2021

City of Markham

Asset Management Plan

On the Cover

- Aaniin Community Centre & Library grand opening celebration, 2018
- Fire Trucks in front of Fire station 99
- Cornell Woodlot Park
- Rehabbed Dennison Road

Table of Contents

Table of Figures

1. EXECUTIVE SUMMARY

1.1 PURPOSE

The purpose of an asset management plan is to document the comprehensive strategies and practices that a municipality has adopted to provide the set level of services to its community in a financially sustainable way. The plan includes the details of existing state of municipal infrastructure assets, the level of services to be provided, how these services are provided and the strategy for required funding over a set period of time. The City of Markham has included its 25-year financial strategy in this plan.

The City developed its first *Asset Management Plan (AMP)* in 2016 as part of the Municipal Funding Agreement renewal for the Canada Community Building Fund. The 2016 AMP was developed in accordance with guidelines provided in the Ministry of Infrastructure's *"Building Together: Guide for Municipal Asset Management Plans"* (2012) in order to be eligible for Canada Community Building Fund (formerly Federal Gas Tax Fund).

On January 01, 2018 the Ontario Regulation 588/17 (O. Reg. 588/17) – *Asset Management Planning for Municipal Infrastructure* came into force. The O. Reg. 588/17 was created under the *Infrastructure for Jobs and Prosperity Act, 2015*. The regulation requires municipalities to create a strategic asset management policy and an asset management plan in respect to its core and non-core infrastructure assets. This is required by all municipalities in Ontario to maintain eligibility for Canada Community Building Fund.

The City of Markham Asset Management Plan is created in alignment with Provincial Regulation, *Building Markham's Future Together: 2020 – 2023 Strategic Plan* and other key plans.

1.2 INFRASTRUCTURE ASSETS

Markham's Asset Management Plan includes both Core and Non-Core Infrastructure Assets. The Core and Non-core assets are defined in O. Reg. 588/17 as follows:

Core Municipal Infrastructure Assets	Non-Core Municipal Infrastructure Assets
Water Assets	Facilities
Wastewater Assets	Parks
Stormwater Assets	Streetlights
Road Assets	Fleet
Bridges and/or Culverts	Information Technology Infrastructure Hardware

This plan includes the above mentioned Core and Non-Core Assets. Details related to these assets include:

- Assets Summary
- Inventory/Quantity
- Replacement Cost
- Average Age
- Condition

Markham's 2016 Asset Management Plan reported the estimated replacement cost of the City's overall infrastructure asset portfolio to be $7.94B. In 2020, the estimated total replacement cost of City of Markham Core and Non-Core Assets is $9.63B. Core Assets make up approximately 85.7 per cent of the overall infrastructure asset portfolio whereas Non-Core Assets make up the remaining 14.3 per cent.

The estimated replacement cost of City of Markham overall infrastructure asset portfolio between 2016 and 2020 increased by $1.69B or 21.24 per cent and is driven by:

- Volume – The volumetric change in City's asset inventory between 2016 and 2020 has contributed to $416M or 25 per cent of $1.69B increase. Increase due to volume change represents the collective increase due to addition of formerly missing assets and any new assets that the City acquired from 2016 to 2020.
- Unit Rate – The change in unit rates used for calculation of replacement cost of different assets between 2016 and 2020 have contributed to $1.27B or 75 per cent of $1.69B increase. Increase due to unit rate change represents the collective increase due to inflation and latest unit costs. Latest unit costs have changed due to variety of reasons that includes but are not limited to, change in technology, regulatory requirements, obsolescence, and change in standards.

1.3 LEVELS OF SERVICE

The ultimate goal of asset management planning is the delivery of set levels of service in a financially sustainable way. Levels of service enable a municipality to develop a financial strategy and serve as a performance measuring scale to benchmark success in delivering the services it commits to offer to its community.

O. Reg. 588/17 requires municipalities to include their levels of service in their Asset Management Plan for its Core and Non-Core Assets. Levels of service for Core Assets included in this plan align with the qualitative description and technical metrics for Core Assets as set out in O. Reg. 588/17.

Further, the regulation requires levels of service for Core Assets only for this update, however levels of service for Non-Core Assets have also been included in this plan.

1.4 ASSET MANAGEMENT FRAMEWORK AND STRATEGY

The City's asset management framework ties municipal goals (e.g. Building Markham's Future Together - 2020-2023 Strategic Plan) and planning (Official Plan, Departmental Business Plans and capital budget) to infrastructure management to realize our strategic objectives. The Markham Asset Management Framework, developed in consultation with senior staff and industry experts illustrates the relationship between business processes and activities conducted by the City to manage its infrastructure assets.

Asset Management Strategy is a set of planned actions that will ensure the assets provide levels of service in a sustainable way, while managing risk, at the lowest total cost of ownership. The actions for management of City's infrastructure listed below have been developed with reference to organizational goals, customer expectation, applicable standards, legislative requirements and industry best practices:

- Rehabilitation and Replacement
- Preventive Maintenance
- Corrective Maintenance
- Condition Assessment
- Climate Change Adaptation and Mitigation
- Enterprise Asset Management (Software) Solution
- Non-Infrastructure Solutions

Staff in business units responsible for the management of relevant infrastructure continually evaluate the strategies in place and make necessary changes to ensure optimum delivery of levels of service in a fiscally responsible way. Frequent review of current practices and the overall Asset Management Program is conducted to identify gaps, how to bridge those gaps, and what resources, including human resources are required to bridge the gaps. This enables the City to ensure that the right investment is made on the right asset, at the right time to meet expected service levels while managing risks at the lowest total cost of ownership. However there are risks that will create challenges for the City in the foreseeable future, impacting its ability to continue providing the approved levels of service to its residents and businesses. These risks include but are not limited to impacts due to:

- Aftermath of Global Pandemic/Loss of Revenue
- Climate Change
- Legislative Changes
- Increasing Number of Aging Assets
- Growth

In order to reduce the impact of anticipated risks and to ensure the City continues to provide satisfactory levels of service in a sustainable manner, ongoing investment is required to enhance the overall Asset Management Program.

This plan also includes population growth figures and employment forecasts for the City of Markham as set out in the York Region 2010 Official Plan. The Region of York and the City of Markham are in the process of updating these forecasts as per the Province's updated Schedule 3, which has extended the forecast horizon to 2051.

1.5 FINANCIAL STRATEGY

Financial strategy outlines the approach the City has taken to ensure adequate funding is available to carry out the asset management strategies outlined throughout this plan and to continue providing the approved levels of service at the lowest total cost of ownership over the life of City's assets.

The long-term financial strategy for municipal infrastructure assets is included in the City's Reserve Studies. A detailed 25-year plan is updated annually to ensure adequate funding is available for the operation and maintenance of the system, and the rehabilitation and replacement of the City's existing assets.

Based on population and employment forecasts, expansion activities are identified in the City's Development Charges Background Study. The Study includes a capital forecast of 10 years for soft services, such as recreation and library facilities, fire services, and parks, and a forecast to buildout (2031) for engineered or "hard" services, such as roads, sidewalks, and bridges.

Regular updates of these studies are undertaken to enable the City to identify risks, including funding shortfalls and to develop strategies to reduce identified risks.

1.6 CONCLUSION

The City of Markham remains in compliance with O. Reg. 588/17 and maintains its eligibility for Canada Community Building Fund. The City has demonstrated continued effectiveness of the strategies included in this plan through successfully and proactively managing its infrastructure assets in a fiscally responsible way to ensure delivery of approved levels of service.

An Enhanced Asset Management Strategy will further enhance how the City's assets are managed, which will provide the following benefits to the City:

- Detailed risk analyses of infrastructure across the City;
- Prioritized infrastructure investments that maximize benefits, reduce risk and provide desired levels of service;
- Support informed decision making over the life of assets (including operation, maintenance, renewal, replacement and decommissioning); and
- More efficient and effective delivery of services.

The process of managing assets is continuous, and the AMP is a living document which will be updated with reference to Ontario Regulation (O. Reg.) 588/17.

2. INTRODUCTION

2.1 PROVINCIAL GUIDELINES ON ASSET MANAGEMENT PLANS

As part of the 2014 renewal of the Municipal Funding Agreement, municipalities were mandated to create an Asset Management Plan (AMP) by December 31, 2016 to be eligible for Canada Community Building Funds. Throughout 2015 and 2016, staff developed the Asset Management Plan in accordance with the Ministry of Infrastructure's — Building Together: Guide for Municipal Asset Management Plans as mandated. Council approved the 2016 Asset Management Plan on November 16, 2016.

In 2018, the Province implemented the Asset Management Planning for Municipal Infrastructure Regulation, O. Reg. 588/17, which took effect on January 1, 2018. In order to comply with O. Reg. 588/17 municipalities are required to:

- Prepare an Asset Management Plan in respect of its core municipal infrastructure assets (water, waste water, storm water, road, bridge or culvert) by July 1, 2022;and
- Prepare an Asset Management Plan in respect of its non-core/other municipal infrastructure assets by July 1, 2024.

An Asset Management Plan developed per O. Reg. 588/17 must include:

- The current Levels of Service (LOS) being provided, determined in accordance with the qualitative descriptions and technical metrics provided in the regulation and based on data from at most the two calendar years prior to the year in which all information required under the Section 5 of O. Reg. 588/17;
- State of Infrastructure – summary of assets, replacement cost, average age, condition and condition assessment strategy;
- Financing Strategy – cost of 10 year life cycle activities to ensure continuous delivery of current Levels of Service;
- Portion of the population and employment growth forecasts allocated to the City of Markham in the official plan of York Region and the estimated 10 years capital and operating costs associated with the increased demand of current Levels of Service due to growth; and
- A Municipal Climate Change Strategy.

Furthermore, by July 1, 2025, every Asset Management Plan prepared under Section 5 of O. Reg. 588/17 must include the following additional information:

- Proposed Levels of Service of both core and non-core municipal assets for the next 10-year period;
- An explanation of why the proposed Levels of Service are appropriate for the municipality, including associated risks, affordability and achievability;
- The proposed performance of each asset category for each year of the 10-year periods;
- A 10-year life cycle management strategy;
- A 10-year financial strategy; and
- For municipalities with a population of 25,000 or more,
  - Estimated capital expenditures and significant operating costs to achieve the proposed Levels of Service in order to accommodate projected increases in demand caused by population and employment growth.
  - Funding sources for projected expenditure.
  - Associated risks with the implementation of the Asset Management Plan.

Every Asset Management Plan must be endorsed by an executive lead of the municipality and approved by a resolution passed by municipal council. The approved current Asset Management Plan and Policy (refer to Appendix A) shall be posted on a website that is available to the public.

2.2 CITY OF MARKHAM GOALS / STRATEGIC PLAN

Historically, the City has been diligent with the management of its assets and currently has a solid foundation to meet the requirements of O. Reg. 588/17. Beginning in 1998, Council recognized the need to set aside funds for the rehabilitation and eventual replacement of aging assets, and approved an 8 per cent property tax increase for this purpose. Markham formally established the Life Cycle Replacement and Capital Reserve in 2004 to address on-going capital replacements and preventative maintenance of capital assets. The adequacy of the Life Cycle Reserve is also reviewed annually using a 25-year rolling planning horizon (AMP minimum requirement is a 10-year period), based on projected inflows and outflows to sustain future rehabilitation and replacement requirements for the City's existing assets, over the next 25 years.

The City of Markham's 2020 – 2023 Strategic Plan, *Building Markham Future Together (BMFT)*, and other key strategic documents, including *Integrated Leisure Master Plan, Greenprint, Markham's Community Sustainability Plan, Municipal Energy Plan and the Official Plan,* help ensure our work is aligned with the City's four goals:

- Exceptional Services by Exceptional People;
- Engaged, Diverse, Thriving, and Vibrant City;
- Safe, Sustainable and Complete Community, and
- Stewardship of Money and Resources.

Further, the City uses Excellence Canada's Excellence Framework for Municipalities to guide how we manage the organization as a whole, focusing on the areas of Customer Satisfaction, Operational Excellence, Staff Engagement and Financial Performance.

For the City to meet its strategic goals and deliver services in a responsible and sustainable manner, the Asset Management Plan has and will ensure City infrastructure is planned, built, and maintained through sound asset management principles and practices, demonstrating fiscal responsibility.

2.3 CITY OF MARKHAM ASSET MANAGEMENT PLAN (AMP)

The City of Markham's Asset Management Plan will:

- Serve as a strategic, tactical, and financial document ensuring the City's investments are timely, while optimizing available resources to deliver current Levels of Service;
- Provide an effective approach to managing the City's existing and future infrastructure assets through sound asset management practices and principles via a comprehensive review of the core and non-core infrastructure assets particularly; constructing, renewing, operating, maintaining, replacing and disposing of infrastructure; and
- Identify funding strategies to accommodate an increase in demand due to population and employment growth.

The City's Asset Management Plan will serve to provide the public with details of our current state of infrastructure, current Levels of Service, asset management strategies and financial strategies. The Asset Management Plan is intended to capture asset management practices within the City, as the Plan is a living document, and will require ongoing refinement to reflect the evolution of asset management practices and maturity within the City of Markham over time. The Plan will be updated with reference to O. Reg. 588/17.

The Asset Management Plan is a key component of the City's planning process linking with multiple other corporate plans and documents and supports the Building Markham's Future Together: 2020 – 2023 Strategic Plan in the following ways:

- Exceptional Services by Exceptional People: The Plan describes the asset management strategy, including processes and practices that empower and inspire City employees to be champions of excellent service delivery by efficient and tactical management of City's assets.

- Engaged, Diverse, Thriving and Vibrant City: The Plan provides current Levels of Service for each asset category to not only document how City employees efficiently manage municipal assets but to also provide what service levels the community shall expect to receive.
- Safe, Sustainable and Complete Community: The Plan is integral to provide excellence in sustainable community planning and infrastructure management to accommodate growth.
- Stewardship of Money and Resources: The Plan provides strategies that demonstrate responsible financial and resource management to mitigate risks while ensuring efficient and effective service delivery. Integration between financial planning and infrastructure management is crucial and is clearly outlined by the Asset Management Plan.

The Asset Management Plan aligns with Excellence Canada's Excellence Framework for Municipalities on how the City manages the organization. The Plan will set out how the infrastructure is managed and identify service levels (Operational Excellence), outline consistent corporate asset management processes and practices (Staff Engagement), and assist with financial investment decisions that optimize the asset's life cycle (Financial Performance).

2.4 WHICH INFRASTRUCTURE IS INCLUDED IN AMP?

CORE ASSETS

- Water
- Wastewater
- Stormwater
- Roads
- Bridge and Culverts

NON-CORE ASSETS

- Streetlights
- Parks (including Forestry)
- Facilities
- Fleet
- Information Technology Assets (infrastructure hardware)

2.5 DEVELOPMENT AND EVALUATION OF THE AMP

The 2016 Asset Management Plan formed the basis of the *2021 Asset Management Plan*. The plan was developed by staff andled by the Acting Manager, Corporate Asset Management from the Sustainability and Asset Management Department, under the direction of Asset Management Steering Committee (AMSC). The AMSC is comprised of heads of stakeholder departments including Engineering, Environmental Services (ES), Finance, Information Technology Services (ITS), Operations, Recreation and Sustainability and Asset Management (S&AM). The working group includes staff from each of the service areas that are responsible for operating, maintaining and replacing the above mentioned core and non-core assets.

AMSC was provided with project status updates on a monthly basis and any outcomes or decisions were presented and approved by AMSC prior to inclusion in the Asset Management Plan, ensuring the Plan aligned with the City's Strategic Plan and with the Excellence Markham Framework.

The Plan covers a 25 year period consistent with the City's Life Cycle Reserve Study that is updated every year, and used the following resources to document the current infrastructure management practices:

- Building Markham's Future Together: 2020-2023 Strategic Plan
- Excellence Markham Framework
- City of Markham Annual Report (2019)
- Yearly capital and operating budget planning documents
- 25 year Life Cycle Reserve Study (2020-2045) of various assets and programs
- Tangible Capital Asset documents
- Department Business Plans and Service Level documentation

The development and implementation of the 2016 Asset Management Plan has provided the following benefits to the City:

- Detailed risk analyses of critical infrastructure across the City;
- Prioritized infrastructure investments that maximize benefits, reduce risk and provide desired levels of service;
- Support informed decision making over the life of assets (including operation, maintenance, renewal, replacement and decommissioning); and
- More efficient and effective delivery of services.

Furthermore, from the development of the 2016 AMP, the gaps in the then-current asset inventory, processes and practices has enabled the City in further enhancing the asset management program. These enhancements are evident in the following ways:

- Improved asset inventory/data in comparison with 2016 data;
- Development of condition audit program;
- Improved methodology and quality of replacement cost estimation;
- Development of asset condition evaluation practices; and
- Synergies through project integration.

The Asset Management Plan will become a living and breathing document that will not only document the City's current state of infrastructure, levels of service, financial and asset management strategies and will continue to evolve. As a living document, the Plan will enable the City in the adoption of asset management best practices that will ensure the community of Markham continues to receive the level of service the City has committed to, while demonstrating fiscal responsibility. The future development of asset management strategies and plan is anticipated to entail the following enhancements:

- Performance Management Framework
- Risk Management Framework
- Enhanced Climate Change Strategy

3. STATE OF LOCAL INFRASTRUCTURE

This chapter provides the following details regarding the state of the City's infrastructure as of December 2019:

- Summary of assets in each category and respective quantities
- Financial accounting valuation and replacement cost valuation
- Average asset age distribution and average asset age as a proportion of expected useful life
- Asset condition

The data gathering is based on:

- PSAB 3150 tangible capital asset data: 2009
- City's 25 year Life Cycle Reserve Studies: 2019
- Department current asset inventory information (e.g. GIS mapping)
- Various departments current asset management strategy/program/practice

The asset classes were reviewed at a medium – high level based on available data. Subsequent detailed reviews and studies are recommended on an annual basis as more information becomes available over time.

3.1 DEFINITIONS

- **Average Asset Age:** defined as the age of the asset since the original construction date. As each asset class has various components, the average asset age is used.
- **Average Asset Life cycle:** defined as the period of time that the asset is expected to be of use and fully functional to the City. As each asset class has various components, the average asset life cycle is used.
- **Remaining Asset Useful Life:** defined as the estimated remaining useful life of the asset based on the age only.
- **Book Value:** defined as the data/inventory collected in 2019 for the City's Tangible Capital Asset (TCA), Public Sector Accounting Board (PSAB).
- **Core Assets:** as per O. Reg. 588/17, Water Asset, Wastewater Asset, Stormwater Management Asset, Roads and Bridges/Culverts are considered as core assets.
- **Life cycle Cost:** cost of activities undertaken with respect to a municipal asset over its service life including reconstructing, maintaining, renewing, operating and decommissioning including associated design and engineering fees. For this update staff is using 2019 dollars that were submitted in early 2020.
- **Non-Core Assets:** tangible assets that are not included in the definition of Core Assets; Facilities, Fleet, ITS Infrastructure and Parks are Non-Core Assets.
- **Plan Rehabilitation/Replacement:** this action involves determining the scope of work and required funding.
- **Replacement Cost:** defined as the cost in 2019 dollars to rebuild the entire asset regardless of maintenance/rehabilitation strategies. It is assumed as a complete new build of the asset, not including the land acquisition cost. The unit replacement costs were estimated using current standard budgeting values that are based on data such as historical tender pricing and current market replacement value.
- **Schedule Rehabilitation/Replacement:** this action involves the scheduling of project following finalizing the scope and identifying the funding source.
- **Useful Life Ratio:** defined as the Average Asset Useful Life Age divided by the Average Asset Life cycle.

3.1.1 Asset Condition

The basic approach to estimating the state of an asset is to use its remaining useful life that is based on age in lieu of other condition data that is based on actual condition assessment of the same asset. This, however, is not the best approach to assessing the useful life of an asset and its condition, as assets have the potential of outperforming their engineered useful life expectancy. To rely solely on age in certain assessments may lead to misrepresentation of an asset's performance. There exist a number of factors that will determine an asset's useful life expectancy, some of these factors could include the conditions under which they were operated and maintained. On the other end of the spectrum, poorly built and/or neglected assets may fail many years before their useful life expectancy. Therefore it is important for asset owners to exercise diligence in establishing robust monitoring and maintenance programs based on condition data attained from a well-developed condition assessment program.

When assets are installed they will naturally pass through a life cycle of maintenance processes which include: repair, rehabilitation, refurbishment and perhaps complete replacement in order to ensure the continuous delivery of defined service levels. Based on the asset, the best combination of information is the inclusion of age as well as condition assessment data and any other relevant information such as: records of historical repair, rehabilitation, refurbishments and expert analysis. Therefore, although the "Remaining Useful Life" indicates the average remaining life of an asset class, it does not reflect the life cycle activity that should be applied to the asset class.

For the purpose of this report, a 5-Point Asset Condition Rating System was developed as illustrated in the table below. This system prioritizes the evaluation of assets based on qualitative scoring i.e. data from actual condition assessment in-lieu of an evaluation based on remaining useful life where data availability made it possible. This rating system and related definitions were developed with reference to industry best practices and standards. A two-pronged approach provided an estimated rating of the current condition of the City's assets:

- **By Age:** where actual condition assessment data was unavailable, asset age and average asset useful life was considered to provide each asset an age-based useful life ratio with an associated scale representing the condition of the asset. The majority of the data was rated based solely on the age of the asset, excluding Bridges/Culverts, Facilities, Information Technology Assets and Road Assets where there was inclusion of condition data for rating purposes.
- **By Actual Condition Assessment:** To obtain the best assessment of an asset in addition to age data, asset owners should assess an asset against various data sources including: asset condition assessments; industry ratings; and evaluations based on cyclic inspection/audit programs and expert judgement to ultimately assess the assets condition and how it is performing against its intended use.

Each asset is assessed based on the table below with asset conditions of Very Good, Good, Fair, Poor or Very Poor.

Table 1: City of Markham Asset Condition Rating

Condition	Design Fulfillment	Service Level	Remaining Useful Life %	Action
Very Good	Performing as Designed	Provides desired service level with basic/ necessary preventative maintenance	>80	No Action Required
Good	Performing as Designed	Provides desired service level with monitoring and preventative maintenance	60 – 80	No Action Required
Fair	Performing as Designed	Provides desired service level with occasional disruption due to repair/ maintenance	40 – 59	No Action Required
Poor	Performance issues due to design limitation *and/or* may perform as designed with high risk of failure	Frequently out of service requiring extensive repairs *and/or* needs ongoing monitoring and frequent maintenance to achieve service levels	20 – 39	Plan Rehabilitation/ Replacement
Very Poor	May fail to meet current applicable codes, standards or legislations	Asset is becoming or may become health and/or safety concern; Unserviceable *and/or* approaching end of service life	<20	Schedule Rehabilitation/ Replacement

This approach has been applied to all asset classes included in this AMP. Although components of the asset classes may rate higher or lower than the overall rating for the Asset type, this is an average rating for the entire Asset class. Consideration must be taken to understand the components that make up the Asset class and the current state of those components as there is generally a spectrum of conditions that make up the average rating.

Understanding the rating condition for each of the assets is the first step in asset planning for replacement and major rehabilitation activities. By employing detailed asset management planning, the intelligence gained from monitoring the assets that are nearing or have exceeded their useful life, the asset owners can make informed decisions and in some cases re-direct focus to those assets with the increasing probability of failure and subsequently deteriorating levels of service.

3.2 CITY INFRASTRUCTURE

The City owns the following assets:

3.2.1 Core Assets

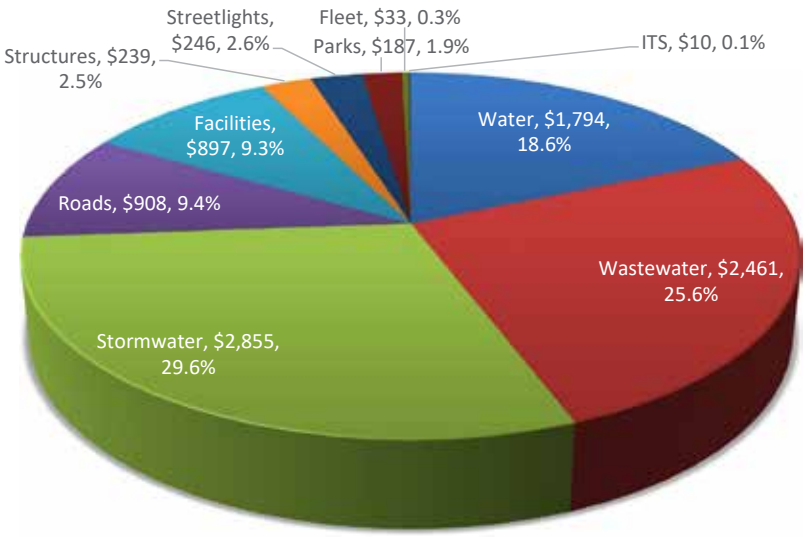
- Water Assets
- Wastewater Assets
- Stormwater Management Assets
- Roads
- Structures (Bridges and Culverts)

3.2.2 Non-Core Assets

- Facilities
- Parks
- Streetlights
- Fleet
- Information Technology Infrastructure Hardware

The total approximate replacement cost of City of Markham core and non-core Assets is $9.63B in infrastructure assets, with primarily 85.7 per cent of these assets representing Core Assets.

Figure 3-1: Asset Distribution (%) by Replacement Value ($M) – Citywide



$9.630B

Note 1: Watercourses, erosion sites and stormwater ponds were not assigned replacement value due to the nature of the asset.
Note 2: Assets not inventoried were not included due to lack of data.

3.3 WATER INFRASTRUCTURE

The City of Markham's Water assets represents the 3rd largest proportion of the total replacement value of overall City assets, at approximately 18.6 per cent of the City's total infrastructure portfolio. The replacement cost of Water assets is estimated at approximately $1.79B.

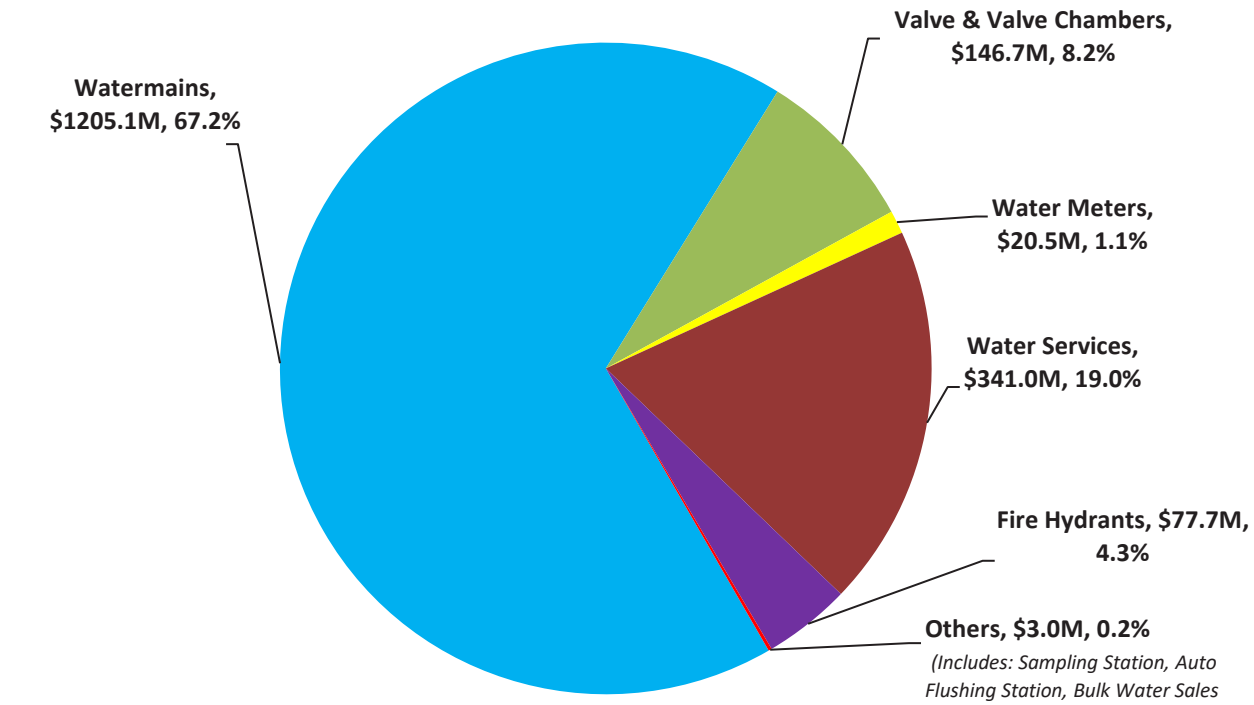
The City of Markham operates and maintains distribution watermains, valves, hydrants and water meters. In addition, in order to ensure the quality of the water per Drinking Water Quality Management Standards) (DWQMS) requirement, the City has a continuous chlorine analyzer, dead-end flushing stations and sampling stations throughout its distribution system.

3.3.1 Inventory – Water Infrastructure

The City is responsible for all water distribution infrastructures totaling $1.794B. This includes:

- Watermains (1,089 kilometers)
- Water Meters (83,179)
- Valve Chamber+Valve Boxes (11,200)
- Water Service/Curb Boxes (83,179)
- Fire Hydrants (8,795),
- Other: Sampling Stations (105), Auto Flushing Stations (12), Bulk Water Sales Stations (2), Suspended Watermain Insulation (13 locations)

Figure 3-2: Asset Distribution (%) by Replacement Value ($M) – Water Infrastructure

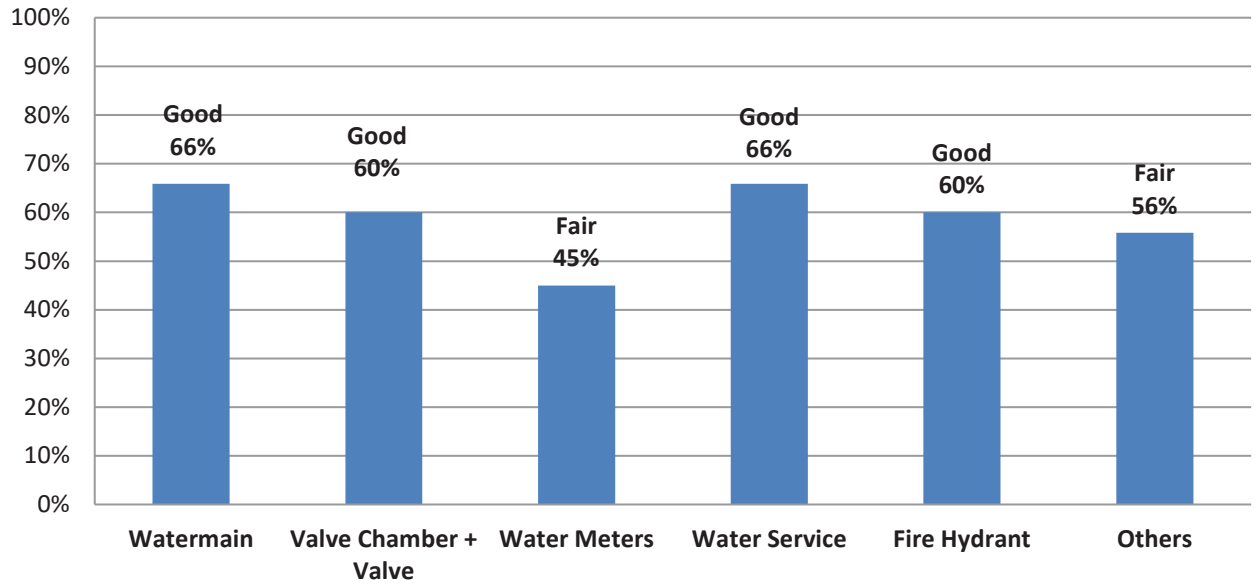


Book Value: $589M

3.3.2 Asset Life Cycle and Useful Life

Assets	Average Asset Life Cycle (years)	Average Asset Age (years)	Remaining Asset Useful Life (years)	Estimated Remaining Service Life (%)
Watermains	85	29	56	66%
ValveChamber+Valves	60	24	36	60%
Water Meters	20	11	9	45%
Water Service	85	29	56	66%
Fire Hydrants	60	24	36	60%

Figure 3-3: % Useful Life by Component and Condition Rating by Age – Water

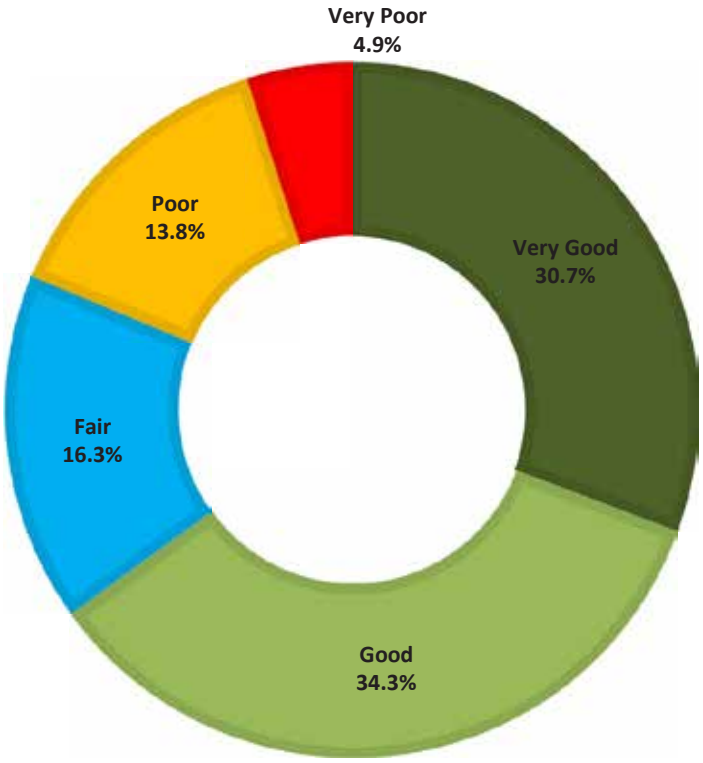


The overall condition rating of the City's water infrastructure is "Good" based on age. The age distribution of the asset components provide a better picture of assets that are near its end of life. Figure 3-4 illustrates the distribution of condition rating of watermains (including water service) based on associated replacement value. The combined replacement value of the watermains and water service is $1.54B, where approximately five per cent are at or in their last 20 per cent (~17 years) useful life of 85 years with an approximate value of $75.8M.

The Figure below shows that approximately five per cent of watermains (Cast Iron pipes) are in very poor condition based on age and are approaching the end of their service life. The City has developed a plan to replace these pipes within the next 12 years in order to provide the required level of service. In addition, the City has also planned to replace/rehabilitate another 14 per cent of watermain pipes of various pipe materials (based on their age) as they approach the end of their service life.

The City manages all of its assets regardless of age distribution, however, currently, the City is only investing in a small proportion of assets nearing their end of service life. Due to the City's significant growth since the 1970s, the AMP data shows the City will have to manage and plan the life cycle activities for almost three times the current number of water-mains scheduled for replacement for example, in the next 20 years; infrastructure demands/needs beyond the next 20 years will be significant. There are a significant number of assets that are relatively young within their life cycle and presently do not require significant attention such as resources/investment at present.

Figure 3-4: Average Asset Condition Distribution by Replacement Value – Watermains



3.4 WASTEWATER INFRASTRUCTURE

The City of Markham's Wastewater assets represent the 2nd largest proportion of the total replacement value of overall City assets, at approximately 25.6 per cent of the City's total infrastructure portfolio. The replacement value of this asset is estimated at approximately $2.461B.

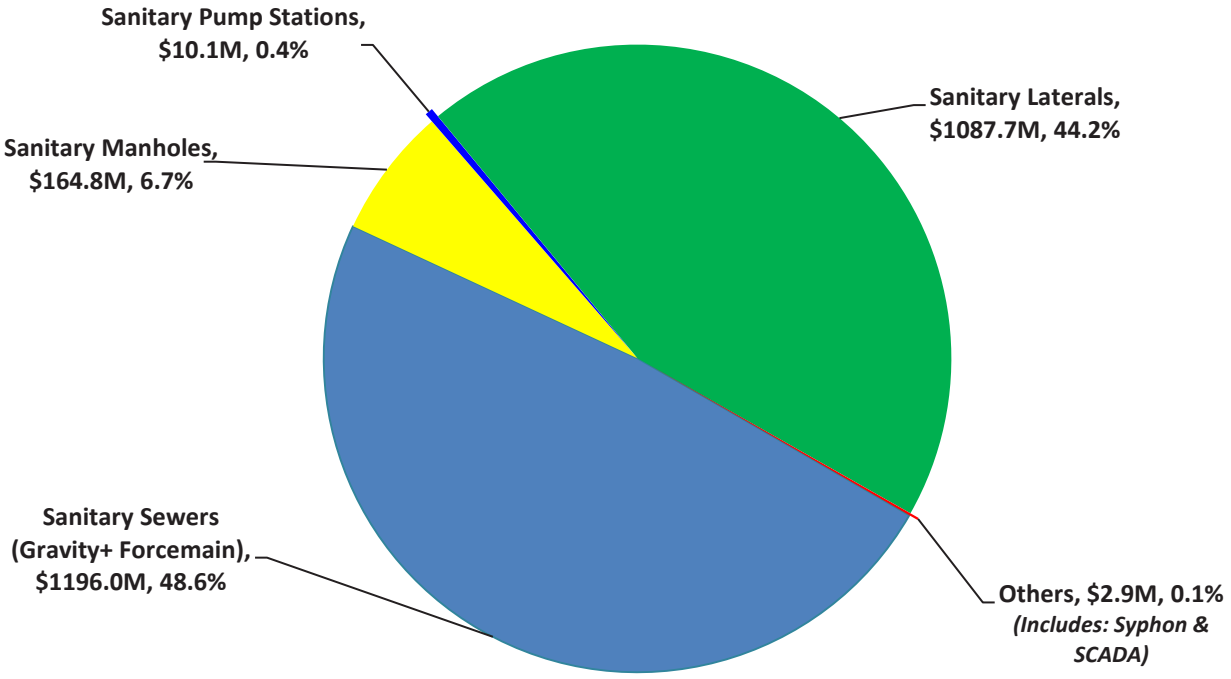
The City of Markham is responsible for managing and maintaining its own sanitary sewers, laterals, manholes, syphons, pump stations and Supervisory Control and Data Acquisition (SCADA) instrumentation. City of Markham does not own or operate a sewage treatment plant and conveys its wastewater to the Region of York's trunk sewer. Markham wastewater is treated at the Dufferin's Creek Wastewater Treatment Plant in Pickering, Ontario which is jointly owned by the Regions of York and Durham. The effluent or treated water is released back into Lake Ontario.

3.4.1 Inventory – Wastewater Infrastructure

The various asset components of Wasterwater Infrastructure includes:

- Sanitary Sewers (Gravity and Force Mains) - (918 kilometers)
- Sanitary Laterals - (82,094)
- Sanitary Manholes - (14,331)
- Sanitary Pump Stations - (5)

Figure 3-5: Asset Distribution (%) by Replacement Value ($M) – Wastewater

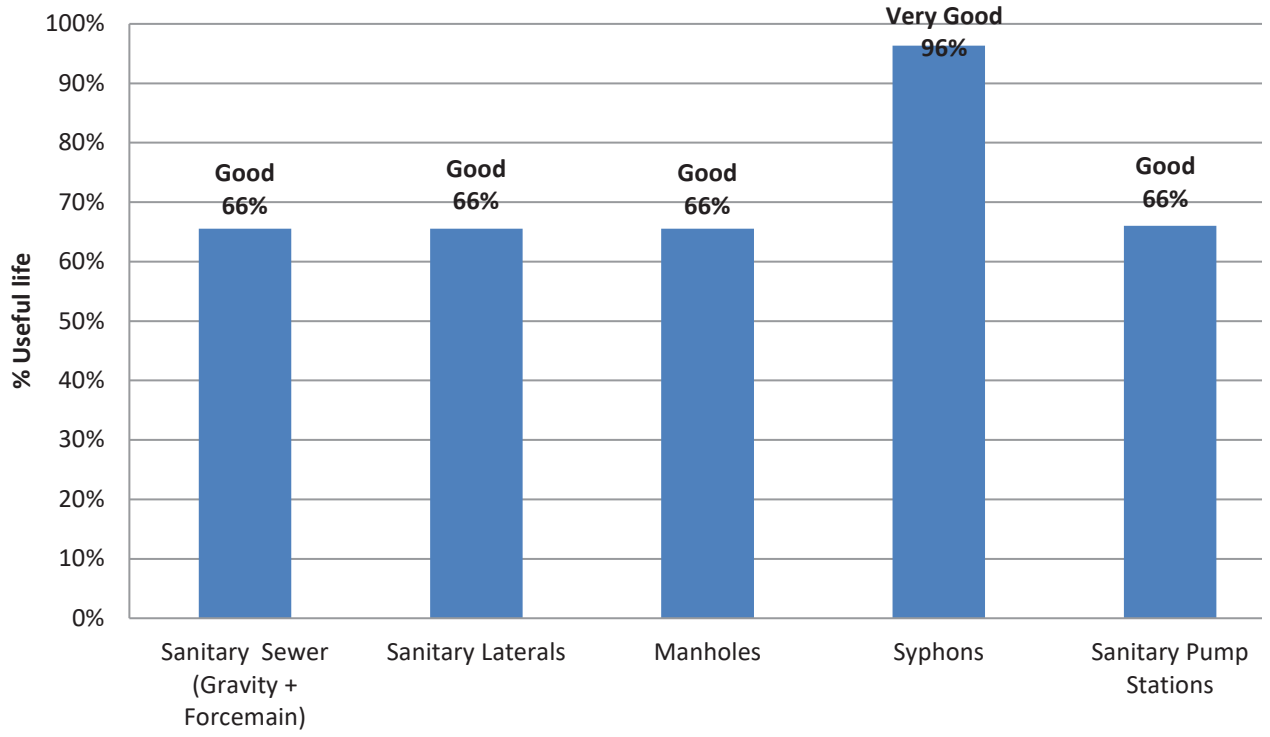


Book Value: $482M

3.4.2 Asset Life Cycle and Useful Life

Assets	Average Asset Life Cycle (years)	Average Asset Age (years)	Remaining Asset Useful Life (years)	Estimated Remaining Service Life (%)
Sanitary Sewers (Gravity and Forcemain)	90	31	59	66%
Sanitary Laterals	90	31	59	66%
Sanitary Manholes	90	31	59	66%
Syphons	55	2	53	96%
Sanitary Pump Stations	100	34	66	66%

Figure 3-6: % Useful Life by Component and Condition Rating by Age – Wastewater

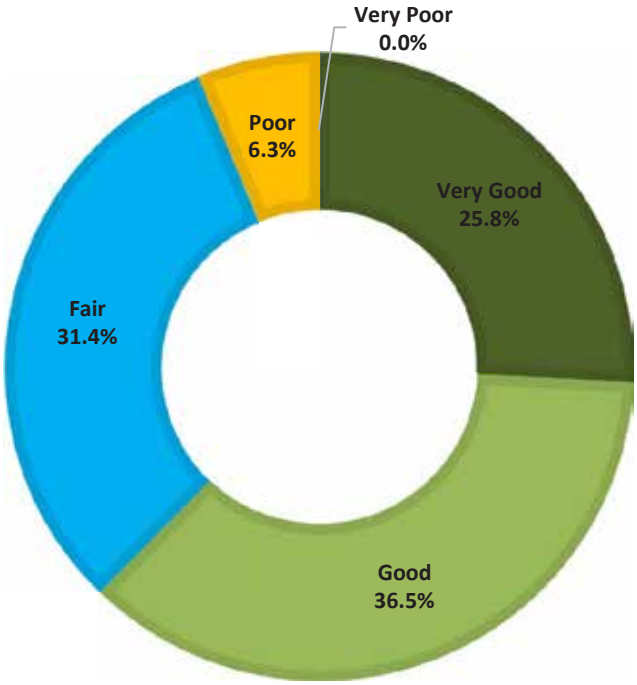


The overall condition rating of the City's wastewater infrastructure is "Good" (average rating 72 per cent) based on age. The age distribution of the asset components provide a better picture of assets that are near its end of life. Figure 3-7 below illustrates the average condition distribution of sanitary sewers based on the associated replacement value. The total replacement value of the sanitary sewers component is $1.19B, where none of the sewer mains are evaluated to be in "Very Poor" condition.

Figure 3-6 shows a breakdown of sanitary sewers evaluated based on remaining useful life in the five condition categories as a proportion of the total replacement cost.

6 per cent of sanitary sewers have a remaining service life of less than 40 per cent (35 years) but are performing as designed with ongoing monitoring to achieve required service levels. Based on CCTV condition inspection results, deficient sewers will be rehabilitated.

Figure 3-7: Average Asset Condition Distribution by Replacement Value – Wastewater (Sanitary Sewers)

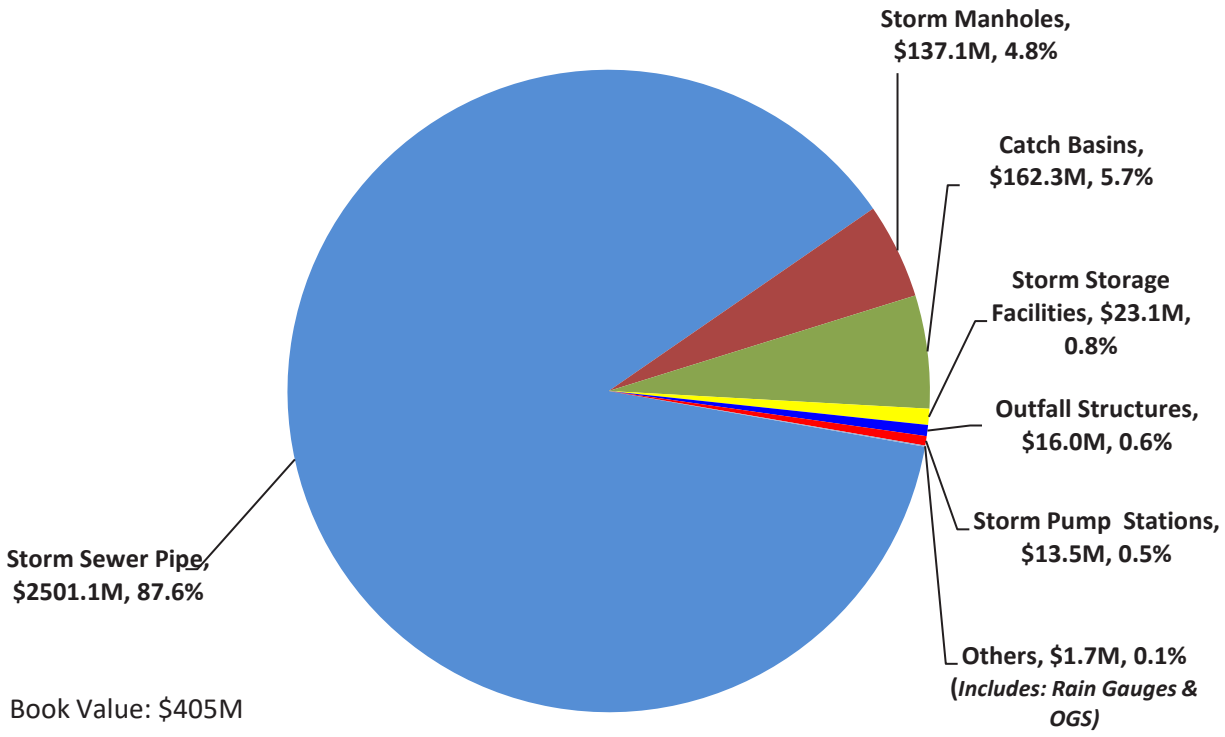


3.5 STORMWATER INFRASTRUCTURE

The storm sewer network makes up the largest proportion of the total replacement value of overall City assets, at a replacement value of $2.85B. This asset category represents approximately 29.6 per cent of the City's total infrastructure portfolio and includes the following assets:

- Stormwater Pipes (AC/Concrete/PVC/CSP) – 920km
- Storm Manholes – 14,431
- Catch Basins – 23,046
- Outfall Structures – 367
- Storm Storage Facilities – 5
- Storm Pumping Stations – 2
- Oil Grit Separators (OGS) – 40
- Rain Gauges – 13

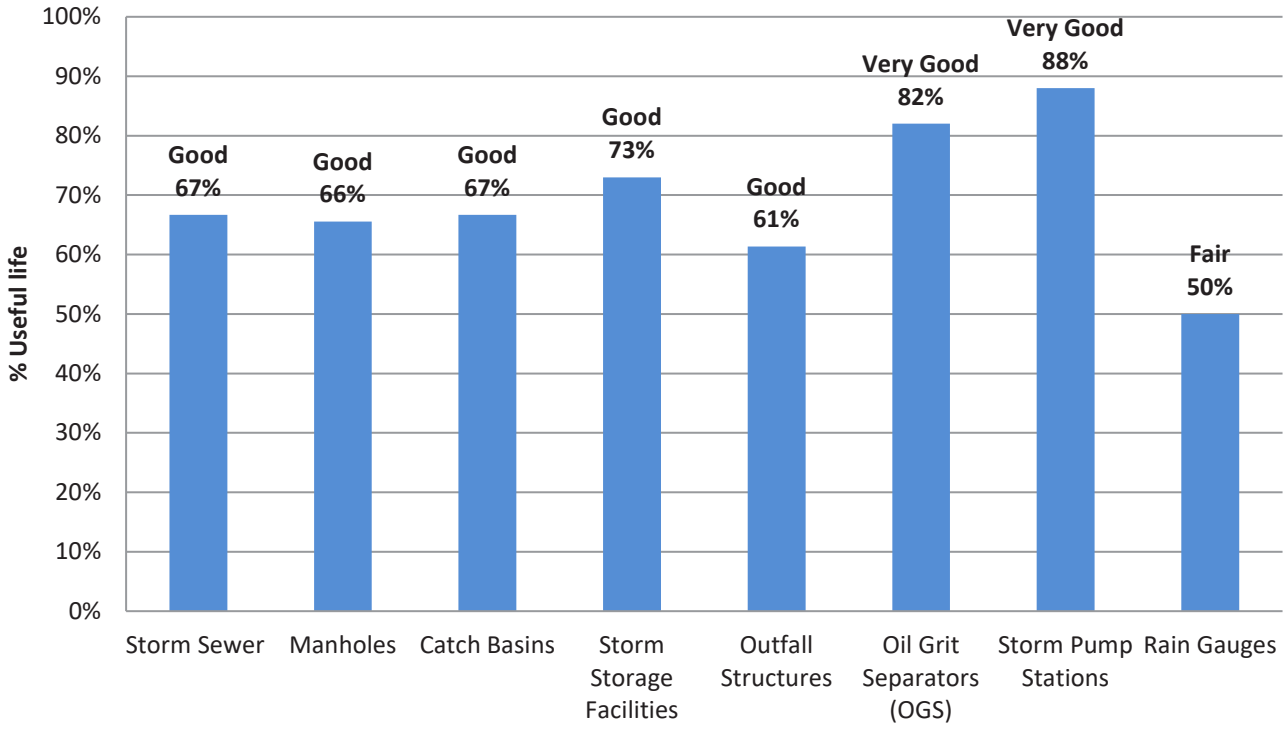
Figure 3-8: Asset Distribution (%) by Replacement Value ($M) – Stormwater



3.5.1 Asset Life Cycle and Useful Life

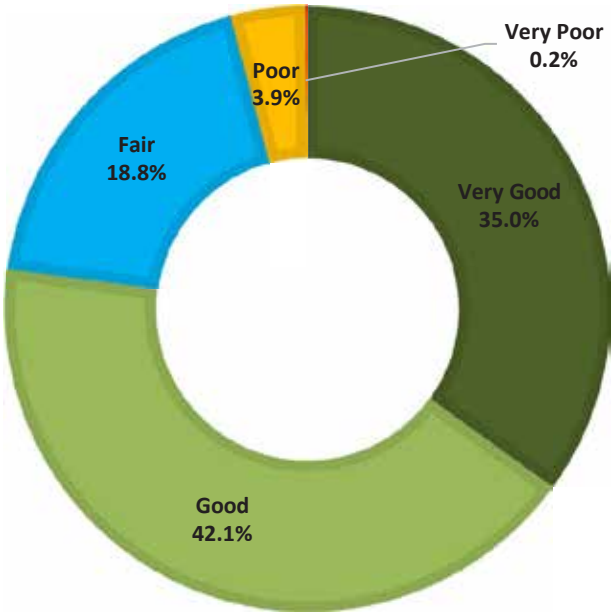
Assets	Average Asset Life Cycle (years)	Average Asset Age (years)	Remaining Asset Useful Life (years)	Estimated Remaining Service Life (%)
Storm Sewers	90	30	60	67%
Manholes	90	31	59	66%
Catch Basins	90	30	60	67%
Storm Storage Facilities	100	27	73	73%
Outfall Structures	75	29	46	61%
Oil Grit Separators (OGS)	50	9	41	82%
Storm Pump Stations	100	12	88	88%
Rain Gauges	10	5	5	50%

Figure 3-9: % Useful Life by Component and Condition Rating by Age – Stormwater



The overall average condition rating of the City's stormwater infrastructure in the ROW is "Good" based on age. The age distribution of the asset component provides a better picture of assets that are near its end of life. Figure 3-10 illustrates the average condition distribution of storm sewers based on the associated replacement value. The replacement value of the storm sewers (including manholes and catch basins) is $2.8B, where 0.2 per cent are within 20 per cent (0-18 years) of useful life with an approximate value of $5.6M. The City has developed a plan to replace these storm sewers within next 10 years in order to provide the required level of service.

Figure 3-10: Average Asset Condition Distribution by Replacement Value – Storm Sewers



3.6 STORMWATER MANAGEMENT (SWM) PONDS / NATURAL INFRASTRUCTURE

Assets	Inventory/ Quantity (#)	Book Value ($)	Replacement Cost ($)	Average Asset Age (year)	Average Asset Life Cycle (year)	Remaining Asset Useful Life (year)	Useful Life Ratio
Wet Ponds	57	$53M	N/A	19	N/A	N/A	N/A
Dry Ponds	41		N/A	29	N/A	N/A	N/A
ErosionSites	458		N/A	N/A	N/A	N/A	N/A

Note 1: Replacement value is not applicable to stormwater ponds due to the nature of the asset. Asset will not be completely replaced but continue to function through regular maintenance and rehabilitation programs.
Note 2: Average asset life cycle is not applicable as there is no end of life for these assets.

3.6.1 Inventory

The City of Markham is responsible for the management of stormwater infrastructure including: SWM ponds that are City-owned, erosion sites in river systems, and a storm channel as noted below:

- Wet Ponds – 57
- Dry Ponds – 41
- Erosion Sites – 458
- Storm Channel – 2 (Don Mills, Rodick/Miller Ditch)

3.6.2 Asset Life Cycle

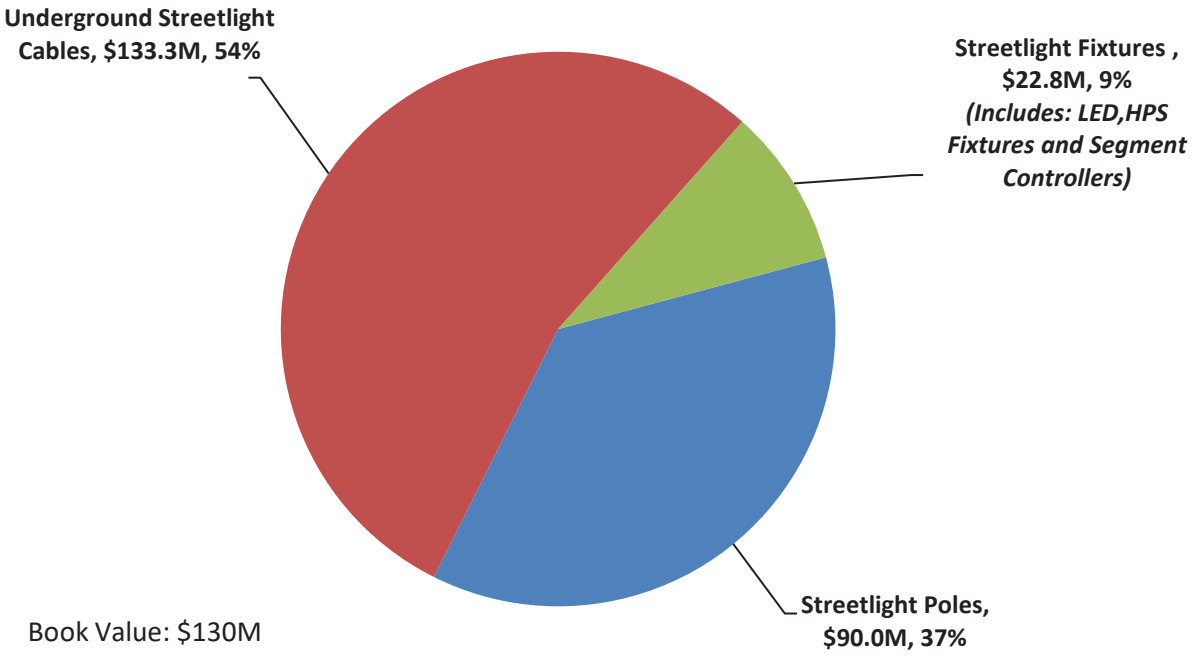
The useful life is not applicable on these assets.

3.7 STREETLIGHTS

The City is responsible for all streetlight infrastructure excluding regional road intersections with a total replacement value of $246M, which represent approximately 2.6 per cent of the City's total infrastructure portfolio. This includes:

- Streetlight Poles – 25,182
- Underground Streetlight Cables – 1,025 km
- Streetlight Fixtures (LED) – 14,111
- Streetlight Fixtures (HPS) – 15,016
- Segment Controllers – 10

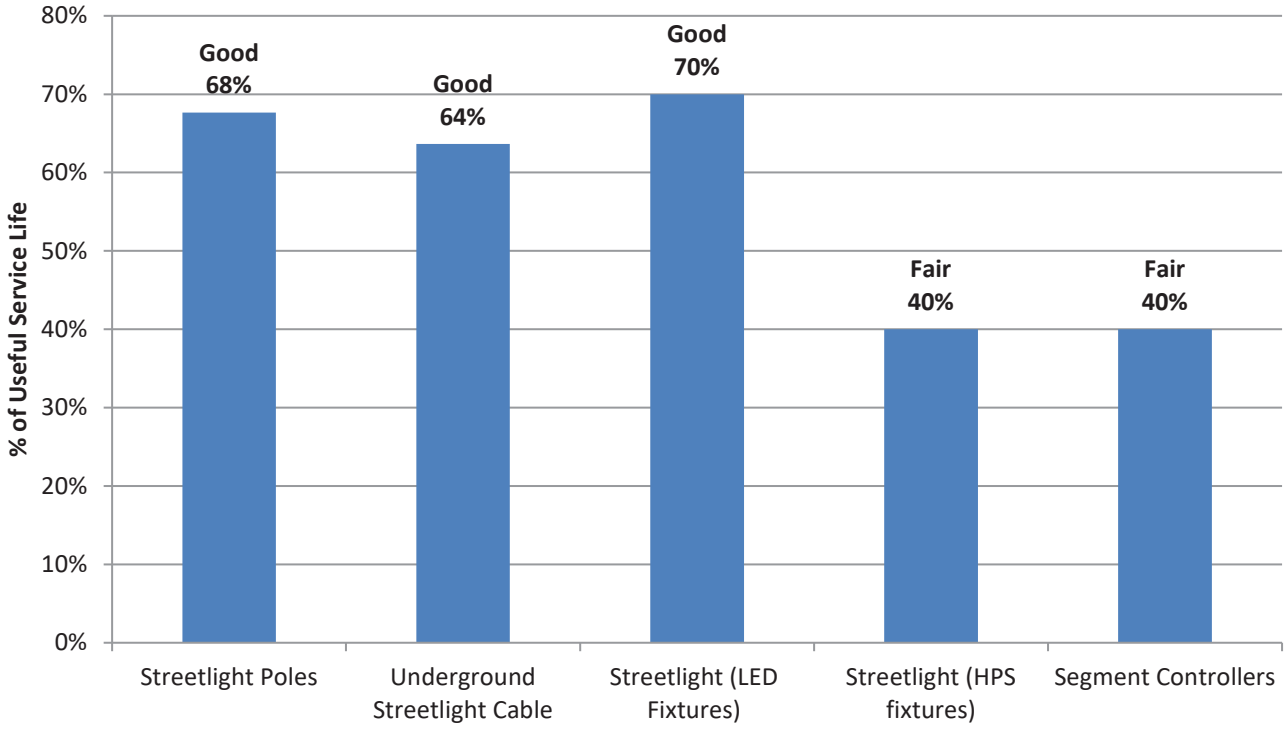
Figure 3-11: Asset Distribution (%) by Replacement Value ($M) – Streetlights



3.7.1 Asset Life Cycle and Useful Life

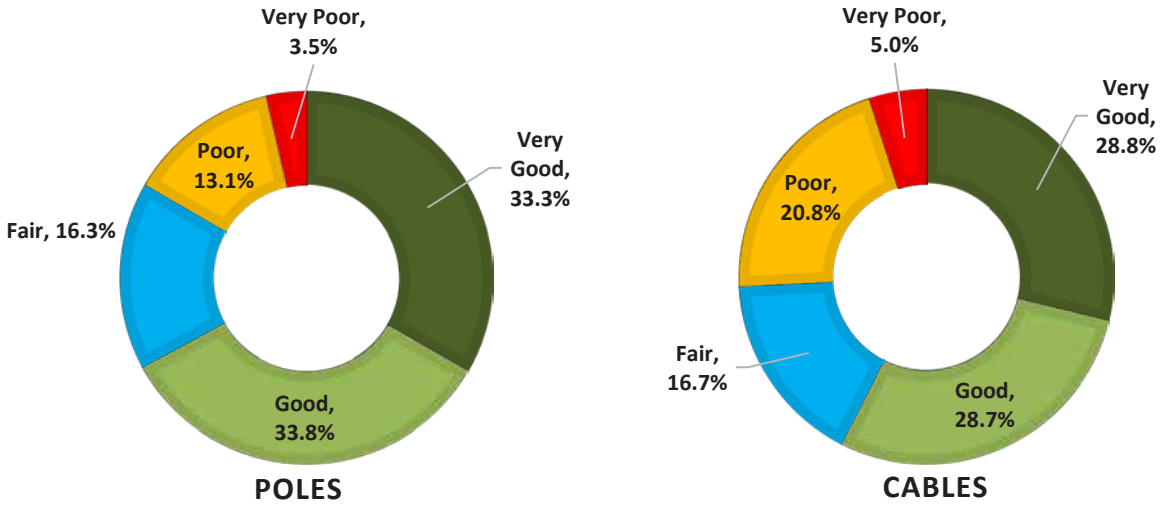
Assets	Average Asset Life Cycle (years)	Average Asset Age (years)	Remaining Asset Useful Life (years)	Estimated Remaining Service Life (%)
Streetlight Poles	68	22	46	68%
Underground Streetlight Cables	55	20	35	64%
Streetlight Fixtures (LED)	20	6	14	70%
Streetlight Fixtures (HPS)	20	12	8	40%
Segment Controllers	10	6	4	40%

Figure 3-12: Useful Life by Component and Condition Rating by Age – Streetlights



The overall condition rating of the City's streetlight infrastructure is "Good" based on age. The majority of streetlight infra- structure is composed of poles and cables at a replacement value of $223M. Figure 3-13 below illustrates the condition distribution of poles and cables based on the associated replacement value. 3.5 per cent of the poles and five per cent of the cables are within their 20 per cent (10-15 years) of useful life with an approximate combined value of $9.8M. The City has developed a plan to replace these poles and cable sections within next 10-12 years in order to provide the required level of service.

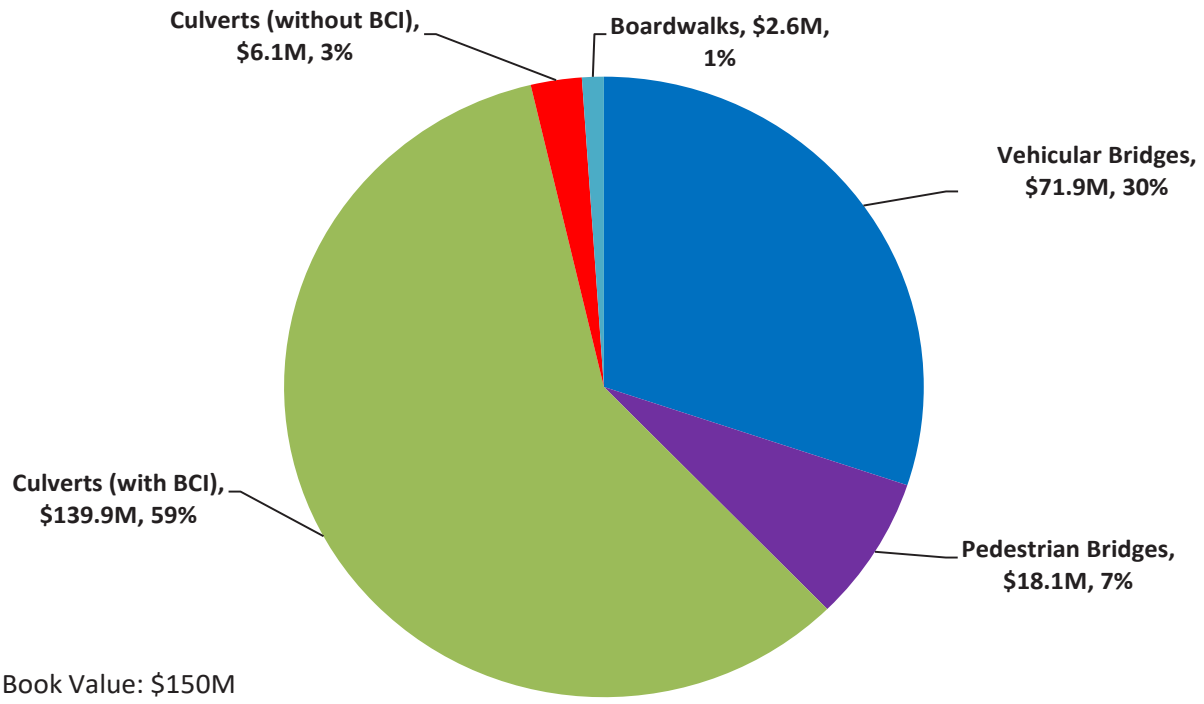
Figure 3-13: Average Asset Condition Distribution by Replacement Value – Streetlight Poles and Cables



3.8 STRUCTURE – VEHICULAR BRIDGES, PEDESTRIAN BRIDGES, CULVERTS

The City's structure program includes all vehicular bridges, pedestrian bridges, boardwalks and culverts in the City with exception to those located on Regional roads which are owned by the Region. There are 351 structures (25 vehicular bridges, 78 pedestrian bridges, 10 boardwalks and 237 culverts) within the City of Markham, with a replacement cost of $239M, which represents approximately 2.5 per cent of the City's total infrastructure portfolio.

Figure 3-14: Asset Distribution (%) by Replacement Value ($M) – Structure

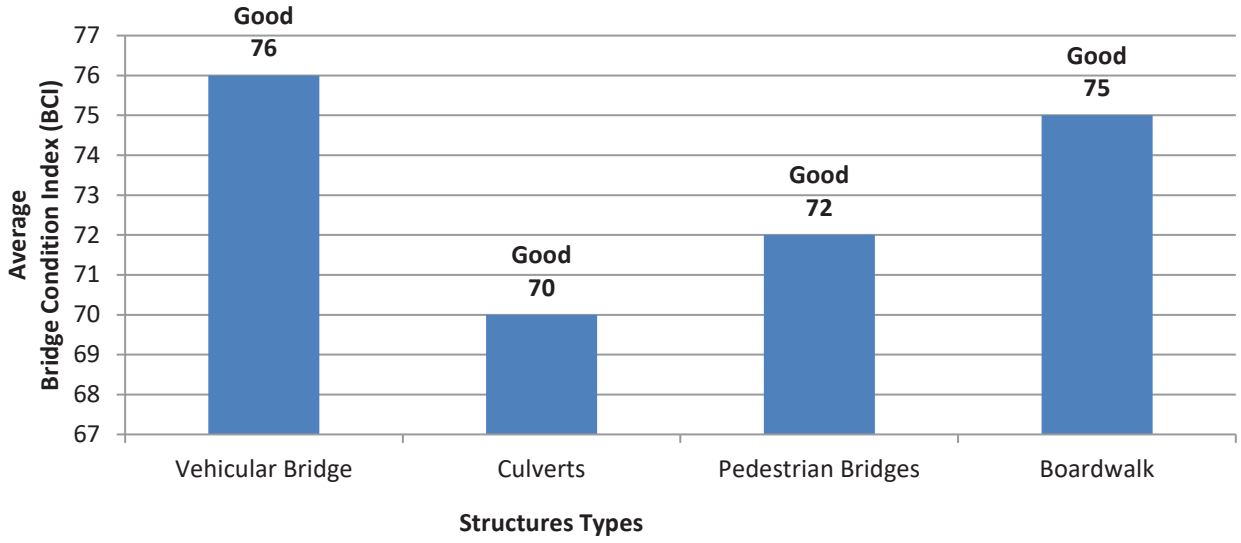


3.8.1 Asset Life Cycle and Useful Life

The useful life of the structures depends on the material.

Assets	Average Asset Life Cycle (year)	Average Asset Age (year)	Remaining Asset Useful Life (year)
Vehicular Bridges	75 -100 years	28	56
Culverts	Average 50 years	24	26
Concrete (open & closed box)	75 years		
Corrugated Steel Pipe (CSP)	30-50 years		
High-Density Polyethylene (HDPE)	50 years		
Pedestrian Bridges	Average 47 years	25	22
Concrete & steel truss and or beam	50 years		
Timber structures	30 years		
Boardwalks	50 Years	5	25

Figure 3-15: Average Bridge Condition Index (BCI) by Structure Type



Note: BCI is calculated for culverts larger than 1.2m diameter (96 per cent of the culverts replacement cost). Culverts with lesser than 1.2m diameter are inspected every four years using CCTV and are currently in good condition.

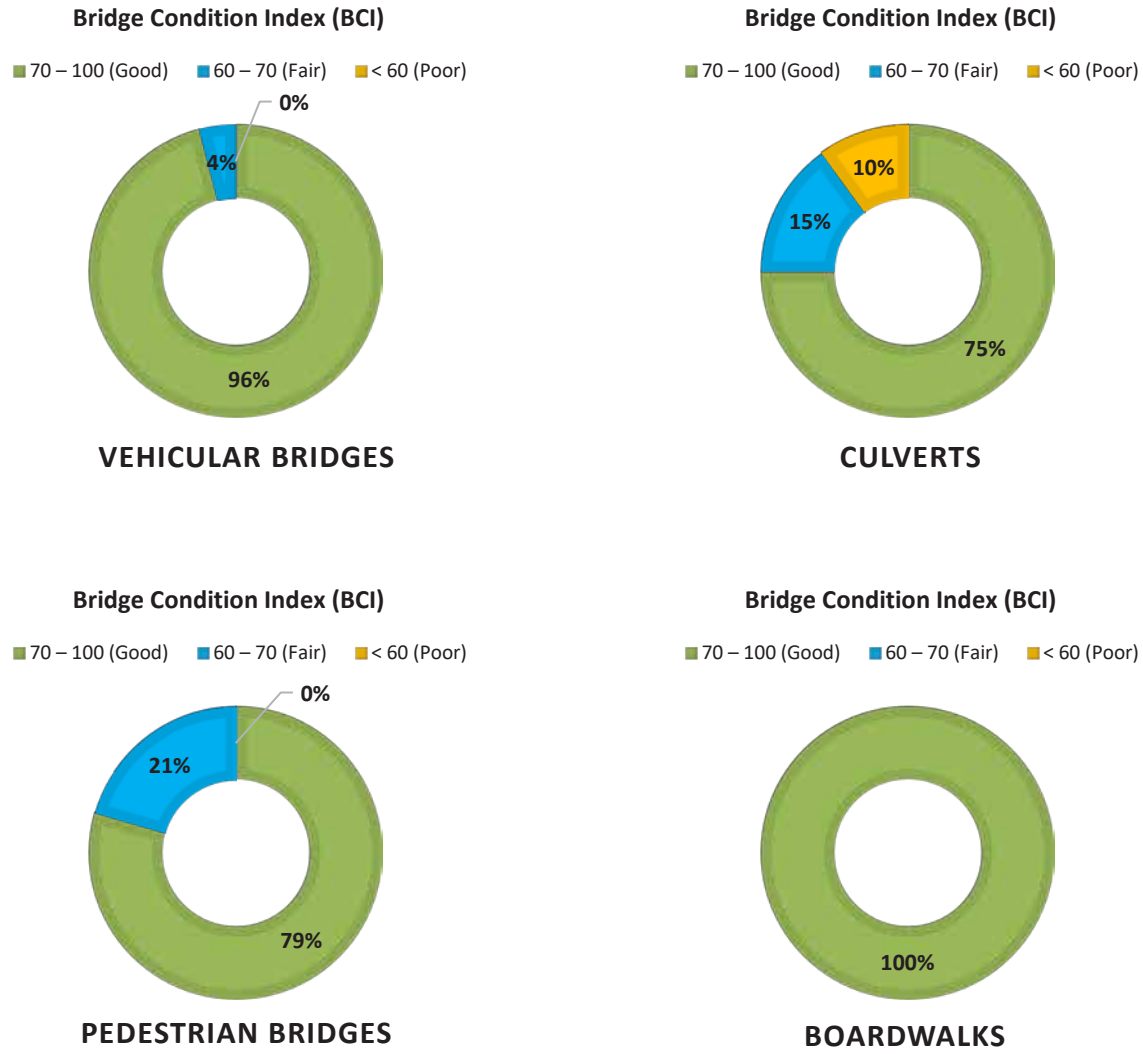
Bridge Condition Index (BCI) is an indication of a structure's current condition and dictates its rehabilitation/replacement needs. All City structures (except culverts less than 1.2m diameter) are inspected in accordance with the Ministry of Transportation (MTO) Ontario Structures Inspection Manual (OSIM, 2008) and are rated according to three condition states (good, fair and poor), as shown in the table below. The weighted average of all structural elements and their condition states is then summarized in a Bridge Condition Index (BCI) using MTO specifications.

BCI Condition Rating (MTO Standard)

BCI Values	Condition
70 – 100	Good
60 – 70	Fair
< 60	Poor

The overall condition rating of the City's structures is "Good" based on inspections. Figure 3-16 illustrates the condition distribution of vehicle bridges, culverts, pedestrian bridges and boardwalks based on their associated replacement value. There are no vehicular bridges, pedestrian bridges or boardwalks with a BCI less than 60; however there are about 10 per cent of culverts that have a BCI below 60 (with a replacement cost of $14M). These culverts are planned for rehabilitation/replacement in the next 10-12 years.

Figure 3-16: Bridge Condition Index Distribution by Replacement Value – Vehicular Bridges

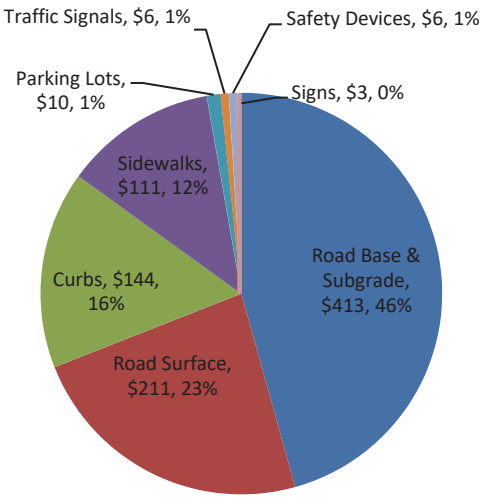


3.9 ROADS AND SAFETY DEVICES

The City is responsible for 1,111.5 km (centreline) of road assets, including safety devices. The total replacement value of these assets is $908M, which represents approximately 9.4 per cent of the City's total infrastructure portfolio. Below are the included assets:

- Sidewalks – 1,118 km
- Curbs – 1,916 km
- Safety devices such as fences (5,423m), guiderails (14,646m), retaining walls (4,301m), entrance features (144), signs (30,989), and railway crossings (13)
- Traffic signals - 101 at City intersections, including approximately 6,800 critical components. Additionally, the City also manages 24 speed-display boards, five solar powered flashing beacons, and one pedestrian crossover.
- Parking lots – 101

Figure 3-17: Asset Distribution (%) by Replacement Value ($M) – Roads



Asset Class	Inventory/ Quantity (#)	Book Value ($)
Roads	2,223 ln-km	$708,434,549
Parking Lots	101	$9,146,760
Fencing	5,423 m	$1,207,123
Retaining Walls	4,301 m	$8,242,472
Signs	30,989	$2,859,847
Entrance Features	144	$2,706,436
Traffic Signals	101	$15,636,888

3.9.1 Asset Life Cycle and Useful Life

The useful life varies depending on the component as shown in table below.

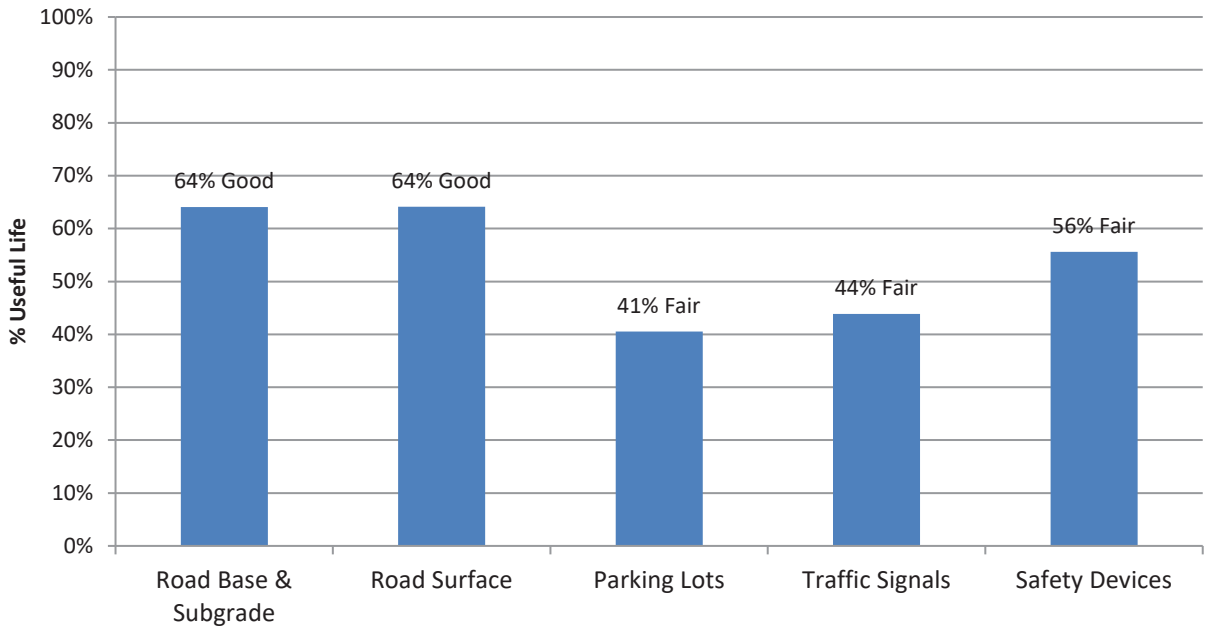
Assets	Average Asset Age (year)	Average Asset Life Cycle (years)	Remaining Asset Useful Life (year)
Roads	17	47 (Note1)	30 (Note1)
Sidewalks	NA	40	NA
Curbs	NA	40	NA
Parking Lots	15	25	10
Guiderails	13	20	7
Fencing	NA	15	NA
Railway Crossings	5	8	3
Retaining Walls	NA	25	NA
Signs	NA	Posts: 25, Signs: 15	NA
Entrance Features	NA	25	NA
Traffic signals	Varies, Average 8 year	Varies, Average 14.5 year	Varies, Average 6.5 year

Note 1: Average asset life cycle of a road is 36 years, however, based on the condition survey and the City's pavement preservation program, the average asset life cycle of a road structure can reach 47 years. The asset's useful life age is also based on a condition survey and the overall condition index, and not strictly based on the age of the road pavement. The age of Sidewalks, Curbs, Fencing and Retaining Walls is not tracked as their maintenance is performed under an annual program as part of operations and maintenance.

The road structure with respect to the overall condition index and its age provides an indication of the health of the road. The methodology is not completely dependent on the age of the road structure, as the class of roadway, loading condition of the road, and different levels of deterioration all contribute to the overall condition. Therefore, the following methodology is used to calculate the service life of the road structure and determine its condition rating:

- The Remaining Service Life (RSL) of pavement is the estimated/predicted number of years remaining until a pavement section reaches its Threshold Value (Th) based on the surveyed Pavement Condition Index (PCI).
- The RSL is calculated using a straight-line relationship beginning when the pavement segment was constructed or rehabilitated (the PCI at this point is 100) and the age when the condition is surveyed. The RSL equals the number of years that the road segment will take to reach the Th, assuming an extension of this straight line relationship. Currently the Th of all road segments is 50.
- The Service Life (SL) of a pavement section is the actual number of years the pavement is expected to serve the travelling public beginning at construction until rehabilitation, or between two consecutive rehabilitation activities. Hence the SL of any pavement section is equal to the sum of its current Age (number of years since construction or last major rehabilitation until present) and the RSL.

Figure 3-18: % Remaining Useful Life by Component and Condition Rating – Roads



Note 2: Only guiderails, RWIS stations and railway crossings were used to represent the % useful life of the safety devices.

The overall condition rating of the City's road infrastructure is "Good to Fair" based on the age and condition assessment as demonstrated in Figure 3-19 below.

The road structure component comprises 69 per cent of the overall road infrastructure at replacement value of $624M with a useful life of 47 years. Road functional classes (Laneways, Locals and Collectors) are included in the figures below which illustrate the condition distribution of the road structure based on the associated replacement value.

Figure 3-19: Average Asset Condition Distribution by Replacement Value – Roadway Classes

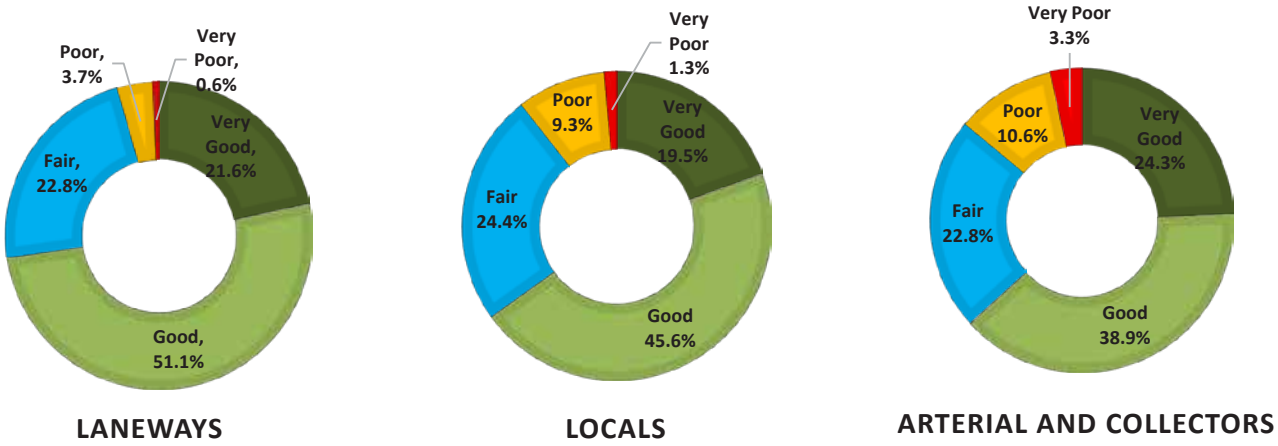


Table below illustrates the breakdown of road structures that are below 60 per cent of their service life and the associated replacement value. The road rehabilitation program is developed while taking into account the class of the road.

Class of Roadway	Useful Life Remaining			Replacement Value
	0% to 19%	20% to 39%	40% to 59%	
Laneways	0.6%	3.7%	22.8%	$5,316,253
Locals	1.3%	9.3%	24.4%	$122,261,485
Arterials & Collectors	3.3%	10.6%	22.8%	$93,122,137
Total				$220,699,874

3.10 FACILITIES

2.9.1 Inventory

The City owns and manages 176 facilities with a total square footage of approximately 2.3 million sq.ft. This includes the following, by building construction type:

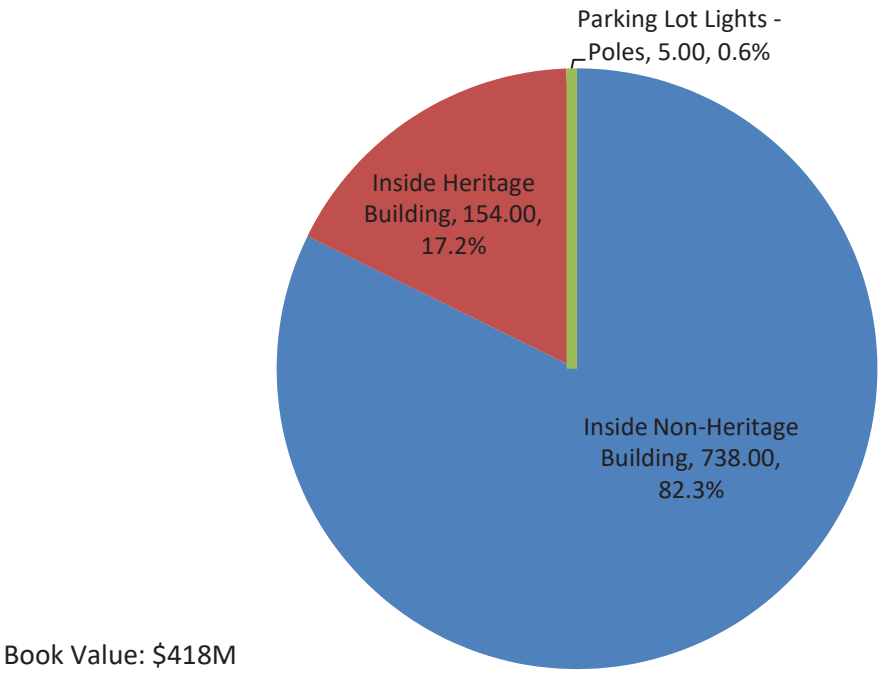
- Administrative Buildings (4)
- Cultural Facilities (6)
- Fire Stations (9)
- Industrial Type Construction (78)
- Libraries (Standalone, excluding at recreation centres) (3)
- Recreation Facilities (26)
- Residential Type Construction Buildings (48)
- School Buildings (2)

A facility is defined as the building assets within the building as well as assets outside of the building footprint within the property line including but not limited to:

- Building envelope (windows, roof, walls,etc.)
- Architectural assets (interior finishes,etc.)
- Mechanical and Electrical equipment
- Hard surfaces (pavers and walkways adjacent to building)
- Parking Lot Lights (light poles and fixtures)

The facilities infrastructure has a Replacement Cost of $897M (2020), with a Book Value of $418M (2020). The replacement of our facility infrastructure (excluding waterworks) represents approximately 9.3 per cent of the City's total infrastructure portfolio. Replacement Cost is calculated based on the weighted average current cost per square foot of the different construction types of each facility.

Figure 3-20: Asset Distribution (%) by Replacement Value ($M) – Facilities



3.10.2 Asset Life Cycle and Useful Life

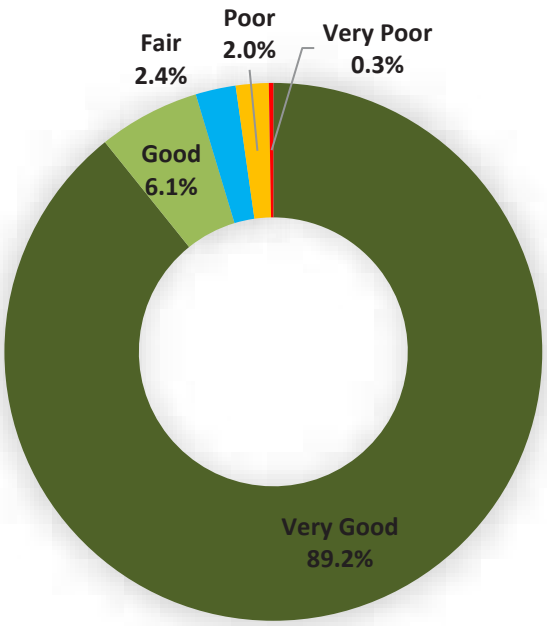
All facility components have been assigned a life cycle based on industry accepted standards. However the actual useful life may vary due to a number of reasons:

- Construction type (e.g. residential, commercial, institutional, etc.)
- The life cycle of an asset component varies, for example, windows 20-25 years, paint 5- 7 years etc.
- Level of use, and operational and maintenance activities also affect the component's useful life

Assets	Inventory/Quantity (#)	Average Asset Age (year)	Average Asset Life Cycle (year)	Average Remaining Asset Useful Life (year)	Average Estimated Remaining Service Life (%)
Facilities					
Heritage	0.43 Million Sq-Ft	119	NA	NA	NA
Non-Heritage	1.86 Million Sq-Ft	45	100	55	55%
Parking Lot Lights	416	21	45	24	53%

Note1: Assets outside of the building such as underground services have not been inventoried, therefore no replacement value has been assigned.

Figure 3-21: Average Asset Condition Distribution by Replacement Value – Facilities



The overall condition rating of the City's facility infrastructure is "Very Good" based on FCI (Facility Condition Index), only 4.7 per cent of facilities has an FCI greater than five per cent. FCI or Facility Condition Index indicates the condition of a facility in terms of ratio of necessary Repair/Replacement Cost and Total Replacement Cost of the facility. The higher the FCI the poorer the condition of the facility and vice versa. Please refer to section 4.8 for more details on FCI.

The City of Markham's strategy for Facility Assets is to keep a minimum of 80 per cent of the assets by cost in "Very Good" condition. A few facilities (four per cent of total Facility Assets) have been excluded from this study due to unavailable data and they will be included in future reports.

3.11 PARKS

The City is responsible for the maintenance of approximately 270 Parks locations, representing 19.69 hectares of parkland and 200 km of pathways. Services include maintenance of park amenities and structures, such as playground elements (229), inclusive of individual play stations, adult exercise equipment, splash pads and specialized safety surfacing and sports fields (265). Park infrastructure has a replacement cost of $187M and represents approximately 1.9 per cent of the City's total infrastructure portfolio. The following outlines the components as well as the asset life cycle.

3.11.1 Pathways Inventory and Asset Life Cycle

- 200 km
- Pathway Resurfacing: Asphalt 20-25 years,
- Stairway Repairs: Concrete stairways 30 years, wood 15 years

Asset Class	Inventory/ Quantity (#)	Average Asset Age (year)	Average Asset Life Cycle (year)	Remaining Asset Useful Life (year)	Estimated Remaining Service Life (%)
Stairway Repairs	73	20	30	10	33%

3.11.2 Sports Fields Inventory and Asset Life Cycle

Asset	Inventory/ Quantity (#)	Average Asset Age (year)	Average Asset Life Cycle (year)	Remaining Asset Useful Life (year)	Estimated Remaining Service Life (%)
Soccer	107	NA	NA	NA	NA
Baseball	61	NA	NA	NA	NA
Cricket	3	NA	NA	NA	NA
Rugby	1	NA	NA	NA	NA
Tennis Courts, Basketball Courts	89	6	14	8	57%
Artificial Turf (2 in partnership with YRDSB)	4	8	10	2	20%
Bleachers – Concrete	11	10	35	25	71%
Bleachers – Metal Frames Large	56	12	30	18	60%
Bleachers – Metal Frame Small	16	11	30	19	63%
Bleachers (Wood Metal)	38	15	20	5	25%
Player Benches	222	10	20	10	50%
Fence – Backstop	72	11	35	24	69%
Fence – Soccer Backstop surrounds	23	15	35	20	57%
Fence – Outfield	31	15	35	20	57%
Talc Metal Cabinets	53	25	30	5	17%
Goal Posts	123	17	30	13	43%
Cricket Cage Practice Areas	1	10	30	20	67%
Cricket Pitch / Baseball Outfield Screening	5	3	12	9	75%
Beach Volleyball Courts	1	7	25	18	72%
Fence Tennis Courts	22	17	35	18	51%

3.11.3 Electrical Structures and Lighting Inventory and Asset Life Cycle

- Floodlights (complete with Poles) – 45 Units with Average Asset Life Cycle of 30 years

3.11.4 Park Structures Inventory and Asset Life Cycle

Asset Class	Inventory/ Quantity (#)	Average Asset Age (year)	Average Asset Life Cycle (year)	Remaining Asset Useful Life (year)	Estimated Remaining Service Life (%)
Gazebo-Major	36	9	28	19	68%
Gazebo-Minor	28	12	30	18	60%
Pavilions	2	12	30	18	60%
Skateboard Parks	6	8	25	17	68%
Clock Towers	3	7	30	23	77%
Fountain-Decorative	6	7	25	18	72%
Parks Entrance Gateways	34	-	-	-	-
Ping Pong Tables	39	7	15	8	53%
Trellis / Pergola	67	10	28	18	64%
Fencing - General (including cemetery)	317	25	35	10	29%

3.11.5 Park Amenities Inventory and Asset Life Cycle

Asset Class	Inventory/ Quantity (#)	Average Asset Age (year)	Average Asset Life Cycle (year)	Remaining Asset Useful Life (year)	Estimated Remaining Service Life (%)
City Park Furniture/Amenities	11,117	15	25	10	40%
Eco Media Portable Zero Waste Bins	20	8	15	7	47%
Heritage Waste Receptacles	46	8	12	4	33%
Recycling Containers	580	9	20	11	55%
Big Bellies	11	8	10	2	20%
Concrete Planters - Civic Centre	70	1	15	14	93%
Wood and Concrete Planters - Yonge between Thornhill Summit and John	30	11	15	4	27%
Wood Planters - Baythorne and Yonge	11	18	15	NA	NA
Park Name Signs	468	3	15	12	80%

3.11.6 Playground Inventory and Asset Life Cycle

Asset Class	Inventory/ Quantity (#)	Average Asset Age (year)	Average Asset Life-cycle (year)	Remaining Asset Useful Life (year)	Estimated Remaining Service Life (%)
Rubberized Surfaces	49	7	15	8	53%
FIBAR Surfaces	12	4	8	4	50%
Exer-Station Equipment Structures	61	6	18	12	67%
Playground Structures	192	5	17	12	71%
Water-play	28	9	21	12	57%

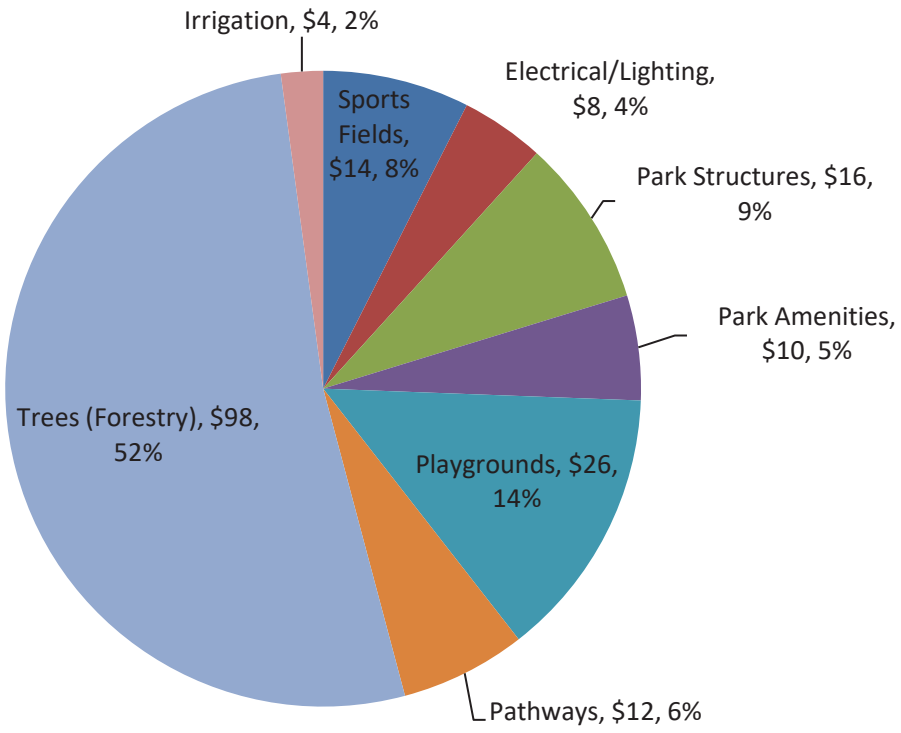
3.11.7 Trees (Forestry) Inventory and Asset Life Cycle

- 177,368 Trees with Average Asset Life Cycle of 40 year; Average Remaining Useful Life is 20 years

3.11.8 Irrigation

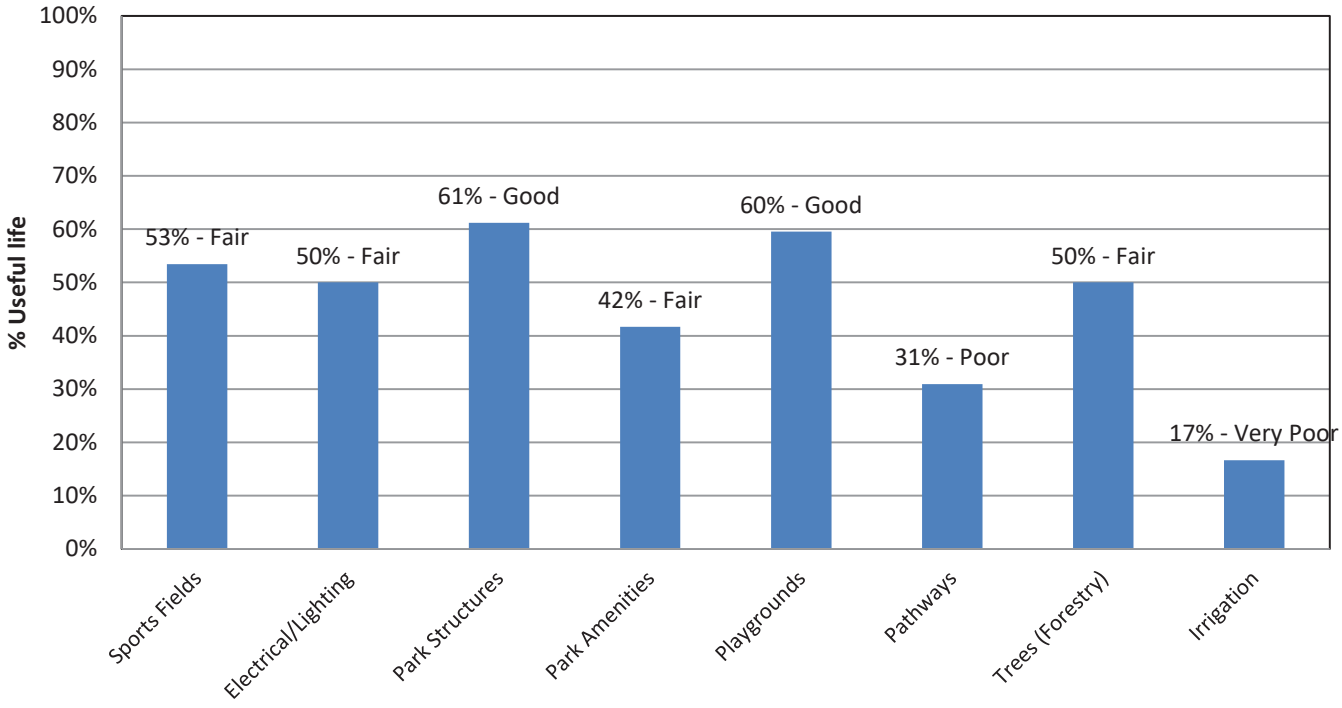
- 98 systems with Average Asset Life Cycle of 30 year; Average Remaining Useful Life is 5 years

Figure 3-22: Asset Distribution (%) by Replacement Value ($M) – Parks



Asset Class	Quantity (#)	Book Value ($)
Sports Fields	767	14,462,380
Electrical Structures/Lighting	45	8,292,664
Park Structures	538	15,967,648
Park Amenities	12,353	9,604,607
Playgrounds	342	25,550,504
Pathways and Stairways	200 km & 73	12,294,106
Trees	177,368	97,552,400
Irrigation	98	3,519,736

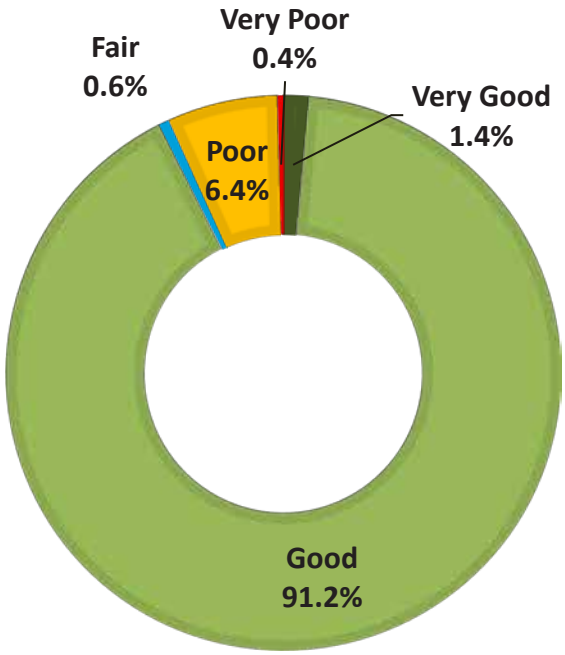
Figure 3-23: % Useful Life by Component – Parks



Gaps seen in the 2016 AMP for Parks assets are filled with improved data. Parks will explore opportunities to further improve their asset inventory and condition data that includes but is not limited to hiring consulting services and/or using summer students.

Figure 3-24 illustrates the average asset condition of Parks asset distributed based on the replacement value. Over 92 per cent of Parks asset are in "Very Good" to "Good" condition. 0.4 per cent of the "Very Poor" asset includes the aging general fencing (including cemeteries) that will be rehabilitated/replaced in the near future. Assets rated as "Poor" will be planned for rehabilitation/replacement in the next five to 10 years.

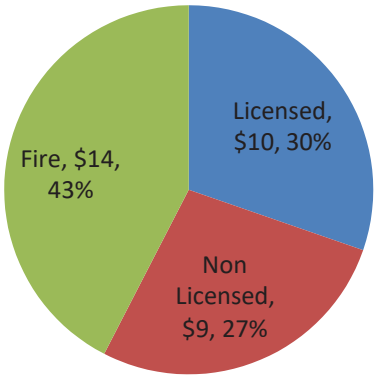
Figure 3-24: Average Asset Condition Distribution by Replacement Value – Parks



3.12 FLEET

The City manages 202 licensed fleet vehicles, with a mixture of light-duty and heavy-duty vehicles as well as 167 non-licensed units, including tractors, loaders, roads, parks, turf and sidewalk maintenance equipment, ice resurfacers, and material handling equipment such as a stockpiling conveyor for stocking winter maintenance materials in storage domes, and 49 Fire units/apparatus. Fleet infrastructure has a replacement value of $33M and represents approximately 0.3 per cent of the City's total infrastructure portfolio.

Figure 3-25: Asset Distribution (%) by Replacement Value ($M) – Fleet



Asset Class	Quantity (#)	Valuation ($)
Licensed	202	$8,082,478
Fire	29	
Non- Licensed	155	$6,654,387
Zamboni	12	
Fire Apparatus	20	10,577,482

Book Value: 25.3M

3.12.1 Asset Life Cycle and Useful Life

Assets	Quantity (#)	Average Asset Age (year)	Average Asset Life Cycle (year)	Remaining Asset Useful Life (year)	Estimated Remaining Service Life (year)
Licensed	202	4.8	9	4.2	47%
Non- Licensed	155	6	11	5	45%
Zambonis	12	6.5	9	2.5	28%
Fire	29	6.2	9.2	3	33%
Fire Apparatus	20	7.2	10.8	3.6	33%

Figure 3-26: % Useful Life by Component and Condition Rating by Age – Fleet

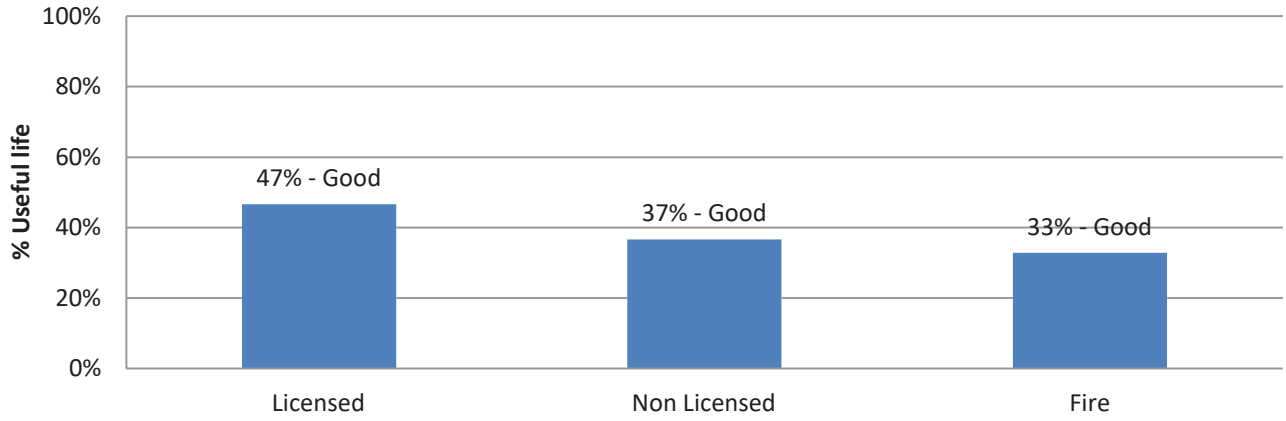


Figure 3-26 illustrates the average remaining useful life of different Fleet assets. The overall condition rating of the City's Fleet assets based on actual condition is "Good". This indicates the effectiveness of the program in place to maintain the state of good repairs for the City's fleet.

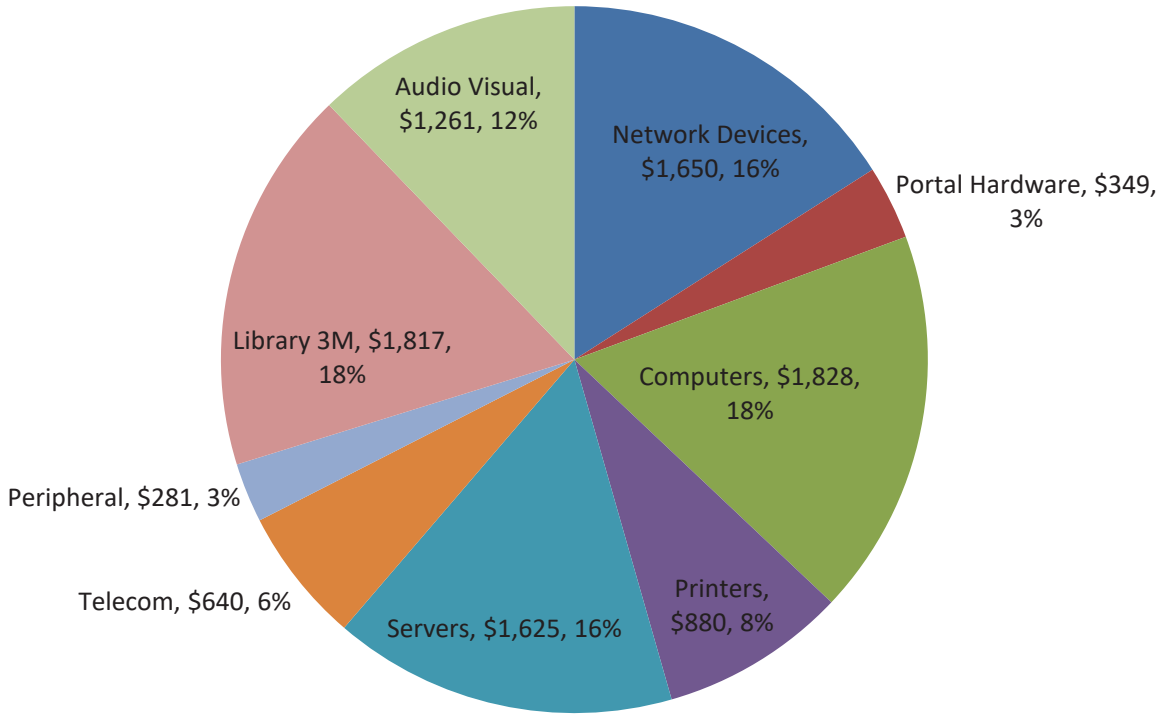
Figure 3-27: Average Asset Condition Distribution by Replacement Value – Fleet

3.13 INFORMATION TECHNOLOGY INFRASTRUCTURE HARDWARE

The City manages more than 5,394 devices with a replacement value of $10M which represents approximately 0.1 per cent of the City's total infrastructure portfolio. Devices and equipment include are:

- Network Devices
- Portal Hardware
- Computers
- Printers
- Servers
- Telecom
- Peripheral
- Library 3M
- Audio Visual

Figure 3-28: Asset Distribution (%) by Replacement Value ($000s) – IT



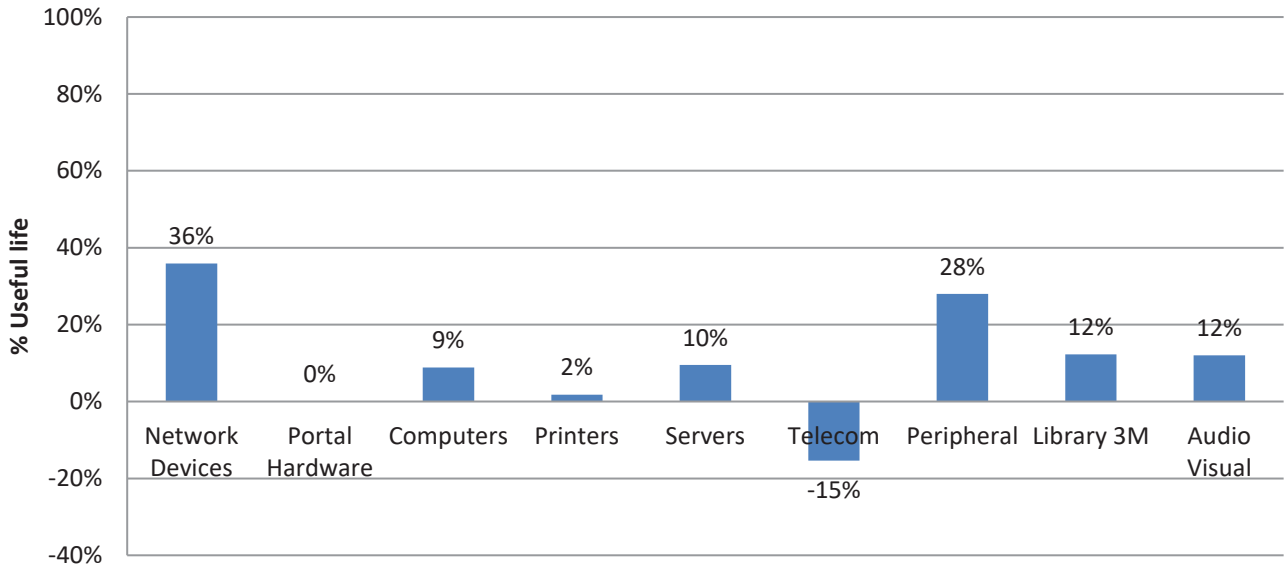
Book Value: $9.9M

3.13.1 Asset Life Cycle

Useful life of the IT assets are specific to the device. The overall range is anywhere from 2.5 years to 9 Years. The other areas identified fall under the following approximate duration:

- Peripheral: 2.5 – 7Years
- Data Centre Hardware: 6Years
- Network and Telecom equipment: 7Years
- Computers & Audio Visuals: 6 Years
- Printers & Library 3M hardware: 8 Years

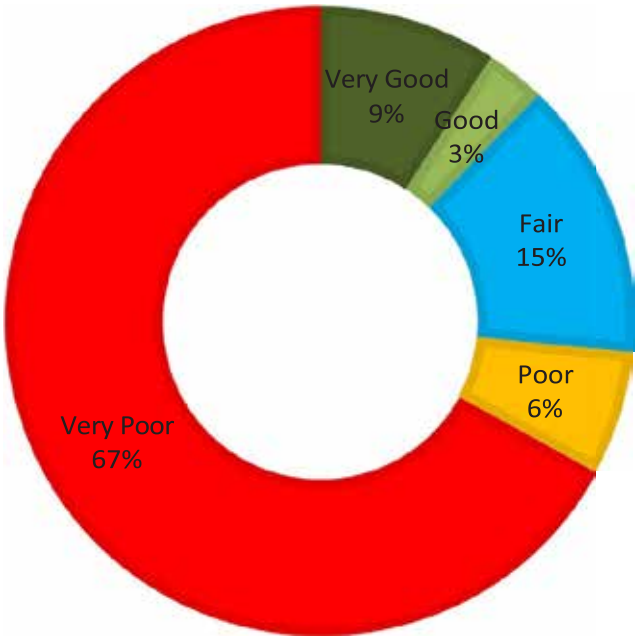
Figure 3-29: % Useful Life by Component and Condition Rating by Age – IT



IT assets have a relatively shorter lifespan and even upon the end of their useful life they tend to continue providing the desired level of service with a higher risk of failure.

Figure 3-30 illustrates the distribution of IT assets in different condition ratings with reference to replacement value. The condition was evaluated based on a combination of age, maintenance support and actual condition. Funding has been approved for the replacement of assets rated from "Very Poor" to "Fair" condition. These assets were scheduled for replacement from 2020-2022, however the replacement projects were deferred during the COVID-19 pandemic. Upon completion of the replacement of these assets, approximately 90 per cent of IT assets will be rated as "Very Good".

Figure 3-30: Average Asset Condition Distribution by Replacement Value – IT



4. LEVELS OF SERVICE

The ultimate goal of asset management planning is ensuring that the City continues to provide a sustainable level of different services it commits to offer to its customers. The level of service is a measurable indicator that enables a service provider to measure its performance against set targets and review strategies to ensure sustainable delivery of services at an acceptable level. The level of service is defined by a number of key influences:

- Legislated/Statutory Standards and Requirements
- Prescribed Assets Intended Function
- Corporate Goals
- Community Expectations
- Technical Metrics for Assets
- Available Financing

Community levels of service define the expectation of what is a satisfactory service for the customers, whereas technical metrics or levels of service define how a service provider successfully delivers satisfactory service to its customers. Community levels of service use qualitative descriptions to describe the scope or quality of service delivered by an asset category. Technical levels of service use metrics to measure the scope or quality of service being provided by an asset category.

Ontario Regulation (O. Reg.) 588/17:

- Provides the qualitative description for minimum customer level of service and technical metrics for core assets
- Allows the municipality to establish its own customer and technical levels of service (metrics) for all other assets

4.1 WATER ASSETS

As mentioned above, levels of service are directly influenced by legislative regulatory requirements. One key legislation that governs drinking water is the Safe Drinking Water Act. What allows drinking water levels of service along with legislative requirements are guidelines and responsibilities attributed to licensing e.g. Drinking Water Licence and permit to operate a drinking water system in Ontario.

O. Reg. 588/17 requires legislated community levels of service for Water assets. Examples of legislated community levels of service include areas of the municipality that are serviced by the water system. Map in Figure 4-1 shows the extent of the services provided through the water assets.

In addition, O. Reg. 588/17 requires legislated technical levels of service for Water assets. An example of technical levels of service includes the percentage of urban properties serviced by the municipal water system.

Table 4.1 provides community levels of service and Table 4.2 provides technical levels of service per O. Reg. 588/17 requirements for water assets.

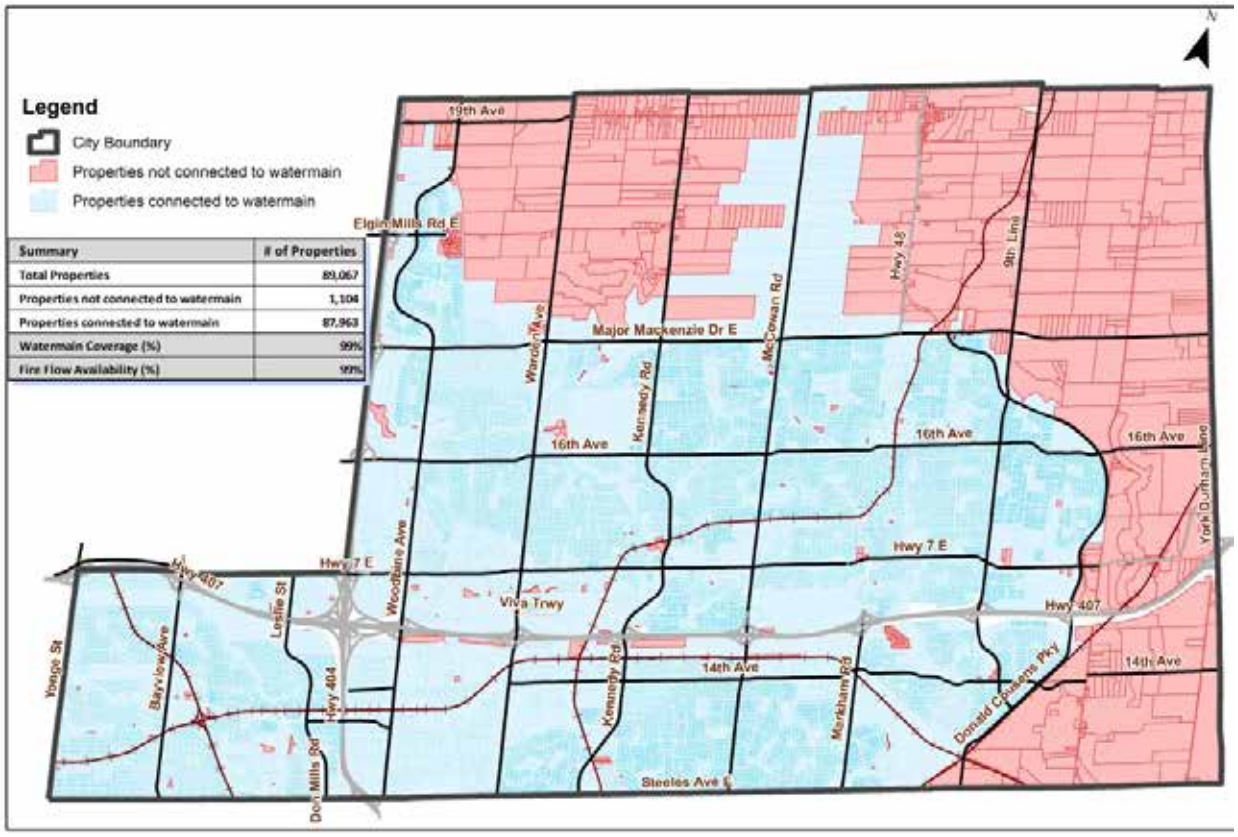
Table: 4.1 - Community Levels of Service for Water Assets

Service Attribute	Community Levels of Service	Qualitative Descriptions
Scope	1. Description, which may include maps, of the user groups or areas of the municipality that are connected to the municipal water system.	Refer to Figure 4.1 - Map showing properties connected to Municipal Water System and Fire Flow Availability
	2. Description, which may include maps, of the user groups or areas of the municipality that have fire flow.	Refer to Figure 4.1 - Map showing properties connected to Municipal Water System and Fire Flow Availability
Reliability	Description of boil water advisories and service interruptions.	No boil water advisories during 2019 and 2020 calendar year. Service interruptions typically occur due to watermain breaks.

Table: 4.2 - Technical Levels of Service for Water Assets

Service Attribute	Technical Levels of Service	Technical Metrics	
		2018	2019
Scope	1. Percentage of properties connected to the municipal water system.	99%	99%
	2. Percentage of properties where fire flow is available.	99%	99%
Reliability	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.	0	0
	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.	467 out of 87,317 properties connected to Municipal water system	267 out of 87,963 properties connected to Municipal water system

Figure 4-1: Properties connected to Municipal Water System and Fire Flow Availability (2019)



Additional Asset Specific Service Level examples:

The City of Markham tracks a variety of levels of service for each asset. Below provides a brief summary of key regulatory levels of service for water assets provided by the City. Note this is not an exhaustive list as there are many lower tier service levels (both legislative and non-legislative) that are also tracked:

Service Area	Service Standard	Legislated (Yes/No)	Service Level Target	Actual Performance
Fire hydrant inspection & pm	Annual (NFPA)	Yes	100%	100%
Sampling	# of Chlorine residual samples completed daily (MOE)	Yes	100%	100%
Sampling	# of Inorganic samples completed annually(MOE)	Yes	100%	100%
Sampling	# of Microbiological samples completed each week (MOE)	Yes	100%	100%
Sampling	# of Organic samples completed annually (MOE)	Yes	100%	100%

4.2 WASTEWATER ASSETS

O. Reg. 588/17 requires legislated community levels of service for Wastewater assets. Examples of legislated community levels of service include areas of the municipality that are serviced by the wastewater system. Map in Figure 4-2 shows the extent of the services provided through the wastewater assets.

In addition, O. Reg. 588/17 requires legislated technical levels of service for Wastewater assets. An example of technical levels of service includes the percentage of urban properties serviced by the municipal wastewater system.

Table 4.3 provides community levels of service and Table 4.4 provides technical levels of service per O. Reg. 588/17 requirements for wastewater assets.

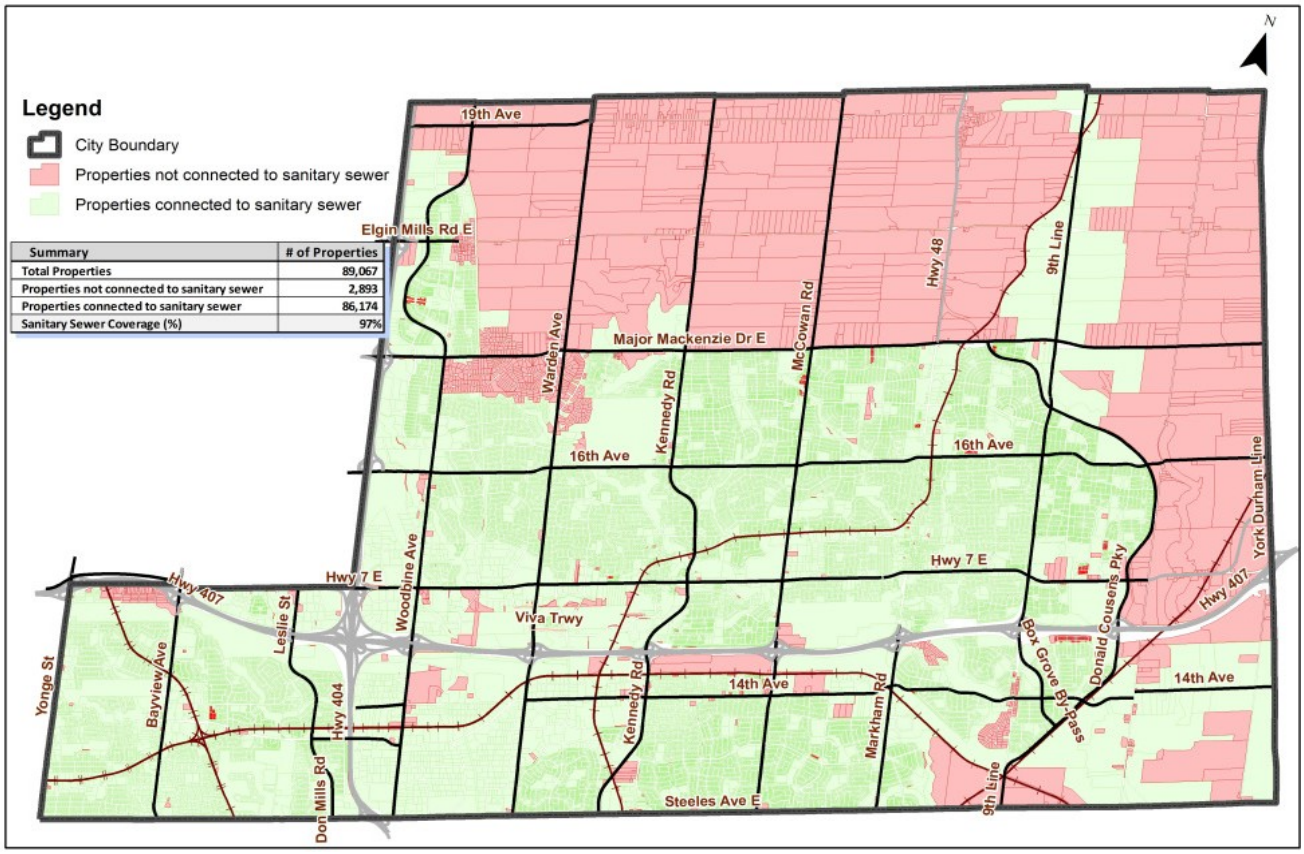
Table 4.3 - Community Levels of Service for Wastewater Assets

Service Attribute	Community Levels of Service	Qualitative Descriptions
Scope	Description, which may include maps, of the user groups or areas of the municipality that are connected to the municipal wastewater system.	Refer to Figure 4.2 - Map showing 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.	City does not have any combined sewers
	2. Description of the frequency and volume of overflows in combined sewers in the municipal wastewater system that occur in habitable areas or beaches.	City does not have any combined sewers
	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.	Infiltration and inflow into sanitary sewers in both groundwater and stormwater which are not intended to be in sanitary system. Infiltration can enter through variety of sources - cracks in pipes, cross connections such as downspout connections, through manhole covers, etc. The City has implemented an annual Infiltration and Inflow (I&I) monitoring program to monitor the I&I impact and provide incentives to home owners to remove the downspouts from sanitary sewers.
	4. Description of how sanitary sewers in the municipal wastewater system are designed to be resilient to avoid events described in paragraph 3.	To minimize sewage overflow into streets and backups into homes, the City has established design standards with 0.26 l/s/ha and other measures to reduce infiltration and inflow such as: • Place manholes outside of surface ponding areas and Regional flood plains; • Install seal tape around rings on the manholes; and • Implement water-tight measures when sewers are installed in high groundwater areas.
	5. Description of the effluent that is discharged from sewage treatment plants into the municipal wastewater system.	City does not have sewage treatment plants

Table 4.4 - Technical Levels of Service for Wastewater Assets

Service Attribute	Technical Levels of Service	Technical Metrics	
		2018	2019
Scope	Percentage of properties connected to the municipal wastewater system.	97%	97%
Reliability	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.	City does not have any combined sewers	City does not have any combined sewers
	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.	14 reported instances of basement flooding/ issues compared to 85,560 connected properties	15 reported instances of basement flooding/ issues compared to 86,174 connected properties
	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.	21 violations compared to 85,560 connected properties	51 violations compared to 86,174 connected properties

Figure 4-2: Properties connected to the Municipal Wastewater System (2019)



4.3 STORMWATER ASSETS

Service Levels:

- **User Expectation** - To ensure adequate function and operation of storm drainage facilities as intended.
- **Regulatory** - To comply with NASSCO's PACP program.
- **Public Safety** - To eliminate the risk of flooding and minimizing disruption to the community.
- **Operational** - To ensure smooth functioning of the storm water system.
- **Public Safety and Sustainability** - Effective outfall rehabilitation program prevents flooding upstream and supports City's vision for a sustainable community.

O. Reg. 588/17 requires legislated community levels of service for Stormwater assets. Examples of legislated community levels of service include areas of the municipality that are serviced by the stormwater system. Map in Figure 4-3 shows the properties resilient to five-year and 100-year storm.

In addition, O. Reg. 588/17 requires legislated technical levels of service for Stormwater assets. An example of technical levels of service includes the percentage of properties resilient to 100-year and five-year storm events.

Table 4.5 provides community levels of service and Table 4.6 provides technical levels of service per O.Reg 588/17 requirements for stormwater assets.

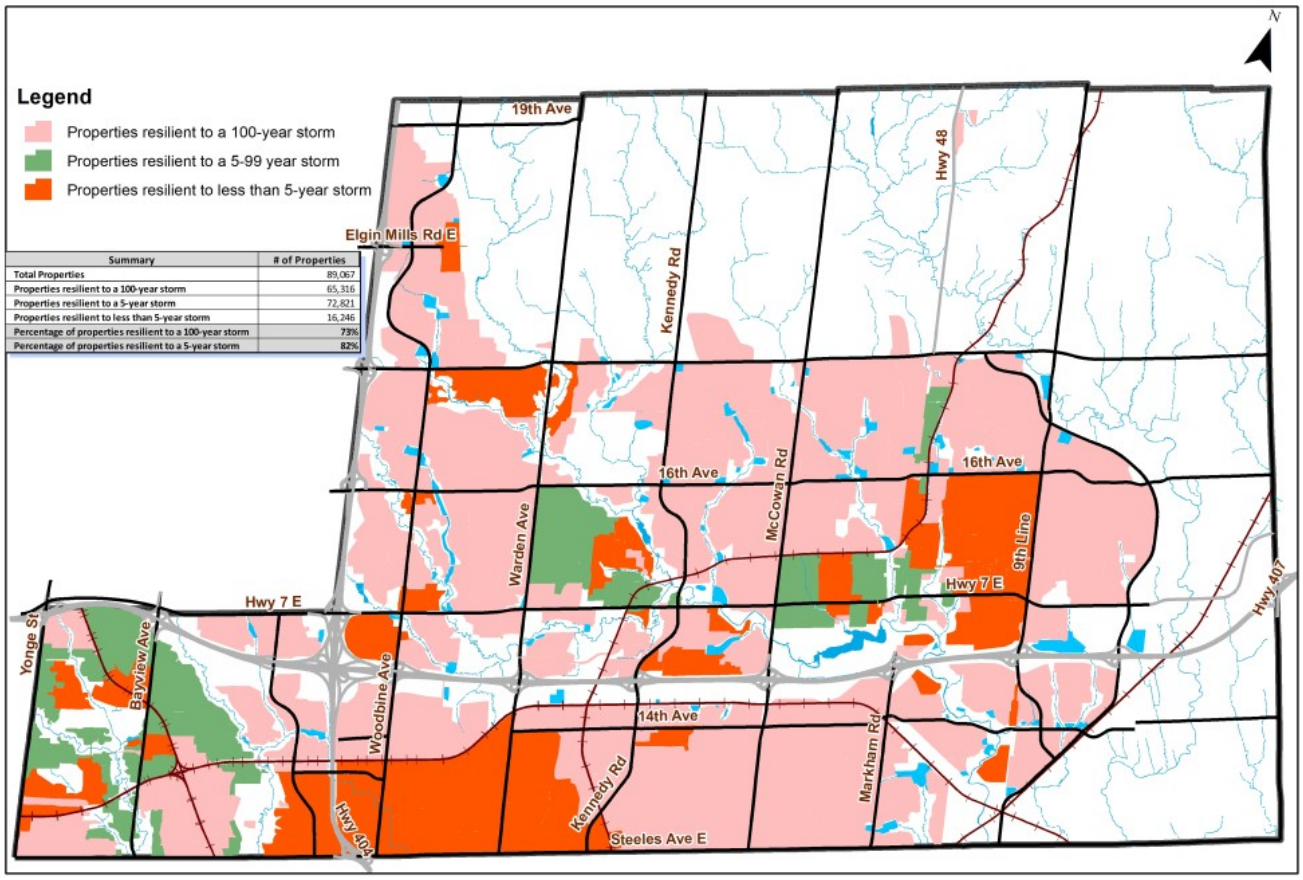
Table 4.5 - Community Levels of Service for Stormwater Assets

Service Attribute	Community Levels of Service	Qualitative Descriptions
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.	Refer to Figure 4-3 - Map of properties resilient to five-year and 100-year storm

Table 4.6 - Technical Levels of Service for Stormwater Assets

Service Attribute	Technical Levels of Service	Technical Metrics	
		2018	2019
Scope	1. Percentage of properties in municipality resilient to a 100-year storm.	73%	73%
	2. Percentage of the municipal stormwater management system resilient to a five-year storm.	81%	82%

Figure 4-3: Properties Resilient to 5-year and 100-year storm (2019)



4.4 STORMWATER MANAGEMENT (SWM) PONDS / NATURAL INFRASTRUCTURE

Service Levels:

- **Environmental and Sustainability** - Efficient functioning of the pond enhances and protects environment and provide a sustainable ecosystem that is in line with City's environmental initiatives.
- **Legislative** - To comply with the Ministry of the Environment and Climate Change (MOECC) requirements.
- **Public Safety** - Decrease the risk of downstream flooding (ponds with quantity control function).
- **Protect Infrastructure** - Decrease downstream erosion (ponds with erosion controlfunction).
- **Environmental** - To protect the environment (watercourse, aquatic life, structures, banks, etc.) from erosion.
- **Public Safety** - To meet the individual and community needs to improve public safety.
- **Protect Infrastructure** - Stabilize watercourses at critical manholes, sewers, outfalls, and roadways.
- **Public Safety and Environmental** - To reduce risks of flooding to the adjoining private properties and roads while maintaining the storm water conveyance system.

4.5 STRUCTURES – VEHICULAR BRIDGES, PEDESTRIAN BRIDGES, AND CULVERTS

Service Levels:

- **Public Safety & User Expectation** - To ensure safe vehicular and pedestrian passage for the public
- **Legislative** - To comply with Public and Highway Transportation Act - Regulation 104/97.
- **Operational** - To maintain culverts free of obstructions that may impede proper surface water flow

O. Reg. 588/17 requires legislated community levels of service for Bridges and Culverts. Examples of legislated community levels of service include images that illustrate the different condition (expressed as BCI) of bridges and culverts. BCI is an indication of a structure's current condition and dictates its rehabilitation/replacement needs. Timely rehabilitation/replacement of structures reduces costs, improves site safety, reduces impact on the environment and reduces time the bridge is out of service and reduces traffic impacts for users.

In addition, O. Reg. 588/17 requires legislated technical levels for Bridges and Culverts. Examples of technical levels of service include average Bridge Condition Index (BCI) for bridges and culverts. Vehicular bridges and culverts over 1.2m width are inspected in accordance with Ministry of Transportation (MTO) Ontario Structures Inspection Manual (OSIM, 2008) and are rated according to three condition states (good, fair and poor). The weighted average of all structural elements and their condition states is then summarized in a Bridge Condition Index (BCI) using MTO specifications.

Note: BCI is calculated for only culverts over 1.2m in width (or diameter). Culverts with diameter equal or smaller than 1.2m width (or diameter) are inspected regularly using CCTV.

Table 4.7 provides community levels of service and Table 4.8 provides technical levels of service per O. Reg. 588/17 requirements for bridges and culverts.

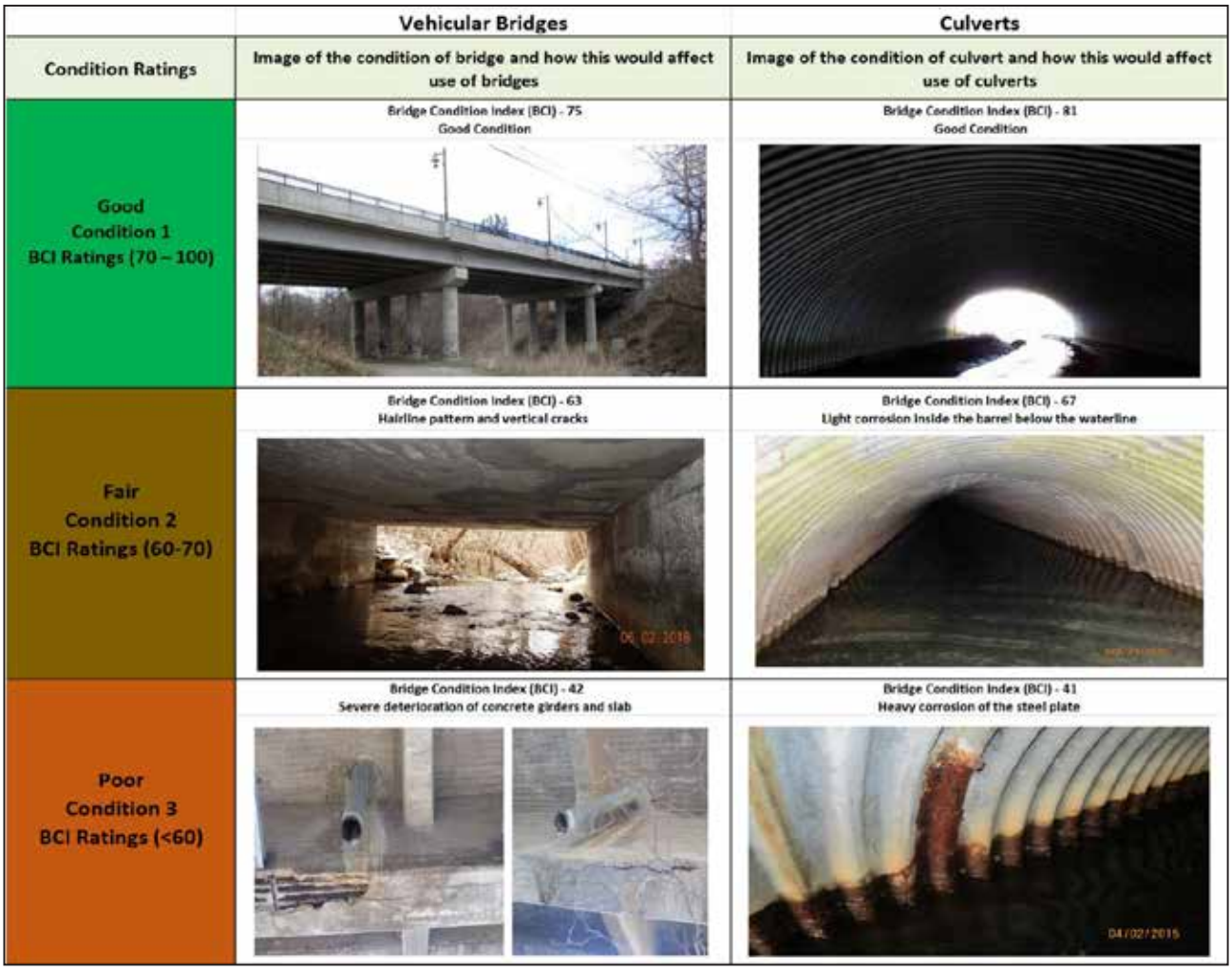
Table: 4.7: Community Levels of Service for Bridges and Culverts

Service Attribute	Community Levels of Service	Qualitative Descriptions
Scope	Description of the traffic that is supported by municipal bridges (e.g., heavy transport vehicles, motor vehicles, emergency vehicles, pedestrians, cyclists).	The City of Markham bridges have been designed in accordance with the municipality standard and requirements of the Canadian Highway Bridge Design Code (CHBDC) at the time of construction. The bridges have been designed to carry heavy transport vehicles, motor vehicles, emergency vehicles, pedestrians, and cyclists.
Quality	1. Description or images of the condition of bridges and how this would affect use of the bridges.	Refer to Figure 4-4 showing images of the condition of bridges. The condition of the bridge has no effect on the use of the bridges as the City undertakes rehabilitation/replacement works if BCI is less than 60.
	2. Description or images of the condition of culverts and how this would affect use of the culverts.	Refer to Figure 4-4 showing images of the condition of culverts. The condition of the culvert has no effect on the use of the culverts as the City undertakes rehabilitation/replacement works if BCI is less than 60.

Table: 4.8: Technical Levels of Service for Bridges and Culverts

Service Attribute	Technical Levels of Service	Technical Metrics	
		2018	2019
Scope	Percentage of bridges in the municipality with loading or dimensional restrictions.	8% 2 out of 25 vehicular bridges have dimensional restrictions, no loading restrictions for City's vehicular bridges.	8% 2 out of 25 vehicular bridges have dimensional restrictions, no loading restrictions for City's vehicular bridges.
Quality	1. For bridges in the municipality, the average bridge condition index value.	76 Average BCI calculated for 25 vehicular bridges	76 Average BCI calculated for 25 vehicular bridges
	2. For structural culverts in the municipality, the average bridge condition indexvalue.	70 Average BCI calculated for 96 culverts over 1.2m width	70 Average BCI calculated for 98 culverts over 1.2m width

Figure 4-4: Images of Condition of Bridges and Culverts



Additional Asset Specific Service Level examples:

The City of Markham tracks a variety of levels of service for each asset. Below provides a brief summary of key regulatory levels of service for bridges and culverts provided by the City. Note this is not an exhaustive list as there are many lower tier service levels (both legislative as well non-legislative) that are tracked:

Service Area	Service Standard	Legislated (Yes/No)	Service Level Target	Actual Performance
Bridges and Culverts	Visual inspection of all bridges (vehicular and pedestrian) and culverts over 3m span once in two years.	Yes	100%	100%
Culverts	Visual inspection of all culverts less than 3m span once in four years if it is in good condition.	Yes	100%	100%

4.6 STREETLIGHTS

Service Levels:

- **Public Safety and User Expectation –** Streetlight outage
- **Legislative –** Luminaires inspection (as per Ontario Regulation 239/02)
- **Public Safety and User Expectation –** To provide uninterrupted service to public.
- **Public Safety and User Expectation –** To provide better lighting to residents
- **Energy Efficiency –** To save energy cost
- **Public Safety and User Expectation –** To reduce streetlight public complaints

Asset Specific Service Level examples:

The City of Markham tracks a variety of levels of service for each asset. Below provides a brief summary of key regulatory levels of service provided by the City. Note this is not an exhaustive list as there are many lower tier service levels (both legislative as well non-legislative) that are tracked;

Service Area	Service Standard	Legislated (Yes/No)	Service Level Target	Actual Performance
Streetlights	Streetlights are to be repaired within 7 days along Regional roads and 14 days within local roads	Yes	100%	80%

4.7 ROADS, SAFETY DEVICES AND TRAFFIC SIGNALS

General Level of Service (Roads & Safety Devices):

- **Roads Asphalt** - Perform biannual pavement condition survey to assess the overall condition index (OCI) rating. As deficient segments are identified in accordance to the Minimum Maintenance Standard, they are repaired within the legislated timeline to provide public safety.
- **Roads Base and Subgrade** - As deficient locations are identified, it is placed under the rehabilitation program.
- **Sidewalk** - Minimum Maintenance Standards, O. Reg. 239/02.
- **Curb** – Subjective: broken, cracked, spalling and prioritized.
- **Parking Lot** - As deficient locations are identified, it is placed under rehabilitation program or the localized repair program based on the usage of the lot and to ensure public safety.
- **Guiderail** - Addressed safety concern within 30 days upon complaint received. As deficient locations are identified, it is placed under the rehabilitation program.
- **Fence** - Addressed safety concern within 30 days upon complaint received. As deficient locations are identified, it is placed under the rehabilitation program.
- **Retaining wall** - Addressed safety concern within 30 days upon complaint received. As deficient locations are identified, it is placed under the rehabilitation program.
- **Sign** - Regulatory and warning signs are repaired within 2 hours for stop signs and within 7 days for other regulatory signs or as indicated by reflectivity survey, other signs such as street name signs are replaced based on street patrols or public complaints and repaired within 21 days of defect identification.
- **Entrance feature** - Addressed safety concern within 30 days upon complaint received. As deficient locations are identified, it is placed under the rehabilitation program.

O. Reg. 588/17 requirements for Road assets is provided in Table 4.9 (Community Levels of Service) and Table 4.10 (Technical Levels of Service).

Table: 4.9: Community Levels of Service for Roads

Service Attribute	Community Levels of Service	Qualitative Descriptions
Scope	Description, which may include maps, of the road network in the municipality and its level of connectivity.	Figure 4-5: City of Markham Road Network and connectivity. The City of Markham road network with total 2223 lane-kilometers are categorized to three different classification as arterial roads, major/ minor collector roads and local/laneway roads
Quality	Description or images that illustrate the different levels of road class pavement condition.	Refer to Figure 4-6: Pavement Condition Index of Arterial Roads; Figure 4-7: Pavement Condition Index of Major/Minor Roads; Figure 4-8: Pavement Condition Index of Local/Laneway Roads

Table: 4.10: Technical Levels of Service for Roads

Service Attribute	Technical Levels of Service	Technical Metrics
Scope	Number of lane kilometres of each of arterial roads, collector roads and local roads as a proportion of square kilometres of land area of municipality.	Refer to Table 4.11: O. Reg. 588/17 Technical Metrics for Roads
Quality	For paved roads in the municipality, the average pavement condition index.	Refer to Table 4.11: O. Reg. 588/17 Technical Metrics for Roads

Figure 4-5: City of Markham Road Network and Connectivity

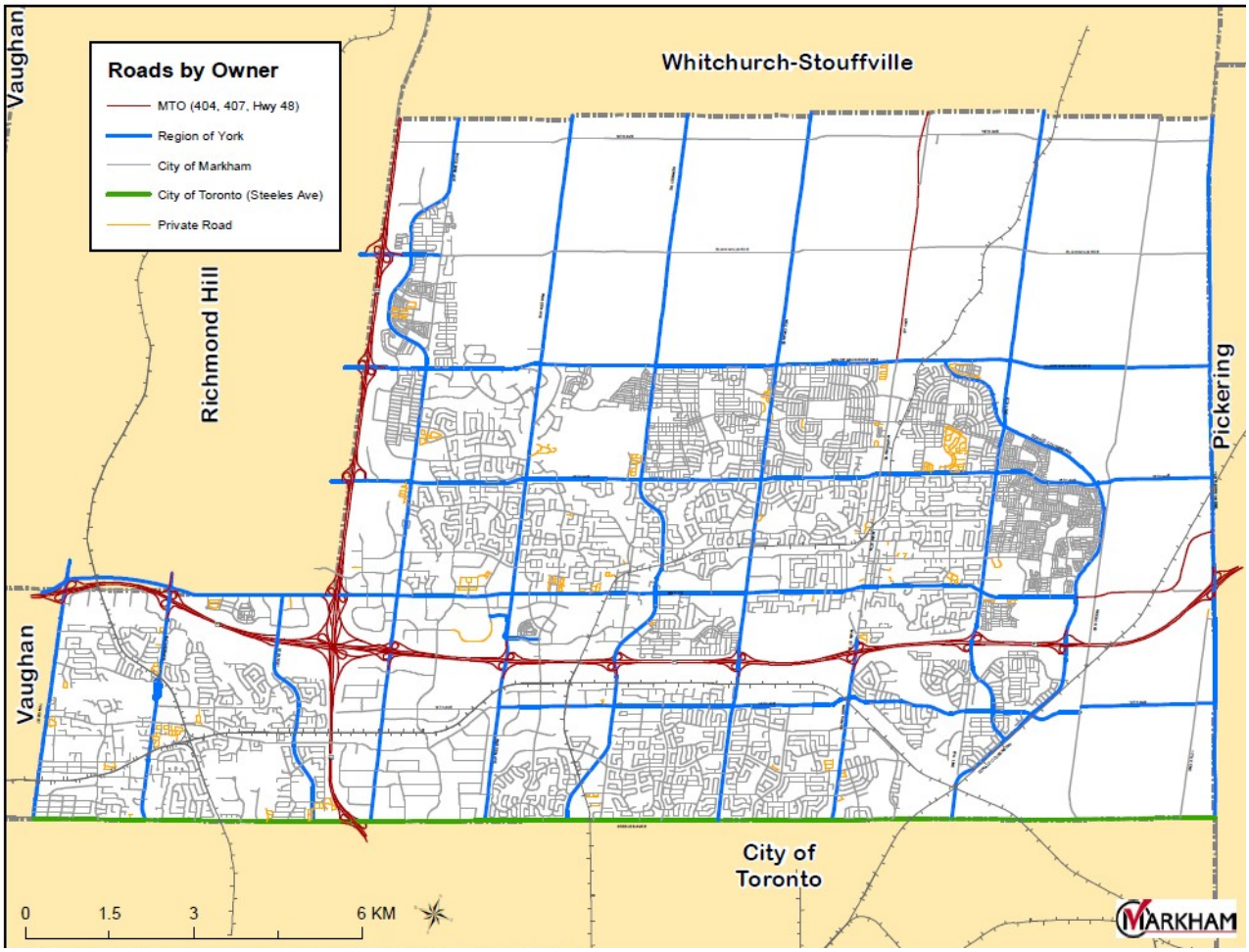


Table: 4.11: O. Reg. 588/17 Technical Metrics for Roads

Road Class	Lane-kilometer	Area (m^2)	% Distribution	Average PCI	Target PCI	Reference Map
Arterial	14.2	50,869	0.6%	80.5	80	Figure 4-6
Major/Minor Collector	1276.2	3,513,638	40.1%	79.3	75	Figure 4-7
Local/Laneway	1405.5	5,205,808	59.4%	79.8	70	Figure 4-8
Total/Overall	2223	8,770,315	100%	79.8	-	-

The City established the PCI target based the University of Waterloo and Ontario Good Road Association (OGRA) pavement management reference materials. The current status of the PCI condition of each classification of road with respect to the defined target level of service are illustrated in following figures. The City of Markham's road preservation and rehabilitation program strategy is to achieve 80 per cent of the entire road network meeting its PCI targets (i.e. Very Good Condition). As per 2019 pavement condition survey results, 80.42 per cent of overall road network have PCI above the target level and are in very good condition, which demonstrates the City's pavement preservation and rehabilitation program is keeping the road network condition above the industry standard.

Figure 4-6: Pavement Condition Index of Arterial Roads

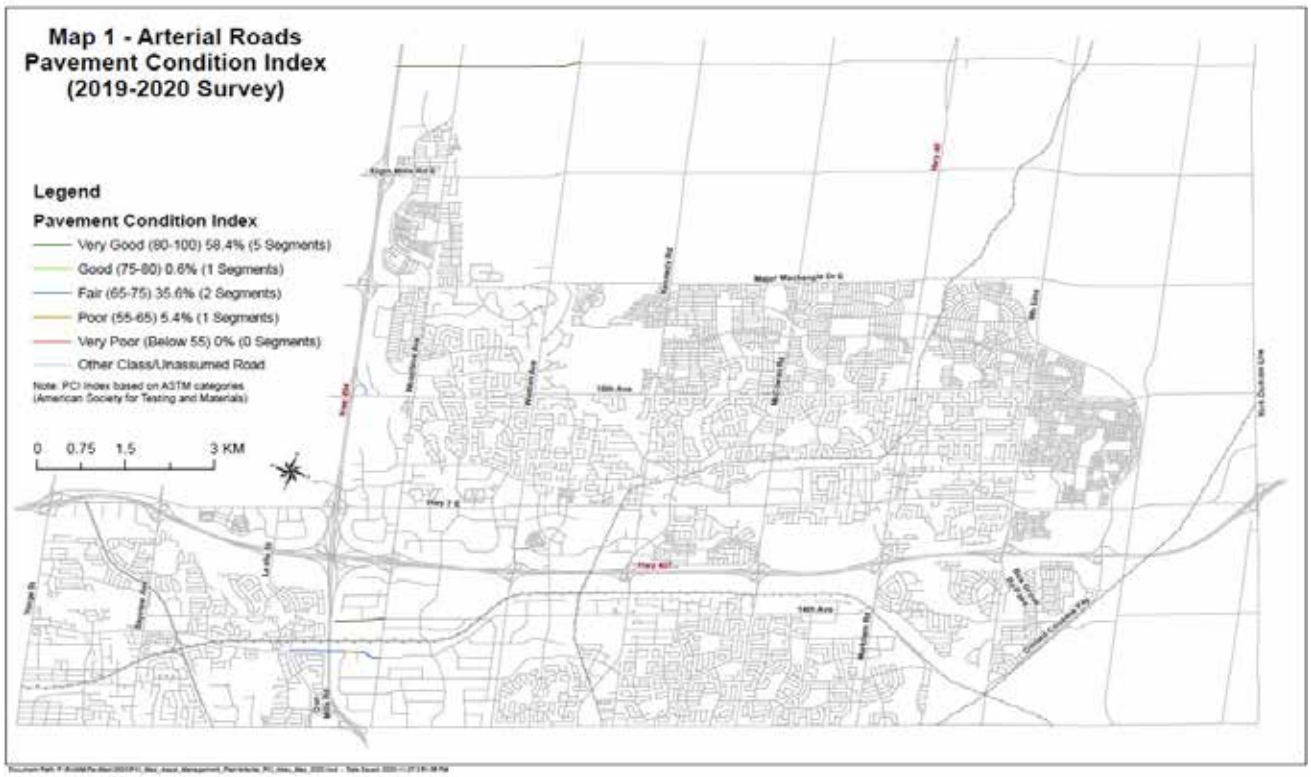


Figure 4-7: Pavement Condition Index of Major/Minor Roads

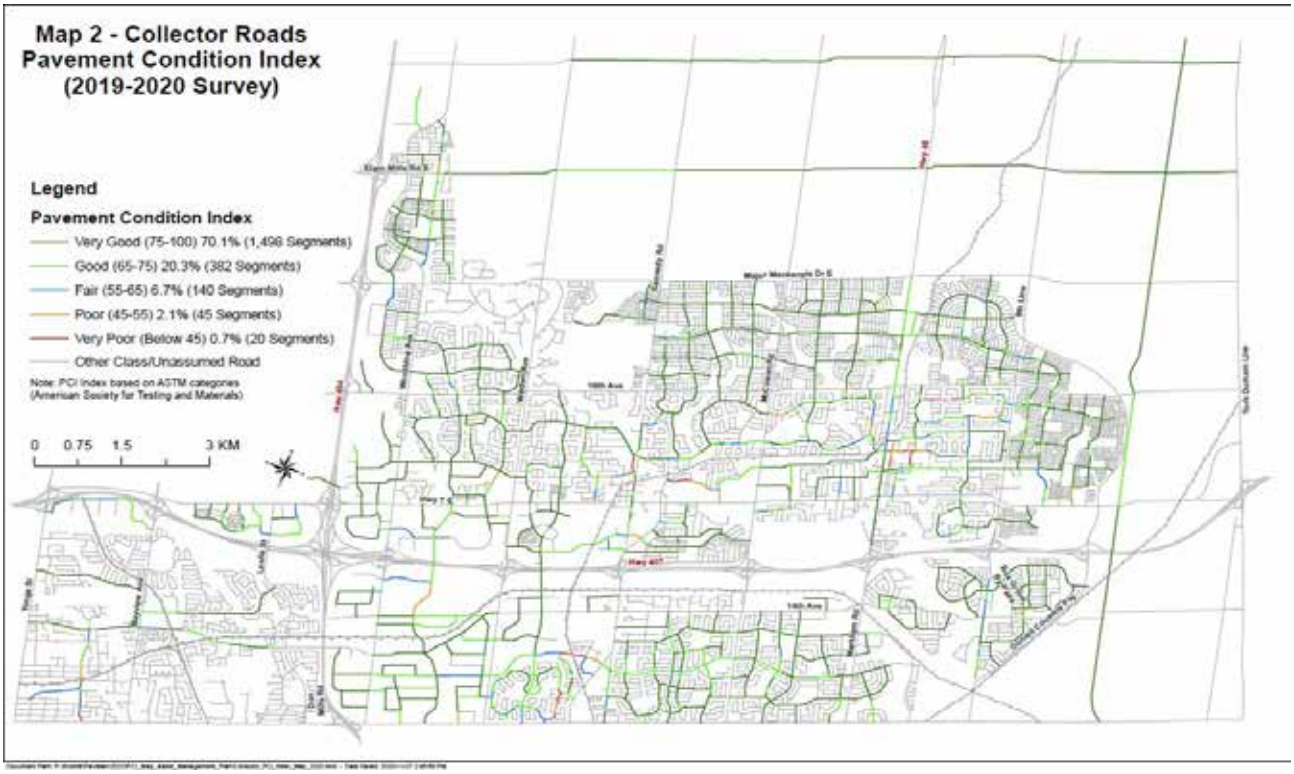
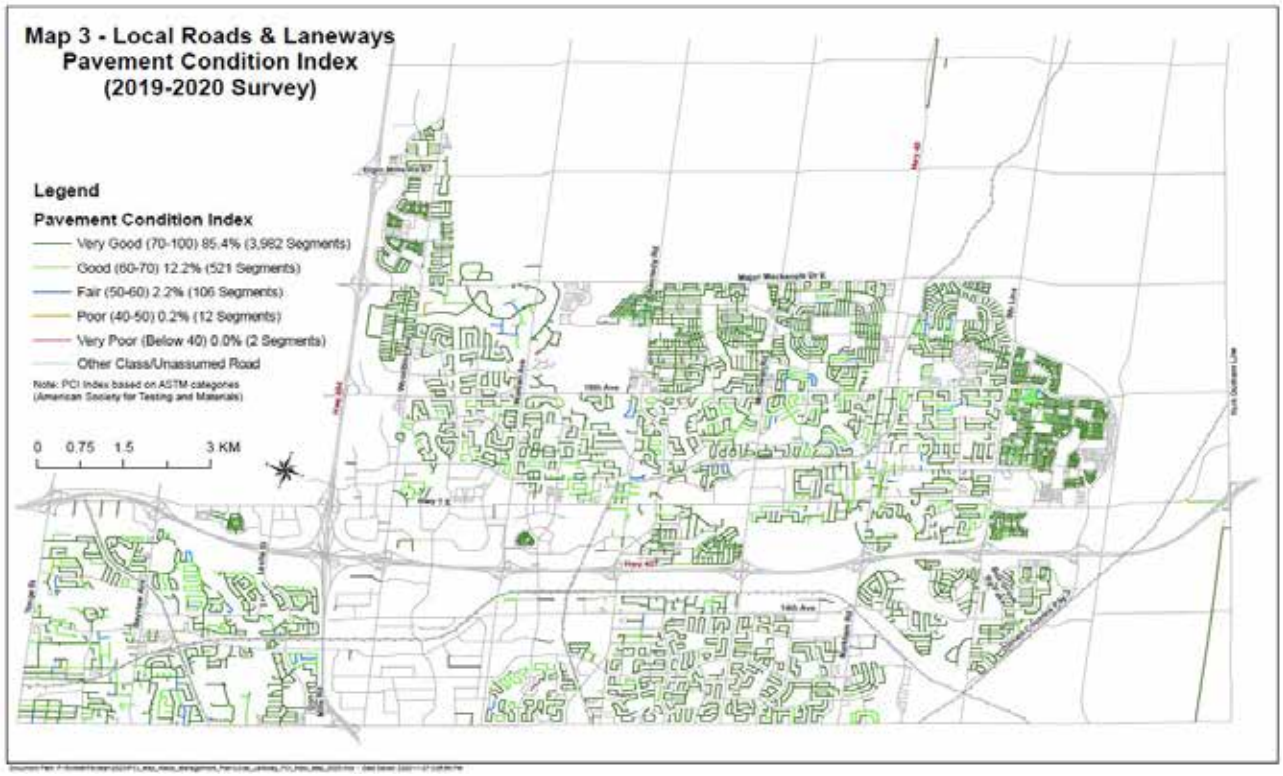


Figure 4-8: Pavement Condition Index of Local/Laneway Roads



Traffic Signals

Service Levels:

- Maintenance practices are in accordance to the Ontario Traffic Manual Book 12 and the Municipal Act, Regulation 239/02 – Minimum Maintenance Standards for Municipal Highways.
- If a traffic control signal system is defective in any ways described in Section 13(2) of the Minimum Maintenance Standards for Municipal Highways, the standard is to deploy resources as soon as practicable after being made aware of the defect to repair or replace the defective equipment.
- If the posted speed of all approaches to the intersection or location of the non-functioning signal lamp or pedestrian control indication is less than 80 kilometres per hour and the signal that is not functioning is a green or a pedestrian "walk" signal, the standard is to repair or replace the defective component by the end of the next business day.
- The standard is to inspect, test and maintain the following traffic control signal system sub-systems once per calendar year, with each inspection taking place not more than 16 months from the previous inspection:
  - The display sub-system, consisting of traffic signal and pedestrian crossing heads, physical support structures and support cables.
  - The traffic control sub-system, including the traffic control signal cabinet and internal devices such as timer, detection devices and associated hardware, but excluding conflict monitors.
  - The external detection sub-system, consisting of detection sensors for all vehicles, including emergency and railway vehicles and pedestrian push-buttons.
- A traffic control signal system sub-system that has been inspected, tested and maintained in accordance with Section 14(1) of the Minimum Maintenance Standards for Municipal Highways is deemed to be in a state of repair until the next inspection in accordance with that subsection, provided that the municipality does not acquire actual knowledge that the traffic control signal system sub-system has ceased to be in a state of repair.
- The standard is to inspect, test and maintain conflict monitors every five to seven months and at least twice per calendar year.

4.8 FACILITIES

The City has a team of building professionals consisting of City Staff, specialized Consultants and Contractors who work to deliver the set service levels for the various facility types. The primary measure for the technical level of service at a City facility is the Facility Condition Index (FCI).

FCI is a widely used facility management benchmark that is used to objectively assess the current and projected condition of a building asset. FCI is defined as the ratio of the deferred renewal costs plus current year required renewal (capital and operating) cost to current replacement value for each facility. This is a quantitative measure which is not subjective and is easily calculated and as such provides clear direction for capital planning and other maintenance works. To clarify, FCI is not strictly a measure of condition, as it is focused only on the current and near-term needs for an asset and not the overall condition or safety of the facility. Condition and safety concerns will inform the required renewal cost.

The level of service for the City facility assets is encompassed by the following principles:

- Accountability and transparency;
- Consistent reporting and auditing of inputs and outcomes;
- To ensure efficiency in delivery of service both internally and externally;
- To align service delivery to organizational goals;
- To maximize useful life of assets and ensure positive relations with stakeholders; and
- To be sustainable and aggressively move toward net zero emissions by 2050.

The City has prepared an FCI for all facilities based on the construction type.

In addition to the factor mentioned above, based on occupancy and data availability, facility assets classification with average FCI as shown in Table 4.1 below. A total of 176 facilities have been taken into consideration in this study to determine the 2019 FCI. The FCI categorizations are interpreted as follows:

- **0% to 2.5%:** Building condition is very good;
- **Above 2.5% to 5%:** Building condition is good;
- **Above 5% to 7.5%:** Building condition is fair;
- **Above 7.5% to 10%:** Building condition is poor;
- **Above 10%:** Building condition is very poor.

Table: 6.12: Facility Condition Index (FCI) of City Facilities (2019)

Building Category Based on Usage Type (A)	Number of Buildings (B)	Replacement Cost (% of Total) (C)	Average FCI (D)	Comments (E)
Administrative Buildings	4	$101.1M (11.6%)	0.84% (Very Good)	Markham Civic Centre, 8100 Warden Ave.
Culture Facilities	6	$61.3M (7.0%)	1.91% (Very Good)	
Fire Stations	9	$42.8M (4.9%)	0.82% (Very Good)	
Industrial type Construction	78	$19.5M (2.2%)	6.4% (Fair)	555 Miller Avenue, West Parks Yard etc.
Libraries	3	$19.2M (2.2%)	1.59% (Very Good)	
Recreation Facilities	26	$583.9M (67%)	1.29% (Very Good)	
Residential Type Construction	48	$25.9M (3.0%)	2.86% (Good)	
School Type Construction	2	$18.6M (2.1%)	3.24% (Good)	7100 Birchmount, 160 Dudley Avenue.
Total	176	$872.3M		

In Table: 4.12 under Column A all City facilities are grouped into eight (8) categories based on usage type. Column B to E of Table 4.1 is summarized as follows:

- Column B – Number of facilities for each Building category
- Column C – Total Replacement Cost for each category (Category Replacement Cost as a percentage of total Replacement cost for all Facilities)
- Column D – Average FCI for facilities within each category
- Column E – Examples of facilities in each category

4.9 PARKS

Service Level:

- **City Sports Fields** - cultural practices (aerating, topdressing, over-seeding, and fertilizing) are performed on the sports fields from spring to fall. A cut schedule is also in place, where they are cut twice a week.
- **Artificial Turf Fields** - are inspected weekly to assess routine maintenance works and audited yearly.
- **Floodlights and Poles** - are inspected yearly.
- **Water Play** - inspections are conducted daily once the location opens and are inspected by a third party contractor at opening and closing.
- **Playgrounds** - inspections are to be completed twice monthly from April 1st to October 31st and then monthly from November 1st to March 31st. An annual audit is conducted once per year inclusive of safety surfacing.
- **Exercise Stations** - are inspected twice monthly from April 1st to October 31st and audited yearly.
- **Tennis Court Surfacing and Fences** - are inspected monthly and audited yearly.
- **Pathways** - inspections are to be conducted weekly. An annual audit is conducted once per year.
- **Stairways** - are inspected monthly at a minimum to address debris.
- **Tree Maintenance** - is dependent upon a current tree inventory which records all tree inquiries, activity, work orders and the history of each City tree with a unique GIS identification. Response time for work varies from hours for hazards and emergency issues to months for regular pruning.

4.10 FLEET

Service Levels:

- Fleet Policy guidelines along with manufacturers recommended maintenance schedules are followed for a majority of units. In house maintenance program have been developed to better suit a majority of the severe and heavy duty applications such as Fire Apparatus, Plow Trucks and some Non-licensed units allowing the ability of the unit to achieve the full asset life expectancy.

4.11 ITS INFRASTRUCTURE HARDWARE

Service Levels:

- Current Service levels are driven by commitment to deliver Excellent Customer Satisfaction by providing reliable information and efficient ITS systems at a reasonable cost.
- Service Levels are established with the City business units by understanding the business needs and expectations, delivery of their services and allocating appropriate resources. Service levels are mainly performance-related (response time, incident resolution, information availability, equipment failure, etc.). These are based on the business demands.

Service Standards	• Service Requests (via ITS Ticketing System) will be resolved in accordance with the service standards applicable to the request (as specified in the ITS Service Catalogue on the City's Intranet 'Checkmark'); • In the case of Critical Network Connectivity issues (Severity 1), all available resources will be assigned to resolve the issue and restore service as soon as possible. • Incidents resolved within set targets (severity-based): at least 85% • Average Customer Satisfaction (from monthly service follow-up survey): at least 75% satisfied or very satisfied • High severity (Severity 2) incidents will be resolved within 8 business hours; medium severity (Severity 3) incidents will be resolved within 2 business days. • Virus signatures updated within 24 actual hours of global release; • Overall Data Centre System Availability – 99% or better; • Individual Server Availability – 90% or better; • A complete list of services and related service standards is found in the ITS Service Catalogue on Checkmark.
Availability	• Network connectivity is normally available 24 hours a day, 7 days a week except during scheduled or emergency system maintenance; • Full support services are available 0800-1700, Monday to Friday (excluding Public Holidays); • Network connectivity incidents occurring after hours will be dealt with on a best effort support basis.

5. ASSET MANAGEMENT FRAMEWORK & STRATEGY

A two-stage process is developed to ensure alignment between the corporate goals, and how the assets are managed. The first step is the development of an Asset Management Framework that ties municipal goals (e.g. Official Plan, Strategic Plan) and planning (Departmental Business Plans and capital budget) to infrastructure management. The second step is the development of the Asset Management Strategy, a set of planned actions that will enable the assets to provide the desired levels of service in a sustainable way, while managing risk, at the lowest life cycle cost. Both steps commits the City to provide approved levels of service in the most effective and efficient way, through the planning, design, construction, acquisition, operation and maintenance, renewal and disposal of assets.

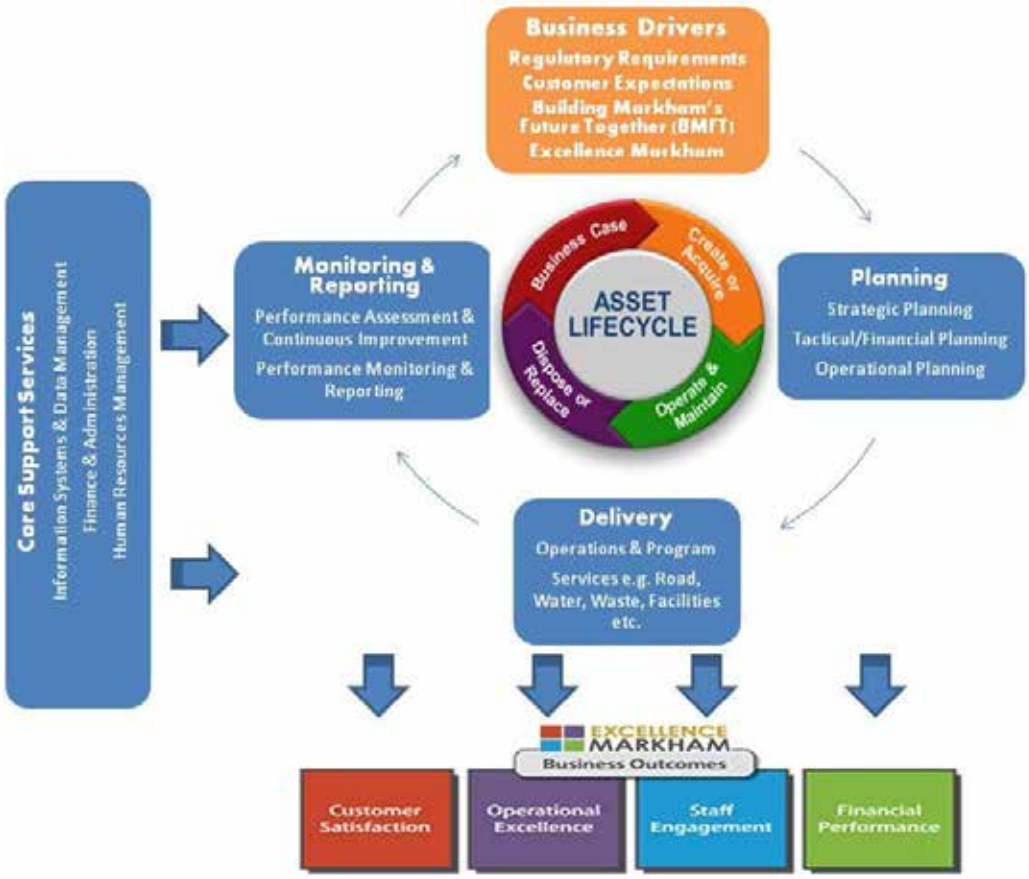
5.1 MARKHAM ASSET MANAGEMENT FRAMEWORK

The City's Asset Management Framework provides a common understanding and lexicon for describing the business processes and activities conducted by the City to manage its various physical assets, and to illustrate the relationships between those activities. Establishment of the Corporate Framework is consistent with leading practices, as defined in the International Infrastructure Management Manual (IIMM), PAS55 and ISO 55000.

The Markham Asset Management Framework, developed in consultation with senior staff and industry experts is illustrated in Figure 5-1: Asset Management Framework. The Framework consists of several major elements:

- Regulatory Requirements, Business Drivers (orange)
- Core Processes (blue) supported by Core Support Services
- Asset Management Life Cycle (centre)
- Excellence Markham Business Outcomes (multi-coloured squares)

Figure 5-1: Asset Management Framework



5.1.1 Business Drivers (Orange)

Business Drivers are the influences that govern how the infrastructures are managed and set overall expectations of how the department operates, including, but not limited to:

- Customer requirements (Levels of Service);
- Corporate goals and strategies;
- Regulatory requirements, such as the O. Reg. 588/17, Municipal Act, the Safe Drinking Water Act, the Ontario Water Resources Act, Regional By-law requirements, municipal bylaws requirements, the Planning Act and Places to Grow requirements;and
- Environmental factors, such as the economy, technology innovations, and political and social priorities.

5.1.2 Plan-Do-Check-Act Cycle (Blue)

The underlying structure is based on the all-encompassing PDCA (Plan Do Check Act) cycle which is an iterative four step universal management method and principle used by various organizations to control and continuously improve on processes and products. This control/cycle has no end, and functions as a constant repetitious process through all business programs and initiatives.

The Core Supporting Services include finance and administration, information systems and data management, and human resources management, which provides the necessary support to the Business unit to successfully manage the infrastructure.

Planning **Strategic Planning** **Tactical/Financial Planning** **Operational Planning**	Converts the Business Drivers (Orange) into a set of operational plans that describe how the department will deliver the service. The levels of planning include: • Long-Term Planning which converts Corporate Strategic Plan/Goals, regulatory and customer requirements into high level strategic deliverables (e.g. Corporate Strategic Plan Actions, Master Plans, Policies, long term funding strategy) • Medium-Term Planning which cascades Corporate requirements to Departmental levels to allocate resources (natural, physical, financial, human, etc.), while meeting defined levels of service (e.g., Departmental Business Plans, Performance Management Plan, Asset Management Plan, 10-Year Capital program) • Short-Term Planning which converts medium term plans into tactical, short term executable plans (e.g. Annual Capital and Operating Budgets, Emergency Preparedness & Response Plans, Operational Standards & Specifications).
Delivery **Operations & Program** **Services e.g. Road, Water, Waste, Facilities etc.**	Refers to the actual action of delivering the services to the customers, both internal and/or external. The services are delivered to meet the Excellence Markham business outcomes: Customer Satisfaction, Operational Excellence, Staff Engagement and Financial Performance.
Monitoring and Reporting Performance **Assessment & Continuous Improvement** **Performance Monitoring & Reporting**	Also known as performance management checks that measure if the Department is doing what it intended/planned to do, including: • Monitoring actual results and reporting actual against targets over time • Conducting results based benchmarking • Assessing gaps, and report on lessons learned • Assess if the results meets the Business Drivers (orange) and modify plan/delivery for continuous improvement
Core Support Services **Information Systems & Data Management** **Finance & Administration** **Human Resources Management**	These internal department services provide support to the various business units to achieve the planned business outcomes: • Information Systems and Data Management – to provide support in the design, selection, implementation and maintenance of corporate information systems infrastructure to meet business objectives • Financial Management and Administration - to provide support to record and report original and depreciated costs of assets; all historical costs associated with service delivery including asset life cycle costs; and forecasts of future asset renewal costs, to develop short term implementation budgets • Human Resources Management – to provide support to recruit, manage and develop human resources to meet business objectives

5.1.3 Asset Life Cycle (Centre)

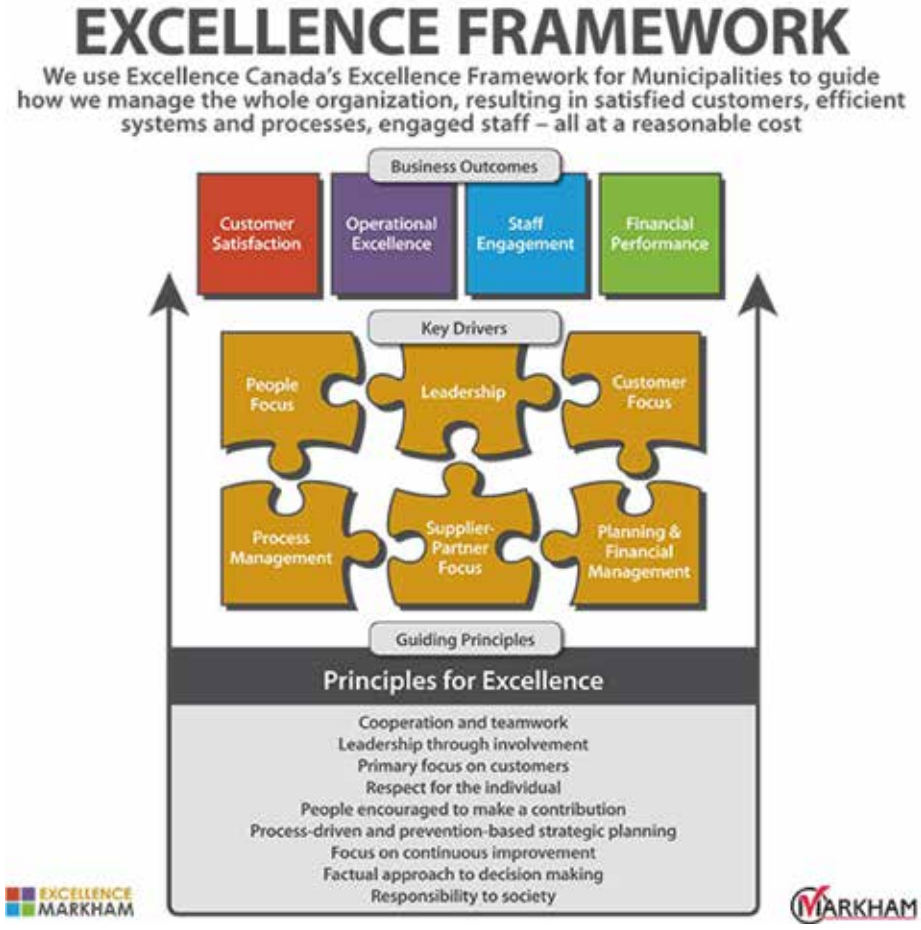
Centered amongst the Business Drivers, and overlaying the Plan-Do-Check-Act cycle, is the management of physical infrastructure. This Asset Management Cycle describes how the various assets are managed, and overall aligns to the Excellence Markham Business Outcomes as shown below:

The Asset Life Cycle includes:

- Asset procurement, creation or acquisition - to provide assets that meet current and future needs while delivering levels of service and mitigating risks.
- Asset operations, maintenance – to maintain an asset to meet the required functional condition and/or extend its life.
- Asset disposal, replace - to rebuild or replace an asset to restore it to a required functional condition.

5.1.4 Excellence Markham Business Outcomes

The City use Excellence Canada's Excellence Framework for Municipalities to guide how the organization is managed, focusing on areas of Customer Satisfaction, Operational Excellence, Staff Engagement, and Financial Performance.\



5.2 CURRENT CITY OF MARKHAM ASSET MANAGEMENT STRATEGIES

Per the Guide for Municipal Asset Management Plans: The Asset Management Strategy is a set of planned actions that will enable the assets to provide the desired levels of service in a sustainable way, while managing risk, at the lowest life cycle cost. While based on the internationally recognized PAS55 by the Institute of Asset Management, asset management can be defined as "the continuous improvement of systematic and coordinated activities and practices through which the City can optimally and sustainably manage its infrastructure systems, associated performance, risks and expenditures over their life cycles for the purpose of achieving the organizational strategic plan".

This chapter describes the current asset management strategies/practices adopted by individual department/asset classes based on the following questions:

- What is the condition audit process and the evaluation criteria?
- What is the rehabilitation/replacement/maintenance program?
- What is the population and employment forecasts for the municipality?

Overall, the City has a strategy to manage major assets through their life cycle which are generally consistent from condition assessment, to program development, to execution. However, the City does not have a documented corporate practice that considers:

- Risk analyses of critical infrastructure across the City;
- Prioritizing infrastructure investments that maximize benefits, reduce risk and provide desired levels of service;
- Making informed decisions over the life of the assets (including operation, maintenance, renewal, replacement and decommissioning); and
- More efficient and effective ways to deliver services.

5.3 WATER INFRASTRUCTURE

5.3.1 Water Infrastructure

- The City of Markham's Water Distribution System is governed by the comprehensive Ministry of the Environment, Conservation and Parks (MECP) Safe Drinking Water Act (SDWA) and associated Regulations. The MECP conducts a yearly inspection of the Drinking Water Distribution System to determine compliance with the Acts and Regulations. Waterworks exercises extreme rigour in operational excellence to remain in compliance and is diligent with conformance to the Drinking Water Quality Management Standard (DWQMS).

5.3.2 Rehabilitation / Replacement / Maintenance Programs

- Rehabilitation and Replacement Programs
  - Watermain Replacement Program
  - Fire Hydrant Replacement Program
  - Sampling Station Replacement Program
  - Auto Flushing Station Replacement Program
  - Water Meter Replacement Program
  - Valve Chamber and Valve Replacement Program
  - Bulk Water Station Replacement Program
  - Insulation Replacement Program for Suspended Watermains
  - Water Meters Replacement Program (annual replacement of approx. 4,000 meters)
- Preventive Maintenance
  - Auto-Flushing Station Maintenance
  - Flushing of Dead-End Watermains
  - Instrumentation Maintenance (Chlorine Pocket Colorimeter, Fluoride Pocket Colorimeter, Gas Detector, Turbidity Meters, pH Meters)
  - Sampling Station Maintenance
  - Water Sampling (THM, Nitrate/Nitrite, Microbiological, Chlorine Residual, Lead, Organic, Inorganic, Fluoride, Sodium)
  - Flushing of Pressure Separation Valves
  - Unidirectional Flushing

- Air Release Valve Inspection - Clean & Exercise
- Fire Hydrant Flushing &Calibration
- Hydrant Inspection (Spring and Winter)
- Visual Suspended Watermains Inspection (annual)
- Valve Inspection & Exercising
- Pressure Reducing Valve Inspection
- Fire Hydrant Painting
- Fire Hydrant Snow Clearing/Thawing
- Valve Chamber Inspection/Maintenance
- Curb Box Operation Check and Maintenance
- Cathodic Protection of Iron Watermains

- Corrective Maintenance
  - Water Sample – Water Quality (Ad-hoc)
  - Hydrant Repair
  - Water Service – Repair or Replacement
  - Watermain Repairs and/or Modifications

5.3.3 Condition Assessment

- Curb box inspections and repairs done by contractor annually; Average of 4,000 Curb boxes are inspected per year
- Detailed Suspended Watermain Inspection - Once every 5 years
- Fire Hydrant – Two inspections annually per hydrant; Replace obsolete hydrants
- Sampling Station – Maintenance once per year
- Auto Flushing Station – Maintenance and programming twice per year
- Systems Engineering Studies:
  - Backflow Prevention Program
  - Water Leak Detection Program
  - Water Pressure Transient Monitoring Study
  - Water Distribution Calibration Model Update
  - Water Distribution Calibration of Water Quality Model Update
  - Water System Instrumentation (Transient Pressure Loggers)
  - Pilot DMA Instrumentation Program

5.3.4 Supervisory Control and Data Acquisition (SCADA) System

The City operates and maintains two continuous chlorine-monitoring stations and four district metering areas where various instrumentation exists for monitoring chlorine and water pressure.

5.3.5 Climate Change Strategy

The water distribution network within the City consists of a network of pressurized pipes. These pipes are most vulnerable at river crossings where they may experience excessive stress due to scour or erosion of riverbanks. Another particularly vulnerable location exists when pipelines cross under bridge decks. If the flood water levels reach the bridge deck or come close, the debris may strike the pipes causing them to fail.

The City will continue to assess and implement climate change initiatives related to the water supply system through continued monitoring and detailed assessment programs such as erosion site inspections and condition inspections of suspended watermains to quantify impacts and risk in order to identify and prioritize implementable initiatives. Asset Management Plans will continue to be key to ensuring a long-term and effective response to future climate changes and to ensuring long-term sustainability of City assets.

Emergency Preparedness and Business Continuity Plans are in place in the event of extreme weather. In addition, climate adaptation requirements are assessed within the asset management planning process to inform:

- Operations and preventative maintenance programs; and
- Capital rehabilitation and replacement priorities.

5.4 WASTEWATER INFRASTRUCTURE

5.4.1 Sanitary Pipes

- Existing Asset Management Strategy/Program Description:
  - Includes CCTV inspection; rehabilitation of deficient pipe sections and flushing of clogged pipes identified through CCTV inspections.
- Condition Assessment:
  - Approximately 80-85 km are inspected by closed circuit television (CCTV) inspections every year over a 10-year cycle.
- Rehabilitation/Replacement:
  - Annual rehabilitation program is in place to rehabilitate the deficient pipe sections identified through CCTV inspection.
  - The City's 25-year Life Cycle Reserve Study includes:
    - CCTV Inspection (one ten-year cycle)
    - Sanitary Sewer Main Replacement Program (Gravity and Force mains)
    - Sanitary Sewer Rehabilitation Program
    - Sanitary Sewer Pipe Upgrade (Upsizing) Program
    - Wastewater Hydraulic Model Update (every 10 years)
    - Wastewater Flow Monitoring Program (annual)
- Preventive Maintenance:
  - Sampling of Wastewater Effluent
  - Sanitary Sewer Manhole Inspection
  - Sewer Flushing Maintenance
  - Sewer Pump Station Inspection and Maintenance
  - Sewer Siphon Flushing and Cleaning
  - Sewer Video Inspection (Mainline) & Sewer Lateral Inspection
- Corrective Maintenance:
  - Mainline Sewer Reaming
  - Manhole Maintenance and/or Repair
  - Repair or Replace a Sanitary Sewer
  - Trunk Sewer & Manhole Zoom Camera Inspection
  - Sanitary Sewer Backup & Blockage Investigation & Corrective Action (Mainline)
  - Sanitary Sewer Lateral Blockage Investigation & Corrective Action
  - Odour Investigation and Corrective Action
  - Sanitary Sewer Lateral – Repair or Replacement
  - Smoke and Dye Tests for Sanitary and Storm Sewers and Laterals
  - Vermin Investigation and Corrective Action
- Evaluation Criteria:
  - The City conforms to National Association of Sewer Service Companies (NASSCO) Pipe Assessment Certification Program (PACP) for all Condition rating for:
    - Structural Pipe Segments
    - Operational and Maintenance

5.4.2 Sanitary Components (Manholes)

- Condition Assessment:
  - Manholes are not condition audited.
- Rehabilitation/Replacement:
  - Minor manhole repair/replacement works are completed through annual maintenance activities by Road Operations Department.

5.4.3 Pumping Stations

- Condition Assessment:
  - The City's five sanitary sewer pumping stations are inspected every 5 years.
- Maintenance activities
  - Routine maintenance works are carried out as per manufacturer's recommendations.
- Rehabilitation/Replacement:
  - The City's 25-year Life Cycle Reserve Study includes $4.2M for pump station rehabilitation and component replacement program.

5.4.4 Supervisory Control and Data Acquisition (SCADA) System

- The City owns, operates and maintains five sanitary pump stations, where various instrumentation exists for monitoring flow.

5.4.5 Climate Change Strategy

- Climate Change is expected to result in increased annual rainfall, and potentially more extreme weather events. This may result in the following:
  - Increasing number of erosion of the asset in close proximity to watercourses;
  - Increasing number of storm events causing basement flooding/power outages;
  - Increasing amount of inflow & infiltration (I & I) into the sanitary sewer system; and
  - Increasing stress/reduced life expectancy on sanitary and storm systems.
- The City has the following safeguards in place to deal with these impacts:
  - City's Design Standards take into consideration of potential climate change impacts.
  - An active erosion inspection, assessment and restoration program to identify and restore erosion sites across the City to protect the City's infrastructure.
  - Implementation of a Flood Control Program to upgrade the neighborhood to become resilient to 100 years storm event.
  - An inflow & infiltration (I & I) program to reduce potential infiltration of groundwater or stormwater into the sanitary system to mitigate basement flooding.
  - Emergency Preparedness and Business Continuity Plan are in place in the event of extreme weather or power outages.
  - Redundancies in City's pump stations and SCADA system to ensure adequate standby power.
  - Assess climate adaptation requirements within the asset management planning process to inform:
    - Operations and preventative maintenance programs; and
    - Capital rehabilitation and replacement priorities.

5.5 STORMWATER INFRASTRUCTURE

5.5.1 Storm Pipes

- Existing Asset Management Strategy/Program Description:
  - Closed circuit television (CCTV) inspections
  - Rehabilitation of deficient pipe sections and flushing of clogged pipes identified through CCTV inspections.
- Condition Assessment:
  - Approximately 80-85 km are inspected by closed circuit television (CCTV) inspections every year over a 10-year cycle
- Rehabilitation/Replacement:
  - A rehabilitation program is in place every two years to rehabilitate the deficient pipe sections identified through CCTV inspection
  - The City's 25-year Life Cycle Reserve Study includes:
    - CCTV Inspection: Currently only one ten-year cycle is included
    - Storm Sewer Pipe Rehabilitation
    - Replacement of Storm Sewer Pipes that are at the end of their life cycle
    - Storm Sewer Pipes Emergency Repairs

- Evaluation Criteria:
  - The City conforms to National Association of Sewer Service Companies (NASSCO) Pipe Assessment Certification Program (PACP) for all Condition Ratings for:
    - Structural Pipe Segments
    - Operational and Maintenance

5.5.2 Storm Components (Manholes and Catch Basins)

- Condition Assessment:
  - Manholes and catch basins are not condition audited.
- Rehabilitation/Replacement:
  - Minor manhole and catch basin repair/replacement are completed through annual maintenance activities by Road Operations Department.

5.5.3 Outfall Structures

- Condition Assessment:
  - Outfall structures visual condition inspection is carried out every four years.
  - Out of a total inventory of 367 outfalls, 245 (67 per cent) outfall structures have been condition assessed as of 2020.
- Maintenance Activity
  - Maintenance activities are carried out on as-required basis.
- Rehabilitation/Replacement:
  - A rehabilitation program is in place every four years for selected outfall structures.
  - The City's 25-year Life Cycle Reserve Study includes:
    - Outfall Inspections
    - Outfall Rehabilitation Works
  - The rehabilitation cost varies based on the condition assessment and is location specific over 25-year period.
- Evaluation Criteria:
  - Outfall structures are inspected based on Ontario Structures Inspection Manual (OSIM) by the Ministry of Transportation. This inspection is not legislated.

5.5.4 Climate Change Strategy

- Refer to Section 5.4.5

5.6 STORMWATER MANAGEMENT (SWM) PONDS / NATURAL INFRASTRUCTURE

5.6.1 Wet Ponds

- Condition Assessment:
  - The City has 57 wet ponds.
  - The City has a condition inspection program for wet ponds every two years where approximately 10-15 ponds are inspected for sediment levels through bathymetric surveys, and conditions of inlet/outlet control structures are visually assessed. Work includes updating the SWM pond database, sediment level of ponds, inspection of inlet/outlet structures and site restoration works as required.
- Rehabilitation/Replacement:
  - The City has a program to clean the sediment that is location based on an as-required basis to ensure that the approved quality control function of the pond is maintained. Sediment removal location is selected through the condition inspection program.

- The City's 25-year Life Cycle Reserve Study includes:
  - SWM Wet Ponds Inspection
  - SWM Wet Ponds Sediment Removal and Restoration Works
  - SWM Wet Ponds Maintenance
  - Pond Retrofit Study Update
  - Pond Retrofit Implementation
  - Swan Lake Chemical Treatment (phoslock application)
  - Water Quality Monitoring

- Maintenance Activities:
  - In order for the wet ponds to function efficiently, maintenance is required. Maintenance work includes repairing/replacing grates, minor repairs to headwalls, railings, inlet/outlet structures, fence and debris cleanup etc.
- Evaluation Criteria:
  - As per Ministry of the Environment, Conservation and Parks (MECP) Environmental Compliance Approval (ECA) requirements, a pond should be cleaned to avoid reduction of capacity of the pond, assumed to occur when five per cent of the facility treatment efficiency is lost through capacity reduction, or when the percentage of accumulated sediment is more than 15-30 per cent of the pool volume. The owner shall ensure that sediment is removed from pond at such a frequency as to prevent the excessive build up and potential overflow of sediment into the receiving watercourse.

5.6.2 Dry Ponds

- Condition Assessment:
  - The City has 41 dry ponds
  - Currently there is no condition inspection program for dry ponds.
- Rehabilitation/Replacement:
  - Accumulation is not expected for dry ponds. Hence, no sediment cleaning is required for dry ponds.
  - The City's 25-year Life Cycle Reserve Study does not include any dry ponds due to nature of the asset.
- Evaluation Criteria:
  - The City is currently re-evaluating a condition audit/maintenance program.

5.6.3 Underground Storage Tanks

- Condition Assessment:
  - There are currently five underground concrete tanks. The tanks are inspected every five years.
- Rehabilitation/Replacement:
  - The tanks are replaced at the end of their service life. Since the service life of these assets is beyond 25 years, they are not included in the City's 25-year Life Cycle Reserve Study. However, the 25-year Life Cycle includes sediment cleaning every five years.

5.6.4 Oil Grit Separators (OGS)

- Condition Assessment:
  - All OGS units are inspected bi-annually per manufacturer's recommendations.
- Maintenance activity:
  - OGS units are cleaned based on the condition inspection results.
- Rehabilitation/Replacement:
  - OGS are replaced at the end of their service life. Since the service life of these assets is beyond 25 years, they are not included in the City's 25-year Life Cycle Reserve Study. However, the 25-year Life Cycle includes annual sediment cleaning based on the results of condition inspection.

5.6.5 Pumping Stations

- Condition Assessment:
  - The two stormwater pumping stations are inspected every five years.
- Maintenance Activity
  - Routine maintenance is carried out as per manufacturer's recommendations.
- Rehabilitation/Replacement:
  - City's 25-year Life Cycle Reserve Study includes $7.6M for various pump station component replacements.

5.6.6 Erosion Sites

- Condition Assessment:
  - The City's erosion restoration program has been set up to complete restoration where the movement of the natural drainage system impacts the environment or public health and safety
  - In 2013/2014, the City developed an Erosion Master Plan and identified the top 30 erosion sites for rehabilitation
  - In 2019, The City completed an Environmental Assessment for East Don Tributary and updated the Five Year Erosion Restoration Plan
  - Inspection Frequency:
    - Sites with high risk are inspected multiple times (2-4) times per year
    - Sites with medium-high risk of failure are inspected annually
    - Sites with low risk of failure are inspected on a five year cycle
    - Site prioritization is updated on an annualbasis
  - Erosion Master Plan will be updated in 2023
- Rehabilitation/Replacement:
  - Based on the 2013/2014 Erosion Master Plan Study, 30 erosion restoration projects were completed between 2014 - 2019
  - The City's 25-year Life Cycle Reserve Study include:
    - Erosion Restoration Study update
    - 75 erosion sites for remediation within 25 years, approximately three sites are restored every year
  - No formal maintenance program for erosion site.
- Evaluation Criteria:
  - As part of Class EA, the Environmental Study Report (ESR) needs to be updated on a five- year basis to ensure consistency with new policies and to update priorities due to changes of erosion conditions over time.

5.6.7 Storm Channel (Don Mills Channel, Rodick / Miller Ditch)

- Condition Assessment:
  - The City has an easement along the majority of the Don Mills Channel and the condition has been assessed as part of the Erosion Master Plan Study. Culverts along the Channel are assessed under the Structures Program.
  - Rehabilitation/Replacement:
  - A Municipal Class Environmental Assessment Study has been completed for the Don Mills Channel and study outcomes are to be implemented from 2023 to 2030.
  - Annual maintenance activities include removal of vegetation, overgrowth and debris to ensure proper storm water conveyance, included in the City's 25-year Life Cycle Reserve Study.
- Evaluation Criteria:
  - Cleaning to maintain treatment efficiency and taking steps to ensure public health and safety.

5.6.8 Climate Change Strategy

- Refer to Section 5.4.5

5.7 STRUCTURE – VEHICULAR BRIDGES, PEDESTRIAN BRIDGES, CULVERTS

5.7.1 Existing Asset Management Strategy / Program Description

- Condition Assessment:
  - The City has an annual detailed condition inspection program for vehicular bridges, pedestrian bridges, culverts and boardwalks.
  - As per this program, all bridges (vehicular and pedestrian) and culverts over 3 metres are assessed every other year (biennial basis) in accordance with the OSIM (Ontario Structure Inspection Manual). Culverts less than a three metre span are assessed every four years, if they are in good condition.
  - All vehicular bridges, pedestrian bridges and culverts have been condition assessed as of December 2020.

- Rehabilitation/Replacement:
  - The City has an annual Structures Rehabilitation/Replacement Program for vehicular bridges, pedestrian bridges, culverts and boardwalks.
  - The annual amount allocated in this program varies each year based on the quantity and condition of the asset.
  - All vehicular bridges, pedestrian bridges and culverts have been captured in the 25-year Life Cycle Reserve Program (2020). Ten boardwalks that were constructed as part of Multi-use Pathway (MUP) are captured in the 25-years Life Cycle Reserve Program.
  - The 25-year Life Cycle (2020) Reserve Program includes:
    - Rehabilitation Works for Vehicular Bridges
    - Rehabilitation Works for Pedestrian Bridges and Boardwalks
    - Rehabilitation Works for Culverts
    - MNR Monitoring for Capital Projects
    - Structure Preventive Maintenance
    - Structures Annual OSIM Inspection
    - Confined Space Assessment for culverts
    - Toogood Dam Inspection and Rehabilitation

  The City has the following annual maintenance activities for vehicular bridges, pedestrian bridges and culverts:
  - Vehicular bridges are washed every year in spring.
  - Bridge Preventive maintenance is an annual program (for both vehicle and pedestrian bridges). The work includes asphalt, concrete and wood repairs.
  - Pedestrian bridges and culverts - There are no planned maintenance activities for pedestrian bridges and culverts.

5.7.2 Condition Audits

- Vehicular bridges, pedestrian bridges and culverts over a three metre span are inspected on a biennial basis (once every two years) in accordance with the OSIM 2008 (Ontario Structure Inspection Manual by the Ministry of Transportation.
- Every year, staff identifies the structures to be visually inspected as per OSIM requirements. The City also performs CCTV inspections for all culverts that are less than 1.2m diameter irrespective of their material type every four years.

5.7.3 Evaluation Criteria

- All vehicular bridge, pedestrian bridge and culvert inspections are performed by or under the guidance of, a structural engineer, and include such information as structure type, dimensions and span lengths, other key attribute data, detailed photo images, and structure element by element inspection, rating and recommendations for repair, rehabilitation, and replacement.
- Based on the inspection of each structure, a Bridge Condition Index (BCI) is allocated for all structures by qualified Licensed Engineer. For BCI, each element of the structure is inspected in accordance with Ministry of Transportation (MTO) Ontario Structures Inspection Manual (OSIM, 2008) and is rated according to three condition states ((good, fair and poor). The weighted average of all structural elements and their condition states is then summarized in a Bridge Condition Index (BCI) using MTO specifications.

5.7.4 Climate Change Strategy

The City will continue to assess and implement climate change initiatives related to the structures (bridges and culverts) through continued monitoring and detailed assessment programs such as OSIM condition inspections. Such programs will help to quantify impacts and risk in order to identify and prioritize implementable initiatives through business planning and asset management planning processes to ensure a well-positioned and proactive approach. Asset management plans will continue to be key to ensuring a long term and effective response to future climate changes and to ensuring long-term sustainability of City assets.

5.8 STREETLIGHTS

5.8.1 Streetlight Poles

- Existing Asset Management Strategy/Program Description Program description:
  - Condition assessment
  - Annual program to replace, rehabilitate and repair deteriorated streetlight poles and components.
- Condition Assessment:
  - Streetlight pole inspection program is scheduled every three years with approximately 5,000 to 8,000 poles inspected during each inspection cycle.
  - Streetlight poles that are older than 15 years are inspected once in nine years. Poles that are in fair to poor condition are candidates for re-inspection every three to six years.
  - As of 2020, all City-owned streetlight poles have been inspected at least once since 2013.
- Rehabilitation/Replacement:
  - Based on the condition inspection results, streetlight poles are either replaced or rehabilitated based on their condition priority.
  - The City's 25-year Life Cycle Reserve Study includes:
    - Pole Condition Inspection
    - Pole Replacement - Due to service life of the poles, not all the poles are captured under the City's 25-year Life Cycle Reserve Study. Replacement of 2,725 poles (average age – 57 years) out of a total inventory of 25,182 poles, has been included in 2020 Life Cycle.
    - Pole Rehabilitation
    - Pole component repairs/replacement (hand holes, foundations, brackets etc.)
  - The City has an annual maintenance program which includes maintenance of the street lighting system, emergency repairs to the damaged poles and fixtures, replacement of burned out bulbs, ballasts, light sensors, fixtures (based on residents' complaints to the City's Contact Centre and outages reported by the City's night patrols), re-lamping of HPS fixtures where bulbs are replaced and fixtures are cleaned on a 5 year cycle, underground and overhead supply line repairs and locating services for underground streetlight infrastructure.
- Evaluation Criteria:
  - Level 1: No concerns; minor, non-critical deficiencies;
  - Level 2: Deficiency identified with potential to deteriorate to point of failure; monitoring recommended; and
  - Level 3: Serious deficiency or safety concern; remediation, immediate repair or replacement recommended.

5.8.2 Underground Streetlight Cables

- Existing Asset Management Strategy/Program Description:
  - Condition Assessment Program
  - Annual program to replace, rehabilitate and repair deteriorated streetlight cables; maintenance program.
- Condition Assessment:
  - Cable condition inspection program is scheduled for every five years based on condition index and Megger testing techniques. Condition Index is a visual inspection of the underground streetlight cables based on their age and condition of the fuse, hand hole, cable and connector condition. For those segments where cable and connector condition were reported to be "fair", a Megger test is performed. The Megger test is a non-destructive method of testing using an insulation resistance meter to verify the condition of electrical insulation. The test collects data about continuity, resistance and insulation integrity. The combined results are used to compute the overall health index to determine which cable section requires replacement.
  - As of 2020, 354 km of cables out of a total inventory of 1,025 km (approx. 35per cent) have been inspected.
- Rehabilitation/Replacement:
  - Based on the condition inspection results, deficient streetlight cables are replaced/repaired every two years after each inspection cycle.
  - The City's 25-year Life Cycle Reserve Study include:
    - Condition Inspection Program – Currently accounts for only 500 km of cable lengths within 25 years.
    - Cable Replacement/Rehabilitation Program - Currently accounts for only 388 km (average age 53 years) of cable lengths. Due to the average service life of the cables, not all the cables are captured under the City's 25-year Life Cycle Reserve Study.

- Evaluation Criteria:
  - Overall Health Index through visual inspection based on age, fuse, hand hole and cable/connector's condition.

5.8.3 Streetlight Fixtures

- Condition Assessment:
  - Majority of the LED fixtures are monitored through Philips Starsense software system, therefore condition assessment is not required.
  - HPS fixtures are not condition assessed, deficiencies are identified through routine patrols, resident calls, etc.
  - The City inspects all luminaires twice a year to check to see they are functioning per O. Reg. 239/02.
- Rehabilitation/Replacement:
  - Deficient fixtures are replaced via the annual streetlight infrastructure maintenance program within the Operating budget as required.
  - City's 25-year Life Cycle Reserve Study includes LED fixtures (decorative and cobra head). HPS fixtures are not included in the City's 25-year Life Cycle Reserve Study.
  - Maintenance program includes washing the LED and re-lamping the HPS lamps every five years through the City's operating budget.

5.8.4 Segment Controllers

- Condition Assessment:
  - Segment controllers are not condition assessed. They need to be replaced every 10 years in line with the evolving technology.
- Rehabilitation/Replacement:
  - Program to replace these assets every 10 years due to technology obsolescence is included in the City's 25-year Life Cycle Reserve Study.
  - There is no maintenance program associated with this asset.

5.8.5 Climate Change Strategy

- The City is contributing to a climate ready City by installing energy efficient technology, such as Light Emitting Diode (LED) streetlights, in all new neighbourhoods since 2014.
- To date, as part of the City's LED conversion program, approx. 12,500 existing HPS cobra-head fixtures have been converted to LED, reducing total energy consumption by approximately 5,297,128 kilowatt-hours annually and reducing greenhouse gas emissions.
- Energy efficiency contributes to resiliency by lowering energy demand. This allows current supply to meet potential future demand growth.
- Use of energy efficient LED technology in street lighting is in line with the City's Sustainability initiatives and moves closer to the Greenprint's Energy and Climate objective of zero energy and emissions by 2050.
- LED luminaires meet the requirements of the International Dark-Sky Association (IDA) as dark-sky friendly by eliminating 'up light' that produces obtrusive sky glow from streetlights.

5.9 ROADS AND SAFETY DEVICES

5.9.1 Road Surface & Base

- Existing Asset Management Strategy/Program Description: includes condition assessment; complete road segment rehabilitation inclusive of identified asphalt resurfacing strategies, concrete curb and sidewalk, catch basin and manhole repair; and maintenance activities.
- Condition Assessment:
  - A consultant is hired to use mechanical testing equipment to evaluate road surface condition and produce an overall condition index (OCI). This index is then used to identify the poorest sections of the road network. Testing is completed every two years and becomes the basis for further evaluation to select roads for repair. The 2,223 lane km of the roads are condition audited every other year.
  - In addition to the consultant, regular road patrol identifies locations for temporary and permanent repairs.

- Rehabilitation/Replacement:
  - Markham's pavement management program incorporate sustainable elements focusing on community, economic and environmental drivers, with the following three goals:
    - Maintain high ratio of roads rated good or very good (Socially focused)
    - Reduce the overall life cycle cost (Economically focused, fiscally and financially prudent)
    - Reduce the environmental impacts of rehabilitation/replacement (Environmentally focused)

The Pavement Preservation Strategy has been in place since 2010, where an estimated annual savings of $1.3M to $1.9M over the entire network since implemented.

Based on the pavement evaluation on each road section every two years, the City determines which roads are suitable candidates for rehabilitation. Once a pavement segment's Pavement Condition Index (PCI) falls below a predetermined threshold level, it becomes a candidate for rehabilitation. Subsequently, staff utilizes pre-engineering data and Annual Average Daily Traffic (AADT) volumes to assess the structural capacity of the potential candidates and confirms the feasibility of in-place asphalt recycling. The City then hires a consultant to perform a pavement evaluation and subsequent design, considering all of the potential rehabilitation strategies such as Full Depth Reclamation (FDR) with Foamed Asphalt, and mill and overlay, with and without the use of a Stress Absorbing Membrane Interlayer.

Through the City's routine condition assessment and rehabilitation/replacement program, the City proactively preserves the roads to prolong their service life. Roads are categorized to three different classification with its targeted PCI ranking. The target PCI for Arterial roads, Major/Minor Collectors and Local/Laneway is 80 per cent, 75 per cent and 70 per cent respectively. The City established the PCI target based the University of Waterloo and Ontario Good Road Association (OGRA) pavement management reference materials.

The City of Markham's road preservation and rehabilitation program strategy is to achieve 80 per cent of the entire road network meeting its PCI targets (i.e. Very Good Condition). The attached maps shown the current status of PCI condition of each classification of road with respect to the defined target level of service.

The current Overall Condition Index of the City road network is 79.87 per cent, which proven the City's pavement preservation and rehabilitation strategy help reduce maintenance costs and extending the life cycle of the pavement.

- An annual resurfacing program of approximately 15-20km is in place where select sections of roadway are repaired based on condition rating vs. target level of service, traffic volumes and budget availability.
- The City's 25-year Life Cycle Reserve Study include 15-20 km resurfacing per year only. The total lane kilometre of roads is not included in the 25-year Life Cycle Reserve Study because it is dependent on condition assessment and prioritized accordingly every year.
- The 25-year Life Cycle Reserve Study includes the following components:
  - Asphalt Rehabilitation (sub base, curb and sidewalk, preservation, steel, FTE) – varies every year, includes approximately 15-20 km.
  - Asphalt-Asphalt Inspection.
  - Asphalt-AC Index – is only incorporated into the life cycle reserve for five year cycle as it is based on the renewal of the contract that is highly dependent on posted price of crude oil.
  - Asphalt-Route and Seal.
- The City has the following annual maintenance activities:
  - Localized asphalt repair - provides repairs to specific locations of the road network.
  - Pothole repairs - utilize artificial intelligence to inspect the road network to identify and keep track of potholes.
  - Minor manhole and catch basin repair/replacement.
- Evaluation Criteria - Empirical OCI data is used to identify roads in most need of repairs. Further subjective evaluations are completed to confirm empirical data and to evaluate the importance of roadway within the transportation network. OCI criteria is rebalanced periodically to ensure quality results

5.9.2 Curbs & Sidewalks

- Existing Asset Management Strategy/Program Description: In addition to the curb and sidewalk embedded in the Road Surface and Base (resurfacing) program, there is an annual localized repair program which repairs deficient concrete curb and sidewalk City wide. The deficiencies are prioritized every year and repaired within the annual budget allowance. Segments not repaired are recorded and prioritized for next year's repair program.
- Condition Assessment:
  - Sidewalks are patrolled once per year and through road patrol identifies deficient locations in alignment with Minimum Maintenance Standards, O. Reg. 239/02.
  - Curb deficiencies are identified through road patrols, resident calls, etc.
- The City has the following annual maintenance activities:
  - Eliminating trip edges of sidewalks includes grinding, asphalt ramping and mortar repairs.
- Annual program is included in the 25-year Life Cycle Reserve Study.
- Evaluation Criteria
  - Sidewalk - Trip ledges greater than 20mm, O. Reg. 239/02
  - Curb – N/A

5.9.3 Parking Lots

- Existing Asset Management Strategy/Program Description: condition assessment, annual replacement program supported by localized repair.
- Condition Assessment: 101 parking lots are visually condition inspected Bi- annually.
- Rehabilitation/Replacement:
  - Rehabilitation - The City has an annual program for the removal and replacement of concrete, interlock and asphalt infrastructure. The annual amount allocated in this program varies each year based on condition and location of the asset. All 101 parking lots are accounted for in the 25-year Life Cycle Reserve Study.
  - Localized repairs – Annual maintenance and repairs include localized repairs, maintenance holes and catch basin adjustments. The locations are prioritized annually.
- The City has the following annual maintenance activities:
  - Pothole repair, catch basin repair/replacement.
  - Snow removal, line marking and painting.
- Evaluation Criteria – Subjective evaluation based field inspection of surface and support apparatus, based on defects, age and frequency of use of the lot.

5.9.4 Safety Devices: Guide Rail

- Existing Asset Management Strategy / Program Description: condition assessment, annual replacement program supported by localized repair.
- Condition Assessment: Guide rail deficiencies are identified through road patrols, resident calls, etc.
- Rehabilitation/Replacement:
  - Rehabilitation - The City has an annual program for replacement guide rail and recently documented guide rail end treatment replacement in the asset inventory. End treatment is required to be in compliance with provincial engineering guideline and requirements. The annual amount allocated in this program varies each year based on condition and location of the asset. All 14.7 km are accounted for in the 25-year Life Cycle Reserve Study.
  - Localized repairs – Annual maintenance and repairs are performed.
- Evaluation Criteria – Subjective evaluation based field inspection of guide rail based on if the posts are rotten, failing, and those requiring upgrading to current OPSD standards.

5.9.5 Safety Devices: Railway Crossing

- Existing Asset Management Strategy / Program Description: condition assessment, location specific rehabilitation program of level crossings to ensure vehicular and pedestrian safety. There are no operating and maintenance impacts on this program.
- Condition Assessment: 13 Locations are visually condition inspected annually.
- Rehabilitation/Replacement: Based on the condition audit, each crossing is identified for either grind-and-pave operation once every seven years, or full depth removal and replacement of rubber rail. All 13 locations are accounted for in the 25-year Life Cycle Reserve Study.
- Evaluation Criteria: Subjective field inspection evaluation based on if there are trip ledges near rails, condition of pedestrian crossing areas adjacent to roadway, condition of rubber mud rail, movement of rails affecting structural integrity of adjacent asphalt, approach areas.

5.9.6 Safety Devices: Fencing / Retaining Wall / Entrance Features

- Existing Asset Management Strategy / Program Description: Not condition assessed, annual replacement program supported by localized repair.
- Condition Assessment:
  - The inventory has been updated to capture the fencing, retaining wall and entrance features that are in public right-of-way. Deficiencies are identified through patrols, resident calls, etc.
- Rehabilitation/Replacement:
  - An annual replacement program of deficient assets located within the City's property and is included in the 25-year Life Cycle Reserves.
  - Localized repairs – Annual maintenance and repairs are performed.
- Evaluation Criteria: Subjective evaluation based field inspection based on:
  - Fence - deficient material, decaying, leaning, or rotten wooden
  - Retaining wall - spalling, missing coping stone, leaning, vandalized, damaged due to vehicular accidents

5.9.7 Safety Devices: Signs

- Existing Asset Management Strategy / Program Description: Condition assessed for Regulatory and Warning Sign only, annual maintenance / replacement program.
- Condition Assessment:
  - Regulatory and Warning Signs - Minimum Maintenance Standards dictate a Reflectivity Program. Reflectivity is measured against industry standard yearly.
  - Inventory update is in progress to capture the signs.
  - Deficiencies are identified through patrols, resident calls, etc.
- Rehabilitation/Replacement: City has an annual maintenance and replacement program.
- Evaluation Criteria: Minimum Maintenance Standards set out criteria for replacement of Regulatory and Warning Signs.

5.9.8 Climate Change Strategy

The City's Operations Department has engaged the University of Waterloo and other industry leaders in numerous research papers and strategies, all intended to extend the life of our road pavement. The City's pavement preservation and rehabilitation program reduces the environmental footprint while employing various technologies to achieve a financially sustainable program.

The City continues to improve standards for road construction and survey technologies to inspect the pavement condition to monitor the road network. Furthermore, The City has a fulsome maintenance program focusing on preventative maintenance.

More details on the road maintenance program are outlined below:

- Preserve the road by proactively treating the surface early in its life to prolong its state of good repair and reduce the need for raw material and energy required by full reconstruction strategies – primary preservation treatment applied is micro-surfacing
- Strengthen roads during rehabilitation for longer life. Revise standards for new road construction to reflect a longer life cycle – using various design such as the Expanded Asphalt Stabilization (EAS) technique.

- Trial green technologies such as warm asphalt mix designs to reduce emissions, save energy, and use recycled aggregate and asphalt roofing shingles in order to reduce use of virgin material, and divert shingles from landfill.
- Monitor, track performance, and survey pavement condition on a regular two year cycle to monitor the network's overall level of service and ensure the road network remains in good repairs.

The key of the program to minimize climate change impact is to apply the right strategies to the right locations at the right time. Taking a proactive approach to preserve the existing assets in a timely manner is the key to achieving a state of good repair of the entire road network, and eventually reducing the overall cost and environmental and social impact.

5.10 FACILITIES

The City's strategy for successfully delivering the set levels of service for its facilities are given below. These strategies relate to ongoing monitoring of facility components, evaluation of underperforming components requiring preventive maintenance or replacement and capital life cycle planning of major rehabilitation/replacement of facility components.

5.10.1 Existing Asset Management Strategy / Program Description:

- Building condition audits are completed every 10 years;
- Annual reviews of the building components due for rehabilitation/replacement over the next two years;
- Replacement/repairs program on building components as required; and
- Preventive maintenance activities.

5.10.2 Rehabilitation/Replacement:

- Repairs/replacement - The City has an annual life cycle program for repairs/replacement of building components. The annual amount allocated varies each year based on the annual review and 10-year building condition audit results. Each facility has a 25-year Life Cycle Reserve Study to ensure that funding for future capital works is available.
- Programs – A plan that is implemented city wide and not specific to one building. The plan helps the City to ensure that minimum standards are met (e.g. dark-sky compliant light fixtures) and that projects are completed to meet corporate strategic goals (e.g. AODA compliance). Facility related programs are also included in the Life Cycle Reserve Study as shown below
  - Accessibility improvement to meet or exceed AODA (Accessibility for Ontarians with Disabilities Act) and Markham's Accessibility Design Guidelines
  - Corporate security operations and system improvements
  - Designated substance management program
  - Parking lot lights replacement program
  - Roofing replacement program
  - Municipal building backflow prevention program; and
  - Corporate accommodation program
- Annual maintenance activities required to operate the buildings and maintain the targeted levels of service are included as part of the annual operating budget, including over 20 City wide maintenance contracts (e.g. janitorial, elevator, ESA, Emergency generator, Roofing, Mechanical maintenance etc.)

5.10.3 Evaluation Criteria:

The condition of each component of a facility is evaluated based on year of installation, typical life cycle of the component, frequency of use, reported issues, recent repairs and overall functional quality. Most components such as flooring, painting, and ceiling are evaluated through visual inspections. Technical components such as electrical, fire systems are evaluated by licensed contractors or specialized professionals on an as required basis.

The City recently reviewed and changed its evaluation criteria for the condition for each component from a three scale rating to a 5 point rating. The new scale is as follows 'Very Good', 'Good', 'Fair', 'Poor' or 'Very Poor' based on the component condition, design fulfillment and service level. The Life Cycle Reserve Study is used to develop annual repair/replacement programs and it is being updated to reflect the five point rating. Components rated as 'Very Good' are in life cycle plan for longer term replacement or repair. Components rated as 'Fair' are planned for shorter term replacement. Components rated as 'Very Poor' are planned for immediate (soonest possible) replacement or repair.

5.10.4 Climate Change Strategy

New Construction & Major Renovation

New buildings constructed for a growing population will result in increased energy consumption, water, waste, and GHG emissions in the City. To mitigate these impacts, the City of Markham has pursued a sustainable approach to growth since 2009 by ensuring all new facilities, and major renovations to existing buildings, are designed and constructed to higher energy efficiency and sustainability standards beyond those set forth in the Ontario Building Code (OBC).

In addition to meeting OBC requirements, all new buildings (and major renovations) aim to achieve:

- LEED Silver or higher,
- Designed as 'solar-ready', and
- Connect to Markham District Energy's efficient district energy system, where feasible.

Existing Building Modifications

Additionally, in 2014 the City adopted higher energy-efficiency standards for equipment replacement that are incorporated in the long-term planning and life cycle asset renewal process. This strategy is advantageous because the City is better able to leverage the capital renewal schedule and a zero-over-time approach to retrofit existing facilities to lower energy consumption and carbon emissions. When equipment, systems, and components in facilities have reached the end of their service life and are due for replacement, the new equipment should aim to achieve:

- Minimum energy-efficiency criteria as outlined in the latest version of ASHRAE Standard 90.1

This approach focuses on long-term planning to deliver a series of cost effective incremental projects over time that, together, can amount to zero energy emissions for the entire building portfolio.

Increased Community Resilience

Community resilience is defined as a community's reduction of, and preparation for risk. Energy efficiency can support community resilience by strengthening local energy systems and delivering more reliable and affordable energy for the local governments, households and businesses.

Detailed throughout the 2019 Corporate Energy Management Plan (CEMP), the City values the importance of increasing community resilience and prioritizes initiatives that enhance our ability to build more reliable, heathy, resilient, and sustainable infrastructure.

Energy Efficiency Measure	Resilience implications	Markham examples
Microgrids	Cost-effective heating, cooling, and/or electricity using local energy sources. Can reduce peak power demand, GHG emissions, and provide backup power during emergencies. Can provide cost savings	Markham District Energy, net-metered solar, Combined Heat and Power (CHP), geothermal
Energy efficiency programs	Increases reliability, resilience against extreme weather events, and indoor air quality. Reduces energy consumption, costs, GHG emissions, and exposure to rate fluctuations	Over 200 energy initiatives implemented since 2013
Demand Management programs	Decreases stress on utility grid, ability to respond to system emergencies, reduces costs, and can provide revenue source	Demand Response, peak reduction initiatives, EV Workplace Charging Pilot

5.11 TRAFFIC SIGNALS

5.11.1 Condition Assessment

Condition assessments are completed twice annually (spring and fall) through visual and physical inspection by qualified electrical contractors for above ground infrastructure only. Below ground infrastructure are not condition assessed.

5.11.2 Rehabilitation/Replacement:

The City has an annual program for replacement of signal equipment that has reached the end of its expected life. The annual amount allocated in this program varies each year based on the condition and location of the asset. All 92 signalized intersections and their associated components are accounted for in the 25-year Life Cycle Reserve Study. However, if conditions assessment identifies that such equipment is still in good operating condition, replacement will be deferred to a future year. Replacement scheduling is based on anticipated life cycle derived based on industry standard and benchmarking against other municipalities.

Preventative maintenance practices are completed twice annually, with minor repairs completed on an as-needed basis. Where possible, major preventative replacements are recorded and prioritized for incorporation into the following year's capital budget, while failures/emergencies are addressed immediately.

5.11.3 Evaluation Criteria

Above-ground equipment is visually and physically inspected twice annually. There are no defined criteria to determine replacement requirements. Any minor repair or replacements are accomplished during inspection. Any repairs or replacements that are may pose a pressing (although not emergency) concern and require attention is documented by the maintenance contractor and submitted to the City for approval prior to executing repairs.

5.11.4 Climate Change Strategy

With respect to traffic signal assets, the City is taking any opportunity to adopt greener initiatives through the procurement of equipment that uses less energy (i.e. LED vehicular/pedestrian signal indications) and conducting regular condition assessment reviews in accordance with the Minimum Maintenance Standards for Municipal Highways to reduce unnecessary asset replacement resulting in a lower carbon footprint.

Signalized intersections across the City have been upgraded to meet the regulations of the Accessibility for Ontarians with Disabilities Act (AODA) through the City's pedestrian accessibility improvement program. In addition, the City takes advantage of opportunities to upgrade intersections to accommodate cycling infrastructure (e.g. traffic signals for cyclists), where applicable. While making City facilities more accessible for vulnerable road users of all ages and abilities, these upgrades improve intersection safety and encourage the use of active transportation to reduce emissions.

The City is also working to upgrade the traffic controller systems to facilitate traffic signal coordination on the Denison Street and Main Street Markham corridors. A completed feasibility study has shown that the use of traffic signal coordination on these corridors can result in the following:

- Annual delay savings of 44,250 hours;
- Annual fuel savings of 8,450,250 litres; and
- Annual stop savings (i.e. number of vehicular stops) of 434,250.

The total monetized value of these annual savings amount to an estimated $6.75M.

5.12 PARKS

Existing Asset Management Strategy / Program Description: condition assessment, annual replacement program supported by localized repair.

5.12.1 Sports Fields:

- Asset Management Strategy / Program Description - This is an annual program that involves the annual inspections and rehabilitation of the approximately 200 sports fields every season.
- Condition Assessment: Sports fields are inspected/reviewed four times a year.
- Evaluation Criteria: Based on condition assessment, use, field type and location.
- Rehabilitation/replacement: The fields are assessed and work is allocated according to those that require immediate attention. The 25-year Life Cycle reserve study allocates approximately $3.3M each year. As a result a maintenance program is continued throughout the season that involves top-dressing, aerating, over-seeding, sodding, and fertilizing, as well as having at least one crew in the parks weekly to inspect bleachers and cut fields.
- Artificial turf fields are subject to their own program and are included in the 25-year Life Cycle Reserve Study and are inspected weekly and audited yearly.
- Protective netting is subject to monthly inspections and twice yearly condition assessment.

5.12.2 Electrical Structures/Lighting:

- Asset Management Strategy/Program Description - There is an annual program for repair and replacement however budget varies from year to year depending on inspections.
- Condition Assessment: All structures/lighting inspected once a year. Annual inspection of all lighting occurs every spring. Staff and various user groups continue to use lighting throughout the operating season and provide information to Operations of any deficiencies for repair or replacement.
- Evaluation Criteria: Based on condition assessment.
- Rehabilitation/Replacement: All lighting is being replaced with efficient environmentally friendly LED lighting the approximate capital project is estimated at $416,400. An annual re-lamping program is performed every five years and includes the replacement of bulbs, blown ballasts, cables and broken lenses. Replacements are based on the life cycle analysis and actual condition after inspections. Operations retains an Electrical Consultant yearly to provide an independent assessment with costs.
- Annual maintenance as required.
- There is currently no information on age and inventory of parks pathway lighting.

5.12.3 Park Structures:

- Water play (splash pads) are inspected daily, and crews are in parks at least once a week overseeing the condition of the structures. Structures are inspected weekly as part of maintenance operations with repairs being performed as required on a yearly basis outside of life cycle replacements.
- Park Amenities: Parks Operations supervisors inspect amenities such as benches, waste receptacles, bike racks, picnic tables, games tables and Moloks as part of their weekly inspections. Parks Operations staff attends to waste receptacles, and recycling bins at least once a week. Moloks are inspected twice a week in the summer months and monthly throughout the winter season. Condition audits are conducted once a year. Crews are in parks all year emptying trash receptacles (at least once a week), removing damaged bins and reporting any damage or repairs necessary.
- Playgrounds: As per CSA guidelines, all 229 playgrounds are inspected twice a month from April 1st to October 31st and splash pads are inspected weekly throughout the operating season, with an annual audit performed by consultant. Average asset age is not available as there have been replacements to the older playgrounds and data is not available. Updates have been made to identify replacement playgrounds, age, costs, and life cycle cost consistent with three year average awards.
- Pathways: Existing annual programs for resurfacing and stairway repairs assess conditions once a year, and inspections occur weekly from April 1st to October 31st. The approximate yearly cost based on a three year average is $326,900. The maintenance of these assets includes but is not limited to grading, adding material, blowing off debris, repairs due to tree roots. An improved inspection program and current inventory is needed to better address life cycle issues.

- Courts and Court Fencing are inspected monthly and audited yearly
- Trees (Forestry): Block pruning is performed every eight years. Forestry crews respond to residential concerns/ inquiries about trees on a regular basis using current inventory to track issues of the City's inventory of 177,368 trees.
- Replacements are tracked yearly and carried out within 12 months of the stump removal
- Irrigation: A program is in place where the irrigation systems are serviced in both the spring and fall, and repairs are completed throughout the season where needed from inspection on a yearly basis. Systems are tested in the spring for leaks and other problems, and again in the fall when blown out for the winter. Issues addressed weekly as required.

5.13 FLEET

5.13.1 Existing Asset Management Strategy / Program Description - Overview

The Corporate Fleet Maintenance and Management Policy identifies the baseline criteria established for the fleet refurbishing and fleet replacement programs. The City's Life Cycle Reserve is the source of funding for both these programs. The refurbishing program has an annual amount of approximately $30,000. The replacement program has an annual amount that varies each year based on the number of units recommended for replacement, based on age and annually assessed condition. Fleet Services monitors use of assets through specific maintenance schedules and data that highlight fleet and equipment that require replacement. This reduces down time of vehicles and equipment and increases efficiency. Maintenance of fleet and equipment is in accordance with the performance standards set out in the Highway Traffic Act regulations.

Various maintenance programs exist, such as Fleet refurbishing, which is an annual program that includes refurbishing and corrosion protection at approximately $30,000 per year. The activities involved in this process include body work and other repairs that extend an asset's useful life to meet or exceed its anticipated replacement timeframe.

A Life Cycle Replacement program exists and utilizes parameters that identify the most cost effective time period for replacement or optimal replacement interval (ORI). The ORI program considers fleet unit downtime, operating and maintenance costs, reliability and serviceability as factors in performing fleet condition audits/assessments identified in each year's replacement program schedule.

5.13.2 Condition Audits

All units are inspected at scheduled preventative maintenance service intervals and tracked in Fleet Maintenance software program flagging exceptions that may accelerate or defer units that are outside set criteria as identified in the Fleet Policy.

5.13.3 Evaluation Criteria

Scheduled maintenance programs with condition assessments along with repair history and downtime are applied to all units.

5.13.4 Climate Change Strategy

Fleet acquisition and replacement provides opportunities for continuous improvement in the reduction of greenhouse gas emissions from vehicles and equipment. Other strategies includes right-sizing of vehicles to consider not only what vehicles and equipment are used for, but also the way in which they are used.

5.14 INFORMATION TECHNOLOGY INFRASTRUCTURE HARDWARE

5.14.1 Existing Asset Management Strategy / Program Description – Overview

The City of Markham demonstrates responsive management of Information Technology Services assets. Unlike most of the City's assets, IT asset types do not display visible physical deterioration over time, however the functional condition can decrease over time. In addition the other contributing factors are changing technology and short useful life, so it is not practical to implement a condition monitoring program. New technology standards and current performance of the assets drives the current replacement strategy.

The life cycle replacement of the asset is based on historical data, industry standards and best practices, as well as vendor support for the hardware.

ITS uses various tools for monitoring of the performance of its assets to inform decision making for asset renewal, replacement, upgrade and disposal. Technology asset concerns are captured on a reactive basis through routine maintenance program executions or problems reported by the user to the internal IT Helpdesk.

5.14.1 Evaluation Criteria

Due to the relatively short life of IT assets, physical conditions are not a key driver for replacement. The technology and ability to maintain the service level drive the performance measure of the assets. The assets are evaluated as:

- Excellent condition: when no routine maintenance is required
- Good: planned routine maintenance is required.
- Fair: minor unplanned maintenance (with part replacement) is required.
- Due for Immediate Replacement: when the manufacturer has discontinued the hardware model and replacement parts are hard to find.

5.15 ENTERPRISE ASSET MANAGEMENT (EAM)

The City is in the process of implementing software as part of its Enterprise Asset Management solution. The initial software will be implemented in three Phases over a total period of 18 months. The anticipated project schedule is given below:

- Phase 1 (May 2021 – February 2022): Water, Wastewater, Stormwater, Structures and Streetlights
- Phase 2 (February 2022 – August 2022): Roads, Traffic Signals, Parks and Fleet
- Phase 3 (August 2022 – November 2022): Facilities

The successful implementation of initial software will enable the business units to efficiently manage maintenance activities relating to tangible assets and will form the basis for a decision support system that will be implemented in future.

5.16 CLIMATE CHANGE MITIGATION

5.16.1 Greenhouse Gas Reduction Goals & Targets

The Greenprint, Markham's Community Sustainability Plan

In 2011, the Greenprint was endorsed by Council as a plan for Markham over the next 100 years to become one of the most sustainable communities in North America. The energy objective of the Greenprint is to achieve net-zero energy by 2050.

Building Markham's Future Together (BMFT)

Building Markham's Future Together: 2020 - 2023 Strategic Plan goal is "ensure business continuity of our services and infrastructure, and enable community resilience and safety."

Municipal Energy Plan (MEP) Getting to Zero

In 2017, the City set aggressive targets via Markham's long-term Municipal Energy Plan (MEP) "Getting to Zero" to achieve net zero energy emissions for Markham's community by 2050, across all sectors.

2019 Corporate Energy Management Plan (CEMP)

The City is committed to leading the community by example, through its City assets, towards a sustainable future. To accomplish this, the City develops five-year forward-looking CEMPs to improve energy management and reduce GHG emissions for the City's corporate operations.

5.16.2 Improvement Commitments

- Continue increasing staffing capacity, literacy, and capabilities to design, build, retrofit, operate, and maintain energy-efficient, resilient, low-carbon assets.
- Aspire to design and construct new and retrofit assets that are lower carbon and more resilient.
  - Complete feasibility analysis of lower energy and reduced carbon options in new construction and major equipment replacement.
    - Embed Federal Carbon Pricing escalation of $170/ton in business case analysis.
- Improve monitoring, verification, and reporting of energy and GHG reduction projects.
- Re-evaluate the City's green building standards (LEED Silver and ASHRAE 90.1) to determine if they are still the most suitable to combat climate change and achieve net-zero carbon by 2050.
  - Investigate green building standard alternatives and options of layering on additional energy and GHG efficiency performance metrics and testing.
- Develop a Corporate Net-Zero Energy Emissions (NZEE) reduction strategy with short, medium, and long-term reduction goals.

5.17 NON-INFRASTRUCTURE SOLUTIONS

Non-infrastructure solutions includes but are not limited to studies, needs assessments, policy development, data collection, condition assessments and benchmarking against industry best practices. These solutions are implemented to explore and develop strategies that will result in extension of useful life of assets and/or lower total asset program costs in the future.

The City has adopted the 2020 – 2023 Strategic Plan in consultation with residents, businesses and community stakeholders that will guide the City's actions through to 2023. The strategic plan focuses on following four goals:

- Exceptional Services by Exceptional People
- Engaged, Diverse, Thriving & Vibrant City
- Safe, Sustainable & Complete Community
- Stewardship of Money & Resources

The plan further lays out the goal description, how to achieve the goal and how the success will be measured. Based on success indicators, the future asset management strategies will be configured with reference to lessons learned and best practices to further optimize fiscal and resource management.

Through the implementation of this plan the City aims to demonstrate 'Stewardship of Money and Resources' by proactively managing City assets to maximize the return (financial, social, environmental and cultural) on taxpayer investment.The City of Markham will be reviewing the overall asset management program in 2021 with the help of a consultant that will review the City's existing policies, practices and procedures with reference to industry best practices. The intent of this assignment is to complete a strategic level review of the City's Corporate Asset Management (CAM) activities and to create a 'roadmap' of activities that the City can plan and implement. The roadmap will provide detailed needs for near term activities and high level details for medium and long term tasks. The intent of this project and the resulting roadmap is to enable the City to mature their Asset Management (AM) practices to be able to proactively plan infrastructure investments on the right assets at the right time for the right benefit to customer Levels of Service (LOS).

Staff in relevant departments will be interviewed and current practices/initiatives will be reviewed to identify long term asset management objectives and identify key projects. Current corporate best practices will be reviewed, outlining a variety of successful strategies implemented by other Canadian municipalities in order to highlight the return on investments that asset management approaches can achieve. This will result in an asset management roadmap, tailored to the needs of the City. The resulting projects will be scoped, and cost and resource estimates provided to assist with later implementation and procurement phases.

In 2019, the City of Markham Auditor General audited the City's 2016 Asset Management Plan. This audit resulted in identifying a number of gaps in the implementation of the asset management plan between the period 2016 and 2019. In order to achieve compliance with the Auditor General Report and to bridge these gaps, staff has identified the following projects that are planned for execution through the years 2022 to 2023.

- Create outcome-based levels of service
- Create performance management framework
- Create risk management framework and strategy
- Create performance monitoring and reporting system that enables staff to measure performance in an efficient way
- Create an Asset Management Manual that details both business-unit specific and enterprise-wide business processes along with transition and resource planning

5.17.1 Disposal Activities

The practice for linear assets is generally to retain the asset and maintain its life through renewal/rehabilitation/replacement activities. Facilities and land are the only asset classes that may be disposed of, and the process is managed through the City's Real Property Department, where a business case is prepared to make the decision regarding the disposal of an asset.

5.17.2 Expansion Activities & Growth Forecast

The City's strategy related to expansion activities is driven by long range planning documents such as the Official Plan, Secondary Plans of subdivision, Master Transportation Plans, Integrated Leisure Master Plan, Culture Strategic Plan, Public Realm Master Plan, Public Art Policy, etc. The long-range plans dictate the timing of the growth activities and provide appropriate funding sources (e.g. Development Charges) for the construction of new infrastructure.

The population and employment forecast for City of Markham as set out in the York Region 2010 Official Plan are given in Table 5.1 below:

Table: 5.1: City of Markham Population & Employment Forecast

Markham	2006	2016	2021	2026	2031
Population	273,000	337,800	370,300	398,300	421,600
Employment	144,800	200,300	221,500	231,200	240,400

Source: The Regional Municipality of York Official Plan, 2016 Office Consolidation, Table 1.

Notes:

- The forecasts are based on the Schedule 3 forecasts for York Region in the 2006 Growth Plan which was based on a 2031 planning horizon.
- Schedule 3 in the 2017 Growth Plan updated the 2031 forecasts and extended the forecast horizon to 2041. The 2017 Growth Plan was replaced by the 2019 Growth Plan, but the Schedule 3 forecasts did not change from the 2017 Growth Plan.

- The Region has been working on updating its forecasts to reflect the 2017 Growth Plan Schedule 3 since 2015, but various changes to the Growth Plan since then have prevented them from finalizing and seeking Regional Council endorsement of the new forecasts. Most recently, the forecasting work has been put on hold, pending the Province's release of an updated Schedule 3, which has extended the forecast horizon to 2051. The Region anticipates having new forecasts for local municipalities by the end of Q2 2021.
- In the meantime, both the Region and Markham used (unofficial) updated Growth Plan 2017 Schedule 3 figures for 2031 in our latest respective Development Charges Background Studies.

5.17.3 Procurement Methods

The City utilizes a number of procurement strategies and delivery mechanisms in order to ensure the most efficient allocation of the City's resources. The key strategies include undertaking spend analysis, membership with the York Purchasing Co-operative, and utilizing Supply Chain Ontario's Vendor of Record Arrangements.

The Procurement Department regularly reviews purchasing card transactions, small invoices less than $5,000 and purchasing acquisitions between $5,000 and $25,000 in order to complete a spend analysis. By collecting, classifying and analyzing expenditure data, goods and contracts sourced from numerous suppliers may be consolidated to reduce procurement costs and increase efficiency.

Membership with the York Purchasing Co-operative allows the City to realize savings by combining individual requirements and seeking bids for larger volumes of goods and services. In addition, one agency within the Co-operative takes the lead and awards the bid on behalf of the group, reducing the workload which would normally be done by each agency.

The vendor of record arrangement provides a list of vendors resulting from a procurement process that meets the requirements of the government procurement directive. An arrangement is valid for a defined time period, with defined terms and conditions and pricing. The arrangement allows the City to leverage the greater buying power of Provincial agencies.

5.17.4 Risks Associated with the Strategy

The risks associated with the current City of Markham asset management strategy are:

- Lack of funding to proceed with projects identified for 2022 as a result of the latest Asset Management Plan Audit
- Delays in timely completion of outstanding asset management projects due to lack of dedicated human resources
- Proceeding with inefficient practices without exploring and adopting feasible best practices
- Aging infrastructure, climate change impact and legislative changes may create a need for imminent actions resulting in higher costs

6. FINANCING STRATEGY

6.1 INTRODUCTION

A financial plan is a key component for integrating asset management planning with financial planning and budgeting, and to make full use of all available infrastructure financing tools. As such, the financing strategy outlines the approach the City has taken to ensure adequate funding is available to carry out the asset management strategies outlined in the previous chapters.

The long-term financial strategy for both expenditures and revenue sources is consistent with the City's budget structure. Assets, excluding water and wastewater infrastructure, are included in the City's Life Cycle Replacement and Capital Reserve Study, a detailed 25-year plan. The Reserve Study is updated annually to ensure adequate funding is available for the rehabilitation and replacement of the City's existing assets. The maintenance activities for these assets are identified in the multi-year operating budget forecast.

The long-term financial strategy for water and wastewater assets is included in the City's Water and Wastewater Reserve Study, a detailed 25-year plan updated annually to ensure adequate funding is available for the operation and maintenance of the system, and the rehabilitation and replacement of the City's existing assets.

Expansion activities are identified in the City's Development Charges Background Study. The Study includes a capital forecast of 10 years for soft services, such as recreation and library facilities, fire services, and parks, and a forecast to buildout (2031) for engineered services, such as roads, sidewalks, and bridges.

This chapter of the Asset Management Plan includes:

- Summary of the City's current financial strategies;
- Impact of funding shortfalls;
- Alternative strategies for managing those impacts;
- Historic revenue and expenditures; and
- Annual forecast of revenues and expenditures.

6.2 FINANCIAL STRATEGIES

A new asset at the beginning of its life cycle, may be eligible to be financed through Development Charges. However, rehabilitation requirements partway through an asset's life cycle, and the replacement of the asset at the end of its life cycle, must be funded through other means. Therefore, the City utilizes various financing tools to support its asset management plan based on the type of asset, and the stage of an asset's life cycle, from emplacement to maintenance, and eventual replacement.

6.2.1 Development Charges

The City utilizes Development Charges to fund capital projects related to growth throughout Markham so that development pays for its capital requirements to the extent allowed by the Development Charges Act. This ensures that additional services required by growth are provided in a fiscally responsible manner.

The City currently levies three types of Development Charges for the recovery of development-related capital costs:

- **City Wide Soft (CWS) Service Development Charges —** for the recovery of development-related costs for the provision of general government, library, fire, indoor recreation, parks development and facilities, public works (building, equipment and fleet), and parking services.
- **City Wide Hard (CWH) Service Development Charges —** for the recovery of development-related costs for the provision of major roads and related services, including structures, sidewalks, streetlights and special traffic management and design features, as well as stormwater management projects (erosion control projects), special projects (streetscaping), and related studies.
- **Area Specific Development Charges (ASDC) —** for the recovery of development-related costs for the provision of some roads, intersection improvements, streetlighting, watermains, sanitary sewers, stormwater management facilities (stormwater ponds), and related studies.

In accordance with the Development Charges Act, CWS Development Charges have been calculated at a level no higher than the average service level provided in the City over the ten-year period immediately preceding the preparation of the background study, on a service-by-service basis.

The By-laws governing the Development Charges rates must be revisited at least every five years, ensuring adequate financing of expansion activities to maintain service levels are recovered.

6.2.2 Life Cycle Replacement and Capital Reserve Study

The City implemented its Life Cycle Replacement and Capital Reserve Study in 2004. The purpose of the reserve study was to address the on-going capital replacements and preventative maintenance of capital assets over their useful lives.

The reserve study uses a rolling 25-year planning horizon. The reserve study is updated annually to identify if there is adequate funding in the reserve based on projected inflows and outflows to sustain future rehabilitation and replacement requirements of the City's existing assets for the next 25 years. For example, the update for 2020 applies to a forecast period of 2021-2045, and the update for 2021 would apply to the period 2022-2046. The use of a rolling 25-year planning horizon provides a number of key benefits to the City's asset management strategy. This allows the City to adapt to changes in asset management practices or asset useful life assumptions. Also, positive reserve balances are invested to generate returns in order to offset the effects of inflation.

The inflows to the Life Cycle Replacement and Capital Reserve include annual contributions from the operating budget, interest and dividends earned from investments, and Canada Community Building Fund.

It is projected that each year $2M of Canada Community Building Fund will be allocated to the Stormwater Fee Reserve and $8M to fund incremental life cycle projects, of which $4M is transferred to fund the non-growth portion of the growth-related projects.

Although the replacement values of assets summarized in the State of the Infrastructure chapter provide a good measure of the quantum of the City's assets, it is not the basis for calculating the future asset rehabilitation and replacement funding requirement over the planning period. The timing and amount of outflows from the Life Cycle Replacement and Capital

Reserve are identified through development of a long-term rehabilitation and replacement program based on the City's asset management strategies. The outflows include the cost of periodic rehabilitation, and required replacements of the City's assets over the 25 year planning period. To estimate the future cost of rehabilitation or replacement of an asset, the current value of this activity is inflated at an assumed rate of inflation.

A cash flow analysis of the projected inflows and outflows of the Life Cycle Replacement and Capital Reserve is used to determine the adequacy of the reserve over the 25-year planning horizon. The analysis targets available funding at the time of rehabilitation and replacements, and a revenue neutral position for the reserve at the end of the planning period. If the analysis identifies a shortfall, then the necessary steps are taken to address it, either by increasing the transfer to the reserve or finding mitigating strategies to reduce outflows from the reserve.

6.2.3 User Fee Supported – Water and Wastewater Reserve Study

The City implemented the Water and Wastewater Reserve Study in 2007 with the purpose of addressing the ongoing replacement and rehabilitation requirements for Waterworks infrastructure and other Waterworks related capital assets, such as Fleet, Facilities and ITS infrastructure, over their useful lives.

The Reserve Study is updated annually to establish the water and wastewater rate. The rate revenues ensure that there is adequate funding in the Water and Wastewater Reserve to sustain future replacement and rehabilitation requirements of the City's water and wastewater infrastructure for the next 25 years. Rate revenues also finance the operation and maintenance activities of the water and wastewater systems. The approach is the same as that implemented in the Life Cycle Replacement and Capital Reserve Study.

The water and wastewater system is self-funded. As such, the sources for annual contributions to the Water and Wastewater Reserve are user rate revenues, revenues from water system related fees, and interest earned on the reserve balance. The water and wastewater rates are reviewed annually and rate adjustments are applied as necessary to ensure adequate funding is available.

6.2.4 Funding Shortfall

Assets with useful lives beyond the study period

Currently, the financing strategies only account for assets due for replacement in the coming 25-year period. Therefore, provisions for rehabilitation or replacement are only made once the scheduled rehabilitation or replacement is within the 25-year period.

Growth-related assets not in service at time of study update

It is estimated that the City's asset base will grow by approximately $80M per year until build-out (currently forecasted to be 2031) through capital projects and the assumption of subdivision internal works. Although some of these assets are infrastructure with life cycle's greater than 25 years, there are assets that require funding within the 25-year period after its initial purchase or assumption, creating a funding shortfall. However, since the Reserve forecast is updated on an annual basis, mitigating strategies can be identified to close the gap.

Infrastructure Funding Gap

It is forecasted that every year the Reserve forecast is updated, there will be a funding shortfall due to new assets being constructed and assumed, as well as accounting for inflation and replacement of assets that were previously outside of the 25-year planning horizon.

Markham will continue to seek out sustainable ways to mitigate the forecasted infrastructure funding gaps to reduce the impact on Markham taxpayers. Potential methods of closing the funding gap are to reduce replacement/rehabilitation costs, extend the life cycles of assets, new technology and to identify new revenue opportunities. This may involve trying to get increased levels of Canada Community Building Fund and/or improved legislative powers from the Province.

Staff will continue to work with Council to develop a phased approach to reduce the future infrastructure funding gaps.

Assets not yet fully addressed

The City has identified assets that may require additional funding in the future. Some asset categories are managed through annual programs. Annual programs forecast a funding requirement for the group of assets rather than the individual assets within the asset category. The annual programs have identified sufficient funding is available for the next 25 years. The sufficiency of annual programs beyond 25 years is currently being assessed.

Projects related to watercourse management implementation for 13 watercourses are estimated to require $13.5M to undertake. However, the need to conduct the remediation work is fully dependent on future development.

Flood control program

Markham's Flood Control Program, initiated in 2015, is a long-term, City-wide initiative to improve storm drainage capacity and limit surface and basement flooding risks in urban areas. These flood control improvements will be primarily funded through a Stormwater Fee, and charged to all property owners, residential and non-residential. This fee, combined with funds from the Canada Community Building Fund, will provide dedicated funds for both approved and future storm infrastructure improvement projects Citywide. The current allocation of Canada Community Building Fund totals $2M per year. The program's financial sustainability is reviewed and updated every five years.

6.2.5 Alternative Scenarios

Alternative Funding Strategies

Markham is a growing City and builds or assumes approximately $80M of new assets per year. This translates into approximately

$30M to $35M of repair/rehabilitation/replacement work needing to be performed over the next 25 years. The City is currently in the process of identifying the future replacement requirements and the funding implications for assets with useful lives greater than 25 years that are currently outside the 25-year period.

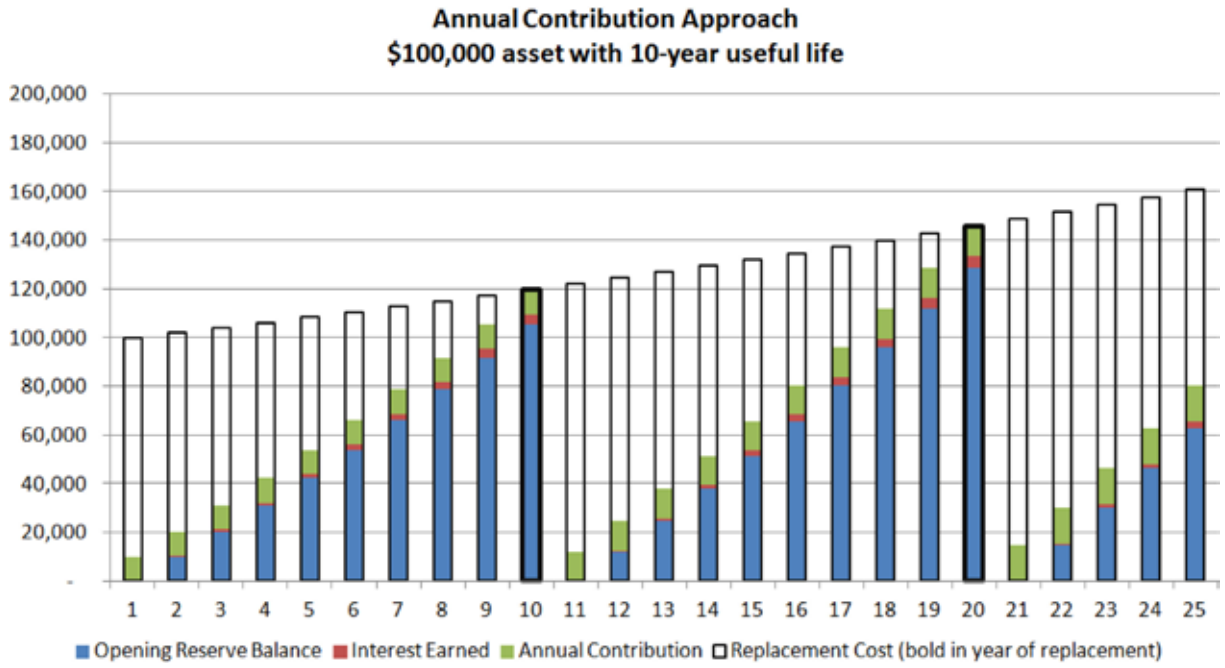
Pay as you Go

One alternative strategy that the City has considered is whereby the full contribution from taxpayers is collected in the year of replacement of the asset, there is no accumulation of reserve funding for future replacements. This strategy is considered to be more risky as it's subject to greater fluctuations year over year, with greater financial burden being placed on future taxpayers and the City may need to borrow additional funds in order to meet the asset replacement requirements in future years.

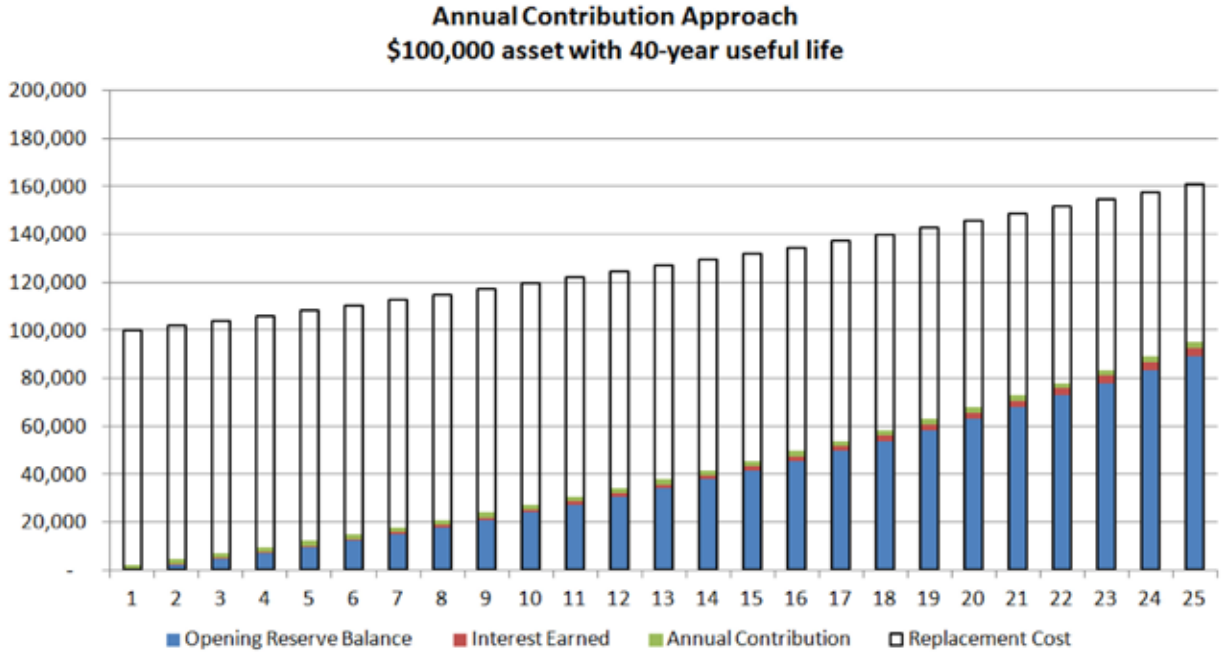
Fully Funding Amortization

The City is also currently reviewing alternative approaches for determining and ensuring reserve fund adequacy. One such approach is to calculate the required provisions for the funding of future rehabilitation and replacements using an annual contribution methodology. To estimate the future cost of rehabilitation and/or replacement of an asset, the current value of this activity is inflated at an assumed rate of inflation. To ensure adequate funds are available at the time of rehabilitation or replacement of an asset, a calculation is then performed to determine an even annual contribution which, when invested in a reserve fund will increase to match the future cost of rehabilitation or replacement.

The following graph illustrates the alternative approach considered for the Life Cycle Replacement and Capital Reserve Study, and Water and Wastewater Reserve Study. This example is for a single asset with a 10-year life cycle and a current replacement value of $100,000. In this example, an annual rate of two per cent for inflation and four per cent for investment earnings is assumed.



The example illustrates over the next 25 years, the asset will need to be replaced twice. Although the cost to initially replace the asset is $100,000, the replacement cost inflates to approximately $120,000 by the end of the first asset life cycle, and to more than $145,000 by the time the asset is due for its second replacement. Despite the increase in replacement cost, planning for these replacements allows for even annual contributions to the reserve (as represented by the green bar segments), and ensures adequate funds are available as the asset comes due for replacement. The future cost of rehabilitation and replacements are accrued over the asset's useful life. In the example, annual contributions are made for one half of the asset's third life cycle replacement, even though the third replacement does not occur in the 25-year planning period. Similarly, annual contributions are accrued for assets with useful lives greater than the 25-year planning period as outlined in the following graph. This example is for a single asset with a 40-year life cycle and a current replacement value of $100,000. The future replacement cost of this asset is estimated to be about $216,000 based on an annual rate of two per cent for inflation. Again, a four per cent investment earnings rate is assumed.



Fluctuations in capital expenditures are unavoidable due to the differences in useful lives and costs of asset rehabilitation and replacement. Using the annual contribution approach assists in identifying the requirement of a stable funding source, while reducing spikes in revenue requirements due to fluctuations in capital expenditures.

Markham's 25-Year Approach

Markham's approach as stated previously is to ensure sufficient funds are in the reserve study for infrastructure rehabilitation and replacement requirements within the next 25 years. In other words, the City begins collecting for the funds once the replacement requirement falls within the 25-year window. This provides a better balance between placing the funding burden on current and future taxpayers.

Excellence through Efficiency & Effectiveness (E3) – Capital

In 2008, the City launched an initiative – "Excellence through Efficiency & Effectiveness" (E3) – with the objective of developing and implementing a sustainable process to deliver the lowest possible tax rate increases. The E3 initiative involved a corpo- rate-wide business transformation through the review of services to find efficiencies to either maximize revenue opportunities or reduce expenditures, without reducing levels of service. To date, the City has been successful in finding efficiencies through the operating budget amounting to $29M. Moving forward, a greater focus on the capital and asset management opportunities will be relied upon to reduce funding requirements.

6.3 FINANCIAL MANAGEMENT

6.3.1 Historical Financial Data

The following table outlines the historical maintenance/non-infrastructure costs for 2018 and 2019. All maintenance for waterworks-related assets was funded through the water and wastewater user charges, and maintenance for all other assets was funded through taxation.

MAINTENANCE AND REPAIR	2018 Actual	2019 Actual
Expenses		
All Departments (excl. Waterworks)	$6,296,391	$7,028,599
Waterworks	$393,045	$519,629
Revenues		
Taxation	$(6,296,391)	$(7,028,599)
Water and Wastewater Rate Charges	$(393,045)	$(519,629)
Net Surplus/(Deficit)	$0	$0

The following table outlines the historical capital expenses for 2018 and 2019, including rehabilitation, replacement, disposal, and expansion activities. The capital funding includes Development Charges, capital reserves, and grants.

REHABILITATION, REPLACEMENT, DISPOSAL AND EXPANSION	2018 Actual	2019 Actual
Capital Expenses		
Rehabilitation, Replacement, and Disposal	$(59,503,005)	$(67,096,131)
Expansion	$(20,572,757)	$(39,156,543)
Capital Financing		
Federal Gas Tax	$8,902,815	$13,321,387
Development Charges	$19,006,203	$39,270,970
Other External	$12,190,862	$1,364,016
Capital Reserves (Life Cycle)	$21,607,634	$29,065,836
Capital Reserves (Waterworks)	$8,585,565	$14,491,589
Capital Reserves (Stormwater)	$9,782,682	$8,738,875
Net Surplus/(Deficit)	$0	$0

6.3.2 Forecast Revenue and Expenditures

Assumptions

- Canada Community Building Fund has been identified as a funding source for the incremental asset life cycle capital program as part of the financing strategy. A key assumption is that the City will continue to receive this funding at the current levels throughout the forecast period.
- The first $500,000 of taxation assessment growth is allocated to the Life Cycle Replacement and Capital Reserve. Note that this amount has been growing by two per cent since 2016.
- Since 2017 and continuing into 2022 (end of current Council term), Council approved an additional 0.5% tax rate increase each year for infrastructure investment.
- Dividends received from investments are consistent with current forecasts.
- Development charges rates are assumed to increase at two per cent annually.
- Interest earned on reserve balances will be two per cent annually.
- In the case where debt financing is needed, the analysis assumes debt using an annual interest rate of 2.5 per cent . For growth related debt, debt payments are shown as funded directly from the development charge reserve funds.

7. Appendices

Appendix A: 2019 Asset Management Policy

Appendix B: Cashflow Projection – Capital Rehabilitation, Replacement, Maintenance and Repairs

Appendix C: Cashflow Projection – Waterworks

Appendix D: Cashflow Projection – Development Charges Reserves

MARKHAM	**Asset Management Policy**	
	Policy Category: corporate-wide	
	Policy No.: (Follow corporate standard, assigned by Clerk's Dept.)	**Implementing Procedure No.:** (Follow corporate standard, assigned by Policy Author)
Approving Authority: Council	**Effective Date:** (Date of this policy has been approved to become effective)	
Approved or Last Reviewed Date: N/A	**Next Review Year:** 2024 (Every 5 years)	
Area(s) this policy applies to: City Wide	**Owner Department:** Sustainability & Asset Management	
Related Policy(ies): • O. Reg. 588/17 Asset Management Planning for Municipal Infrastructure made under the Infrastructure For Jobs and Prosperity Act, 2015		

Appendix A: 2019 Asset Management Policy

1. Policy Statement

The City of Markham will ensure infrastructure are planned, built and maintained effectively through sound Asset Management principles and practices to meet its strategic goals and deliver services in a socially, economically and environmentally responsible manner.

2. Purpose

Asset Management in the City is to be guided by the following objectives:

- **A.** Align Asset Management practice with the City of Markham's Strategic Plan, Building Markham's Future Together (BMFT), and other key strategic documents, including the Greenprint, Markham's Community Sustainability Plan, and the Official Plan;
- **B.** Ensure strong governance, accountability and transparency by:
  - **a.** Demonstrating to owners, customers and stakeholders that services are delivered effectively and efficiently;
  - **b.** Providing a transparent and auditable basis for making service/risk/cost trade-off decisions; and
  - **c.** Improving accountability for use of resources through performance and financial metrics
- **C.** Make effective and long term sustainable decisions by:
  - **a.** Having robust information/documentation to support evidence-based decisions;
  - **b.** Considering viable options and all aspects of decisions; and
  - **c.** Ensuring total cost of ownership is the basis of decision making processes, so that emphasis is placed on sustainable long term efficiencies rather than short term gains
- **D.** Provide customer service by:
  - **a.** Defining level of service in consultation with stakeholders; and
  - **b.** Ensuring service delivery meets the defined level of service
- **E.** Manage risk effectively by:
  - **a.** Understanding the risks related to asset management and service delivery and applying a framework to prioritize risk mitigation
  - **b.** Developing and implementing risk management strategies; and
  - **c.** Demonstrating compliance with legal and regulatory requirements;

F. Demonstrate fiscal stewardship and financial efficiency through:
   a. Balancing cost, risk and service performance to achieve the lowest total cost of ownership; and
   b. Updating the Life Cycle Reserve Study annually to determine if there are sufficient funds in the reserve to sustain the future replacement and rehabilitation requirements of the City's assets for the next 25 years based on known inflows and outflows.

G. Provide excellent sustainable community planning and infrastructure management to accommodate growth.

3. Definitions

For consistency, terminology in all official asset management documents shall be consistent with ISO 55000:2014(E) – International Standard for Asset Management. For the purpose of this document, the following definitions apply:

Asset: Item, thing or entity that has potential or actual value to an organization. Value can be tangible or intangible financial or non-financial, and includes consideration of risks and liabilities.

Asset Management: Coordinated activity of an organization to realize value from assets. Realization of value will normally involve an appropriate balancing of costs, performance and risks, opportunities and performance benefits.

Asset Management Plan: Documented information that specifies the activities, resources, and timescales required for an individual asset, or grouping of assets, to achieve the organization's asset management objectives.

Level of Service: Parameters or a combination of parameters, which reflect social, political, environmental and economic outcomes that an organization delivers from their assets.

Life Cycle: Phases involved in the management of an asset.

Asset Manager: All employees of the City that have a direct and/or indirect link to assets

4. Guiding Principles

A. Customer Focused:

The City will apply asset management practices to promote confidence of customers in how City assets are managed.

B. Service focused:

The City will consider all the assets in a service context and take into account their inter-relationships as opposed to optimizing individual assets in isolation.

C. Risk-based

The City will manage the asset risk associated with attaining the agreed level of service by focusing resources, expenditures and priorities based upon risk assessments and the corresponding cost/benefit, recognizing that public safety is a priority.

D. Value-based / Affordable

The City will choose practices that aim at reducing the life cycle cost of asset ownership, while satisfying agreed level of service. Decisions are based on balancing pre-determined service level, acceptable risks, and minimizing costs.

E. Forward Looking:

The City will make the appropriate decisions and provisions to better enable its assets to meet future challenges, including changing demographics and populations, customer expectations, legislative requirements, technological and environmental factors.

F. Holistic

The City will take a comprehensive approach that looks at the "big picture" and considers the combined impact of managing all aspects of the asset life cycle.

G. Systematic

The City will adopt a formal, consistent, repeatable and standardized approach to the management of its assets that will ensure services are provided in the most effective manner.

H. Innovative

The City will continually improve its asset management approach, by driving innovation in the development of tools, practices, and solutions.

The City will adopt and adhere to the asset managing planning principles listed in Section 3 of the Infrastructure for Jobs and Prosperity Act, 2015.

5. Application

The City of Markham relies on a wide range of diversified assets to provide services to its customers at the agreed Level of Service. Service is critically important to the well-being of present and future customers and it drives the implementation of a structured approach to asset management.

This policy applies to all assets related service provision such as Right of Way Assets (Roads, Storm Water Management, Bridges, Streetlight, Traffic Light, Water, and Wastewater), Parks, Facilities, Community Centers, Libraries, Library Collections, Fire Equipment, IT infrastructure, and Fleet.

This policy applies to all departments and employees of the City that have a direct and/or indirect link to assets.

6. Asset Management Framework

To meet the objectives of this policy, the City will follow Asset Management Framework in Figure 1. The Framework describes the business processes and asset management activities, and illustrates the relationships between those activities.

The Framework consists of several major elements:

A. Regulatory Requirements, Business Drivers

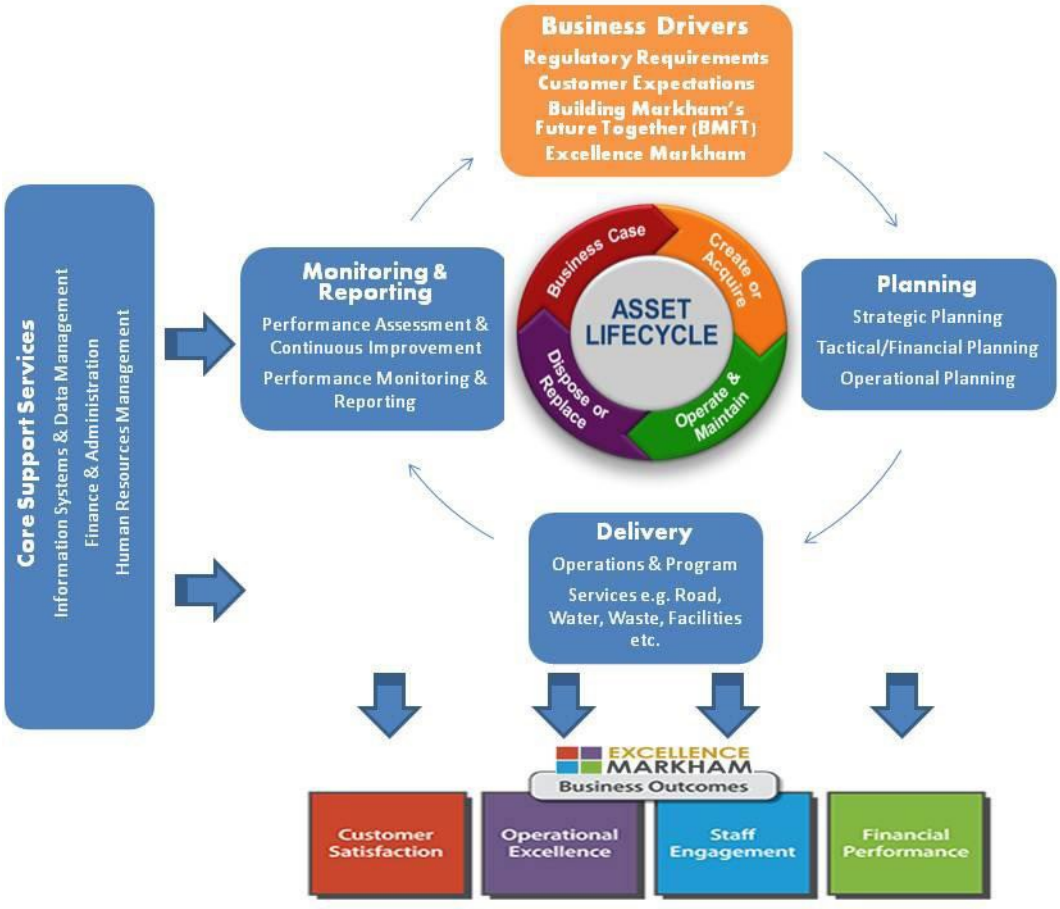
Business Drivers are the external influences that govern how the infrastructures are managed and set overall expectations of how the departments operate, including, but not limited to:

a. Customer requirements (residents and businesses);
b. Corporate goals and strategies;
c. Regulatory requirements, such as the Safe Drinking Water Act, the Ontario Water Resources Act, Fire Code, the Highway Traffic Act, the Municipal Act and provincial regulation Minimum Maintenance Standards for Municipal Highways, Regional By-law requirements, municipal by-laws requirements, the Planning Act and Places to Grow requirements; and
d. Environmental factors, such as the economy, technology innovations, political and social priorities.

B. Core Processes supported by Core Support Services

The underlying structure is based on the all-encompassing PDCA (Plan Do Check Act) cycle to control and continuously improve on processes and products.

Figure 1: Asset Management Framework



a. Planning - Converts the Business Drivers (Orange) into a set of operational plans that describe how the department will deliver the service.
b. Delivery - Refers to the actual delivery of the services to the customers, both internal and/or external.
c. Monitoring and Reporting - Also known as performance management checks that measures if the department is doing what it intended/planned to do, including:
    i. Monitoring and reporting actual results against targets over time;
    ii. Conducting results based benchmarking against internal and external data sets;
    iii. Assessing gaps, and reporting on lessons learned; and
    iv. Assessing if the results meet the Business Drivers (orange) and applying continuous improvement to the Planning and Delivery.
    d. Core Support Services - The Core Support Services include finance and administration, information systems and data management, and human resources management, which provide the necessary support to Business units to successfully manage infrastructure.

C. Asset Life Cycle

Centred amongst the Business Drivers, and overlaying the Plan-Do-Check-Act cycle, is the management of physical infrastructure. This Asset Management Cycle describes how the various assets are managed.

The asset Life Cycle Reserve includes:

a. Asset procurement, creation or acquisition - to provide assets to meet current and future needs while achieving the defined levels of service and risks;
b. Asset operations, maintain – to maintain an asset to meet the required functional condition and/or extend its life; and
c. Asset disposal, replace - To rebuild or replace an asset to restore it to a required functional condition.

D. Excellence Markham Business Outcomes

The City use Excellence Canada's Excellence Framework for municipalities to guide how the organization is managed, focusing on areas of Customer Satisfaction, Operational Excellence, Staff Engagement, and Financial Performance. Asset Management Framework aligns to the Excellence Markham Business outcomes.

7. Responsibilities

A. Customers

Customers include both internal and external customers who receive and experience service delivery.

a. Participate in stakeholder engagement initiatives, where applicable;
b. Provide feedback related to levels of service and experience; and
c. Report concerns related to assets.

B. Asset Managing Departments

Asset managing departments comprise of Environmental Services, Operations, Sustainability and Asset Management, Recreation, Library, Engineering, Information Technology Services, Economic Growth, Culture and Entrepreneurship and Fire. These departments are to:

a. Lead and implement the asset management process for assets under their accountability including the development, implementation, operation and continuous improvement of departmental asset management programs;
b. Include all assets in life cycle studies;
c. Liaise with Finance to update long term financial forecasts, which will ensure that sustainable financial strategies support asset life cycle needs; and provide asset management requirements as inputs to the annual budget process;

d. Participate in the development of the Asset Management Plans pertaining to assets under each department's accountability and related asset management initiatives; and
e. Engage customers to obtain feedback on levels of service and asset management planning and incorporate feedback.

C. Corporate Asset Management Steering Committee – Executive Lead

The Corporate Asset Management Steering Committee comprises of Director of Environmental Services, Director of Operations, Director of Sustainability and Asset Management, Director of Engineering, Treasurer, Director of Recreation, and Chief Information Officer. Corporate Asset Management Steering Committee serves as executive lead for asset management planning.

a. Develop and update Asset Management Policy and Asset Management Plan;
b. Ensure systematic and uniformity of approach across the organization;
c. Ensure all Assets identified in Asset Management Plan are included in the City's Life Cycle Replacement and Capital Reserve Study or the City's Water and Wastewater Reserve Study;
d. Align asset management planning to address vulnerabilities caused by climate change and to support implementation of the City's Emergency Management Plan;
e. Encourage information sharing and collaboration across departments;
f. Disseminate Steering Committee information within applicable departments where necessary;
g. Ensure organization-wide accountability for achieving and reviewing corporate asset management goals and objectives;
h. Review asset management programs;and
i. Consider opportunities to coordinate asset management planning with the Region of York and neighbouring municipalities
j. Select the Chair from among the committee members and define the process, term(s) and address any other governance matters necessary for the efficient function of the committee.

D. Executive Leadership Team

Executive leadership team comprises of Chief Administrative Officer (CAO), Commissioner of Community and Fire Services, Commissioner of Corporate Services, Commissioner of Development Services, City Solicitor and Director of Human Resources.

a. Endorse Asset Management Policy and Plan;
b. Ensure alignment of Asset Management Policy and Plan with corporate strategies and objectives;
c. Champion asset management practices at the corporate level; and
d. Ensure compliance with the plan for assets within their commission

E. Council

a. Approves Asset Management Policy and Plan;
b. Serves as the representative of customers; and
c. Approves funding to meet the objectives and outcomes of the Asset Management Plan.

8. Reference

A. O. Reg. 588/17: Asset Management Planning for Municipal Infrastructure;
B. Infrastructure for Jobs and Prosperity Act, 2015, S.O. 2015, c. 15;
C. International Infrastructure Management Manual, Institute of Public Works Engineering Australasia; and
D. ISO 55000:2014(E) – Asset Management – Overview, Principles and Terminology, International Organization for Standardization (ISO)

9. Non-Compliance

Accountability and compliance with this policy is the responsibility of all Asset Managers and the Corporate Asset Management Steering Committee.

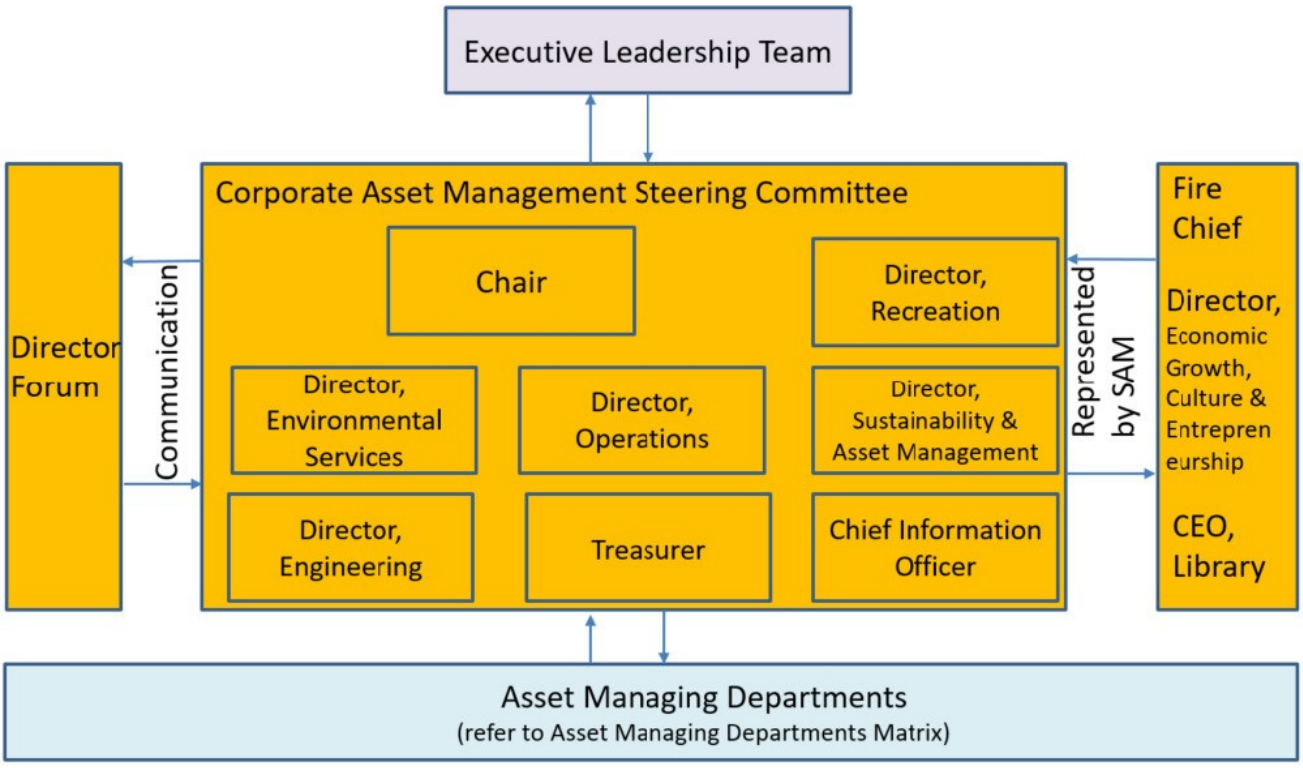
10. Contact

Director, Sustainability and Asset Management

11. Appendix

Asset Management Organization Structure

Appendix: Asset Management Organization Structure



Asset Managing Departments Matrix

Asset	Asset Construction / Procurement	Asset Operation & Maintenance	Asset Rehabilitation/ Replacement (Life Cycle)
Water/Wastewater	ENG	ES	ES
Stormwater Management			
Bridges/Culverts			
Streetlight			
Roads	ENG	OP	OP
Parks	UD		
Fleet	OP		
Traffic Lights	ENG	ENG	ENG
IT Infrastructure Hardware	ITS	ITS	ITS
Libraries	SAM	LIB/REC	SAM/LIB/REC
SAM		SAM	SAM
Facility Buildings (including Fire Stations, Culture and others)			
Community Centres		REC	REC/SAM
Library/Facility/Community Centre Exterior Property*	SAM	OP/others*	OP/others*
Library Collections	LIB	LIB	LIB
Fire Equipment	FIRE	FIRE	FIRE

Note:

* Refer to detailed roles and responsibilities for each fire station/library/facility/community center exterior property within SAM
ES: Environmental Services
OP: Operations
SAM: Sustainability and Asset Management
ITS: IT Services
ENG: Engineering
LIB: Library
REC: Recreation
UD: Urban Design
Fire

Appendix B: Cashflow Projection – Capital Rehabilitation, Replacement, Maintenance and Repairs (excl. Waterworks and Development Charges)

	2020	2021	2022	2023	2024
Opening Balance	**81,024,957**	**78,255,098**	**76,280,424**	**44,098,825**	**28,051,027**
Interest	1,523,876	1,461,152	970,401	894,806	968,442
Inflows					
Operating Budget	7,658,399	7,811,567	7,967,798	8,127,154	8,289,697
Transfer to reserve	28,887,784	27,686,640	29,118,993	29,717,549	30,328,077
Stormwater Management Fee	0	9,735,533	10,027,447	10,326,038	10,631,463
DMAF Grant	7,520,000	11,840,000	1,200,000	3,560,000	7,200,000
Investment Income	12,210,546	8,598,546	13,865,146	13,098,346	15,642,931
Canada Community Building Fund	6,433,207	6,433,207	6,433,207	6,886,825	6,886,825
Other	649,145	3,358,145	2,673,187	2,340,924	2,380,358
Subtotal Revenues	63,359,081	75,463,638	71,285,778	74,056,837	81,359,351
Outflows					
Maintenance & Repair	-7,658,399	-7,811,567	-7,967,798	-8,127,154	-8,289,697
Capital Rehabilitation, Replacement, and Disposal	-57,503,672	-68,547,335	-93,878,607	-80,229,086	-71,333,771
Expansion Activities	-2,490,747	-2,540,562	-2,591,373	-2,643,200	-2,696,064
Subtotal Expenditure	-67,652,817	-78,899,463	-104,437,778	-90,999,440	-82,319,533
Closing Balance	**78,255,098**	**76,280,424**	**44,098,825**	**28,051,027**	**28,059,288**

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	2033	2034	2035	2036	2037
Opening Balance	**21,726,806**	**758,569**	**16,230,069**	**-5,112,547**	**4,762,710**
Interest	1,028,099	1,236,699	898,150	1,017,662	941,770
Revenue					
Operating Budget	9,906,955	10,105,094	10,307,196	10,513,340	10,723,607
Transfer to reserve	36,402,658	37,146,888	37,906,002	38,680,299	39,470,082
Stormwater management	13,716,242	14,099,736	14,492,117	14,893,600	15,304,411
DMAF Grant	0	0	0	0	0
Investment Income	17,839,386	17,710,907	17,482,013	17,721,362	17,965,498
Canada Community Building Fund	6,886,825	6,886,825	6,886,825	6,886,825	6,886,825
Other	2,772,707	2,820,776	2,869,807	2,919,817	2,970,829
Subtotal Revenues	87,524,774	88,770,227	89,943,959	91,615,244	93,321,252
Expenditure					
Maintenance & Repair	-9,906,955	-10,105,094	-10,307,196	-10,513,340	-10,723,607
Capital Rehabilitation, Replacement, and Disposal	-96,392,108	-61,143,844	-98,525,312	-68,825,049	-83,163,042
Expansion Activities	-3,222,046	-3,286,487	-3,352,217	-3,419,262	-3,487,647
Subtotal Expenditure	-109,521,110	-74,535,426	-112,184,725	-82,757,650	-97,374,296
Closing Balance	**758,569**	**16,230,069**	**-5,112,547**	**4,762,710**	**1,651,435**

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2025	2026	2027	2028	2029	2030	2031	2032
28,059,288	**24,778,314**	**36,225,936**	**24,397,192**	**29,749,108**	**32,320,435**	**25,229,964**	**39,630,119**
1,086,335	1,321,150	1,394,431	1,480,437	1,528,737	1,433,044	1,634,059	1,355,099
8,455,491	8,624,601	8,797,093	8,973,035	9,152,495	9,335,545	9,522,256	9,712,701
30,950,815	31,586,008	32,233,905	32,894,760	33,568,832	34,256,386	34,957,690	35,673,021
10,943,886	11,263,474	11,590,400	11,924,838	12,266,972	12,616,986	12,975,071	13,341,422
7,120,000	6,240,000	880,000	0	0	0	0	0
15,813,528	15,889,990	17,030,125	17,391,143	17,571,688	17,774,528	17,976,181	18,097,903
6,886,825	6,886,825	6,886,825	6,886,825	6,886,825	6,886,825	6,886,825	6,886,825
2,420,579	2,461,606	2,503,453	2,546,136	2,589,674	2,634,082	2,679,379	2,725,581
82,591,125	82,952,504	79,921,801	80,616,738	82,036,486	83,504,352	84,997,401	86,437,454
-8,455,491	-8,624,601	-8,797,093	-8,973,035	-9,152,495	-9,335,545	-9,522,256	-9,712,701
-75,752,957	-61,396,445	-81,486,798	-64,853,917	-68,864,728	-79,656,115	-59,612,118	-92,824,296
-2,749,986	-2,804,985	-2,861,085	-2,918,307	-2,976,673	-3,036,206	-3,096,930	-3,158,869
-86,958,433	-72,826,031	-93,144,976	-76,745,259	-80,993,897	-92,027,867	-72,231,305	-105,695,867
24,778,314	**36,225,936**	**24,397,192**	**29,749,108**	**32,320,435**	**25,229,964**	**39,630,119**	**21,726,806**

2038	2039	2040	2041	2042	2043	2044	2045
1,651,435	**-15,835,412**	**-13,264,839**	**-10,317,334**	**-611,685**	**-10,081,713**	**-3,919,503**	**7,572,729**
649,736	650,204	652,099	749,484	558,847	594,324	475,771	112,592
10,938,079	11,156,841	11,379,978	11,607,577	11,839,729	12,076,523	12,318,054	12,564,415
40,275,660	41,097,350	41,935,474	42,790,360	43,662,344	44,551,768	45,458,980	46,384,336
15,724,779	16,154,938	16,595,131	17,045,606	17,506,619	17,978,430	18,461,309	18,955,533
0	0	0	0	0	0	0	0
18,214,517	18,468,517	18,727,596	18,991,857	19,324,404	19,663,601	20,009,582	20,362,483
6,886,825	6,886,825	6,886,825	6,886,825	6,886,825	6,886,825	6,886,825	6,886,825
3,022,860	3,075,932	3,130,065	3,185,281	3,241,602	3,299,048	3,357,644	3,417,412
95,062,721	96,840,403	98,655,069	100,507,507	102,461,522	104,456,195	106,492,394	108,571,003
-10,938,079	-11,156,841	-11,379,978	-11,607,577	-11,839,729	-12,076,523	-12,318,054	-12,564,415
-98,703,825	-80,134,645	-81,278,567	-76,168,624	-96,800,023	-82,884,130	-79,151,669	-95,799,078
-3,557,400	-3,628,548	-3,701,119	-3,775,141	-3,850,644	-3,927,657	-4,006,210	-4,086,334
-113,199,304	-94,920,034	-96,359,663	-91,551,342	-112,490,396	-98,888,310	-95,475,933	-112,449,827
-15,835,412	**-13,264,839**	**-10,317,334**	**-611,685**	**-10,081,713**	**-3,919,503**	**7,572,729**	**3,806,497**

Appendix C: Cashflow Projection – Waterworks

	2020	2021	2022	2023	2024
Opening Balance	**61,853,261**	**55,042,857**	**49,765,691**	**38,844,755**	**36,115,823**
Interest	562,171	533,250	485,682	575,985	682,080
Revenue	11,489,265	14,051,115	14,871,690	15,760,254	16,685,302
Expenditure					
Maintenance & Repair	-486,640	-496,373	-506,300	-516,426	-526,755
Capital Rehabilitation, Replacement, and Disposal	-18,375,200	-19,365,159	-25,772,007	-18,548,745	-17,686,919
Subtotal Expenditure	-18,861,840	-19,861,532	-26,278,308	-19,065,171	-18,213,673
Closing Balance	**55,042,857**	**49,765,691**	**38,844,755**	**36,115,823**	**35,269,531**

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	2033	2034	2035	2036	2037
Opening Balance	**10,815,628**	**14,571,582**	**9,030,466**	**10,609,572**	**20,438,968**
Interest	1,214,685	1,358,484	1,492,012	1,853,761	2,010,707
Revenue	24,575,518	25,460,510	26,382,188	27,341,857	28,455,314
Expenditure					
Maintenance & Repair	-629,521	-642,111	-654,953	-668,052	-681,413
Capital Rehabilitation, Replacement, and Disposal	-21,404,729	-31,717,998	-25,640,141	-18,698,170	-33,899,967
Subtotal Expenditure	-22,034,250	-32,360,109	-26,295,094	-19,366,222	-34,581,380
Closing Balance	**14,571,582**	**9,030,466**	**10,609,572**	**20,438,968**	**16,323,609**

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	2025	2026	2027	2028	2029	2030	2031	2032
	35,269,531	**33,442,805**	**30,927,721**	**33,423,719**	**28,288,100**	**22,510,634**	**14,943,063**	**11,791,413**
	749,688	795,070	916,785	957,687	976,877	902,887	981,203	906,554
	17,465,583	18,256,797	19,091,916	19,972,765	20,901,371	21,879,895	22,910,731	23,725,978
	-537,290	-548,036	-558,996	-570,176	-581,580	-593,211	-605,076	-617,177
	-19,504,708	-21,018,916	-16,953,707	-25,495,894	-27,074,135	-29,757,141	-26,438,507	-24,991,139
	-20,041,998	-21,566,951	-17,512,704	-26,066,070	-27,655,715	-30,350,353	-27,043,583	-25,608,317
	33,442,805	**30,927,721**	**33,423,719**	**28,288,100**	**22,510,634**	**14,943,063**	**11,791,413**	**10,815,628**

	2038	2039	2040	2041	2042	2043	2044	2045
	16,323,609	**17,303,653**	**19,630,565**	**19,763,204**	**17,843,216**	**15,005,981**	**14,551,571**	**13,349,770**
	2,187,283	2,416,903	2,662,160	2,940,079	3,164,150	3,383,308	3,635,667	3,873,133
	29,614,510	30,821,334	32,077,754	33,385,823	34,747,673	36,165,530	37,641,710	39,178,626
	-695,042	-708,943	-723,121	-737,584	-752,336	-767,382	-782,730	-798,385
	-30,126,707	-30,202,382	-33,884,154	-37,508,306	-39,996,723	-39,235,866	-41,696,448	-55,603,144
	-30,821,748	-30,911,325	-34,607,275	-38,245,890	-40,749,058	-40,003,248	-42,479,178	-56,401,529
	17,303,653	**19,630,565**	**19,763,204**	**17,843,216**	**15,005,981**	**14,551,571**	**13,349,770**	**0**

Appendix D: Cashflow Projection – Development Charges Reserves
(excl. non-growth & discounted share)

	2020	2021	2022	2023
LIBRARY				
Opening Balance	1,738,982	5,061,789	8,094,495	11,232,122
Interest	42,605	124,014	198,315	275,187
Revenues	3,280,202	2,908,692	2,939,312	1,764,642
Expenditures	0	0	0	0
Closing Balance	**5,061,789**	**8,094,495**	**11,232,122**	**13,271,952**
FIRE SERVICE				
Opening Balance	3,055,595	5,003,543	-6,395,828	-4,689,966
Interest	74,862	122,587	-156,698	-114,904
Revenues	1,873,087	1,678,042	1,862,560	1,252,441
Expenditures	0	-13,200,000	0	0
Closing Balance	**5,003,543**	**-6,395,828**	**-4,689,966**	**-3,552,429**
INDOOR RECREATION				
Opening Balance	-57,764,104	-43,376,211	-30,426,646	-16,960,418
Interest	-1,415,221	-1,062,717	-745,453	-415,530
Revenues	15,803,114	14,012,282	14,211,681	8,553,982
Expenditures	0	0	0	-6,983,100
Closing Balance	**-43,376,211**	**-30,426,646**	**-16,960,418**	**-15,805,066**
PARK DEVELOPMENT AND FACILITIES				
Opening Balance	38,239,022	29,367,533	19,044,371	19,510,958
Interest	936,856	719,505	466,587	478,018
Revenues	10,891,656	9,657,333	9,793,021	5,893,603
Expenditures	-20,700,000	-20,700,000	-9,793,021	-5,893,603
Closing Balance	**29,367,533**	**19,044,371**	**19,510,958**	**19,988,976**
PUBLIC WORKS				
Opening Balance	3,294,676	-479,498	-3,678,793	-2,526,882
Interest	80,720	-11,748	-90,130	-61,909
Revenues	1,625,731	1,456,499	1,621,172	1,091,851
Expenditures	-5,480,625	-4,644,046	-379,130	0
Closing Balance	**-479,498**	**-3,678,793**	**-2,526,882**	**-1,496,939**
PARKING				
Opening Balance	213,083	257,514	299,013	350,860
Interest	5,221	6,309	7,326	8,596
Revenues	39,211	35,189	44,521	31,979
Expenditures	0	0	0	0
Closing Balance	**257,514**	**299,013**	**350,860**	**391,436**
HARD SERVICES				
Opening Balance	60,034,173	59,455,817	52,564,402	44,550,889
Interest	1,470,837	1,456,668	1,287,828	1,091,497
Revenues	33,212,340	30,596,117	31,044,191	21,309,717
Expenditures	-35,261,532	-38,944,199	-40,345,532	-37,910,699
Closing Balance	**59,455,817**	**52,564,402**	**44,550,889**	**29,041,404**

Continued on next page

2024	2025	2026	2027	2028	2029	2030	2031
13,271,952	15,381,498	10,402,505	8,884,624	10,953,615	12,086,062	13,257,342	14,469,401
325,163	376,847	254,861	217,673	268,364	296,109	324,805	354,500
1,784,383	1,806,283	1,827,258	1,851,317	864,084	875,171	887,253	899,478
0	-7,162,123	-3,600,000	0	0	0	0	0
15,381,498	**10,402,505**	**8,884,624**	**10,953,615**	**12,086,062**	**13,257,342**	**14,469,401**	**15,723,379**
-3,552,429	-2,374,720	-4,543,410	-3,363,262	-3,402,447	-142,584	3,238,082	6,746,186
-87,035	-58,181	-111,314	-82,400	-83,360	-3,493	79,333	165,282
1,264,743	1,278,391	1,291,462	1,306,455	3,343,223	3,384,160	3,428,771	3,473,906
0	-3,388,900	0	-1,263,240	0	0	0	0
-2,374,720	**-4,543,410**	**-3,363,262**	**-3,402,447**	**-142,584**	**3,238,082**	**6,746,186**	**10,385,374**
-15,805,066	-15,408,616	-7,030,294	-2,233,031	6,686,390	12,906,517	19,356,745	26,049,687
-387,224	-377,511	-172,242	-54,709	163,817	316,210	474,240	638,217
8,649,674	8,755,833	8,857,506	8,974,130	6,056,310	6,134,019	6,218,702	6,304,381
-7,866,000	0	-3,888,000	0	0	0	0	0
-15,408,616	**-7,030,294**	**-2,233,031**	**6,686,390**	**12,906,517**	**19,356,745**	**26,049,687**	**32,992,286**
19,988,976	20,478,706	21,119,508	21,846,060	22,670,766	23,958,955	25,363,727	26,895,570
489,730	501,728	517,428	535,228	555,434	586,994	621,411	658,941
5,959,533	6,032,676	6,102,727	6,183,080	6,626,357	6,711,381	6,804,034	6,897,778
-5,959,533	-5,893,603	-5,893,603	-5,893,603	-5,893,603	-5,893,603	-5,893,603	-5,893,603
20,478,706	**21,119,508**	**21,846,060**	**22,670,766**	**23,958,955**	**25,363,727**	**26,895,570**	**28,558,687**
-1,496,939	-2,493,534	-2,702,641	-1,642,972	-544,264	2,252,283	5,151,697	8,159,581
-36,675	-61,092	-66,215	-40,253	-13,334	55,181	126,217	199,910
1,102,581	1,114,484	1,125,884	1,138,961	2,809,882	2,844,233	2,881,667	2,919,540
-2,062,500	-1,262,500	0	0	0	0	0	0
-2,493,534	**-2,702,641**	**-1,642,972**	**-544,264**	**2,252,283**	**5,151,697**	**8,159,581**	**11,279,031**
391,436	411,466	424,807	438,474	452,477	466,822	481,519	496,577
9,590	10,081	10,408	10,743	11,086	11,437	11,797	12,166
10,440	3,260	3,260	3,260	3,260	3,260	3,260	3,260
0	0	0	0	0	0	0	0
411,466	**424,807**	**438,474**	**452,477**	**466,822**	**481,519**	**496,577**	**512,003**
29,041,404	43,534,180	50,934,685	54,487,316	63,898,671	78,961,336	84,754,421	90,939,763
711,514	1,066,587	1,247,900	1,334,939	1,565,517	1,934,553	2,076,483	2,228,024
21,490,140	21,690,297	21,881,997	21,788,540	22,988,386	23,218,097	23,468,423	23,124,163
-7,708,879	-15,356,380	-19,577,265	-13,712,124	-9,491,239	-19,359,565	-19,359,565	-6,168,868
43,534,180	**50,934,685**	**54,487,316**	**63,898,671**	**78,961,336**	**84,754,421**	**90,939,763**	**110,123,083**

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