interlock paver, concrete retaining wall, Pattern concrete. Final restoration within 1 year or following a period of settlement. Performed by either City staff or Contractor.

Benefits of this practice area are to ensure the proper restoration of the work area.

4. Administer Over Strength Discharge Agreements and Calculate Fees

Enforce the sewer use bylaw, monitor industrial, commercial, & institutional dischargers, administer agreements, rebates, compliance programs, pollution prevention plans and respond to spills & complaints. To inspect and locate various sampling points and collect water samples for further analysis, staff follow enforcement actions and issue Notice of Violation as required and investigate any spills and complaints. Staff review and plan administration of industrial waste agreements, compliance programs, rebates and pollution prevention.

Benefits of this practice area are to ensure legislative and regulatory requirements and environmental protection objectives are met, to protect sewer infrastructure and sewage plant treatment, and to ensure the health and safety of the public and City staff.

5. As-Constructed Drawings and Records

This practice is to update the City as-constructed drawings for water and wastewater construction projects using mapping tools. Drawings are updated by Engineering and Construction Services Division, based on construction notes provided by inspectors and engineering survey crews. Review submitted as-built drawings and inspections notes, update CAD drawings, stamp approved as-built drawings and store in archive. Also update TIMS, PUCC and GIS database.

Benefits of this practice area are to protect infrastructure and improve delivery of services and to ensure Toronto Water records are current, accurate and protected.

B. Sanitary, Storm

1. Sewer Service Line – Repair/ Replacement

Sewer Service Line Repair – Partial
Excavation and repair of a portion of a sewer (sanitary or storm) service line on City property, from the sewer to the property line. After utility locates are complete, vacuum excavation exposes the utilities and section of pipe is cut for replacement. Bedding material is tampered down and excavation is backfilled. This ensures continuous SSL operation.

Sewer Service Line Replacement
Excavation and replacement of sewer (sanitary or storm) service line on City property (from the sewer to the property line). A clean-out is installed at street line and pipe is replaced with PVC and rubber couplings. Bedding material is tampered down and excavation is backfilled. This ensures continuous operation of Sewer Service Line.

Benefits of this practice area are to ensure a state-of-good-repair of the sewage system.

2. Sewer Cleaning and Flushing	**Sewer Cleaning & Flushing** Cleaning the sewers by flushing sewer mains. Crew uses high pressure water to flush any debris down the sewer system to the vacuum hose. This will reduce the risk of sewer mains blockage. **Emergency Sewer Flushing** Perform emergency flushing of blocked sewer mains to restore unobstructed flow by releasing and clearing any material causing the blockage. Using high pressure water to break up the blockage, clean the pipe walls and flush the debris down the sewer system to the vacuum hose. **Sewer Acoustic Inspection** Sewer lines assessment by using Sewer Line Rapid Assessment Tool (SL-RAT). SL-RAT utilizes acoustic technology to provide real-time blockage assessments in sewer gravity mains. It is a quick, safe, easy to use and cost effective way for crews to better allocate the cleaning and CCTV resources. Benefits of this practice area are to ensure a state-of-good-repair of the sewage system.
3. Sewers - CCTV Inspection & Condition Rating	**Sewers - CCTV Inspection & Condition Rating** Perform Closed Circuit Television Inspection and evaluate condition rating of mainline sewers 200mm in diameter and greater to determine structural integrity and condition of sewer pipes. Goals are to assess the sewer pipes structural and hydraulic condition in order to identify immediate problems. Benefits of this practice area are to ensure a state-of-good-repair of the sewage system.

4. Sewer - Inspection (Non-CCTV)

Maintenance Holes – Surface Inspection - Non-Entry
Perform a non-entry inspection of maintenance holes for any structural damage, serviceability or service adjustments or for identifying signs of surcharge. Safely remove the lid and inspect for deterioration, defect, surcharge and structures condition using mirror or flashlight. Structural integrity of MH needs to be checked/raised, steps are inspected, and deteriorated concrete shelf to be repaired if needed. This practice is to observe any problems and create related work orders.

Sewers, Maintenance Holes, Weirs, Gates, Diversion Structure – Inspect - Entry
Perform a safe entry (when required) and/or visual inspection from the top into maintenance holes to inspect sewer pipes, maintenance holes, weirs, gates and gate valves, diversion structures and complete assigned work orders to insure a properly functioning sewer system.

Benefits of this practice area are to ensure a state-of-good-repair of the sewage system.

5. Pump Stations - Inspection & Maintenance

This practice is for the Inspection and Maintenance of the various types of Pump Stations including both sewage and stormwater pumping stations. A proactive maintenance schedule for pump stations is required to meeting these key objectives:

i) To ensure that all stations operate in a manner that is free from failure and meet accepted operation standards and efficiencies.

ii) To prevent adverse impact on private property and the natural environment.

iii) To enable the early detection of potential problems to avert serious failure.

- Pumps with Drive Shaft in Dry Well - Inspection and Maintenance
- Submersible Pump in Dry Well - Inspection and Maintenance
- Submersible Pump in Wet Well - Inspection and Maintenance

Conduct regular inspections of drive shaft, bearings, pressure readings, check valve and any unusual leak, damage, noise or vibration and apply grease to parts as needed. Perform required maintenance as per manufacturer's specifications and operational needs; including removal, repair or replacement of pump, pump base and graphite packing.

Wet Well Screens - Cleaning
Cleaning should be done on as-needed-basis as identified through the regular inspection of pumping stations. Clean screens using a rake and high-powered hose, remove and properly dispose of large objects.

Wet Well – Pumping Down
Start the duty pump using manual control, where comminutors (sewage grinders) exist, perform a visual inspection; grease bearings and inspect teeth as required.

Pump – Removal of Blockage
Drain the pump and attempt to clear the blockage using hooks or each nto the impeller, if needed disassemble the pump and remove any material from the shaft and the impeller.

Sensors and Instrumentation – Inspection and Testing

Reset the processor and the alarm, check each pump's operations and calibration if necessary, perform required quality control check and call technical support if needed.

Pump Stations - General Cleaning

Perform general cleaning of floors, walls and electrical panels.

Stormwater Pump Station Specific Requirements

In addition to inspecting the pumping station, inspect the associated storage/detention tank. Check inlets and outlets, clean and remove accumulated sediments on the floor of the tank after a tank dewatering event. Check flushing system if present.

Recognize facility is designed to operate on an infrequent basis and will require regular inspection and performance verification.

Benefits of this practice area are to ensure a state-of-good-repair of the sewage system.

6. Odour Complaints

Investigate Odour Complaints –Drain Related
Determine whether odour originates from inside or outside of the house.

Check sewer main gas levels via upstream/downstream MHs and for signs of decay.

Check floor traps and house main trap to ensure they are retaining water. Note that any issues on private side need a plumber.

Check nearby CBs for signs of organic decay. Chemical odours may need SPILL response.

Investigate Odour Complaints - Main Sewer
Odour inspection of the area includes checking upstream/downstream MHs & CBs for decay and determining if the sewer requires cleaning. Secluded areas require ventilation of sewer system. Change MH filtering system, if exists.

Benefits of this practice area include ensuring health and safety of the public, environmental protection, and avoiding municipal liability claims.

7. Illegal Sewer Service Line Connections	Tracing Dye is introduced in to the sanitary/storm sewer (via MH, roof leaders, rear yard drain, driveway CB, internal plumbing) after a complaint is received to identify source of discharge. Property owner must give permission. Benefits of this practice area are to ensure health and safety of the public, environmental protection, reduced basement flooding, and avoiding municipal liability claims.
8. Spills Response & Clean Up	**Spill Response and Clean-up** Includes identifying nature/source of spill, containment and clean-up by City operation and maintenance staff, EM&P and the contractor. Construct a dike using booms, pads, absorbent materials, and sand to prevent spill from entering watercourses, storm and sewer systems. Contain all material in hazardous waste bins. Spill tracing is performed using a dye. **Hazardous Waste Disposal** Hazardous wastes generated due to spill response activities is temporarily disposed of at Operations yards. Collections bins are licensed and the waste material cannot be stored on site for more than 90 days. Benefits of this practice area are to prevent spill entering into watercourses and sewer system, to protect the health & safety of public and environment, ensuring environmental compliance and proper waste material containment and protecting City against any liabilities

9. Wastewater and Stormwater Facilities Inspection & Maintenance

Stormwater Management Dry Ponds – Inspection and Maintenance
After each significant rainfall or monthly, erect 'Flooded Area' signs if needed and identify control structures (MH, tipping gates, floats and alarms) for operation. Remove excessive debris from inlet/outlet structures.

Stormwater Management Wet Ponds – Inspection and Maintenance
Inspect Hickenbottom weir, orifice, and flow control structures (inflow and outflow). Remove large debris and sediment built-up.

Storm Sewer and Sanitary Sewer Detention Tanks – Inspection and Maintenance
Passive storage tanks with no automated flushing system, where monitoring equipment and valves are checked. Outlet structure is checked for debris. A hose/sewer-combination machine is used to remove any sediment in the tank. Structural deficiencies are checked and marked in the Work Management System (WMS).

Oil/grit Separator Tanks – Inspection and Maintenance
Vacuum/flusher cleans the tanks from sediments. Inlet/outlet structures are checked for debris. Cracks or structural deficiencies are repaired. Large tanks are contracted out for inspection.

Combined Sewer Overflow Tanks - Inspection and Maintenance
CSO tanks are maintained and inspected via the MH. Vacuum/flusher unit cleans any sediments/debris. Structural deficiencies are reported. Control gates are greased and checked.

Benefits of this practice area are to; improve water quality, minimize sewer surcharge, basement flooding, surface flooding and combined sewer discharges to receiving watercourses, and to ensure reliable operation and public safety.

10. Maintenance Holes, Valve Chamber & Catch Basin - Repair/Replacement

Maintenance Hole Repair/Replacement – with Excavation
Repairing/replacing bricks, frames and lids or deteriorated maintenance holes identified through the performance of other practices.

Catchbasin Repair/Replacement – with Excavation
Repairing/replacing deteriorated catchbasins and making grade adjustments previously identified through inspection.

Maintenance Hole/Catch Basin Repair – No Excavation
Repairing previously identified defects in maintenance holes and catchbasins with no excavation. It may include benching repair, step/ladder replacement and lid or grate adjustment or replacement.

Rehabilitation for All Valve Chambers – Structural
May include but not limited to; step and brick replacement, crack sealing/repair and frame and lid adjustment/replacement.

Benefits of this practice area are to; eliminate roadway hazards to prevent personal injuries, improve staff accessibility, reduce environmental hazards, minimize the possibility of flooding, and to maintain the structural integrity of infrastructure.

Appendix 2A-2 Maintenance Activities for Linear Water Assets

PRACTICE NAME	SUMMARY
1. Hydrant – Inspection	**Hydrant Inspection – Summer - Winter – Fire Flow Testing For Hydrant Colour Coding** Perform required water flow test, regular winter and summer inspections of hydrants, and main valves, in order to determine operating condition, and system capacity. Prepare a database for analyzing and prioritizing the maintenance work to be performed. Hydrants opened/closed and inspected for; potential leaks, deficiencies, missing caps, lubrication as needed, and to conduct fire flow testing. Goals are to ensure hydrant is functioning and available for firefighting activities.
2. Valve and Hydrants – Rehabilitation & Maintenance	**Valves and Hydrants – Maintenance and Rehabilitation – Non–Excavation** Without excavation, hydrants and valves are checked by opening/closing them to see if they are operable and not seized. Practice includes replacement of nozzles, caps, gaskets, bolts, head-castings and lubricating nozzles & spindle, painting the barrel, pump-out water, upper barrel repairs, etc. In addition, staff check condition of valve and chamber, repair or replace packing gland & stem and ensure valves are operational and can be turned on/off. Replace valve and operating nuts as required. **Valves and Hydrants – Maintenance and Rehabilitation – With Excavation** Check valves and hydrants with excavation to; expose the underground asset to replace, relocate and repair the hydrant, hydrant lead, valve box and chamber to ensure proper operation and continuous supply of safe drinking water to residents. **Valves - Exercise** Valves are turned on/off on a periodic basis to ensure they are not seized and to ensure reliability of valves when required to isolate sections of watermains within the water distribution system. Valve exercise task is; utilizing valve key, Hand Held or Truck Mounted Valve Turning Machines through chamber lid or valve box. The vehicle/staff is located on top of the valve chamber and the key is placed on the operating nut to begin with a steady torque to close and open the valve which may be left/right turning.

Hydrant – Pump Out
Pump-out of hydrants is required to ensure that hydrant barrels are drained and are free of water over the winter to avoid freezing. Hydrants should be drained or pumped out after each use as required and depending on weather conditions. Remove nozzle cap and attach approved hose to pump and start pumping until water flow stops.

Hydrant – Thaw Frozen
It is important that all frozen hydrants are returned to service in a timely manner during Winter conditions. Utilizing a steamer trailer, hydrant is thawed and barrel is pumped out. The steamer tank water has hot water and once the hose is inserted into the hydrant via hydrant nozzle, it allows any frozen water to thaw and be pumped out. This ensures sound hydrant operation for fire-fighting purposes and during emergencies.

Colour Coding
Hydrants are categorized based on the water pressure they provide. By measuring static (non-flowing) and residual (flowing) pressure, as well the rate of discharge in (liters per second) of each fire hydrant, City can determine the hydrant flow. Once pressure test is complete, staff place coloured rings on hydrants in accordance with the National Fire Protection Association Recommended Practice. Colour coding of hydrants is based on data acquired from Practice 1.2 - Hydrant - Inspection - Fire Flow Testing for Hydrant Colour Coding.

Pressure Reducing Valves – and Maintenance
Regular operational checks to ensure Pressure Reducing Valves (PRV) which are performing as intended. These valves are located between neighbouring pressure districts of the water distribution system and areas of extreme elevation change. Staff check the condition of the valve and chamber, repair or replace damaged parts, ensure valves are operating, and record inlet and outlet pressure readings.

3. Water Meter Testing & Calibration

Water Meter Leaking
Repairs of leaking water meters will be initiated by a complaint from a property owner. Observe leak location. If leak at tail piece then replace washers. If meter is leaking, replace meter. Goals are to eliminate leaking water meter, reduce water loss and ensure safety of drinking water.

4. Water Audit & Leak Detection	**Water Leak Detection (Reactive – Emergency)** Use of acoustic sensors to locate hissing or irregular sound on watermain/water service to locate water leaks by isolating section of the main. Ground is marked where suspected leak sound is found. If leaks can be detected effectively then the location is passed on to appropriate Toronto Water team to be rectified efficiently. **Use of City Contractor for Leak Detection** Staff shall call the City contractor to locate the leak on the underground infrastructure, close valves to stop leakage and ensure public safety. **In-house Leak Detection** Staff shall install acoustic sensors and aqua phone equipment to locate the leak, generate report, and mark the location in the field. Goals are to improve public health, minimize water loss, protect buried infrastructure, ensure water quality and improve pressure, and avoid municipal liability claims.
5. Watermain Flushing	**Watermain Flushing – Unidirectional** Unidirectional watermain flushing is to address water quality issues related to accumulated sediment, biofilm, increased chlorine demand, discoloured water and customer complaints. Steps include determining the location of discharge, gauging hydrants and creating a directional flow, and increasing the water velocity to create a scouring effect on the interior walls of the watermain. **Watermain Flushing – Segments, Extremities, Deadend, and Adverse Water Quality** Traditional flushing of watermain in segments and dead ends is to improve water quality and remove sediment, clear undesirable water and maintain proper chorine residuals. This method consists of opening hydrants in the different targeted areas and discharging the water until the accumulations are removed and the water becomes clear. Goals are to meet water quality standards and reach the desired turbidity.

6. Watermain Disinfection	**Watermain Flushing – Unidirectional** Unidirectional watermain flushing is to address water quality issues related to accumulated sediment, biofilm, increased chlorine demand, discoloured water and customer complaints. Steps include determining the location of discharge, gauging hydrants and creating a directional flow, increasing the water velocity to create scouring effect on the interior walls of the watermain. **Watermain Flushing – Segments, Extremities, Deadend, and Adverse Water Quality** Traditional flushing of watermain in segments and dead ends is to improve water quality and remove sediment and clear undesirable water and maintain proper chorine residuals. This method consists of opening hydrants in the different targeted areas and discharging the water until the accumulations are removed and the water becomes clear. Goals are to meet water quality standards and reach the desired turbidity.
7. Watermain – Breaks	**Watermain – Breaks – First Response** Investigate and confirm the watermain break, notify and create required work orders. **Watermain – Break Repairs and Former Deadend Area Municipality Connections** A visual site assessment will determine the repair process requirements including leak detection, excavation, isolation valves, traffic control, utility pole support, saw cut, installing repair clamps, disinfection, turbidity and chlorine residual test, restoration, etc., in order to complete watermain repair. Goals are to repair and restore watermain service as soon as possible.
8. Water Service Line – Repair/ Replacement	**Water Service Line – Repair/Replacement** Perform repair or replacement of water service line on City property after water service investigation reveals that a replacement or repair of the water service line is required. The water service line repair work requires excavation and/or minor repairs following the required provincial health and safety, and drinking water regulations. **Water Service Box – Repair/Replacement** Perform repair or replacement of water service box after water service investigation reveals that a replacement or repair of the water service box is required. The water service box repair work that requires excavation following the required provincial health and safety, and drinking water regulations. Goals are to repair and restore water service as soon as possible.

9. Water Service Line Investigation	**Water Service Line – Investigate Low Pressure Complaints** Investigate when receive a complaint about low pressure or low flow from a property owner. Conduct a flow test to determine whether to replace the water service line on the City property or to advise the property owner that the water service line pressure exceeds the City's minimum standard. **Water Service Line – Investigate No Water Complaints** Investigate when receive a 'no water' complaint from a property owner. Inspect to determine the cause; internal plumbing problem, frozen service line, closed service box and/ or a leak. **Water Service Line – Investigate Visible Leaks** Investigate when receive a complaint indicated that there is a visible leak. Inspect for any leak on City portion of water service, control the leak and create required work order for repair or replacement.
10. Water Service Line – Thaw Frozen	**Water Service Line – Thaw Frozen** Thawing of frozen water services on City property using an approved thawing machine. Heat is applied to the water service line and as it travels throughout the pipe it thaws the frozen water. The service valve is open, then utilize the Portable Hot Water Pulsating Machine or the Full Current Pipe Thawing Machine, for thawing of the frozen water service.
11. Water Service On/Off	**Water Service Turn Off/On - Specific Customer Service Requests** Water service line will be turned off/on using a special key at the curb stop or water service box, when a property owner submits a request. Toronto Water staff will be dispatched to shut off or turn on the water supply at the property water service box.

12. Adverse Water Quality	**Water Quality – Taste And Odour** Perform a water quality investigation. Water sampling may result in localized watermain and/or service connection flushing in order to eliminate taste and odour from the water distribution system. **Water Quality – Discoloured Water** Temporary discolouring of the water supply is often caused by a disruption within the local distribution system. Typical response includes flushing of the private internal plumbing and may include local watermain flushing in order to eliminate discoloured water. **Adverse Water Notifications** Toronto Water staff will execute this practice immediately following any adverse water quality result recorded. Corrective actions include resampling and flushing of the local water distribution system. The process includes notification of the Health Department and the Ministry of the Environment and Climate Change.
13. Watermain Condition Rating	**Watermain Condition Rating (Short Term Analysis)** Based on available data (installation year/breakage//maintenance cost/etc.) on City databases a score is assigned to each pipe and a performance indicator. This helps management to assess the condition of the water distribution system and to assist in the development of a water distribution system replacement program. The calculated overall score for each pipe, links with the GIS database to develop colour coded maps to indicate the total score for each pipe. The renewal plan prioritizes the pipe segments that are determined to have the highest scores. The overall scores are used to develop a renewal plan. Goals are to assist in planning capital budgets, reduce unaccounted-for water, and ensure a safe and reliable potable water supply.
14. Backflow Prevention Program	**Backflow Prevention Program** Consist of two types of inspections: initial and annual. Toronto Water staff identify all possible sources that may be a point of potential cross connection contamination, compliance with City's Water Use By-Law and the criteria in CAD/CSA-B64.10-M94, and ensure that all proper tags are affixed. The inspections ensure there is no backflow and there is safe drinking water.

Appendix 2A-3 Maintenance Activities for Linear Sanitary or Combined Sewer Assets

PRACTICE NAME	SUMMARY
1. Sewer Service Line Blockage	**Sewer Service Line Blockage Investigation** Investigation of sewer service line blockage via cleanout using a CCTV system. Cleanout must have been installed by property owner to allow access. Staff attempt to unblock service line by plunging or snaking & perform CCTV inspection if needed. The goal is to restore the sewer service line to sound operation, satisfy property owner and avoid City's liability. **Sewer Service Line Evaluation and Remediation** Conduct required evaluation and remediation of a previously blocked sewer service line. To identify the cause, inform and advise the property owner of the required action, and rectify the problem.
2. Sewer Main - Repair with Excavation	**Sewer Main – Repair with Excavation** Sewer main is exposed with excavation to perform partial repair of the sewer main. Sewer bypass is set up to ensure dependable flow of sewage collection. Upstream maintenance hole is located and prepared to temporarily plug the sewer. Use appropriate machinery to cut out damaged section of pipe, based on pipe material. Clay - pipe cutters, Cast Iron - hydraulic pipe cutters or speed saw, PVC/ Concrete - power saw. Benefits of practice are to ensure health and safety of the public, environmental protection, reduced basement flooding, and avoiding municipal liability claims.
3. Sewer Main Bypass	**Sewer Main Bypass** Pumps and hoses are used to accommodate the required flow and volume. Bypass installed between maintenance holes and is designed to stop, minimize or prevent basement flooding, sewage overflows and spills. If vacuum/flusher unit cannot be used, a submersible pump or intake hoses are lowered into the upstream MH. Toronto construction specification TS 4.01 applies for local sewers (and TS 4.02 applies for trunk sewers.)

Appendix 2A-4 Maintenance Activities for Linear Storm Sewer Assets

PRACTICE NAME	SUMMARY
1. Catchbasin Cleaning	Catchbasin cleaning is to be completed annually on arterial roads and bi-annually for local roads. By inserting a vacuum/flusher unit's suction pipe in the CB, any debris or standing water is removed. For tightly packed debris, operations and maintenance staff use a long handled shovel and chop bar to loosen the material. High pressure water is used to free up debris at the bottom of CB. Staff use goss trap cleaner for trap. Vacuum/ flusher unit is decanted when full in an appropriate Sanitary MH. Benefits are to ensure there are no service disruption due to blockages, overflow of stormwater into the streets and properties, or ponding on surfaces.
2. Flow Monitoring	**Flow Monitoring Plus Sampler – All Sewers** Flow monitoring in sanitary, combined and storm sewers allows for an understanding and quantification of flow components in the sewer system. Popular flow monitoring devices include area-velocity (A/V) meters, weirs and flumes. Ultrasonic and pressure sensors are typically used by these devices to determine flow depth. For determining flow velocity, typically Doppler and electromagnetic sensors are used. In contrast, rain gauges generally employ the mechanistic tipping-bucket system to record rainfall. **Install, Maintain, and Interrogate** An ultrasonic level monitor measures the depth (level) of wastewater using ultrasonic waves that are sent to the surface of the flow. Echoes bounce back and are received by the sensor. Flowrates are normally calculated using a predefined rating curve. Specialized software provided by the vendor of the monitor, may also be used to calculate flowrates.

Appendix 2A-5 Maintenance Activities for Stormwater Management Ponds and other End of Pipe Facility Assets

PRACTICE NAME	SUMMARY
1. Lakes, Beaches, Streams, Storm, Outfalls, & Stormwater Management Facilities - Collect Samples	**Lakes and Streams – Collect Samples to Identify Over strength Discharges** Assist in identifying existing industrial, commercial or institutional customers that discharge over-strength effluent to City sewer systems and ultimately receiving watercourses without an over-strength agreement. **Beaches – Collect Samples to Identify the Need to Post for Unsafe Swimming Conditions** Collection of water quality samples at fourteen (14) swimming beaches across the City of Toronto waterfront to assess the need for posting of unsafe swimming conditions. **Lakes – Collect Samples to Assess Pollutant Migration throughout the Waterfront** Perform as part of the Lake Sampling Program. The program is intended to assess pollutant migration throughout the waterfront. **Storm Outfalls** – Water samples (by EM&P/other) are collected to establish priority outfalls based on water quality and issues found. This will result in organizing the inspection schedule such that the outfalls are attended more or less frequently based on the needs. Benefits are to ensure proper frequency of inspection and upkeep of each outfall before/after a rainfall event. **Stormwater Management Facilities - Collect Samples for ECA Requirements** Collection of samples at stormwater management facilities to meet monitoring requirements specified in Environmental Compliance Approval (ECA) issued for the facility, and to establish the effectiveness of each facility in improving water quality (by WIM, EM&P/other). **Stormwater Outfall Inspection Maintenance** A visual inspection of stormwater outfalls, gates, inlet/ outlet pipes, nearby MHs and CBs for any structural damage, serviceability or for identifying signs of surcharge. Debris/branches are removed from the structure and water samples are taken (by EM&P, WIM/other) to ensure outfalls and watercourse contaminant concentrations meet City and Provincial limits. Benefits are to ensure compliance with Environmental Compliance Approval requirements for stormwater management facilities.

2. Stormwater Management Facilities –Inspection and Maintenance

Stormwater Pond Inspection and Maintenance – a visual inspection of pond permanent pools, embankments, and appurtenances. Common factors that need to be checked to keep SWM pond in state-of-good repair include:

- Blockage to inlet and outlet, and associated effect on water level
- Damage to; concrete, fencing, signage, berms, site access, and equipment such as a related hydrodynamic separation unit
- Oil sheen or evidence of spills
- Missing equipment
- Erosion, sediment accumulation and clean-up
- Wildlife presence affecting water quality and quantity (waterfowl, beavers)
- Downed trees and tree protection
- Vegetative growth and invasive species
- Encroachment Issues (structures, illegal dumping)
- Structural deficiencies
- Trash accumulation

Appendix 2A-6 Maintenance Activities for Facility Assets

Facility Maintenance Activities

Facility maintenance activities are tracked for water and wastewater treatment plants, all pumping stations, reservoirs, and tanks. The scope and frequency of the activities is customized to each asset class based on a number of factors including: its configuration within a system: the manufacturer, make and model of equipment; to meet regulatory requirements; and to delay or prevent known failure modes. The types of maintenance activities undertaken on facility infrastructure and classified and described in the table below.

ACTIVITY TYPE	DESCRIPTION
1. Condition Based Maintenance	**Predictive Maintenance** Condition monitoring is the process of monitoring a parameter of condition in machinery (vibration, temperature etc.), in order to identify a significant change which is indicative of a developing fault. The use of condition monitoring allows maintenance to be scheduled, or other actions to be taken to prevent consequential damages and avoid its consequences. TW uses a combination of vibration, oil analysis, ultrasonic and infrared thermography technologies as the foundation of this approach.
2. Calibrate	Calibration is the comparison of measurement values delivered by a device under test with those of a calibration standard of known accuracy. Calibration typically involves the removal of an instrument from service. Equipment that is not within tolerance of the standard is either removed and replaced or adjusted to reduce the gap in measurement. The removed equipment is sent to the manufacturer for calibration.
3. Clean	**Restoration, Flush** A preventive activity, cleaning involves the removal of deposits, dirt or corrosion from external and internal surfaces of equipment in order to prevent physical and performance degradation.
4.Replace Component	**Discard, Install, Change** A preventive activity, replacement of components occurs on equipment with wear components that follow a known wear pattern. Wear components (i.e. wear bars, grease, filters) are replaced based on wear life to maximize the use of the component and decrease costs while preventing failure.
5. Inspect	**Check, Measure, Record** A preventive activity, replacement of components occurs on equipment with wear components that follow a known wear pattern. Wear components (i.e. wear bars, grease, filters) are replaced based on wear life to maximize the use of the component and decrease costs while preventing failure.
6. Sample	Sampling involves the collection of process materials for physical laboratory testing in order to determine process conditions and performance. Sampling is typically performed where instrumentation cannot be used to collect data automatically.
7. Exercise	**Operate, Test, Failure-Finding** A preventive activity, exercising involves periodic full operation of equipment to verify the equipment is in operational condition and to prevent deposits and corrosion from building up that will hinder operation when the equipment's operation is called for.

8. Lubricate	A preventive activity, lubricating involves the periodic application of a lubricant (oil, grease, solid) to contact and wear surfaces to prevent wear, corrosion and friction. Lubrication schedules typically follow manufacturer's recommendations.
9. Overhaul	**Rebuild** Overhauling involves a thorough examination of machinery or a system often through removal and dismantling of the equipment, to determine what repairs or changes are necessary to maintain or restore the equipment to expected performance capability.
10. Adjust	**Refill, Tighten** The process of adjusting equipment to improve equipment/component/part life or to introduce a change to the performance of the equipment for operational or maintenance purposes.
11. Verify	Verification is the periodic comparison of measurement values delivered by a device under test with those of other corroborating devices, measurements or a given values. Verification is typically performed where it would be impractical to remove equipment for calibration (due to size or access possibly). Equipment that is not within acceptable tolerance of the expected measurement or value is either removed and replaced or adjusted to reduce the gap in measurement. Verification may also involve the triggering of an internal self-diagnostic routine for some equipped instrumentation. Removed equipment is sent to the manufacturer for calibration.

APPENDIX 3

Corporate Asset Management Policy

1. BACKGROUND

The City of Toronto has a large, complex and diverse range of infrastructure assets on which it relies to deliver essential services to the community. It is important that these assets continue to meet acceptable levels of performance and support the delivery of services in a sustainable manner. The scale and criticality of the City's asset portfolio requires a systematic approach to total lifecycle asset management that allows the organization to make informed decisions, maintain vital services, and realize maximum value from its infrastructure assets.

The Corporate Asset Management Policy provides the framework to develop a whole of government asset management approach that will ensure long-term asset sustainability; demonstrate a commitment to good stewardship of the City's infrastructure assets; and support improved accountability and transparency to the community through the adoption of appropriate asset management practices.

2. PURPOSE

The purpose of this policy is to guide the development and implementation of the City of Toronto's asset management framework and asset management plans. It is intended to promote a consistent and integrated approach to asset management across the organization; facilitate logical and evidence-based decision-making for the management of infrastructure assets, and support the delivery of sustainable community services now and in the future.

3. DEFINITIONS

For the purposes of this policy, the following definitions apply:

Act	The Infrastructure for Jobs and Prosperity Act, 2015.
Asset	Tangible assets that are purchased, constructed, developed or otherwise acquired for use in the delivery of services.
Asset Management	A business practice that integrates planning, finance, engineering and operations to effectively manage existing and new assets to realize value, reduce risk and provide satisfactory levels of service to community users in a socially, environmentally and economically sustainable manner.
Asset Management Plan (AMP)	A long-term plan developed for the management of physical assets that at a minimum complies with the requirements of the Act and the Regulation, and details the characteristics and conditions of the assets, the levels of service expected from the assets, financing and other strategies, and planned actions over the lifecycle of the assets to ensure assets are providing a specified level of service in the most cost-effective manner.
Asset Management Policy	High-level statement of the principles and mandated requirements for undertaking asset management across the organization in an integrated, systematic and coordinated manner that complies with the requirements of the Act and the Regulation.

Asset Management Strategy	The high level long-term approach to asset management, including asset management action plans, and objectives for managing the assets.
Asset Management System	The complete set of interrelated and interacting elements, including the asset management policy, the asset management strategy, processes, tools, data and other resources required to achieve asset management goals.
Capitalization Threshold	The value of a municipal infrastructure asset at or above which the city will capitalize the value of the asset and below which it will expense the value of it.
City Agencies	For the purpose of this policy, the Service and Community-based Agencies established by the City under the City of Toronto Act, 2006 as set out in Schedule A and as amended from time to time.
City Corporations	All wholly-owned corporations established by City Council in accordance with the Business Corporations Act (Ontario).
Corporate Asset Management	The application of asset management principles, standards, policies and practices on a corporate level to ensure a coordinated, consistent, effective and organizationally sustainable approach across diverse asset groups.
Green Infrastructure Asset	An infrastructure asset consisting of natural or human-made elements that provide ecological and hydrological functions and processes and includes natural heritage features and systems, parklands, storm-water management systems, street trees, urban forests, natural channels, permeable surfaces and green roofs.
Level of Service	The condition and performance standard for a particular asset against which service performance may be measured.
Lifecycle	The time interval that commences with the identification of the need for an asset and terminates with the disposal of the asset.
Lifecycle Activities	Activities undertaken with respect to an asset over its service life, including planning, constructing, operating and maintaining, renewing, and decommissioning, and all engineering and design work associated with those activities.
Lifecycle Cost	The total cost of an asset throughout its useful life, including capital costs, operating and maintenance costs, rehabilitation, renewal and disposal costs.
Regulation	Ontario Regulation 588/17 made under the Act.

4. SCOPE

This policy applies to the lifecycle management activities of municipal infrastructure assets that are owned and/or controlled by the City of Toronto for the provision of services. Some of these City-owned assets maybe managed solely by the City, or by an agency or corporation of the City, or a combination of the above. This policy may also be used for third-party assets that the City has a significant interest in.

The policy applies to all physical assets, including but not limited to infrastructure asset classes categorized as follows:

- Buildings and building improvements
- Machinery and equipment
- Water, wastewater and stormwater linear
- Roads linear
- Transit
- Vehicles
- Land and land improvements

5. ASSET MANAGEMENT VISION AND GOALS

The asset management vison and goals are consistent with Council's emphasis on effective stewardship of the City resources and assets and fiscal sustainability.

5.1 Vision

To ensure the sustainability of municipal services through the effective stewardship of assets and the management of risk, while optimizing asset value.

5.2 Goals

To provide a framework and principles for asset planning and management that will:

- Ensure legislative requirements for asset management are achieved.
- Optimize asset life-cycle costs while achieving defined levels of service.
- Continually seek opportunities for improving efficiencies in operations, maintenance and asset renewal practices.
- Foster an environment where staff across the organization are integral in the overall management of assets through training and development of asset management knowledge and competencies.

- Ensure existing and future asset needs are prioritized.
- Link infrastructure investment decisions to service outcomes.
- Improve decision-making, accountability and transparency.

6. ASSET MANAGEMENT PRINCIPLES

6.1 Key Principles

The following principles will guide asset management planning and decision-making related to infrastructure assets: The City will:

Holistic

Take a comprehensive approach that looks at all assets and considers the interrelationships and the combined impact of managing all aspects of the asset life cycle.

Systematic

Adopt a formal, consistent and methodical approach to the management of assets that will ensure services are provided in the most effective manner.

Sustainable

Manage assets to achieve sustainable service delivery that can meet future challenges, including changing demographics, legislative requirements, technological and environmental factors, and climate change.

Integrated

Consider assets in a larger service delivery context and integrate corporate, business, technical, financial and budgetary planning for all asset classes.

Risk-Based

Assess risks related to assets and the City's ability to mitigate risks through appropriate strategies.

Continual Improvement and Innovation

Continually improve asset management practices, by driving innovation in the development of processes, tools, techniques, and strategies.

The City shall also consider the following principles as required by the Act and the Regulation when making decisions regarding asset management. Infrastructure planning and Investment should:

1. Take a long-term view, and decision-makers should take into account the needs of citizens by being mindful of, among other things, demographic and economic trends.

2. Take into account any applicable budgets or fiscal plans, such as fiscal plans released under the following:

    i. Budgets adopted under Part VII of the City of Toronto Act, 2006.

3. Clearly identify infrastructure priorities in order to better inform investment decisions regarding infrastructure.

4. Ensure the continued provision of core public services, such as health care and education.

5. Promote economic competitiveness, productivity, job creation and training opportunities.

6. Ensure that the health and safety of workers involved in the construction and maintenance of infrastructure assets is protected.

7. Foster innovation by creating opportunities to make use of innovative technologies, services and practices, particularly where doing so would utilize technology, techniques and practices developed in Ontario.

8. Be evidence based and transparent, and, subject to any restrictions or prohibitions under an Act or otherwise by law on the collection, use or disclosure of information:

    i. Investment decisions respecting infrastructure should be made on the basis of information that is either publicly available or is made available to the public; and

    ii. Information with implications for infrastructure planning should be shared between the City and broader public sector entities, and should factor into investment decisions respecting infrastructure.

9. Promote accessibility for persons with disabilities.

10. Minimize the impact of infrastructure on the environment and respect and help maintain ecological and biological diversity, and infrastructure should be designed to be resilient to the effects of climate change.

11. Endeavour to make use of acceptable recycled aggregates.

12. Promote community benefits, being the supplementary social and economic benefits arising from an infrastructure project that are intended to improve the well-being of a community affected by the project, such as:

    i. Local job creation and training opportunities;

    ii. Improvement of public space within the community; and

    iii. Any specific benefits identified by the community.

13. Where provincial or municipal plans or strategies have been established in Ontario, under an Act or otherwise, but do not bind or apply to the City, the City should nevertheless be mindful of those plans and strategies and make investment decisions respecting infrastructure that support them, to the extent that they are relevant and appropriate.

7. CORPORATE ASSET MANAGEMENT FRAMEWORK

The City will adopt and implement a Corporate Asset Management Framework to facilitate a coordinated approach to the management of all infrastructure assets essential for service delivery. The Framework, as illustrated in Figure 1, represents the integrated relationship between elements of an effective asset management system, and provides a structure for standardization and consistency of asset management practices across the organization.

Figure 1: Corporate Asset Management Framework

The elements of the framework together with related policies, plans, strategies and appropriate technologies will provide a robust foundation for the implementation of asset management in accordance with the principles and concepts outlined in this policy.

8. POLICY STATEMENT

The following policy directions shall be embedded into the City's asset management practices and will guide the development of asset management strategies and plans.

8.1 Asset Planning and Strategic Alignment

8.1.1 The City will take an evidence-based approach to infrastructure investment decisions, including acquisition, renewal, maintenance and disposal, by considering the total lifecycle costs of assets and ensuring an appropriate balance between the acquisitions of new assets and maintaining the existing asset base.

8.1.2 Asset management planning will not occur in isolation from other City goals, plans, and policies. An integrated approach will be followed to develop asset management plans that foster alignment with City documents such as:

- **i.** Strategic Plan
- **ii.** The Official Plan
- **iii.** The Long Term Financial Plan
- **iv.** Capital Plan
- **v.** Climate Mitigation Strategy
- **vi.** Resilience Strategy
- **vii.** Master Plans
- **viii.** Service Plans

8.1.3 Asset management will be an integral element of Council's planning, budgeting and reporting frameworks. The City will integrate information from the asset management plans into its financial planning and budgeting strategies and processes.

8.1.4 The City will ensure that all asset management planning is aligned with financial plans related to wastewater assets, and water assets including any financial plans prepared under the Safe Drinking Water Act, 2002.

8.1.5 The City will align all asset management planning with the City's Official Plan and with the Province of Ontario's land use planning framework, including the Provincial Policy Statement (2014), the

Growth Plan for the Greater Golden Horseshoe (2017) and any other provincial plans as defined in the Planning Act.

8.1.6 The City will consider, as part of its asset management planning, risks and vulnerabilities and the impact of climate change on its municipal infrastructure assets and relevant adaptation and mitigation actions including:

i. The actions that may be required to address risks and vulnerabilities in respect of such matters as:

- Operations, such as increased maintenance schedules;
- Levels of service; and
- Lifecycle management

ii. The anticipated costs that could arise from these risks and vulnerabilities;

iii. Adaptation opportunities that may be undertaken to manage these risks and vulnerabilities;

iv. Mitigation approaches to climate change, such as greenhouse gas emission reduction goals and targets; and

v. Disaster planning and contingency funding.

8.1.7 The City recognizes stakeholder engagement as an integral part of its asset management approach and will:

i. Provide opportunities for residents and other stakeholders to have input in asset management planning, wherever and whenever feasible; and

ii. Coordinate asset management planning for interrelated municipal infrastructure assets with separate ownership structures by pursuing collaborative opportunities with neighbouring municipalities and jointly-owned municipal bodies, wherever viable and beneficial.

8.2 Asset Management Plans

8.2.1 Asset management plans will be developed for all infrastructure assets owned and, or controlled by the City of Toronto. The asset management plans will be developed in accordance with the Act and the Regulation.

8.2.2 Asset management plans will be consistent with the City's Official Plan and will reflect how and where the City is growing.

8.2.3 Asset management plans will incorporate all assets that meet the capitalization threshold as well as assets below the capitalization threshold that, based upon professional judgement, are critical to service delivery and should be included in the plan.

8.2.4 Asset management plans will be updated in accordance with the dates outlined in the Regulation, and at least every five years thereafter.

8.3 Continuous Improvement and Reporting Requirements

8.3.1 The City will implement continuous improvement protocols and adopt best practices regarding asset management planning, including:

- **i.** Comprehensive and Accurate Asset Data
- **ii.** Condition Assessment Standards and Protocols
- **iii.** Risk and Criticality Models
- **iv.** Lifecycle Management
- **v.** Financial Strategy Development
- **vi.** Service Levels and Performance

8.3.2 The City will develop meaningful performance metrics and reporting tools to transparently communicate the current state of asset management to Council and the community.

8.3.3 The asset management plans, and progress made on the plans will be considered annually as part of the City's budget process.

8.3.4 The review of asset management planning progress must be reported to Council on or before July 1 in each year. The annual review must address at a minimum:

- **i.** The City's progress in implementing its asset management plan;
- **ii.** Any factors impeding the City's ability to implement its asset management plan; and
- **iii.** A strategy to address the identified factors.

9. ROLES AND RESPONSIBILITIES

The development and continuous support of the City's asset management function requires a collaborative and integrated approach across the whole of City government. The asset management roles and responsibilities are summarized below:

Council

- Approve the asset management policy by a resolution passed by City Council.
- Approve asset management strategies and plans, as required.
- Establish priorities and articulate strategic direction for corporate asset management to the City's Administration.
- Approve asset funding through the annual budget process.

Executive Lead

- Endorse the corporate asset management policy and asset management plans.
- Provide organization-wide leadership in asset management practices and concepts, including implementation of the Asset Management Policy and Asset Management Strategy.
- Communicate the vision and goals of asset management at a corporate level, and provide the guidance necessary to ensure alignment and integration across the organization.
- Promote and raise awareness of asset management to Council, staff and other stakeholders.
- Ensure organization-wide accountability mechanisms for achieving corporate asset management goals and priorities.

- Maintain the necessary corporate capacity (including, but not limited to, resourcing, financial support, staff competencies, business processes, data and integrated information systems) to support the implementation and best practices of asset management.

- Track, analyze and report on a City wide basis asset management implementation and continuous improvement progress.

- Direct/facilitate the review and update of the Corporate Asset Management Policy and Asset Management Plans.

Division Heads

- Provide senior support for asset management and ensure alignment of asset management plans and strategies with City objectives and plans.

- Provide input and direction to corporate asset management strategies and work plans to ensure consistency with other corporate initiatives.

- Track, analyze and report on asset management implementation and continuous improvement progress for assets within the division's portfolio.

- Champion asset management practices and collaboration across the organization.

Agency and Corporation Heads

- Provide senior support for asset management and ensure alignment of asset management plans and strategies with City, Agency and/or Corporation objectives and plans.

- Provide input and direction to corporate asset management strategies and work plans to ensure consistency with other City, Agency and/or Corporation initiatives.

- Track, analyze and report on asset management implementation and continuous improvement progress for assets within the agency's or corporation portfolio.

- Champion asset management practices and collaboration across the Agency or Corporation.

10. REVIEW PERIOD

This Policy will be reviewed and updated in alignment with the dates outlined in the Regulation for the preparation of Asset Management Plans; 2022, 2024, 2025, and every five years thereafter.

REFERENCES

- Ontario Regulation 588/17 – Asset Management Planning for Municipal Infrastructure

- Infrastructure for Jobs and Prosperity Act, 2015

Schedule A

City Agencies and Corporations That Are In Scope For Asset Management Policy

Wholly-Owned Corporations

- Toronto Community Housing Corporation

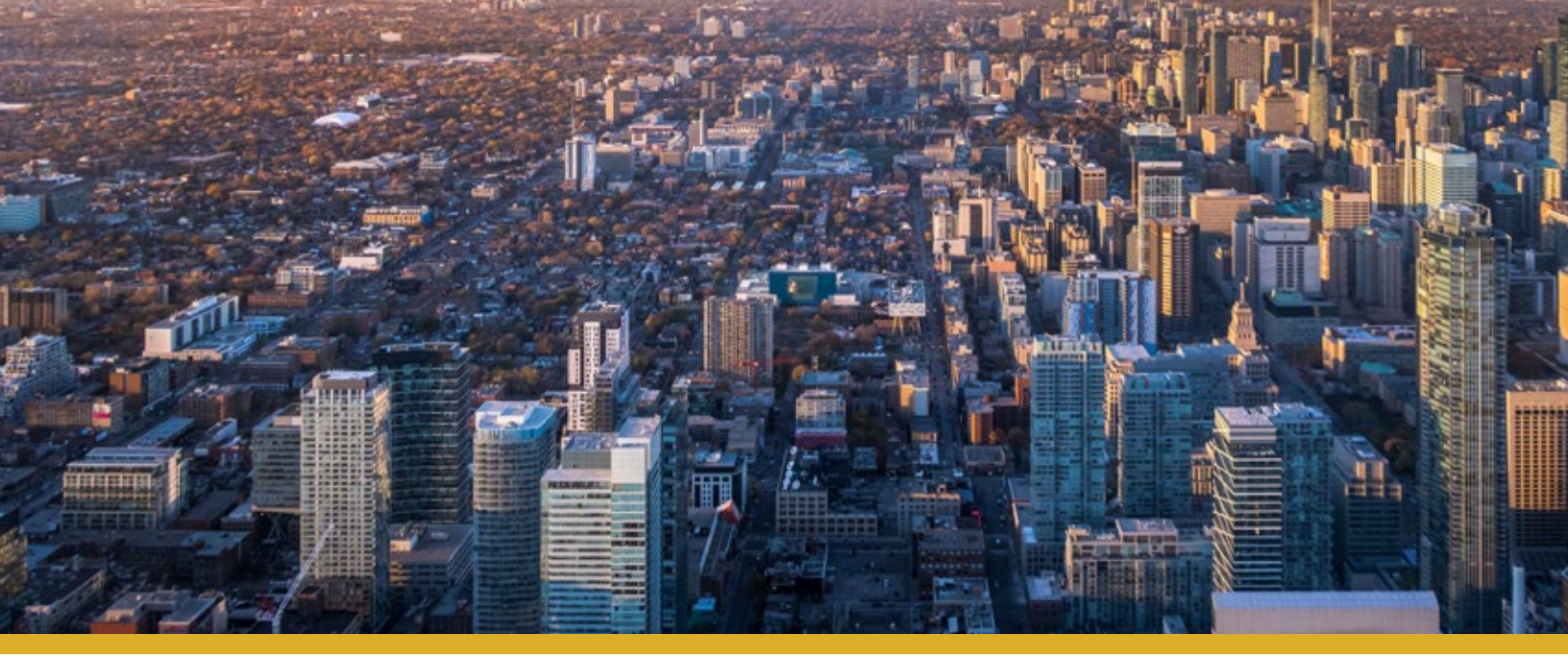
Service Agencies

- Exhibition Place
- Toronto Police Service
- Toronto Public Library
- Toronto Transit Commission
- Toronto Zoo
- TO Live
- Yonge-Dundas Square

APPENDIX 4

Ontario Regulation 588/17

Asset Management Planning For Municipal Infrastructure



Definitions

1. (1) In this Regulation,

"asset category" means a category of municipal infrastructure assets that is,

a. an aggregate of assets described in each of clauses (a) to (e) of the definition of core municipal infrastructure asset, or

b. composed of any other aggregate of municipal infrastructure assets that provide the same type of service; ("catégorie de biens")

"core municipal infrastructure asset" means any municipal infrastructure asset that is a,

a. water asset that relates to the collection, production, treatment, storage, supply or distribution of water,

b. wastewater asset that relates to the collection, transmission, treatment or disposal of wastewater, including any wastewater asset that from time to time manages stormwater,

c. stormwater management asset that relates to the collection, transmission, treatment, retention, infiltration, control or disposal of stormwater,

d. road, or

e. bridge or culvert; ("bien d'infrastructure municipale essentiel")

"ecological functions" has the same meaning as in Ontario Regulation 140/02 (Oak Ridges Moraine Conservation Plan) made under the *Oak Ridges Moraine Conservation Act, 2001*; ("fonctions écologiques")

"green infrastructure asset" means an infrastructure asset consisting of natural or human-made elements that provide ecological and hydrological functions and processes and includes natural heritage features

and systems, parklands, stormwater management systems, street trees, urban forests, natural channels, permeable surfaces and green roofs; ("bien d'infrastructure verte")

"hydrological functions" has the same meaning as in Ontario Regulation 140/02; ("fonctions hydrologiques")

"joint municipal water board" means a joint board established in accordance with a transfer order made under the *Municipal Water and Sewage Transfer Act, 1997*; ("conseil mixte de gestion municipale des eaux")

"lifecycle activities" means activities undertaken with respect to a municipal infrastructure asset over its service life, including constructing, maintaining, renewing, operating and decommissioning, and all engineering and design work associated with those activities; ("activités relatives au cycle de vie")

"municipal infrastructure asset" means an infrastructure asset, including a green infrastructure asset, directly owned by a municipality or included on the consolidated financial statements of a municipality, but does not include an infrastructure asset that is managed by a joint municipal water board; ("bien d'infrastructure municipale")

"municipality" has the same meaning as in the *Municipal Act, 2001*; ("municipalité")

"operating costs" means the aggregate of costs, including energy costs, of operating a municipal infrastructure asset over its service life; ("frais d'exploitation")

"service life" means the total period during which a municipal infrastructure asset is in use or is available to be used; ("durée de vie")

"significant operating costs" means, where the operating costs with respect to all municipal infrastructure assets within an asset category are in excess of a threshold amount set by the municipality, the total amount of those operating costs. ("frais d'exploitation importants")

(2) In Tables 1 and 2,

"connection-days" means the number of properties connected to a municipal system that are affected by a service issue, multiplied by the number of days on which those properties are affected by the service issue. ("jours-branchements")

(3) In Table 4,

"arterial roads" means Class 1 and Class 2 highways as determined under the Table to section 1 of Ontario Regulation 239/02 (Minimum Maintenance Standards for Municipal Highways) made under the *Municipal Act, 2001*; ("artères")

"collector roads" means Class 3 and Class 4 highways as determined under the Table to section 1 of Ontario Regulation 239/02; ("routes collectrices")

"lane-kilometre" means a kilometre-long segment of roadway that is a single lane in width; ("kilomètre de voie")

"local roads" means Class 5 and Class 6 highways as determined under the Table to section 1 of Ontario Regulation 239/02. ("routes locales")

(4) In Table 5,

"Ontario Structure Inspection Manual" means the Ontario Structure Inspection Manual (OSIM), published by the Ministry of Transportation and dated October 2000 (revised November 2003 and April 2008) and available on a Government of Ontario website; ("manuel d'inspection des structures de l'Ontario")

"structural culvert" has the meaning set out for "culvert (structural)" in the Ontario Structure Inspection Manual. ("ponceau structurel")

Application

2. For the purposes of section 6 of the Act, every municipality is prescribed as a broader public sector entity to which that section applies.

STRATEGIC ASSET MANAGEMENT POLICIES

Strategic asset management policy

3. **(1)** Every municipality shall prepare a strategic asset management policy that includes the following:

1. Any of the municipality's goals, policies or plans that are supported by its asset management plan.

2. The process by which the asset management plan is to be considered in the development of the municipality's budget or of any long-term financial plans of the municipality that take into account municipal infrastructure assets.

3. The municipality's approach to continuous improvement and adoption of appropriate practices regarding asset management planning.

4. The principles to be followed by the municipality in its asset management planning, which must include the principles set out in section 3 of the Act.

5. The municipality's commitment to consider, as part of its asset management planning,

    i. i.the actions that may be required to address the vulnerabilities that may be caused by climate change to the municipality's infrastructure assets, in respect of such matters as,

        A. operations, such as increased maintenance schedules,

        B. levels of service, and

        C. lifecycle management,

    ii. the anticipated costs that could arise from the vulnerabilities described in subparagraph i,

    iii. adaptation opportunities that may be undertaken to manage the vulnerabilities described in subparagraph i,

    iv. mitigation approaches to climate change, such as greenhouse gas emission reduction goals and targets, and

    v. disaster planning and contingency funding.

6. A process to ensure that the municipality's asset management planning is aligned with any of the following financial plans:

    i. Financial plans related to the municipality's water assets including any financial plans prepared under the *Safe Drinking Water Act, 2002*.

    ii. Financial plans related to the municipality's wastewater assets.

7. A process to ensure that the municipality's asset management planning is aligned with Ontario's land-use planning framework, including any relevant policy statements issued under subsection 3 (1) of the *Planning Act*, any provincial plans as defined in the *Planning Act* and the municipality's official plan.

8. An explanation of the capitalization thresholds used to determine which assets are to be included in the municipality's asset management plan and how the thresholds compare to those in the municipality's tangible capital asset policy, if it has one.

9. The municipality's commitment to coordinate planning for asset management, where municipal infrastructure assets connect or are interrelated with those of its upper-tier municipality, neighbouring municipalities or jointly-owned municipal bodies.

10. The persons responsible for the municipality's asset management planning, including the executive lead.

11. An explanation of the municipal council's involvement in the municipality's asset management planning.

12. The municipality's commitment to provide opportunities for municipal residents and other interested parties to provide input into the municipality's asset management planning.

(2) For the purposes of this section,

"capitalization threshold" is the value of a municipal infrastructure asset at or above which a municipality will capitalize the value of it and below which it will expense the value of it. ("seuil de capitalisation")

Update of asset management policy

4. Every municipality shall prepare its first strategic asset management policy by July 1, 2019 and shall review and, if necessary, update it at least every five years.

ASSET MANAGEMENT PLANS

Asset management plans, current levels of service

5. **(1)** Every municipality shall prepare an asset management plan in respect of its core municipal infrastructure assets by July 1, 2021, and in respect of all of its other municipal infrastructure assets by July 1, 2023.

(2) A municipality's asset management plan must include the following:

1. For each asset category, the current levels of service being provided, determined in accordance with the following qualitative descriptions and technical metrics and based on data from at most the two calendar years prior to the year in which all information required under this section is included in the asset management plan:

   i. With respect to core municipal infrastructure assets, the qualitative descriptions set out in Column 2 and the technical metrics set out in Column 3 of Table 1, 2, 3, 4 or 5, as the case may be.

   ii. With respect to all other municipal infrastructure assets, the qualitative descriptions and technical metrics established by the municipality.

2. The current performance of each asset category, determined in accordance with the performance measures established by the municipality, such as those that would measure energy usage and operating efficiency, and based on data from at most two calendar years prior to the year in which all information required under this section is included in the asset management plan.

3. For each asset category,

   i. a summary of the assets in the category,

   ii. the replacement cost of the assets in the category,

   iii. the average age of the assets in the category, determined by assessing the average age of the components of the assets,

   iv. the information available on the condition of the assets in the category, and

   v. a description of the municipality's approach to assessing the condition of the assets in the category, based on recognized and generally accepted good engineering practices where appropriate.

4. For each asset category, the lifecycle activities that would need to be undertaken to maintain the current levels of service as described in paragraph 1 for each of the 10 years following the year for which the current levels of service under paragraph 1 are determined and the costs of providing those activities based on an assessment of the following:

   i. The full lifecycle of the assets.

   ii. The options for which lifecycle activities could potentially be undertaken to maintain the current levels of service.

   iii. The risks associated with the options referred to in subparagraph ii.

   iv. The lifecycle activities referred to in subparagraph ii that can be undertaken for the lowest cost to maintain the current levels of service.

5. For municipalities with a population of less than 25,000, as reported by Statistics Canada in the most recent official census, the following:

   i. A description of assumptions regarding future changes in population or economic activity.

   ii. How the assumptions referred to in subparagraph i relate to the information required by paragraph 4.

6. For municipalities with a population of 25,000 or more, as reported by Statistics Canada in the most recent official census, the following:

   i. With respect to municipalities in the Greater Golden Horseshoe growth plan area, if the population and employment forecasts for the municipality are set out in Schedule 3 or 7 to the 2017 Growth Plan, those forecasts.

   ii. With respect to lower-tier municipalities in the Greater Golden Horseshoe growth plan area, if the population and employment forecasts for the municipality are not set out in Schedule 7 to the 2017 Growth Plan, the portion of the forecasts allocated to the lower-tier municipality in the official plan of the upper-tier municipality of which it is a part.

   iii. With respect to upper-tier municipalities or single-tier municipalities outside of the Greater Golden Horseshoe growth plan area, the population and employment forecasts for the municipality that are set out in its official plan.

   iv. With respect to lower-tier municipalities outside of the Greater Golden Horseshoe growth plan area, the population and employment forecasts for the lower-tier municipality that are set out in the official plan of the upper-tier municipality of which it is a part.

   v. If, with respect to any municipality referred to in subparagraph iii or iv, the population and employment forecasts for the municipality cannot be determined as set out in those subparagraphs, a description of assumptions regarding future changes in population or economic activity.

   vi. For each of the 10 years following the year for which the current levels of service under paragraph 1 are determined, the estimated capital expenditures and significant operating costs related to the lifecycle activities required to maintain the current levels of service in order to accommodate projected increases in demand caused by growth, including estimated capital expenditures and significant operating costs related to new construction or to upgrading of existing municipal infrastructure assets.

(3) Every asset management plan must indicate how all background information and reports upon which the information required by paragraph 3 of subsection (2) is based will be made available to the public.

(4) In this section,

"2017 Growth Plan" means the Growth Plan for the Greater Golden Horseshoe, 2017 that was approved under subsection 7 (6) of the *Places to Grow Act, 2005* on May 16, 2017 and came into effect on July 1, 2017; ("Plan de croissance de 2017")

"Greater Golden Horseshoe growth plan area" means the area designated by section 2 of Ontario Regulation 416/05 (Growth Plan Areas) made under the *Places to Grow Act, 2005*. ("zone de croissance planifiée de la région élargie du Golden Horseshoe")

Asset management plans, proposed levels of service

6. (1) Subject to subsection (2), by July 1, 2024, every asset management plan prepared under section 5 must include the following additional information:

7. For each asset category, the levels of service that the municipality proposes to provide for each of the 10 years following the year in which all information required under section 5 and this section is included in the asset management plan, determined in accordance with the following qualitative descriptions and technical metrics:

i. With respect to core municipal infrastructure assets, the qualitative descriptions set out in Column 2 and the technical metrics set out in Column 3 of Table 1, 2, 3, 4 or 5, as the case may be.

ii. With respect to all other municipal infrastructure assets, the qualitative descriptions and technical metrics established by the municipality.

2. An explanation of why the proposed levels of service under paragraph 1 are appropriate for the municipality, based on an assessment of the following:

i. The options for the proposed levels of service and the risks associated with those options to the long term sustainability of the municipality.

ii. How the proposed levels of service differ from the current levels of service set out under paragraph 1 of subsection 5 (2).

iii. Whether the proposed levels of service are achievable.

iv. The municipality's ability to afford the proposed levels of service.

3. The proposed performance of each asset category for each year of the 10-year period referred to in paragraph 1, determined in accordance with the performance measures established by the municipality, such as those that would measure energy usage and operating efficiency.

4. A lifecycle management and financial strategy that sets out the following information with respect to the assets in each asset category for the 10-year period referred to in paragraph 1:

   i. An identification of the lifecycle activities that would need to be undertaken to provide the proposed levels of service described in paragraph 1, based on an assessment of the following:

      A. The full lifecycle of the assets.

      B. The options for which lifecycle activities could potentially be undertaken to achieve the proposed levels of service.

      C. The risks associated with the options referred to in sub-subparagraph B.

      D. The lifecycle activities referred to in sub-subparagraph B that can be undertaken for the lowest cost to achieve the proposed levels of service.

   ii. An estimate of the annual costs for each of the 10 years of undertaking the lifecycle activities identified in subparagraph i, separated into capital expenditures and significant operating costs.

   iii. An identification of the annual funding projected to be available to undertake lifecycle activities and an explanation of the options examined by the municipality to maximize the funding projected to be available.

   iv. If, based on the funding projected to be available, the municipality identifies a funding shortfall for the lifecycle activities identified in subparagraph i,

      A. an identification of the lifecycle activities, whether set out in subparagraph i or otherwise, that the municipality will undertake, and

      B. if applicable, an explanation of how the municipality will manage the risks associated with not undertaking any of the lifecycle activities identified in subparagraph i.

5. For municipalities with a population of less than 25,000, as reported by Statistics Canada in the most recent official census, a discussion of how the assumptions regarding future changes in population and economic activity, set out in subparagraph 5 i of subsection 5 (2), informed the preparation of the lifecycle management and financial strategy referred to in paragraph 4 of this subsection.

6. For municipalities with a population of 25,000 or more, as reported by Statistics Canada in the most recent official census,

   i. the estimated capital expenditures and significant operating costs to achieve the proposed levels of service as described in paragraph 1 in order to accommodate projected increases in demand caused by population and employment growth, as set out in the forecasts or assumptions referred to in paragraph 6 of subsection 5 (2), including estimated capital expenditures and significant operating costs related to new construction or to upgrading of existing municipal infrastructure assets,

   ii. the funding projected to be available, by source, as a result of increased population and economic activity, and

   iii. an overview of the risks associated with implementation of the asset management plan and any actions that would be proposed in response to those risks.

7. **(1)** An explanation of any other key assumptions underlying the plan that have not previously been explained.

(2) With respect to an asset management plan prepared under section 5 on or before July 1, 2021, if the additional information required under this section is not included before July 1, 2023, the municipality shall, before including the additional information, update the current levels of service set out under paragraph 1 of subsection 5 (2) and the current performance measures set out under paragraph 2 of subsection 5 (2) based on data from the two most recent calendar years.

Update of asset management plans

8. **(1)** Every municipality shall review and update its asset management plan at least five years after the year in which the plan is completed under section 6 and at least every five years thereafter.

9. **(2)** The updated asset management plan must comply with the requirements set out under paragraphs 1, 2 and 3 and subparagraphs 5 i and 6 i, ii, iii, iv and v of subsection 5 (2), subsection 5 (3) and paragraphs 1 to 7 of subsection 6 (1).

Endorsement and approval required

8. Every asset management plan prepared under section 5 or 6, or updated under section 7, must be,

   (a) endorsed by the executive lead of the municipality; and

   (b) approved by a resolution passed by the municipal council.

Annual review of asset management planning progress

9. **(1)** Every municipal council shall conduct an annual review of its asset management progress on or before July 1 in each year, starting the year after the municipality's asset management plan is completed under section 6.

(2) The annual review must address,

(a) the municipality's progress in implementing its asset management plan;

(b) any factors impeding the municipality's ability to implement its asset management plan; and

(c) a strategy to address the factors described in clause (b).

Public availability

10. Every municipality shall post its current strategic asset management policy and asset management plan on a website that is available to the public, and shall provide a copy of the policy and plan to any person who requests it.

Table 1: Water Assets

Column 1 Service attribute	Column 2 Community levels of service (qualitative descriptions)	Column 3 Technical levels of service (technical metrics)
Scope	1. Description, which may include maps, of the user groups or areas of the municipality that are connected to the municipal water system. 2. Description, which may include maps, of the user groups or areas of the municipality that have fire flow.	1. Percentage of properties connected to the municipal water system. 2. Percentage of properties where fire flow is available.
Reliability	Description of boil water advisories and service interruptions.	1. The number of connection-days per year where a boil water advisory notice is in place compared to the total number of properties connected to the municipal water system. 2. The number of connection-days per year due to water main breaks compared to the total number of properties connected to the municipal water system.

Table 2: Wastewater assets

Service attribute	Community levels of service (qualitative descriptions)	Technical levels of service (technical metrics)
Scope	Description, which may include maps, of the user groups or areas of the municipality that are connected to the municipal wastewater system.	Percentage of properties connected to the municipal wastewater system.
Reliability	1. Description of how combined sewers in the municipal wastewater system are designed with overflow structures in place which allow overflow during storm events to prevent backups into homes. 2. Description of the frequency and volume of overflows in combined sewers in the municipal wastewater system that occur in habitable areas or beaches. 3. Description of how stormwater can get into sanitary sewers in the municipal wastewater system, causing sewage to overflow into streets or backup into homes. 4. Description of how sanitary sewers in the municipal wastewater system are designed to be resilient to avoid events described in paragraph 3. 5. Description of the effluent that is discharged from sewage treatment plants in the municipal wastewater system.	1. The number of events per year where combined sewer flow in the municipal wastewater system exceeds system capacity compared to the total number of properties connected to the municipal wastewater system. 2. The number of connection-days per year due to wastewater backups compared to the total number of properties connected to the municipal wastewater system. 3. The number of effluent violations per year due to wastewater discharge compared to the total number of properties connected to the municipal wastewater system.

Table 3: Stormwater management assets

Service attribute	Community levels of service (qualitative descriptions)	Technical levels of service (technical metrics)
Scope	Description, which may include maps, of the user groups or areas of the municipality that are protected from flooding, including the extent of the protection provided by the municipal stormwater management system.	1. Percentage of properties in municipality resilient to a 100-year storm. 2. Percentage of the municipal stormwater management system resilient to a 5-year storm.

Table 4: Roads

Service attribute	Community levels of service (qualitative descriptions)	Technical levels of service (technical metrics)
Scope	Description, which may include maps, of the road network in the municipality and its level of connectivity.	Number of lane-kilometres of each of arterial roads, collector roads and local roads as a proportion of square kilometres of land area of the municipality.
Quality	Description or images that illustrate the different levels of road class pavement condition.	1. For paved roads in the municipality, the average pavement condition index value. 2. For unpaved roads in the municipality, the average surface condition (e.g. excellent, good, fair or poor).

Table 5: Bridges and Culverts

Service attribute	Community levels of service (qualitative descriptions)	Technical levels of service (technical metrics)
Scope	Description of the traffic that is supported by municipal bridges (e.g., heavy transport vehicles, motor vehicles, emergency vehicles, pedestrians, cyclists).	Percentage of bridges in the municipality with loading or dimensional restrictions.
Quality	1. Description or images of the condition of bridges and how this would affect use of the bridges. 2. Description or images of the condition of culverts and how this would affect use of the culverts.	1. For bridges in the municipality, the average bridge condition index value. 2. For structural culverts in the municipality, the average bridge condition index value.

Commencement

11. This Regulation comes into force on the later of January 1, 2018 and the day it is filed.

TORONTO