



**Sustainability and
Asset Management**

2025 Asset Management Plan

City of Markham



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Definitions

Asset

An item, thing or entity that has potential or actual value to an organization. The value can be tangible or intangible, financial or non-financial, and includes consideration of risks and liabilities.

Asset Category

A category of municipal infrastructure assets that is an aggregate of assets.

Asset Hierarchy

A logical digital index of assets and asset information.

Asset Management

Planned actions and coordinated activities of an organization to optimally and sustainably manage its assets that will enable the assets to provide the desired level of service in a sustainable way, while managing their risk at the lowest lifecycle cost. It encompasses all asset types, tangible or intangible, individual components or complex systems, and all activities involved in the asset's lifecycle from acquisition/creation, through maintenance to renewal or disposal.

Asset Management Plan (AMP)

A strategic document (long-term) that states how a group of assets is to be managed over a period of time. The plan describes the characteristics and performance of infrastructure assets, the levels of service expected from them, planned actions to ensure the assets are providing the expected level of service, and financial strategies to implement the planned actions. Specific criteria to be included is defined in Ontario Regulation 588/17.

Asset Management Policy

Mandated requirements, overall intentions/principles and framework for control of asset management. An Asset Management Policy guides the overall direction of the asset management system, providing direction to the appropriate focus and level of asset management practice expected. It shall establish key principles, overall vision for the program, and align other municipal plans.

Asset Management Strategy

Documents the intended approach by which the assets and other resources will be used to achieve the agreed upon objectives within the agreed Policy framework. It provides clear direction, intentions and rationale. It also identifies the organizational readiness, including identification of barriers and appropriate implementation plans to overcome the barriers.

Backlog

Backlog refers to the value of immediate work that is required (not including additional work that may occur over the forecast periods) based on asset needs. This work could include asset replacements that are required when an asset has passed the end of its life. It may also include rehabilitations that are required immediately. The City understands the term “backlog” to mean those assets that have been identified as having needs (either rehabilitation or replacement) but are also not identified in the City’s Lifecycle Reserve Study.

Backlog (Managed)

Managed backlog refers to the value of immediate work that is required (not including additional work that may occur over the forecast periods) based on asset needs that the City has identified and has planned to complete. These items include both rehabilitations and replacements (i.e. renewals), and they are identified in the City’s Lifecycle Reserve Study.

Building Together – Guide for Municipal Asset Management Plans

A document, released by the Government of Ontario, which explains the importance and the features of an AMP.

Community (Customer) Levels of Service

Community Levels of Service (also known as Customer Levels of Service) measures are typically expressed in non-technical terms and describe the general public’s understanding of services being provided by infrastructure systems. Community LoS measures are typically related to the service that is provided by the overall system supporting the service delivery, rather than the specific assets.

Core Asset

Includes any municipal infrastructure asset that is a:

- water asset that relates to the collection, production, treatment, storage, supply or distribution of drinking water;
- wastewater asset that relates to the collection, transmission, treatment or disposal of wastewater, including any wastewater asset that from time to time manages stormwater;
- stormwater management asset that relates to the collection, transmission, treatment, retention, infiltration, control or disposal of stormwater;
- road; or,
- bridge or culvert.

Current Replacement Value (CRV)

The amount that an entity would have to pay to replace an asset of the same function and capacity at the present time, according to its current worth, including costs related to removal, installation, excavation, design, engineering, contingencies, disposal, material and labour.

Deterioration Curve

A mathematical representation used to model and predict the change in performance of an asset over time. These curves can be plotted on a graph, with the x-axis representing time (age), and the y-axis representing performance values (or ratings).

Estimated Service Life (ESL)

The estimated period of time (usually in years) that an asset is in use or is expected to be available for use, assuming perfect construction and general maintenance is carried out. ESLs may vary according to material type or functional component.

Infrastructure

The physical structures and associated facilities that form the foundation of development, and by or through which a public service is provided.

Infrastructure Deficit

A spending shortfall in comparison to an established need. This can include the accumulated deficit that results year over year due to financial shortfalls.

Key Performance Indicator (KPI)

A quantifiable measure used to evaluate the success of an organization, employee, asset, etc. in meeting objectives for performance.

Level of Service (LoS)

The parameters or combination of parameters that reflect the social, political, economic, and environmental outcomes the organization delivers. Level of service statements describe the outputs or objectives of the organization's activities that are intended to be delivered to the community.

Lifecycle Activity

Activities undertaken with respect to an infrastructure asset over its service life, including constructing, maintaining, renewing, operating, and decommissioning, and all engineering and design work associated with those activities.

Lifecycle Cost

The total cost of ownership over the life of an asset. This may include but is not limited to capital costs, operating costs, maintenance costs, renewal costs, replacement costs, environmental costs, and user delay.

Lifecycle Management Strategy

The 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 lifecycle cost.

Long-Term Financial Plan

A plan that projects a forecast of financial performance and position over a period of at least five years. The Long-Term Financial Plan should be consistent with actions required to implement strategies proposed in other plans/documents.

Maintenance

Activities that allow assets meet their required performance objectives, including regularly scheduled inspection and activities associated with unexpected or unplanned events.

Missing Assets

Missing assets are assets that have been built and are currently in-service. These assets are not captured within the City's database system(s) or asset registry and are not captured in the City's Lifecycle Reserve Study.

Non-core Asset

All other municipally owned assets not included in the definition of a core asset (as per O. Reg 588/17).

Non-infrastructure Lifecycle Activities

Actions, studies, master plans or policies that are not capital in nature, which result in the lowering of costs and/or extend the useful life of an asset.

Ontario Regulation 588/17

Under the Infrastructure for Jobs and Prosperity Act, 2015, principles are set out by the provincial government to regulate asset management planning for municipalities. On December 27, 2017, O. Reg. 588/17 was released which regulates asset management planning for municipal infrastructure.

Operations

Regular, routine or regularly scheduled activities that are required or regularly anticipated as part of the assets service (for example, fueling a vehicle, completing an inspection or condition assessment, winter control, staffing/overhead).

Performance

A measure of how well an asset is fulfilling its intended purpose and meets the defined levels of service for its users and stakeholders.

Preventive Maintenance

Regular, routine or regularly scheduled maintenance activities that are intended to keep assets in good working order and prevent or minimize unplanned failures or downtime.

Rehabilitation

Significant repairs designed to extend the life of an asset. Rehabilitations are considered renewal lifecycle activities. They provide a significant improvement in an asset's performance, as opposed to maintenance activities that could occur more frequently and are designed to maintain functionality and performance as opposed to improve or restore it. For example, the re-lining of a length of sewer pipe can be considered a rehabilitation activity, whereas a spot repair may be considered maintenance.

Renewal/Replacement

Major rehabilitation or replacement of an existing asset to an equivalent capacity, function and/or performance.

Risk

The effect of uncertainty on an organization's objectives. It considers financial, socioeconomic and environmental variables and is determined by assigning a numeric rating for the likelihood of an asset failing and the consequence if it does.

Risk Management Strategy

A Risk Management Strategy details the methodology and framework used to assess an asset portfolio. It details the methodology and results used to assign Likelihood of Failure, Consequence of Failure and Risk Ratings to assets, which assists in understanding asset criticality, and prioritizing assets for rehabilitation or replacement.

Technical Levels of Service (LoS)

Technical LoS are technical measures applied against assets and overall systems that define the performance requirements to support Community Levels of Service and are used to determine which criteria will be used to drive business decisions. Technical LoS are often expressed in quantitative or numerical terms.

Acronyms and Abbreviations

Acronym or Abbreviation	Meaning
AM	Asset Management
AMP	Asset Management Plan
AODA	Accessibility for Ontarians with Disabilities Act
BCI	Bridge Condition Index
BMFT	Building Markham's Future Together
CIPi	Costing Climate Change Impacts to Public Infrastructure
COF	Consequence of Failure
CRV	Current Replacement Value
DSS	Decision Support System
ESA	Environmentally Sensitive Area
ESL	Estimated Service Life
FAO	Financial Accountability Officer
FCI	Facility Condition Index
GHG	Greenhouse Gas
ISO	International Organization for Standardization
KPI	Key Performance Indicator
LCRS	Life Cycle Reserve Study
LOF	Likelihood of Failure
LoS	Levels of Service
OP	City's Official Plan
O. Reg. 588/17	Ontario Regulation 588/17
PCI	Pavement Condition Index
PCP	Partners for Climate Protection
SOTI	State of the Infrastructure

Assumptions and Limitations

The analysis, findings, and recommendations presented in this AMP contain certain assumptions and limitations and represents the best information available as of its reporting to Markham's General Committee on June 17, 2025. Throughout this AMP, where assumptions have been made or limitations exist (i.e., data availability, data granularity, etc.) it has been noted. The purpose of this section is to summarize these assumptions and limitations into a single, referenceable location. This section contains general and specific assumptions and limitations.

General Assumptions and Limitations

Asset Information – The detail, quantity, and quality of asset information varies across the City's different asset classes. As the City's asset management program continues to develop, asset data will also continue to improve over time. Where assumptions have been made due to the state of the available asset information, it has been noted.

Furthermore, it is noted that to complete the analyses that are reported in this AMP, the City utilized a combination of 2023, 2024 and 2025 asset and financially based data sources. No dataset is without errors and/or gaps. Therefore, the findings in this AMP are based on the best information available, and as a result, output reports and modeling results are subject to change as this data improves.

Since the 2024 AMP development, asset registers have been updated to revise ESLs, conditions, and installation dates for some assets. In addition, assets that have been decommissioned have been removed from the register and some newly acquired or renewed assets have also been updated in the register. The City should continue to update its asset registers to reflect the most up to date asset attributes for future asset management analyses and iterations of the AMP.

Decision Support System (DSS) – The DSS is a software model that generates a financial needs-based forecast over a forward-looking planning horizon. The DSS applies interventions (i.e., renewals, replacements, etc.) to assets at set trigger points (condition or age), and captures the cost of the intervention and post-intervention condition state of the asset. The interventions, their timing (i.e., trigger point), cost, and post-intervention condition state rely on input from subject matter experts. At the same time, the condition values used to trigger interventions is an estimated condition. Therefore, the financial forecast created by the DSS (any DSS) provides a best practice-based estimate of future costs and asset performance.

Having said this, forecasts are based upon a computational modeling exercise underpinned by assumptions and information that is subject to change and refinement as part of the annual resource and budget planning process.

Improvement and Monitoring Plan – It is assumed that the City will resource and action the elements of the improvement and monitoring plan. However, the rate at which the plan's components can be actioned will limit the rate at which future AMPs and the City's overall asset management program can mature.

Specific Assumptions and Limitations

Estimated Service Life (ESL) – is an asset management best practice that assigns a lifespan to an asset. It is a key datapoint that enables forecasting of asset performance and costs over time.

- **Assumptions:** as defined in the Definitions section (above), ESL assumes every asset is constructed perfectly and receives a regular maintenance regime over its entire service life. Many assets are not constructed perfectly. Furthermore, many assets exist in hostile environments (i.e., are exposed to salt water, corrosives, temperature extremes, etc.) or experience heavy utilization (i.e., heavy construction vehicle traffic on paved roads). As a result, actual service life can vary from estimated service life.
- **Limitations:** The ESL is typically assigned to an asset based on a combination of input from subject matter experts, direct experience with assets, and published service lives (City's Tangible Capital Asset Policy, from manufacturers or industry standards and guidelines). Small changes in ESL can have compounding impacts on forecasts that contain large volumes of assets and/or span long time planning horizons.

Lifecycle Activity Costs – are defined in Section 9.2 and listed in Table 9-2 and are annual operation costs related to non-infrastructure solutions, asset acquisitions, asset operation, and service improvements. These costs are incorporated into the financial forecasts within this AMP where appropriate.

- **Assumptions: all monetary values in this report are presented in 2025 dollars and exclude inflationary increases.** It is assumed that non-renewal based lifecycle activity costs (non-infrastructure, and service improvement primarily) will remain constant over future time periods, with the exception of roads and growth scenarios as outlined. The funding for non-renewal lifecycle activity costs from the City's 2025 capital budget were used from 2026 to 2051 in the long-term forecasting model. For road assets, the operating costs to keep 70% of roads in good or better condition, asset acquisition, and lifecycle renewal were determined and included in the proposed LoS forecasting. For growth scenarios, acquisition, operating and lifecycle renewal costs were determined.

- Limitations: because no year over year escalation is applied to the lifecycle activity costs portion of the forecasts, users of this AMP should limit their interpretation of the forecasts and related decision making with this in mind.

Lifecycle Reserve Study (LCRS) – The City’s 2025 LCRS determines the available renewal activity funding year over year for each service area from 2025 to 2051. The LCRS outflows for asset renewals have been used as an input in the DSS model to determine if the City’s anticipated renewal funding is sufficient to maintain assets at an appropriate LoS.

- Assumptions: all monetary values are presented in 2025 dollars. The LCRS outflows were first calculated in 2024 dollars and inflated to 2025 dollars.
- Limitations: the required funding determined in the LCRS is based on asset needs over the next 26 years. The accuracy of the LCRS will decrease year by year as it is sometimes difficult to forecast asset needs as assets do not always require renewals as forecasted. The LCRS should be used by the City as a tool to help determine an approximate amount of funding that will be needed year by year. Knowing this, the City updates the LCRS annually with up to date asset data and stakeholder input.

Likelihood of Failure (LOF) – Likelihood of Failure is defined in Section 7 – Risk Management Framework. The LOF of an asset is a key metric that guides its management approach.

- Assumptions: the LOF value assigned to assets is currently based on either observed condition or the asset’s age (either known or estimated).
- Limitations: many assets do not fail based on condition or age (i.e., an asset can fail due to obsolescence, lack of capacity, poor efficiency, regulatory requirements, etc.). Further, when LOF is based on age, the rating is based upon the remaining Estimate Service Life, which is exactly that – an estimate. Therefore, users of this AMP should limit their interpretation of risk information presented in the AMP and any related decision making with this in mind.

As the City advances its asset management program and new or improved information becomes available, assumptions, limitations and outputs may be subject to change as needed by the City to ensure we continue to manage our assets to meet their service level expectations.

1 Executive Summary

1.1 Introduction

The City of Markham's 2025 Asset Management Plan (AMP) provides an overview of the asset management practices and processes undertaken by the City in order to provide services to its residents and businesses, as well as maintain the assets that support these services in a state of good repair.

The 2025 AMP was developed in alignment with the Ontario Regulation 588/17 (O.Reg.588/17) and key strategic documents, such as the City's Official Plan, Strategic Plan, Building Markham's Future Together (BMFT), the Greenprint, Markham's Community Sustainability Plan, and more.

This AMP formally documents the City's approach to performing sound asset management for the asset portfolio. The AMP contains the following content:

1. **Introduction:** provides a brief description of the City's asset management objectives, and the scope of the AMP.
2. **Alignment with Organization Goals:** documents the City's asset management journey and how the AMP is aligned with the City's strategic goals, objectives, and vision.
3. **Future Demand:** outlines internal and external factors that may influence future demand and how growth has been considered in this AMP.
4. **State of the Infrastructure:** provides an overview of the assets owned and maintained by the City, including asset valuation, quantities, average age and current performance.
5. **Levels of Service (LoS):** documents the established LoS measures and performance indicators used by the City to assess if adequate service is being provided to the community.
6. **Risk Management Strategy:** details the City's approach to evaluating risk, as well as the risks associated with the current state of assets.
7. **Lifecycle Management Strategy:** documents the lifecycle activities performed by the City to maintain their assets.
8. **Financial Strategy:** details the funding that is required based on asset needs and lifecycle management strategies to maintain current LoS and achieve proposed LoS. Provides a summary of the City's finances, projected into the future, with the perspective of maintaining service levels, achieving proposed LoS, accommodating for growth, and identification of any funding gaps.

9. **Improvement Plan:** provides recommendations and initiatives for the City to undertake to improve their AM program and future iterations of this AMP.

In addition to this information, this AMP is organized by providing more detailed analysis on major service areas. **Appendices A to K** contain chapters for each service area that include the following sections/information at a more granular level:

- a. **State of the Infrastructure**
- b. **Levels of Service**
- c. **Risk Management Strategy**
- d. **Lifecycle Management Strategy and Forecasting**

This AMP includes all infrastructure assets that are owned by the City and that the City is responsible for maintaining. The City's asset hierarchy, provided in Figure 1-1, details these service areas and associated assets.

To complete the analyses that are reported in this AMP, the City utilized a combination of 2023, 2024 and 2025 asset and financially based data sources and represents the best information available as of its reporting to Markham's General Committee on June 17, 2025. As a result, any planned renewal work that the City undertakes in 2025 is not reflected in the outputs of this AMP. Please refer to the Assumptions and Limitations section for further details.



Figure 1-1: Service areas in scope.

1.2 State of the Infrastructure

The City's total asset portfolio is valued at \$17.5B. This value is based on the assets' current replacement cost, which represents the cost required to replace the assets like-for-like. To align with the data, which was a combination of 2023, 2024 and 2025 asset and financially based data sources, this value is reported in 2024 dollars. Table 1-1 provides a summary of the asset portfolio, including replacement values and average asset performance by service.

Table 1-1: Summary of assets by service.

Service	Current Replacement Value	Overall Performance	Percentage of Replacement Value
Arts and Culture	\$94M	Good	0.5%
Fire & Emergency Service	\$83M	Good	0.5%
General Support Service	\$280M	Good	1.6%
Library	\$51M	Fair	0.3%
Natural Assets	\$170M	Good	1.0%
Parks	\$106M	Good	0.6%
Potable Water	\$1,926M	Fair	11.0%
Recreation	\$988M	Very Good	5.7%
Solid Waste Management	\$2M	Very Good	<0.1%
Stormwater Management	\$3,229M	Good	18.5%
Transportation	\$7,903M	Good	45.2%
Wastewater	\$2,671M	Good	15.3%
Total	\$17.5B	Good	100.0%

Figure 1-2 provides a visualization of the total asset replacement value by service.

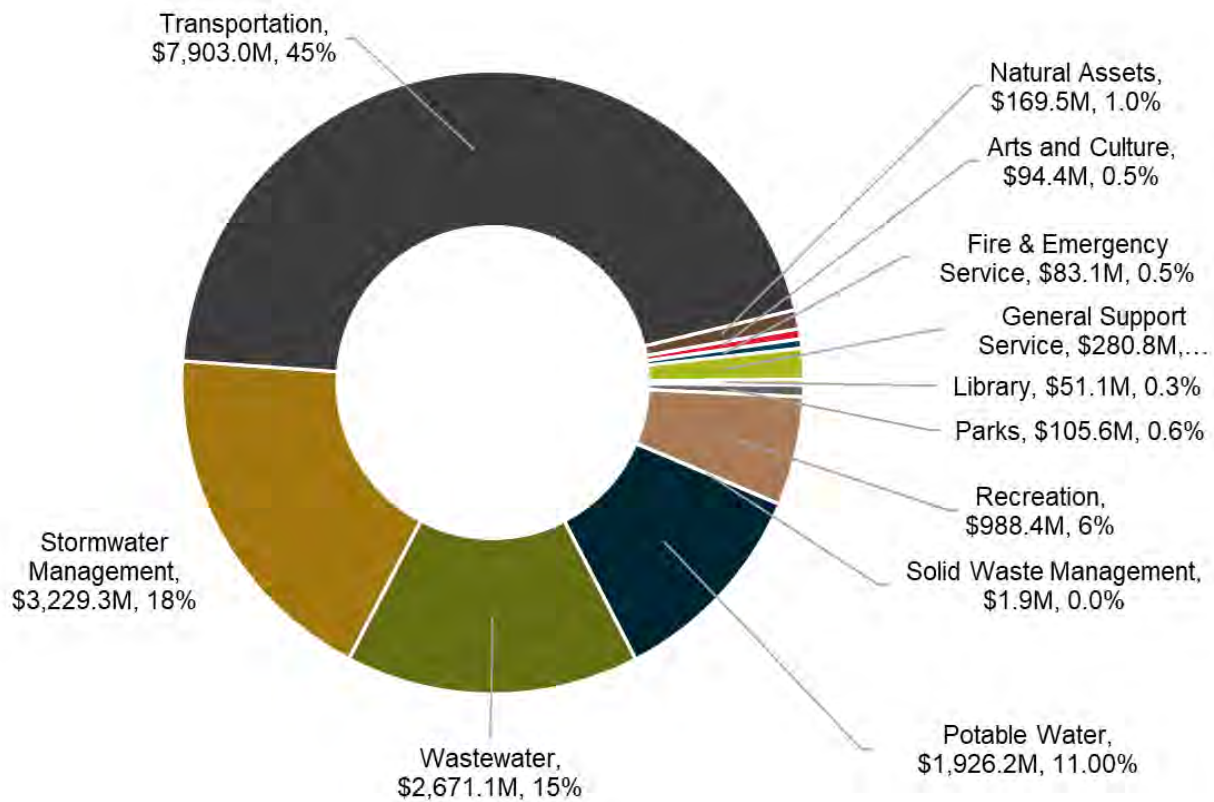
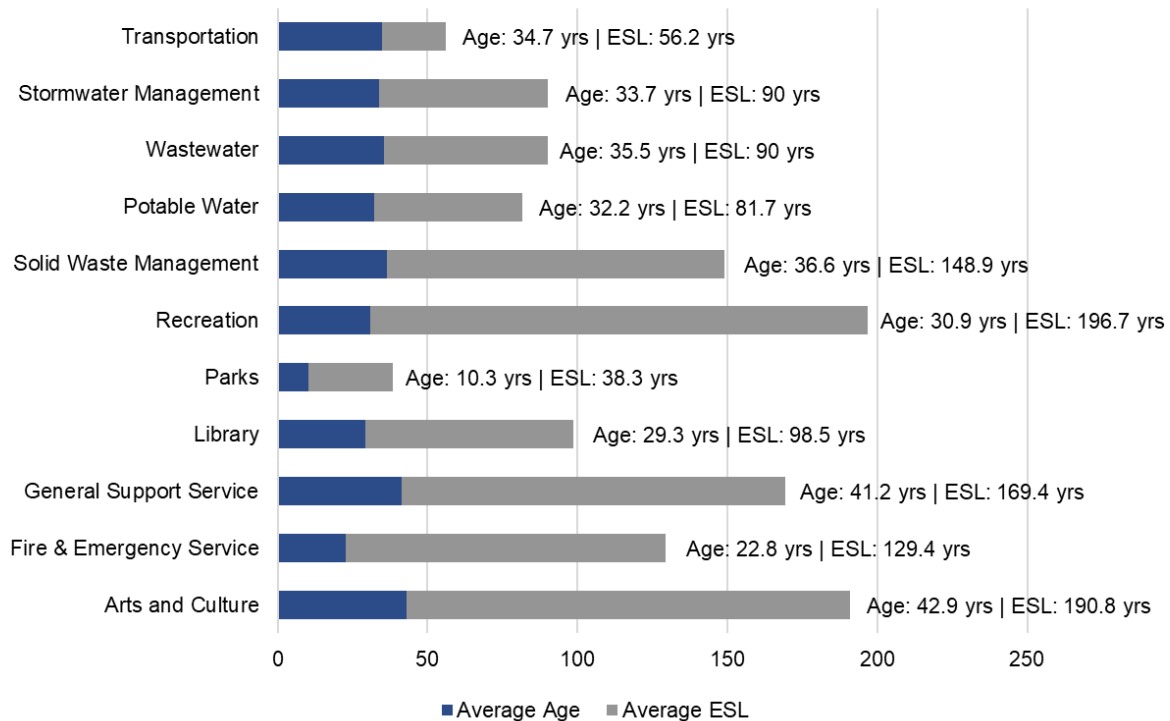


Figure 1-2: Replacement value distribution by service.

Figure 1-3



provides a visualization of the average asset age as a proportion of the average asset estimated service life (ESL), by service¹.

Figure 1-3: Average age as a proportion of average estimated service life (ESL) by service.

¹ Natural assets are not included in this figure, as the City's Natural Assets Inventory and Evaluation Study did not provide installation dates, ages, or service life for these assets.

The following figure provides a visualization of the value of major asset acquisition, by decade, within each service².

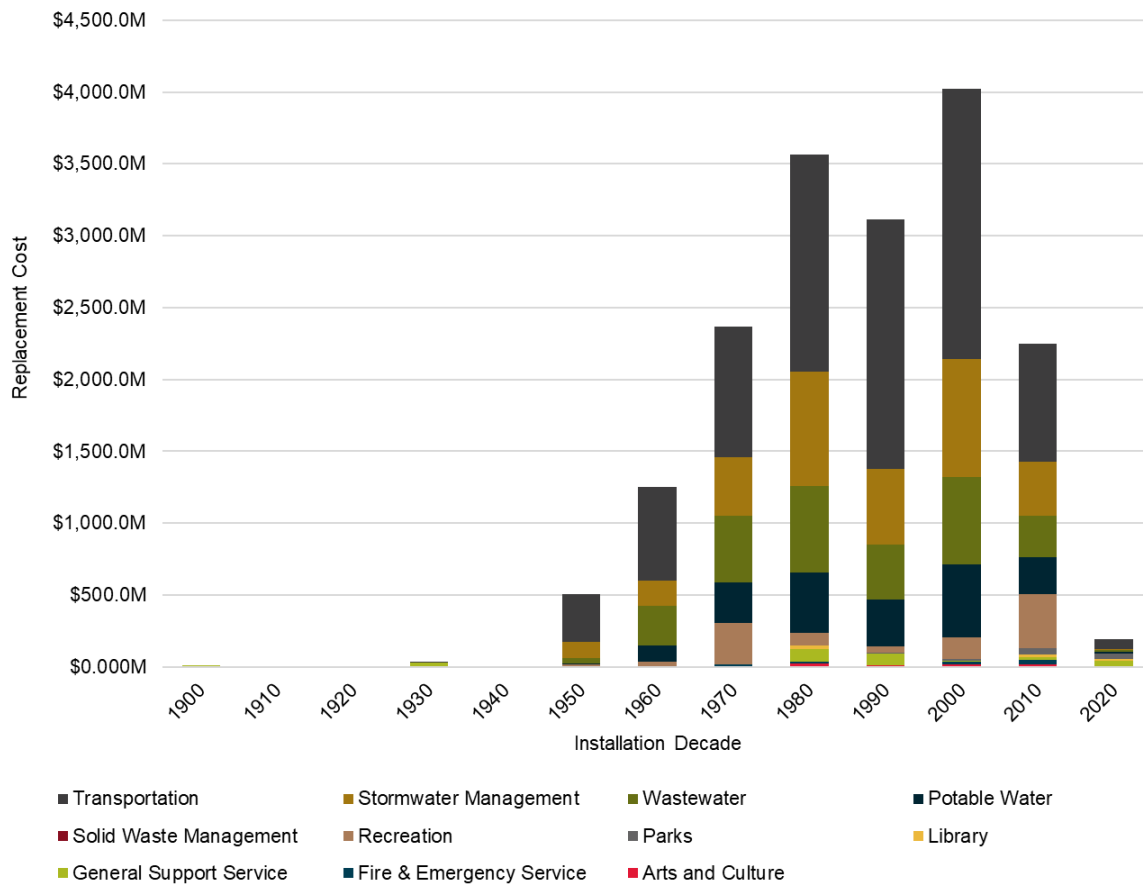


Figure 1-4: Age distribution by installation decade of all assets.

² Natural assets are not included in this figure, since the City's Natural Assets Inventory and Evaluation Study did not provide installation dates for these assets.

The following figures provide a visualization of the distribution of asset performance considering either asset age or rated physical condition over five (5) performance categories for the City as a whole, and then by service. Definitions of condition performance are provided in **Section 5** in the AMP.

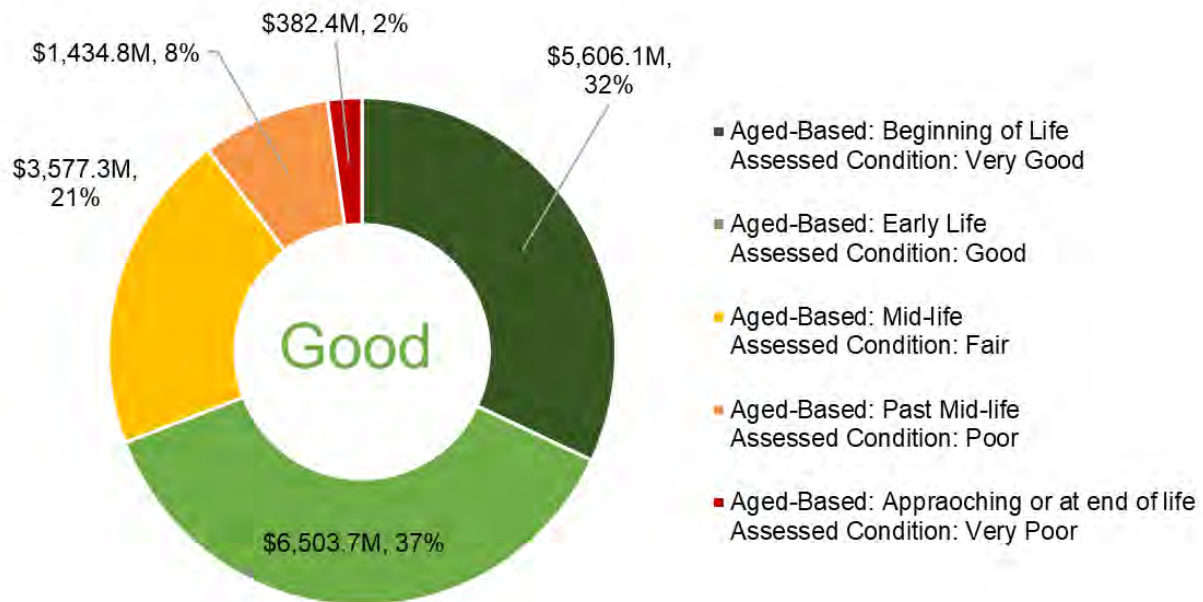


Figure 1-5: Condition distribution of all assets.

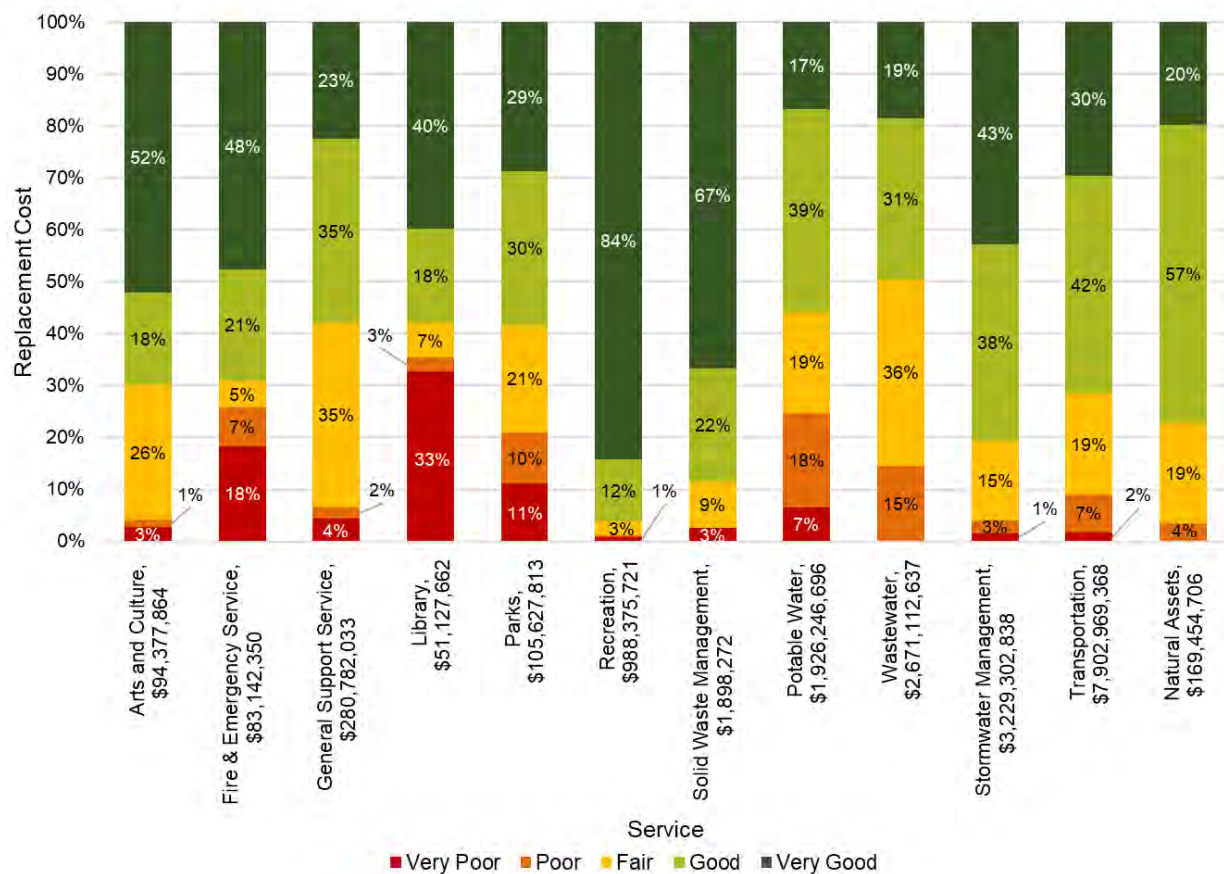


Figure 1-6: Condition distribution of all assets by service.

Overall, assets remain in a **“GOOD” state of performance** since last reported in the City’s 2024 Asset Management Plan, where:

- Assets in a Fair or better state **improved to 90% or \$15.7B** (from 88% or \$15.4B) and are performing as intended
- Assets in a Poor and Very Poor state was **reduced to 10% or \$1.8B** (from 12% or \$2.1B) and are subject of planned maintenance or renewal

1.3 Levels of Service

Levels of Service (LoS) are a measure of the degree to which an asset meets functional or user requirements. Levels of service reflect documented approved or endorsed performance or service measures, which are articulated or reflected in a number of policy documents (i.e. plans or studies). The City has developed an LoS strategy and framework, which documents the approach the City takes to monitor and report on these LoS. As part of that strategy, Levels of Service are regularly reviewed and updated to ensure that they reflect the current landscape at the City, which may take

into account items such as Council directives, changes in policy or resource/funding constraints.

LoS measures were established for each service area to determine if service levels are being met. These measures were developed to be asset-focused and based on customer expectations and values, available asset data, and factors that support decision-making. Typically, LoS are measured in terms of parameters that reflect social, political, legislative, environmental, and economic outcomes that an organization delivers.

The full suite of LoS measures for each service area are presented in **Appendix A to Appendix L** of this AMP document. The current performance reported in these sections take into account data for year ending 2024, unless otherwise stated. The LoS framework is presented as three tables within this AMP:

- Customer Values: summarizes the different customer expectations of each service
- Customer LoS: contains a suite of LoS measures that focus on customer experiences that use language that is familiar to the community.
- Technical LoS: details measures that the City uses to understand if it is managing assets to the level appropriate to meet community expectations. Note that technical LoS are linked to significant activities within the asset lifecycle and include the following: Acquisition, Operation, Maintenance, Renewal, Disposal, Service Improvement and Non-Infrastructure.

This AMP also reports on the City's proposed levels of service (PLoS). The PLoS for each service area is documented in **Appendix A to Appendix L**. PLoS have been established in the LoS tables as well as in the lifecycle forecasting to determine the levels of funding required for the City to achieve these PLoS.

1.4 Risk Management Strategy

As part of the development of this AMP, a risk management strategy was developed to assess the risk of the City's asset portfolio to meet LoS goals. This was done by evaluating the likelihood of failure (LOF) and consequence of failure (COF) of each asset using a standardized framework. The risk management strategy was developed to provide the City with a formal and standardized methodology in assessing asset risk across all assets and service areas.

LOF represents the likelihood of an asset failing, relative to a specific failure event. For the purposes of this AMP, asset failure refers to failure due to poor performance, resulting in the asset no longer functioning as intended, and/or inability to provide its intended service. Therefore, the LOF of an asset is linked to its performance.

The COF framework defines the consequences that may occur should an asset fail or stop providing its intended service. The City's COF framework contains evaluation criteria, which were developed using a "triple bottom line" analysis, which evaluates the financial, social, and environmental consequences of asset failure.

Using the LOF and COF frameworks, LOF and COF scores can be assigned to each asset, on a 5-point rating scale. When the LOF and COF ratings are combined, an overall asset risk score ranging from 1 to 25 is determined. Detailed definitions of LOF, COF, risk, and the associated frameworks/rating scales are provided in Section 7.

The following risk matrix summarizes the risk scores for all assets within the scope of this AMP. It detailed the total replacement value of assets within each combination of LOF and COF ratings.

The City's Risk Management strategy has identified some assets that are considered "high" risk and none that are "very high" risk. Through regular business and operational planning processes, the City ensures that attention is given to critical or high-risk assets, and that initiatives are implemented to ensure that the needs of critical asset are addressed so as not to compromise the safety of the public, legislative compliance or other matters of concern.

Table 1-2: Risk score distribution for all in-scope assets.

	COF 1	COF 2	COF 3	COF 4	COF 5	Subtotal
LOF 1	\$55.4M (0.3%)	\$2.4B (13.9%)	\$2.9B (16.6%)	\$164.4M (0.9%)	None	\$5.6B (31.8%)
LOF 2	\$123.9M (0.7%)	\$2.6B (15.0%)	\$3.5B (19.9%)	\$266.6M (1.5%)	None	\$6.5B (37.1%)
LOF 3	\$103.4M (0.6%)	\$1.7B (9.4%)	\$1.8B (10.2%)	\$63.6M (0.4%)	\$2.8M ($<0.1\%$)	\$3.6B (20.7%)
LOF 4	\$59.9M (0.3%)	\$815.3M (4.7%)	\$546.3M (3.1%)	\$10.7M (0.1%)	None	\$1.4B (8.2%)
LOF 5	\$64.4M (0.4%)	\$203.3M (1.2%)	\$110.1M (0.6%)	\$4.6M ($<0.1\%$)	None	\$382.4M (2.2%)
Subtotal	\$407.0M (2.3%)	\$7.7B (44.2%)	\$8.8B (50.5%)	\$509.9M (2.9%)	\$2.8M ($<0.1\%$)	\$17.5B (100.0%)

Table 1-3: Risk score mapping legend.

Risk	Risk Score	Risk Description
Very Low	1 – 5	Fit for the Future
Low	6 – 10	Adequate for Now
Moderate	11 – 15	Requires Attention
High	16 – 20	At Risk
Very High	21 – 25	Unfit for Sustained Service

1.5 Lifecycle Management Strategies

The City's lifecycle strategy is a set of planned actions or activities performed on assets to provide LoS in a sustainable way, while managing risk, and at the lowest lifecycle cost. These activities include major asset renewals (such as rehabilitations and replacements), operations and maintenance, disposals, acquisitions and service improvements. These lifecycle activities work together to extend asset life, reduce overall lifecycle costs, minimize risk, and achieve other objectives such as environmental goals.

Lifecycle model forecasting uses logical assumptions about an asset's expected or intended behaviours over time to predict future financial requirements for maintaining those assets in good working condition to provide services. These models incorporate the City's lifecycle activities, such as rehabilitation and replacements. As part of the City's lifecycle strategy, a set of models have been developed to project future asset needs. These models are integrated with the City's LoS and risk management strategies that inform decision-making into a decision support system (DSS) tool. This decision support tool combines the City's asset inventories and current performance data with the lifecycle, risk, and LoS strategies to forecast future investment (i.e., renewals) required to meet asset performance goals (which in turn enables achievement of LoS goals).

1.6 Financial Strategy

This section presents the City's projected funding levels, as identified in the Lifecycle Reserve Study, alongside the funding required to maintain current service levels and the additional funding needed to achieve the proposed levels of service based on planned lifecycle activities. Establishing funding needs for each service area will help the City sustain healthy reserve balances, secure the necessary staffing resources to keep assets in a state of good repair, support the development of new infrastructure, and guide the annual capital budgeting process. Note that acquisitions of new assets are not included in this section and are included in Sections 1.6.2 and 9.5.3.

1.6.1 Forecasted Operating and Capital Budgets

The City's 2025 budget was reviewed to determine the City's anticipated funding towards each lifecycle activity and service area. The City categorizes their budget into the following groups:

- **Operating budget:** This supports the day-to-day activities and functions to provide City Services. Operating expenses include equipment maintenance, materials supply, facilities services, and contributions to reserves; all of which are expensed in the current fiscal year.
- **Capital budget:** This includes a comprehensive financial plan that addresses the financial requirements needed for growth, major rehabilitations, and major replacements of existing infrastructure.

To provide a forecast of required operating and capital needs, an analysis was used that incorporates the results of the City's lifecycle forecasts and other forecasts to understand future projections. To forecast the operating budget, the City's 2025 operating budget of \$495.8M was applied to the entire 26-year forecast. To forecast the capital budget, renewals were obtained from the City's LCRS. For non-renewal lifecycle activities (including non-infrastructure solutions, service improvements, etc.) forecasts were developed by looking at the City's 2025 line-item budget to determine recent spending amounts.

The following table summarizes the forecasted capital and operating expenditures, based on required asset replacements, rehabilitations, and operations and maintenance activities for the City to continue meeting current service levels (acquisition expenditures are not included). Note that natural assets are not included in Table 1-4 since forecasting for these assets was completed separately in the City's Natural Assets AMP and have not yet been considered nor deliberated to any degree, and of which may be addressed incrementally through future updates to either the Natural Assets AMP or this AMP.

Table 1-4: Forecasted capital expenditures (Life Cycle Reserve Study and capital budget) and operating expenditures.

Year	Renewal (LCRS) and Non-Renewal (Capital Budget)	Operating Budget	Total Expenditures
2026	\$123.3M	\$495.8M	\$619.1M
2027	\$106.9M	\$495.8M	\$602.7M
2028	\$76.7M	\$495.8M	\$572.5M
2029	\$95.2M	\$495.8M	\$591.0M
2030	\$106.1M	\$495.8M	\$601.9M
2031	\$75.3M	\$495.8M	\$571.1M

Year	Renewal (LCRS) and Non-Renewal (Capital Budget)	Operating Budget	Total Expenditures
2032	\$84.3M	\$495.8M	\$580.1M
2033	\$96.8M	\$495.8M	\$592.6M
2034	\$76.9M	\$495.8M	\$572.7M
2035	\$91.1M	\$495.8M	\$586.9M
2036	\$80.1M	\$495.8M	\$575.9M
2037	\$84.5M	\$495.8M	\$580.3M
2038	\$83.5M	\$495.8M	\$579.3M
2039	\$87.7M	\$495.8M	\$583.5M
2040	\$91.7M	\$495.8M	\$587.5M
2041	\$73.7M	\$495.8M	\$569.5M
2042	\$89.7M	\$495.8M	\$585.5M
2043	\$83.0M	\$495.8M	\$578.8M
2044	\$89.9M	\$495.8M	\$585.7M
2045	\$87.6M	\$495.8M	\$583.4M
2046	\$80.5M	\$495.8M	\$576.3M
2047	\$88.1M	\$495.8M	\$583.9M
2048	\$79.8M	\$495.8M	\$575.6M
2049	\$70.0M	\$495.8M	\$565.8M
2050	\$88.2M	\$495.8M	\$584.0M
2051	\$73.1M	\$495.8M	\$568.9M
Total	\$2,263.8M	\$12,890.8M	\$15,154.6M
Equivalent Average Annual	\$87.1M	\$495.8M	\$582.9M

Table 1-5 below shows the annual expenditures from the 2025 capital budget by lifecycle activity. It was assumed that these annual expenditures are sufficient to provide current LoS from 2026 to 2051. These annual expenditures were used to forecast the non-renewal expenditures from 2026 to 2051.

Table 1-5: Forecasted capital expenditures (non-renewal activities).

Lifecycle Activity Type	2025 Budget
Non-Infrastructure Solutions (Capital)	\$3.8M
Operation (Capital)	\$9.0M
Maintenance (Capital)	\$4.2M
Service Improvement (Capital)	\$10.6M

The operating and capital budgets (planned funding) are the City's current LoS. Through the development of this AMP, asset performance was forecasted based on the

proposed LoS to determine and compare the total lifecycle costs to the City's current LoS.

1.6.2 Lifecycle Forecasting

For this AMP, the required funding levels to achieve proposed LoS including maintaining current performance levels and accommodating growth, were determined. These funding levels were then compared to the City's current LoS (planned budget) to determine if there is an infrastructure funding gap, and the amount of funding that would be required by the City to accommodate future population and employment growth objectives.

The forecasting model is primarily related to capital renewal needs. The City employs two primary renewal strategies: asset replacements, which consider the removal of an existing asset and its replacement with a like asset; and rehabilitations, which include major retrofits and other significant works that extend asset life.

The following scenarios were forecasted:

- **Current Level of Service – Planned Funding Levels:** The current LoS is the City's planned funding as identified through the City's LCRS for the years 2026 to 2051. For this modelling exercise, the City's LCRS financial forecasts and current operating and capital budgets were used as upset limits or constraints, to model an asset performance forecast over the planning horizon.
- **Proposed Levels of Service – Maintain Current Performance:** determine the funding required using the lifecycle models in conjunction with the City's LoS and risk management strategies. The forecasting was performed using the following parameters:
 - o For road assets, maintaining 70% of roads in good or better condition.
 - o For all other assets, needs were determined as assets that are beyond their service life or in a condition that is considered unfit to provide service. These assets are renewed in the forecast following the lifecycle management strategies detailed in Appendix A to Appendix L.
- **Proposed Levels of Service – Impact of Growth Scenario #1 (Official Plan Objectives):** determine the funding required for the City to accommodate for growth in population and employment in alignment with the OP.
- **Proposed Levels of Service – Impact of Growth Scenario #2 (Realistic Growth Objectives):** determine the funding required for the City to accommodate for growth in population and employment based on historic actuals which represents achieving approximately 63% of the OP's growth objectives.

The detailed forecast results are presented in Section 9.5. To determine the costs for the City to achieve proposed service levels, maintaining current performance was established as PLoS. This means that the City is setting a target to maintain current service levels for all asset groups (excluding roads) and to maintain 70% of roads in good or better condition. The following figures illustrate the spending forecast for capital renewal and replacement for the scenarios listed above and the expected asset performance for the current LoS (planned funding levels) and proposed LoS (maintain current performance) scenarios.

Note that these forecasts do not include natural assets, since forecasting for these assets was completed separately in the City's Natural Assets AMP and have not yet been considered nor deliberated to any degree, and of which may be addressed incrementally through future updates to either the Natural Assets AMP or this AMP. Furthermore, as noted above, the outputs reported herein are subject to change as the City advances its asset management practice and data maturity capabilities and represents the best information available as of it's reporting to Markham's General Committee on June 17, 2025.

1.6.2.1 Current Level of Service – Planned Funding Levels

Figure 1-7 illustrates the City's planned funding levels to maintain current service and performance over the planning horizon spanning 2026-2051. The total planned budget is approximately **\$15.15B**, or an equivalent average annual expenditure of **\$582.9M**. The total operating portion of this budget is approximately **\$12.89B**, or an equivalent average annual expenditure of **\$495.8M**. The capital portion of this budget is approximately **\$2.26B**, or an equivalent average annual expenditure of **\$87.1M**, is planned to fund asset renewal, service improvements and other life cycle activities noted in Table 1-5. Of this amount, approximately **\$1.55B**, or an equivalent average annual expenditure of **\$59.5M** is planned exclusively for asset renewals. Figure 1-8 illustrates the anticipated asset performance results that is related to this spending forecast. Each bar of this graph illustrates a performance distribution for a given year of the forecast.

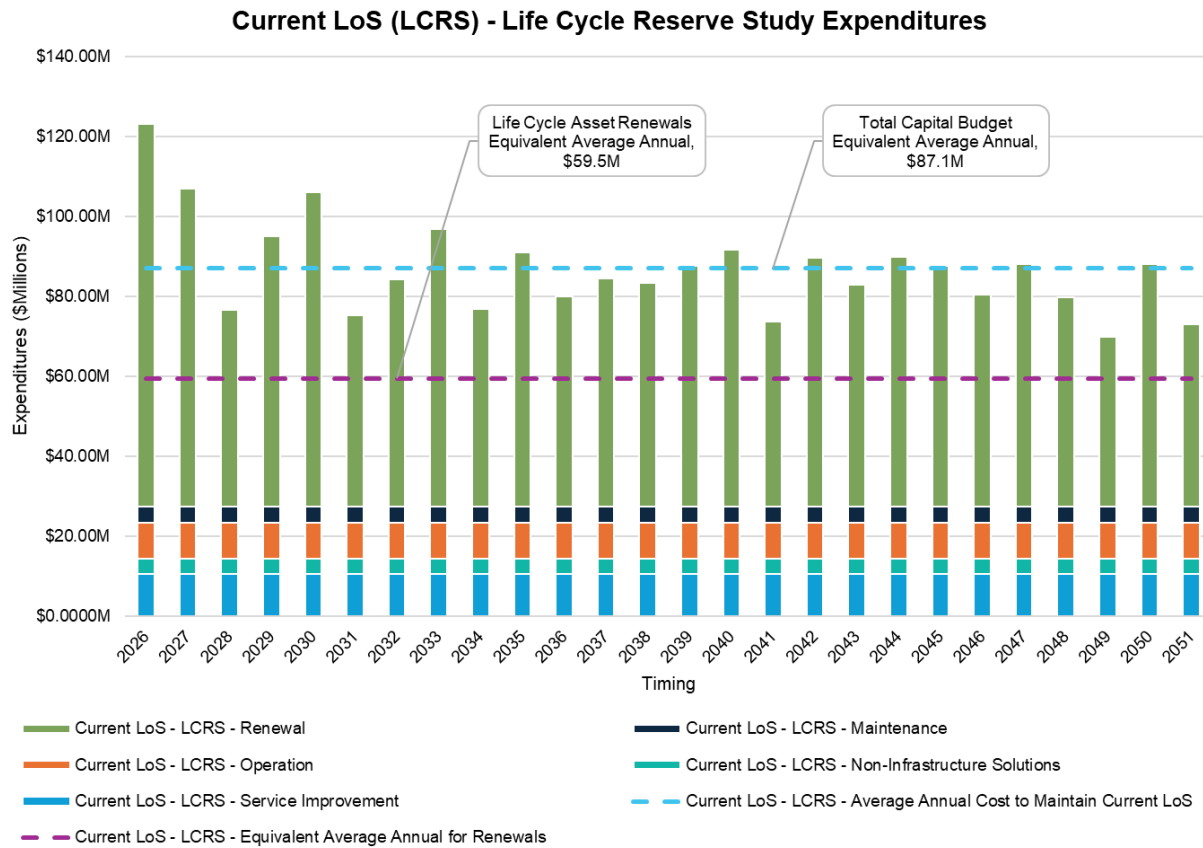


Figure 1-7: Current levels of service – 2024 Life Cycle Reserve Study expenditures.

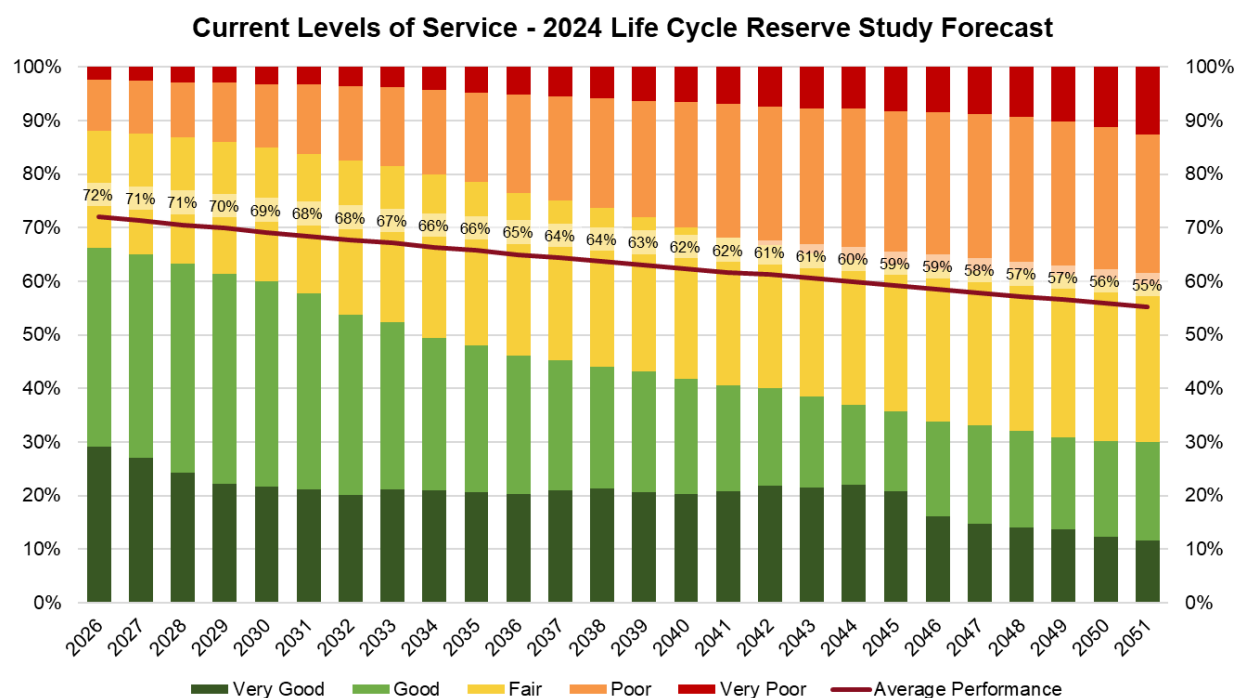


Figure 1-8: Current levels of service – 2024 Life Cycle Reserve Study forecast.

The results illustrated in Figure 1-8 indicate that the City's 2024 LCRS, which forecasts planned funding levels totaling approximately **\$1.55B** (excluding inflationary increases) over the planning horizon, may result in a **decline in asset performance**. By 2051, performance may decline to:

- **59.4% or \$10.30B** of assets performing as intended
- **40.6% or \$7.03B** of assets are subject of planned maintenance or renewal

This anticipated decline in performance represents **approximately 30.6%** of assets shifting from a Fair or better state of performance to a Poor or Very Poor state of performance. An analysis of appropriate funding levels required to maintain current performance levels is discussed further Sections 1.6.2.2 and 9.5.2.

1.6.2.2 Proposed Levels of Service – Maintain Current Performance

Figure 1-9 below illustrates the funding needed to maintain current performance levels through to 2051. The figure illustrates each year's projected asset renewal needs. These needs are forecasted using a computational model based on the City's lifecycle forecasting logic and anticipated renewal costs. Figure 1-10 illustrates the anticipated resulting asset performance that is related to the spending forecast to maintain current performance. Each bar of this graph illustrates a performance distribution for a given year of the forecast.

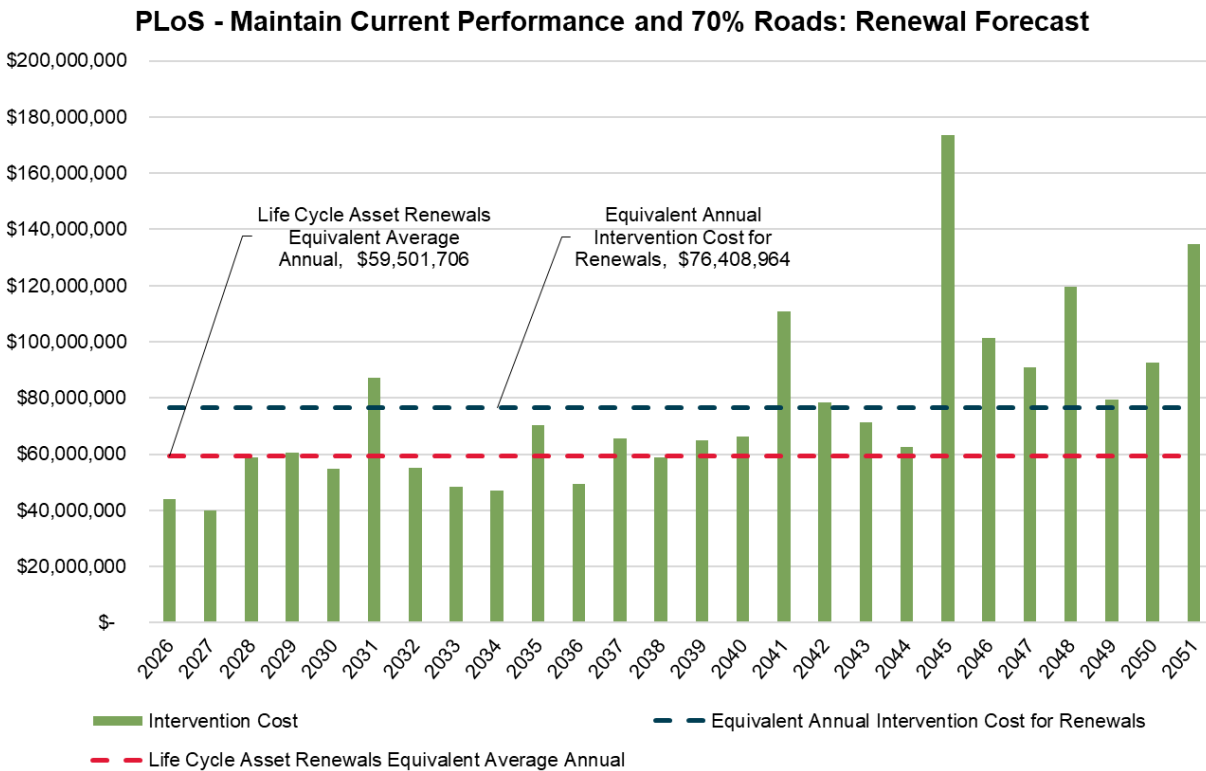


Figure 1-9: Proposed levels of service – maintain current performance and 70% roads: renewal forecast.

Computational modelling suggests that, exclusively for renewals, an overall increase to forecasted funding levels noted in Section 1.6.2.1 of **\$439.6M** over the planning horizon, or an equivalent average annual expenditure of **\$16.9M** (representing 0.1% of the total replacement value, excluding natural assets) is required to maintain current asset performance levels through to 2051. Non-renewal-based capital and operating forecasted costs were held to current levels for this analysis. The proposed funding levels shown in Figure 1-9 results in the anticipated performance forecast shown in Figure 1-10.

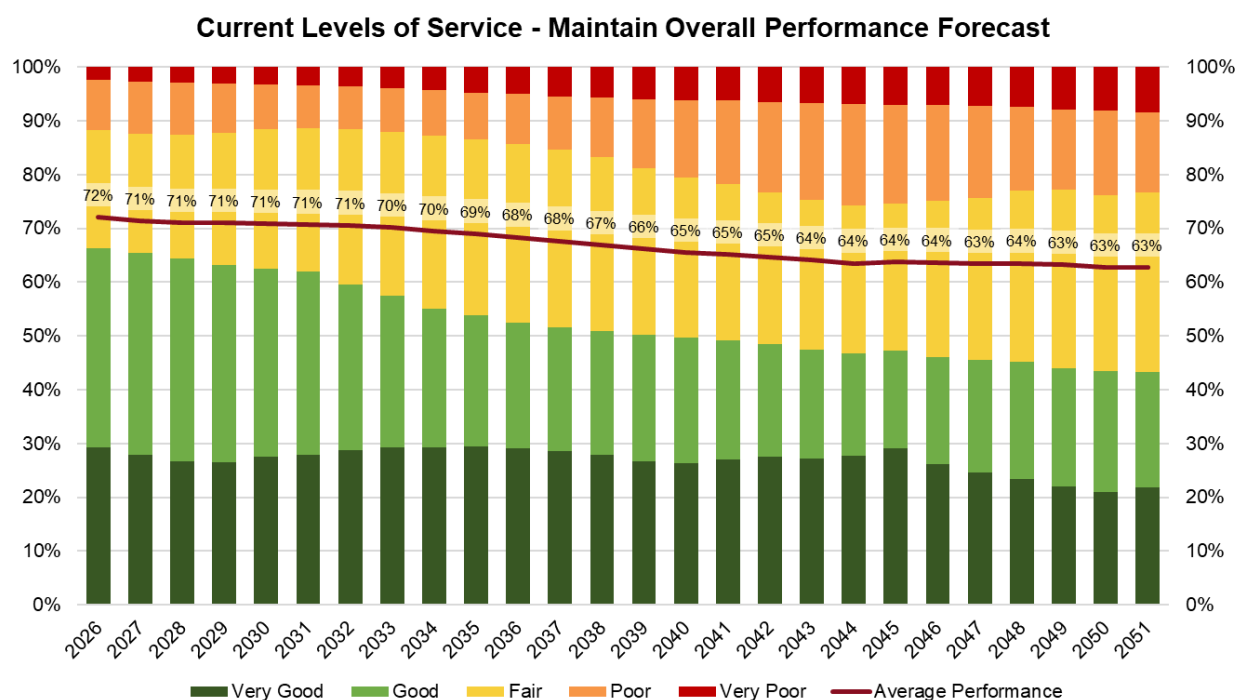


Figure 1-10: Proposed level of service – maintain overall performance forecast.

Assuming funding levels are incrementally increased over time to meet these performance level targets, the overall performance forecast shown in Figure 1-10 suggests that by 2051:

- **76.7% or \$13.30B** of assets performing as intended
- **23.3% or \$4.04B** of assets are subject of planned maintenance or renewal

While these forecasted results are lower than the current state of performance by approximately **13.3%**, the overall performance outlook at 2051 rates the City's assets at the cusp of the Good and Fair categories, of which represent assets that are performing as intended and may require some form of normal attention and/or maintenance.

By adjusting the performance target for roads from 85% PCI to 70% of roads performing in good or better condition, the City will be able to better maintain performance and at a lower annual cost increase.

1.6.2.3 Proposed Levels of Service – Impact of Growth Scenario #1 (Official Plan Objectives)

In Growth Scenario #1 (OP Objectives), by 2051, and based upon the modelling conducted, the City may acquire approximately **\$6.89B** worth of additional assets in order to meet the City's intended growth objectives. For this scenario, the City would be required to fund approximately **\$2.69B** in acquisition costs.

To fund these acquisitions and subsequent renewal and operating budget impacts, would require an overall increase to forecasted funding levels noted in Section 1.6.2.1 of approximately **\$3.10B** over the planning horizon, or an equivalent annual expenditure of **\$119.29M** to maintain current service and performance levels while accommodating growth objectives through to 2051. Figure 1-11 illustrates the additional funding required by the City to meet the OP growth objectives. Performance modeling was not completed for the growth scenarios. However, performance will be the same or likely better than the proposed level of service scenario as the proportion of new assets increases.

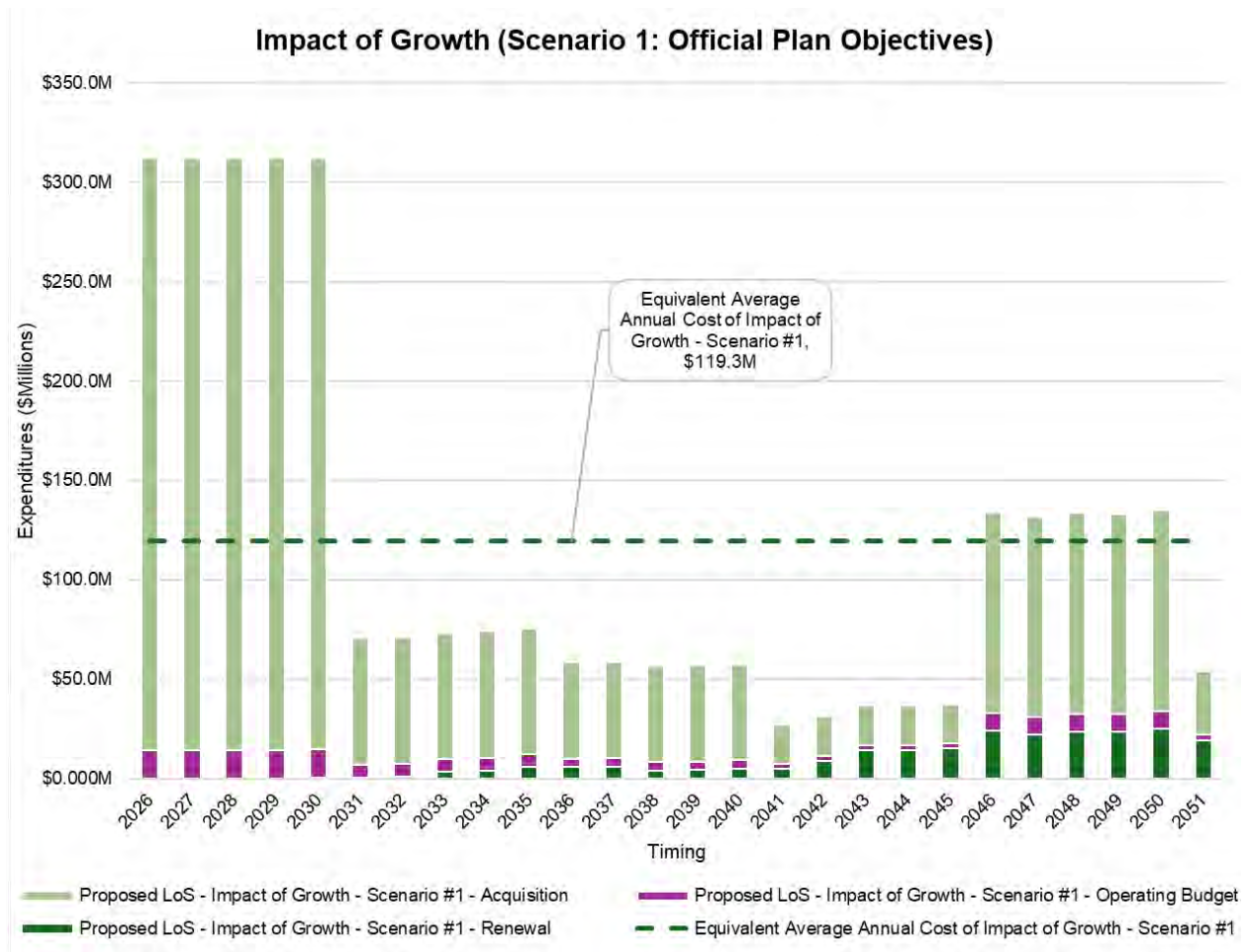


Figure 1-11: Impact of Growth (Scenario 1: Official Plan Objectives).

1.6.2.4 Proposed Levels of Service – Impact of Growth Scenario #2 (Realistic Growth Objectives)

In Growth Scenario #2 (Realistic Growth Objectives), by 2051, and based upon the modelling conducted, the City may acquire approximately **\$4.83B** worth of additional

assets in order to meet the City's intended growth objectives. For this scenario, the City would be required to fund approximately **\$1.98B** in acquisition costs.

To fund these acquisitions and subsequent renewal and operating budget impacts, would require an overall increase to forecasted funding levels noted in Section 1.6.2.1 of approximately **\$2.23B** over the planning horizon, or an equivalent annual expenditure of **\$85.93M** to maintain current service and performance levels while accommodating growth objectives through to 2051.

Figure 1-12 illustrates the additional funding required by the City to meet the realistic growth objectives. Performance modeling was not completed for the growth scenarios. However, performance will be the same or likely better than the proposed level of service scenario as the proportion of new assets increases.

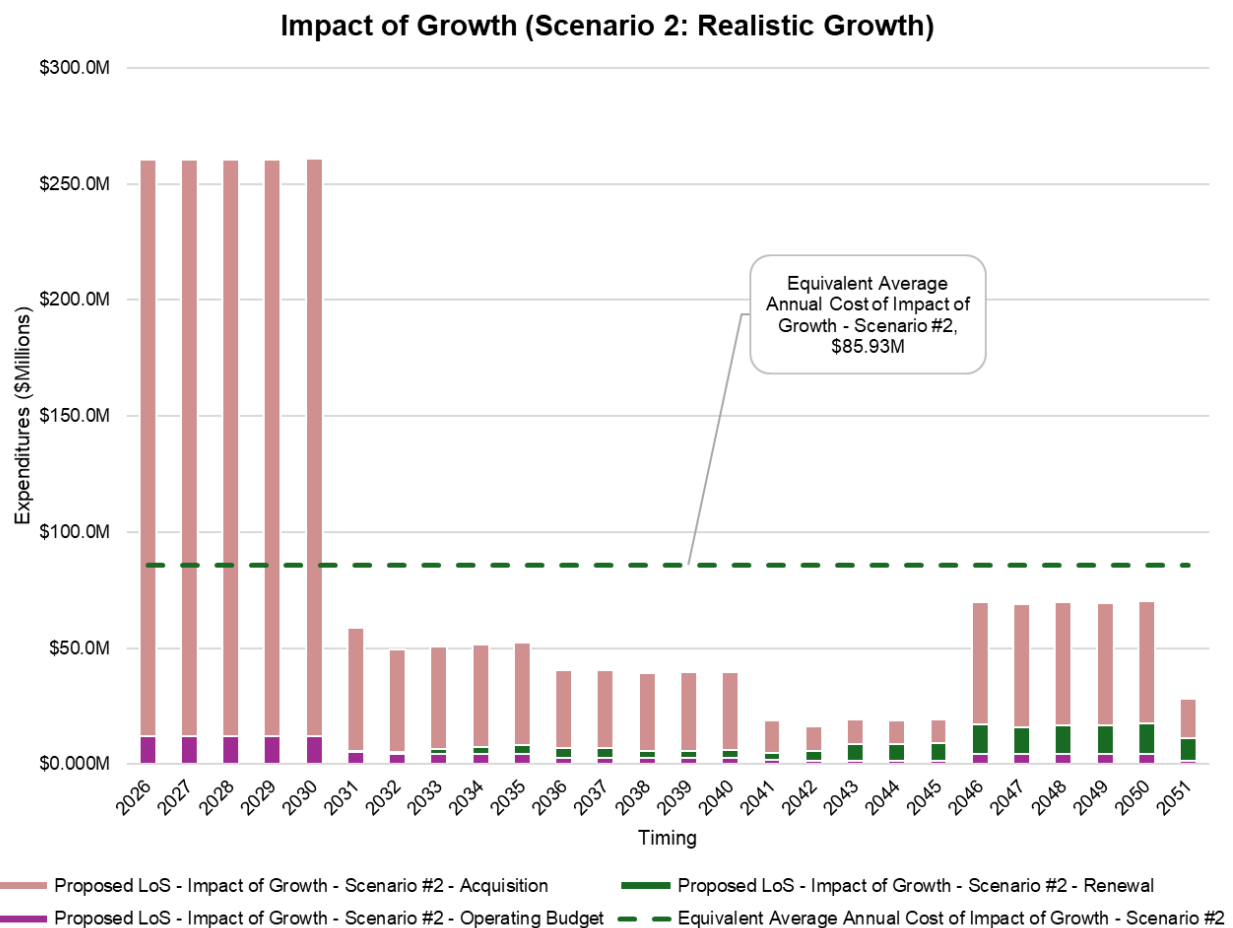


Figure 1-12: Impact of Growth (Scenario 2: Realistic Growth Objectives).

1.6.3 Financial Summary and Comparison

The City's current LoS (planned funding), proposed LoS to maintain current performance, and proposed LoS to achieve growth objectives are summarized and compared in the tables below.

Table 1-6: Current levels of service and proposed levels of service scenarios comparison and annual average infrastructure gap.

Expenditures	Current LoS - Planned Funding	Proposed LoS - Maintain Current Performance
Total Capital Expenditures (2026 to 2051)	\$2,263.8M	\$2,703.4M
Overall Funding Gap	-	\$439.6M
Equivalent Average Annual Capital Expenditures	\$87.1M	\$104.0M
Equivalent Average Annual Capital Funding Gap	-	\$16.9M
Annual Operating Expenditures	\$495.8M	\$495.8M
Annual Total Expenditures (CAPEX+OPEX)	\$582.9M	\$599.8M
Total Average Annual Funding Gap	-	\$16.9M

Table 1-7: Impact of growth scenarios comparison.

Impact	Proposed LoS - Impact of Growth (Scenario #1: Official Plan Objectives)	Proposed LoS - Impact of Growth (Scenario #2: Realistic Growth)
Total Value of Acquisitions	\$6,893.5M	\$4,830.1M
City Funded Acquisitions	\$2,686.1M	\$1,976.7M
Operating Budget	\$183.5M	\$128.6M
LC Renewals	\$232.0M	\$128.8M
Total Impact of Growth	\$3,101.6M	\$2,234.1M
Equivalent Average Annual Impact of Growth	\$119.3M	\$85.9M

Table 1-6 summarizes the total capital expenditures required for each scenario from 2026 to 2051, and the funding gaps. To achieve the proposed LoS of maintaining the current performance, an additional **\$439.6M** is required, which represents an equivalent average annual funding gap of **\$16.9M**.

Over the planning horizon (2026 to 2051), an additional **\$3,101.6M** over the planning horizon (including initial acquisition costs) may be required to accommodate for growth to achieve the Official Plan growth objectives. Under the realistic growth scenario, an additional **\$2,234.1M** over the planning horizon (including initial acquisition costs) may be required.

1.7 Improvement Plan

As part of its Asset Management program, the City has completed a detailed maturity assessment on their AM processes and practices. The maturity assessment was performed against the City's AM Framework, provided in Figure 2-1. The purpose of the maturity assessment was to identify areas to advance the City's AM System and program. The assessment framework was aligned to the Institute of Asset Management's Maturity Assessment Framework. This framework was used to assign ratings of 0 (Innocent) through 5 (Excellent) to each major AM process. The full methodology of the maturity assessment will be detailed in the City's forthcoming *Asset Management Strategy* document which is currently being developed.

Overall, the City's current state of practice when analyzed using this framework was rated ranging from "1 – Aware", to "2 – Developing". The City aspires to mature its asset management planning capabilities to a "3 – Core" rating.

The results of this assessment in conjunction with the development of this AMP were used to identify areas for improvement. The Improvement Plan of this AMP summarizes the key activities and initiatives for the City to undertake to continually improve the City's asset management system and future iterations of the AMP.

The City has identified draft improvement themes that will increase the maturity of its AM system, and by extension, better integrate and improve the practice of asset management in Markham, as well as its reporting outputs through future iterations of this AMP. The following themes have emerged:

- Defining and evaluating asset management governance, roles and responsibilities
- Consistent and formalized standards, processes and procedures
- Improved data and information
- Formalized resource planning
- Improved demand/ growth analysis
- Stakeholder engagement
- Implement/develop supporting systems, tools and integrations (ex. decision support systems)

As the City undertakes and completes these initiatives, the overall maturity of the AM System will improve and the confidence of the AM analyses that support this AMP will increase.

Part of the City's AM program is to adopt a culture of continual improvement to ensure that AM planning processes are reviewed regularly to evolve as needed to suit the City's changing landscape, as well as improve the confidence in the AM analyses that support this AMP and future AMPs. The City's improvement plan is a significant step forward in adopting this culture.

1.8 Closing Remarks

The City of Markham is a relatively young municipality, evidenced by Figure 1-4 which illustrates that the majority of its assets have been constructed/acquired since the 1970s. As a young municipality, the majority of the City's asset portfolio on average is within the early stages of its service life (refer to Figure 1-3). Overall, the City's infrastructure is in a "Good" performance state (Figure 1-5), which is a reflection not only of the fact that the City is relatively young, but also that the City has been successful in managing its assets to ensure that they are fit for service and providing value to the community.

The City has a robust, annual lifecycle planning process, which has been put in place to assist the City in taking a proactive approach to planning for and managing its state of infrastructure well into the future. The resulting asset performance noted in this document is a reflection of the success of this process.

Although the City has some assets in a poor and very poor performance state, it is important to note that this does not necessarily mean that assets are not fit for service. Through condition assessments and other asset monitoring exercises, the City identifies if any needs are required to ensure that these assets can remain in service. As assets near the end of their life, and enter poor or very poor performance states, the frequency of monitoring and maintenance may increase compared to assets that are near the beginning of their life or are in very good or good performance states. This is a normal practice that occurs in all municipalities.

The City always operates in a manner to ensure that services are provided safely by managing and maintaining its poor/very poor performance assets. City staff pay close attention to assets that have poor/very poor performance states and/or are high risk, to ensure that they implement appropriate initiatives to protect the safety of the public, meet legislative compliance and address any other matters of concern.

Note that within this AMP, assets have been included that are considered consumables, which have a short service life where information was available. The City's Asset Management program can assist the City in understanding how to manage these assets

by developing processes and data to better-understand consumable asset risk and ensuring that the City's investments minimize risks and maximize levels of service.

The forecasting exercise completed in this AMP provides the City with an estimate of financial needs over the next 26-years. Note that the forecast is based on a modelling exercise that is underpinned by assumptions and asset information that is subject to change and represents the best information available as of it's reporting to Markham's General Committee on June 17, 2025. As the City continues to refine the information that supports this AMP during annual resource and budget planning processes the fidelity of the models will improve.

As part of the closing remarks this AMP reiterates the following points:

- The City pays close attention to, and implements initiatives as part of, normal business to ensure assets are safe, meeting legislative compliance, etc.
- The forecasts are based on a modelling exercise underpinned by assumptions and information subject to change and refinement as part of the annual resource / budget planning process.
- As part of the future updates to the 2025 AMP and continuous improvement efforts, there will be an opportunity to review and refine assumptions, estimates, etc.

A key piece of this AMP is the Improvement Plan. It sets up a series of actions for the City's AM program to mature and provide better data/analyses to support better decision-making. Through continual improvement initiatives, including future iteratives of this AMP, the City has an opportunity to revise and refine the information and assumptions that underpin this AMP.

Furthermore, this AMP represents a significant step forward in the City's AM journey. It has introduced key asset management analyses that support better decision-making. Particularly, the City has enacted a framework to record and monitor levels of service, which is paired with performance and financial forecasts. The City will continue to monitor its levels of service against its spending, to better understand how services are being delivered, and how assets are being managed. Asset management is a journey, and the processes and data that it provides will ensure the City continues to keep a proactive approach to providing services to the community.

2 Introduction

The City of Markham (the City) is a municipality located in the Region of York (the Region), adjacent to Toronto's northern border, part of the Greater Toronto Area (GTA), and has a land area of approximately 212 square kilometres. Markham is located in the south of the Region and shares borders with five (5) other municipalities: the City of Richmond Hill; the Town of Whitchurch-Stouffville; the City of Vaughan; the City of Pickering; and the City of Toronto. In 2024, population and employment are estimated to be 363,549 and 184,645 respectively.

Due to its proximity to Toronto, Markham has experienced significant development over the last several decades. As a result, Markham's population has grown substantially, particularly after the opening of Highway 404 in the mid-1970s. The City is projected to grow to approximately 610,500 residents and host 301,600 jobs by 2051.

The June 2015 [House of Commons Report of the Standing Committee on Transport, Infrastructure and Communities; Updating Infrastructure in Canada: An Examination of Needs and Investments](#) notes that across Canada, the municipal share of public infrastructure has increased from 22% in 1955 to nearly 60% in 2013. The federal government's share of critical infrastructure stock, including roads, water and wastewater, has declined by nearly 80% in value since 1963. Ontario's municipalities own and manage more infrastructure assets in the province than both the provincial and federal governments combined.³

As a result of this growth, and as part of its planning practices, the City has taken a proactive approach to asset management planning. Asset management planning assists the City in understanding the ways in which it should maintain its infrastructure, with the objective of delivering high quality services to the community.

The City first formally documented some of its asset management planning practices as part of its original Asset Management Plan (AMP) – developed in 2016. The development of this AMP was driven by the 2014 renewal of the Municipal Funding Agreement. As part of this renewal, municipalities were mandated to create an AMP by December 31, 2016 to be eligible for Canada Community Building Funds.

In January of 2018, Ontario Regulation 588/17 (O.Reg. 588/17): Asset Management Planning for Municipal Infrastructure came into effect. The regulation sets out requirements for municipal asset management planning to help municipalities better understand their infrastructure needs and inform infrastructure planning and investment decisions. This regulation offered the City another opportunity to continue developing its

³ House of Commons Report of the Standing Committee on Transport, Infrastructure and Communities, [Updating Infrastructure in Canada: An Examination of Needs and Investments](#)

asset management practices through the advancement of its asset management program and further documentation of AM practices in a series of AMPs. In 2021, the City prepared an AMP in compliance with O. Reg. 588/17, which exceeded the minimum scope requirements of the regulation by including additional asset classes over and above what was mandated.

The last major milestone of O. Reg. 588/17 includes the development of an AMP that includes both core and non-core asset groups and reports on the funding required to provide the City's PLoS. The AMP is an output of several AM processes as well as a guiding document for service delivery and continual improvement for the AM Program. Relevant documents that support the Asset Management Program include the following, which can be made available upon request.

- City of Markham Strategic Plan
- City of Markham Official Plan and Secondary Plans
- City of Markham Asset Management Policy
- City of Markham Asset Management Plan
- Integrated Leisure Master Plan
- Digital Markham Strategy
- Greenprint, Markham's Community Sustainability Plan
- Library Strategic Plan
- Active Transportation Master Plan
- Pathways and Trails Master Plan
- Corporate Energy Management Plan
- Municipal Energy Plan
- Region of York Transportation, Water and Wastewater Master Plans
- Region of York Official Plan

Figure 2-1 below is the City's asset management framework. It provides a visual representation of the various processes and activities within the City that make up all of its Asset Management practices. Note that it details the cyclical processes that form part of service delivery at the City, illustrating the feedback loop wherein the outputs of service delivery feed into the business drivers that drive further planning work.

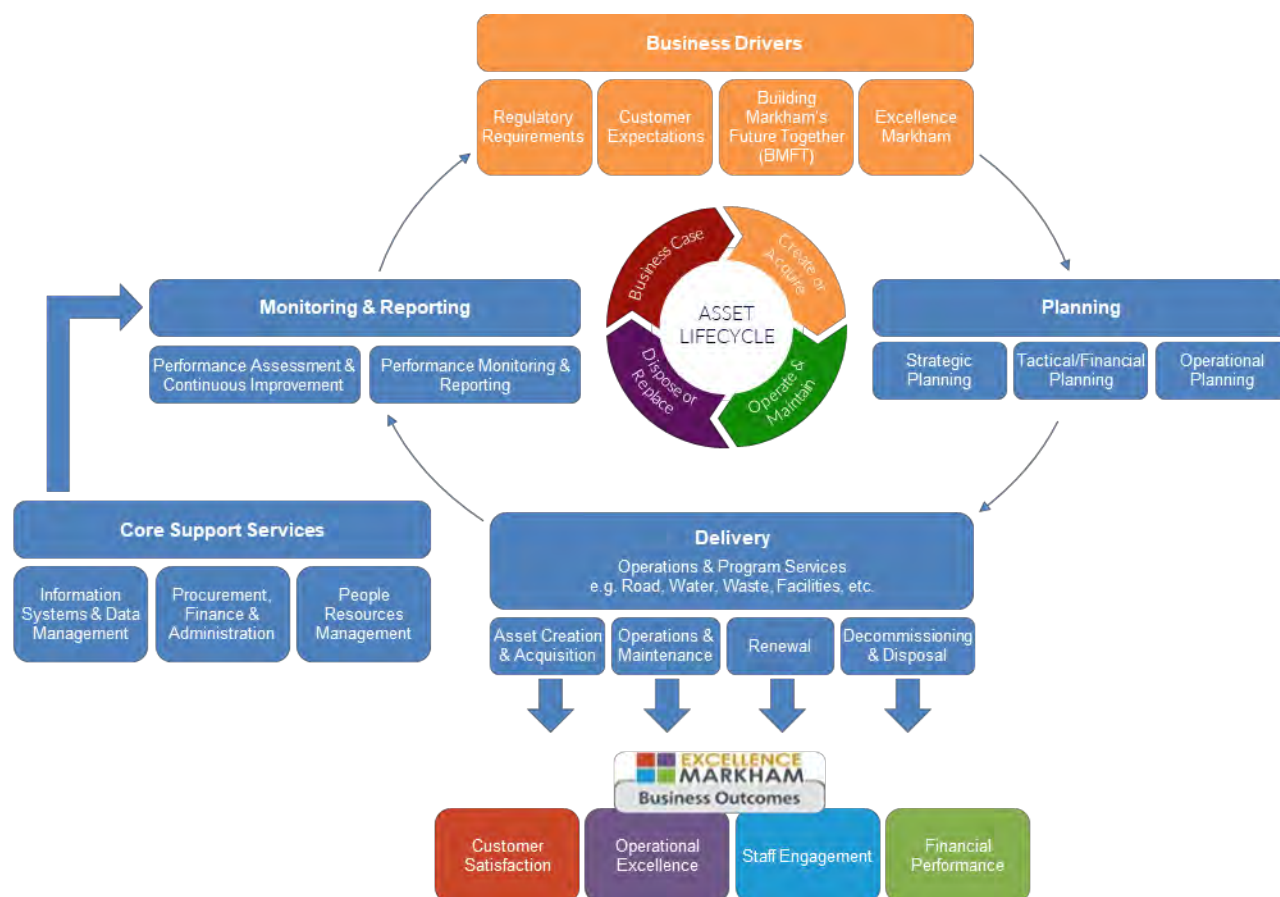


Figure 2-1: The City of Markham's Asset Management Framework.

2.1 Objectives

The City of Markham is actively working to improve its Asset Management (AM) Program through various initiatives. By maturing the AM Program, the City will continue making data driven decisions in order to meet its strategic goals and deliver services in a responsible and sustainable manner which support the livelihood of its residents, attracts businesses, and maintains the vibrancy of the City.

One such initiative is this Asset Management Plan (AMP), which has been developed in compliance with O.Reg.588/17 and in alignment with the City's 2020-2026 Strategic Plan.

This AMP was developed in alignment with the organizational objectives outlined in the City's Strategic Plan, the current LoS being provided, and the asset management activities and processes currently performed to provide the intended LoS to the community.

2.2 Purpose

Asset management (AM) is the coordinated effort of the City of Markham to realize value from its assets in the form of the services they provide. It includes an integrated set of business processes that support decision making regarding acquiring, operating, maintaining, renewing, replacing, and disposing of infrastructure assets. It is an ongoing practice that is not limited to individual studies or reports. It is a way of doing business that provides the means through which the City's high-level strategic goals relate to the day-to-day activities of staff. The AMP helps guide the next step in the City's asset management journey to further develop and mature the City's AM program.

The purpose of this AMP is to:

- Meet the requirements of O. Reg. 588/17.
- Support the line of sight between the organization's strategic objectives, Council approved plans and initiatives, and asset investment needs.
- Report on and understand the current state of the City's assets.
- Document the City's current LoS, proposed LoS, and related performance measures.
- Document lifecycle management strategies that the City applies to assets to maintain service levels and achieve PLoS.
- Determine the funding required for the City to undertake lifecycle management strategies, sustain current levels of service, and achieve PLoS.
- Determine any funding shortfalls between planned spending and required funding.
- Provide recommendations to meet future O. Reg. 588/17 requirements and to continually improve the City's asset management processes.

2.3 Scope

The assets included within the scope of this AMP are illustrated in Figure 2-2. The assets are organized into an asset hierarchy that details the relationship between the assets and the services that they support. The following figure details the services that the City provides and their associated assets. Detailed asset hierarchies are provided in **Appendices A to K**.

To complete the analyses that are reported in this AMP, the City utilized its asset inventory data that was current to year-end 2024.



Figure 2-2: Asset hierarchy of in-scope assets.

2.4 Planning Horizon

This AMP covers a planning horizon of 26 years ending in 2051. This horizon aligns with the City's Official Plan. Note that the requirements of O. Reg. 588/17 require asset management plans to cover a 10-year time horizon. This AMP looks beyond the minimums specified by the regulation.

O. Reg 588/17 requires municipalities to prepare an AMP at least once every five (5) years following the completion this AMP. As part of the City's asset management approach, the City endeavors to review its AM practices on a more regular basis to continually assess appropriate levels of service and integrate improved condition assessment strategies so the AMP can be used to support long-term planning.

It should also be noted that the anticipated growth in population and employment for the City has been summarized in Section 4, from 2021 to 2051, as established in the Region of York's Official Plan. However, the Current LoS – Planned Funding, Proposed LoS – Maintain Current Performance, and Proposed LoS – Impact of Growth scenarios each cover the 26-year planning horizon as mentioned above, from 2026 to 2051. The annual funding required for each scenario was determined through to 2051.

The Markham Official Plan, 2014 (the "Official Plan") was adopted by Markham Council on December 10, 2013, and modified and approved by York Region on June 12, 2014. Since that time, York Region has updated their Official Plan, which aligns population and employment projections, and a planning horizon to 2051, with objectives outlined by the Province of Ontario. The City is updating the Markham Official Plan, 2014, starting in 2025.

Figure 2-3 and Table 2-1 show the areas and years of where growth in population and employment is anticipated.

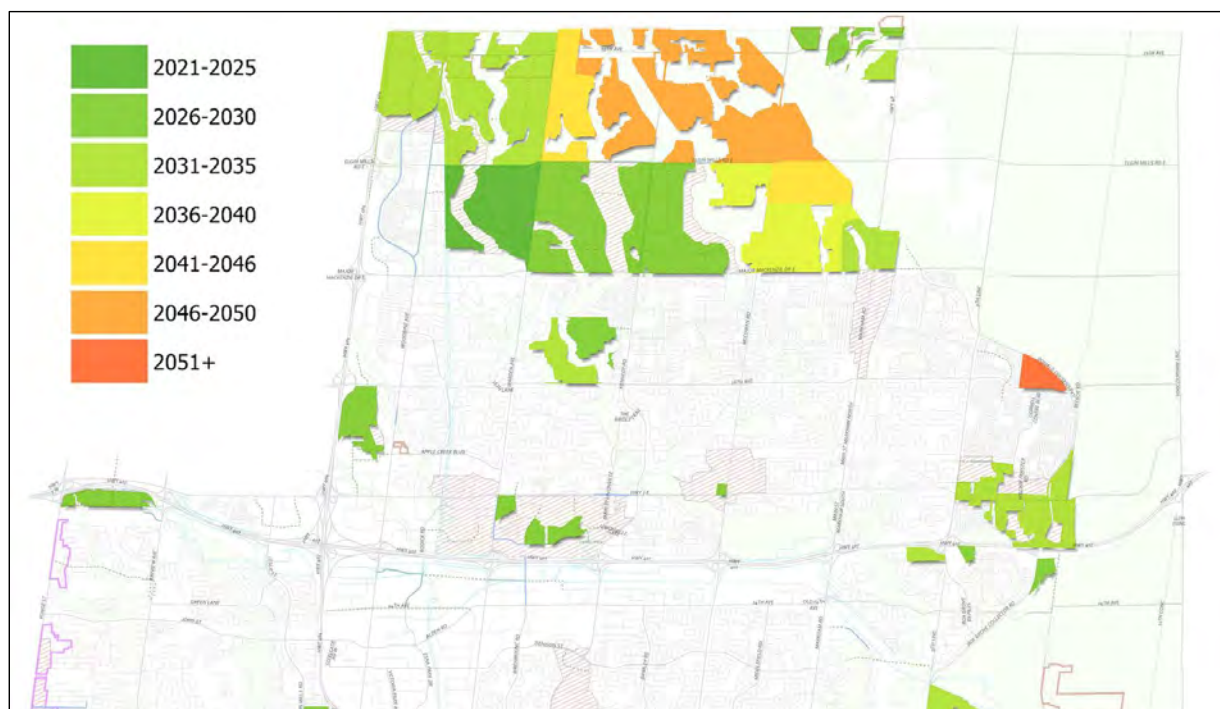


Figure 2-3: Areas of anticipated population and employment growth.

Table 2-1: Official Plan population and employment objectives.

Sum of Area (ha)	2021-2025	2026-2030	2031-2035	2036-2040	2041-2045	2046-2050	2051+
Employment	193,200	208,600	224,000	243,000	262,000	281,850	301,700
Employment Area Subtotal	n/a	83.29	529.73	n/a	143.67	n/a	n/a
2014 OP	n/a	83.29	529.73	n/a	n/a	n/a	n/a
2022 YROP	n/a	n/a	n/a	n/a	143.67	n/a	n/a
Population	351,800	383,950	416,100	460,300	504,500	556,500	608,500
Urban Area Subtotal	214.6	682.61	336.9	257.67	106.41	539.15	34.41
2014 OP	214.6	631.26	241.93	n/a	n/a	n/a	34.41
2022 YROP	n/a	51.35	94.97	257.67	106.41	539.15	n/a

The York Region Official Plan 2022 has identified additional lands for employment and urban development. The differences in employment, employment areas, population, and population areas are shown in Table 2-1.

2.5 AMP Overview

The AMP is structured to provide consistency and ease of understanding for readers. The structure and content within this AMP are influenced by several guidelines and best practices, including:

- Province of Ontario Guide: Building Together – Guide for Municipal Asset Management Plans,
- Institute of Public Works Engineering Australia (IPWEA) guidelines and resources, and,
- Institute of Asset Management (IAM) guidelines.

All of these resources and guidelines are in alignment with the International Organization for Standardization (ISO) 55000 series of standards pertaining to asset management.

Sections 5 to 9 provide the overall State of the Infrastructure (SOTI) analysis, levels of service (LoS), risk management strategies, lifecycle management strategies, lifecycle forecasting, and financial strategy for the City as a whole.

Appendices A to K provide the SOTI analysis, LoS, risk management strategies, lifecycle management strategies, and lifecycle forecasting for each individual service area, further broken down by specific asset classes.

2.6 What's new in the 2025 AMP?

This AMP retains the same service area structure as the 2024 Plan; however, it reflects several key updates and enhancements. These include refinements to the asset data and information previously used, as well as the integration of Proposed Levels of Service (PLOS). The specific changes are detailed below.

2.6.1 Ontario Regulation 588/17 Requirements

The 2024 and 2025 AMPs were developed in compliance with O. Reg. 588/17. Table 2-2 summarizes the main differences and similarities between the 2024 and 2025 requirements. The 2024 Plan required the same information previously reported on for Core assets due in 2022. The 2025 Plan was required to be completed for all assets.

Table 2-2: Ontario Regulation 588/17 requirements for asset management plans.

2024 Requirements	2025 Requirements
Non-core assets	All assets
Document current levels of service (CLOs)	Document proposed levels of service and explain why the proposed levels of service (PLOS) are appropriate, including: • Lifecycle activities that are required to achieve them • How are the PLOS different from the CLOS? • Can the City afford the PLOS? • Are the PLOS achievable? • Were the PLOS developed to support the City in achieving their long-term sustainability goals?
Report on current performance	Report on proposed performance
Provide cost to maintain CLOS over 10-years	Provide cost to maintain CLOS over 10-years
Forecast asset performance based on the City's anticipated budget	• Provide an estimate of the annual funding projected to be available • How will the City manage the risks if PLOS cannot be achieved?

2.6.2 Asset Inventories and State of the Infrastructure

Table 2-3 summarizes the changes in the reported asset condition and asset valuations between 2024 and 2025. In general, there have been minor changes to the City's overall asset portfolio. The changes are due to updates to the asset inventory, where new assets have been added to the inventory, decommissioned assets have been removed, and replacement values have been updated.

In addition, there are changes to the overall condition of some service areas. This may be due to assets continually degrading, renewal projects that have taken place, and updates to asset condition upon further investigation/assessment.

Table 2-3: 2024 and 2025 asset condition and replacement value comparison by service area.

Service	2024 Performance	2025 Performance	2024 Replacement Value	2025 Replacement Value
Arts & Culture	Good	Good	\$94,377,864	\$94,377,864
Fire & Emergency Service	Good	Good	\$83,236,115	\$83,142,350
General Support Service – Facilities	Good	Good	\$238,407,707	\$238,407,707
General Support Service – Fleet	Poor	Fair	\$27,348,548	\$34,828,925
General Support Service – Information Technology	Fair	Fair	\$7,864,811	\$7,545,401
Library	Very Good	Fair	\$51,575,488	\$51,127,662
Natural Assets	Good	Good	\$169,493,517	\$169,454,706
Parks	Fair	Good	\$105,739,510	\$105,627,813
Potable Water	Fair	Fair	\$1,926,246,695	\$1,926,246,696
Recreation	Very Good	Very Good	\$988,375,721	\$988,375,721
Solid Waste Management	Good	Very Good	\$1,887,449	\$1,898,272
Stormwater Management	Good	Good	\$3,229,302,838	\$3,229,302,838
Transportation	Good	Good	\$7,902,969,362	\$7,902,969,368
Wastewater	Good	Good	\$2,671,112,637	\$2,671,112,637
Total	Good	Good	\$17,497,938,261	\$17,504,417,959

The overall performance for libraries, parks, potable water, and solid waste management assets has changed from the 2024 AMP. The performance for library assets has declined from very good to fair as the asset inventory data, specifically for library collections, has been updated with their performance evaluation based upon age and estimated service life. Age and estimated service life methodology is typically used as a proxy in the absence of actual physical condition ratings, of which were not available at the time of this AMP's development. The performance of parks, potable

water, and solid waste management assets has improved due to recently completed renewals and the updating of age, estimated service life, and physical condition ratings.

2.6.3 Levels of Service

This AMP requires the City to establish PLoS, and determine the costs required to achieve those PLoS, while the regulation required the 2024 AMP to report on the costs required to **maintain current levels of service**.

Through the 2024 AMP, LoS frameworks were developed for each service area. These LoS frameworks included sets of customer values, customer performance metrics, and technical performance metrics that were used to determine the current levels of service (CLoS). In this AMP, the same LoS frameworks have been applied and the current performances for each metric have been updated. Recommended (proposed) performances have also been established and documented within the technical LoS.

The recommended performance represents the target considered by the City to achieve over the planning horizon. These proposed performance targets were established through discussions with key stakeholders from each service area, customer expectations, asset performance, current backlog, the City's available resources, affordability, and achievability.

3 Alignment with Organization Goals

3.1 Asset Management Policy

In 2019, the City established their AM Policy documenting their commitment to practice sound asset management principles and practices to meet strategic goals and objectives. The City aims to deliver services in a socially, economically and environmentally responsible manner. The City is in the process of updating the policy as part of its requirements to update the document every 5-years under O.Reg. 588/17.

By practicing asset management, the City hopes that customers are confident in how the City manages assets, that assets are considered across all related services, that asset risk is considered when prioritizing projects, that lifecycle costs and risks are reduced while providing services at appropriate levels of service, and that decisions made today will put the City in a position for assets to meet future challenges.

The City's AM Policy identifies the objectives and goals of the AM Program to guide AM at the City. These include:

- 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 the 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

3.2 2020 – 2026 Strategic Plan

Building Markham's Future Together is the City of Markham's 2020-2026 Strategic Plan. The Strategic Plan was approved on May 1, 2024 following months of consultation with Members of Council, Markham staff, community and business stakeholders and the general public. The Strategic Plan is the blueprint for how City Council and Senior Staff will make thoughtful decisions about the City's future to ensure its success.

In 2019 and 2023, the City conducted community engagement with residents, businesses, and community stakeholders. There were over 2,000 survey responses which informed the strategic priorities established by the City. This resulted in the 2020-2023 Strategic Plan and the revised 2020-2026 Strategic Plan. The Strategic Plan focuses on four goals:

- **Goal 1 - Exceptional Services by Exceptional People:** We embrace a bold and innovative culture that empowers and inspires excellent services within a collaborative and healthy work environment.

- **Goal 2 - Engaged, Diverse, Thriving & Vibrant City:** We are an inclusive city, engaging everyone in building a livable, caring and culturally vibrant community while respecting our past. We enable a strong economy; we proactively work to attract investment in our community; and we effectively manage change to meet future needs.
- **Goal 3 - Safe, Sustainable & Complete Community:** We strive to achieve complete communities with an excellent quality of life. We ensure community safety and enhance the natural environment and built form through sustainable integrated planning, infrastructure management, and services.
- **Goal 4 - Stewardship of Money & Resources:** We demonstrate exceptional leadership using sound, transparent and responsible fiscal & resource management, and policy development to mitigate risks while enabling efficient and effective service delivery.

The Strategic Plan outlines the actions the City will undertake to achieve each goal. These include holding more community events, implementing strategies and master plans, the implementation of new technology, and many more. The City has also documented a number of metrics to report against (e.g., overall customer satisfaction (internal and external services) taken from Department Surveys completed each year) for each goal so the City can measure their success.

This AMP was developed using a service-centric approach, and by doing so it aligns asset management to service delivery, which in turn is connected to the City's Strategic Plan. All the frameworks and strategies that have been put in place to support this AMP have been completed in alignment with the Strategic Plan.

3.3 2024 Citizen Survey

In 2024 a citizen survey was conducted. This survey asked questions focused on satisfaction with living in Markham and service delivery. The survey had the following parameters:

- Telephone survey
- Random sample of 300 residents, weighted to ensure representation.
- Identical questionnaire used in 2022 and 2024
- Current survey results update 2022 results
- Survey conducted July 30 to August 22, 2024
- Margin of error +/- 5.7%, 19 times out of 20
- Survey conducted in English

The survey questions were focused on the following themes:

- Satisfaction with life in Markham
- Cleanliness
- How Markham supports various demographics
- Accessibility of services and facilities
- Supporting the physical and mental well-being of citizens through services, outdoor areas, programs, and events
- Service delivery
- Climate change
- How the City communicates with citizens and addresses concerns
- Cost of living
- Safety

Overall, attitudes and satisfaction levels have not changed significantly since 2022. The following summarizes the results from the 2024 survey:

- Satisfaction with life in Markham is high, both generally and with specific services and programs
- Nine in ten strongly (57%) or somewhat (36%) agree that they are satisfied with life in Markham.
- The City gets high marks on:
 - o Cleanliness
 - o Accessibility and Diversity
 - o Culture, library and recreation
 - o Parks and green spaces
 - o Protecting heritage
- As in 2022, there are some areas where majorities are still satisfied but with less enthusiasm (lower strongly held positivity):
 - o Services: communicating, delivering, representing good value
 - o Planning development of livable communities
 - o Tackling climate change
 - o Interacting with the City of Markham

- Areas worth monitoring where results are more concerning:
 - o A comparably high level of dissatisfaction
 - Markham's efforts to bring affordable and rental housing to the City
 - o A significant decline since 2022 in strongly held satisfaction:
 - Great place for both residents and businesses (down 14 points)
 - Markham is a safe city (down 12 points)
 - o Roads in good condition (down 10 points)
- There is enthusiasm about life in Markham
- Attitudes are generally positive with respect to many services and programs

As the City continues to grow and expand service delivery while providing appropriate LoS to the existing population, it is important that feedback from citizens is collected to understand the changing needs of the citizens and that the City is growing in a sustainable way. The City should continue to track levels of satisfaction with life in Markham and incorporate survey results into asset management processes.

3.4 Ontario Regulation 588/17

In January of 2018, Ontario Regulation 588/17: Asset Management Planning for Municipal Infrastructure came into effect. The regulation sets out requirements for municipal asset management planning to help municipalities better understand their infrastructure needs and inform infrastructure planning and investment decisions.

The regulation will be phased in over a total of six years; and, in 2025, will culminate in the development of an AMP that addresses the investment needs for all infrastructure assets owned by the City. Key legislative deadlines for all Ontario municipalities are provided in Table 3-1 below.

Table 3-1: O. Reg. 588/17 milestones and timelines.

Date	Milestone	City Status
July 1, 2019	Prepare and publish a strategic asset management policy.	Complete
July 1, 2022	Develop an Asset Management Plan that details the cost to maintain current service levels for core infrastructure assets.	Complete
July 1, 2024	Develop an Asset Management Plan that details the cost to maintain current service levels for all other assets (i.e. non-core Assets).	Complete

Date	Milestone	City Status
July 1, 2025	Expand the City's 2024 AMP to provide further details on all infrastructure assets, including proposed levels of service and the revenue and expenditure plan to achieve them.	Completed herein

This AMP has been developed in line with the requirements of O. Reg. 588/17 and meets the requirements for the July 1, 2025, milestone. This AMP addresses these requirements as follows:

- i. It applies to all assets (including those that are defined as “core assets” in O. Reg. 588/17).
- ii. It details the current and target performances for Community and Technical LoS specified in O. Reg. 588/17 (for core assets).
- iii. It details current and target performances for the Community and Technical LoS established by the City (for all assets).
- iv. It includes a summary of replacement costs, average age, and performance (age or physical condition based) of all assets.
- v. It includes a description of the City's approach to assessing the condition of assets.
- vi. It includes a description of the lifecycle activities that need to be undertaken to maintain current LoS and achieve PLoS, as well as noting any risks in the delivery of services as appropriate.
- vii. It includes population and employment forecasts as set out in the Region of York's 2022 Official Plan.
- viii. It includes the estimated capital expenditures and operating costs related to the lifecycle activities required to maintain current LoS, achieve PLoS, and accommodate growth.
- ix. It applies a 26-year horizon to these activities and projections (the regulation requires a 10-year horizon).
- x. It is supported by the best available data at the City from within the last two calendar years (data has been collated as of year-end 2024).
- xi. It will be made available to the public via the City's website.

3.5 Legislative Requirements

There are many legislative requirements relating to the management of assets. Legislative requirements that impact the delivery of the services are outlined in Table 3-2.

Table 3-2: Other legislative requirements.

Legislation	Requirement
Municipal Act, 2001	Municipalities are created by the Province of Ontario to be responsible and accountable governments with respect to matters within their jurisdiction and each municipality is given powers and duties under this Act and many other Acts for the purpose of providing good government with respect to those matters. The powers of a municipality under this or any other Act shall be interpreted broadly so as to confer broad authority on the municipality to enable the municipality to govern its affairs as it considers appropriate and to enhance the municipality's ability to respond to municipal issues. A lower-tier municipality and an upper-tier municipality may pass by-laws, subject to the rules set out in subsection (4), respecting the following matters: Governance structure of the municipality and its local boards. Accountability and transparency of the municipality and its operations and of its local boards and their operations. Financial management of the municipality and its local boards. Public assets of the municipality acquired for the purpose of exercising its authority under this or any other Act. Economic, social and environmental well-being of the municipality, including respecting climate change. Health, safety and well-being of persons. Services and things that the municipality is authorized to provide under subsection (1). Protection of persons and property, including consumer protection. 2006, c.32, Sched. A, s.8; 2017, c.10, Sched.1, s.2.

Legislation	Requirement
Planning Act, R.S.O. 1990, c. P.13	The purposes of this Act are: (a) to promote sustainable economic development in a healthy natural environment within the policy and by the means provided under this Act; (b) to provide for a land use planning system led by provincial policy, (c) to integrate matters of provincial interest in provincial and municipal planning decisions, (d) to provide for planning processes that are fair by making them open, accessible, timely and efficient, (e) to encourage co-operation and co-ordination among various interests, (f) to recognize the decision-making authority and accountability of municipal councils in planning.
Infrastructure for Jobs and Prosperity Act, 2015, and Ontario Regulation 588/17: Asset Management Planning for Municipal Infrastructure	The purpose of this Act is to establish mechanisms to encourage principled, evidence-based and strategic long-term infrastructure planning that supports job creation and training opportunities, economic growth and protection of the environment, and incorporate design excellence into infrastructure planning. Furthermore, to provide a framework for the development and implementation of the City's Corporate Asset Management Program. It is intended to guide the consistent use of asset management practices across the organization, to facilitate logical and evidence-based decision-making for the management of municipal infrastructure assets and to support the delivery of sustainable community services now and in the future. By using sound asset management practices, the City will work to ensure that all municipal infrastructure assets meet expected performance levels and continue to provide desired service levels in the most efficient and effective manner. Linking service outcomes to infrastructure investment decisions will assist the Town in focusing on service, rather than budget driven asset management approaches.
Ontario Regulation 239/02: Minimum Maintenance Standards for Municipal Highways	The purpose of this Regulation is to clarify the scope of the statutory defence available to a municipality under clause 44 (3) (c) of the Act by establishing maintenance standards which are non-prescriptive as to the methods or materials to be used in complying with the standards but instead describe a desired outcome by setting out the minimum standards of repair for highways under municipal jurisdiction.
Development Charges Act, 1997, S.O. 1997, c. 27	The council of a municipality may by by-law, impose development charges against land to pay for increased capital costs required because of increased needs for services arising from development of the area to which the by-law applies.

Legislation	Requirement
Ontario Regulations 104/97, 160/02 and 472/10: Standards for Bridges	These regulations clarify the procedures and standards that must be adhered to when designing, inspecting and maintaining the integrity of municipal structures in Ontario. It specifies the requirements and standards for bridge designs, evaluation, construction and rehabilitations. It also mandates the structural integrity, safety and condition of every bridge must be determined by at least one inspection every second calendar year, under the direction of a professional engineer and in accordance with the Ontario Structure Inspection Manual (OSIM).
Safe Drinking Water Act, 2002, S.O. 2002, c. 32, Ontario Regulation 163/03: Ontario Drinking Water Quality Standards and Ontario Regulation 170/03: Drinking Water Systems	The purposes of this Act are to recognize that the people of Ontario are entitled to expect their drinking water to be safe and to provide for the protection of human health and the prevention of drinking water health hazards through the control and regulation of drinking water systems and drinking water testing.
Ontario Water Resources Act, R.S.O. 1990, c. O.40	The purpose of this Act is to provide for the conservation, protection and management of Ontario's waters and for their efficient and sustainable use, in order to promote Ontario's long-term environmental, social and economic well-being.

Notably, Ontario Regulation 588/17 has mandated specific levels of service that apply to core assets. These are provided within the Appendices for each applicable service area.

3.6 Climate Change Adaptation

O. Reg. 588/17 requires municipalities to state how they will consider climate change in their Asset Management Policy. The City's 2021 AMP recognized that future iterations of the AMP should consider climate change through the asset management strategies. The City currently undertakes climate change adaptation and mitigation initiatives, and it is important that these current initiatives are recognized and considered, and that the City continues to forecast initiatives that will be needed in the future to adapt its infrastructure to become more resilient to the effects climate change. Adapting infrastructure proactively will result in less funding required in overall operations and maintenance, rehabilitations, and renewals of assets.

3.6.1 Costing, Climate Change Impacts to Public Infrastructure Report

In 2023, the Financial Accountability Officer (FAO) published a report analyzing the cost impacts of climate change on Ontario's provincial and municipal infrastructure. This report was developed through the FAO's *Costing Climate Change Impacts to Public Infrastructure* (CIPI) project. Through the CIPI project, \$708 billion of public

infrastructure was analyzed. This included buildings and facilities, transportation infrastructure, and linear storm and wastewater infrastructure.

It is predicted that the province will experience more frequent and intense extreme rainfall and extreme heat, and fewer freeze-thaw cycles. These climate hazards will impact the infrastructure by accelerating asset deterioration, resulting in the need for higher capital investments, more frequent rehabilitations, earlier asset renewals, and more operations and maintenance activities.

Three strategies were explored in the CIPI project:

- No adaptations;
- Reactive adaptation: assumes that assets are adapted when replaced at the end of their useful lives; and
- Proactive Adaptation: assumes asset stewards will adapt infrastructure either during an assets' next major rehabilitation or upcoming renewal.

The CIPI report concluded that the following additional funding would be required annually to maintain Ontario's public infrastructure:

- **No Adaptations:** \$4.1 billion per year on average.
- **Reactive Adaptation:** \$3.5 billion per year on average.
- **Proactive Adaptation:** \$3.0 billion per year on average.

The proactive adaptation strategy results in the lowest additional required funding per year and adapts almost all public infrastructure by 2050. The reactive adaptation strategy leaves most of Ontario's public infrastructure vulnerable to climate risk through to the mid-2060s. Adapting infrastructure can reduce the risk of climate-related infrastructure service disruption.

3.6.2 The City's Climate Change Initiatives

The City has been undertaking a variety of climate change initiatives, such as policies and plans to support the mitigation and adaptation of climate change, achieving \$2M in utility savings and \$1.6M in revenue, and is recognized for its leadership in sustainability, energy, and climate action through receiving over a dozen rewards. The City recognizes the urgency of climate change and is committed to implementing and completing climate change mitigation and adaptation initiatives.

The City's current climate change initiatives include:

- Net Zero Facility Program;
- Erosion site inspections;
- Condition inspections of suspended watermains;

- LEED Silver certification for new buildings;
- Installing LED fixtures for streetlights;
- The 30-year city-wide Flood Control Program to improve storm drainage and limit surface and basement flooding risks in urban areas;
- Using solar and geo-thermal energy sources and building automation;
- The development of a community-scale distributed geothermal energy system for heating, cooling and domestic hot water in the Berczy-Glen neighbourhood; and
- Planting new trees to reach a target of 30% tree canopy.

The City's climate change mitigation goals are laid out in the following documents:

- **Building Markham's Future Together (BMFT):** ensure business continuity of our services and infrastructure, and enable community resilience and safety.
- **The Greenprint: Markham's Community Sustainability Plan:** a 50- to 100-year plan for the City to achieve an environmentally, economically, socially and culturally vibrant community. This plan documents a total of 12 sustainability priorities and 23 objectives that the community will work towards to meet its vision of sustainability. These objectives include creating a culture of walking, cycling, and transit usage, reaching 30% tree canopy and vegetation coverage city-wide, achieving net-zero energy, water, waste, and emissions by 2050, and more.
- **Municipal Energy Plan:** targets to achieve net zero energy emissions by 2050.
- **Corporate Energy Management Plan:** 5-year plan to improve energy management and reduce greenhouse gas (GHG) emissions for the City's corporate operations.

3.6.3 Partners for Climate Change Protection (PCP) Program

As of February 24, 2023, the PCP program has recognized the City of Markham with Milestone 5 for its corporate assets. This is the final milestone of the PCP framework demonstrating leadership on energy and greenhouse gas emissions management.

Milestone 5 includes monitoring and reporting results to determine if the City's initiatives are working and if targets will be met. Since 2013, the City has implemented more than 200 initiatives that are saving energy, GHGs and utility costs. The PCP framework is provided below.



Figure 3-1: Partners for Climate Change Protection Framework.

3.7 Stakeholder Engagement and Future Challenges

A series of working sessions was held with stakeholders from each service area. Proposed LoS were discussed in the working session, along with the current challenges that each service area faces and future challenges that the service areas will face based on ongoing trends. The feedback from the stakeholders was used to develop common themes on current and future challenges and future desires which will inform the development of future proposed LoS and asset management planning. The following customer values and customer LoS attributes were discussed:

Customer values (what do these mean to the stakeholder?)

- Safe and reliable
- Convenient
- Sustainable
- Accessible
- Available
- Aesthetic quality
- Customer LoS
 - o Condition
 - o Capacity
 - o Function
 - o Accessibility

The following are common challenges amongst most or all of the service areas:

- Aligning master plans with the City's growth objectives as outlined in the OP
- Being able to conduct condition assessments through a program to ensure that assets are in a state of good repair (limitations being budget and resources)
- Technology advancements – the City needs to continue learning about new technologies and implementing them
- A drop in LoS due to growth
- Sustainability – having energy efficient assets and reducing consumption
- Keeping assets modern so people want to continue using them
- Accessibility – making facilities and services more accessible and AODA compliant where possible
- Offering services that continue to evolve with the community to meet needs (e.g., ageing populations, changing demographics, etc.)
- Upgrading capacity to be able to accommodate for growth

The challenges specific to each service area are provided in the Levels of Service sections of Appendices A to L.

4 Future Demand

4.1 Demand Drivers

Drivers of demand include items such as population change, regulations, changes in demographics, seasonal factors, vehicle ownership rates, consumer preferences and expectations, technological changes, economic factors, agricultural practices and environmental awareness.

4.2 Demand Forecasts

The Region of York's 2022 Official Plan guides growth and development across the nine municipalities within the Region, including the City of Markham. The Plan provides the policies to be followed in partnership with the local municipalities to achieve the Region's vision of creating "Strong, Caring, Safe Communities". The Official Plan includes seven goals:

1. To provide an overview of the Purpose, Regional Vision, Goals, Objectives, and Key Guiding Principles of the Plan.
2. To enhance York Region's urban structure through a comprehensive integrated growth management process that provides for healthy, sustainable, complete communities with a strong economic base.
3. To protect and enhance the natural environment for current and future generations so that it will sustain life, maintain health and provide a high quality of life.
4. To enhance York Region's urban system through city building, intensification, and compact and complete communities including employment areas.
5. To protect the Agricultural, Rural and Holland Marsh Specialty Crop Areas and support the agricultural industry as essential components of the Regional fabric.
6. To provide the services required to support York Region's residents and businesses to 2051 and beyond, in a financially and environmentally sustainable manner.
7. To ensure resiliency and the ability to adapt to changing economic and environmental conditions and increasing social diversity.

The Region's Official Plan outlines the population and employment forecasts to 2051 in Table 4-1.

Table 4-1: Population and employment forecasts for the City of Markham (Region of York Official Plan).

Markham	2021	2031	2041	2051
Population	349,000	416,300	496,700	610,500
Employment	190,300	221,200	258,500	301,600

From 2021 to 2051, these forecasts represent a population growth of 75% over 30 years and an employment growth of 58% over the same period. Growth within Markham will primarily be accommodated through development within designated growth areas (typically green fields) and intensification within strategic growth areas (Yonge Street corridor, etc.).

To support asset management requirements and inform more granular financial planning, City staff developed growth projections that align the City's land use policies with the population and employment projections noted above. For the 2021-2051 planning horizon, overall preliminary projections suggest possible asset growth needs averaging a 74% increase across all portfolios with resource-hour equivalency needs averaging a 70% increase. Further granularity of growth projections is shown in Figure 4-1 and Table 4-2 below.

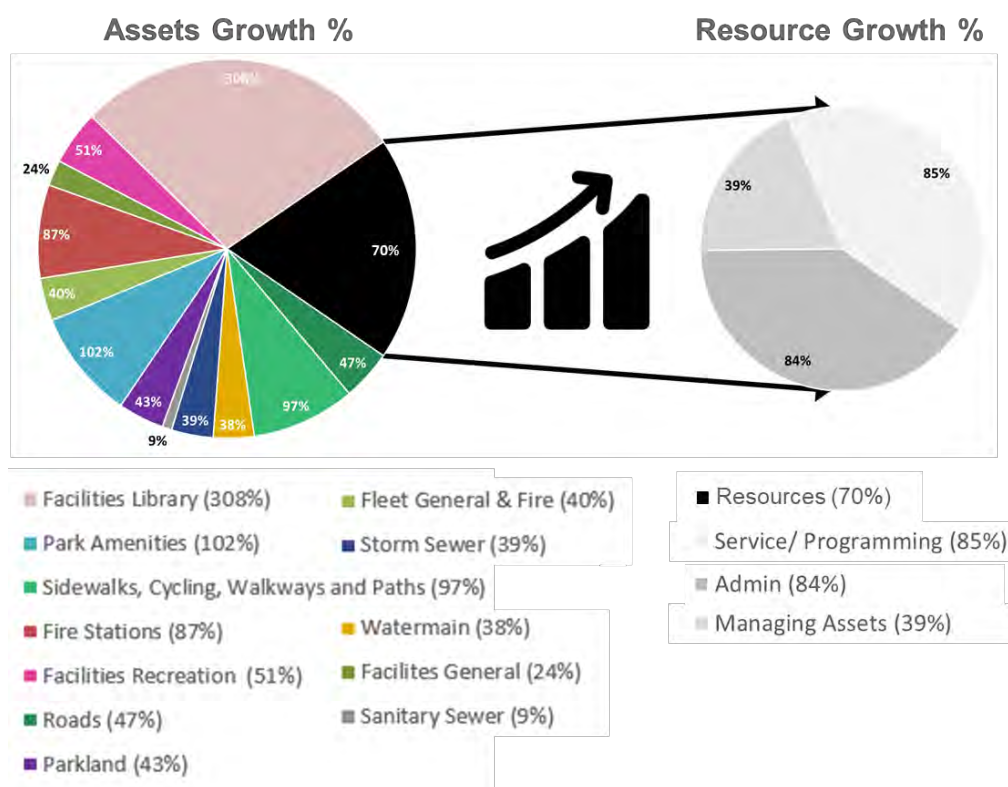


Figure 4-1: Growth and resource projections.

Table 4-2: Growth projections by service or subservice.

Service	Subservice	Anticipated Growth %
All	Not Applicable	Admin (84%)
All	Not Applicable	Managing Assets (39%)
All	Not Applicable	Service/ Programming (85%)
Transportation	Vehicular Transportation	Roads (47%)
Transportation	Active Transportation	Sidewalks, Cycling, Walkways & Paths (97%)
Potable Water	Not Applicable	Watermain (38%)
Stormwater Management	Not Applicable	Storm Sewer (39%)
Wastewater	Not Applicable	Sanitary Sewer (9% under review)
Parks	Not Applicable	Parkland (43%)
Parks	Not Applicable	Park Amenities (102%)
General Support Service	Fleet	Fleet General & Fire (40%)
Fire & Emergency	Not Applicable	Fire Stations (87%)
General Support Service	Facility	Facilities General (24%)
Recreation	Facility	Facilities Recreation (51%)
Library	Facility	Facilities Library (308%)

This growth in asset base will require additional funding and resourcing to adequately support acquisition, operations, maintenance and renewal pressures. The effects of growth using historical budgeting trends on capital and operating expenditures are detailed in the financial summary section of this report. Outputs from the previously noted growth modelling and resulting financial projections that have been further evaluated specifically for this AMP cover the **2026 to 2051 planning horizon**, as part of the City's regulatory obligation to assess proposed levels of service for July 1, 2025. These are detailed in Section 9.5.

4.3 Demand Impact and Demand Management Plan

The impact of demand drivers that may affect future service delivery and use of assets are provided in Table 4-3.

Demand for new services will be managed through a combination of managing existing assets, upgrading of existing assets and providing new assets to meet demand and demand management. Demand management practices can include non-infrastructure solutions, insuring against risks and managing failures.

Opportunities identified to date for demand management are provided in Table 4-3. Further opportunities will be developed in future revisions of this asset management plan.

Table 4-3: Demand Management Plan.

Demand driver	Current position	Projected position	Impact on services	Demand Management Plan
Population Intensification in Existing Areas and Population Growth in New Areas	Ongoing implementation of projects to accommodate for new and existing growth	The City will continue to implement projects to accommodate for new and existing growth	Increase cost pressure for acquisition, operation, maintenance and renewal	Develop a program to ensure resources are available to acquire new infrastructure, maintain existing and new infrastructure, and provide levels of service.
Capacity	Population intensification and growth may result in services not being available to all users.	Projects to alleviate capacity and congestion issues are identified through the City's Growth Model and studies.	Overall increase in usage due to growing customer base, need for projects to increase capacity	Implementing infrastructure and upgrading existing infrastructure as recommended through the City's Growth Model and studies.

4.4 Asset Programs to Meet Demand

Asset acquisition is required to meet future demand from rising population and employment. These acquisitions will require the City to allocate more resources towards the operations, maintenance, and the renewal of assets for the entirety of their lifecycle. The costs associated with new assets in previous years were identified in the City's capital budgets and used to forecast costs associated with acquiring new assets for the 26-year planning horizon. These additional costs are detailed in Section 9.5.

5 State of the Infrastructure

The State of the Infrastructure section summarizes the assets included in each service area. This subsection illustrates the current performance of all assets, provides an asset inventory and valuation and provides a summary of asset age and useful life. The asset inventory was aligned to the City's asset hierarchy. The following figure illustrates the structure of the City's asset hierarchy. Granular versions of the hierarchy, aligned to specific services, are provided in **Appendix A to L**.

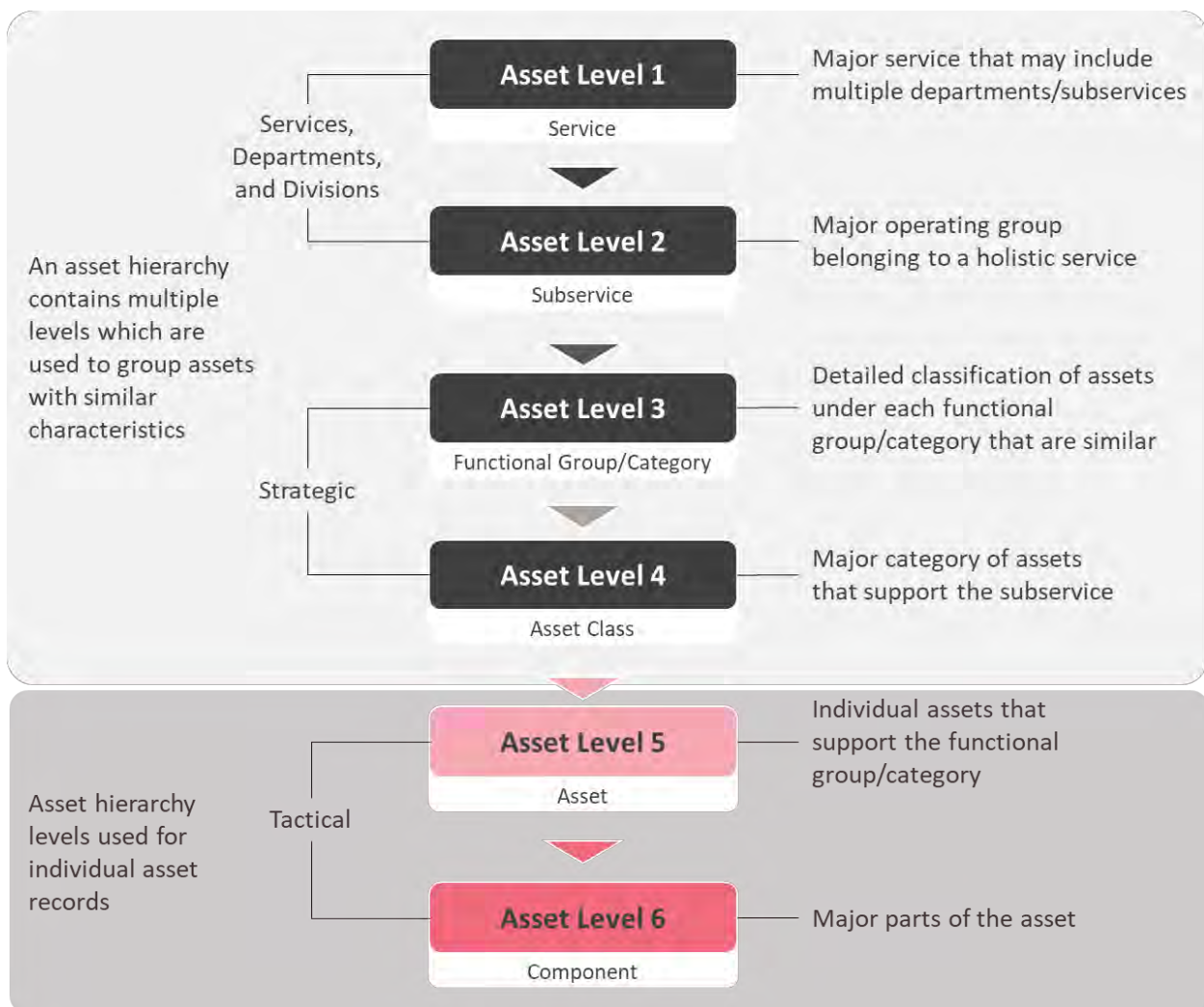


Figure 5-1: Asset hierarchy structure.

5.1 Asset Inventory and Valuation

The first subsection within the State of the Infrastructure section reports on the inventory and valuation of the in-scope assets. This is documented in a table with the following columns:

- **Subservice** details the applicable subservice of each asset that is being reported, as per the City's Asset Hierarchy (refer to Figure 2-2).
- **Asset Category** details the general category of assets that is being reported within each subservice, as per the City's Asset Hierarchy (refer to Figure 2-2).
- **Asset Class** groups together similar types of assets that are organized within each asset category that is being reported, as per the City's Asset Hierarchy (refer to Figure 2-2).
- **Replacement Value** details the total estimated replacement value (replacement cost) of the assets for the given asset class in 2023 dollars. This value represents the full project cost of replacing an asset on a like-for-like basis, including construction costs, material costs, design/engineering, project management and contingencies.
- **Quantity** details the total quantity of assets for the given asset class.
- **Average Performance** details the average age based on physical condition of the assets for the given asset class. This condition is a weighted average that is weighted by replacement value (see **Subsection 5.3** below for a description of performance categories).

As noted above, the analyses that are reported in this AMP use a combination of 2023, 2024, and 2025 asset and financially based data sources. As a result, any planned renewal work that the City undertakes in 2025 is not reflected in the outputs of this AMP.

5.2 Age and Estimated Service Life

A summary of asset age and installation dates is reported through two figures. The first reports on average age and average estimated service life (ESL) by asset class, an example of which is provided below. The average age in this figure is represented by the horizontal blue bar, and the average ESL is by the horizontal grey bar. Average age and ESLs are weighted by replacement value for each asset class. This figure is useful to provide context to the reader regarding the average state of the network in terms of its age. While age is not always a predictor of an asset's performance, in general, most assets begin to deteriorate and require replacement or rehabilitations as they advance

in age. As is illustrated in the following figure, nearly all of the City's assets are relatively young on average when compared to their estimated service lives.

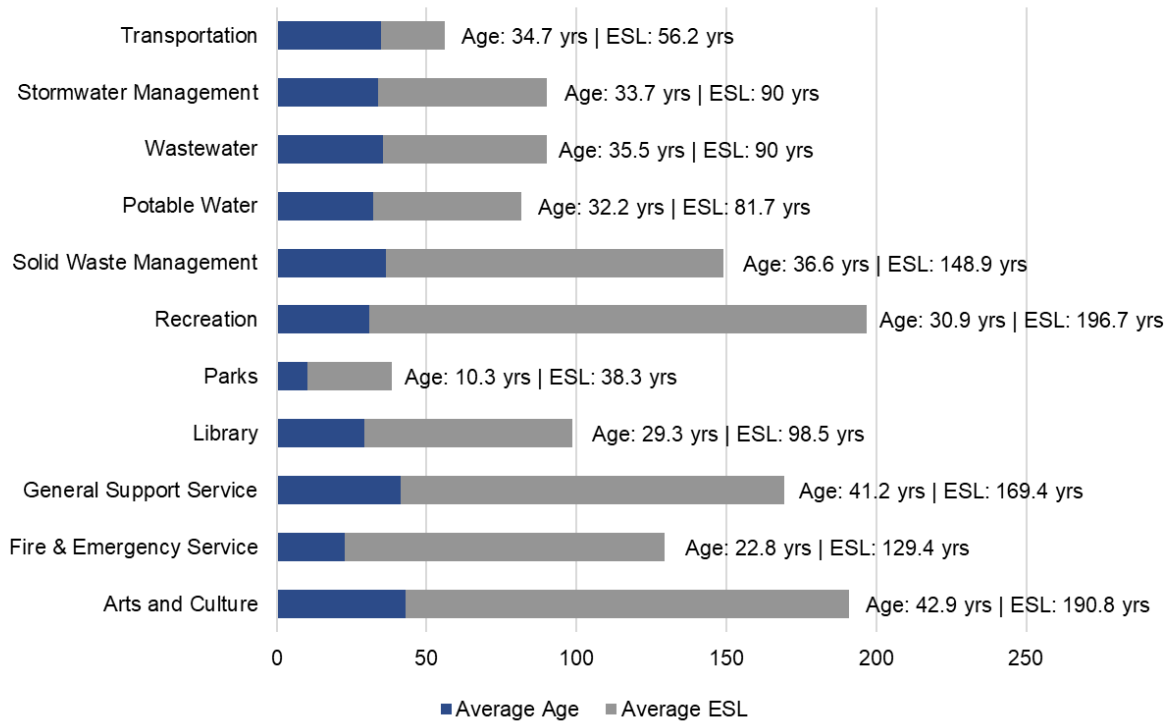


Figure 5-2: Average age/average estimated service life for each service area.

A figure reporting on installation dates follows, an example of which is provided below. The years are separated into installation decades, which helps to visualize the value of assets by the decade that they were constructed/installed or procured. Note that each decade of installation may have a corresponding decade in the future where the infrastructure could reach its end of life and will result in a large financial burden for replacement needs. In decades with significant construction, the City can expect significant renewal needs to occur in the future once these assets become aged and near the end of their service lives. For assets with long lifecycles, many of these needs are beyond the 26-year forecast included in this AMP. Note that asset performance will drive the need for major rehabilitation or replacement activities regardless of installation year (i.e., some long lived assets will experience short service lives for a variety of reasons).

The following figure illustrates that the City has seen its most significant asset acquisitions in the 1980s, 1990s and 2000s.

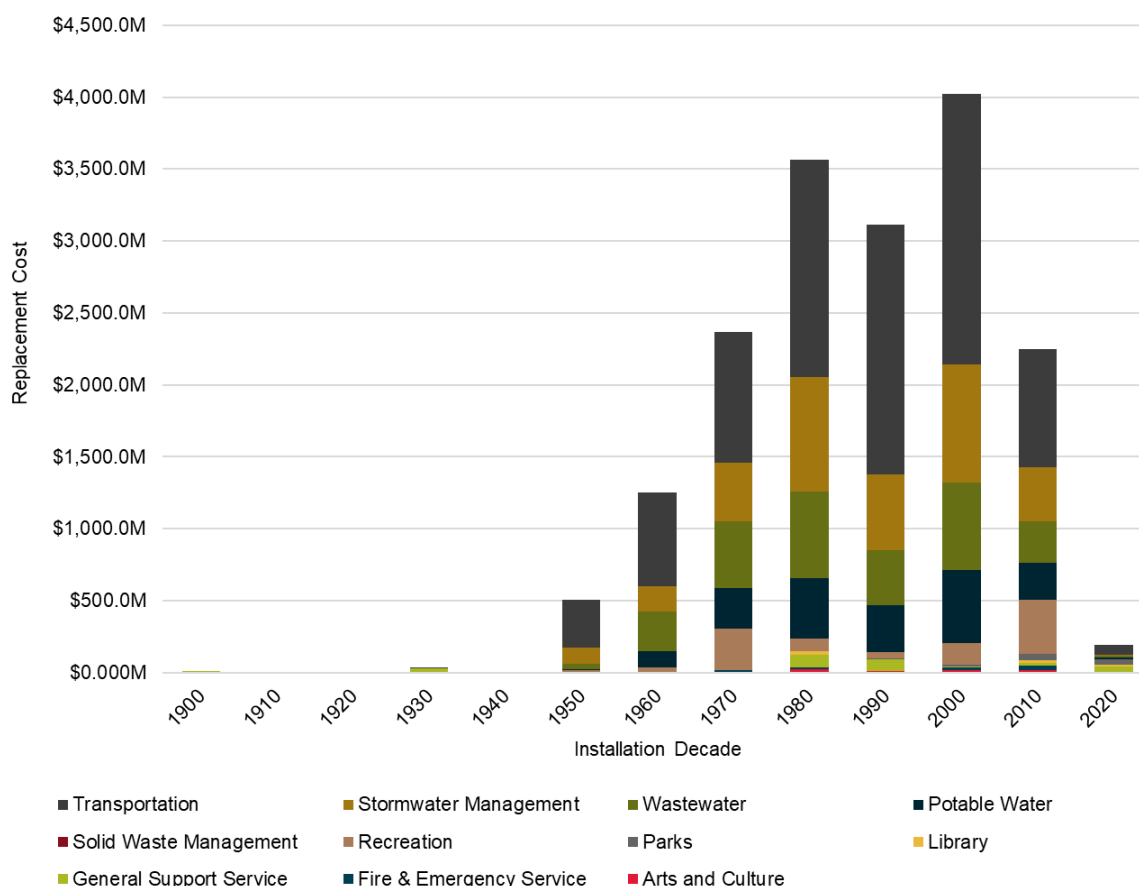


Figure 5-3: Age distribution by installation year of all service areas.

5.3 Asset Condition

Categories, describing asset physical condition or age state (i.e. performance), were assigned to all assets across each service area using a common 5-point categorical rating scale. This scale is aligned to the Canadian Infrastructure Report Card condition rating scale. Since methods for determining asset performance vary amongst different asset classes, all existing asset information, whether it be condition ratings or age-based assessments, were converted to the common 5-point categorical scale for a standardized and consistent basis to understand asset performance within the AMP.

Table 5-1 illustrates the definitions for each category, aligned to the age-based or assessed condition state of the assets. Using these categories, Figure 5-4 illustrates the performance distribution for all assets within the City and Figure 5-5 displays the same information, further subdivided by the City's service areas.

Table 5-1: Overall condition rating scale with examples.

Age-Based	Assessed Condition	Description	Useful Service Life Consumed	Example Condition Rating
Beginning of Life	Very Good	Asset is typically new or recently rehabilitated.	0% to 20%	1
Early Life	Good	Condition of assets is acceptable. Assets are generally in the early stages of their service life. Assets may show early signs of deterioration and may require attention or minor maintenance.	20% to 40%	2
Mid-Life	Fair	Assets are at the mid-point of their service life. Assets show some signs of deterioration that may require attention and maintenance.	40% to 60%	3
Past Mid-life	Poor	Assets show signs of deterioration and are beyond the mid-point of their service life. Ongoing monitoring and maintenance may be required.	60% to 80%	4
Approaching or at end of life	Very Poor	Assets are approaching the end or are beyond their useful service life and may shows signs of advanced deterioration. Assets may exhibit signs of imminent failure that can affect service or increased risk. Extensive monitoring, rehabilitation and/or replacement likely required in the near future.	>80%	5

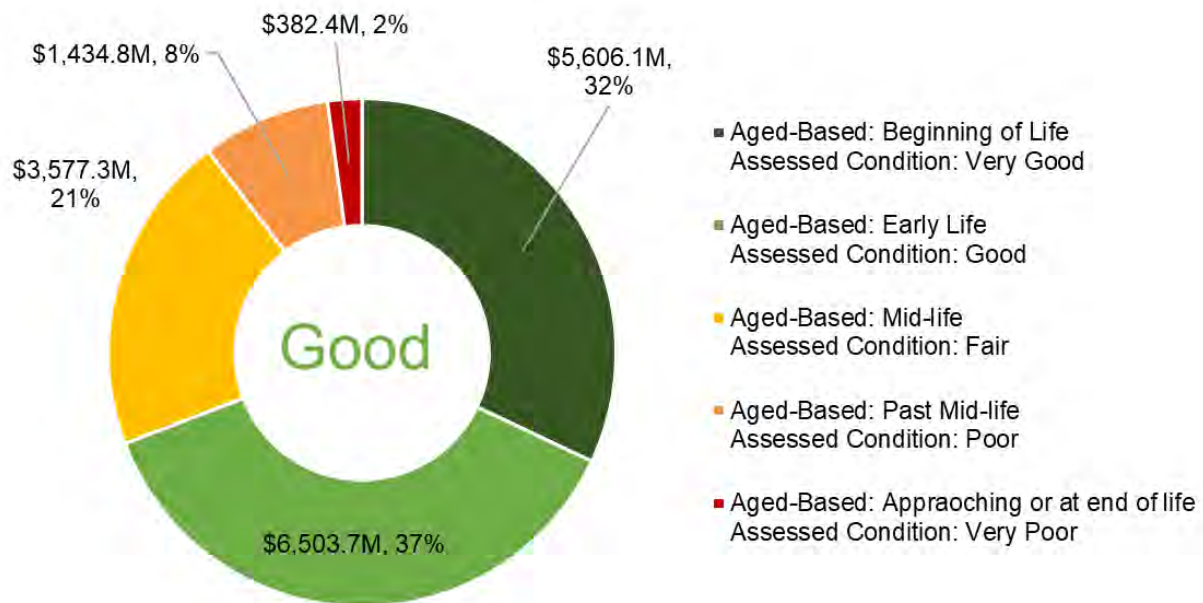


Figure 5-4: Condition distribution of all assets.

Overall, assets remain in a **“GOOD” state of performance** since last reported in the City’s 2024 Asset Management Plan, where:

- Assets in a Fair or better state **improved to 90% or \$15.7B** (from 88% or \$15.4B) and are performing as intended
- Assets in a Very Poor and Poor state was **reduced to 10% or \$1.8B** (from 12% or \$2.1B) and are subject of planned maintenance or renewal

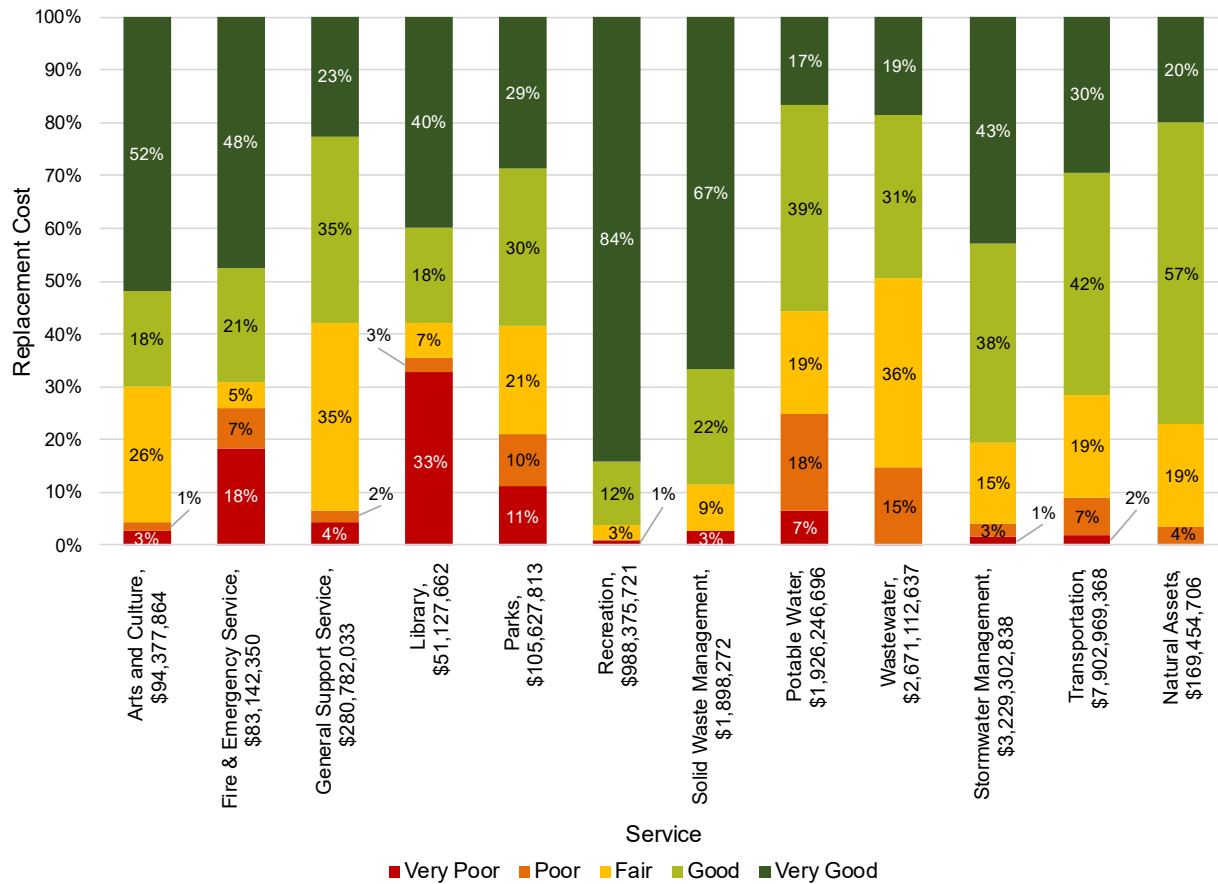


Figure 5-5: Condition distribution for all assets by service area.

For each service area, the same performance information is reported at a more granular level in the appendices. The appendices also contain information on how performance is assessed for each major asset class, as well as the alignment between asset data and each of the 5 categories listed above.

As noted above, the analyses that are reported in this AMP utilizes a combination of 2023, 2024, and 2025 asset and financially based data sources. As a result, any planned renewal work that the City undertakes in 2025 is not reflected in the outputs of this AMP.

6 Levels of Service

The following section describes the City's approach to monitoring and reporting on levels of service. The purpose of the LoS framework is to provide each service area with a set of performance measures that can be used to monitor asset performance and service delivery using measures that are relevant to each service area and will assist the City in determining if current LoS are adequate, and in the next iteration of the AMP, what proposed LoS should be. The City's initial work in developing LoS has resulted in the development of an LoS framework and a series of preliminary measures. A preliminary suite of measures has been reported in this AMP, however, the City expects to build these out and enhance them as it continues to mature its asset management practice.

Customer Research and Expectations

Subject matter experts and other stakeholders were engaged to introduce the concept of LoS and present a proposed framework, as well as a series of measures that will be used to monitor service delivery across asset classes. These experts provided context regarding customer needs relevant to the service areas. The initial suite of performance measures, as well as additional measures that are under consideration (but are not yet reported in the City's AMP) have been designed to align to customer expectations.

Strategic and Corporate Goals

The LoS framework and performance measures were developed in alignment with the City's strategic and corporate mission, vision, and goals. The City's 2020-2026 Strategic Plan focuses on four goals:

- Goal 1 – Exceptional Services by Exceptional People
- Goal 2 – Engaged, Diverse, Thriving & Vibrant City
- Goal 3 – Safe, Sustainable & Complete Community
- Goal 4 – Stewardship of Money & Resources

Mission

Working with the community to provide high-quality municipal services that meet, if not exceed, the expectations of residents and businesses.

Vision

Markham, the leading Canadian municipality - embracing technological innovation, celebrating diversity, characterized by vibrant and healthy communities - preserving the past and building for the future.

Values

- Cooperation and teamwork
- Focus on continuous improvement
- Respect for the individual
- Process-driven and prevention-based strategic planning
- Primary focus on the customer
- Responsibility to society
- Leadership through involvement
- Factual approach to decision-making
- People encouraged to make a contribution

Customer Values

Service levels are defined in three ways, customer values, customer levels of service and technical levels of service. Customer Values indicate:

- What aspects of the service are important to the customer;
- Whether customers see value in what is currently provided; and,
- The likely trend over time based on the current budget provision.

The City's customers refer to anybody who is using the service, including internal and external customers. Several common themes for Customer Values were identified across service areas and are documented in the table below.

Table 6-1: Common themes for customer values and applicable services.

Customer Value Theme	Applicable Services
Service assets are safe and reliable to use	All service areas (including Arts and Culture, Fire and Emergency Services, General Support Services, Library, Parks, Potable water, Recreation, Solid Waste Management, Stormwater Management, Transportation, Wastewater Collection).
Service assets are convenient to use	All service areas.
Aesthetic Quality	• Arts and Culture • Fire and Emergency Services • General Support Services • Library • Parks • Recreation • Transportation
Environmentally sustainable	All service areas.

Customer and Community Levels of Service

Customer and Community LoS have been developed to report on several key aspects of service delivery. These aspects include condition, function, capacity, and accessibility.

- **Condition:** How good is the service? What is the condition or quality of the service?
- **Function:** Is it suitable for its intended purpose? Is it the right service?
- **Capacity or Use:** Is the service over or under-utilized? Do we need more or less of the assets that make the service possible?
- **Accessibility:** Is the service convenient and/or available to use? Is the service easy to use?

Technical Levels of Service

Technical Levels of Service are required to deliver the customer values, impact the achieved Customer Levels of Service, and are operational or technical measures of performance. These technical measures relate to the activities and allocation of resources to best achieve the desired customer outcomes and demonstrate effective performance.

Technical Levels of Service can also be referred to as dials or levers that when increased or decreased, should improve or reduce the state of overall asset performance documented within the Customer/ community Levels of Service section.

Technical service measures are linked to the activities carried out over the asset lifecycle and include the following:

- **Acquisition** – the activities to provide a higher level of service (e.g. widening a road, paving a gravel road, replacing a pipe with a larger size) or a new service that did not exist previously (e.g. a new library).
- **Operation** – the regular activities to provide services (e.g. opening hours, cleaning, mowing grass, energy, inspections, etc.).
- **Maintenance** – the activities necessary to retain an asset as near as practicable to an appropriate service condition. Maintenance activities enable an asset to provide service for its planned life (e.g. road patching, gravel road grading, building and structure repairs).
- **Renewal** – the activities that return the service capability of an asset up to that which it had originally provided (e.g. road resurfacing and reconstruction, pipe replacement and building component replacement).
- **Disposal** – the activities that are required when it is removed from service (e.g. decommissioning of a well, demolition of a building, ongoing testing and monitoring of a decommissioned waste landfill site, etc.).
- **Service Improvement** – activities to improve or upgrade services to meet changing business drivers, such as a change in community needs or regulatory requirements (ex. upgrading assets to meet Accessibility for Ontarians with Disabilities Act (AODA) requirements, converting to green fleet, etc.)
- **Non-Infrastructure** – actions or policies that can lower costs, reduce risk of asset or service delivery failure, or extend asset life (ex. reducing water demand, reducing traffic on roads, etc.).

In compliance with Ontario Regulation 588/17, this AMP also reports on the City's proposed levels of service (PLoS) and consists of the cost to maintain current service and performance levels, an assessment of the Impact of Growth for all service areas and specifically establishing a target PLoS for road pavement management. The PLoS for each service area is documented in **Appendix A** to **Appendix L**. PLoS have been established in the technical LoS tables as well as in the lifecycle forecasting to determine the levels of funding required for the City to achieve these PLoS.

7 Risk Management Strategy

As part of the development of this AMP, the City developed a risk management strategy to assess the risk of each asset by evaluating its likelihood of failure (LOF) and consequence of failure (COF). The risk analysis will help the City assess and compare the risk assessment commonly across all services and can be incorporated into future operation, maintenance, and capital strategies.

LOF represents the probability (or likelihood) that an asset will fail, relative to a specific failure event. For the purposes of this AMP, LOF represents a failure of an asset due to its performance rating and therefore the LOF framework directly relates to the asset's physical condition or age. Simply put, it is assumed that an asset with poorer performance rating is more likely to fail than an asset with a better performance rating. The LOF framework is defined in the following table.

Table 7-1: Likelihood of failure framework.

Age-Based	Assessed Condition	Likelihood of Failure Rating	Description
Beginning of Life	Very Good	1	Failure Almost Impossible
Early Life	Good	2	Failure Unlikely
Mid-life	Fair	3	Failure Possible
Past Mid-life	Poor	4	Failure Likely
Approaching or at end of life	Very Poor	5	Failure Imminent/Failed

COF of an asset is assessed using a “triple bottom line” analysis to evaluate consequence of failure based on the three following characteristics of risk:

- **Financial**– the direct costs (such as costs associated with replacing failed assets) and indirect costs (such as loss of revenue) of the failure that are borne by the City.
- **Socio-Economic**– the impacts to the community.
- **Environmental**– the impacts to the natural environment or the environmental objectives of the City.

These consequence of failure categories are intended to capture the range of considerations that account for the consequence of an asset failing and in turn affecting the intended service level.

COF ratings were developed for each category on a 5-point scale with one (1) being minimal, and five (5) being extreme. This assessment was completed for individual assets throughout the City and paired to the asset data. Table 7-2 below illustrates the City's COF framework, which details the definitions for assigning COF Ratings for each category.

Table 7-2: Consequence of failure framework.

Rating	Direct Financial	Environmental	Socio-Economic
5 – Extreme	Cost to City: > \$5M	Irreparable damage	• Death • Severe impact to critical customers • Public inquiry/inquest • Severe negative impact on city reputation, international media coverage • 3-month disruption to local businesses or transportation routes • More than 2,000 people/businesses affected
4 – Major	Cost to City: \$500k - \$5M	Some permanent damage, Major and extensive clean-up efforts required	• Serious injuries • Major impact to critical customers • Criminal charges or public trial • Major negative impact on city reputation, national media coverage • 1-to-3-month disruption to local businesses or transportation routes • 500 to 2,000 people/businesses affected
3 – Moderate	Cost to City: \$50k - \$500k	Important non-permanent damage, Important clean-up efforts required	• Moderate injuries • Moderate impact to critical customers • Continuous litigation • Moderate negative impact on city reputation, important local media coverage • 1-to-4-week disruption to local businesses or transportation routes • 100 to 500 people/businesses affected
2 – Minor	Cost to City: \$5k – \$50k	Minor non-permanent damage, Minor clean-up effort required	• Minor injuries • Minor impact to critical customers • Potential lawsuits • Minor negative impact on city reputation, some media coverage • 1-to-7-day disruption to local businesses or transportation routes • 10 to 100 people/businesses affected

Rating	Direct Financial	Environmental	Socio-Economic
1 – Minimal	Cost to City: < \$5k	Trivial, No remedial action required	- No injuries - Minimal impact to critical customers - Routine claims - Minimal negative impact on city reputation, minimal media coverage < 1 day disruption to local businesses or transportation routes - Less than 10 people/businesses affected

For each major asset grouping, one or many criteria for assessing COF was used to determine the appropriate COF ratings to align with the definitions laid out in the COF framework in Table 7-2. At least one criterion was selected for each of the three major COF categories (Direct Financial, Socio-Economic, and Environmental). Figure 7-1 below demonstrates the procedure taken to calculate an asset grouping's COF rating.

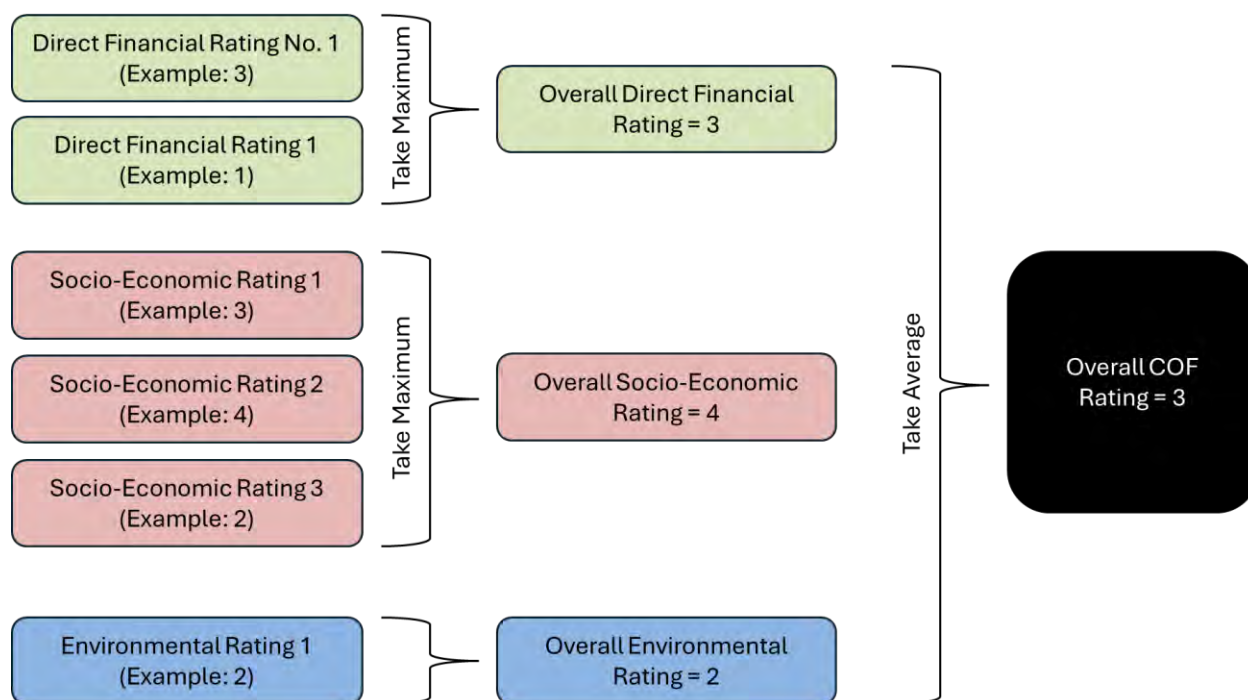


Figure 7-1: COF rating calculation methodology.

Individual COF models were developed for each in scope asset class. The criteria used to evaluate COF are summarized in tables for each asset class. Within each COF category of Direct Financial, Socio-Economic and Environmental, there are several different criteria that can be evaluated for an asset class.

For Direct Financial, the main criterion is Replacement cost. As asset failure will result in capital expenditures for emergency repairs and asset replacement, the rating for this criterion will increase as replacement cost is greater. Another criterion used in this category was also Revenue Loss. Assets that generate revenue and go offline will cost the City money in lost revenue, and therefore, add to the City's COF. These criteria are applicable to all assets.

For Socio-Economic, the criteria used to evaluate COF are Land Use, Asset Type, Asset Size, and Road Class. Generally, these criteria pertain to the number of people they service, and the more users an asset has, the higher the COF rating will be. It is also important to note an asset and the land it is situated on or nearby. If an asset is closer to open/unused land, the COF rating will be lower as opposed to it being closer to institutional land (e.g. a hospital) and or railway tracks, its failure will affect a greater and more at-risk population.

For Environmental, the criteria used to evaluate COF are Proximity to environmentally sensitive areas (ESA), Public Recreational Area, Watercourse, or Habitat.

Once LOF and COF were determined, the Risk Rating was calculated by using the following equation:

$$\text{Risk Rating} = \text{LOF Rating} \times \text{COF Rating}$$

Equation 1: Risk rating formula.

Both LOF and COF ratings range from 1 to 5, yielding a Risk rating between 1 and 25. Three categories of Low, Medium and High are associated with these scores and are illustrated in Table 7-3 and Table 7-4 below.

Table 7-3: Risk score matrix.

	COF 1	COF 2	COF 3	COF 4	COF 5	Subtotal
LOF 1	\$55.4M (0.3%)	\$2.4B (13.9%)	\$2.9B (16.6%)	\$164.4M (0.9%)	None	\$5.6B (31.8%)
LOF 2	\$123.9M (0.7%)	\$2.6B (15.0%)	\$3.5B (19.9%)	\$266.7M (1.5%)	None	\$6.5B (37.1%)
LOF 3	\$103.4M (0.6%)	\$1.7B (9.4%)	\$1.8B (10.2%)	\$63.7M (0.4%)	\$2.8M (<0.1%)	\$3.6B (20.7%)
LOF 4	\$59.9M (0.3%)	\$815.3M (4.7%)	\$546.3 (3.1%)	\$10.8M (0.1%)	None	\$1.4B (8.2%)
LOF 5	\$64.4M (0.4%)	\$203.3B (1.2%)	\$110.1M (0.6%)	\$4.6M (<0.1%)	None	\$382.4M (2.2%)
Subtotal	\$407.0M (2.3%)	\$7.7B (44.2%)	\$8.8B (50.5%)	\$509.9M (2.9%)	\$2.8M (<0.1%)	\$17.5B (100.0%)

Table 7-4: Risk score mapping legend.

Risk	Risk Score	Risk Description
Very Low	1 – 5	Fit for the Future
Low	6 – 10	Adequate for Now
Moderate	11 – 15	Requires Attention
High	16 – 20	At Risk
Very High	21 – 25	Unfit for Sustained Service

The risk matrix illustrated above indicates the following:

- **48.9% or \$8.6B** of all assets assessed as **Very Low risk or fit for future use**
- **46.9% or \$8.2B** of all assets assessed as **Low risk or adequate for now**
- **4.1% or \$722.8M** of all assets assessed as **Moderate risk or may require attention**
- **0.1% or \$15.3M** of all assets assessed as **High risk or at risk or requires attention**
- **No assets** are assessed as **Very High risk or unfit for sustained service**

COF and Risk Ratings can provide additional functions when completing evaluations at the asset level. They can be used to assign different Technical Levels of Service thresholds, by managing assets with higher COF scores at higher target performance states. For instance, a critical asset may be replaced at an earlier time than a non-critical asset of the same type, due to a higher consequence of failure. On the other hand, assets with lower COF and Risk Ratings may be allowed to reach lower target performance states.

Another important use for these ratings is to assist the City with its selection of capital projects. When completing an annual capital planning exercise, Markham can incorporate risk ratings developed through these strategies to understand how much risk will be reduced for each planned project. Therefore, utilizing these strategies as a tool to help prioritize projects or determine tiebreakers when analyzing capital projects for inclusion of the forthcoming capital plan.

As the City matures its asset management practice, further consideration can be given to using the cost of treatment and risk-reduction combined to determine an incremental cost-benefit ratio as a means to rank assets from those with the greatest return on investment through to those with the least return on investment.

It should be noted that since likelihood of failure is tied to asset performance, it is expected to change as asset performance changes over time. As a result, risks may vary. Assets that are renewed or maintained may experience a reduction in risk, whereas those that age may experience an increase in risk. The City responds to these changes through regular activities that they employ to manage assets such as operation, maintenance and renewal programs.

8 Lifecycle Management Strategies

The City's lifecycle management strategy is a set of planned actions and activities performed on its assets over their service lives to provide LoS in a sustainable way, manage the risk of failures and manage lifecycle costs. These activities include acquisition of assets and service improvements, operations and maintenance, major asset renewals (including rehabilitations and replacements), and disposals. Lifecycle activities work together to extend asset life, reduce overall costs, minimize risk, and can help achieve strategic, social, environmental, and fiscal goals. Documentation on the planned lifecycle activities for each asset is provided as part of the City's technical levels of service framework. These Technical Levels of service detail the activities that the City undertakes to ensure that its assets are providing services at target levels.

A series of lifecycle modelling logic was also developed as part of a computational forecasting tool used to project asset needs forward over the planning horizon of 2026 through to 2051 (26 years) based on their intended and expected behaviours over the course of their service lives. Using these models, forecasting can be completed to understand the relationship between financial investment levels and anticipated resulting performance (maintaining assets in a state of good repair) and the reduction of risk.

9 Financial Strategy

This section presents the City's projected funding levels, as identified in the Lifecycle Reserve Study, alongside the funding required to maintain current service levels and the additional funding needed to achieve the proposed levels of service based on planned lifecycle activities. Establishing funding needs for each service area will help the City sustain healthy reserve balances, secure the necessary staffing resources to keep assets in a state of good repair, support the development of new infrastructure, and guide the annual capital budgeting process.

Markham takes pride in its overall Financial Strategy that has resulted in one of the lowest tax rates in the Greater Toronto Area, while being virtually debt-free. A major component of the broader financial strategy is how the City manages planning and allocating financial resources to manage its assets at set service levels.

The Asset Management Plan (AMP) is required to maintain the City's compliance with Ontario regulation 588/17 and is meant to guide Markham's ongoing success in asset management through its execution of the annual budget process and Life Cycle Reserve updates over the past 20+ years. Keeping assets in a state of good repair, while being cognizant of the total cost of ownership, is of tantamount importance to Markham. "Value for Money" is a key tenet of planning and decision-making over the four major components of asset ownership:

- 1) Planning and Acquisition
- 2) Operating and Maintenance
- 3) Repair, Rehabilitation, and Replacement
- 4) Disposal and ongoing liabilities

9.1 Acquisition of New Assets

Municipalities acquire new assets mainly through purchasing, construction, or assumption. Assumption of assets occurs through the development process where developers build infrastructure for their developments and then transfer ownership to the City after a defined period of time. If the City is purchasing or constructing an asset, the City has to identify a funding source, often through the annual budget process. While there are numerous funding sources for new assets, such as taxes, Community Benefits Charges, grants, and various reserves, the main funding source for new assets is Development Charges. Markham operates on the principle that growth should pay for growth.

Development Charges

Development Charges (DCs) are fees levied by municipalities on new residential and non-residential developments to help pay for the infrastructure needed to support growth. DCs are intended to ensure that new development contributes to the cost of municipal services, like roads, water, and community centres, that are required to support the new growth.

To set the DC rates, a municipality must undertake a Development Charges Background Study, and update their associated by-laws, at a minimum of every ten years. A Background Study outlines the growth-related capital program for eligible infrastructure, through the planning horizon chosen by the municipality. Markham's current DC Background study and by-laws have a planning horizon through to 2031 and was endorsed by Council in 2022.

The growth-related assets that Markham funds through DCs include:

- water supply services, including distribution and treatment services
- wastewater services, including sewers and treatment services
- storm water drainage and control services
- services related to a highway as defined in subsection 1 (1) of the *Municipal Act, 2001*
- waste diversion services
- fire protection services
- services provided by a board under the *Public Libraries Act*
- parks and recreation services, but not the acquisition of land for parks

It is a requirement that when Council approves a DC Background study that they are “in principle” endorsing the capital program contained within. However, the actual approval to implement these projects is subject to the annual budget process. This is important as the actual growth patterns and changing priorities often differ from projections and capital programs and need to be adjusted to account for this, as well as any changes to legislation.

Staff note that the timelines identified in the current Development Charges Background Study and by-law are not in alignment with the Region's Official Plan, and by extension, the City's current growth targets, of which are to be integrated within the proposed update to the City's Official Plan.

9.2 Operating Costs

Once a new asset is in place, the next step is to provision for the operating costs. The operating budget requirements provisioned for each year encompass staffing resources, 3rd party service contracts and contract escalations, and related supports for new growth. Markham utilizes specific methodologies to incorporate the incremental budget impacts each year which are primarily funded through property tax levies. Below are just a couple of examples of how the City addresses the operating costs of its assets.

9.2.1 Parks

Each year, Urban Design provides a forecast of the new parks coming into service in the following year(s) along with the size of each park. In prior years, a unit cost was then applied to the new hectares of parks in any given year. This unit cost was derived by dividing the current Parks operating budget (personnel, non-personnel & revenue) less the budget relating to storm water management ponds and natural areas, by the total number of hectares of parks across the City. This figure, although not 100% accurate, was an indicator of the required maintenance cost per new hectare of parks and was added to the Parks operating budget for the forthcoming year.

Staff have taken the recommendation from a recent external audit of the Cornell Community Park project, and where appropriate, will be adopting an amenity-based costing model to calculate the growth costs effective for the future budgets. The amenity-based model is meant to more accurately reflect the changing landscape of the City's parks growth in recent years, whereby more concentrated amenities within less hectares of land are the result of development trends towards condominium builds in the face of limited developable land. The amenity-based model provides a more accurate figure required for future on-going maintenance as it is based on the actual assets contained within each park. In addition, the model is updated annually to reflect updated pricing for asset maintenance and other related parks expenditures.

9.2.2 Roads, Sidewalks, and Trails

On an annual basis, the unit cost to maintain one lane kilometre of the City's road network (including winter maintenance) is calculated by dividing the Roads operating budget (personnel, non-personnel & revenue; excluding winter maintenance) by the total number of lane kilometres of the City's road network and adjusted for cost escalations. As new lane kilometres of roads are added, the operating budget is incrementally increased based on the calculated unit cost. Additional vehicles are purchased, or added to the City's contracts with external vendors, when required to address the operating requirements for roads.

A similar approach is taken for the City's sidewalk and trail inventory.

9.3 Repair, Rehabilitation, and Replacement

Markham manages the repair, rehabilitation, and replacement of assets through its Life Cycle (LC) Reserve Strategy and associated reserve that was first adopted by Council in 2004. The Life Cycle Strategy is a critical component of how the City manages and funds its asset renewals to maintain service levels. Keeping assets in a state of good repair has always been important to Markham, and the need to fully understand what this entailed was the driving force behind the establishment of this strategy. After examining several options for a Life Cycle strategy, Council approved a rolling 25-year funding model. Essentially, the model is updated on an annual basis to ensure the City has the proper funding to address the next 25 years of repair, rehabilitation, and replacement costs, and can be expressed by the following formula:

[Starting LC Reserve Balance + inflows over 25 years = outflows over 25 years]

This proactive approach ensures that the City has at least 25 years to fund any single asset replacement and smooths out year to year fluctuations in inflows and outflows, while having the added benefit of better allocating the financial responsibility between current and future taxpayers.

At the beginning of each Council term, a forecast is undertaken to determine the projected funding requirements over the upcoming four years in order to smooth out any budget impacts. Then in the subsequent years, the model is adjusted to account for changes in assumptions and actual experience.

Each year, departments are engaged in updating the City's known asset inventory information (price and useful life), using a combination of the following methodologies:

- Historical trending
- 3-year average price
- Most recent awarded price or vendor quote
- Industry standard pricing and useful life
- Condition assessment

These annual inventory updates are submitted to Finance in Q1/Q2 to analyze, and the information is used to update the Life Cycle model's outflow projections, as well as form the current year's Capital Budget for Life Cycle funded projects.

When the Life Cycle study is updated, there is usually a funding shortfall, or adjustment that would need to be addressed as part of the annual budget / financial planning process. This funding discrepancy is due to:

- Inflation
- Past Growth
- New Assets

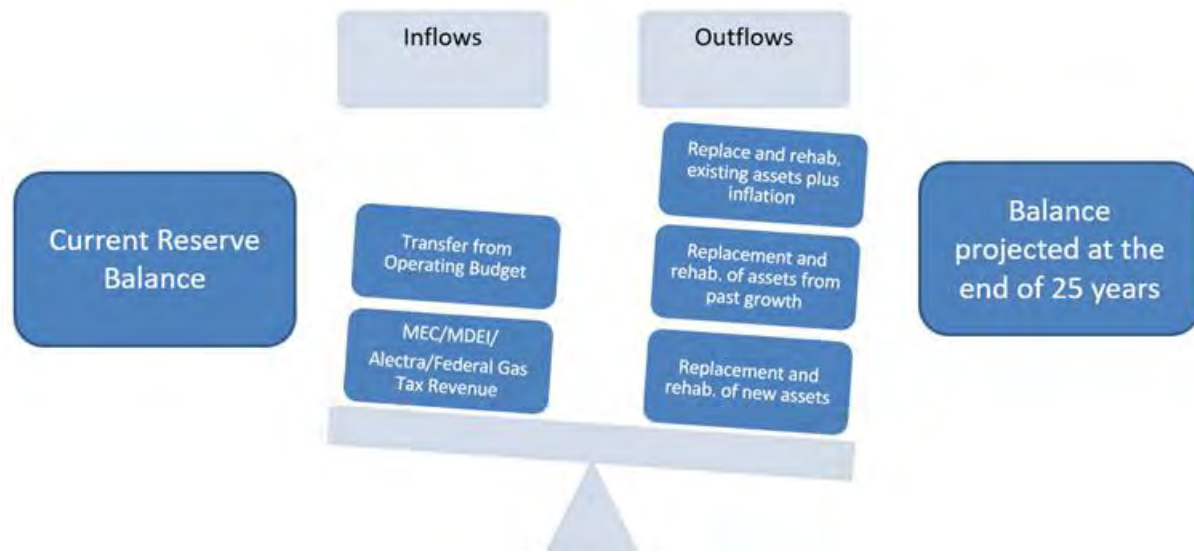


Figure 9-1: Balance of inflows and outflows projected at the end of 25 years.

If there is a shortfall (i.e. the projected balance of the reserve at the end of year 25 is negative), staff identify potential cost savings or incremental revenue tools to get the Year 25 balance to \$0.

The City has a diversified set of funding sources for the Life Cycle Reserve, such as:

- Annual transfer from the operating budget (mainly through property taxes)
- Annual Council adopted incremental infrastructure investment
- Federal and Provincial grants, including Canada Community-Building Fund
- Investment Income and Dividends from the City's interests in Markham Enterprises Corporation (full owner of Markham District Energy and part owner of Alectra)
- City's share of the Municipal Accommodation Tax
- Various lease revenues on City-owned property
- Unspent funds from closed capital projects and year-end surplus as per the City's Financial Planning and Budgeting policy
- Interest earned on the Reserve balance

Markham's asset base is continuously growing due to new assets being built as well as new assets being assumed from developers. Therefore, the inflows into the Life Cycle Reserve need to continuously grow as well. However, most of the growing inflows are allocated to funding existing asset renewal needs over the 25-year planning period and are already included in the model.

The main methodology to address new assets being added to the Life Cycle is a tax-funded infrastructure investment which is ramping up to an incremental 1% each year

by 2027. The 2025 budget included a 0.8% infrastructure investment, which is equivalent to approximately \$1.5M/year. This becomes part of the City's base budget so the \$1.5M/year (x 25 years) gets added to the model to help pay for any work that needs to be done on those new assets over the next 25 years. Based on the current plan the proposed 2026 Budget will include an incremental 0.9% infrastructure investment, and the 2027 Budget, and every subsequent budget, is expected to include, at a minimum, an incremental 1% infrastructure investment in perpetuity. The infrastructure investment will be reviewed each year as part of the Life Cycle Reserve Study update and may need to be increased in future years.

9.3.1 Future Life Cycle Reserve Study Updates

In alignment with the City's 2020-2026 Strategic Plan goals, and in conjunction with the next Council term (2027-2030), the City will continue to recalibrate lifecycle requirements as part of the annual Reserve Study update.

Along with regular Life Cycle updates related to pricing, volume and newly assumed assets, Departments will refine their Life Cycle submissions to reflect the City's approved levels of service. In the immediate term (2026), this work will include:

- Incorporation of past growth for road and pavement lane kilometre inventory
- Cost update to annual asphalt program to achieve a minimum target of 70% of the City's road network to be in a "good" or better state of performance, and subject to funding and resource availability, work towards an aspirational target of 75% of the City's road network to be in a "good" or better state of performance
- Addition of, or reasonable placeholders for known missed assets (ie. exterior assets, backlogged streetlight poles and their modernization LED technology)
- Adjustment of annual program budgets to reflect current levels of service

The outcome of the refinement work will be included in the projected outflows to the Life Cycle Reserve model, and any shortfalls will be addressed as part of the City's Financial Strategy and future budgets.

As referenced in this document, levers to balance outflow pressures can include increasing the Life Cycle contribution from operating budget, increasing the annual incremental infrastructure investment, reprioritizing the capital plan, incorporating the risk management strategy into operation, maintenance and capital strategies to reduce outflows and exploring additional revenues such as applying for grants and reviewing the Stormwater fee to increase inflows.

9.3.2 Water & Wastewater Assets

In 2002, the Province introduced the *Safe Drinking Water Act Ontario* that sought to ensure that all households receive clean drinking water, free from contaminants. The

Act establishes a licensing regime for municipal drinking water systems under its Licensing of Municipal Drinking Water Systems Regulation (O. Reg. 188/07), along with a Financial Plans Regulation (O. Reg. 453/07), that requires financial plans from municipal drinking water systems in order to obtain the necessary licenses.

A component of the Act is that water & wastewater revenues can only be used to fund water & wastewater costs. As such, the City of Markham implemented a similar 25-year Life Cycle strategy for water & wastewater assets prior to 2004.

Similar to the City's main Life Cycle Reserve Study, the Waterworks Reserve Study is updated annually to determine the required increase in the annual water rate charged on a per cubic metre of consumption.

As part of the annual Waterworks Reserve Study, the water rate is calibrated to raise sufficient revenues for the following main expenditures:

1. Cost to purchase water from the Region for both City residents and businesses
2. Operating Costs – the on-going maintenance costs related to the City's water & wastewater infrastructure, including personnel costs
3. Capital Investment – rehabilitation and replacement of existing water & wastewater assets

9.4 Forecasted Operating and Capital Budgets

By analyzing the City's 2025 budget, it was determined how much funding the City has and anticipates to allocate towards each respective lifecycle activity and service area.

The City categorizes their budget into the following groups:

- **Operating budget:** This supports the day-to-day activities and functions to provide City Services. Operating expenses include equipment maintenance, materials supply, facilities services, and contributions to reserves; all of which are expensed in the current fiscal year.
- **Capital budget:** This includes a comprehensive financial plan that addresses the financial requirements needed for growth, major rehabilitations, and major replacements of existing infrastructure.

The expenditures from the budget data were projected forward and compared with forecasted financial lifecycle needs which were developed from the City's lifecycle models. The forecasts cover projections from 2026 through to 2051 (26 years), and in alignment with the City's Official Plan. All forecasted results are reported in present day dollars. It should be noted that with inflation and economic pressures, these costs are anticipated to rise.

To provide a forecast of required operating and capital needs, an analysis was used that incorporates the results of the City's lifecycle forecasts and other forecasts to understand future projections. To forecast the operating budget, the City's 2025 operating budget of \$495.8M was applied to the entire 26-year forecast.

To forecast the capital budget, renewals anticipated were obtained from the City's LCRS. For other lifecycle activities (including non-infrastructure solutions, service improvements, etc.) forecasts were developed by looking at the City's 2025 line-item budget to determine recent spending amounts. These amounts were carried forward using the assumption that spending will be the same in these categories if service levels are maintained moving forward.

The following table summarizes the forecasted capital and operating expenditures, based on required asset replacements, rehabilitations, and operations and maintenance activities for the City to continue meeting current service levels (acquisition expenditures are not included). Note that natural assets are not included in Table 9-1 since forecasting for these assets was completed separately in the City's Natural Assets AMP and have not yet been considered nor deliberated to any degree, and of which may be addressed incrementally through future updates to either the Natural Assets AMP or this AMP.

Table 9-1: Forecasted capital expenditures (Life Cycle Reserve Study and capital budget) and operating expenditures.

Year	Renewal (LCRS) and Non-Renewal (Capital Budget)	Operating Budget	Total Expenditures
2026	\$123.3M	\$495.8M	\$619.1M
2027	\$106.9M	\$495.8M	\$602.7M
2028	\$76.7M	\$495.8M	\$572.5M
2029	\$95.2M	\$495.8M	\$591.0M
2030	\$106.1M	\$495.8M	\$601.9M
2031	\$75.3M	\$495.8M	\$571.1M
2032	\$84.3M	\$495.8M	\$580.1M
2033	\$96.8M	\$495.8M	\$592.6M
2034	\$76.9M	\$495.8M	\$572.7M
2035	\$91.1M	\$495.8M	\$586.9M
2036	\$80.1M	\$495.8M	\$575.9M
2037	\$84.5M	\$495.8M	\$580.3M
2038	\$83.5M	\$495.8M	\$579.3M
2039	\$87.7M	\$495.8M	\$583.5M
2040	\$91.7M	\$495.8M	\$587.5M
2041	\$73.7M	\$495.8M	\$569.5M

Year	Renewal (LCRS) and Non-Renewal (Capital Budget)	Operating Budget	Total Expenditures
2042	\$89.7M	\$495.8M	\$585.5M
2043	\$83.0M	\$495.8M	\$578.8M
2044	\$89.9M	\$495.8M	\$585.7M
2045	\$87.6M	\$495.8M	\$583.4M
2046	\$80.5M	\$495.8M	\$576.3M
2047	\$88.1M	\$495.8M	\$583.9M
2048	\$79.8M	\$495.8M	\$575.6M
2049	\$70.0M	\$495.8M	\$565.8M
2050	\$88.2M	\$495.8M	\$584.0M
2051	\$73.1M	\$495.8M	\$568.9M
Total	\$2,263.8M	\$12,890.8M	\$15,154.6M
Equivalent Average Annual	\$87.1M	\$495.8M	\$582.9M

Table 9-2 below shows the annual expenditures from the 2025 capital budget by lifecycle activity. It was assumed that these annual expenditures are sufficient to provide current LoS from 2026 to 2051. These annual expenditures were used to forecast the non-renewal expenditures from 2026 to 2051. Note that acquisitions are not included in this section and are included in Proposed Levels of Service – The Impact of Growth.

Table 9-2: Forecasted capital expenditures (non-renewal costs).

Lifecycle Activity Type	2025 Budget
Non-Infrastructure Solutions (Capital)	\$3.8M
Operation (Capital)	\$9.0M
Maintenance (Capital)	\$4.2M
Service Improvement (Capital)	\$10.6M

A summary of the anticipated capital budget (LCRS) is provided in Figure 9-2. The capital budget expenditures were compared to the forecasted capital needs, which is illustrated in Figure 9-2 and Figure 9-3.

The operating and capital budgets (planned funding) are the City's current LoS. Through the development of this AMP, asset performance was forecasted based on the proposed LoS to determine and compare the total lifecycle costs to the City's current LoS. This forecasting is explained further in Section 9.5.

9.5 Lifecycle Forecasting

For this AMP, the required funding levels to achieve proposed LoS (Maintain Current Performance) and accommodate growth were determined. These funding levels were then compared to the City's current LoS (planned budget) to determine if there is an infrastructure funding gap, and the amount of funding that would be required by the City to accommodate for future population and employment respectively.

The forecasting model is primarily related to capital renewal needs. The City employs two primary renewal strategies: asset replacements, which consider the removal of an existing asset and its replacement with a like asset; and, prominent rehabilitations, which include major retrofits and other significant works that extend asset life.

The following subsections illustrate the City's planned funding levels and funding required to achieve the established proposed LoS.

9.5.1 Current Levels of Service – Planned Funding Levels

The current LoS is the City's planned funding as identified through the City's LCRS for the years 2026 to 2051. The planned funding was evaluated to determine if the City is reinvesting the right amount of money, at the right time, to maintain current performance levels for each service area. For this modelling exercise, the City's LCRS financial forecasts and current operating and capital budgets were used as upset limits or constraints, to model an asset performance forecast over the same planning horizon.

Figure 9-2, illustrates the City's planned funding levels to maintain current service and performance over the planning horizon spanning 2026-2051. The total planned budget is approximately **\$15.15B**, or an equivalent average annual expenditure of **\$582.9M**. The total operating portion of this budget is approximately **\$12.89B**, or an equivalent average annual expenditure of **\$495.8M**. The capital portion of this budget is approximately **\$2.26B**, or an equivalent average annual expenditure of **\$87.1M**, is planned to fund asset renewal, service improvements and other life cycle activities noted in Table 9-2. Of this amount, approximately **\$1.55B**, or an equivalent average annual expenditure of **\$59.5M** is planned exclusively for asset renewals.

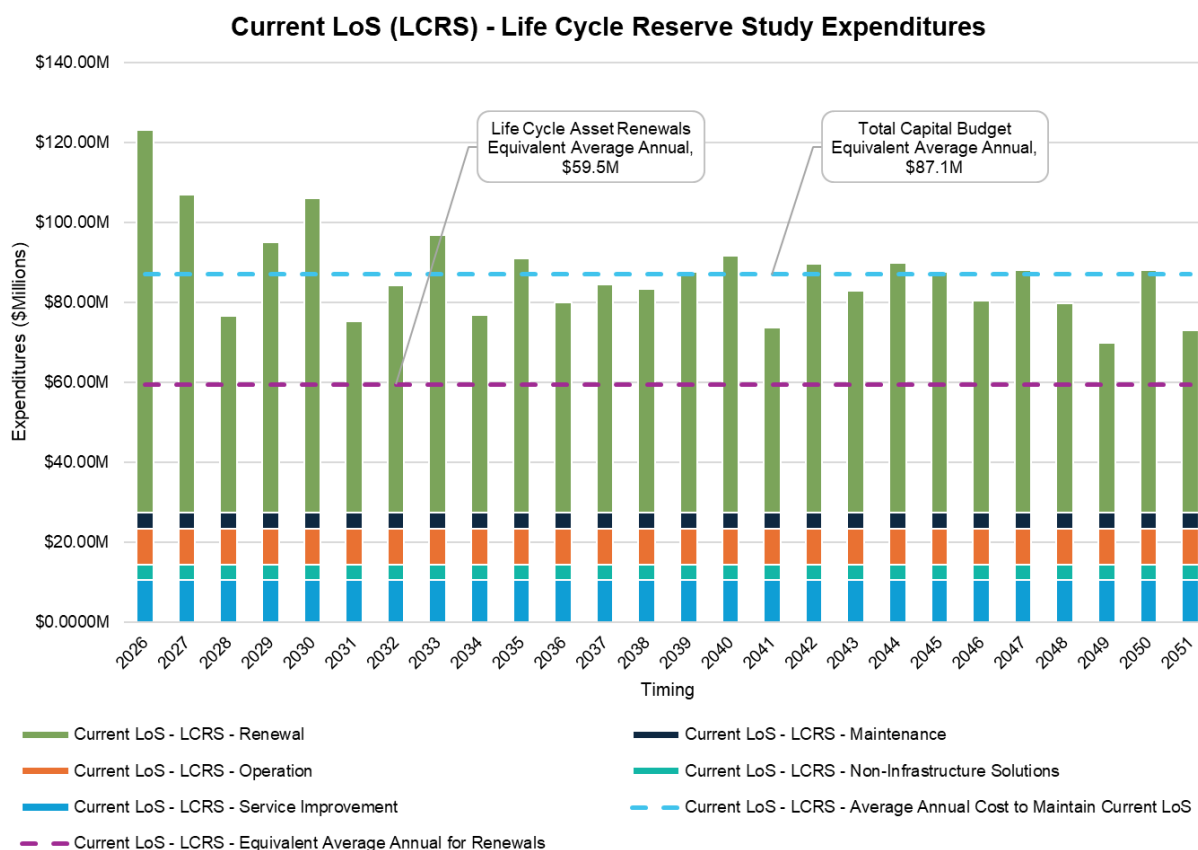


Figure 9-2: Current levels of service – 2024 Life Cycle Reserve Study expenditures.

The results illustrated in Figure 9-3 indicate that the anticipated resulting performance based upon planned renewal funding levels totaling approximately **\$1.55B** (excluding inflationary increases) over the planning horizon, may result in a **decline in asset performance**. By 2051, performance may decline to:

- **59.4% or \$10.30B** of assets performing as intended
- **40.6% or \$7.03B** of assets are subject of planned maintenance or renewal.

This anticipated decline in performance represents **approximately 30.6% or \$5.3B** of assets shifting from a Fair or better state of performance to a Poor or Very Poor state of performance, which are unacceptable outcomes for the City. Therefore, an analysis of appropriate funding levels required to maintain current performance levels was developed as an alternative scenario and is discussed further Section 9.5.2.

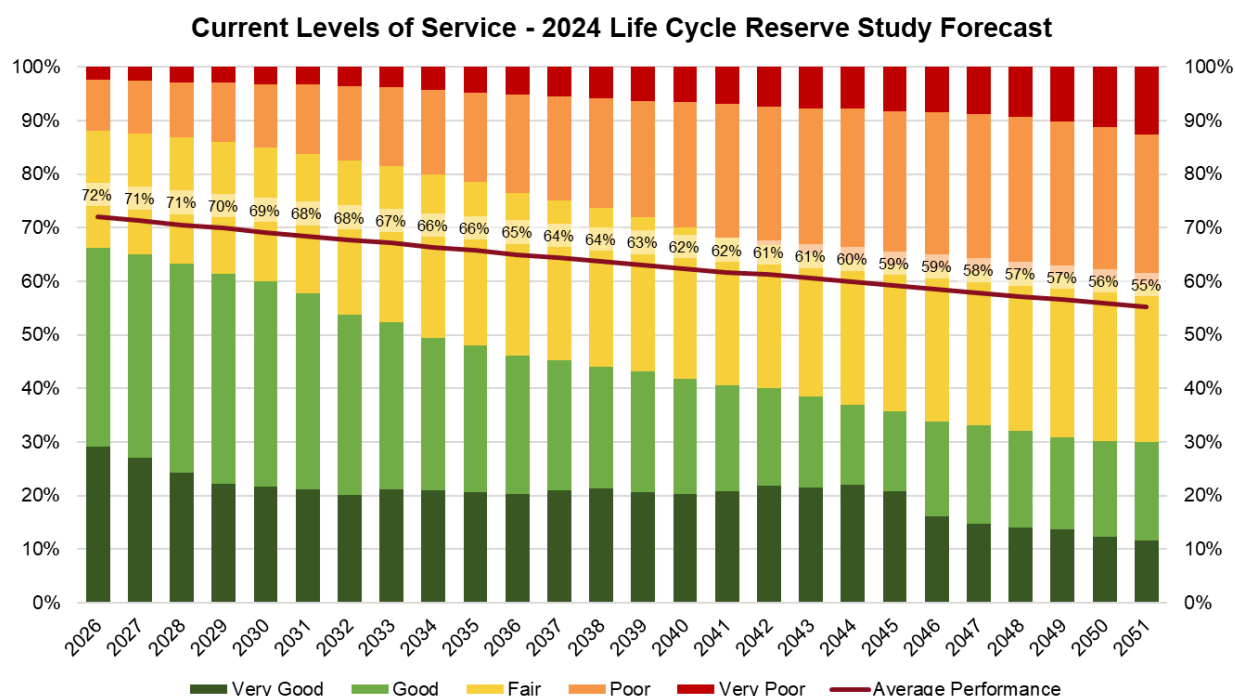


Figure 9-3: Current levels of service – 2024 Life Cycle Reserve Study forecast.

9.5.2 Proposed Levels of Service – Maintain Current Performance

As a part of the City's lifecycle strategy, a series of models were developed to forecast assets needs over a 26-year period (from 2026 to 2051). The lifecycle models in conjunction with the City's LoS and risk management strategies were implemented in the decision support system (DSS) tool. The DSS tool pairs the City's asset inventory and current performance of respective assets with the lifecycle, LoS and risk management strategies logic to analyze the relationship between planned capital investment levels and anticipated resulting asset performance under various scenarios. In this instance, the model was set to determine the funding levels required to sustain current performance levels over the planning horizon.

The road assets replacement value was updated in the 2024 AMP and as a result, the City has conducted an in-depth review of the funding and performance of the asset and determined that there are gaps and opportunities for improvement.

The forecasting was performed using the following parameters:

- For roads assets, the funding required to maintain 70% of roads in good or better condition, adjusted from 85% Pavement Condition Index. See Appendix D for more information.

- For all other assets, needs were determined for assets that are beyond their service life or in a condition state that is considered unfit to provide service. These assets are renewed in the forecast following the lifecycle management strategies detailed in Appendix A to Appendix L.

Figure 9-4 and Figure 9-5 show the annual funding requirements exclusively for renewals and the anticipated resulting performance distribution over a 26-year period to maintain the current performance levels. Note that this forecast does not include natural assets, since forecasting for these assets was completed separately in the City's Natural Assets AMP.

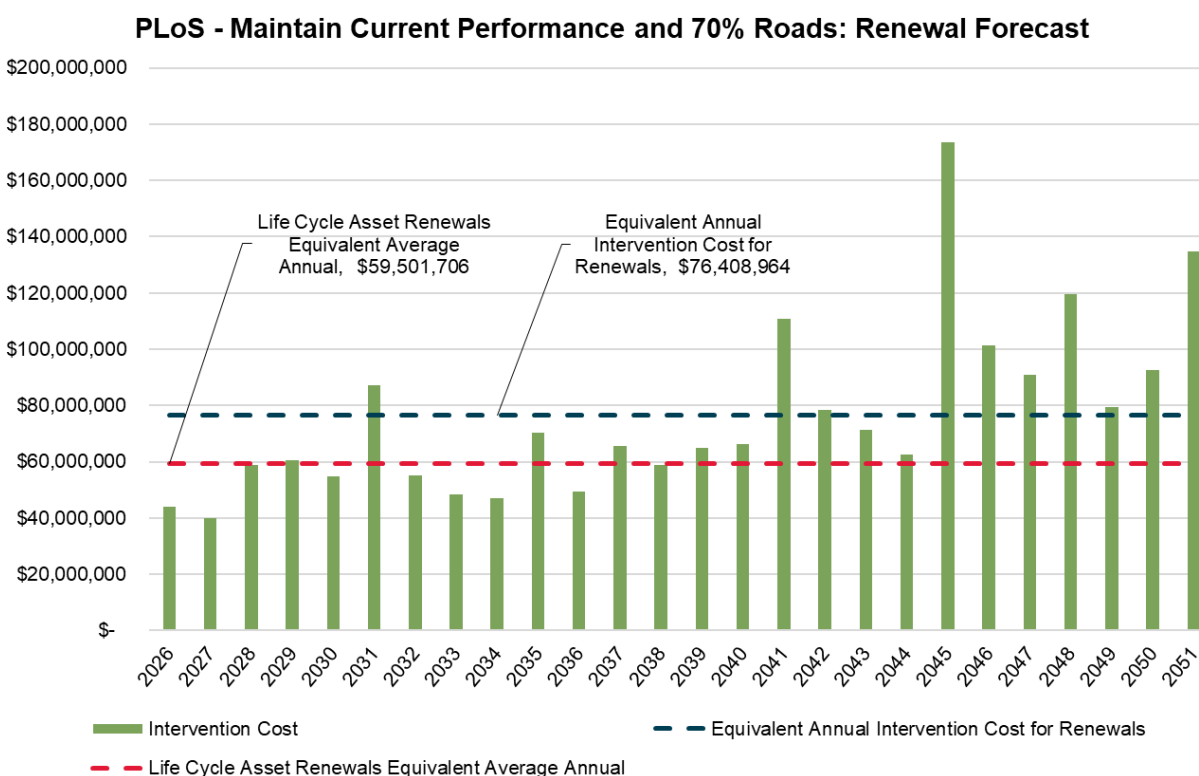


Figure 9-4: Spending forecast (for renewals) to maintain current performance for all City's assets to 2051.

Computational modelling suggests that, exclusively for renewals, an overall increase to forecasted funding levels noted in Section 9.5.1 of **\$439.6M** over the planning horizon, or an equivalent annual expenditure of **\$16.9M** (0.1% of the total replacement value, excluding natural assets) is required to maintain current asset performance levels through to 2051. Non-renewal-based capital and operating forecasted costs were held to current levels for this analysis. The funding in Figure 9-4 results in the anticipated performance forecast shown in Figure 9-5.

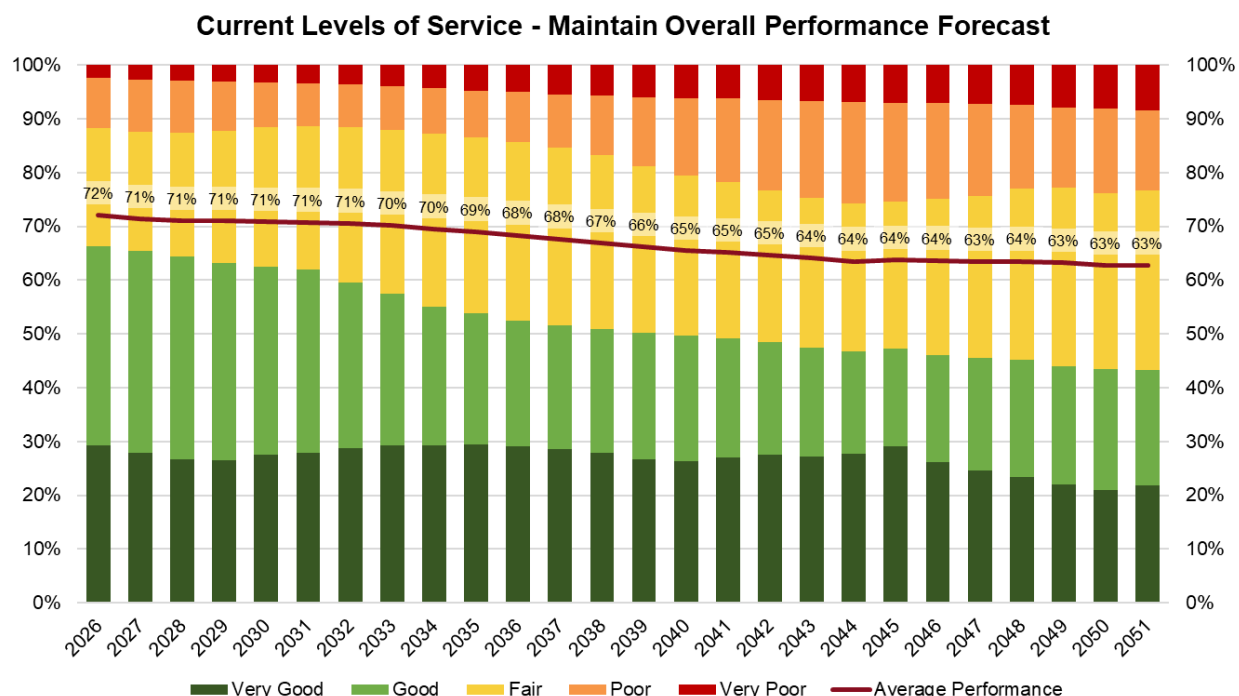


Figure 9-5: Proposed levels of service – maintain overall current performance forecast.

Assuming funding levels are incrementally increased over time to meet these performance level targets, the overall performance forecast shown in Figure 9-5 suggests that by 2051:

- **76.7% or \$13.30B** of assets performing as intended
- **23.3% or \$4.04B** of assets are subject of planned maintenance or renewal

While these forecasted results are lower than the current state of performance by approximately **13.3%**, the overall performance outlook at 2051 rates the City's assets at the cusp of the Good and Fair categories, of which represent assets that are performing as intended and may require some form of normal attention and/or maintenance.

By adjusting the performance target for roads from 85% PCI to 70% of roads performing in good or better condition, the City will be able to better maintain performance and at a lower annual cost increase.

9.5.3 Proposed Levels of Service – The Impact of Growth

Two (2) growth scenarios were modelled to forecast the level of funding required for additional people resources, acquiring new assets, and maintaining and operating those assets. The two scenarios are:

- **Scenario #1: Official Plan Objectives** – population and employment growth in alignment with the OP.
- **Scenario #2: Realistic Growth** – population and employment growth based on historic actuals and represents achieving approximately 63% of the OP's growth objectives. Scenario 2 was developed to forecast a growth scenario that the City is more likely to achieve as the OP objectives in scenario 1 are considered ambitious.

The following figure illustrates the combined population and employment projections from 2026 to 2051 for both scenarios.

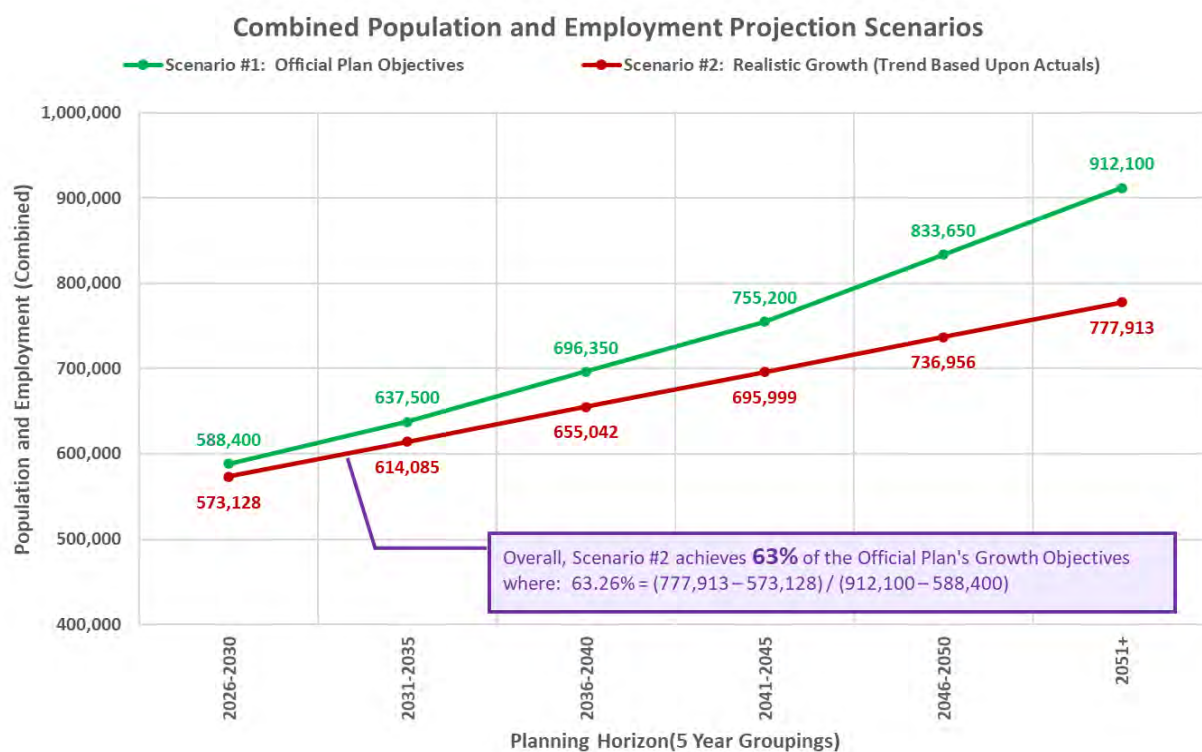


Figure 9-6: Scenario 1 and Scenario 2 combined population and employment projections.

Figure 9-7 and Table 9-3 show the areas and years of anticipated growth. Significant acquisitions are anticipated from 2026-2030, shown in Table 9-4 and Table 9-5.

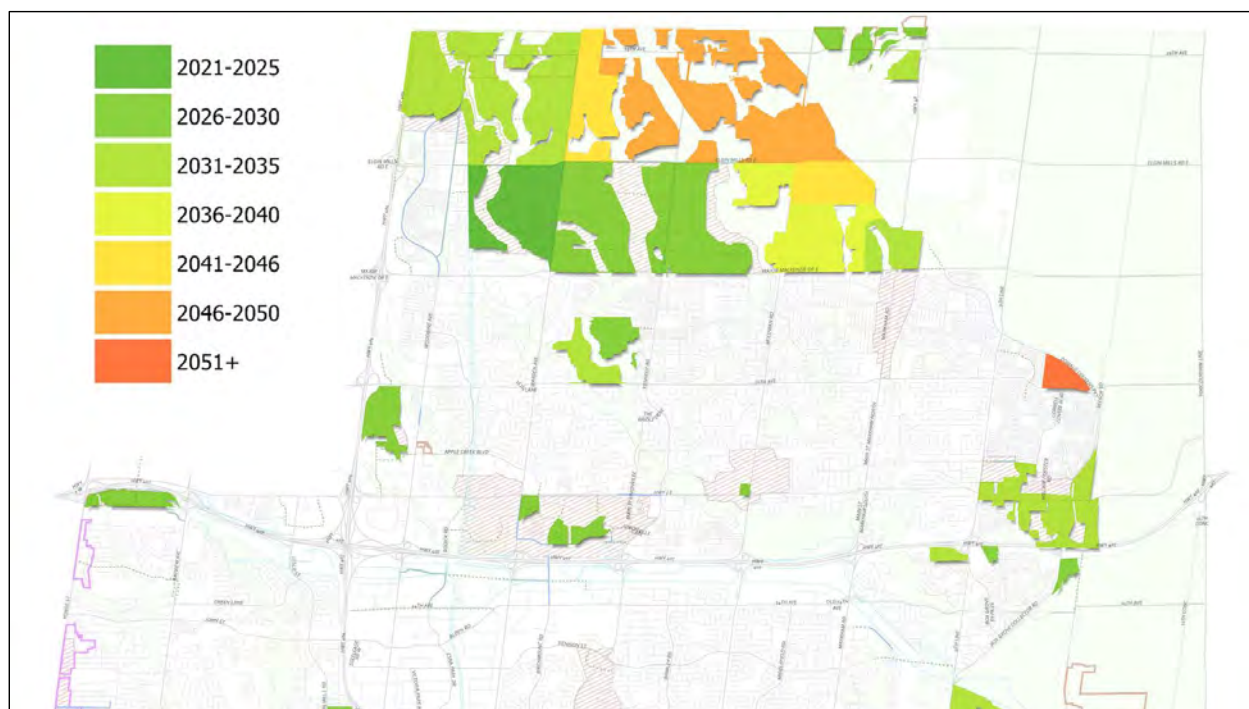


Figure 9-7: Areas of anticipated population and employment growth.

Table 9-3: Official Plan population and employment objectives.

Sum of Area (ha)	2021- 2025	2026- 2030	2031- 2035	2036- 2040	2041- 2045	2046- 2050	2051+
Employment	193,200	208,600	224,000	243,000	262,000	281,850	301,700
Employment Area Subtotal	-	83.29	529.73	-	143.67	-	-
2014 OP	-	83.29	529.73	-	-	-	-
NEW OP	-	-	-	-	143.67	-	-
Population	351,800	383,950	416,100	460,300	504,500	556,500	608,500
Urban Area Subtotal	214.6	682.61	336.9	257.67	106.41	539.15	34.41
2014 OP	214.6	631.26	241.93	-	-	-	34.41
NEW OP	-	51.35	94.97	257.67	106.41	539.15	-

The City modelled growth asset acquisition quantities, costs and their timing, following the areas and corridors outlined in Figure 9-7 and the guiding principles and criteria outlined in many of the City's strategies, master plans, planning policies and current engineering design criteria. Contributions to the City's LCRS were determined for assets with an estimated service life of 12 years or less, as any asset with an estimated service

life greater than 12 years would fall outside of this AMP's planning horizon. The growth asset's acquisition cost was used to determine the cost of the contribution. Operating costs were determined by establishing an **Operating Budget to Asset CRV Ratio of 0.0266**, which was developed by using the City's current operating budget compared with the replacement value of assets in service. This ratio was then applied to the value of growth assets starting in their year of anticipated acquisition. All impact of growth costs were compiled into a financial summary.

The following subsections illustrate the impact of growth for Scenario 1 and Scenario 2, which includes the costs to acquire the new assets, renew and operate those assets, and the operating budget.

9.5.3.1 Growth Scenario #1: Official Plan Objectives

For Growth Scenario #1 (OP Objectives), by 2051, and based upon the modelling conducted, the City may acquire approximately **\$6.89B** worth of additional assets in order to meet the City's intended growth objectives. For this scenario, the City would be required to fund approximately **\$2.69B** in acquisition costs.

To fund these acquisitions and subsequent renewal and operating budget impacts, would require an overall increase to forecasted funding levels noted in Section 9.5.1 of approximately **\$3.10B** over the planning horizon, or an equivalent annual expenditure of **\$119.29M** to maintain current service and performance levels while accommodating growth objectives through to 2051. Performance modeling was not completed for the growth scenarios. However, performance will be the same or likely better than the proposed level of service scenario as the proportion of new assets increases.

Table 9-4 summarizes the forecasted growth expenditures that may be required to achieve the City's Official Plan growth objectives, as prescribed by the York Region's 2022 Official Plan.

Table 9-4: Forecasted growth expenditures (Scenario 1: Official Plan Objectives).

Year	Acquisition	Renewal	Operating Costs	Total
2026	\$297.9M	\$0.0M	\$14.3M	\$312.2M
2027	\$297.9M	\$0.0M	\$14.3M	\$312.2M
2028	\$297.9M	\$0.0M	\$14.3M	\$312.2M
2029	\$297.9M	\$0.0M	\$14.3M	\$312.2M
2030	\$297.9M	\$0.4M	\$14.3M	\$312.6M
2031	\$63.6M	\$0.5M	\$6.3M	\$70.4M
2032	\$63.6M	\$1.1M	\$6.3M	\$71.0M
2033	\$63.6M	\$3.1M	\$6.3M	\$73.0M
2034	\$63.6M	\$4.0M	\$6.3M	\$73.9M

Year	Acquisition	Renewal	Operating Costs	Total
2035	\$63.6M	\$5.6M	\$6.3M	\$75.5M
2036	\$48.3M	\$5.6M	\$4.2M	\$58.1M
2037	\$48.3M	\$5.7M	\$4.2M	\$58.3M
2038	\$48.3M	\$3.8M	\$4.2M	\$56.3M
2039	\$48.3M	\$4.2M	\$4.2M	\$56.7M
2040	\$48.3M	\$4.8M	\$4.2M	\$57.3M
2041	\$20.0M	\$4.6M	\$2.5M	\$27.0M
2042	\$20.0M	\$8.8M	\$2.5M	\$31.3M
2043	\$20.0M	\$14.1M	\$2.5M	\$36.6M
2044	\$20.0M	\$14.1M	\$2.5M	\$36.5M
2045	\$20.0M	\$14.9M	\$2.5M	\$37.3M
2046	\$101.0M	\$24.0M	\$8.8M	\$133.8M
2047	\$101.0M	\$21.9M	\$8.8M	\$131.8M
2048	\$101.0M	\$23.6M	\$8.8M	\$133.4M
2049	\$101.0M	\$23.4M	\$8.8M	\$133.2M
2050	\$101.0M	\$25.0M	\$8.8M	\$134.8M
2051	\$32.0M	\$19.0M	\$2.9M	\$53.9M
Total	\$2,686.1M	\$232.0M	\$183.6M	\$3,101.6M
Equivalent Average Annual	\$103.3M	\$8.9M	\$7.1M	\$119.3M

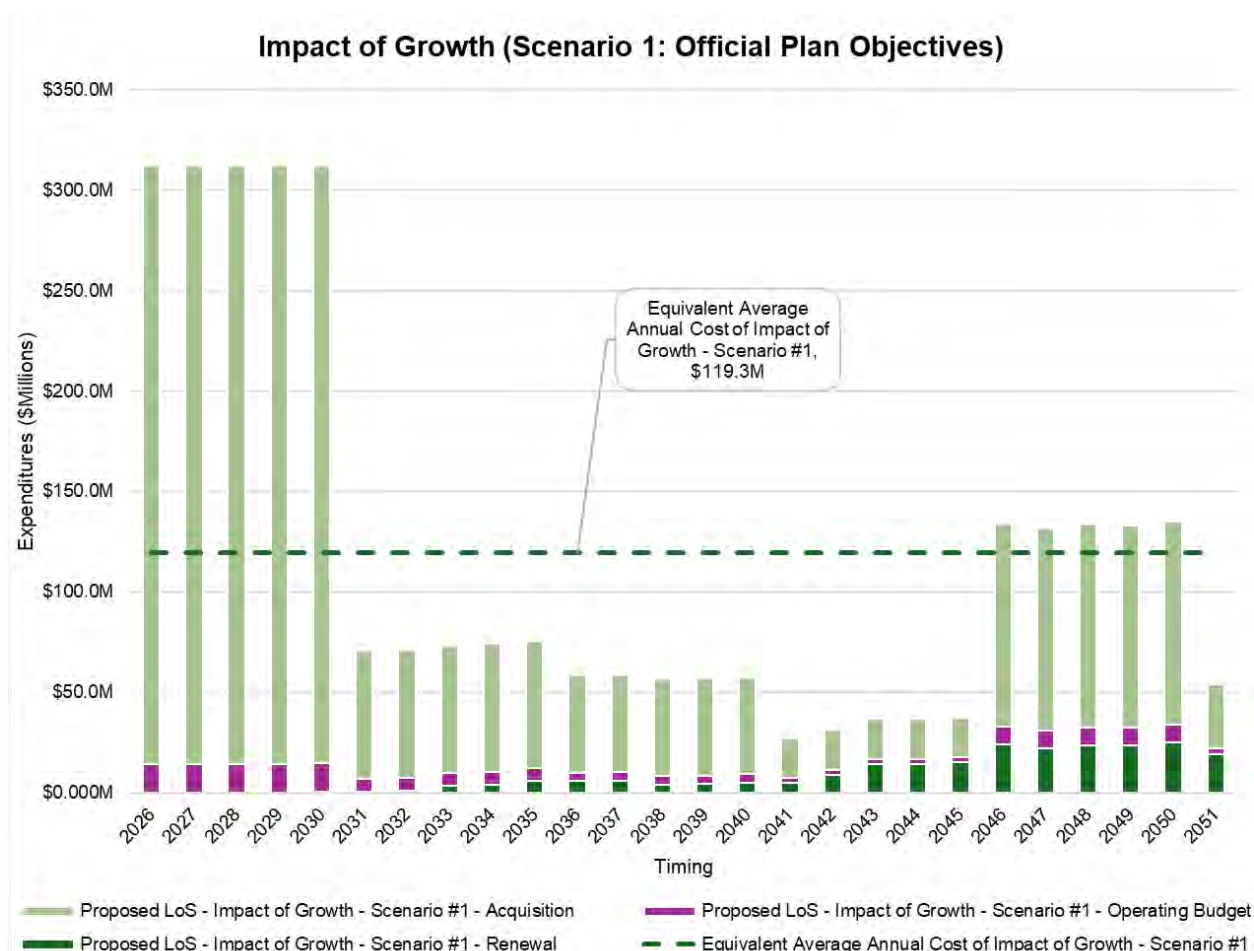


Figure 9-8: Impact of Growth (Scenario 1: Official Plan Objectives).

To accommodate the anticipated growth in population and employment, the City will need to acquire new assets as well as maintain and renew those assets. Figure 9-8 illustrates the additional funding required by the City to meet the OP's growth objectives.

9.5.3.2 Growth Scenario #2: Realistic Growth

For Growth Scenario #2, population and employment growth was determined based on historic actuals and represents achieving approximately 63% of the OP's growth objectives outlined in Scenario #1. Scenario #2 was developed to forecast a growth scenario that the City is more likely to achieve as the OP objectives in Scenario #1 are considered ambitious.

By 2051, and based upon the modelling conducted, the City may acquire approximately **\$4.83B** worth of additional assets in order to meet the City's intended growth objectives. For this scenario, the City would be required to fund approximately **\$1.98B** in acquisition costs.

To fund these acquisitions and subsequent renewal and operating budget impacts, would require an overall increase to forecasted funding levels noted in Section 9.5.1 of approximately **\$2.23B** over the planning horizon, or an equivalent annual expenditure of **\$85.93M** to maintain current service and performance levels while accommodating growth objectives through to 2051. Performance modeling was not completed for the growth scenarios. However, performance will be the same or likely better than the proposed level of service scenario as the proportion of new assets increases.

Table 9-5 summarizes the forecasted growth expenditures to achieve the Realistic growth objectives.

Table 9-5: Forecasted growth expenditures (Scenario 2: Realistic Growth).

Year	Acquisition	Renewal	Operating Costs	Total
2026	\$248.5M	\$0.0M	\$11.9M	\$260.4M
2027	\$248.5M	\$0.0M	\$11.9M	\$260.4M
2028	\$248.5M	\$0.0M	\$11.9M	\$260.4M
2029	\$248.5M	\$0.0M	\$11.9M	\$260.4M
2030	\$248.5M	\$0.3M	\$11.9M	\$260.7M
2031	\$53.0M	\$0.4M	\$5.3M	\$58.7M
2032	\$44.2M	\$0.7M	\$4.4M	\$49.4M
2033	\$44.2M	\$2.2M	\$4.4M	\$50.8M
2034	\$44.2M	\$2.8M	\$4.4M	\$51.5M
2035	\$44.2M	\$3.9M	\$4.4M	\$52.6M
2036	\$33.6M	\$3.9M	\$2.9M	\$40.4M
2037	\$33.6M	\$4.0M	\$2.9M	\$40.5M
2038	\$33.6M	\$2.7M	\$2.9M	\$39.2M
2039	\$33.6M	\$2.9M	\$2.9M	\$39.5M
2040	\$33.6M	\$3.3M	\$2.9M	\$39.9M
2041	\$13.9M	\$3.2M	\$1.7M	\$18.8M
2042	\$10.4M	\$4.6M	\$1.3M	\$16.3M
2043	\$10.4M	\$7.4M	\$1.3M	\$19.1M
2044	\$10.4M	\$7.3M	\$1.3M	\$19.1M
2045	\$10.4M	\$7.8M	\$1.3M	\$19.5M
2046	\$52.7M	\$12.5M	\$4.6M	\$69.9M
2047	\$52.7M	\$11.4M	\$4.6M	\$68.8M
2048	\$52.7M	\$12.3M	\$4.6M	\$69.7M
2049	\$52.7M	\$12.2M	\$4.6M	\$69.6M
2050	\$52.7M	\$13.0M	\$4.6M	\$70.4M
2051	\$16.7M	\$9.9M	\$1.5M	\$28.1M

Year	Acquisition	Renewal	Operating Costs	Total
Total	\$1,976.7M	\$128.8M	\$128.6M	\$2,234.1M
Equivalent Average Annual	\$76.0M	\$5.0M	\$5.0M	\$85.9M

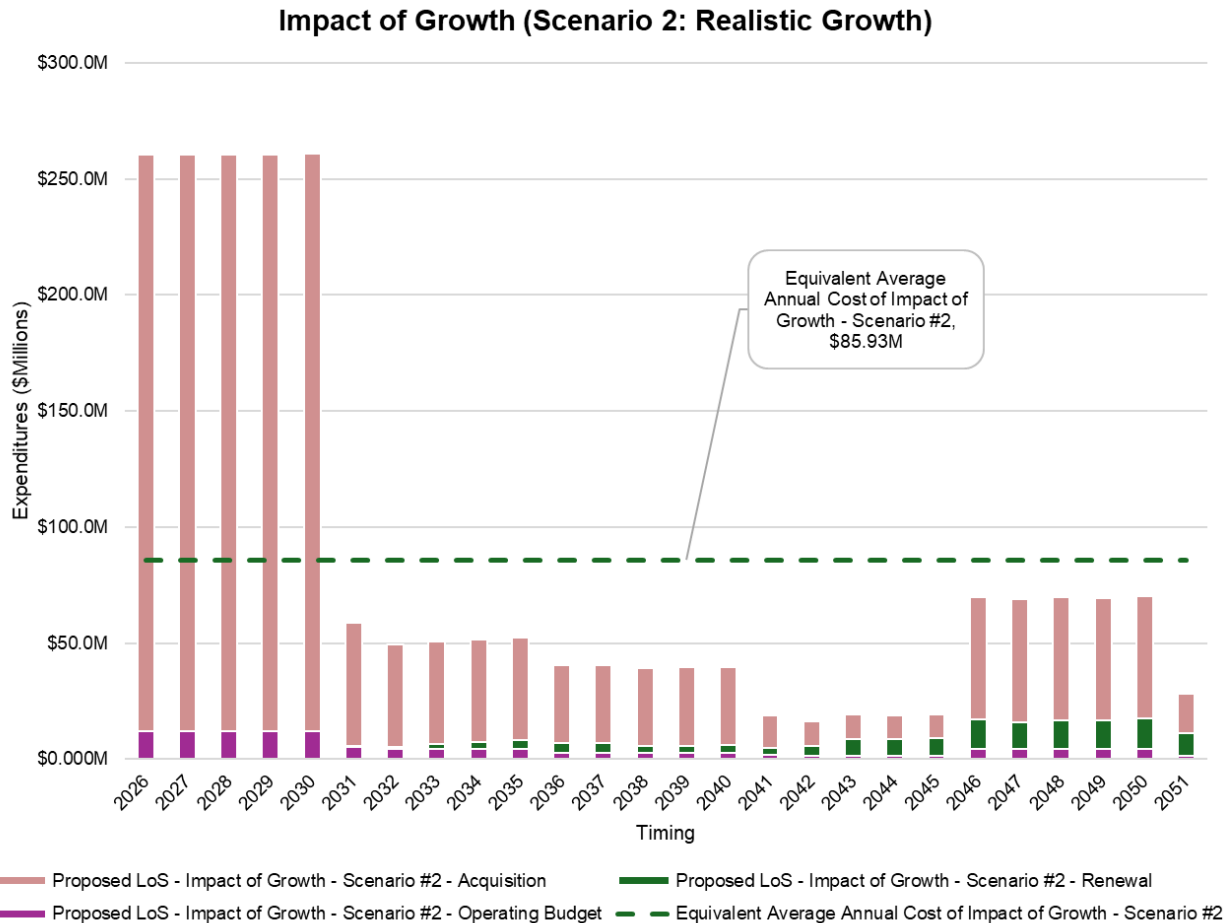


Figure 9-9: Impact of Growth (Scenario 2: Realistic Growth).

For the City to accommodate the anticipated growth in population and employment, the City will be required to acquire new assets as well perform maintenance on those assets and asset renewals. Figure 9-9 illustrates the additional funding required by the City to accommodate to meet the realistic growth objectives.

9.6 Financial Summary and Comparison

The City's current LoS (planned funding), proposed LoS (maintain current performance), and proposed LoS to achieve growth objectives are summarized and compared in the tables below.

Table 9-6 summarizes the total capital expenditures required for each scenario from 2026 to 2051 and identifies any potential funding gaps. To achieve the proposed LoS to maintain current performance levels, including maintaining 70% of the road network in a good or better state of performance, an additional **\$439.6M** will be required over the planning horizon, or an equivalent average annual funding gap of **\$16.9M**, when compared with the currently planned funding level over the same planning horizon.

Table 9-6: Current levels of service and proposed levels of service scenarios comparison and annual average infrastructure gap.

Expenditures	Current LoS - Planned Funding	Proposed LoS - Maintain Current Performance
Total Capital Expenditures (2026 to 2051)	\$2,263.8M	\$2,703.4M
Overall Funding Gap	-	\$439.6M
Equivalent Average Annual Capital Expenditures	\$87.1M	\$104.0M
Equivalent Average Annual Capital Funding Gap	-	\$16.9M
Annual Operating Expenditures	\$495.8M	\$495.8M
Annual Total Expenditures (CAPEX+OPEX)	\$582.9M	\$599.8M
Total Average Annual Funding Gap	-	\$16.9M

Table 9-7: Impact of growth scenarios comparison.

Impact	Proposed LoS - Impact of Growth (Scenario #1: Official Plan Objectives)	Proposed LoS - Impact of Growth (Scenario #2: Realistic Growth)
Total Value of Acquisitions	\$6,893.5M	\$4,830.1M
City Funded Acquisitions	\$2,686.1M	\$1,976.7M
Operating Budget	\$183.5M	\$128.6M
LC Renewals	\$232.0M	\$128.8M
Total Impact of Growth	\$3,101.6M	\$2,234.1M
Equivalent Average Annual Impact of Growth	\$119.3M	\$85.9M

Table 9-7 summarizes anticipated cost increases related to supporting the City's growth objectives under both scenarios assessed. Over the planning horizon spanning from 2026 through to 2051, City funded acquisition costs may range from **\$1,976.7M to \$2,686.1M**. Anticipated increases to the Operating budget may range from **\$128.6M to \$183.5M**. Contributions to the City's Life Cycle reserve may range from **\$128.8M to \$232.0M**. The combined equivalent average annual impact of growth cost may range from **\$85.9M to \$119.3M**.

Note that the forecasts developed herein are based on a modelling exercise that is developed and supported by a series of assumptions and represents the best information available as of it's reporting to Markham's General Committee on June 17, 2025. Therefore, these results are subject to change, as the information that supports this modelling is refined as part of the City's ongoing annual resource and budget planning process.

Based on the current financial strategy with respect to both existing and new assets, the City has a robust process and sufficient reserves to fund its assets for the next 25 years per the findings in the 2025 Asset Management Plan update.

Markham is also very aware that the costs to maintain its assets will continue to increase at an accelerated pace as new assets continue to be added and existing larger assets with longer useful lives begin to enter the 25-year life cycle horizon. Given staff's heightened attention to this issue, and the excellent track record of Council's commitment to funding the life cycle requirements on an annual basis, Markham is well positioned to deal with the complexities of keeping its assets in a state of good repair and delivering on its Asset Management plan, now and into the future.

10 Improvement and Monitoring Plan

As part of the City's Corporate Asset Management program, a detailed maturity assessment was completed for AM processes and practices.

The purpose of the maturity assessment is to identify and compare processes and practices with industry benchmarks in order to develop appropriate improvement strategies required to advance the City's AM maturity level and capabilities. The assessment framework was aligned to the Institute of Asset Management's Maturity Assessment Framework and scoring system, illustrated in Figure 10-1. This framework was used to assign ratings of 0 (Innocent) to 5 (Excellent) to each major AM process. The full methodology of the maturity assessment will be detailed in the City's forthcoming *Corporate Asset Management Strategy and Governance Framework project report*.

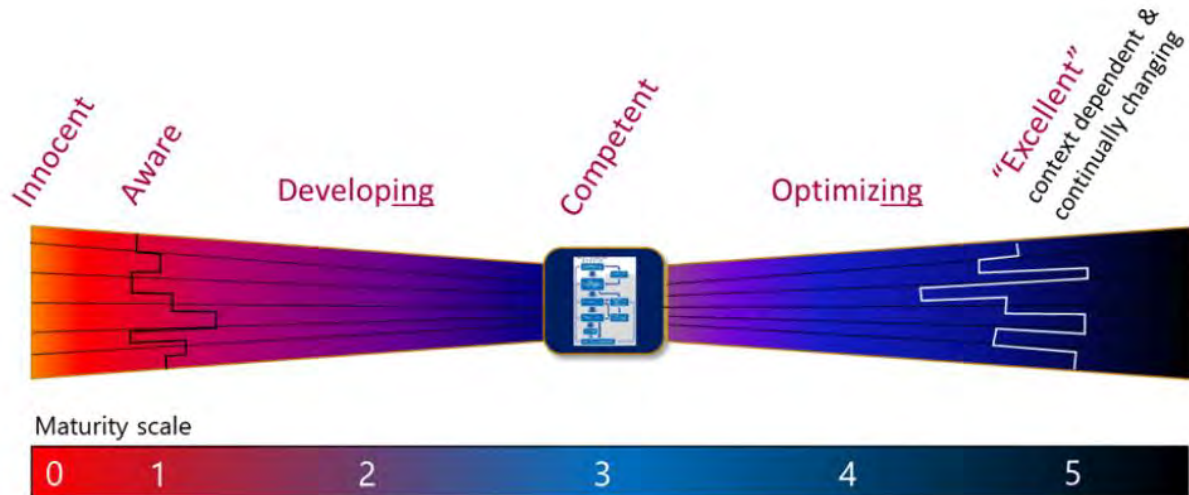


Figure 10-1: Institute of Asset Management Maturity Assessment Framework.

The asset management categories that were assessed in this maturity assessment were aligned to the City's AM Framework.

The maturity assessment was conducted on four (4) of the components in the AM Framework: Planning, Delivery, Monitoring & Reporting, and Core Support Services. The maturity of each process was assessed through a series of workshops held with City stakeholders.

The results from the assessment overlaid with the City's AM framework are illustrated in Figure 10-2.

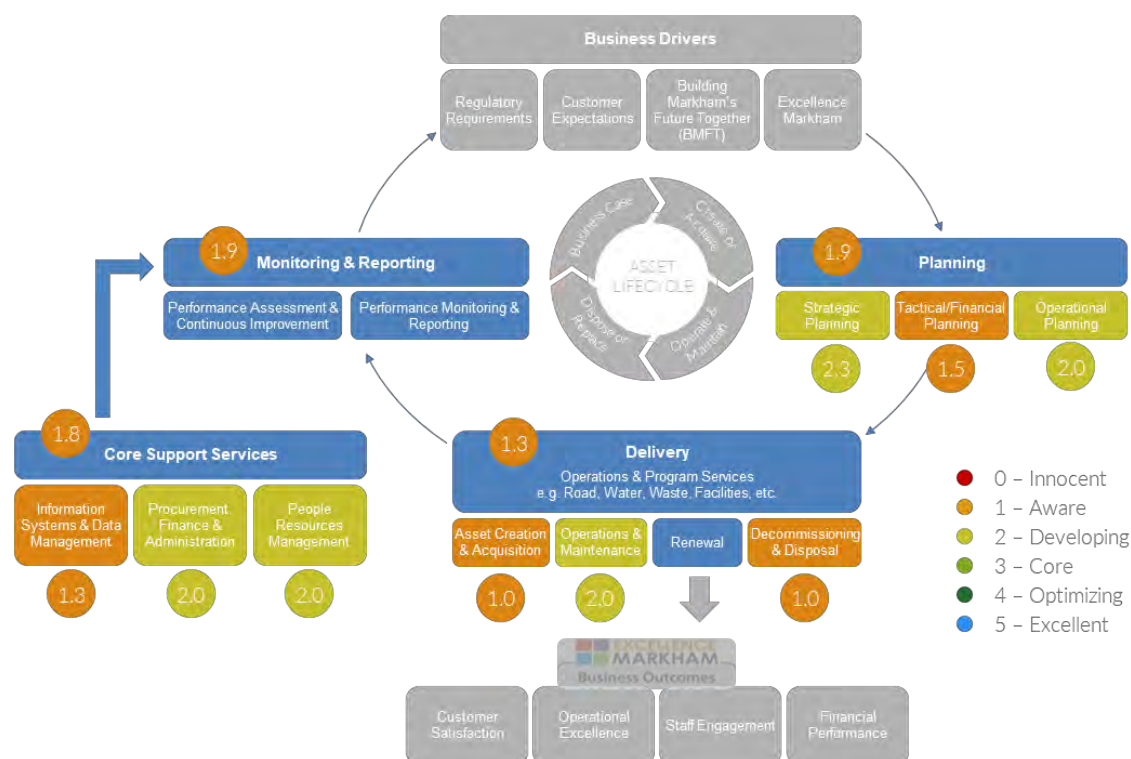


Figure 10-2: Maturity assessment results.

Overall, the City's current state of practice when analyzed using this framework was rated as "1 – Aware" to "2 – Developing", as shown in Table 10-1. Over time, the City aspires to mature its asset management planning capabilities to a "3 – Core" rating.

Table 10-1: Maturity assessment results by AM Framework category.

Category	Sub-Category	Maturity Score
Planning	Asset Management Planning	Developing
Planning	Strategic Planning	Aware to Developing
Planning	Tactical/Operational Planning	Developing
Delivery	Operations & Program Services	Aware to Developing
Monitoring & Reporting	Performance Assessment & Continuous Improvement and Performance Monitoring & Reporting	Aware to Developing
Core Support Services	Information Systems & Data Management	Aware to Developing
Core Support Services	Finance & Administration	Developing
Core Support Services	People Resources Management	Developing

The results of this assessment in conjunction with the development of this AMP were used to identify areas for improvement. The City has identified draft improvement themes that will increase the maturity of its AM system, and by extension, better integrate and improve the practice of asset management in Markham.

This assessment identified initiatives related to the following categories to increase the maturity of its AM system, and by extension, future iterations of this AMP and reporting outputs. While these initiatives have been formally endorsed along with the City’s 2024 Asset Management Plan, City staff intend to complete their review and refinement through the completion of the *Corporate Asset Management Strategy and Governance Framework project report expected in late 2025 or early 2026*.

A high-level summary of improvements includes the following initiatives:

- Defining and evaluating asset management governance, roles and responsibilities
 1. Asset Management Strategic Documents Regulatory Reporting (Strategic Upkeep)
 2. Financial Planning Support and Regulatory Reporting Plan
- Consistent and formalized standards, processes and procedures
 3. Develop Emergency/Continuity Plans
 4. Develop an Asset Management Lifecycle Strategy/SOPs
 5. Develop Asset Condition and Performance Assessment Procedures
 6. Asset Management Strategies Maintenance
- Improved data and information
 7. Develop an Asset Data and Information Strategy
- Formalized resource planning
 8. Develop a Resourcing Strategy
- Improved demand/growth analysis
 9. Implement a Formalized Demand Analysis (i.e. Growth) planning process
- Stakeholder engagement
 10. Develop a Stakeholder Engagement Plan
- Implement/develop supporting systems, tools and integrations (ex. decision support systems)
 11. Implement a Decision-Support System and integrate it with the Lifecycle Planning Process
 12. Enterprise Asset Management (EAM) System Implementation & Integration

The following table summarizes the initiatives and how completing each initiative will increase the maturity of the City’s AM System to a “3 – Core” rating.

Table 10-2: Asset Management System improvement initiatives.

No.	Initiative	AM Framework Category	Description	Timeline
1	Asset Management Strategic Documents Regulatory Reporting (Strategic Upkeep)	Planning	- Establish guidelines and enact a process to continually update the Asset Management System: - Update the AM Policy every 5 years - Update the AM strategy (including governance framework) every 5 years - Update the AMP every 5 years - Perform a maturity assessment every 5 years - Annual review of asset management planning progress - Identify the means for rolling out these procedures to the organization (i.e. cross-disciplinary collaboration)	Ongoing

No.	Initiative	AM Framework Category	Description	Timeline
2	Financial Planning Support and Regulatory Reporting Plan	Core Support Services	- Establish roles and responsibilities from applicable service areas for various types of regulatory reporting. - Standardize frameworks to determine if regulatory reporting can be completed in-house or through consulting services. - Integrate regulatory reporting with AM program. - Provide a clear definition of Finance department's responsibilities to support AM processes. - Establish roles and responsibility to support finance in the lifecycle process. - Develop a corporate-wide framework to integrate the asset risk management strategies into the City's financial planning processes in order to prioritize projects using prioritization criteria to assist in the allocation of financial resources and decision-making.	Longer-Term
3	Develop Emergency/Continuity Plans	Planning	- Develop Business Continuity Plans, Emergency Management Plans, etc. for each service area, including: - Procedures, roles and responsibilities - Outlining highly critical assets	Medium- to long-term

No.	Initiative	AM Framework Category	Description	Timeline
4	Develop an Asset Management Lifecycle Strategy/SOPs	Planning and Core Support Services	- Formally document the lifecycle procedures for each asset group. - Formally document processes for updating asset inventories with new assets including roles and responsibilities, i.e., when asset replacements or renewals take place, decommissioning, etc. - Tie processes to the City's lifecycle management strategy/activities - Address implementation and training of new procedures related to AM data management. - Implement a formal communication process to notify appropriate departments of changes to asset data that affect them (ex. onboarding new assets).	Medium-term
5	Develop Asset Condition and Performance Assessment Procedures	Monitoring & Reporting	- Formally develop condition assessment procedures and integrate across all service areas. - Develop a formal process for integrating condition data into AM data, processes and ensure it aligns with AM objectives. - Develop definitions for asset performance across all service areas.	Medium-term

No.	Initiative	AM Framework Category	Description	Timeline
6	Asset Management Strategies Maintenance	Monitoring & Reporting	• Develop processes and collect/improve asset data (identify data gaps and collect appropriate data/asset attributes to be used in a risk management strategy) to better understand consumable asset risk. Enhance the risk management strategy to include the updated asset data. • Implement the asset management strategies (LoS, lifecycle management, and risk management strategies) • Integrate a regular process of reporting on performance and levels of service to align with O.Reg. 588/17. Asset data should be formatted in a way so it is easy for staff to pull the required data for reporting. • Integrate the asset management strategies with each other. • Commit to continually updating the strategies (5-years). • Update the strategies to include climate change considerations.	Ongoing

No.	Initiative	AM Framework Category	Description	Timeline
7	Develop an Asset Data and Information Strategy:	All	- Define and establish the asset information systems that will be used, the data they will store, and how each system will link to one another to produce and formally establish one “source of truth”. - Formally document processes on maintaining the integrity of the “source of truth” and keeping it current (up to date). - Develop data standards indicating what information is required to support asset management analyses, reporting, and AM/organizational objectives. - Establish definitions for data quality and accuracy. - Establish QA/QC procedures to ensure that data is correct, up to date (including key attributes such as installation dates, replacement dates, rehabilitation dates, replacement values, etc.), and in a consistent format. - Ensure the appropriate groups of people have access to the data and that data is in a usable format that supports other AM processes. - Define governance for various datasets.	Short-term

No.	Initiative	AM Framework Category	Description	Timeline
8	Develop a Resourcing Strategy	Core Support Services	- Implement the current growth model (under development) as part of identifying people resources to support this strategy. - Develop a formal process and resourcing strategy that identifies required staffing levels for the City to be able to meet its AM objectives.	Short- to medium-term
9	Implement a Formalized Demand Analysis (i.e. Growth) planning process	Planning	- Identify the types of demand analysis that need to be performed for each service area and their frequency (e.g., master plans, vs. others) - Adopt a regular cycle of updates to this process. - Integrate the demand analysis with future resource planning for growth (ex. impact of growth model). - Formally document processes, roles, and responsibilities across all service areas with respect to demand analysis. - Integrate this process with Asset Management objectives. - Perform the studies more frequently to understand how they are sequenced along with other related initiatives.	Short-term

No.	Initiative	AM Framework Category	Description	Timeline
10	Develop a Stakeholder Engagement Plan:	Monitoring & Reporting and Core Support Services	- Staff are educated on asset management, the asset management system, and are engaged in a combined effort to achieve the City's AM objectives. - Develop and implement a formal framework to engage both stakeholders and community members. - Develop a framework to implement stakeholder and community member feedback into current and future AM planning. - Hold community engagement events and incorporate feedback into decision-making processes and LoS.	Longer-term
11	Implement a Decision-Support System and Integrate it with the Lifecycle Planning Process	Planning, Delivery, and Core Support Services	- Formally document processes, roles, and responsibilities across all service areas for the lifecycle planning process. - Define and centralize the sub-processes of the lifecycle process. - Establish ownership of the lifecycle planning process via the AM group (or another neutral party). Coordinate the processes, policies and decision points. - Perform the AM analyses annually to support capital planning and budgeting. - Integrate the standardized risk framework into decision-making. - Integrate the lifecycle planning process with Asset Management objectives.	Short- to medium-term

No.	Initiative	AM Framework Category	Description	Timeline
12	Enterprise Asset Management (EAM) System Implementation & Integration:	All	- Continue to implement the EAM system and integrate it into day-to-day operations. - Incorporate the standardized risk framework to be incorporated into operations and maintenance strategies. - Develop a process or role to operationalize the EAM platform across all service areas. - Integrate the EAM system with a DSS system or AM planning activities.	Ongoing

These initiatives were prioritized based on:

- If the initiative targets lower maturity scores resulting a more significant impact/improvement to the overall maturity
- Appropriate sequencing: The downstream effect the project may have on other processes and projects (i.e., projects that are required to be completed first. For example, data is used for all AM analyses. Developing a data strategy for consistent data collection and understanding what data is available should be completed before developing a risk management strategy).
- The resources required for each initiative, including both internal and external resources.

As the City undertakes and completes these initiatives, the overall maturity of the AM system will improve and the confidence of the AM analyses and reporting outputs that support this AMP will increase.

Part of the City's AM program is to adopt a culture of continual improvement to ensure that AM planning processes are reviewed regularly to evolve as needed to suit the City's changing landscape, as well as improve the confidence in the AM analyses that support this AMP and future AMPs. The City's improvement plan is a significant step forward in adopting this culture.

11 Closing Remarks

The City of Markham is a relatively young municipality – the average age of its asset portfolio is approximately 34 years. The majority of the City’s asset portfolio on average is within the early stages of its service life. Overall, the City’s infrastructure is in “Good” state of performance, which is a reflection of the fact that the City has responsibly allocated financial resources to manage its assets, ensuring they remain fit for service, and provide exceptional services to the community.

The City has a robust, annual lifecycle planning process, which has been put in place to assist the City in taking a proactive approach to planning for and managing its state of infrastructure into the future. The City’s overall asset performance reflects this process.

Although the City has some assets in poor and very poor performance, it is important to note that this does not necessarily mean that assets are not fit for service. The rating could simply mean that the assets are coming up for replacement under the City’s planned life cycle model and will be addressed in the coming years, or are short-life consumable assets, or that they will be conditioned-assessed to determine if the useful service life can be extended beyond the prescribed industry standard useful life. This is a normal practice that occurs in all municipalities in their efforts to maximize the useful service life of an asset and the allocation of limited financial resources. The City always operates in a manner to ensure that services are provided safely by managing and maintaining its poor/very poor performance assets.

The City’s Asset Management program can assist to create better understanding of how to manage these assets, by developing processes and data to better understand asset risk and ensure alignment that the City’s investment analysis and decisions minimize risks and maximize levels of service.

A key piece of this AMP is the City’s Improvement Plan. It sets up a series of actions for the City’s AM program to mature and provide better data/analyses to support better decision-making. Furthermore, this AMP represents a significant step forward in the City’s AM journey. It has introduced key frameworks and analyses that support better decision-making. Particularly, the City has enacted a framework to record and monitor levels of service, which is paired with an investment and performance forecast, and financial summary. The City should continue to monitor its levels of service against its spending, to better understand how services are being delivered, and assets are being managed. Asset management is a journey, and the processes and data that it provides will ensure the City continues to keep a proactive approach to providing exceptional services to the community.



2025 Asset Management Plan

City of Markham

Appendices

Appendix A. Potable Water

Service Summary



The City's potable water services contain assets that support the distribution of clean and safe drinking water to residents and businesses.

The City of Markham's water comes from Lake Ontario, which is treated by the City of Toronto's and Region of Peel's water treatment facilities. The City is responsible for water distribution assets, such as watermain and fire hydrants, as well as water management assets like sampling stations and bulk water sales stations, as shown in Figure A - 1.

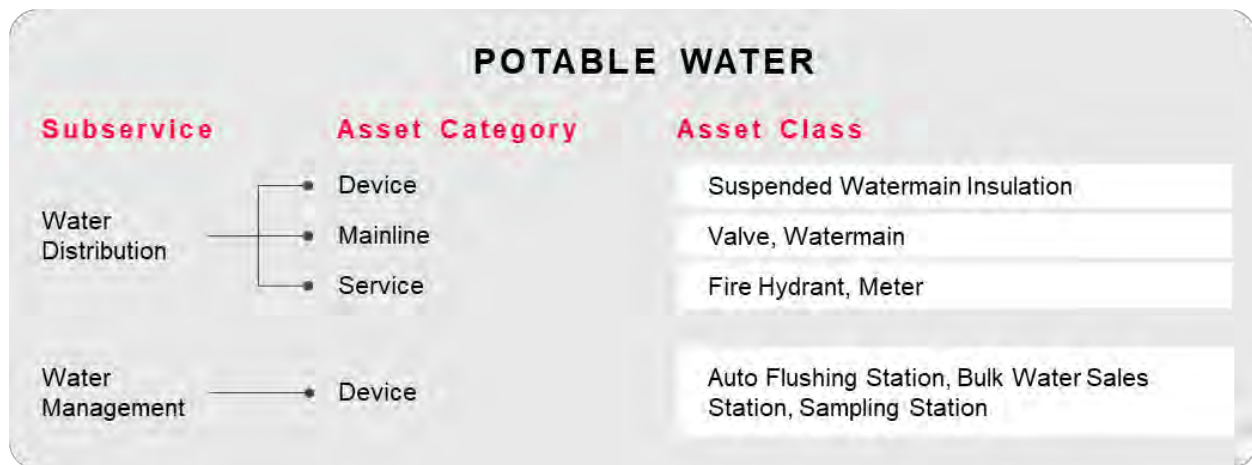


Figure A - 1: Potable Water hierarchy.

More information on potable water assets such as state of infrastructure, levels of service, risk management strategies, lifecycle management strategies and forecasting can be found in the following sections. The sections are split by the major subservices: Water Distribution and Water Management.

A.1 Water Distribution

A.1.1 State of the Infrastructure

Figure A - 2 provides the replacement value for all potable water assets, while Figure A - 3 illustrates the replacement values for water distribution assets. The total replacement value for water distribution assets is \$1,925.1M.

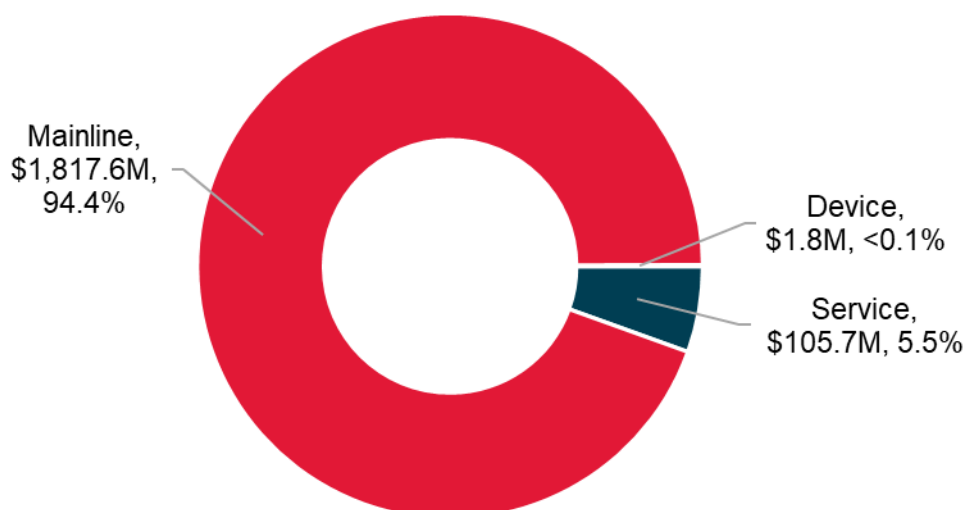


Figure A - 2: Replacement value distribution of Water Distribution assets.

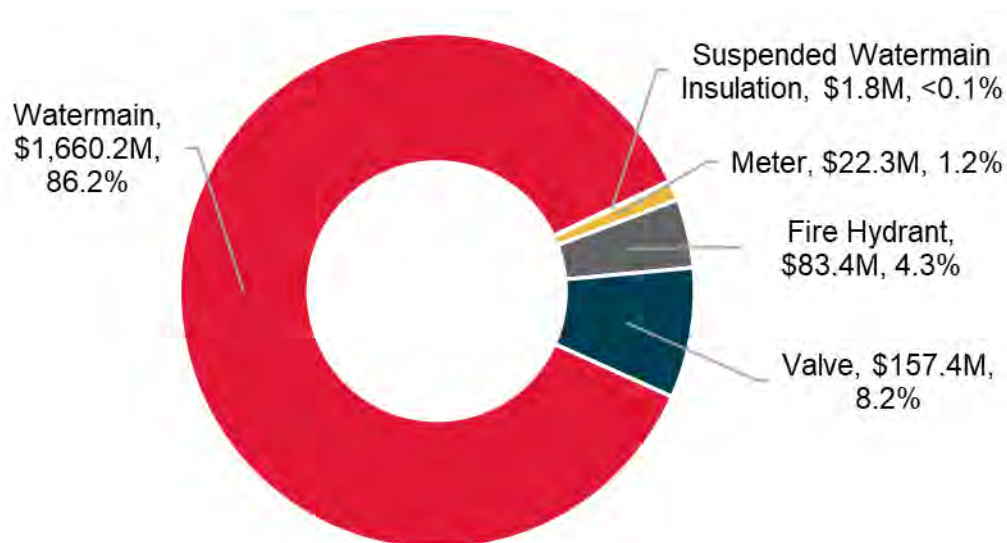


Figure A - 3: Replacement value of Water Distribution assets by asset class.

A.1.1.1 Asset Inventory and Valuation

Table A - 1 below summarizes the asset valuation, quantities, and condition for each asset category for Water Distribution assets.

Table A - 1: Inventory and valuation for Water Distribution assets.

Asset Category	Asset Class	Replacement Cost	Inventory	Average Performance
Device	Suspended Watermain Insulation	\$1,806,319	13 Assets	Good
Mainline	Valve	\$157,368,602	11,320 Assets	Fair
Mainline	Watermain	\$1,660,224,176	1,097,996 m	Fair
Service	Fire Hydrant	\$83,369,243	8,894 Assets	Fair
Service	Meter	\$22,343,109	85,240 Assets	Fair
Total	-	\$1,925,111,450	-	-

A.1.1.2 Age and Estimated Service Life

Figure A - 4 illustrates the age of water distribution assets as a proportion of their estimated service life. Figure A - 5 illustrates the value of water distribution assets acquired by decade. Generally, all asset types are on average between a third and halfway through their estimated service life. No asset classes have an average age that exceeds the average ESL.

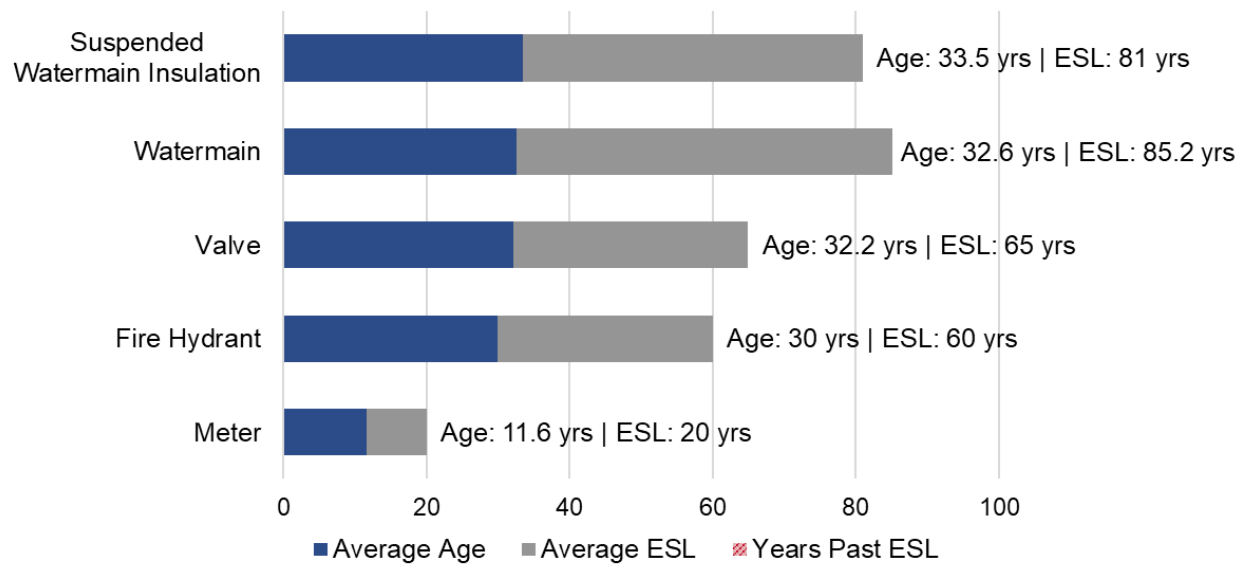


Figure A - 4: Age as a proportion of estimated service life (ESL) of Water Distribution assets.

The installation profile of potable water assets illustrates that the majority of watermains were installed from the 1980s to 2000s, which is in line with decades that experienced significant growth and corresponding development in the City.

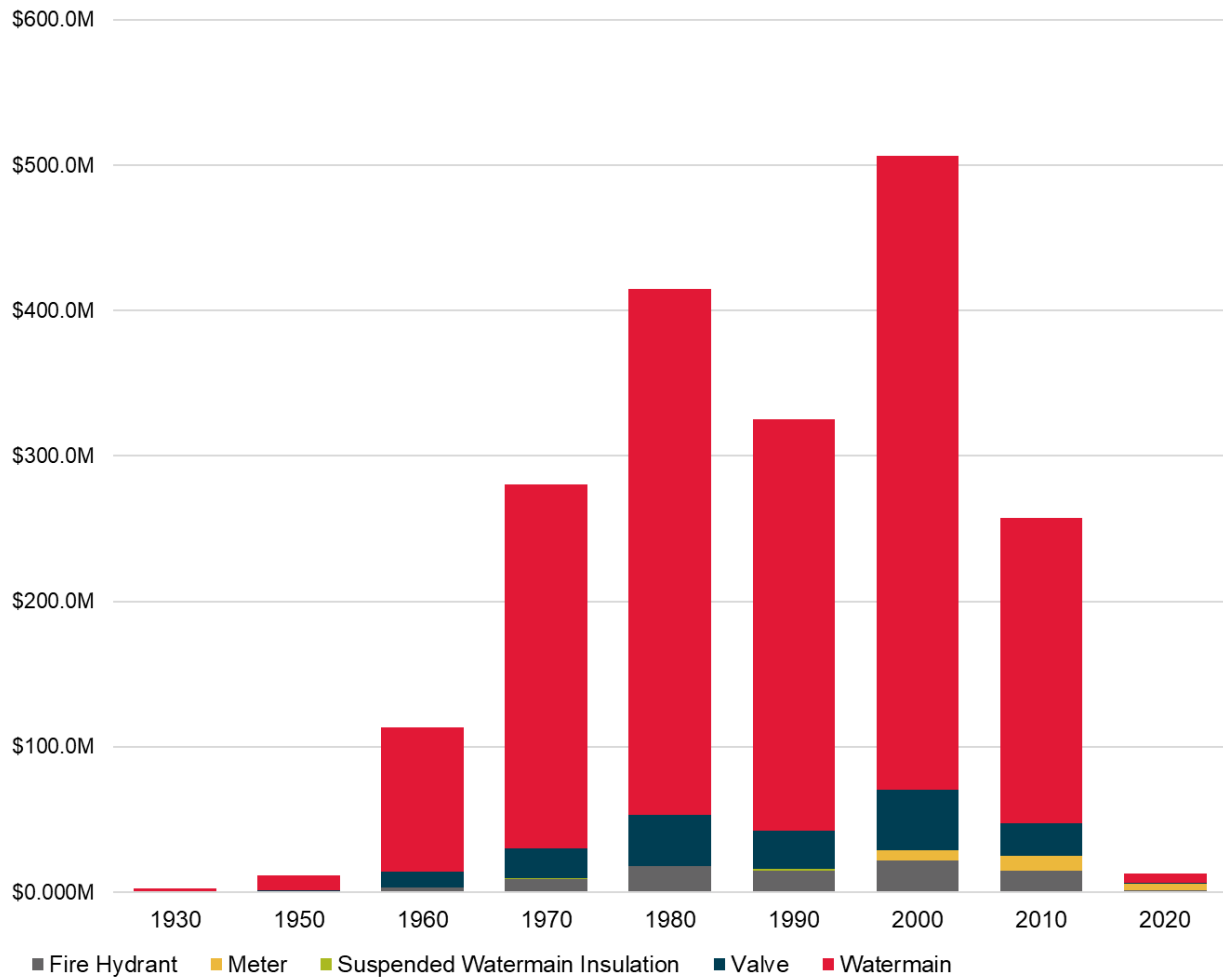


Figure A - 5: Age distribution by installation decade of Water Distribution assets.

A.1.1.3 Asset Performance

Table A - 2 details the approaches that the City utilizes to assess asset performance for of each asset class in potable water services.

Table A - 2: Performance assessment approaches to Water Distribution assets.

Asset Class	Performance Reporting Metric	Description
Suspended Watermain Insulation	Remaining Life/ESL	The City understands the performance of these assets based on asset age and estimated service life.
Watermain	Remaining Life/ESL (Derived from a combination of asset age and watermain break data)	The City records watermain breaks as maintenance records against each watermain asset in their digital inventory. The City uses a combination of breaks and watermain age as a metric to understand performance (with a 60% to 40% ratio of age to breaks). This ratio is translated to a remaining life, which is used in the asset management plan for forecasting purposes.
Meter	Remaining Life/ESL	The City understands the performance of these assets based on asset age and estimated service life.
Fire Hydrant	Remaining Life/ESL	The City understands the performance of these assets based on asset age and estimated service life.
Valve	Remaining Life/ESL	The City understands the performance of these assets based on asset age and estimated service life.

Table A - 3 summarizes the relationship between the performance categories and how performance ratings are determined. Figure A - 6 and Figure A - 7 illustrate the performance distribution of all drinking water distribution assets.

Table A - 3: Performance rating of Water Distribution assets.

Condition Category	Remaining Life/ESL ⁴	Age/ESL
Very Good	100% - 80%	0% - 20%
Good	80% - 60%	20% - 40%
Fair	60% - 40%	40% - 60%
Poor	40% - 20%	60% - 80%
Very Poor	< 20%	> 80%

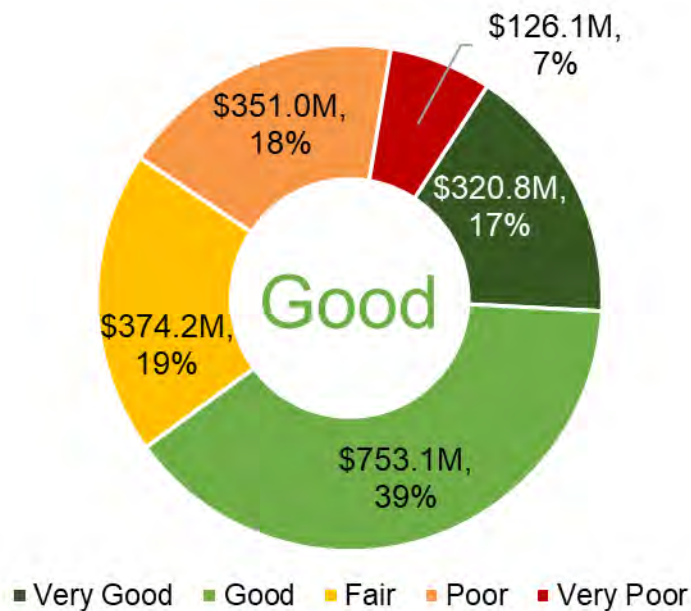


Figure A - 6: Condition distribution of Water Distribution assets.

⁴ For Watermains, remaining life is derived from a combination of breaks and age.



Figure A - 7: Condition distribution of Potable Water assets by asset class.

A.1.2 Levels of Service

Customer values, customer levels of service and technical levels of service for Water Distribution assets can be found in Table A - 4 to Table A - 8. Furthermore, mandated O.Reg. LoS can be found in Table A - 9 to Table A - 10.

A.1.2.1 Customer Values

Table A - 4: Potable Water customer values.

Customer Satisfaction Measure		Current Feedback & Expected Trend Based on Planned Budget
Potable water distribution and management services assets are safe and reliable to use		
Assets are structurally adequate for use and in overall good working condition.		Future Iterations ⁵
Assets can support customer water demand, including peak demand hours.		Future Iterations ⁵
Water distribution system has adequate pressure and flow for fire fighting purpose.		Future Iterations ⁵
Quality controls and devices have been installed to increase water quality consumption safety and reduce overall number of watermain breaks and property related damages.		Future Iterations ⁵
Potable water distribution and management services assets are convenient to use		
The quality of assets does not negatively affect water usage.		Future Iterations ⁵
Potable water distribution and management services assets are accessible and easy to access.		Future Iterations ⁵

⁵ The City is currently reviewing the data that supports this metric, which will be reported in future iterations of the City's AMP. These metrics are subject to change as data is reviewed and incorporated into future AMPs.

A.1.2.2 Customer and Technical Levels of Service

Table A - 5: Water Distribution – Mainlines customer LoS.

Type of Measure	Level of Service	Performance Measure	Current Performance	Confidence Level
Condition	Condition of Watermain	Weighted Index (60% age & 40% watermain breaks) – expressed as a remaining life and aggregated into 5-point rating scales.	Fair	High – watermain break data is used in conjunction with age/estimated service life to evaluate watermain condition.
Condition	Condition of Valves and Valve Chambers	Condition or Age/Remaining Useful Life - Aggregated into 5-point rating scale.	Fair	Low – age and ESL are used to evaluate asset condition in place of condition data.
Condition	Individual element/element group condition.	Percentage of all elements/element groups in very poor to poor condition.	24%	Low – age and ESL are used to evaluate asset condition where condition data is not available.
Function	Measure of whether the service is appropriate for its intended use	Future Iterations ⁶	Future Iterations ⁶	Future Iterations ⁶
Capacity	Measure of whether the service is adequate to meet water demand needs	Future Iterations ⁶	Future Iterations ⁶	Future Iterations ⁶
Accessibility	Service interruptions	Number of properties that experienced a service interruption.	159 out of 91,375 properties	Not applicable

⁶ The City is currently reviewing and selecting measures for this category, which will be developed and integrated into future iterations of the City's AMP.

Table A - 6: Water Distribution – Services customer LoS.

Type of Measure	Level of Service	Performance Measure	Current Performance	Confidence Level
Condition	Condition of Fire Hydrants and Condition of Meters	Condition or Age/ Remaining Useful Life – Aggregated into 5-point rating system.	Fair	Low – age and ESL are used to evaluate asset condition where condition data is not available
Condition	Individual element/element group condition	Percentage of all elements/element groups in very poor to poor condition	37%	Low – age and ESL are used to evaluate asset condition where condition data is not available
Function	Measure of whether the service is appropriate for its intended use	Future Iterations ⁶	Future Iterations ⁶	Future Iterations ⁶
Capacity	Measure of whether the service is adequate to meet water demand needs	Future Iterations ⁶	Future Iterations ⁶	Future Iterations ⁶
Accessibility	Service Interruptions	Number of properties that experienced a service interruption.	159 out of 91,375 properties	High

Table A - 7: Water Distribution – Devices customer LoS.

Type of Measure	Level of Service	Performance Measure	Current Performance	Confidence Level
Condition	Condition of Suspended Watermain Insulation	Condition or Age/Remaining Useful Life - Aggregated into 5- point rating scale.	Good	Moderate to High – age and ESL are used to evaluate asset condition where condition data is not available.
Condition	Individual element/ element group condition	Percentage of all elements/element groups in very poor to poor condition.	31%	Moderate to High – age and ESL are used to evaluate asset condition where condition data is not available.
Function	Measure of whether the service is appropriate for its intended use.	Future Iterations ⁶	Future Iterations ⁶	Future Iterations ⁶
Capacity	Measure of whether the service is adequate to meet water demand needs	Future Iterations ⁶	Future Iterations ⁶	Future Iterations ⁶
Accessibility	Service interruptions	Number of properties that experienced a service interruption.	159 out of 91,375 properties	High

Table A - 8: Water Distribution technical LoS.

Lifecycle Activity	Purpose of Activity	Activity Measure	Current Performance (\$2025 Budget)	Recommended Performance
Acquisition	Growth Expansion Development	Projects developed in Future Urban Area Conceptual Master Plan - Transportation, Water and Wastewater Master Plan Class Environmental Assessment Study	\$31,549,100	Growth Planning Horizon: 2026-2051 Total Acquisition Value Range: \$424.4M - \$605.7M City Funded Acquisition Value Range: \$30.9M - \$37.0M
Operation	Inspections	Annual programs	\$36,300 The City's 2025 operating budget for all services was \$495.8M.	Maintain current performance for assets in service. Anticipated operating budget increase ranges from \$11.3M to \$16.1M over the growth planning horizon: 2026-2051.
Operation	Regulator Operations	As required	See above	See above
Maintenance	Minor Repairs	As required	City performs the following annual programs (part of 2025 capital budget): 1. Cathodic Protection of DI watermain \$477,900 2. Curb Box inspection and replacements Program (\$747,900)	Maintain current performance for assets in service. Anticipated maintenance budget increases are included in the operating or renewal budget forecasts.
Maintenance	Regular Maintenance	Annual Programs	See above	See above

Lifecycle Activity	Purpose of Activity	Activity Measure	Current Performance (\$,2025 Budget)	Recommended Performance
Maintenance	Major Maintenance (Holding Strategies)	As Required	See above	See above
Renewal	Major rehabilitation or replacement	As required	\$13,012,200 (City's LCRS)	PLoS Maintain Current Performance requires \$16.29M or \$3.27M per year on average of additional funds from 2026 to 2051.
Disposal	Disposal of replaced assets	As required	Included with renewal costs	Maintain current performance for assets in service.
Service Improvement	Upgrades to improve LoS to benefit existing serviced areas	As required	\$750,100	Maintain current performance

A.1.2.3 Ontario Regulation 588/17 Levels of Service

Levels of service that are prescribed by O.Reg. 588/17 apply to all water assets that relate to the collection, production, treatment, storage, supply or distribution of water. The following tables detail the O.Reg. 588/17 prescribed levels of service for the Potable Water group.

Table A - 9: Potable Water O.Reg. 588/17 customer LoS.

Service Attributes	Qualitative Descriptions or Technical Metrics	Metric
Scope	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 A - 8: showing properties connected to Municipal Water System and Fire Flow Availability
Scope	Description, which may include maps, of the user groups or areas of the municipality that have fire flow.	Refer to Figure A - 8: 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 2024 calendar year. Service interruptions typically occur due to watermain breaks.

Table A - 10: Potable Water O.Reg. 588/17 technical LoS.

Service Attributes	Qualitative Descriptions or Technical Metrics	Metric
Scope	Percentage of properties connected to the municipal water system.	97%
Scope	Percentage of properties where fire flow is available	97%
Reliability	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
Reliability	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.	11 connection-days for a total of 91,375 properties (159 out of 91,375 properties)

Properties Connected to Municipal Water System and Fire Flow Availability

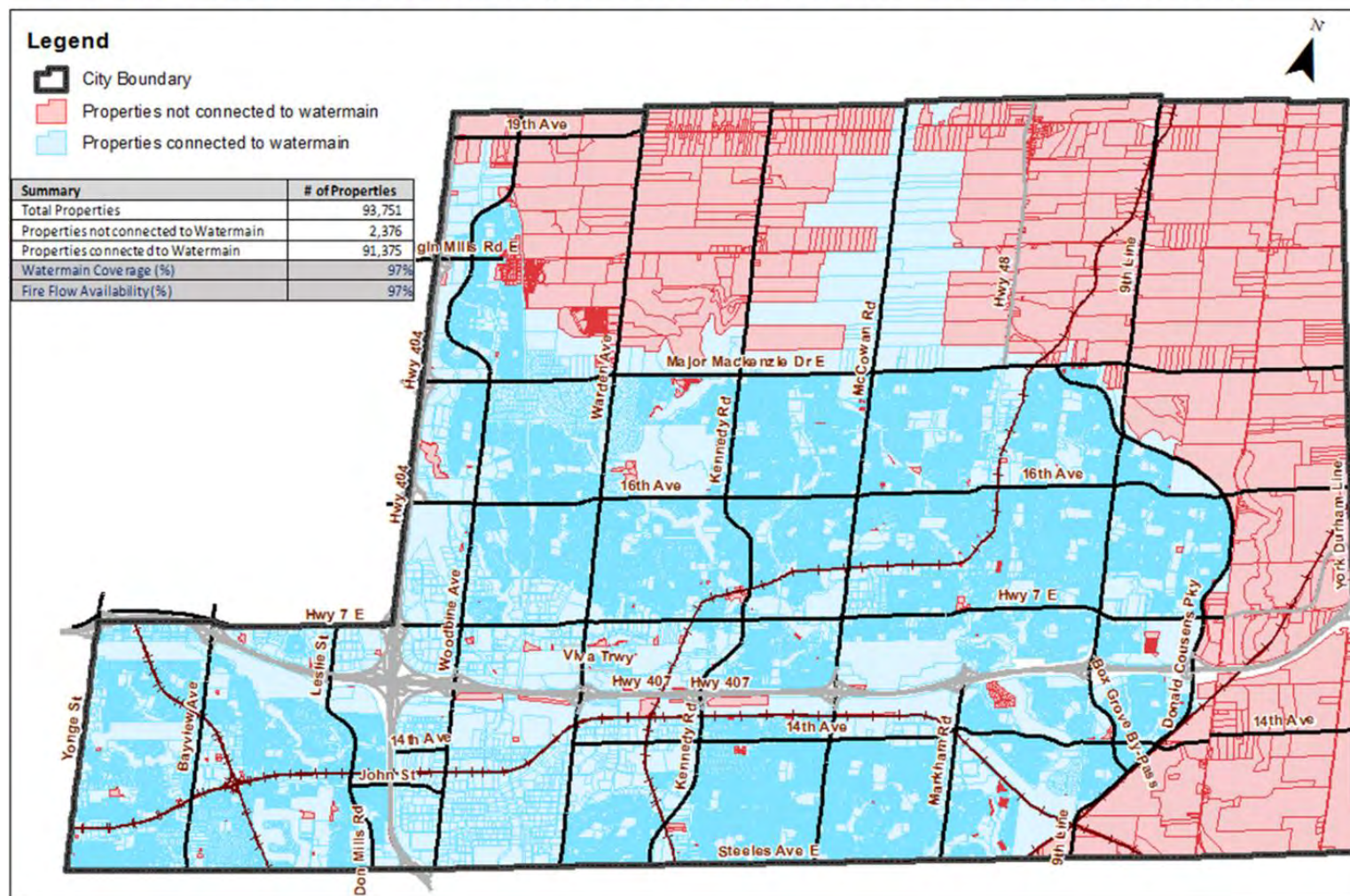


Figure A - 8: City of Markham Water network connectivity and fire flow availability.

A.1.3 Risk Management Strategy

The criteria used to determine the consequence of failure for Water Distribution Assets can be found in Table A - 11 below.

Table A - 11: COF criteria used for Water Distribution assets.

Direct Financial	Socio-Economic	Environmental
Replacement cost	- Land use - Diameter	- Proximity to ESA or Public Recreational Areas - Proximity to ESA, watercourse, or habitat

Table A - 12 displays the risk score for Potable Water assets along with the proportion of assets within each risk score, likelihood of failure and consequence of failure.

Table A - 12: Risk score distribution of Water Distribution assets.

	COF 1	COF 2	COF 3	COF 4	COF 5	Subtotal
LOF 1	\$3.7M (0.2%)	\$270.5M (14.0%)	\$43.6M (2.3%)	\$3.0M (0.2%)	None	\$320.8 (16.7%)
LOF 2	\$4.9M (0.3%)	\$624.8M (32.5%)	\$116.2M (6.0%)	\$7.3M (0.4%)	None	\$753.1M (39.1%)
LOF 3	\$4.4M (0.2%)	\$306.3M (15.9%)	\$62.5M (3.2%)	\$1.0M (<0.1%)	None	\$374.2M (19.4%)
LOF 4	\$2.8M (0.1%)	\$280.0M (14.5%)	\$64.1M (3.3%)	\$4.3M (0.2%)	None	\$351.0M (18.2%)
LOF 5	\$6.6M (0.3%)	\$97.0M (5.0%)	\$22.1M (1.1%)	\$0.4M (0.0%)	None	\$126.1M (6.5%)
Subtotal	\$22.3M (1.2%)	\$1.6B (82.0%)	\$308.5M (16.0%)	\$15.9M (0.8%)	None	\$1.9B

Table A - 13: Risk score mapping legend.

Risk	Risk Score	Risk Description	Total Replacement Cost
Very Low	1 – 5	Fit for the Future	\$965,143,917 (50.1%)
Low	6 – 10	Adequate for Now	\$869,326,918 (45.1%)
Moderate	11 – 15	Requires Attention	\$87,135,799 (4.5%)
High	16 – 20	At Risk	\$4,640,061 (0.2%)
Very High	21 – 25	Unfit for Sustained Service	None

A.1.4 Lifecycle Management Activities

The City's lifecycle management activities for Water Distribution assets are listed in Table A - 8. These activities include the acquisition of assets and service improvements, operations and maintenance, major asset renewals (including rehabilitations and replacements), and disposals.

These lifecycle management activities in conjunction with the lifecycle forecasting are used to determine the funding required for the City to continue performing these lifecycle activities to extend asset life, reduce overall costs, and minimize risk while providing the proposed service levels.

A.1.5 Lifecycle Forecasting

The following section outlines the funding required for the entire lifecycle of Water Distribution assets. The expenditures were determined using the lifecycle activities outlined in Table A - 8 and the PLoS established.

Required funding was determined for PLoS using the following forecasting analysis parameters:

- Proposed LoS – Maintain Current Performance:** funding required to maintain a similar asset performance over a 26-year period. The City has established this LoS as the PLoS for Water Distribution assets. It focuses on maintaining the percentage of assets in backlog in a similar state. Backlog is defined as assets that are in need of renewal work (either significant rehabilitation or replacement). For example, if 20% of assets are past their service life, or are in need of renewal work, then the forecast model will determine the funding to maintain 20% of assets in this state over the forecast period.

The following table summarizes the anticipated funding from the LCRS for renewal activities for Water Distribution assets. A total of **\$269.3M** over the next 26 years (or an equivalent average annual of **\$10.4M**) for renewals is anticipated to be spent.

Table A - 14: Forecasted capital renewal expenditures (Life Cycle Reserve Study) for Water Distribution assets.

Year	Capital Expenditures (Renewal)
2026	\$13,133,127
2027	\$15,825,718
2028	\$4,330,973
2029	\$11,299,534
2030	\$10,582,459
2031	\$10,094,621

Year	Capital Expenditures (Renewal)
2032	\$8,013,631
2033	\$4,160,438
2034	\$4,141,615
2035	\$4,062,276
2036	\$4,907,271
2037	\$10,641,760
2038	\$8,161,556
2039	\$12,539,674
2040	\$11,519,809
2041	\$11,680,871
2042	\$13,327,315
2043	\$14,200,953
2044	\$13,523,018
2045	\$13,116,537
2046	\$15,107,374
2047	\$15,158,803
2048	\$11,302,582
2049	\$10,972,467
2050	\$10,018,082
2051	\$7,504,567
Total	\$269,327,031
Equivalent Average Annual	\$10,358,732

Figure A - 9 and Figure A - 10 illustrate the performance and financial forecasts to achieve PLoS for all Water Distribution assets. The forecast analysis identified a total of **\$423.5M** (or an equivalent average annual of **\$16.3M**) that is anticipated to be spent over the next 26 years to maintain current performance. This represents funding gap of **\$154.1M** over the planning horizon, or an equivalent average annual amount of **\$5.9M**. Note that there is a significant expenditure forecasted in 2048, which represents a significant amount of asset renewal needs that are forecasted to occur in or near that timeframe.

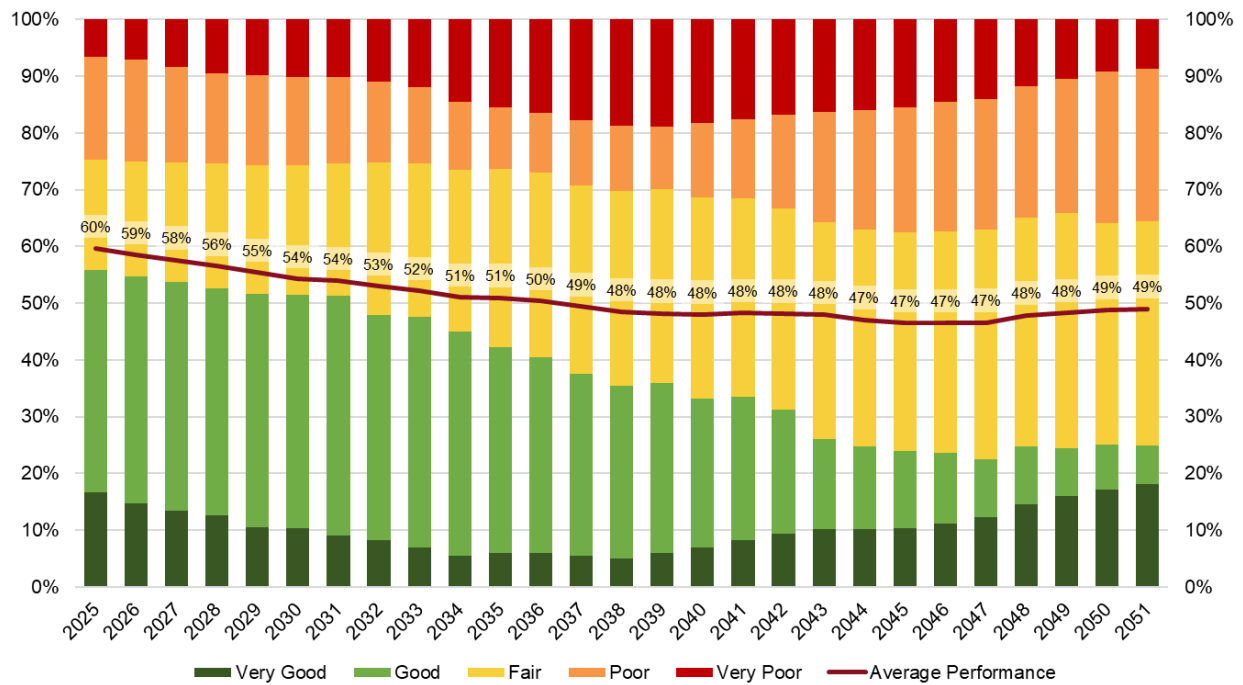


Figure A - 9: Performance Distribution – maintain current performance for Water Distribution assets.

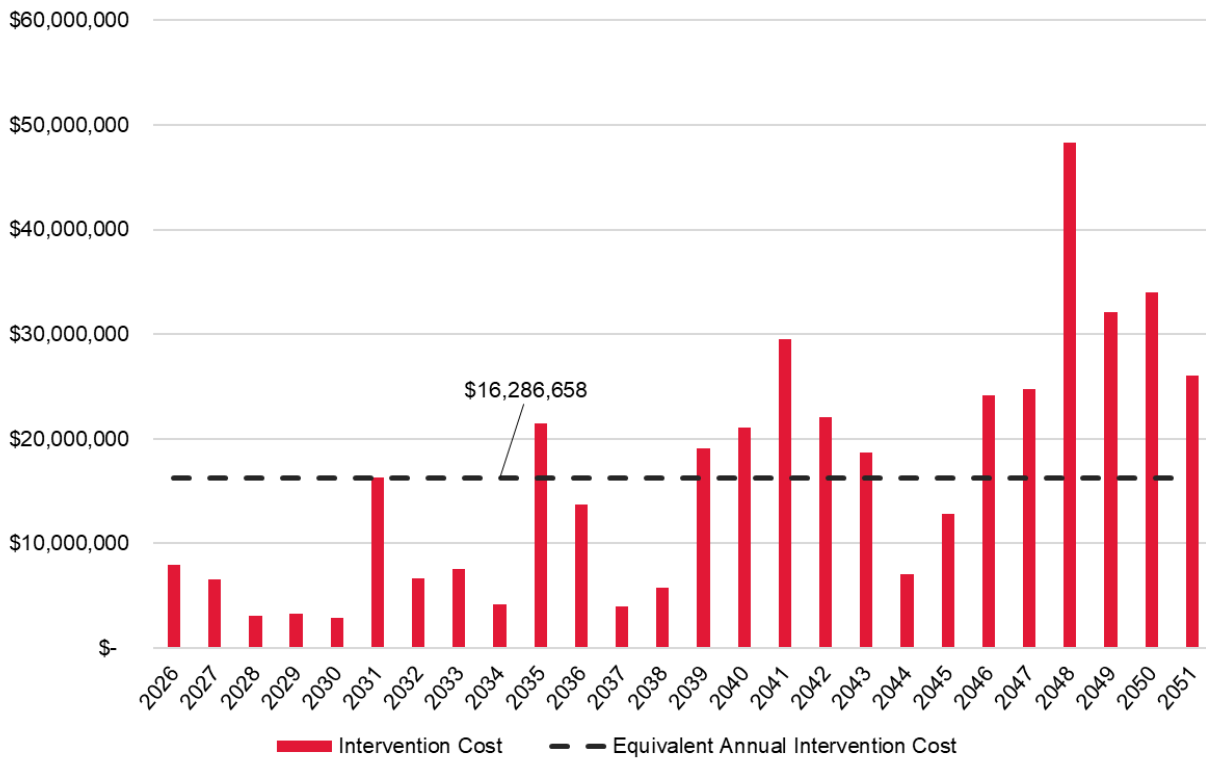


Figure A - 10: Maintain current performance intervention costs for Water Distribution assets.

A.2 Water Management

A.2.1 State of the Infrastructure

Figure A - 11 shows the replacement value of Water Management assets while Figure A - 12 illustrates the replacement value of Water Management assets by asset class. The total replacement value for water distribution assets is \$1.1M.

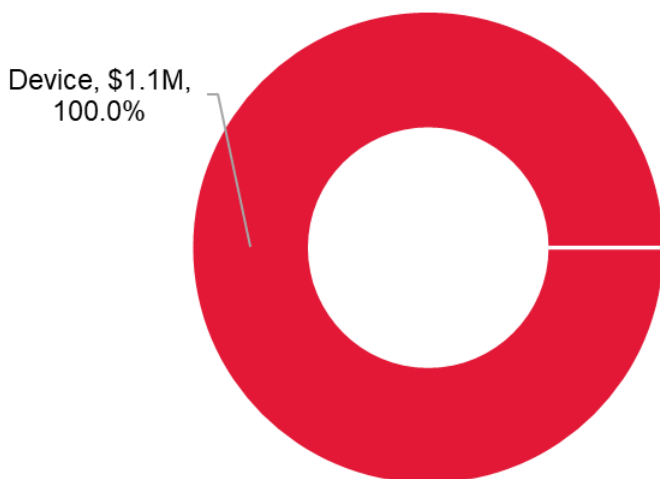


Figure A - 11: Replacement value distribution of Water Management assets.

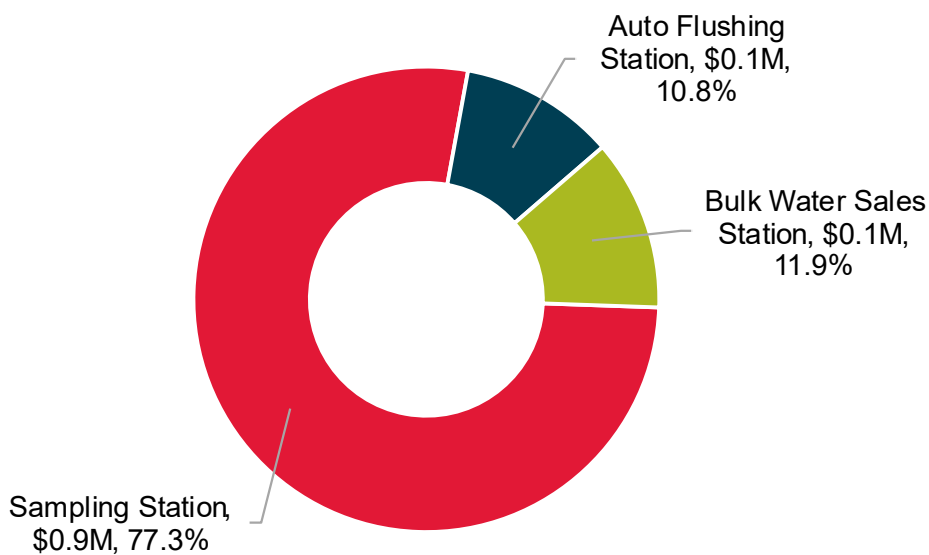


Figure A - 12: Replacement value of Water Management assets by asset class.

A.2.1.1 Asset Inventory and Valuation

Table A - 15 below summarizes the asset valuation, quantities, and performance for each asset category of Water Management assets.

Table A - 15: Inventory and valuation for Water Management assets.

Asset Category	Asset Class	Replacement Cost	Inventory	Average Condition
Device	Auto Flushing Station	\$122,364	5 Assets	Fair
Device	Bulk Water Sales Station	\$135,138	2 Assets	Fair
Device	Sampling Station	\$877,744	106 Assets	Good
Total	-	\$1,135,246	-	-

A.2.1.2 Age and Estimated Service Life

Figure A - 13 illustrates the age of Water Management assets as a proportion of their estimated service life. Figure A - 14 illustrates the value of Water Management assets acquired by decade. No asset classes have an average age that exceeds the average ESL.

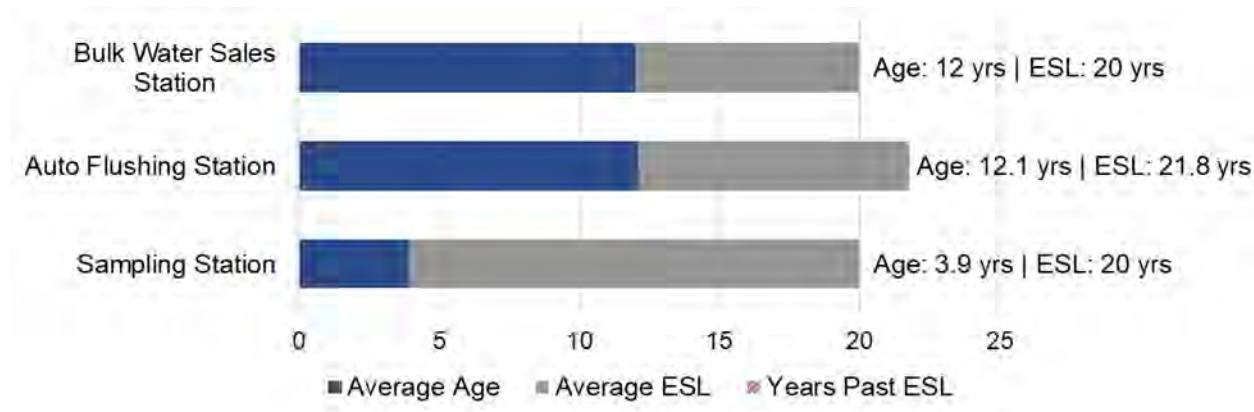


Figure A - 13: Age as a proportion of estimated service life (ESL) of Water Management assets.

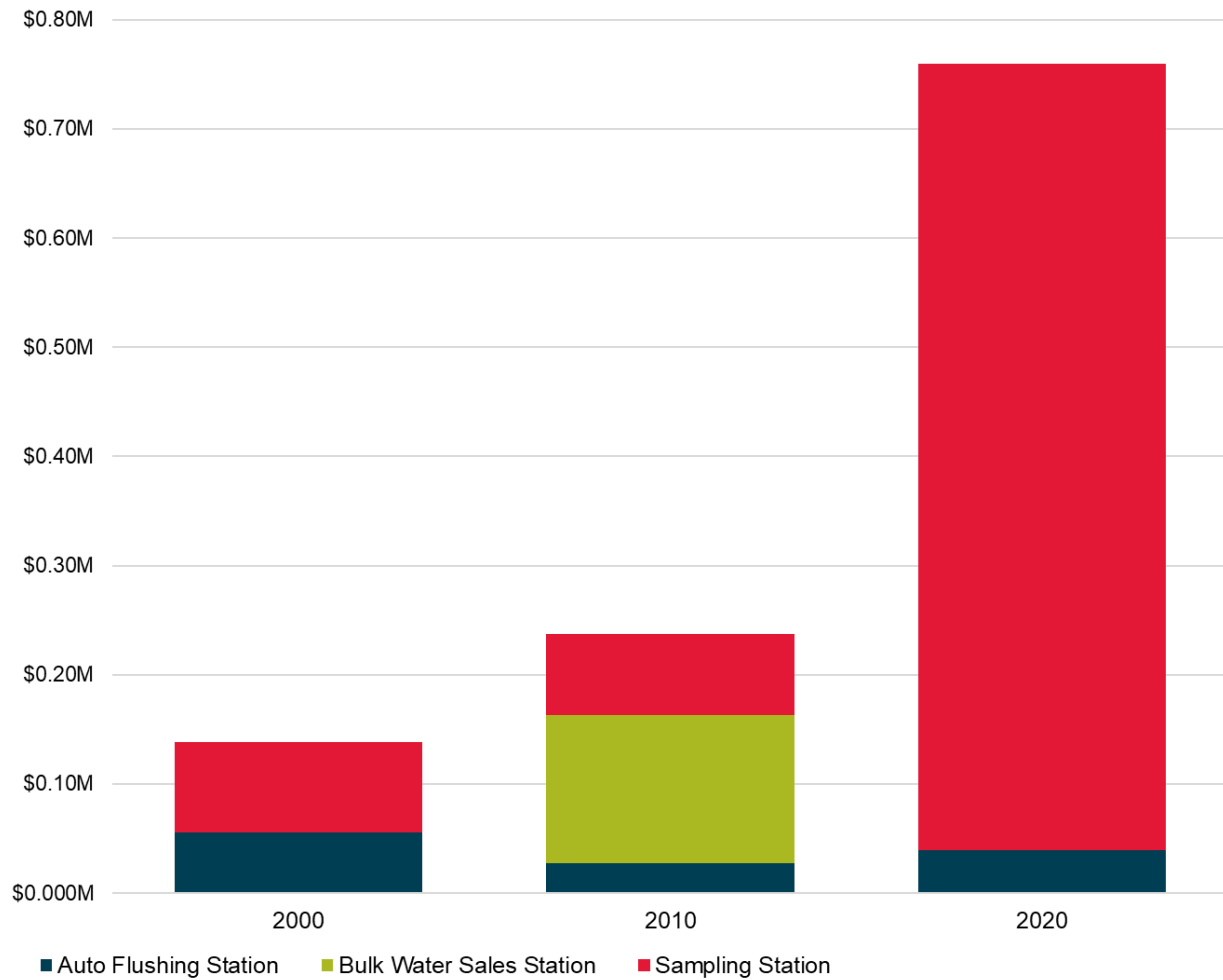


Figure A - 14: Age distribution by installation decade of Water Management assets.

A.2.1.3 Asset Performance

Table A - 16 details the approaches that the City utilizes to understand the performance of Water Management assets.

Table A - 16: Performance assessment approaches to Water Management assets.

Asset Class	Performance Reporting Metric	Description
Sampling Station	Remaining Life/ESL	The City understands the performance of these assets based on remaining life and estimated service life.
Auto Flushing Station	Remaining Life/ESL	The City understands the performance of these assets based on remaining life and estimated service life.
Bulk Water Sales Station	Remaining Life/ESL	The City understands the performance of these assets based on remaining life and estimated service life.

Figure A - 15 illustrates the performance distribution of the Water Management services asset portfolio, while Figure A - 16 shows the performance distribution of Water Management assets by asset class. Table A - 17 summarizes the relationship between the performance categories and how performance ratings are determined.

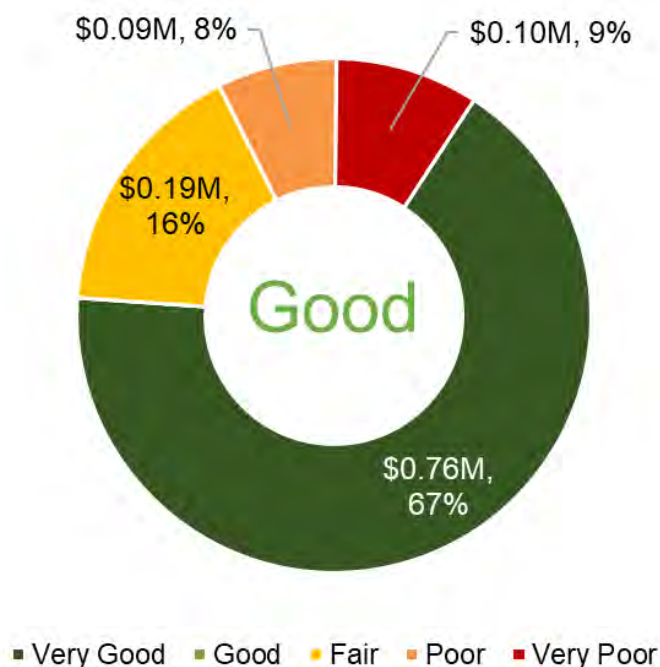


Figure A - 15: Condition distribution of Water Management assets.

Table A - 17: Performance rating of Water Management assets.

Condition Category	Remaining Life/ESL	Age/ESL
Very Good	100% - 80%	0% - 20%
Good	80% - 60%	20% - 40%
Fair	60% - 40%	40% - 60%
Poor	40% - 20%	60% - 80%
Very Poor	< 20%	>80%



Figure A - 16: Condition distribution of Water Management assets by asset class.

A.2.2 Levels of Service

Customer values, customer levels of service and technical levels of service for Water Management assets can be found in Table A - 18 to Table A - 20.

A.2.2.1 Customer Values

Table A - 18: Potable Water customer values.

Customer Satisfaction Measure		Current Feedback & Expected Trend Based on Planned Budget
Potable water distribution and management services assets are safe and reliable to use		
Assets are maintained in a state of good repair, are adequate for use, and in overall good working condition.		Future Iterations ⁷
Assets can support customer water demand, including peak demand hours.		Future Iterations ⁷
Water distribution system has adequate pressure and flow for fire fighting purpose.		Future Iterations ⁷
Quality controls and devices have been installed to increase water quality consumption safety and reduce overall number of watermain breaks and property related damages.		Future Iterations ⁷
Potable water distribution and management services assets are convenient to use		
The quality of assets does not negatively affect water usage.		Future Iterations ⁷
Potable water distribution and management services assets are accessible and easy to access.		Future Iterations ⁷
Environmentally sustainable		
Environmental impacts are minimized.		Future Iterations ⁷

⁷ The City is currently reviewing the data that supports this metric, which will be reported in future iterations of the City's AMP. These metrics are subject to change as data is reviewed and incorporated into future AMPs.

A.2.2.2 Customer and Technical Levels of Service

Table A - 19: Water Management customer LoS.

Type of Measure	Level of Service	Performance Measure	Current Performance	Confidence Level
Condition	- Condition of Sampling Station - Condition of Auto Flushing Station - Condition of Bulk Water Sales Station	Condition or Age/Remaining Useful Life - Aggregated into 5- point rating scale	Good	Moderate to High – age and ESL are used to evaluate asset condition where condition data is not available
Condition	Individual element/ element group condition.	Percentage of all elements/element groups in very poor to poor condition	17%	Moderate to High – age and ESL are used to evaluate asset condition where condition data is not available
Function	Measure of whether the service is appropriate for its intended use.	Future Iterations ⁸	Future Iterations ⁸	Future Iterations ⁸
Capacity	Measure of whether the service is adequate to meet water demand needs.	Future Iterations ⁸	Future Iterations ⁸	Future Iterations ⁸
Accessibility	Service interruptions	Future Iterations ⁸	Future Iterations ⁸	Future Iterations ⁸

⁸ The City is currently reviewing and selecting measures for this category, which will be developed and integrated into future iterations of the City's AMP.

Table A - 20: Water Management technical LoS.

Lifecycle Activity	Purpose of Activity	Activity Measure	Current Performance (\$,2025 Budget)	Recommended Performance
Acquisition	Growth Expansion Development	Projects developed in Future Urban Area Conceptual Master Plan - Transportation, Water and Wastewater Master Plan Class Environmental Assessment Study	-	Growth Planning Horizon: 2026-2051 Total Acquisition Value Range: \$5.77M - \$6.91M City Funded Acquisition Value Range: \$5.77M - \$6.91M
Operation	Inspections	Annual programs	Operating costs are funded through the operating budget and may also be funded through the capital budget depending on asset needs. In 2025, there are no operating costs funded through the 2025 capital budget. The City's 2025 operating budget for all services was \$495.8M.	Maintain current performance for assets in service. Anticipated operating budget increase ranges from \$0.15M to \$0.18M over the growth planning horizon: 2026-2051. These costs may vary year over year depending on asset needs.
Operation	Regulator Operations	As required	See above	See above

Lifecycle Activity	Purpose of Activity	Activity Measure	Current Performance (\$,2025 Budget)	Recommended Performance
Maintenance	Minor Repairs	As required	Maintenance costs are funded through the operating budget and may also be funded through the capital budget depending on asset needs. In 2025, there are no maintenance costs funded through the 2025 capital budget.	Maintain Current Performance for assets in service. Anticipated maintenance budget increases are included in the operating or renewal budget forecasts.
Maintenance	Regular Maintenance	Annual Programs	See above	See above
Maintenance	Major Maintenance (Holding Strategies)	As required	See above	See above
Renewal	Major rehabilitation or replacement	As required	-	PLoS Maintain Current Performance requires \$44.16k per year on average from 2026 to 2051.
Disposal	Disposal of replaced assets	As required	Included with renewal costs	Maintain current performance for assets in service.
Service Improvement	Upgrades to improve LoS to benefit existing serviced areas	As required	-	Maintain LoS – The City continues to assess needs annually to determine and balance appropriate funding levels to support service improvement activities.

A.2.3 Risk Management Strategy

The criteria used to determine the consequence of failure for Water Management assets can be found in Table A - 21 below.

Table A - 21: COF criteria used for Water Management assets.

Direct Financial	Socio-Economic	Environmental
- Replacement Cost - Revenue Loss	Asset Type	- Proximity to ESA or Public Recreational Areas - Proximity to ESA, watercourse, or habitat

Table A - 22 displays the risk score for Water Management assets along with the proportion of assets within each risk score, likelihood of failure and consequence of failure.

Table A - 22: Risk score distribution of Water Management assets.

	COF 1	COF 2	COF 3	COF 4	COF 5	Subtotal
LOF 1	None	\$760,003 (66.9%)	None	None	None	\$760,003 (66.9%)
LOF 2	None	None	None	None	None	None
LOF 3	\$135,138 (11.9%)	\$52,433 (4.6%)	None	None	None	\$187,571 (16.5%)
LOF 4	None	\$85,555 (7.5%)	None	None	None	\$85,555 (7.5%)
LOF 5	None	\$102,116 (9.0%)	None	None	None	\$102,116 (9.0%)
Subtotal	\$135,138 (11.9%)	\$1,000,108 (88.1%)	None	None	None	\$1,135,246

Table A - 23: Risk score mapping legend.

Risk	Risk Score	Risk Description	Total Replacement Cost
Very Low	1 – 5	Fit for the Future	\$895,141 (78.9%)
Low	6 – 10	Adequate for Now	\$240,104 (21.1%)
Moderate	11 – 15	Requires Attention	None
High	16 – 20	At Risk	None
Very High	21 – 25	Unfit for Sustained Service	None

A.2.4 Lifecycle Management Activities

The City's lifecycle management activities for Water Management assets are listed in Table A - 20. These activities include the acquisition of assets and service improvements, operations and maintenance, major asset renewals (including rehabilitations and replacements), and disposals.

These lifecycle management activities in conjunction with the lifecycle forecasting are used to determine the funding required for the City to continue performing these lifecycle activities to extend asset life, reduce overall costs, and minimize risk while providing the proposed service levels.

A.2.5 Lifecycle Forecasting

The following section outlines the funding required for the entire lifecycle of Water Management assets. The expenditures were determined using the lifecycle activities outlined in Table A - 20 and the PLoS established.

Required funding was determined for PLoS using the following forecasting analysis parameters:

- Proposed LoS – Maintain Current Performance:** funding required to maintain a similar asset performance over a 26-year period. The City has established this LoS as the PLoS for Water Management assets. It focuses on maintaining the percentage of assets in backlog in a similar state. Backlog is defined as assets that are in need of renewal work (either significant rehabilitation or replacement). For example, if 20% of assets are past their service life, or are in need of renewal work, then the forecast model will determine the funding to maintain 20% of assets in this state over the forecast period.

The following table summarizes the anticipated funding from the LCRS for renewal activities for Water Management assets. A total of **\$1.0M** over the next 26 years (or an equivalent average annual of **\$40.0k**) for renewals is anticipated to be spent.

Table A - 24: Forecasted capital renewal expenditures (Life Cycle Reserve Study) Water Management assets.

Year	Capital Expenditures (Renewals)
2026	\$0
2027	\$0
2028	\$96,404
2029	\$0
2030	\$68,502
2031	\$82,562

Year	Capital Expenditures (Renewals)
2032	\$0
2033	\$8,287
2034	\$8,202
2035	\$0
2036	\$0
2037	\$63,610
2038	\$0
2039	\$0
2040	\$0
2041	\$0
2042	\$7,035
2043	\$69,992
2044	\$473,712
2045	\$20,659
2046	\$0
2047	\$0
2048	\$61,131
2049	\$0
2050	\$38,043
2051	\$42,240
Total	\$1,040,380
Equivalent Average Annual	\$40,015

Figure A - 17 and Figure A - 18 illustrate the performance and financial forecasts for to achieve PLoS for all Water Management assets. The forecast analysis identified a total of **\$1.2M** (or an equivalent average annual of **\$44.1K**) that is anticipated to be spent over the next 26 years to maintain current performance. This represents funding gap of **\$107.7k** over the planning horizon, or an equivalent average annual amount of **\$4.1k**. The average annual spending identified attempts to maintain this percentage over the next 26 years.

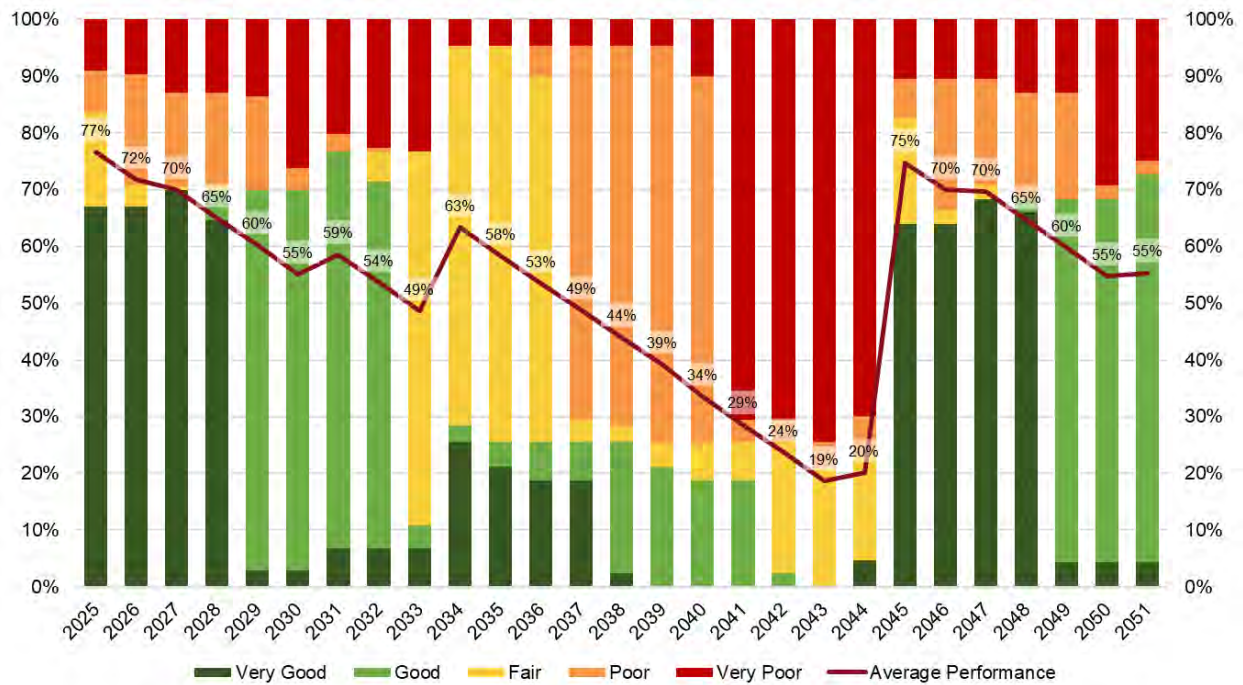


Figure A - 17: Performance Distribution – maintain current performance for Water Management assets.

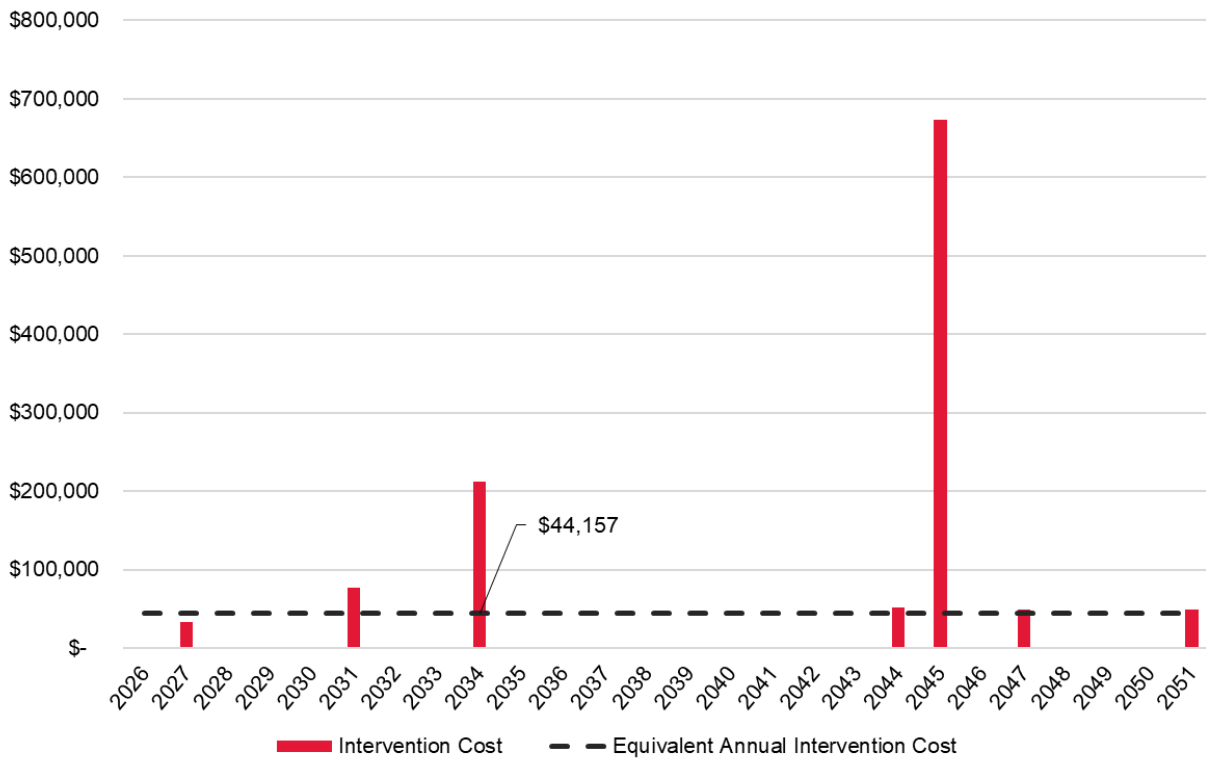


Figure A - 18: Maintain current performance intervention costs for Water Management assets.

A.3 Proposed Levels of Service Themes & Future Challenges

The customer values and customer LoS were discussed with stakeholders. The following summarizes the feedback from the stakeholders related to service delivery, customer expectations, and challenges faced by the City, particularly challenges that may be encountered in the future:

Table A - 25: Proposed LoS themes for Potable Water assets.

Challenge	Discussion
Customer Expectations	- Customers expect safe and reliable drinking water every time they turn on the tap and that demand is managed (for firefighting and personal use). - Customers do not like to see a reduction in LoS, e.g., new subdivisions being built causing a drop in water pressure due to the same size watermain servicing the existing subdivisions and the new adjacent subdivisions. - York Region priorities may influence and change the City's proactive planning approaches from time to time.
Traffic and Accessibility	- The City's Water and Wastewater Master Plan can address growth uncertainties and can be aligned with the Region's master plan, but the City's objectives may not align with some of the Region's objectives. - The City has completed a DC study to identify which pipes need to be upsized from the City's funding sources and the developers. This has been incorporated into the lifecycle.
Technology	The City should continue looking into new technology, such as using advanced/smart metering infrastructure technology for water meters to measure and record consumption data.

The insight from this discussion will be considered and incorporated into the City's AM processes and future iterations of the AMP. As the City continues to grow, it is important that current and future challenges are addressed in order to maintain service levels and achieve proposed service levels.

Appendix B. Stormwater Management

Service Summary



The City's stormwater management services contain assets that support the collection, diversion and treatment of stormwater.

The City is responsible for stormwater collection assets including pump stations and storm sewers as well as stormwater management assets including rain gauges, hickenbottoms, orifice controls, and Stormwater Management (SWM) Facilities, as detailed in Figure B - 1.

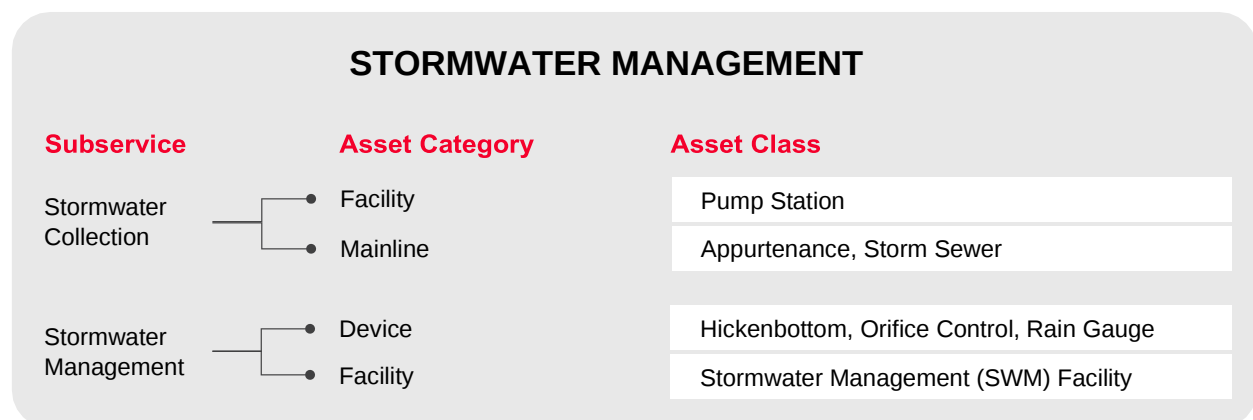


Figure B - 1: Stormwater Management hierarchy.

More information on stormwater such as state of infrastructure, levels of service, risk management strategies, lifecycle management strategies and forecasting can be found in the following sections. The sections are split by the major subservices: Stormwater Collection and Stormwater Management.

B.1 Stormwater Collection

B.1.1 State of the Infrastructure

Figure B - 2 shows the replacement value of all Stormwater Collection assets while Figure B - 3 illustrates the replacement value breakdown by asset class. The total replacement value for Stormwater Collection assets is \$3,182.7M.

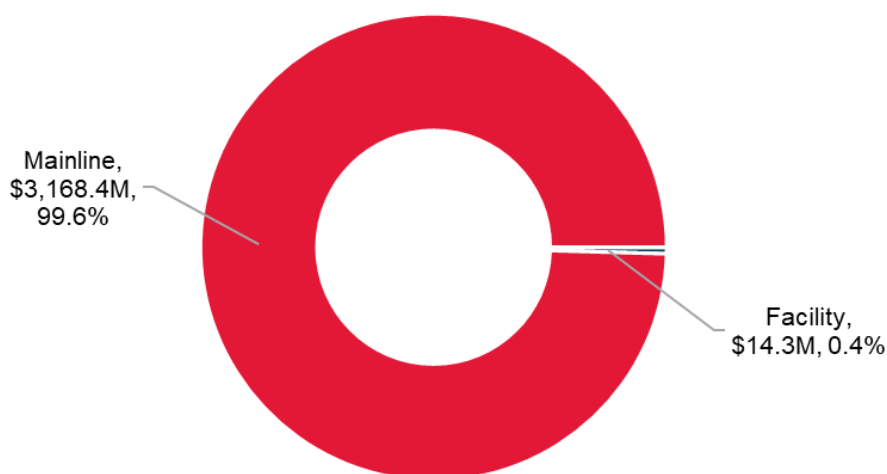


Figure B - 2: Replacement value distribution of Stormwater Collection assets.

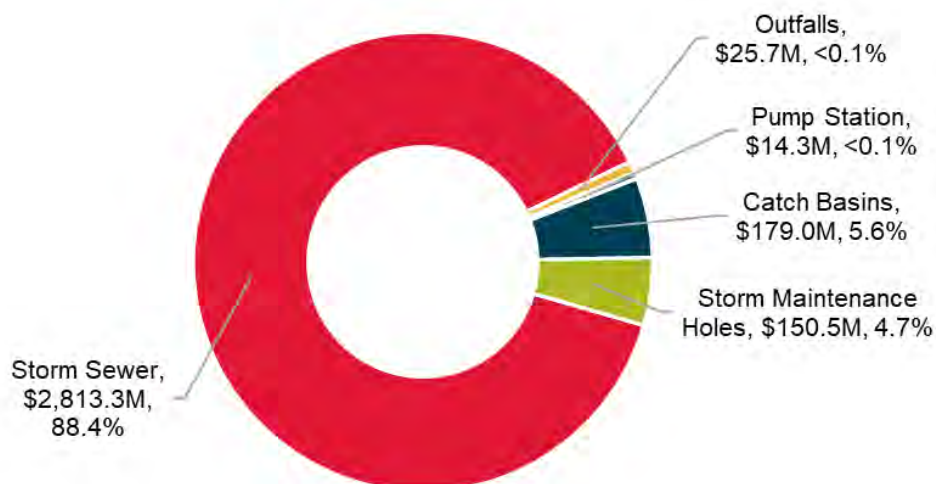


Figure B - 3: Replacement value of Stormwater Collection assets by asset class.

B.1.1.1 Asset Inventory and Valuation

Table B - 1 below summarizes the asset valuation, quantities, and performance for each asset category of Stormwater Collection assets.

Table B - 1: Inventory and valuation for Stormwater Collection assets.

Asset Category	Asset Class	Replacement Cost	Inventory	Average Performance
Facility	Pump Station	\$14,302,263	2 Assets	Very Good
Mainline	Appurtenance	\$355,096,665	39,453 Assets	Good
Mainline	Storm Sewer	\$2,813,312,472	943,114 m	Good
Total	-	\$3,182,711,400	-	-

B.1.1.2 Age and Estimated Service Life

Figure B - 4 illustrates the age of Stormwater Collection assets as a proportion of their estimated service life. Figure B - 5 illustrates the value of Stormwater Collection assets acquired by decade. Generally, all assets are on average less than half through their estimated service life, which indicates that they are relatively young. No asset classes have an average age that exceeds the average ESL.

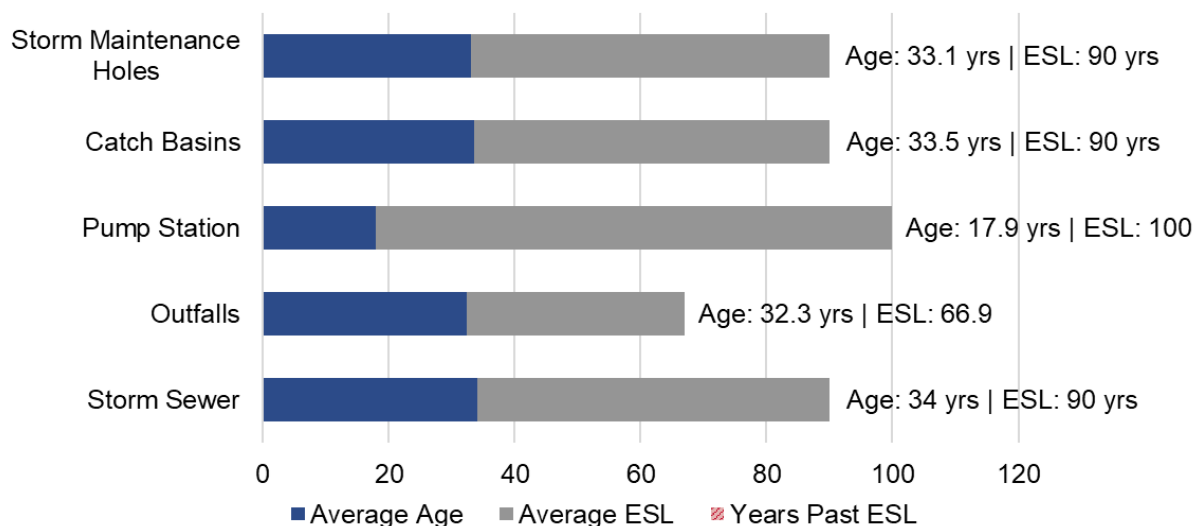


Figure B - 4: Age as a proportion of estimated service life (ESL) of Stormwater Collection assets.

The installation profile of Stormwater Collection assets illustrates that the majority of sewers were installed from the 1980s to 2000s, in line with decades that experienced significant growth and corresponding development in the City.

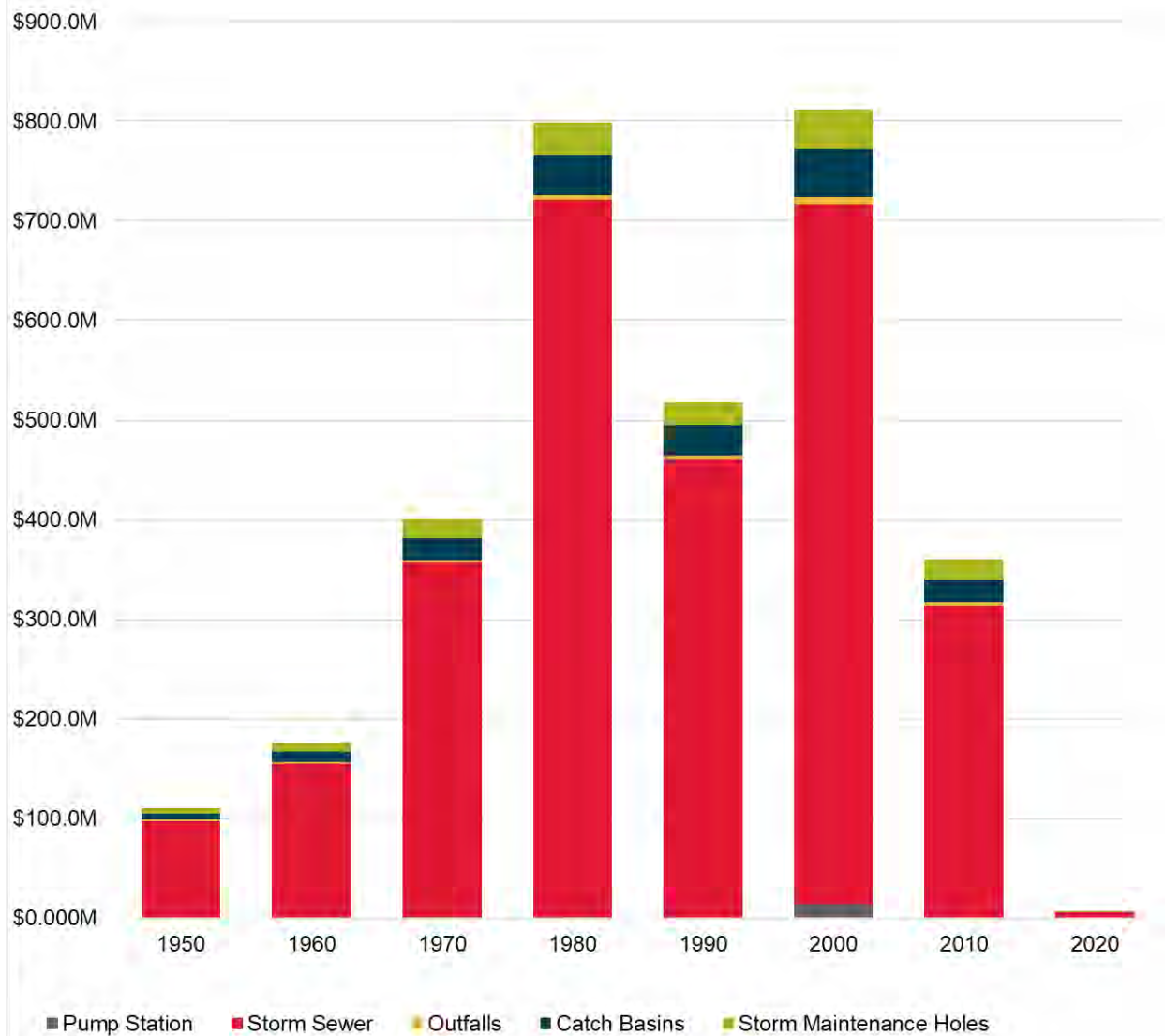


Figure B - 5: Age distribution by installation decade of Stormwater Collection assets.

B.1.1.3 Asset Performance

Table B - 2 details the approaches that the City utilizes to understand the performance of Stormwater Collection assets.

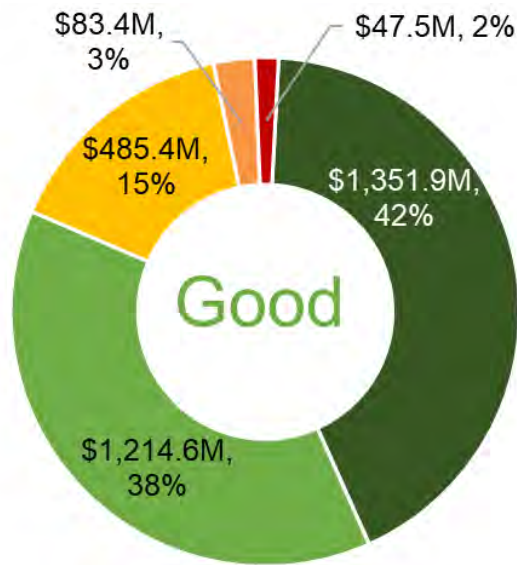
Table B - 2: Performance assessment approaches to Stormwater Collection assets.

Asset Class	Condition Rating Metric	Approach to Assessing Condition
Storm Sewer	CCTV Inspection, Remaining Life/ESL	Inspections are performed based on CCTV inspections under NASSCO-PACP standards on a 10-year cycle, remaining life and estimated service life.
Pump Station	Remaining Life/ESL	The City understands the performance of these assets based on asset age and estimated service life.
Appurtenances	Remaining Life/ESL	The City understands the performance of these assets based on asset age and estimated service life.

Table B - 3 summarizes the relationship between the performance categories and how performance ratings are determined. Figure B - 6 and Figure B - 7 illustrate the performance distribution of all Stormwater Collection assets.

Table B - 3: Performance rating of Stormwater Collection assets.

Condition Category	Remaining Life/ESL	Facility Condition Index (FCI)	CCTV Condition Index (CCTVCI)
Very Good	100% - 80%	0% - 20%	1.0 - 2.0
Good	80% - 60%	20% - 40%	2.0 - 3.0
Fair	60% - 40%	40% - 60%	3.0 - 4.0
Poor	40% - 20%	60% - 80%	4.0 - 5.0
Very Poor	< 20%	80% - 100%	5.0



■ Very Good ■ Good ■ Fair ■ Poor ■ Very Poor

Figure B - 6: Condition distribution of Stormwater Collection assets.

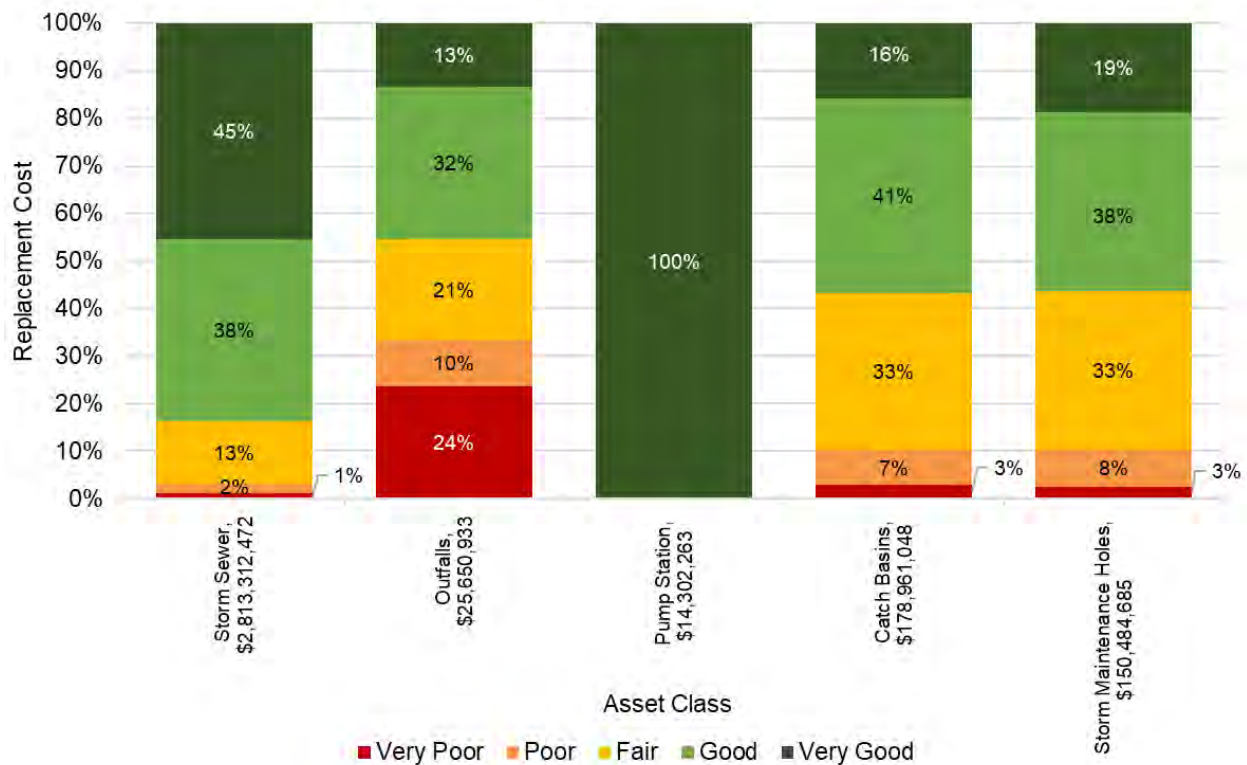


Figure B - 7: Condition distribution of Stormwater Collection assets by asset class.

B.1.2 Levels of Service

Customer values, customer levels of service and technical levels of service for Stormwater Collection assets can be found in Table B - 4 to Table B - 7. Furthermore, mandated O.Reg. LoS for stormwater assets can be found in Table B - 8 to Table B - 9.

B.1.2.1 Customer Values

Table B - 4: Stormwater Management customer values.

Customer Satisfaction Measure		Current Feedback & Expected Trend Based on Planned Budget
Stormwater management assets are safe and reliable to use		
Assets are maintained in a state of good repair, are adequate for use, and in overall good working condition.		Future Iterations ⁹
Assets are resilient to 5-year and 100-year storms.		82% of assets are resilient to 5- year storms and 73% of assets are resilient to 100-year storms.
Transportation impacts from flooding are minimized.		Future Iterations ⁹
Quality controls and devices have been installed to reduce overall number of incidents (e.g. property impacts from flooding).		Future Iterations ⁹
Stormwater management assets offer convenience to the customer		
The quality of assets does not negatively affect the customer.		Future Iterations ⁹
Stormwater management assets are accessible.		Future Iterations ⁹
Environmentally sustainable		
Environmental impacts from flooding are minimized.		Future Iterations ⁹

⁹ The City is currently reviewing the data that supports this metric, which will be reported in future iterations of the City's AMP. These metrics are subject to change as data is reviewed and incorporated into future AMPs

B.1.2.2 Customer and Technical Levels of Service

Table B - 5: Stormwater Collection – Mainlines customer LoS.

Type of Measure	Level of Service	Performance Measure	Current Performance	Confidence Levels
Condition	Condition of Storm Sewers	CCTV Condition Index	1.5	Confidence Levels: High – CCTV data is used to determine storm sewer condition
Condition	Condition of Appurtenance	Condition or Age/Remaining Useful Life - Aggregated into 5-point rating scale	Good	Confidence Levels: Low – age and ESL are used to evaluate asset condition in place of condition data
Condition	Individual element/element group condition.	Percentage of all elements/element groups in very poor to poor condition	4%	Confidence Levels: Low – age and ESL are used to evaluate asset condition where condition data is not available
Function	Measure of whether the service is appropriate for its intended use	Future Iterations ¹⁰	Future Iterations ¹⁰	Future Iterations ¹⁰
Capacity	Measure of whether the service is adequate to meet consumer stormwater needs	Future Iterations ¹⁰	Future Iterations ¹⁰	Future Iterations ¹⁰
Accessibility	Service interruptions	Future Iterations ¹⁰	Future Iterations ¹⁰	Future Iterations ¹⁰

¹⁰ The City is currently reviewing and selecting measures for this category, which will be developed and integrated into future iterations of the City's AMP.

Table B - 6: Stormwater Collection – Facilities customer LoS.

Type of Measure	Level of Service	Performance Measure	Current Performance	Confidence Levels
Condition	Condition of Pump Stations	Condition or Age/Remaining Useful Life - Aggregated into 5-point rating scale	Very Good	Confidence Levels: Low to medium – Condition assessments are performed to determine pump station condition. However, age and ESL are used to evaluate asset condition in place of condition data.
Condition	Individual element/element group condition.	Percentage of all elements/ element groups in very poor to poor condition.	0%	Confidence Levels: Low to medium – Condition assessments are performed to determine pump station condition. However, age and ESL are used to evaluate asset condition in place of condition data.
Function	Measure of whether the service is appropriate for its intended use	Future Iterations ¹⁰	Future Iterations ¹⁰	Future Iterations ¹⁰
Capacity	Measure of whether the service is adequate to meet consumer stormwater needs	Future Iterations ¹⁰	Future Iterations ¹⁰	Future Iterations ¹⁰
Accessibility	Service interruptions	Future Iterations ¹⁰	Future Iterations ¹⁰	Future Iterations ¹⁰

Table B - 7: Stormwater Collection technical LoS.

Lifecycle Activity	Purpose of Activity	Frequency	Current Performance (\$, 2025 Budget)	Recommended Performance
Acquisition	Growth Expansion Development	Projects developed in Future Urban Area Conceptual Master Plan - Transportation, Water and Wastewater Master Plan Class Environmental Assessment Study	\$12,224,600	Growth Planning Horizon: 2026-2051 Total Acquisition Value Range: \$736.0M - \$1,063.8M City Funded Acquisition Value: \$0 (all funding is developer funded)
Operation	Inspections	Annual Programs	\$337,200 The City's 2025 operating budget for all services was \$495.8M.	Maintain current performance for assets in service. Anticipated operating budget increase ranges from \$19.6M to \$28.3M over the growth planning horizon: 2026-2051. These costs may vary year over year depending on asset needs.
Operation	Regular Operations	As required	See above	See above

Lifecycle Activity	Purpose of Activity	Frequency	Current Performance (\$, 2025 Budget)	Recommended Performance
Maintenance	Minor repairs	As required	Maintenance costs are funded through the operating budget and may also be funded through the capital budget depending on asset needs. In 2025, there are no maintenance costs funded through the 2025 capital budget.	Maintain current performance for assets in service. Anticipated maintenance budget increases are included in the operating or renewal budget forecasts.
Maintenance	Regular Maintenance	Annual Programs	See above	See above
Maintenance	Major maintenance (holding strategies)	As required	See above	See above

Lifecycle Activity	Purpose of Activity	Frequency	Current Performance (\$, 2025 Budget)	Recommended Performance
Renewal	Major rehabilitation or replacement	As required	\$60,800 (City's LCRS)	PLoS Maintain Current Performance requires \$2.52M or \$2.46M per year on average of additional funds from 2026 to 2051.
Disposal	Disposal of replaced assets	As required	Included with renewal costs	Maintain current performance for assets in service.
Service Improvement	Upgrades to improve LoS to benefit existing serviced areas	As required	-	Maintain LoS – The City continues to assess needs annually to determine and balance appropriate funding levels to support service improvement activities.

B.1.2.3 Ontario Regulation 588/17 Levels of Service

Levels of service that are prescribed by O.Reg. 588/17 apply to assets that relate to the collection, transmission, treatment, retention, infiltration, control or disposal of stormwater. The following tables detail the O.Reg. 588/17 prescribed levels of service for the Stormwater Management group.

Table B - 8: Stormwater Management O. Reg. 588/17 customer LoS.

Service Attributes	Qualitative Descriptions or Technical Metrics	Metric
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 B - 8: showing areas of the municipality that are protected from flooding

Table B - 9: Stormwater Management O. Reg. 588/17 technical LoS.

Service Attributes	Qualitative Descriptions or Technical Metrics	Metric (By Asset)
Scope	1. Percentage of properties in municipality resilient to a 100-year storm.	71%
Scope	2. Percentage of the municipal stormwater management system resilient to a 5-year storm.	79%

Properties resilient to a 5-year and 100-year storm

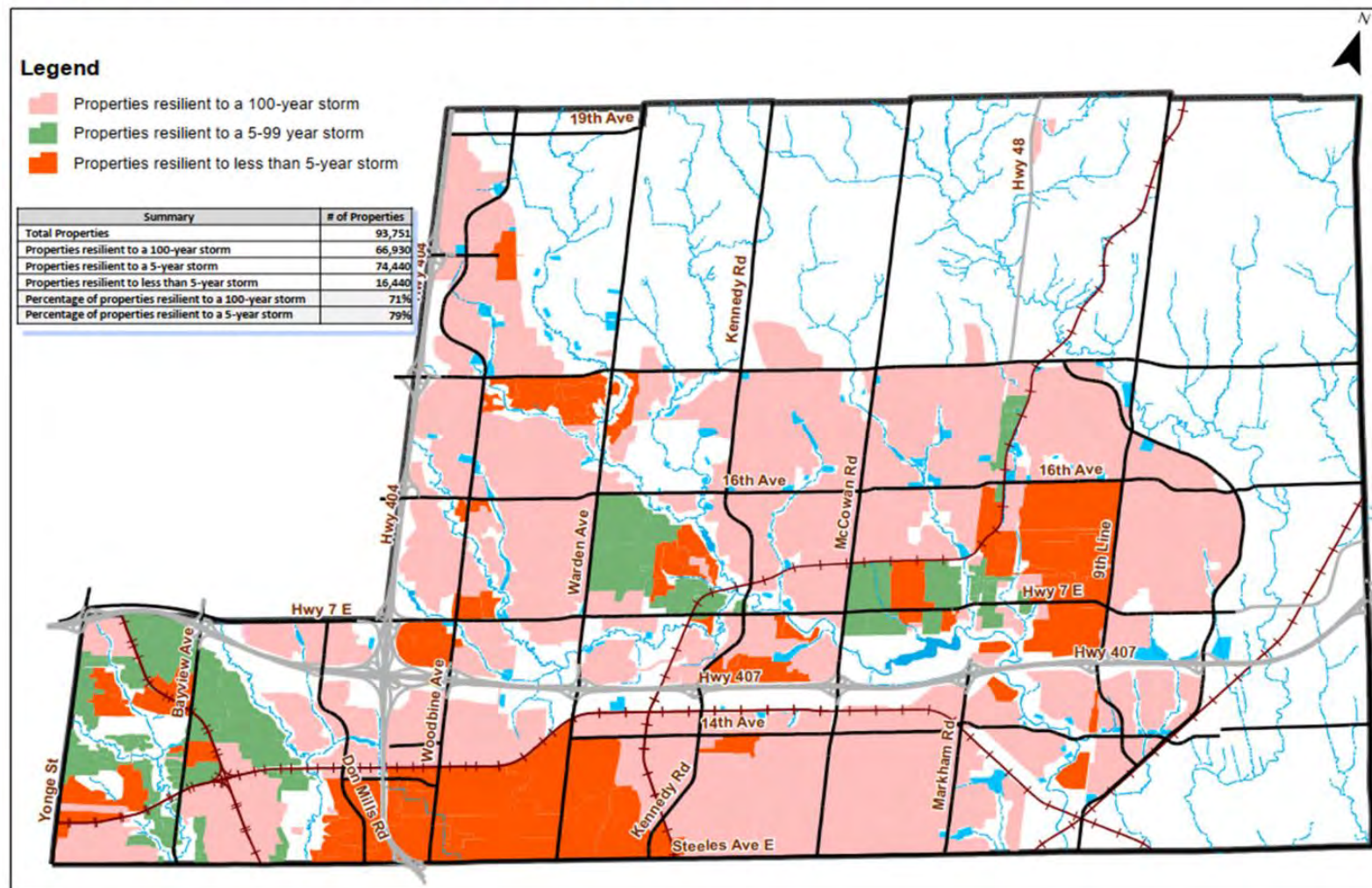


Figure B - 8: Properties resilient to 5-year and 100-year storms.

B.1.3 Risk Management Strategy

The criteria used to determine the consequence of failure for Stormwater Collection assets can be found in Table B - 10 below.

Table B - 10: COF criteria used for Stormwater Collection assets.

Direct Financial	Socio-Economic	Environmental
Replacement Cost	- Diameter - Land Use	- Proximity to ESA or Public Recreational Areas - Proximity to ESA, watercourse, or habitat

Table B - 11 displays the risk score for Stormwater Collection assets along with the proportion of assets within each risk score, likelihood of failure and consequence of failure.

Table B - 11: Risk score distribution of Stormwater Collection assets.

	COF 1	COF 2	COF 3	COF 4	COF 5	Subtotal
LOF 1	\$0.5M (<0.1%)	\$578.3M (18.2%)	\$715.8M (22.5%)	\$57.3M (1.8%)	None	\$1.4B (42.5%)
LOF 2	\$0.9M (<0.1%)	\$581.1M (18.3%)	\$567.8M (17.8%)	\$64.8M (2.0%)	None	\$1.2M (38.2%)
LOF 3	\$0.1M (<0.1%)	\$202.1M (6.3%)	\$256.8M (8.1%)	\$26.4M (0.8%)	None	\$485.4M (15.3%)
LOF 4	None	\$41.7M (1.3%)	\$39.2M (1.2%)	\$2.5M (0.1%)	None	\$83.4M (2.6%)
LOF 5	None	\$27.3M (0.9%)	\$18.3M (0.6%)	\$1.9M (0.1%)	None	\$47.5M (1.5%)
Subtotal	\$1.5M (<0.1%)	\$1.4B (44.9%)	\$1.6B (50.2%)	\$152.8M (4.8%)	None	\$3.2B

Table B - 12: Risk score mapping legend.

Risk	Risk Score	Risk Description	Total Replacement Cost
Very Low	1 – 5	Fit for the Future	\$1,933,967,863 (60.8%)
Low	6 – 10	Adequate for Now	\$1,160,495,907 (36.5%)
Moderate	11 – 15	Requires Attention	\$83,877,779 (2.6%)
High	16 – 20	At Risk	\$4,369,850 (0.1%)
Very High	21 – 25	Unfit for Sustained Service	None

B.1.4 Lifecycle Management Activities

The City's lifecycle management activities for Stormwater Collection assets are listed in Table B - 7. These activities include the acquisition of assets and service improvements, operations and maintenance, major asset renewals (including rehabilitations and replacements), and disposals.

These lifecycle management activities in conjunction with the lifecycle forecasting are used to determine the funding required for the City to continue performing these lifecycle activities to extend asset life, reduce overall costs, and minimize risk while providing the proposed service levels.

B.1.5 Lifecycle Forecasting

The following section outlines the funding required for the entire lifecycle of Stormwater Collection assets. The expenditures were determined using the lifecycle activities outlined in Table B - 7 and the PLoS established.

Required funding was determined for PLoS using the following forecasting analysis parameters:

- Proposed LoS – Maintain Current Performance:** funding required to maintain a similar asset performance over a 26-year period. The City has established this LoS as the PLoS for Stormwater Collection assets. It focuses on maintaining the percentage of assets in backlog in a similar state. Backlog is defined as assets that are in need of renewal work (either significant rehabilitation or replacement). For example, if 20% of assets are past their service life, or are in need of renewal work, then the forecast model will determine the funding to maintain 20% of assets in this state over the forecast period.

The following table summarizes the anticipated funding from the City's Life Cycle Reserve Study for renewal activities for Stormwater Collection assets. A total of **\$55.7M** over the next 26 years (or an equivalent average annual of **\$2.1M**) for renewals is anticipated to be spent.

Table B - 13: Forecasted capital renewal expenditures (Life Cycle Reserve Study) for Stormwater Collection assets.

Year	Capital Expenditures (Renewals)
2026	\$2,205,990
2027	\$1,819,744
2028	\$969,780
2029	\$8,042,458
2030	\$531,358

Year	Capital Expenditures (Renewals)
2031	\$107,052
2032	\$670,461
2033	\$1,448,078
2034	\$545,151
2035	\$102,988
2036	\$1,673,817
2037	\$223,421
2038	\$2,062,363
2039	\$322,132
2040	\$541,929
2041	\$144,510
2042	\$1,805,332
2043	\$210,447
2044	\$447,045
2045	\$142,052
2046	\$408,619
2047	\$223,670
2048	\$1,420,345
2049	\$95,462
2050	\$15,120,504
2051	\$14,360,435
Total	\$55,645,143
Equivalent Average Annual	\$2,140,198

Figure B - 9 and Figure B - 10 illustrate the performance and financial forecasts to achieve PLoS for all Stormwater Collection assets. The forecast analysis identified a total of **\$65.4M** (or an equivalent average annual of **\$2.5M**) that is anticipated to be spent over the next 26 years to maintain current performance. This represents funding gap of **\$9.8M** over the planning horizon, or an equivalent average annual amount of **\$376.3k**. Note that there is a significant expenditure forecasted in 2041, which represents a significant amount of asset renewal needs that are forecasted to occur in or near that timeframe.

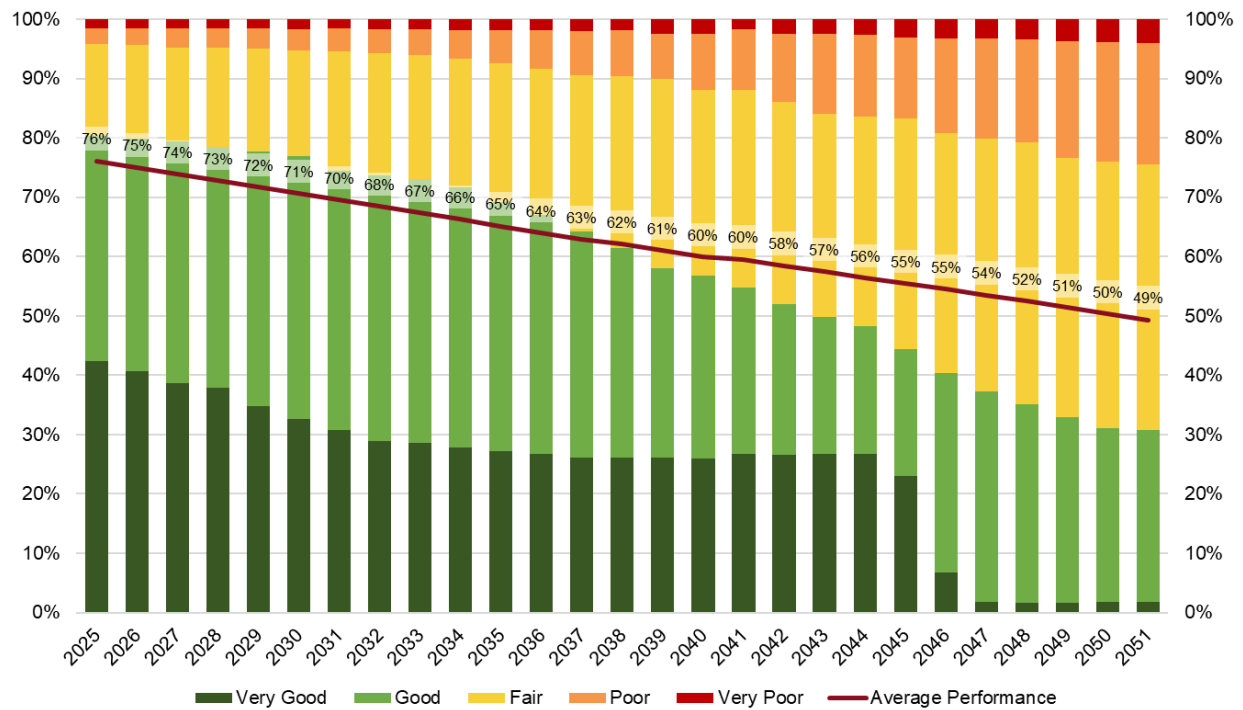


Figure B - 9: Performance Distribution – maintain current performance for Stormwater Collection assets.

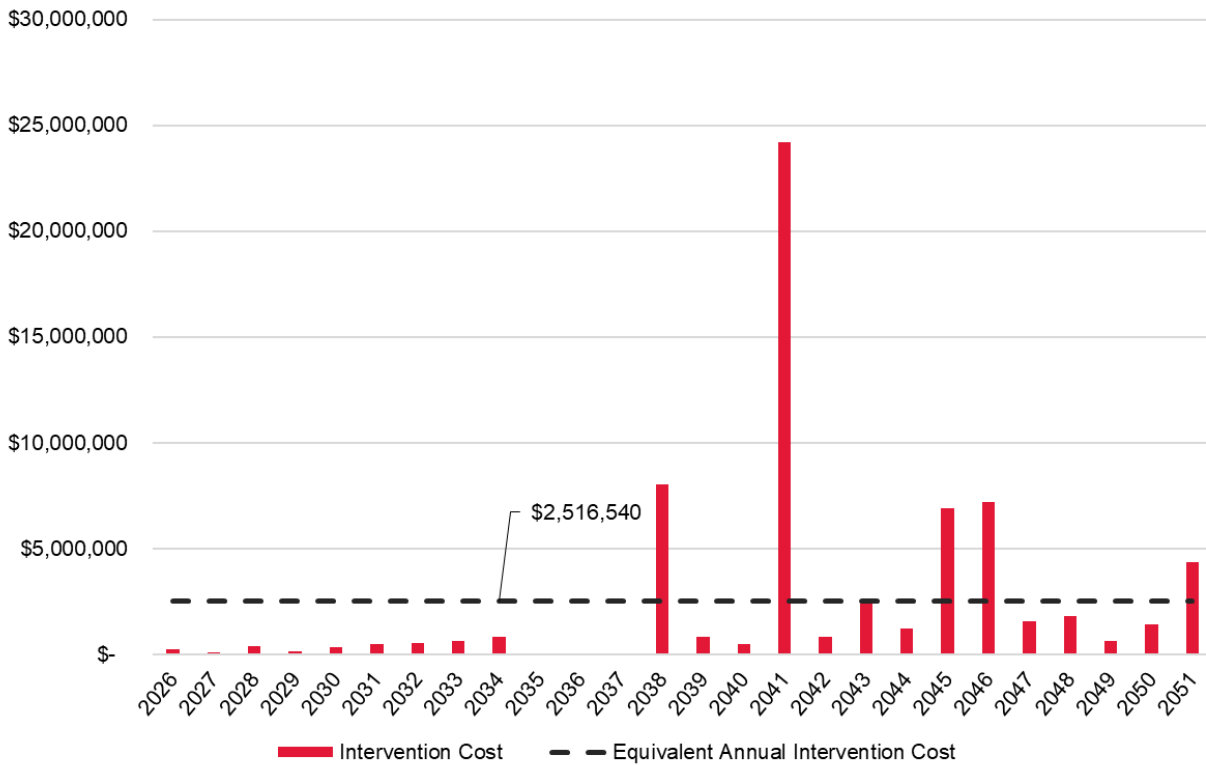


Figure B - 10: Maintain current performance - intervention costs for Stormwater Collection assets.

B.2 Stormwater Management

B.2.1 State of the Infrastructure

Figure B - 11 shows the replacement value of Stormwater Management assets while Figure B - 12 illustrates the replacement value of Stormwater Management assets by asset class. The total replacement value for stormwater management assets is \$46.6M.



Figure B - 11: Replacement value distribution of Stormwater Management assets.

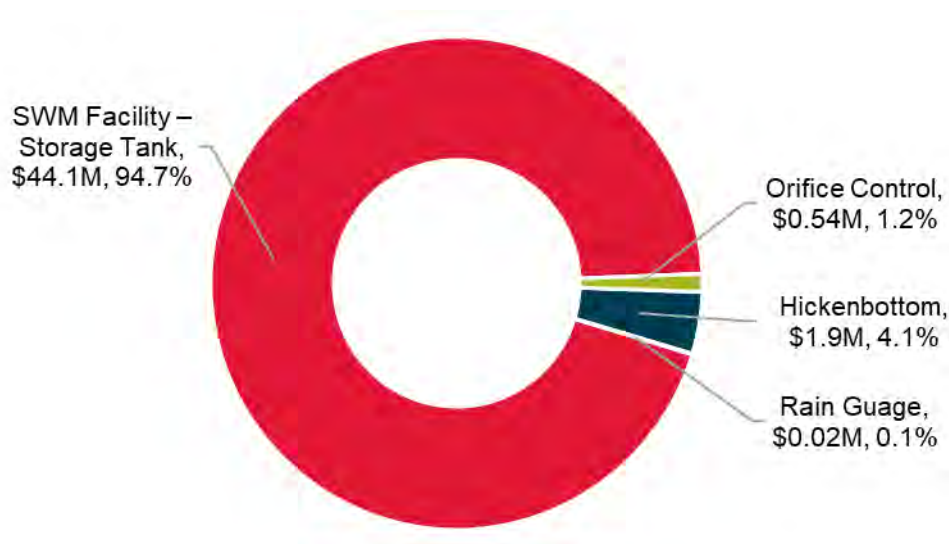


Figure B - 12: Replacement value of Stormwater Management assets by asset class.

B.2.1.1 Asset Inventory and Valuation

Table B - 14 below summarizes the asset valuation, quantities, and performance for each asset category of Stormwater Management assets.

Table B - 14: Inventory and valuation for Stormwater Management assets.

Asset Category	Asset Class	Replacement Cost	Inventory	Average Condition
Device	Hickenbottom	\$1,891,229	41 Assets	Fair
Device	Orifice Control	\$544,400	54 Assets	Fair
Device	Rain Gauge	\$24,239	13 Assets	Fair
Facility	Stormwater Management (SWM) Facility	\$44,131,570	9 Assets	Good
Total	-	\$46,591,438	-	-

B.2.1.2 Age and Estimated Service Life

Figure B - 13 illustrates the age of Stormwater Management assets as a proportion of their estimated service life. Figure B - 14 illustrates the value of Stormwater Management assets acquired by decade.

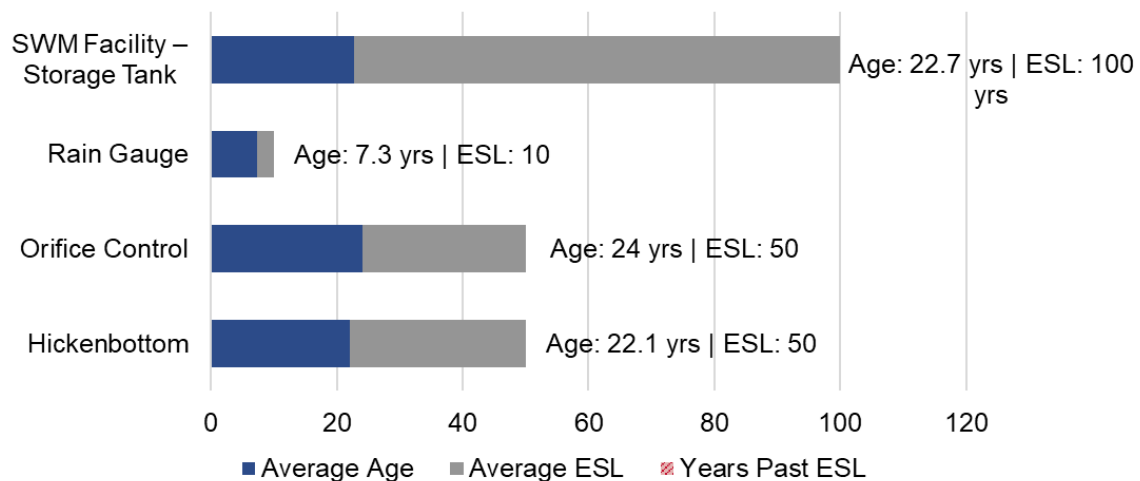


Figure B - 13: Age as a proportion of estimated service life (ESL) of Stormwater Management assets.

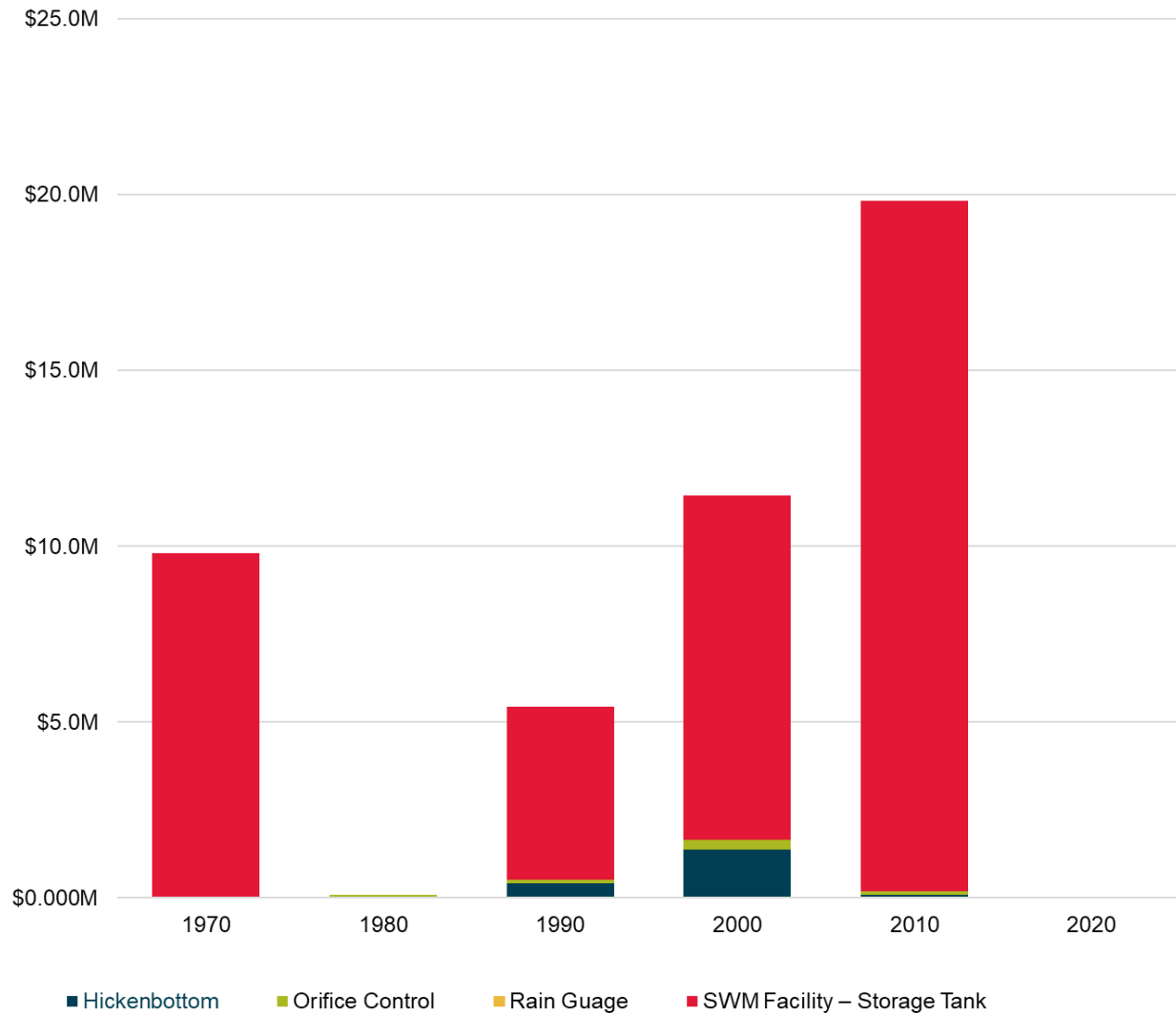


Figure B - 14: Age distribution by installation decade of Stormwater Management assets.

B.2.1.3 Asset Performance

Table B - 15 details the approaches that the City utilizes to understand the performance of Stormwater Management assets.

Table B - 15: Performance assessment approaches to Stormwater Management assets.

Asset Class	Condition Rating Metric	Approach to Assessing Condition
Orifice Control	Remaining Life/ESL	The City understands the performance of these assets based on asset age and estimated service life
Hickenbottom	Remaining Life/ESL	The City understands the performance of these assets based on asset age and estimated service life
Rain Gauge	Remaining Life/ESL	The City understands the performance of these assets based on asset age and estimated service life
Stormwater Management Facility (SWMF)	Remaining Life/ESL	The City understands the performance of these assets based on asset age and estimated service life

Figure B - 15 illustrates the performance distribution of the Stormwater Management services asset portfolio, while Figure B - 16 shows the performance distribution of Stormwater Management assets by asset class. Table B - 16 summarizes the relationship between the performance categories and how performance ratings are determined.

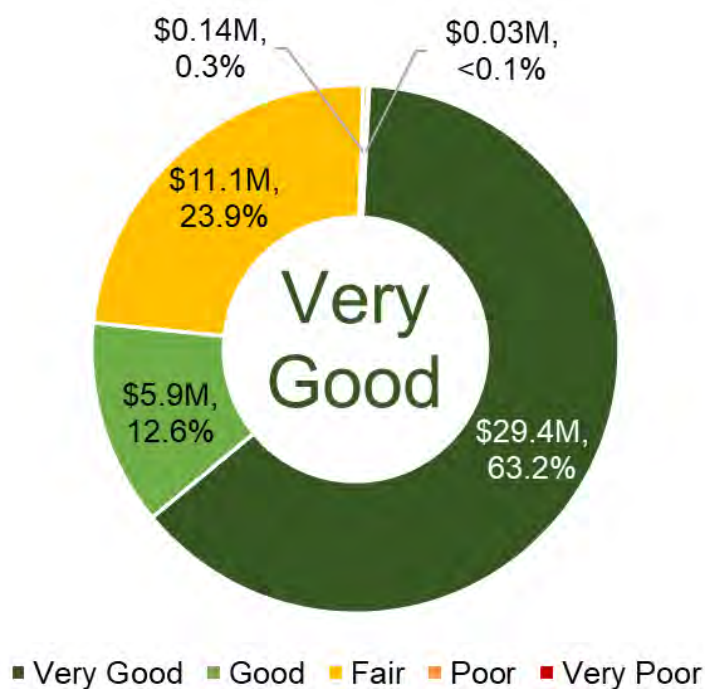


Figure B - 15: Condition distribution of Stormwater Management assets.

Table B - 16: Performance rating of Stormwater Management assets.

Condition Category	Remaining Life/ESL	Age/ESL
Very Good	100% - 80%	0% - 20%
Good	80% - 60%	20% - 40%
Fair	60% - 40%	40% - 60%
Poor	40% - 20%	60% - 80%
Very Poor	< 20%	>80%

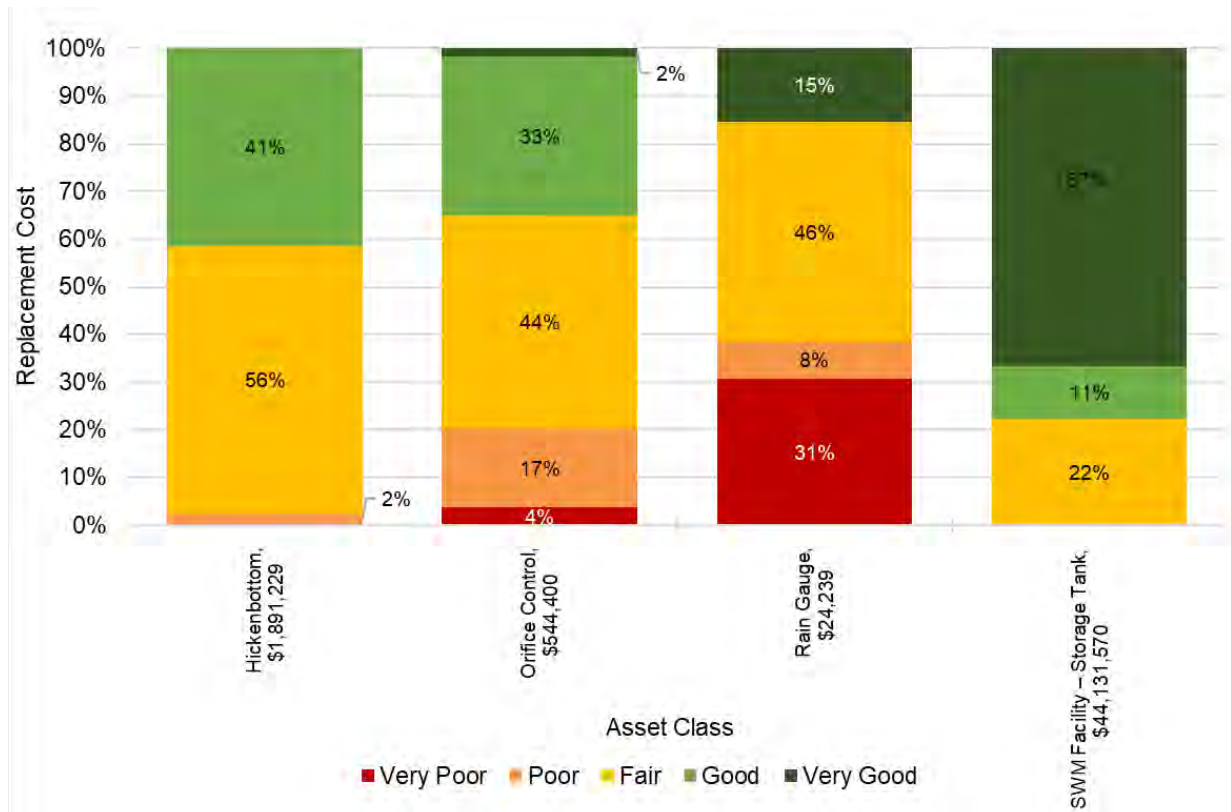


Figure B - 16: Condition distribution of Stormwater Management assets by asset class.

B.2.2 Levels of Service

Customer values, customer levels of service and technical levels of service for Stormwater Management assets can be found in Table B - 17 to Table B - 20.

B.2.2.1 Customer Values

Table B - 17: Stormwater Management customer values.

Customer Satisfaction Measure	Current Feedback & Expected Trend Based on Planned Budget
Stormwater management assets are safe and reliable to use	
Assets are maintained in a state of good repair, are adequate for use, and in overall good working condition.	Future Iterations ¹¹
Assets are resilient to 5-year and 100-year storms.	Future Iterations ¹¹
Transportation impacts from flooding are minimized.	Future Iterations ¹¹
Quality controls and devices have been installed to reduce overall number of incidents (e.g. property impacts from flooding).	Future Iterations ¹¹
Stormwater management assets offer convenience to the customer	
The quality of assets does not negatively affect the customer.	Future Iterations ¹¹
Stormwater management assets are accessible.	Future Iterations ¹¹
Environmentally sustainable	
Environmental impacts from flooding are minimized.	Future Iterations ¹¹

¹¹ The City is currently reviewing the data that supports this metric, which will be reported in future iterations of the City's AMP. These metrics are subject to change as data is reviewed and incorporated into future AMPs.

B.2.2.2 Customer and Technical Levels of Service

Table B - 18: Stormwater Management – Devices customer LoS.

Type of Measure	Level of Service	Performance Measure	Current Performance	Confidence Levels
Condition	Condition of Hickenbottoms	Condition or Age/Remaining Useful Life - Aggregated into 5-point rating scale	Fair	Confidence Levels: Low – age and ESL are used to evaluate asset condition in place of condition data
Condition	Condition of Orifice Control	Condition or Age/Remaining Useful Life - Aggregated into 5-point rating scale	Fair	Confidence Levels: Low – age and ESL are used to evaluate asset condition in place of condition data
Condition	Condition of Rain Gauge	Condition or Age/Remaining Useful Life - Aggregated into 5-point rating scale	Fair	Confidence Levels: Low – age and ESL are used to evaluate asset condition in place of condition data
Condition	Individual element/element group condition.	Percentage of all elements/element groups in very poor to poor condition	7%	Confidence Levels: Low – age and ESL are used to evaluate asset condition in place of condition data
Function	Measure of whether the service is appropriate for its intended use	Future Iterations ¹²	Future Iterations ¹²	Future Iterations ¹²

¹² The City is currently reviewing and selecting measures for this category, which will be developed and integrated into future iterations of the City's AMP.

Table B - 19: Stormwater Management – Facilities customer LoS.

Type of Measure	Level of Service	Performance Measure	Current Performance	Confidence Levels
Condition	Condition of Stormwater Management Facilities	Condition or Age/Remaining Useful Life - Aggregated into 5-point rating scale	Good	Confidence Levels: Low to medium – Condition assessments are performed to determine pump station condition. However, age and ESL are used to evaluate asset condition in place of condition data.
Condition	Individual element/element group condition.	Percentage of all elements/element groups in very poor to poor condition	0%	Confidence Levels: Low – age and ESL are used to evaluate asset condition in place of condition data
Function	Measure of whether the service is appropriate for its intended use	Future Iterations ¹²	Future Iterations ¹²	Future Iterations ¹²
Capacity	Measure of whether the service is adequate to meet consumer stormwater needs	Future Iterations ¹²	Future Iterations ¹²	Future Iterations ¹²
Accessibility	Service interruptions	Future Iterations ¹²	Future Iterations ¹²	Future Iterations ¹²

Table B - 20: Stormwater Management technical LoS.

Lifecycle Activity	Purpose of Activity	Frequency	Current Performance (\$, 2025 Budget)	Recommended Performance
Acquisition	Growth Expansion Development	As required	\$0	Growth Planning Horizon: 2026-2051 Total Acquisition Value Range: \$184.1M - \$259.4M City Funded Acquisition Value Range: \$24.0M - \$28.8M
Operation	Inspections	Annual Programs	\$3,554,500 The City's 2025 operating budget for all services was \$495.8M.	Maintain current performance for assets in service. Anticipated operating budget increase ranges from \$4.9M to \$6.9M over the growth planning horizon: 2026-2051. These costs may vary year over year depending on asset needs.
Operation	Regular Operations	As required	See above	See above
Maintenance	Minor repairs	As required	\$79,200	Maintain current performance for assets in service. Anticipated maintenance budget increases are included in the operating or renewal budget forecasts.
Maintenance	Regular Maintenance	Annual Programs	See above	See above
Maintenance	Major maintenance (holding strategies)	As required	See above	See above
Renewal	Major rehabilitation or replacement	As required	\$24,344,500 (City's LCRS)	Maintain current performance for existing assets

Lifecycle Activity	Purpose of Activity	Frequency	Current Performance (\$, 2025 Budget)	Recommended Performance
Disposal	Disposal of replaced assets	As required	Included with renewal costs	Maintain current performance for existing assets
Service Improvement	Upgrades to improve LoS to benefit existing serviced areas	As required	\$7,079,000	Maintain current performance

B.2.3 Risk Management Strategy

The criteria used to determine the consequence of failure for Stormwater Management assets can be found in Table B - 21 below.

Table B - 21: COF criteria used for Stormwater Management assets.

Direct Financial	Socio-Economic	Environmental
Replacement Cost	- Land Use - Adjacent Land Use	- Proximity to ESA or Public Recreational Areas - Proximity to ESA, watercourse, or habitat

Table B - 22 displays the risk score for Stormwater Management assets along with the proportion of assets within each risk score, likelihood of failure and consequence of failure.

Table B - 22: Risk score distribution of Stormwater Management assets.

	COF 1	COF 2	COF 3	COF 4	COF 5	Subtotal
LOF 1	\$3,729 (<0.1%)	None	\$24,527,627 (52.6%)	\$4,903,510 (10.5%)	None	\$29,434,866 (63.2%)
LOF 2	None	\$151,222 (0.3%)	\$5,671,791 (12.2%)	\$46,128 (0.1%)	None	\$5,869,140 (12.6%)
LOF 3	None	\$172,491 (0.4%)	\$10,902,467 (23.4%)	\$46,128 (0.1%)	None	\$11,121,086 (23.9%)
LOF 4	\$1,865 (<0.1%)	\$106,616 (0.2%)	\$30,244 (0.1%)	None	None	\$138,725 (0.3%)
LOF 5	\$3,729 (<0.1%)	\$23,892 (0.1%)	None	None	None	\$27,621 (0.1%)
Subtotal	\$9,323 (<0.1%)	\$454,222 (1.0%)	\$41,132,129 (88.3%)	\$4,995,765 (10.7%)	None	\$46,591,438

Table B - 23: Risk score mapping legend.

Risk	Risk Score	Risk Description	Total Replacement Cost
Very Low	1 – 5	Fit for the Future	\$29,591,681 (63.5%)
Low	6 – 10	Adequate for Now	\$16,923,385 (36.3%)
Moderate	11 – 15	Requires Attention	\$76,372 (0.2%)
High	16 – 20	At Risk	None
Very High	21 – 25	Unfit for Sustained Service	None

B.2.4 Lifecycle Management Activities

The City's lifecycle management activities for Stormwater Management assets are listed in Table B - 20. These activities include the acquisition of assets and service improvements, operations and maintenance, major asset renewals (including rehabilitations and replacements), and disposals.

These lifecycle management activities in conjunction with the lifecycle forecasting are used to determine the funding required for the City to continue performing these lifecycle activities to extend asset life, reduce overall costs, and minimize risk while providing the proposed service levels.

B.2.5 Lifecycle Forecasting

The following section outlines the funding required for the entire lifecycle of Stormwater Management assets. The expenditures were determined using the lifecycle activities outlined in Table B - 20 and the LoS established. Required funding for PLoS was determined using the following parameter:

- Proposed LoS – Maintain Current Performance:** funding required to maintain a similar asset performance over a 26-year period. The City has established this LoS as the PLoS for Stormwater Management assets. It focuses on maintaining the percentage of assets in backlog in a similar state. Backlog is defined as assets that are in need of renewal work (either significant rehabilitation or replacement). For example, if 20% of assets are past their service life, or are in need of renewal work, then the forecast model will determine the funding to maintain 20% of assets in this state over the forecast period.

The following table summarizes the anticipated funding from the LCRS for renewal activities for Stormwater Management assets. A total of **\$90.9M** over the next 26 years (or an equivalent average annual of **\$3.5M**) for renewals is anticipated to be spent.

Table B - 24: Forecasted capital renewal expenditures (Life Cycle Reserve Study) for Stormwater Management assets.

Year	Capital Expenditures (Renewals)
2026	\$4,932,243
2027	\$5,741,622
2028	\$2,633,727
2029	\$4,630,537
2030	\$6,270,216
2031	\$1,750,125
2032	\$940,003
2033	\$12,510,084

Year	Capital Expenditures (Renewals)
2034	\$844,011
2035	\$1,683,685
2036	\$1,098,312
2037	\$1,813,823
2038	\$2,361,744
2039	\$5,100,865
2040	\$1,765,548
2041	\$3,401,221
2042	\$2,363,491
2043	\$3,172,124
2044	\$5,402,256
2045	\$5,497,594
2046	\$3,787,105
2047	\$3,059,060
2048	\$2,727,633
2049	\$2,215,778
2050	\$3,792,980
2051	\$1,393,167
Total	\$90,888,956
Equivalent Average Annual	\$3,495,729

Figure B - 17 and Figure B - 18 illustrate the performance and financial forecasts to achieve PLoS for all Stormwater Management assets. The forecast analysis identified a total of **\$1.9M** (or an equivalent average annual of **\$73.0k**) that is anticipated to be spent over the next 26 years to maintain current performance. The City plans to spend a total of **\$90.9M** (or an equivalent average annual of **\$3.5M**). This shows that the City's forecasted capital renewal expenditures (LCRS) are appropriate to maintain assets in a SOGR, and funding levels are adequate.

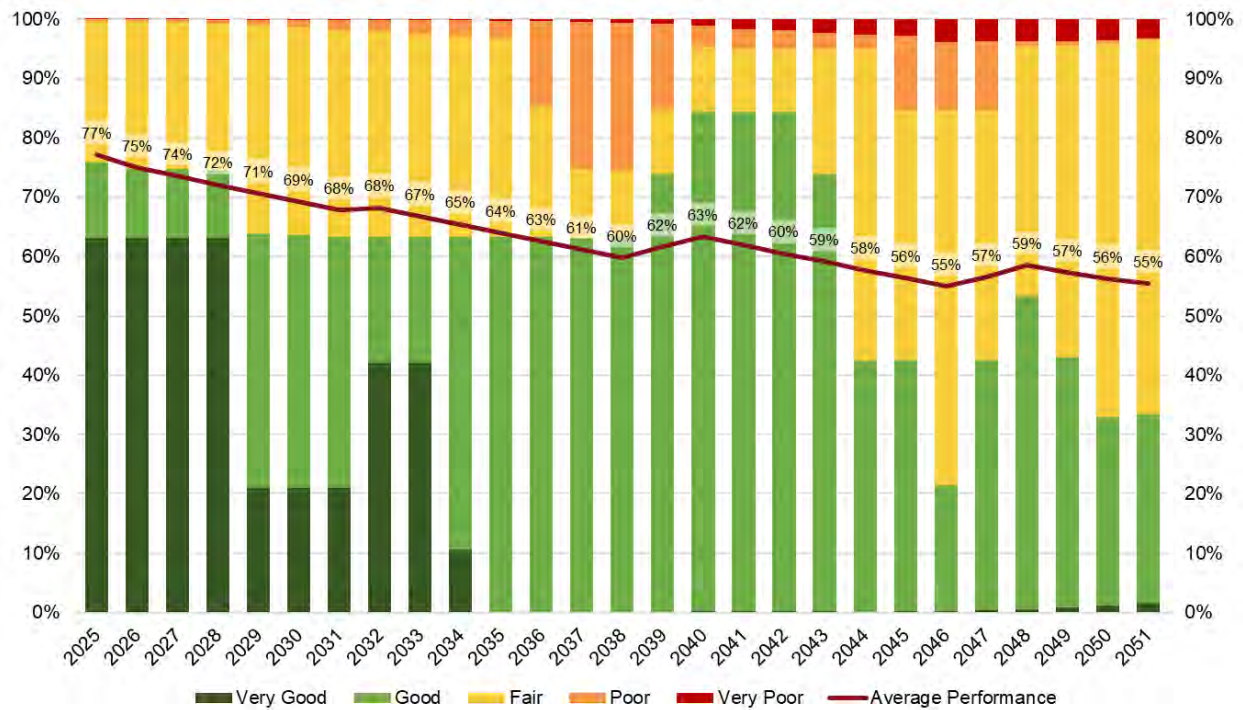


Figure B - 17: Performance Distribution – maintain current performance distribution for Stormwater Management assets.



Figure B - 18: Maintain current performance intervention costs for Stormwater Management assets.

B.3 Proposed Levels of Service Themes & Future Challenges

The customer values and customer LoS were discussed with stakeholders. The following summarizes the feedback from the stakeholders related to service delivery, customer expectations, and challenges faced by the City, particularly challenges that may be encountered in the future:

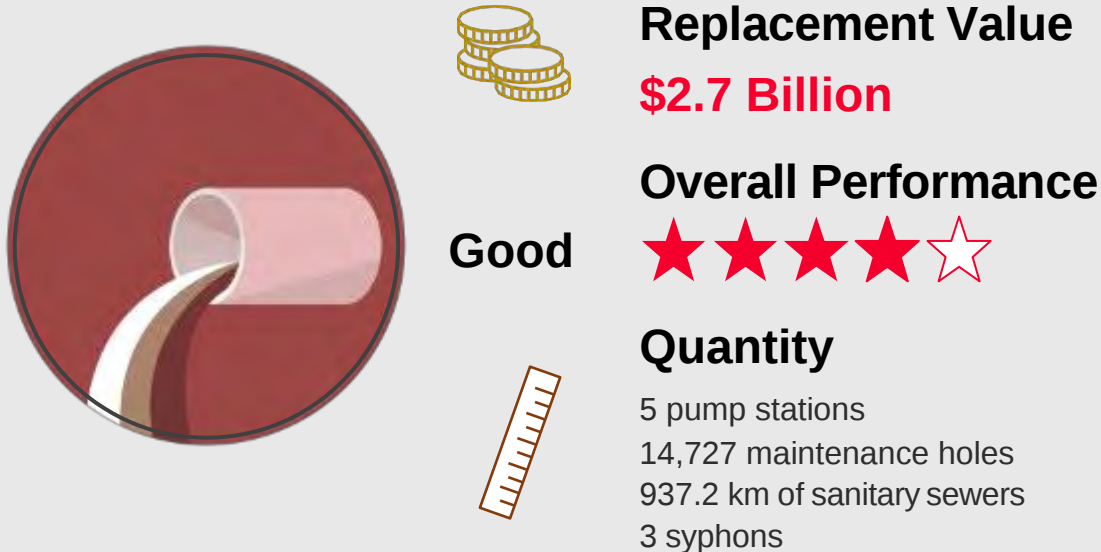
Table B - 25: Proposed LoS themes for Stormwater Management assets.

Challenge	Discussion
Customer Expectations	- The stormwater management network should prevent flooding and damage to properties. - The stormwater management network allows road users and pedestrians to travel safely. - As the City continues with intensification along urban corridors, non-conventional stormwater management technologies and facilities will need to be considered to provide the required service level in an environment of constraint
Performance and Environmental Sustainability	- The City will continue to perform CCTV inspections on the storm sewers on a 10-year cycle. - The stormwater management network is built to be resilient to 5-year and 100-year storms. - The City should explore various options and technologies of quality controls and devices to mitigate the effects of heavy rainfall and flooding as the effects of climate change become more prevalent.

The insight from this discussion will be considered and incorporated into the City's AM processes and future iterations of the AMP. As the City continues to grow, it is important that current and future challenges are addressed in order to maintain service levels and achieve proposed service levels.

Appendix C. Wastewater

Service Summary



The City's wastewater management services contain assets that support the collection and conveyance of wastewater to York Region's wastewater transmission system. The City's wastewater is treated at the Duffin Creek Wastewater Pollution Control Plant located in Pickering, Ontario. The treated water is released into Lake Ontario.

The City is responsible for wastewater collection assets, such as pump stations, sanitary sewers, service connections, and maintenance holes, as detailed in Figure C - 1.

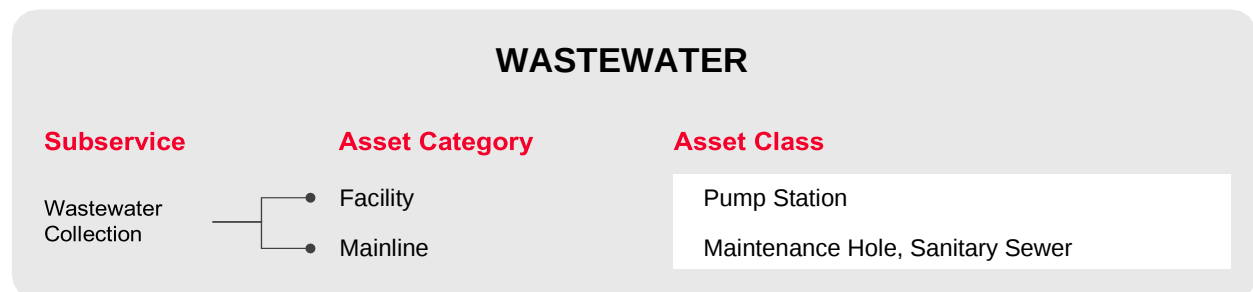


Figure C - 1: Wastewater hierarchy.

More information on wastewater collection such as state of infrastructure, levels of service, risk management strategies, lifecycle management strategies and forecasting can be found in the following sections.

C.1 State of the Infrastructure

Figure C - 2 shows the replacement value of all Wastewater assets while Figure C - 3 illustrates the replacement value breakdown of Wastewater assets by asset class. The total replacement value for State of the Infrastructure assets is \$2,671.1M.



Figure C - 2: Replacement value distribution of Wastewater assets.

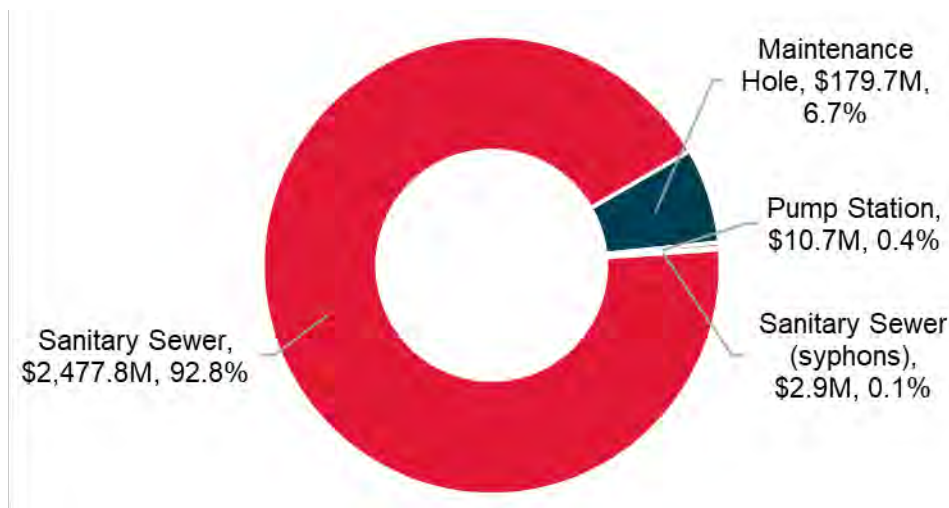


Figure C - 3: Replacement value of Wastewater assets by asset class.

C.1.1 Asset Inventory and Valuation

Table C - 1 below summarizes the asset valuation, quantities, and performance for each asset category of State of the Infrastructure assets.

Table C - 1: Inventory and valuation for Wastewater assets.

Asset Category	Asset Class	Replacement Cost	Inventory	Average Performance
Facility	Pump Station	\$10,667,629	5 Assets	Good
Mainline	Maintenance Hole	\$179,726,688	14,727 Assets	Fair
Mainline	Sanitary Sewer	\$2,477,795,753	937,154 m	Good
Mainline	Sanitary Sewer (syphons)	\$2,922,567	3 Assets	Very Good
Total	-	\$2,671,112,637	-	-

C.1.2 Age and Estimated Service Life

Figure C - 4 illustrates the age of Wastewater assets as a proportion of their estimated service life. Figure C - 5 illustrates the value of Wastewater assets acquired by decade.

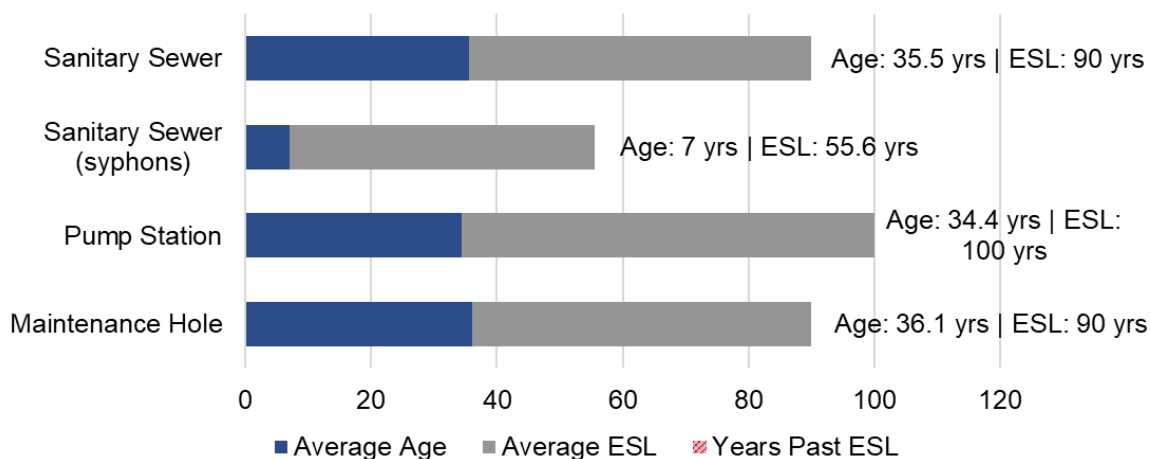


Figure C - 4: Age as a proportion of estimated service life (ESL) of Wastewater assets.

The installation profile of Wastewater assets illustrates that the majority of sewers were installed from the 1970s to 2000s, in line with decades that experienced significant growth and corresponding development in the City.

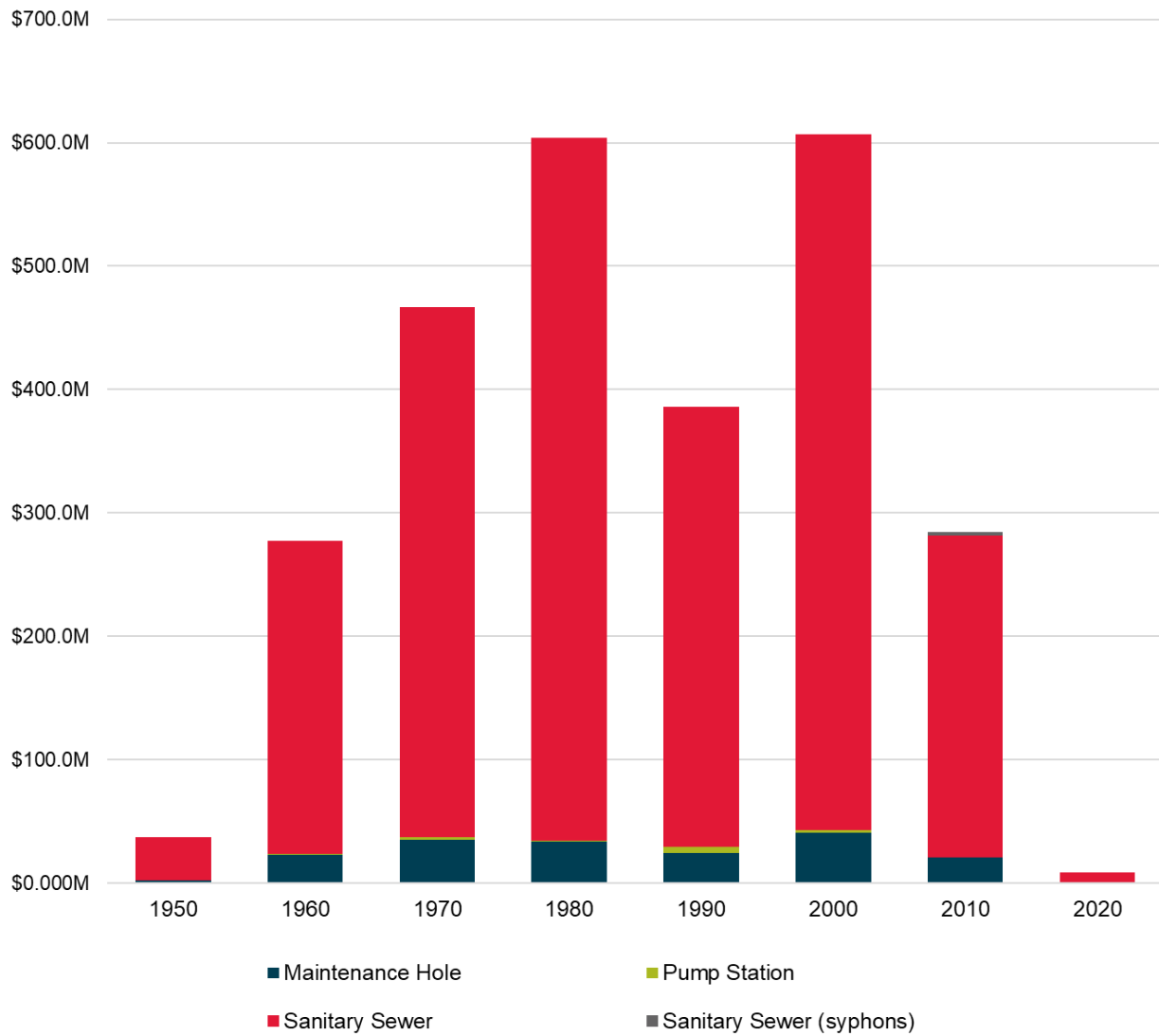


Figure C - 5: Age distribution by installation decade of Wastewater assets.

C.1.3 Asset Performance

Table C - 2 details the approaches that the City utilizes to understand the performance of Wastewater assets.

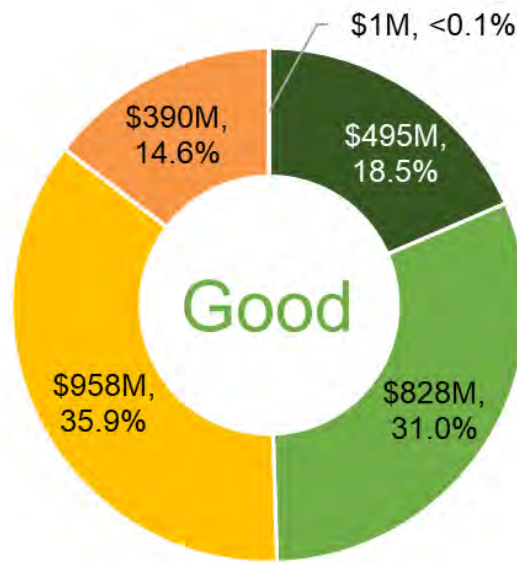
Table C - 2: Performance assessment approaches to Wastewater assets.

Asset Class	Condition Rating Metric	Approach to Assessing Condition
Maintenance Hole	Age/ESL	The City understands the performance of these assets based on asset age and estimated service life.
Pump Station	Remaining Life/ESL	Inspections are performed on pump stations and the results from the inspections are used to determine the asset's remaining life.
Sanitary Sewer	CCTV Condition Index, Remaining Life/ESL	Inspections are performed based on CCTV inspections under NASSCO-PACP standards on a 10-year cycle, remaining life and estimated service life.

Table C - 3 summarizes the relationship between the performance categories and how performance ratings are determined. Figure C - 6 and Figure C - 7 illustrate the performance distribution of all Wastewater assets.

Table C - 3: Performance rating of Wastewater assets.

Condition Category	Remaining Life/ESL	CCTV Condition Index (CCTVCI)
Very Good	100% - 80%	1.0 - 2.0
Good	80% - 60%	2.0 - 3.0
Fair	60% - 40%	3.0 - 4.0
Poor	40% - 20%	4.0 - <5.0
Very Poor	< 20%	5.0



■ Very Good ■ Good ■ Fair ■ Poor ■ Very Poor

Figure C - 6: Condition distribution of State of the Infrastructure assets.

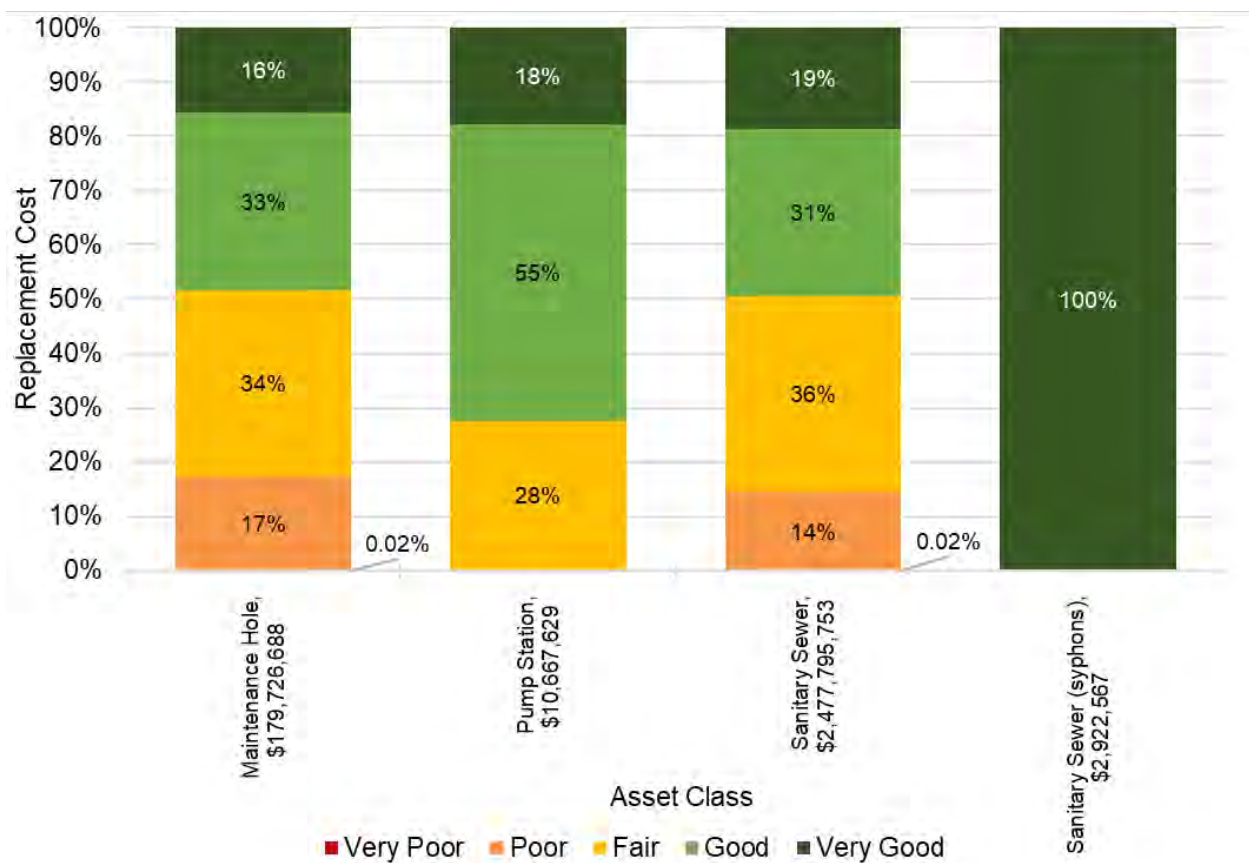


Figure C - 7: Condition distribution of State of the Infrastructure assets by asset class.

C.2 Levels of Service

Customer values, customer levels of service and technical levels of service for Wastewater assets can be found in Table C - 4 to Table C - 7. Furthermore, mandated O.Reg. LoS for wastewater assets can be found in Table C - 8 to Table C - 9.

C.2.1 Customer Values

Table C - 4: Wastewater customer values.

Customer Satisfaction Measure		Current Feedback & Expected Trend Based on Planned Budget
Wastewater collection assets are safe and reliable to use		
Assets are maintained in a state of good repair, are adequate for use, and in overall good working condition.		Future Iterations ¹³
Assets reliably collect and convey wastewater away from properties.		Future Iterations ¹³
Undesirable wastewater odours are minimized.		Future Iterations ¹³
Wastewater collection services are accessible and do not inconvenience customers		
The quality of assets do not negatively affect the customer.		Future Iterations ¹³
Aesthetic Quality		
Wastewater collection assets meet aesthetic expectations.		Future Iterations ¹³
Environmentally sustainable		
Wastewater spills do not negatively affect the environment.		Future Iterations ¹³
Environmental impacts are minimized.		Future Iterations ¹³

¹³ The City is currently reviewing the data that supports this metric, which will be reported in future iterations of the City's AMP. These metrics are subject to change as data is reviewed and incorporated into future AMPs.

C.2.2 Customer and Technical Levels of Service

Table C - 5: Wastewater – Mainlines customer LoS.

Type of Measure	Level of Service	Performance Measure	Current Performance	Confidence Levels
Condition	Condition of Sanitary Sewers	CCTV Condition Index or Condition Based on Remaining Life - Aggregated into 5- point rating scales	Good	Confidence Levels: Low – CCTV data is only available for some sanitary sewer and maintenance hole assets. Where CCTV was unavailable, the assets remaining life, age and ESL are used to evaluation condition.
Condition	Condition of Maintenance Holes	Condition or Age/Remaining Useful Life - Aggregated into 5- point rating scale	Fair	Confidence Levels: Low – CCTV data is only available for some sanitary sewer and maintenance hole assets. Where CCTV was unavailable, the assets remaining life, age and ESL are used to evaluation condition.
Condition	Individual element/element group condition.	Percentage of all elements/element groups in very poor to poor condition	15%	Confidence Levels: Low – CCTV data is only available for some sanitary sewer and maintenance hole assets. Where CCTV was unavailable, the assets remaining life, age and ESL are used to evaluation condition.

Type of Measure	Level of Service	Performance Measure	Current Performance	Confidence Levels
Function	Measure of whether the service is appropriate for its intended use	Future Iterations ¹⁴	Future Iterations ¹⁴	Future Iterations ¹⁴
Capacity	Measure of whether the service is adequate to meet consumer wastewater needs	Future Iterations ¹⁴	Future Iterations ¹⁴	Future Iterations ¹⁴
Accessibility	Service interruptions	Future Iterations ¹⁴	Future Iterations ¹⁴	Future Iterations ¹⁴

¹⁴ The City is currently reviewing and selecting measures for this category, which will be developed and integrated into future iterations of the City's AMP.

Table C - 6: Wastewater – Facilities customer LoS.

Type of Measure	Level of Service	Performance Measure	Current Performance	Confidence Levels
Condition	Condition of Pump Station	Condition or Age/Remaining Useful Life - Aggregated into 5- point rating scale	Good	Confidence Levels: Medium – Condition assessments are performed to determine pump station condition. Age and ESL are used to evaluate asset condition where condition assessment data is unavailable.
Condition	Individual element/element group condition.	Percentage of all elements/element groups in poor condition	0%	Confidence Levels: Medium – Condition assessments are performed to determine pump station condition. Age and ESL are used to evaluate asset condition where condition assessment data is unavailable.
Function	Measure of whether the service is	Future Iterations ¹⁴	Future Iterations ¹⁴	Future Iterations ¹⁴
Capacity	Measure of whether the service is adequate to meet consumer wastewater needs	Future Iterations ¹⁴	Future Iterations ¹⁴	Future Iterations ¹⁴
Accessibility	Service interruptions	Number of properties that experienced a service interruption.	19 reported instances of basement flooding/issues compared to 89,596 connected properties	Not applicable

Table C - 7: Wastewater technical LoS.

Lifecycle Activity	Purpose of Activity	Frequency	Current Performance (\$, 2025 Budget)	Recommended Performance
Acquisition	Growth Expansion Development	Projects developed in Future Urban Area Conceptual Master Plan - Transportation, Water and Wastewater Master Plan Class Environmental Assessment Study	\$2,419,500	Growth Planning Horizon: 2026-2051 Total Acquisition Value Range: \$595.6M - \$860.8M City Funded Acquisition Value Range: \$0 (all funding is developer funded)
Operation	Inspections	Annual programs	\$433,700 The City's 2025 operating budget for all services was \$495.8M.	Maintain current performance for assets in service. Anticipated operating budget increase ranges from \$15.9M to \$22.9M over the growth planning horizon: 2026-2051. These costs may vary year over year depending on asset needs.
Operation	Regular Operations	As required	See above	See above
Maintenance	Minor repairs	As required	The City performs sanitary sewer rehabilitation through the capital budget to address deficiencies identified from CCTV inspections.	Maintain current performance for assets in service. Anticipated maintenance budget increases are included in the operating or renewal budget forecasts.

Lifecycle Activity	Purpose of Activity	Frequency	Current Performance (\$, 2025 Budget)	Recommended Performance
Maintenance	Regular Maintenance	Annual programs	See above	See above
Maintenance	Major maintenance (holding strategies)	As required	See above	See above
Renewal	Major rehabilitation or replacement	As required	\$1,782,800 (City's LCRS)	PLoS Maintain Current Performance requires \$8.68M or \$6.90M per year on average of additional funds from 2026 to 2051.
Disposal	Disposal of replaced assets	As required	Included with renewal costs	Maintain current performance for assets in service.
Service Improvement	Upgrades to improve LoS to benefit existing serviced areas	As required	\$264,500	Maintain Current Performance

C.2.3 Ontario Regulation 588/17 Levels of Service

Levels of service that are prescribed by O.Reg. 588/17 apply to wastewater assets that relate to the collection, transmission, treatment or disposal of wastewater. The following tables detail the O.Reg. 588/17 prescribed levels of service for the Wastewater group.

Table C - 8: Wastewater O. Reg. 588/17 customer LoS.

Service Attributes	Qualitative Descriptions or Technical Metrics	Metric
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 C - 8: 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.	The City does not have any combined sewers.
Reliability	2. Description of the frequency and volume of overflows in combined sewers in the municipal wastewater system that occur in habitable areas or beaches.	The City does not have any combined sewers.
Reliability	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 the sanitary system. Infiltration can enter through a variety of sources – cracks in pipes, cross connections such as downspout connections, through maintenance hole 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 homeowners to remove the downspouts from sanitary sewers.

Service Attributes	Qualitative Descriptions or Technical Metrics	Metric
Reliability	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 - Implement water-tight measures when sewers are installed in high groundwater areas.
Reliability	5. Description of the effluent that is discharged from sewage treatment plants in the municipal wastewater system.	The City does not have sewage treatment plants.

Table C - 9: Wastewater O. Reg. 588/17 technical LoS.

Service Attributes	Qualitative Descriptions or Technical Metrics	Metric
Scope	Percentage of properties connected to the municipal wastewater system.	96%
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.	The City does not have any combined sewers.
Reliability	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.	19 reported instances of basement flooding/issues compared to 89,596 connected properties
Reliability	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.	14 violations compared to 89,596 connected properties

Properties Connected to the Municipal Wastewater System

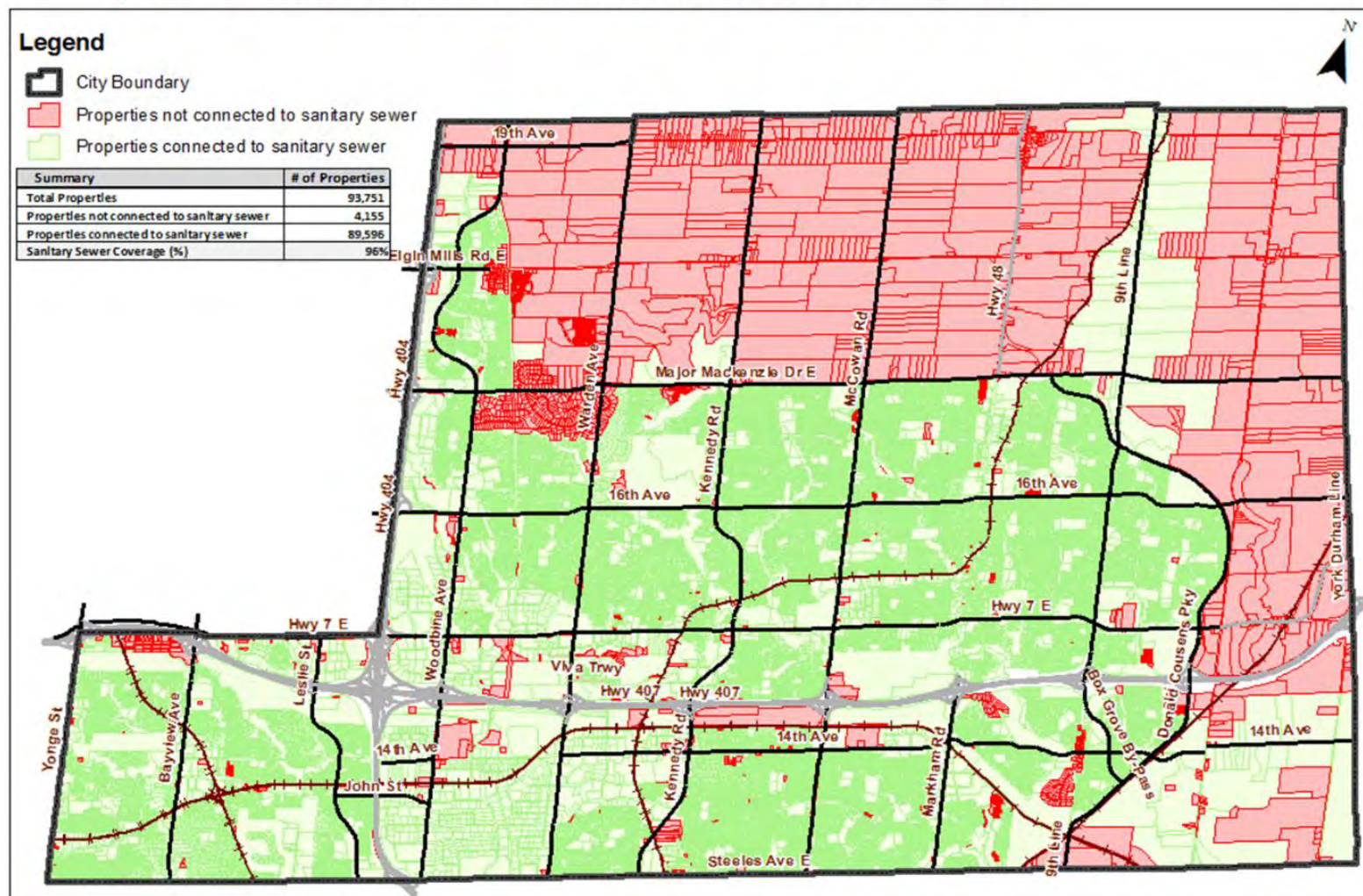


Figure C - 8: Properties connected to the municipal Wastewater System.

C.3 Risk Management Strategy

The criteria used to determine the consequence of failure for Wastewater assets can be found in Table C - 10 below.

Table C - 10: COF criteria used for Wastewater assets.

Direct Financial	Socio-Economic	Environmental
Replacement Cost	- Diameter - Land Use	Proximity to ESA, watercourse, or habitat

Table C - 11 displays the risk score for Wastewater assets along with the proportion of assets within each risk score, likelihood of failure and consequence of failure.

Table C - 11: Risk score distribution of Wastewater assets.

	COF 1	COF 2	COF 3	COF 4	COF 5	Subtotal
LOF 1	\$2.9M (0.1%)	\$425.1M (15.9%)	\$64.1M (2.4%)	\$2.7M (0.1%)	None	\$494.8M (18.5%)
LOF 2	None	\$720.5M (27.0%)	\$96.0M (3.6%)	\$11.3M (0.4%)	None	\$827.8M (31.0%)
LOF 3	None	\$798.6M (29.9%)	\$148.9M (5.6%)	\$10.2M (0.4%)	None	\$957.7M (35.9%)
LOF 4	None	\$341.0M (12.8%)	\$46.8M (1.8%)	\$2.4M (0.1%)	None	\$390.1M (14.6%)
LOF 5	None	\$0.6M (<0.1%)	None	None	None	\$0.6M (<0.1%)
Subtotal	\$2.9M (0.1%)	\$2.3B (85.6%)	\$355.7M (13.3%)	\$26.6M (1.0%)	None	\$2.7B

Table C - 12: Risk score mapping legend.

Risk	Risk Score	Risk Description	Total Replacement Cost
Very Low	1 – 5	Fit for the Future	\$1,215,297,014 (45.5%)
Low	6 – 10	Adequate for Now	\$1,396,452,949 (52.3%)
Moderate	11 – 15	Requires Attention	\$56,997,791 (2.1%)
High	16 – 20	At Risk	\$2,364,883 (0.1%)
Very High	21 – 25	Unfit for Sustained Service	None

C.4 Lifecycle Management Activities

The City's lifecycle management activities for Wastewater assets are listed in Table C - 7. These activities include the acquisition of assets and service improvements, operations and maintenance, major asset renewals (including rehabilitations and replacements), and disposals.

These lifecycle management activities in conjunction with the lifecycle forecasting are used to determine the funding required for the City to continue performing these lifecycle activities to extend asset life, reduce overall costs, and minimize risk while providing the proposed service levels.

C.5 Lifecycle Forecasting

The following section outlines the funding required for the entire lifecycle of Wastewater assets. The expenditures were determined using the lifecycle activities outlined in Table C - 7 and the PLoS established.

Required funding was determined for PLoS using the following forecasting analysis parameters:

- Proposed LoS – Maintain Current Performance:** funding required to maintain a similar asset performance over a 26-year period. The City has established this LoS as the proposed LoS for Wastewater assets. It focuses on maintaining the percentage of assets in backlog in a similar state. Backlog is defined as assets that are in need of renewal work (either significant rehabilitation or replacement). For example, if 20% of assets are past their service life, or are in need of renewal work, then the forecast model will determine the funding to maintain 20% of assets in this state over the forecast period.

The following table summarizes the anticipated funding from the City's Life Cycle Reserve Study for renewal activities for Wastewater assets. A total of **\$33.5M** over the next 26 years (or an equivalent average annual of **\$1.3M**) for renewals is anticipated to be spent.

Table C - 13: Forecasted capital renewal expenditures (Life Cycle Reserve Study) for Wastewater assets.

Year	Capital Expenditures (Renewals)
2026	\$1,420,200
2027	\$1,714,224
2028	\$1,390,485
2029	\$1,384,833

Year	Capital Expenditures (Renewals)
2030	\$1,377,715
2031	\$1,391,073
2032	\$1,417,554
2033	\$1,435,543
2034	\$1,348,308
2035	\$1,398,124
2036	\$1,320,166
2037	\$1,377,383
2038	\$1,360,856
2039	\$1,309,921
2040	\$1,234,532
2041	\$1,194,643
2042	\$1,236,910
2043	\$1,216,573
2044	\$1,221,007
2045	\$1,725,542
2046	\$998,477
2047	\$1,144,783
2048	\$1,060,497
2049	\$955,747
2050	\$1,169,091
2051	\$711,704
Total	\$33,515,892
Equivalent Average Annual	\$1,289,073

Figure C - 9 and Figure C - 10 illustrate the performance and financial forecasts to achieve PLoS for all Wastewater assets. The forecast analysis identified a total of **\$225.8M** (or an equivalent average annual of **\$8.7M**) that is anticipated to be spent over the next 26 years to maintain current performance. This represents funding gap of **\$192.3M** over the planning horizon, or an equivalent average annual amount of **\$7.4M**.

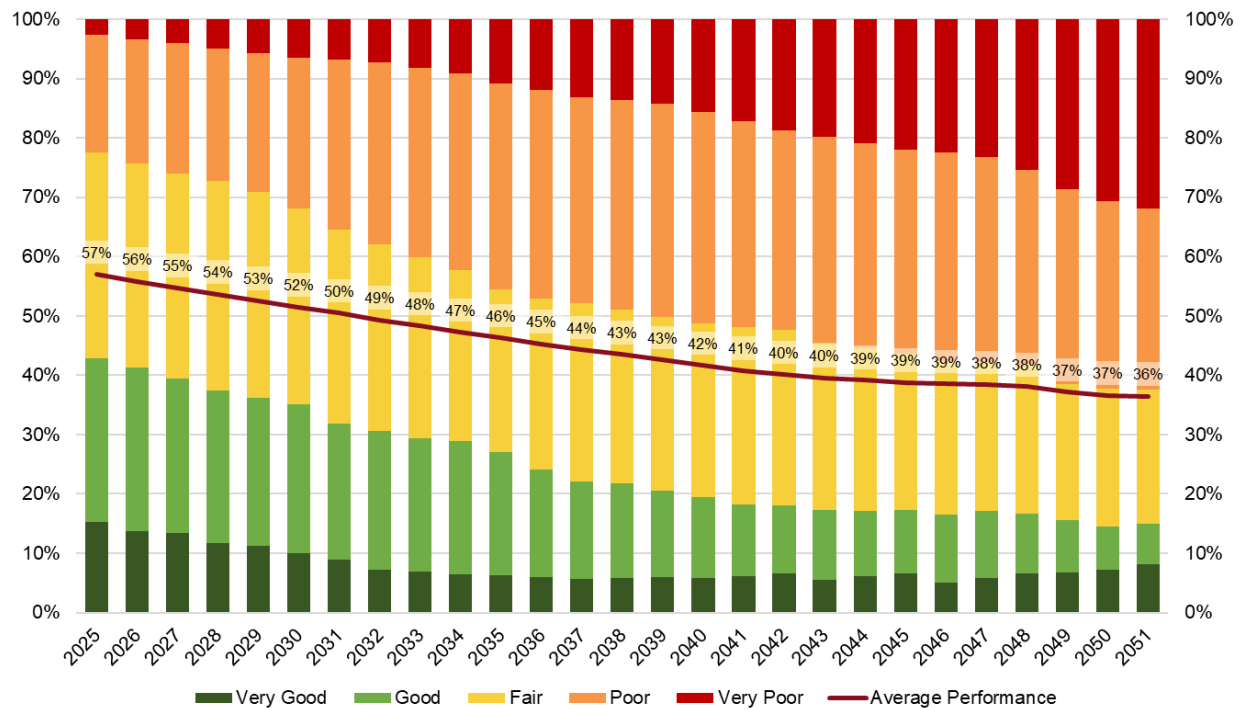


Figure C - 9: Performance Distribution – maintain current performance for Wastewater assets.

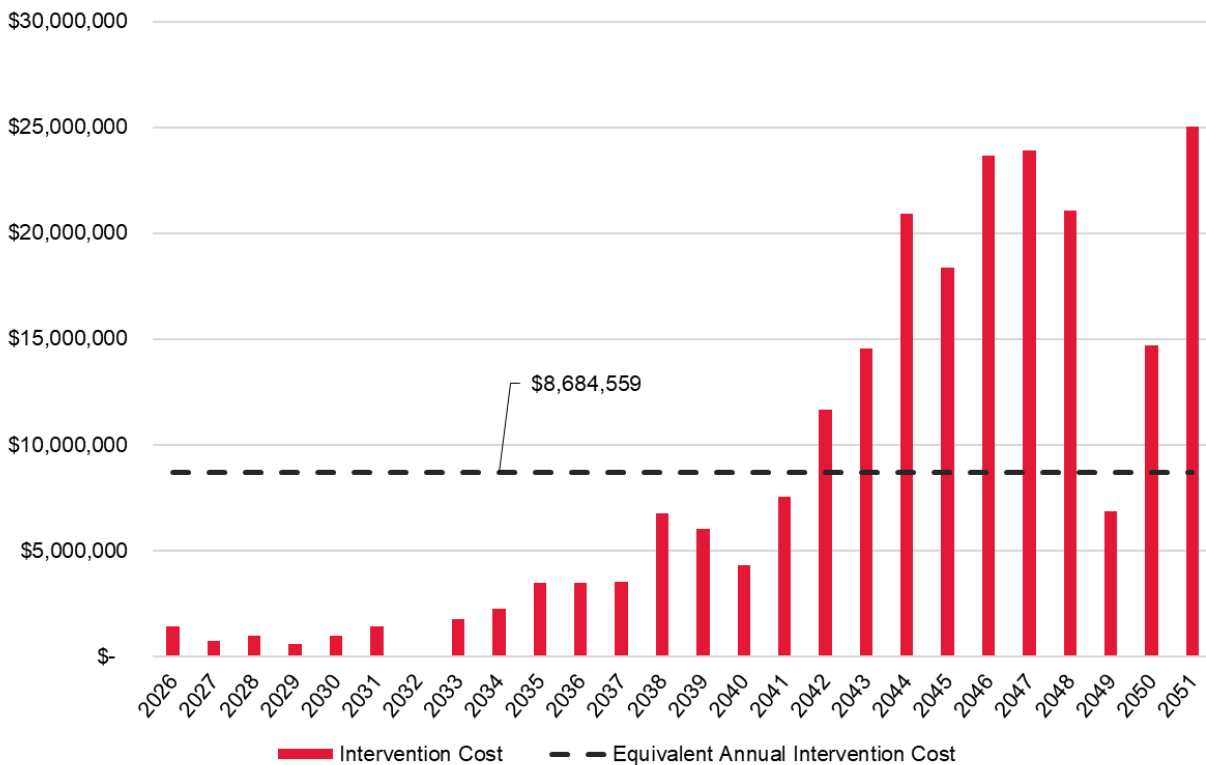


Figure C - 10: Maintain current performance intervention costs for Wastewater assets.

C.6 Proposed Levels of Service Themes & Future Challenges

The customer values and customer LoS were discussed with stakeholders. The following summarizes the feedback from the stakeholders related to service delivery, customer expectations, and challenges faced by the City, particularly challenges that may be encountered in the future:

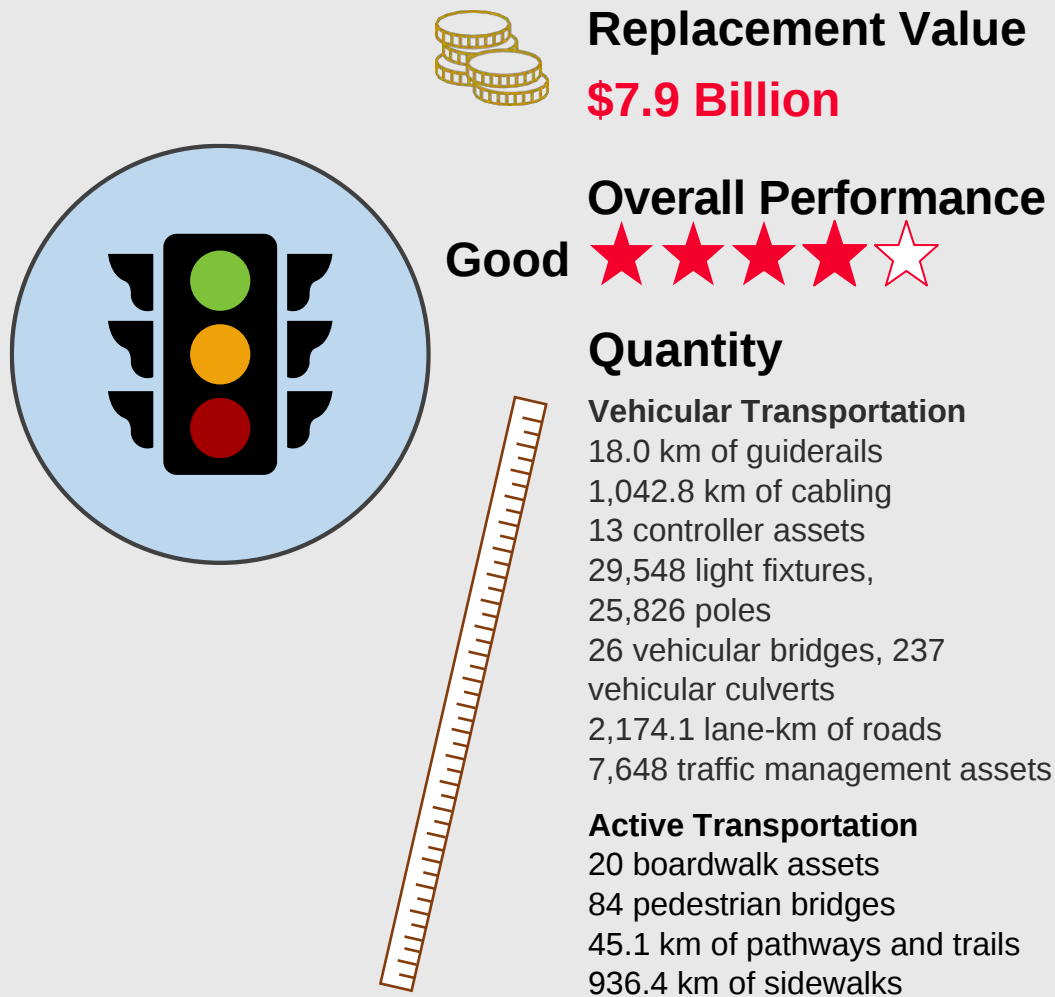
Table C - 14: Proposed LoS themes for Wastewater assets.

Challenge	Discussion
Customer Expectations	- Customers expect that the capacity of the system is sufficient. - Generally, wastewater collection systems are designed and built to support their ultimate use and capacity. - The City does not have ultimate control on overall wastewater servicing capacity because wastewater is conveyed to the York Durham Sewage System. - A water and wastewater master plan can identify the appropriate future system expansion requirements to support growth objectives. It can be aligned with the Region's official plan and master plan, but the City and Region priorities may not necessarily align. - The Engineering team has done a DC study to identify which pipes need to be upsized from the City's funding sources and the developer's. This has been incorporated into the lifecycle.

The insight from this discussion will be considered and incorporated into the City's AM processes and future iterations of the AMP. As the City continues to grow, it is important that current and future challenges are addressed in order to maintain service levels and achieve proposed service levels.

Appendix D. Transportation

Service Summary



The City's transportation services contain assets that directly supports the moving of people, goods and services, while playing a critical role supporting the connectivity, and economic growth for residents and businesses of Markham.

The City is responsible for assets such as various roads, bridges, sidewalks, bicycle lanes, trails, traffic signs and equipment, and many more detailed in Figure D - 1.

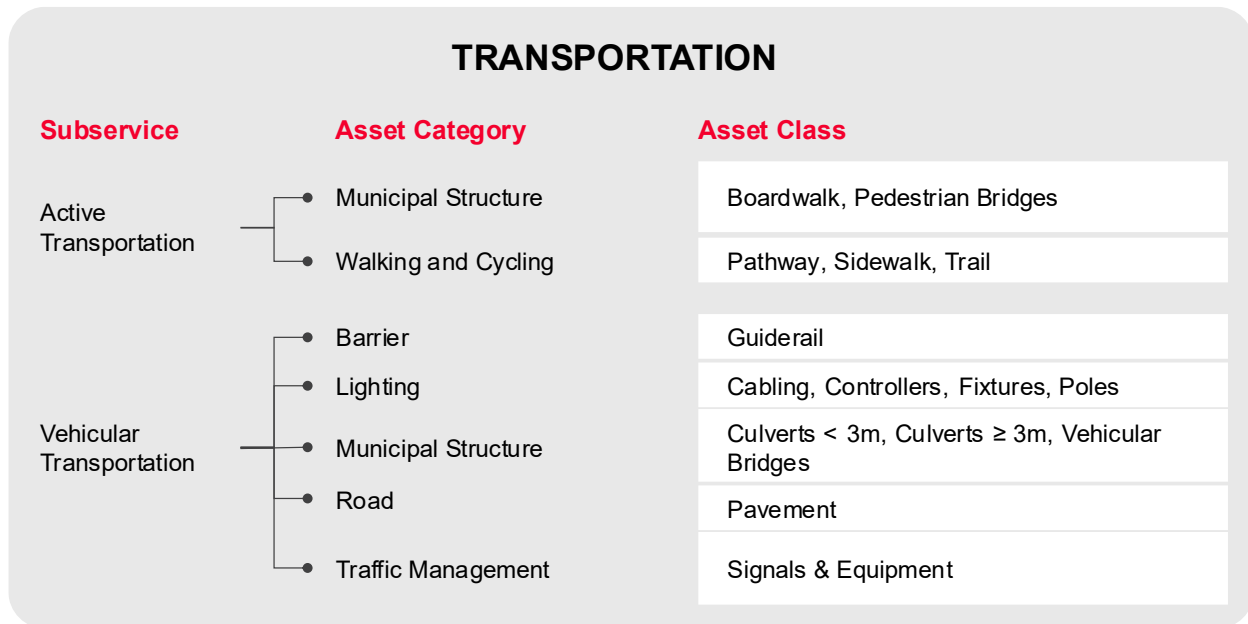


Figure D - 1: Transportation hierarchy.

More information on transportation such as state of infrastructure, levels of service, risk management strategies, lifecycle management strategies and forecasting can be found in the following sections. The sections are split by the major subservices: Vehicular Transportation and Active Transportation.

D.1 Vehicular Transportation

D.1.1 State of the Infrastructure

Figure D - 2 shows the replacement value of all Vehicular Transportation assets while Figure D - 3 and Figure D - 4 illustrate the replacement value breakdown of vehicular transportation assets by asset class. Roads have been broken out separately as they account for the majority of the City's Vehicular Transportation replacement value.

The total replacement value for Vehicular Transportation assets is \$7,678.2M, where roads account for 93.1% of the Vehicular Transportation portfolio at \$7,149.3M.

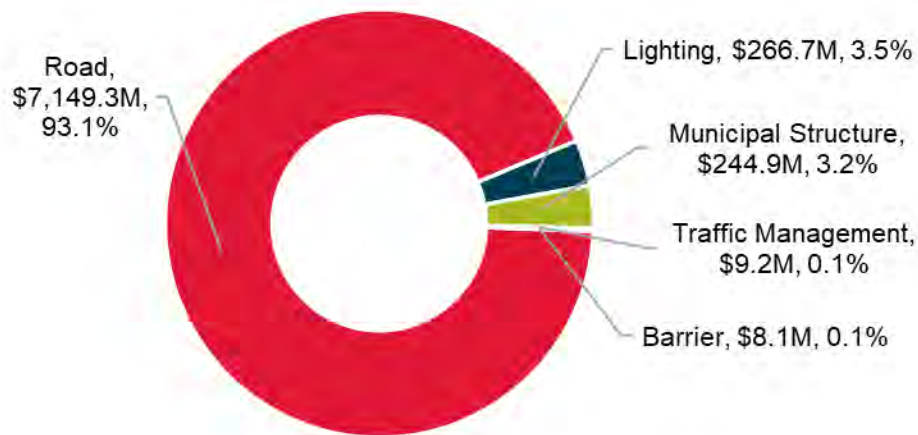


Figure D - 2: Replacement value distribution of Vehicular Transportation assets.

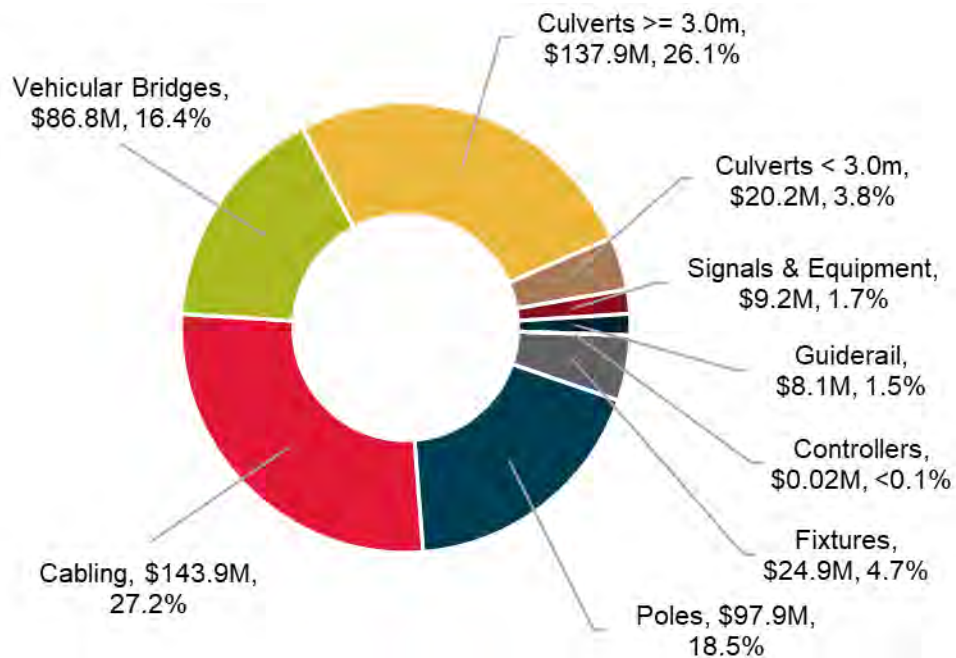


Figure D - 3: Replacement value of Vehicular Transportation assets by asset class (excluding roads).

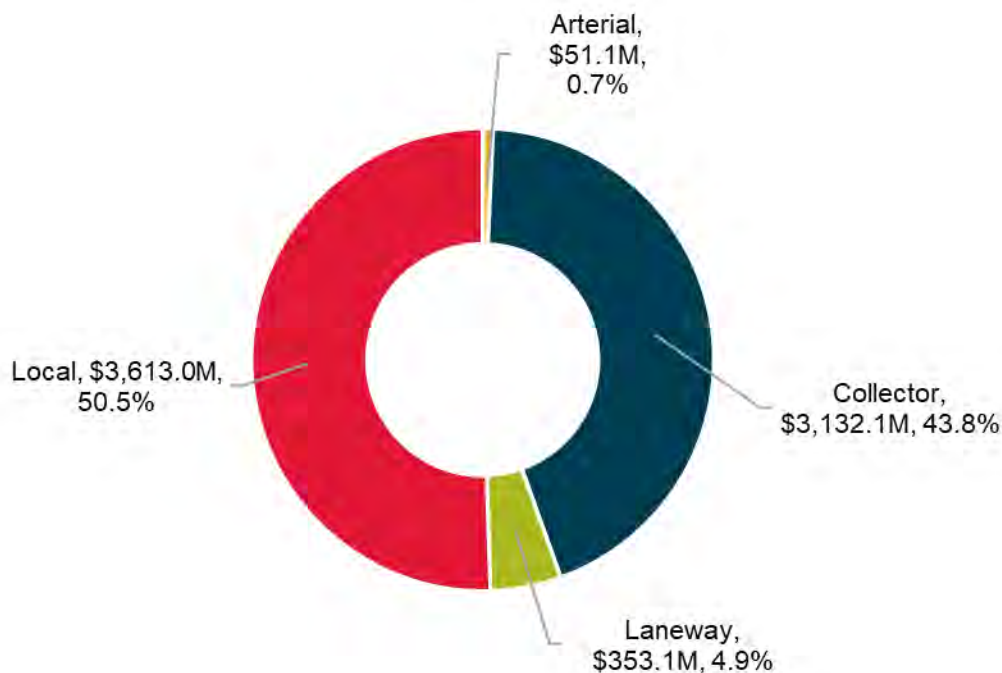


Figure D - 4: Replacement value of Vehicular Transportation assets by asset class (roads only).

D.1.1.1 Asset Inventory and Valuation

Table D - 1 below summarizes the asset valuation, quantities, and performance for each asset category of Vehicular Transportation assets.

Table D - 1: Inventory and valuation for Vehicular Transportation assets.

Asset Category	Asset Class	Replacement Cost	Inventory	Average Performance
Barrier	Guiderail	\$8,117,224	17,959m	Poor
Lighting	Cabling	\$143,868,095	1,042,825m	Fair
Lighting	Controllers	\$21,245	13 Assets	Very Good
Lighting	Fixtures	\$24,890,094	29,548 Assets	Good
Lighting	Poles	\$97,896,810	25,826 Assets	Good
Municipal Structure	Vehicular Bridges	\$86,832,955	26 Assets	Good
Municipal Structure	Culverts < 3m	\$13,625,122	155 Assets	Good
Municipal Structure	Culverts ≥ 3m	\$117,439,623	63 Assets	Good
Road	Pavement	\$7,149,268,886	2,174km	Good
Traffic Management	Signals & Equipment	\$9,212,989	7,648 Assets	Fair
Total	-	\$7,678,185,240	-	-

D.1.1.2 Age and Estimated Service Life

Figure D - 5 and Figure D - 6 illustrate the age of Vehicular Transportation assets as a proportion of their estimated service life. Figure D - 7 illustrates the value of Vehicular Transportation assets acquired by decade. Arterial roads are the only asset group on average that have surpassed the end of their ESL.

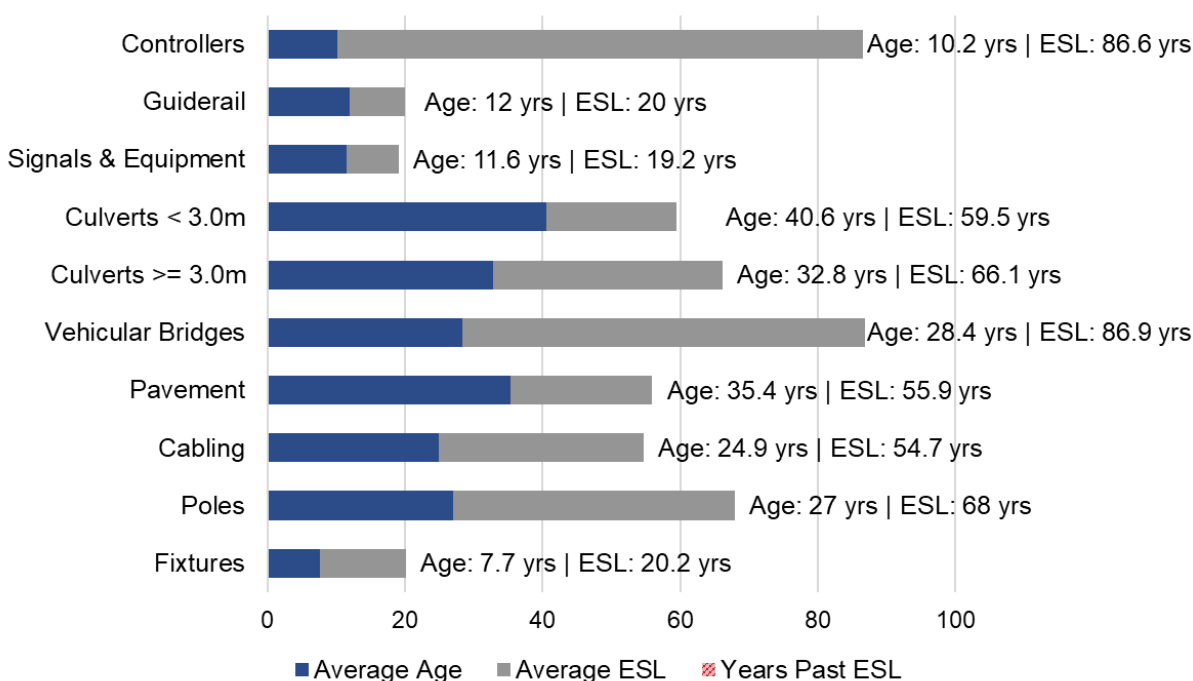


Figure D - 5: Age as a proportion of estimated service life (ESL) of Vehicular Transportation assets.

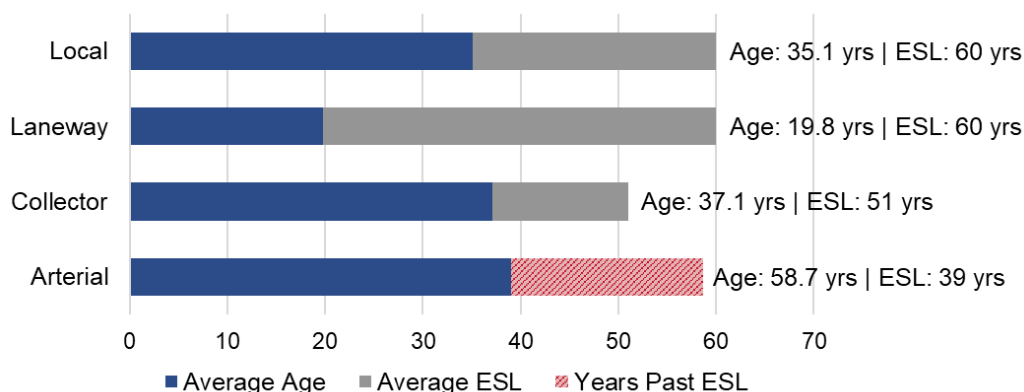


Figure D - 6: Age as a proportion of estimated service life (ESL) of Vehicular Transportation assets (roads only)¹⁵.

The installation profile of Vehicular Transportation assets illustrates that the majority of roads (pavement) were installed from the 1980s to 2000s, in line with decades that experienced significant growth and corresponding development in the City.

¹⁵ Please note that rehabilitation and reconstruction data for road assets were unavailable and the original construction date of the road assets were used to generate this figure. Despite the available age data suggesting otherwise, the corresponding PCI values indicate that the roads have been recently renewed.

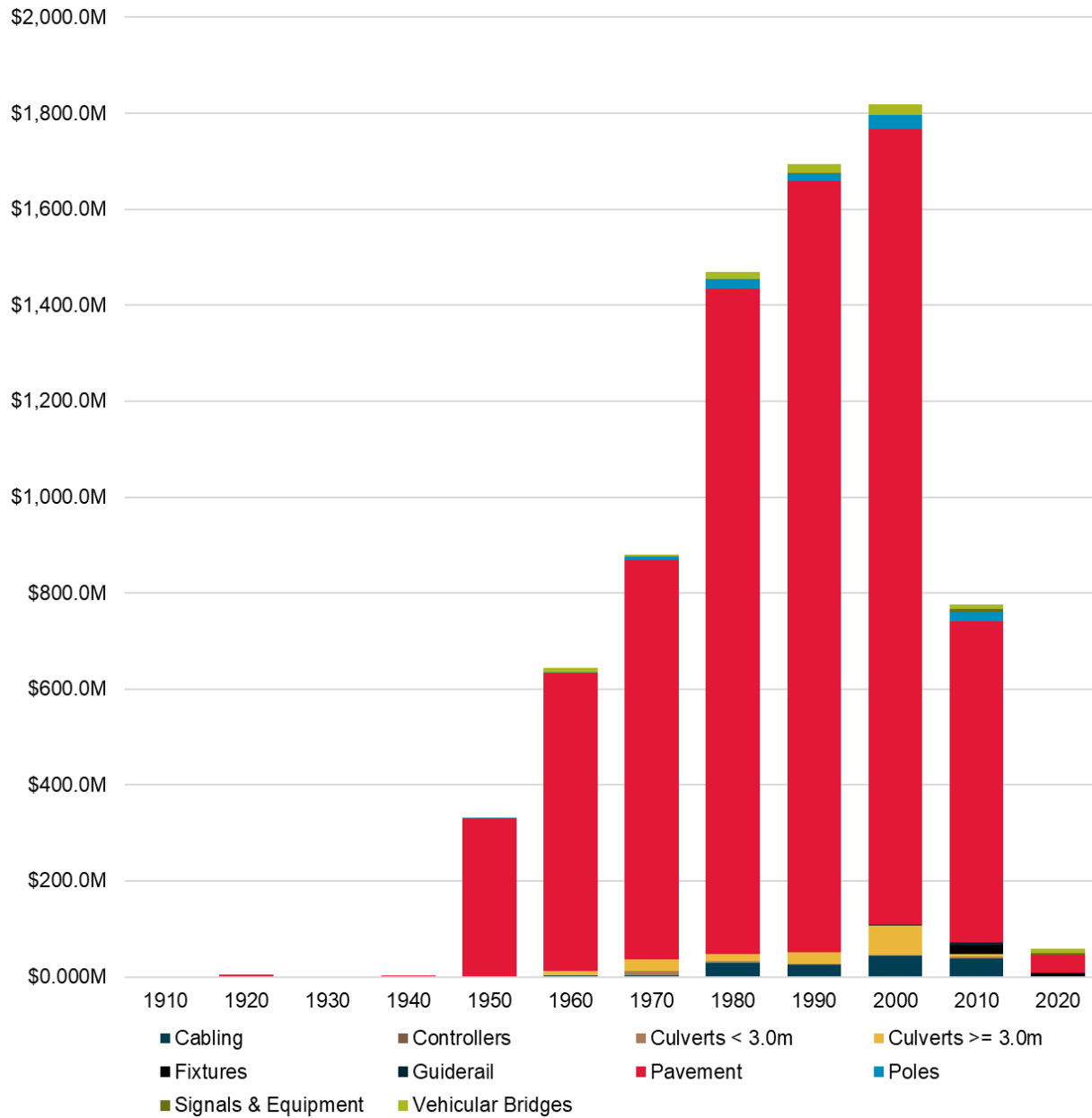


Figure D - 7: Age distribution by installation decade of Vehicular Transportation assets.

D.1.1.3 Asset Performance

Table D - 2 details the approaches that the City utilizes to understand the performance of Vehicular Transportation assets.

Table D - 2: Performance assessment approaches to Vehicular Transportation assets.

Asset Class	Condition Rating Metric	Approach to Assessing Condition
Fixtures, Guiderails, Signals and Equipment	Age/ESL	The City understands the condition of these assets based on asset age and estimated service life.
Bridges < 3m and Bridges ≥ 3m	BCI	OSIM inspections and BCI recorded into the City's database per MTO standards. BCI is used to understand asset condition.
Culverts < 3m and Culverts ≥ 3m	BCI, CCTV Condition Index	OSIM inspections and BCI recorded into City's database per MTO standards, CCTV inspections are all recorded into the City's database. CCTV and BCI ratings are used to understand asset condition.
Pavement	PCI	Inspected biennially using laser technology to obtain a PCI score which is recorded in City's database and used to understand condition. PCI is used to understand asset condition.
Cabling, Poles, and Controllers	Remaining Life/ESL	The City understands the condition of these assets based on asset age and estimated service life. Regular condition assessments on poles and cables are performed every 3 years and 5 years, respectively.

Table D - 3 and Table D - 4 summarize the relationship between the performance categories and how performance ratings are determined. Figure D - 8 and Figure D - 9 illustrate the performance distribution of all Vehicular Transportation assets.

Table D - 3: Performance rating of road assets.

Condition Category	Laneways and Local Roads (PCI)	Collector Roads (PCI)	Arterial Roads (PCI)
Very Good	80 – 100	90 – 100	90 – 100
Good	70 – 80	75 – 90	80 – 90
Fair	60 – 70	60 – 75	60 – 80
Poor	40 – 60	40 – 60	40 – 60
Very Poor	0 – 40	0 – 40	0 – 40

Table D - 4: Performance rating of other Vehicular Transportation assets.

Condition Category	Remaining Life/ESL	Age/ESL	Bridge Condition Index (BCI)	CCTV Condition Index (CCTVCI)
Very Good	100% - 80%	0% - 20%	85 – 100	1.0 - 2.0
Good	80% - 60%	20% - 40%	70 – 85	2.0 - 3.0
Fair	60% - 40%	40% - 60%	60 – 70	3.0 - 4.0
Poor	40% - 20%	60% - 80%	50 – 60	4.0 - 5.0
Very Poor	< 20%	>80%	0 – 50	5.0 - 6.0

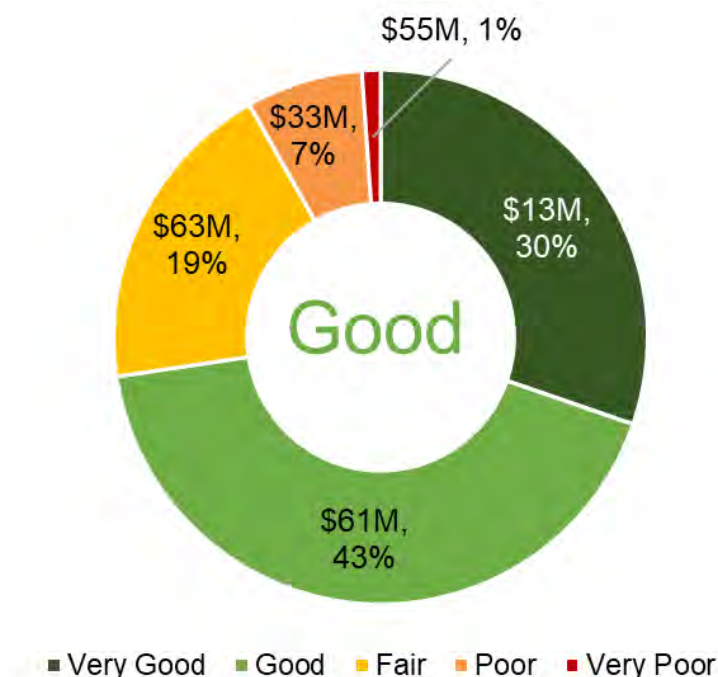


Figure D - 8: Condition distribution of Vehicular Transportation assets.

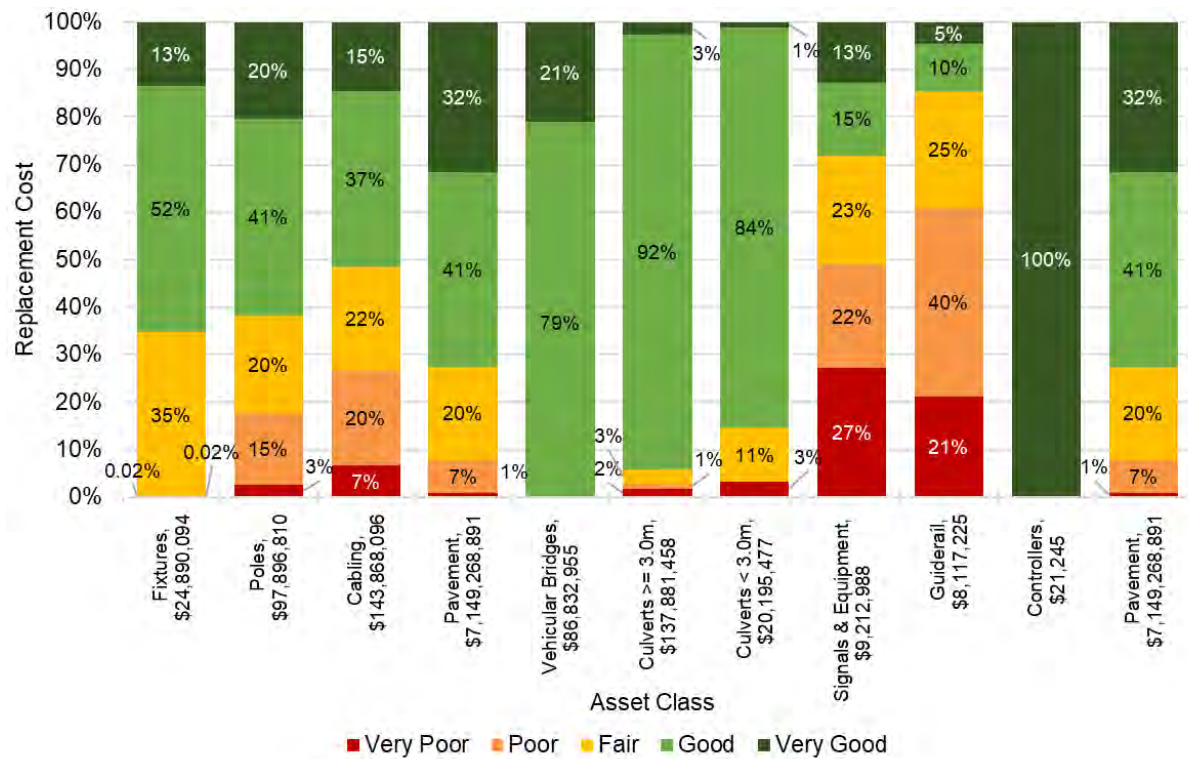


Figure D - 9: Condition distribution of Vehicular Transportation assets by asset class.



Figure D - 10: Condition distribution of Vehicular Transportation assets by asset class (roads only and based on PCI ratings).

D.1.2 Levels of Service

Customer values, customer levels of service and technical levels of service for Vehicular Transportation assets can be found in Table D - 5 to Table D - 10. Furthermore, mandated O.Reg. LoS for roads and bridges can be found in Table D - 11 to Table D - 14.

D.1.2.1 Customer Values

Table D - 5: Transportation customer values.

Customer Satisfaction Measure	Current Feedback & Expected Trend Based on Planned Budget
Transportation services assets are safe and reliable to use	
Assets are maintained in a state of good repair, are adequate for use, and in overall good working condition.	Future Iterations ¹⁶
Assets can support all types of traffic.	Future Iterations ¹⁶
Traffic controls have been installed to increase commuter safety, reduce injury and overall number of incidents.	Future Iterations ¹⁶
Transportation services assets are convenient to use	
The quality of assets does not negatively affect the travelling experience	Future Iterations ¹⁶
Transportation services assets are accessible and easy to access.	Future Iterations ¹⁶
Aesthetic Quality	
Transportation services assets meet aesthetic expectations.	Future Iterations ¹⁶
Environmentally sustainable	
Environmental impacts are minimized.	Future Iterations ¹⁶

¹⁶ The City is currently reviewing the data that supports this metric, which will be reported in future iterations of the City's AMP. These metrics are subject to change as data is reviewed and incorporated into future AMPs.

D.1.2.2 Customer and Technical Levels of Service

Table D - 6: Roads customer LoS.

Type of Measure	Level of Service	Performance Measure	Current Performance	Confidence Levels
Condition	Condition of Local roads	Pavement Condition Index (PCI) - Aggregated into 5-point rating scales	77	High – condition assessments are performed to determine PCI scores
Condition	Condition of Arterial roads	Pavement Condition Index (PCI) - Aggregated into 5-point rating scales	73	High – condition assessments are performed to determine PCI scores
Condition	Condition of Collectors roads	Pavement Condition Index (PCI) - Aggregated into 5-point rating scales	78	High – condition assessments are performed to determine PCI scores
Condition	Condition of Laneways	Pavement Condition Index (PCI) - Aggregated into 5-point rating scales	90	High – condition assessments are performed to determine PCI scores
Condition	Individual element/element group condition.	Percentage of all elements/element groups in very poor to poor condition	8%	High – condition assessments are performed to determine PCI scores

Type of Measure	Level of Service	Performance Measure	Current Performance	Confidence Levels
Function	Measure of whether the service is appropriate for its intended use	Future Iterations ¹⁷	Future Iterations ¹⁷	Future Iterations ¹⁷
Capacity	Measure of whether the service is adequate to meet traffic needs	Future Iterations ¹⁷	Future Iterations ¹⁷	Future Iterations ¹⁷
Accessibility	Service interruptions	Future Iterations ¹⁷	Future Iterations ¹⁷	Future Iterations ¹⁷

¹⁷ The City is currently reviewing and selecting measures for this category, which will be developed and integrated into future iterations of the City's AMP.

Table D - 7: Municipal structures customer LoS.

Type of Measure	Level of Service	Performance Measure	Current Performance	Confidence Levels
Condition	Condition of Vehicular Bridges	Bridge Condition Index (BCI) - Aggregated into 5-point rating scale	74	High – condition assessments are performed to determine BCI scores
Condition	Condition of Culverts	Bridge Condition Index (BCI) - Aggregated into 5-point rating scale	74	High – condition assessments are performed to determine BCI scores
Condition	Individual element/element group condition.	Percentage of all elements/element groups in very poor to poor condition	2%	High – condition assessments are performed to determine BCI scores
Function	Measure of whether the service is appropriate for its intended use	Future Iterations ¹⁷	Future Iterations ¹⁷	Future Iterations ¹⁷
Capacity	Measure of whether the service is adequate to meet traffic needs	Future Iterations ¹⁷	Future Iterations ¹⁷	Future Iterations ¹⁷
Accessibility	Service interruptions	Future Iterations ¹⁷	Future Iterations ¹⁷	Future Iterations ¹⁷

Table D - 8: Barriers customer LoS.

Type of Measure	Level of Service	Performance Measure	Current Performance	Confidence Levels
Condition	Condition of Guiderails	Condition or Age/Remaining Useful Life	Poor	Low – age and remaining service life are used to determine condition in place of condition data
Condition	Individual element/element group condition.	Percentage of all elements/element groups in very poor to poor condition	61%	Low – age and remaining service life are used to determine condition in place of condition data
Function	Measure of whether the service is appropriate for its intended use	Future Iterations ¹⁷	Future Iterations ¹⁷	Future Iterations ¹⁷
Capacity	Measure of whether the service is adequate to meet traffic needs	Future Iterations ¹⁷	Future Iterations ¹⁷	Future Iterations ¹⁷
Accessibility	Service interruptions	Future Iterations ¹⁷	Future Iterations ¹⁷	Future Iterations ¹⁷

Table D - 9: Lighting and traffic management customer LoS.

Type of Measure	Level of Service	Performance Measure	Current Performance	Confidence Levels
Condition	Condition of Cabling	Condition - Aggregated into 5-point rating scales	Fair	Medium – age and remaining service life are used to determine condition in place of condition data and regular condition inspections are performed on streetlight poles.
Condition	Condition of Controllers	Condition - Aggregated into 5-point rating scales	Fair	Medium – age and remaining service life are used to determine condition in place of condition data and regular condition inspections are performed on streetlight poles.
Condition	Condition of Fixtures	Condition - Aggregated into 5-point rating scales	Fair	Medium – age and remaining service life are used to determine condition in place of condition data and regular condition inspections are performed on streetlight poles.
Condition	Condition of Streetlights	Condition - Aggregated into 5-point rating scales	Fair	Medium – age and remaining service life are used to determine condition in place of condition data and regular condition inspections are performed on streetlight poles.

Type of Measure	Level of Service	Performance Measure	Current Performance	Confidence Levels
Condition	Condition of Traffic Signals	Condition - Aggregated into 5-point rating scales	Fair	Medium – age and remaining service life are used to determine condition in place of condition data and regular condition inspections are performed on streetlight poles.
Condition	Condition of Equipment	Condition - Aggregated into 5-point rating scales	Fair	Medium – age and remaining service life are used to determine condition in place of condition data and regular condition inspections are performed on streetlight poles.
Condition	Individual element/element group condition.	Percentage of all elements/element groups in very poor to poor condition	22%	Medium – age and remaining service life are used to determine condition in place of condition data and regular condition inspections are performed on streetlight poles.
Function	Measure of whether the service is appropriate for its intended use	Future Iterations ¹⁷	Future Iterations ¹⁷	Future Iterations ¹⁷
Capacity	Measure of whether the service is adequate to meet traffic needs	Future Iterations ¹⁷	Future Iterations ¹⁷	Future Iterations ¹⁷
Accessibility	Service interruptions	Future Iterations ¹⁷	Future Iterations ¹⁷	Future Iterations ¹⁷

Table D - 10: Vehicular Transportation technical LoS.

Lifecycle Activity	Purpose of Activity	Frequency	Current Performance (\$, 2025 Budget)	Recommended Performance
Acquisition	Growth Expansion Development	Projects developed in transportation master plans and DC study	\$4,734,800	Growth Planning Horizon: 2026-2051 Total Acquisition Value Range: \$1,695.0M - \$2,335.7M City Funded Acquisition Value Range: \$767.4M - \$919.9M
Operation	Inspections	Annual programs	\$423,800 The City's 2025 operating budget for all services was \$495.8M.	Maintain current performance for assets in service. Anticipated operating budget increase ranges from \$45.1M to \$62.2M over the growth planning horizon: 2026-2051.
Operation	Regular Operations	As required	See above	See above
Maintenance	Minor repairs	As needed	\$2,022,700	Maintain current performance for assets in service. Anticipated maintenance budget increases are included in the operating or renewal budget forecasts.
Maintenance	Regular Maintenance	Annual programs	See above	See above
Maintenance	Major maintenance (holding strategies)	As needed	See above	See above

Lifecycle Activity	Purpose of Activity	Frequency	Current Performance (\$, 2025 Budget)	Recommended Performance
Renewal	Major rehabilitation or replacement	As needed	\$8,297,600, for roads \$1,910,300 for other vehicular transportation assets (City's LCRS)	• PLoS Maintain Current Performance requires \$13.27M or \$4.97M per year on average of additional funds from 2026 to 2051 to maintain 70% of roads in good or better condition. • PLoS Maintain Current Performance requires \$5.90M or \$3.99M per year on average of additional funds from 2026 to 2051 for other vehicular assets.
Disposal	Disposal of replaced assets	As required	Included with renewal costs	Maintain current performance for assets in service.
Service Improvement	Upgrades to improve LoS to benefit existing serviced areas	As required	\$1,058,800	Maintain Current Performance

D.1.2.3 Ontario Regulation 588/17 Levels of Service

Levels of service that are prescribed by O.Reg. 588/17 apply to roads, bridges and culverts. Bridges and Culverts can be found both in the Active Transportation and Vehicular Transportation subservices. The following tables detail the O.Reg. 588/17 prescribed levels of service for the Transportation group.

Table D - 11: Roads O. Reg. 588/17 customer LoS.

Service Attributes	Qualitative Descriptions or Technical Metrics	Metric
Scope	Description, which may include maps, of the road network in the municipality and its level of connectivity.	Refer to Figure D - 9: City of Markham Road Network and Connectivity. The City of Markham's road network with a total 2,174 lane-kilometers is 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 D - 10: Pavement Condition Index of Arterial Roads, Figure D - 11: Pavement Condition Index of Major/Minor Roads, Figure D - 12: Pavement Condition Index of Local/Laneway Roads

Table D - 12: Roads O. Reg. 588/17 technical LoS.

Service Attributes	Qualitative Descriptions or Technical Metrics	Metric (By Asset)	Metric (By Replacement Value)
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 the municipality.	- Lanes and local roads: 1,376 km - Collector roads: 785 km - Arterial roads: 14 km - Total Area: 210.9 km²	- Lanes and local roads: \$3,966M - Collector roads: \$3,132M - Arterial roads: \$51.1M - Total Area: 210.9 km²
Quality	1. For paved roads in the municipality, the average pavement condition index value.	78	78
Quality	2. For unpaved roads in the municipality, the average surface condition (e.g. excellent, good, fair or poor).	The City of Markham does not have unpaved roads.	The City of Markham does not have unpaved roads.

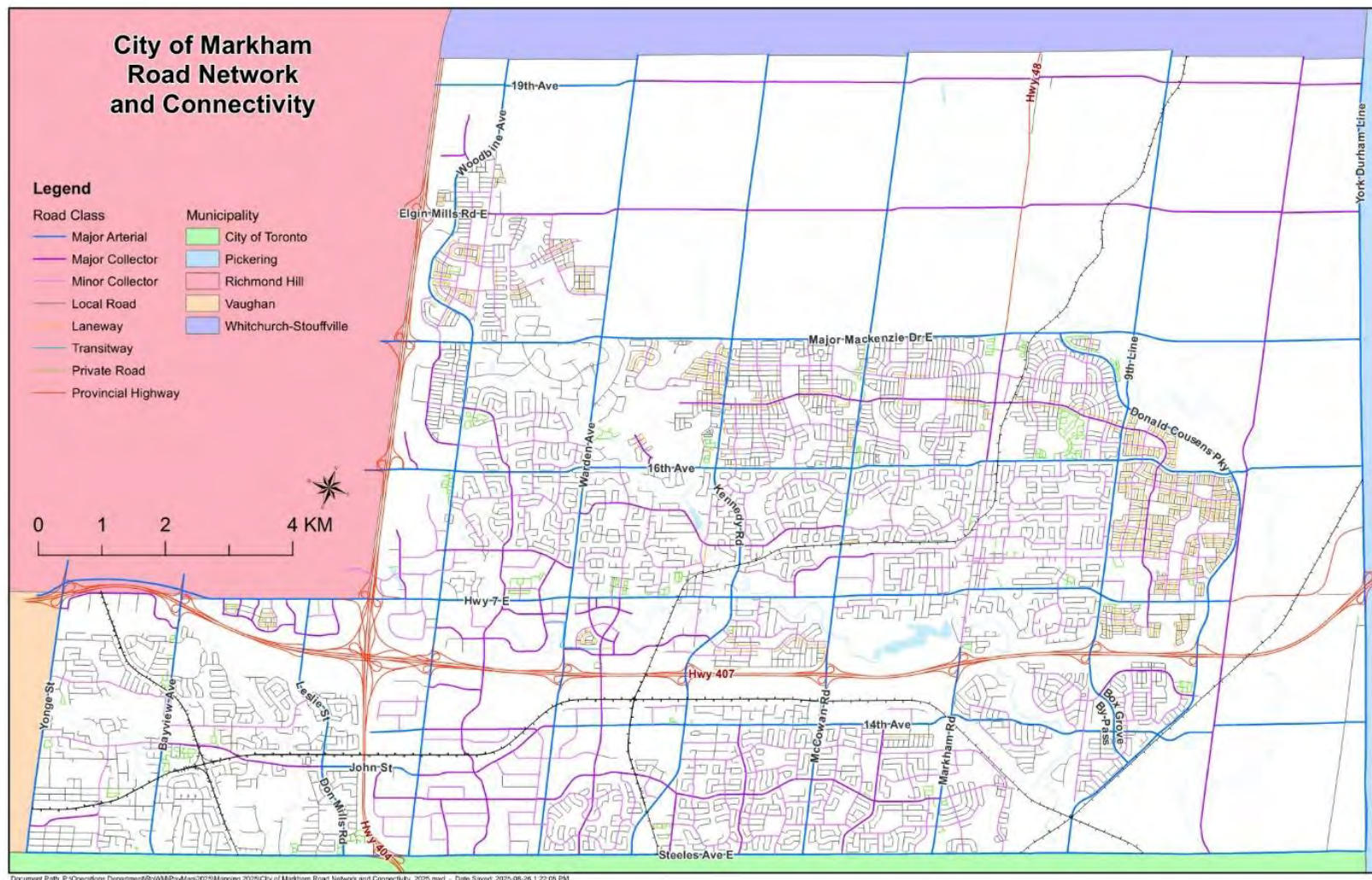


Figure D - 11: City of Markham road network and connectivity.

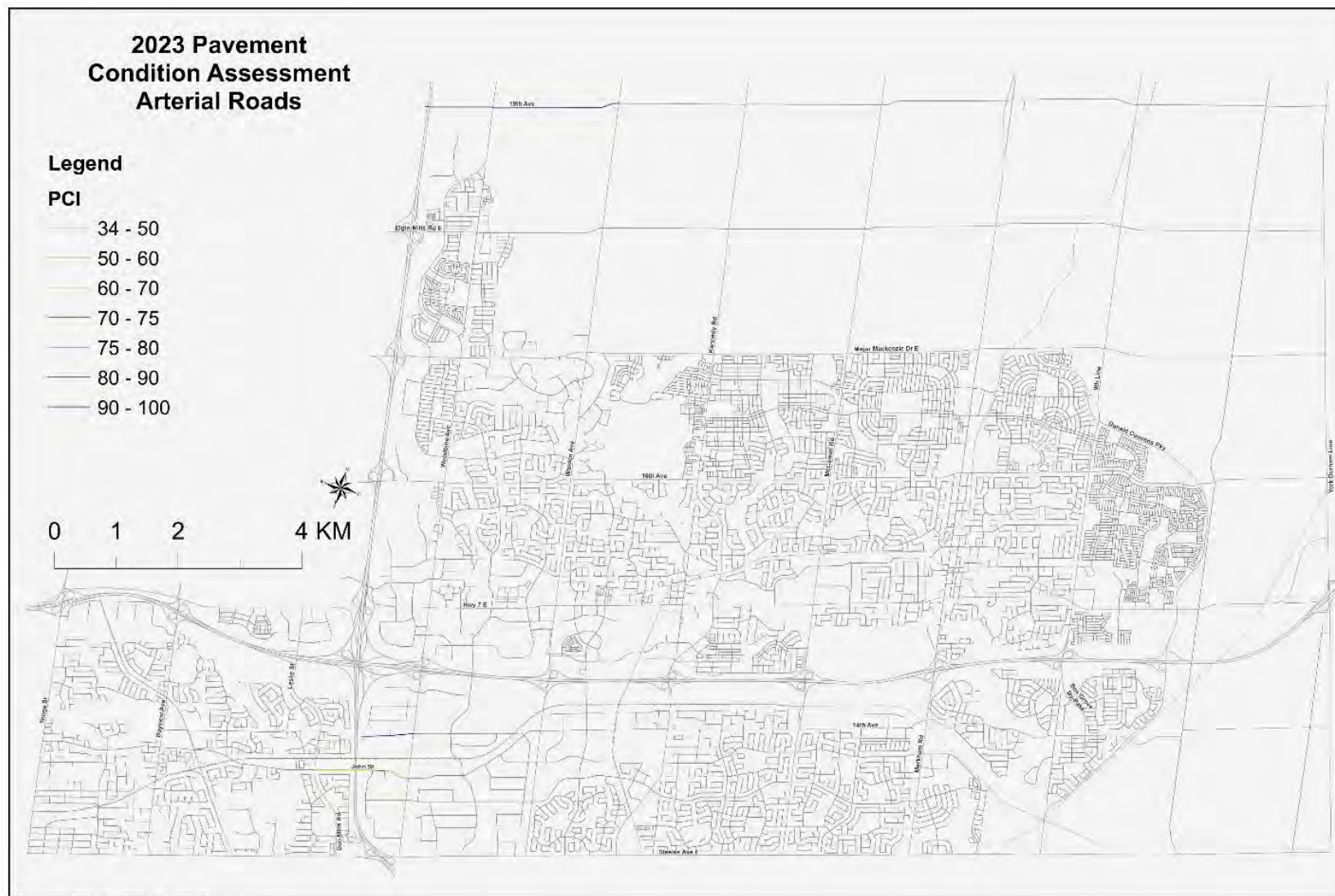


Figure D - 12: Pavement condition index of arterial roads.

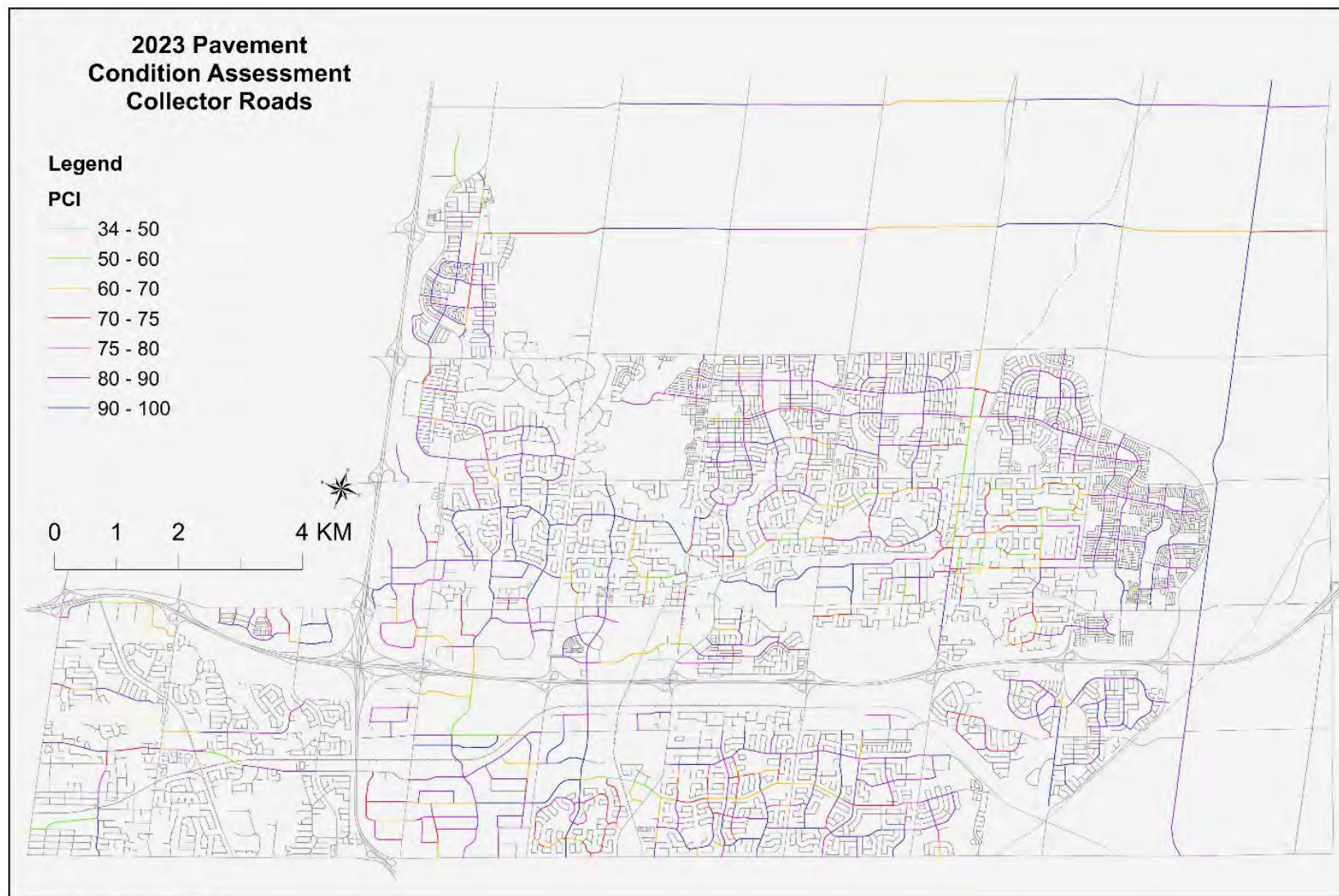


Figure D - 13: Pavement condition index of major/minor roads.

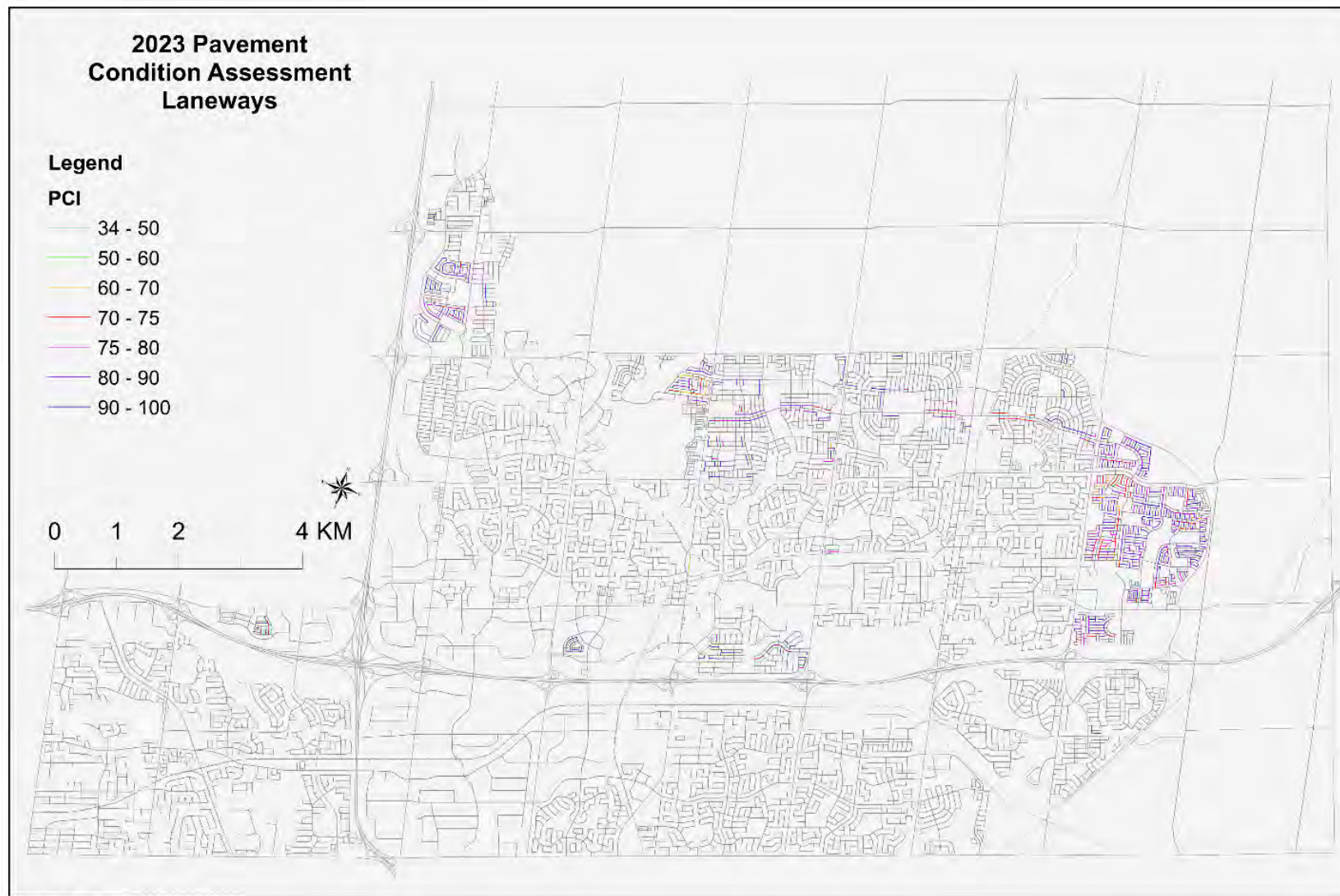


Figure D - 14: Pavement condition index of laneway roads.

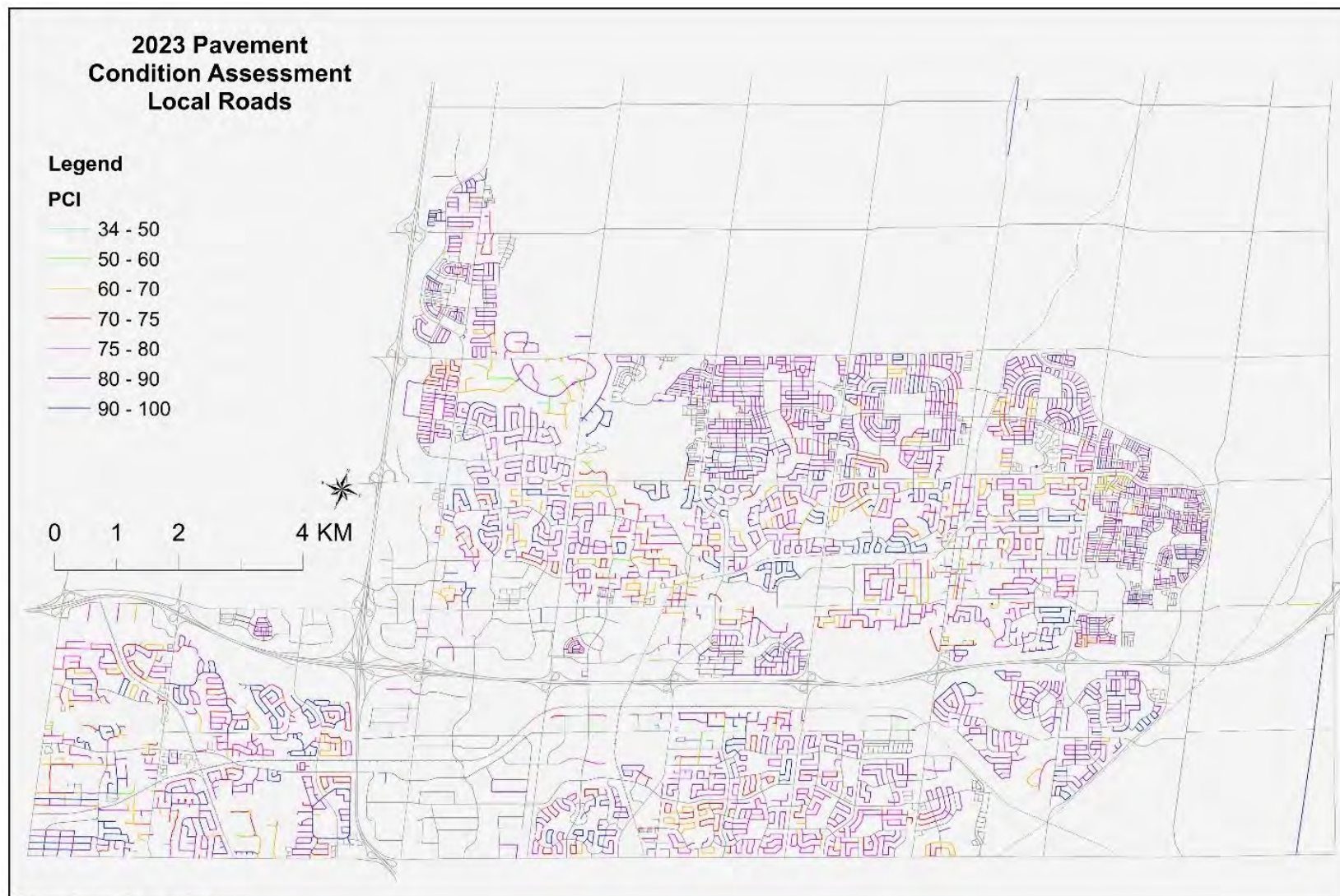


Figure D - 15: Pavement condition index of local roads.

Table D - 13: Bridges O. Reg. customer LoS.

Service Attributes	Community Levels of Service (qualitative descriptions)	Metric
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 D - 16 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.
Quality	2. Description or images of the condition of culverts and how this would affect use of the culverts.	Refer to Figure D - 16 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 D - 14: Bridges O. Reg. technical LoS.

Service Attributes	Technical levels of service (technical metrics)	By Structure	By Replacement Value	Proposed Performance
Scope	Percentage of bridges in the municipality with loading or dimensional restrictions.	0 (loading restrictions) 2 (dimensional restrictions)	0% (loading restrictions) 2% (dimensional restrictions)	Maintain

Service Attributes	Technical levels of service (technical metrics)	By Structure	By Replacement Value	Proposed Performance
Quality	1. For bridges in the municipality, the average bridge condition index value.	76	79	Maintain
Quality	2. For structural culverts in the municipality, the average bridge condition index value.	71	74	Maintain

	Vehicular Bridges	Culverts
Condition Ratings	Image of the condition of bridge and how this would affect use of bridges	Image of the condition of culvert and how this would affect use of culverts
Good Condition 1 BCI Ratings (70 – 100)	Bridge Condition Index (BCI) - 75 Good Condition 	Bridge Condition Index (BCI) - 81 Good Condition 
Fair Condition 2 BCI Ratings (60-70)	Bridge Condition Index (BCI) - 63 Hairline pattern and vertical cracks 	Bridge Condition Index (BCI) - 67 Light corrosion inside the barrel below the waterline 
Poor Condition 3 BCI Ratings (<60)	Bridge Condition Index (BCI) - 42 Severe deterioration of concrete girders and slab 	Bridge Condition Index (BCI) - 41 Heavy corrosion of the steel plate 

Figure D - 16: Images of condition of bridges and culverts.

D.1.3 Risk Management Strategy

The criteria used to determine the consequence of failure for Vehicular Transportation assets can be found in Table D - 15 below.

Table D - 15: COF criteria used for Vehicular Transportation assets.

Direct Financial	Socio-Economic	Environmental
Replacement cost	- Land Use and Zone Description - Road Class - Accessible Pedestrian Signal Assets (Traffic Management Assets)	N/A

Table D - 16 displays the for Vehicular Transportation assets with the proportion of assets within each risk score, likelihood of failure and consequence of failure.

Table D - 16: Risk score distribution of Vehicular Transportation assets.

	COF 1	COF 2	COF 3	COF 4	COF 5	Subtotal
LOF 1	\$35.7M (0.5%)	\$1.1B (14.4%)	\$1.2B (15.1%)	\$21.9M (0.3%)	None	\$2.3B (30.3%)
LOF 2	\$86.5M (1.1%)	\$579.4M (7.5%)	\$2.4B (31.6%)	\$160.1M (2.1%)	None	\$3.3B (42.3%)
LOF 3	\$50.1M (0.7%)	\$266.6M (3.5%)	\$1.2B (15.0%)	\$4.1M (0.1%)	None	\$1.5B (19.2%)
LOF 4	\$32.8M (0.4%)	\$122.4M (1.6%)	\$385.8M (5.0%)	\$1.6M ($<0.1\%$)	None	\$542.6M (7.1%)
LOF 5	\$8.8M (0.1%)	\$27.3M (0.4%)	\$47.7M (0.6%)	\$2.3M ($<0.1\%$)	None	\$86.1M (1.1%)
Subtotal	\$213.9M (2.8%)	\$2.1B (27.4%)	\$5.2B (67.4%)	\$190.1M (2.5%)	None	\$7.7B

Table D - 17: Risk score mapping legend.

Risk	Risk Score	Risk Description	Total Replacement Cost
Very Low	1 – 5	Fit for the Future	\$3,083,555,609 (40.2%)
Low	6 – 10	Adequate for Now	\$4,152,985,314 (54.1%)
Moderate	11 – 15	Requires Attention	\$437,689,499 (5.7%)
High	16 – 20	At Risk	\$3,954,817 (0.1%)
Very High	21 – 25	Unfit for Sustained Service	None

D.1.4 Lifecycle Management Activities

The City's lifecycle management activities for Vehicular Transportation assets are listed in Table D - 10. These activities include the acquisition of assets and service improvements, operations and maintenance, major asset renewals (including rehabilitations and replacements), and disposals.

These lifecycle management activities in conjunction with the lifecycle forecasting are used to determine the funding required for the City to continue performing these lifecycle activities to extend asset life, reduce overall costs, and minimize risk while providing the proposed service levels.

D.1.5 Lifecycle Forecasting

The following section outlines the funding required for the entire lifecycle of Vehicular Transportation assets. The expenditures were determined using the lifecycle activities outlined in Table D - 10 and the PLoS established.

Required funding was determined for PLoS using the following forecasting analysis parameters:

- Proposed LoS – Maintaining 70% of Roads in Good or Better Condition.**
 Where short and long term business planning, contributions to the City's life cycle reserve, annual budgets, and effective program delivery strategies, are based upon a minimum target of 70% of the City's road network be in a "good" or better state of performance, and subject to funding and resource availability, work towards an aspirational target of 75% of the City's road network be in a "good" or better state of performance.
- Proposed LoS – Maintaining Current Performance for all other Vehicular Transportation assets.** The City has established this LoS as the PLoS for active transportation assets. It focuses on maintaining the percentage of assets in backlog in a similar state. Backlog is defined as assets that are in need of renewal work (either significant rehabilitation or replacement). For example, if 20% of assets are past their service life, or are in need of renewal work, then the forecast model will determine the funding required to maintain 20% of assets in this state over the forecast period.

The following table summarizes the anticipated funding from the City's Life Cycle Reserve Study for renewal activities for Vehicular Transportation assets. A total of **\$389.5M** over the next 26 years (or an equivalent average annual of **\$15.0M**) for renewals is anticipated to be spent.

Table D - 18: Forecasted capital renewal expenditures (Life Cycle Reserve Study) for Vehicular Transportation assets.

Year	Capital Expenditures (Renewals)
2026	\$31,322,987
2027	\$16,165,068
2028	\$12,592,379
2029	\$11,199,527
2030	\$18,287,138
2031	\$10,551,498
2032	\$16,483,609
2033	\$22,356,115
2034	\$16,422,625
2035	\$22,693,535
2036	\$16,303,973
2037	\$10,372,407
2038	\$20,354,184
2039	\$9,067,577
2040	\$19,372,506
2041	\$9,225,932
2042	\$15,860,477
2043	\$11,969,404
2044	\$14,218,511
2045	\$17,924,942
2046	\$14,162,157
2047	\$8,111,258
2048	\$17,640,280
2049	\$7,616,596
2050	\$12,044,083
2051	\$7,153,397
Total	\$389,472,164
Equivalent Average Annual	\$14,979,699

Figure D - 17 and Figure D - 18 illustrate the performance and financial forecasts to maintain 70% of roads in good or better condition. The forecast analysis identified a total of **\$345.0M** (or an equivalent average annual of **\$13.3M**) that is anticipated to be spent to maintain 70% of roads in good or better condition over the next 26 years. This represents funding gap of **\$161.7M** over the planning horizon, or an equivalent average annual amount of **\$6.2M**. The PCI threshold for good or better condition has been determined based on road class as follows:

Table D - 19: Road PCI thresholds.

Road Class	PCI Score (Good or Better Condition)
Laneways	PCI $\geq$ 70
Local Roads	PCI $\geq$ 70
Collector Roads	PCI $\geq$ 75
Arterial Roads	PCI $\geq$ 80

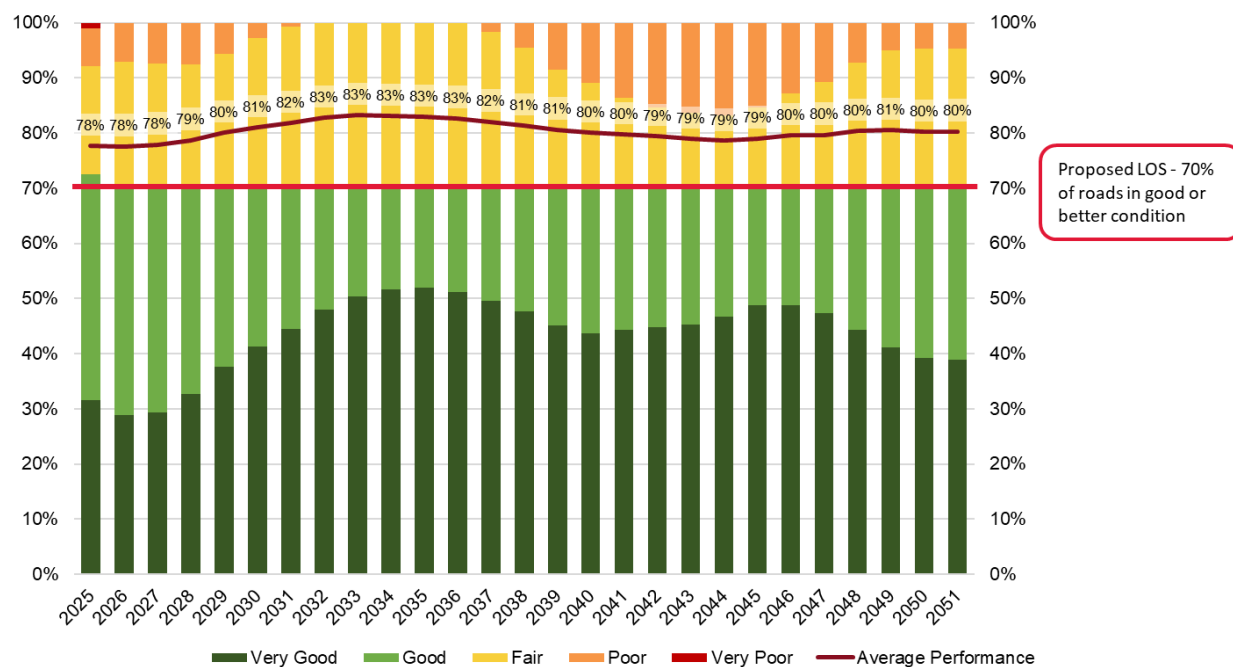


Figure D - 17: Maintain 70% of roads in good or better condition performance distribution.

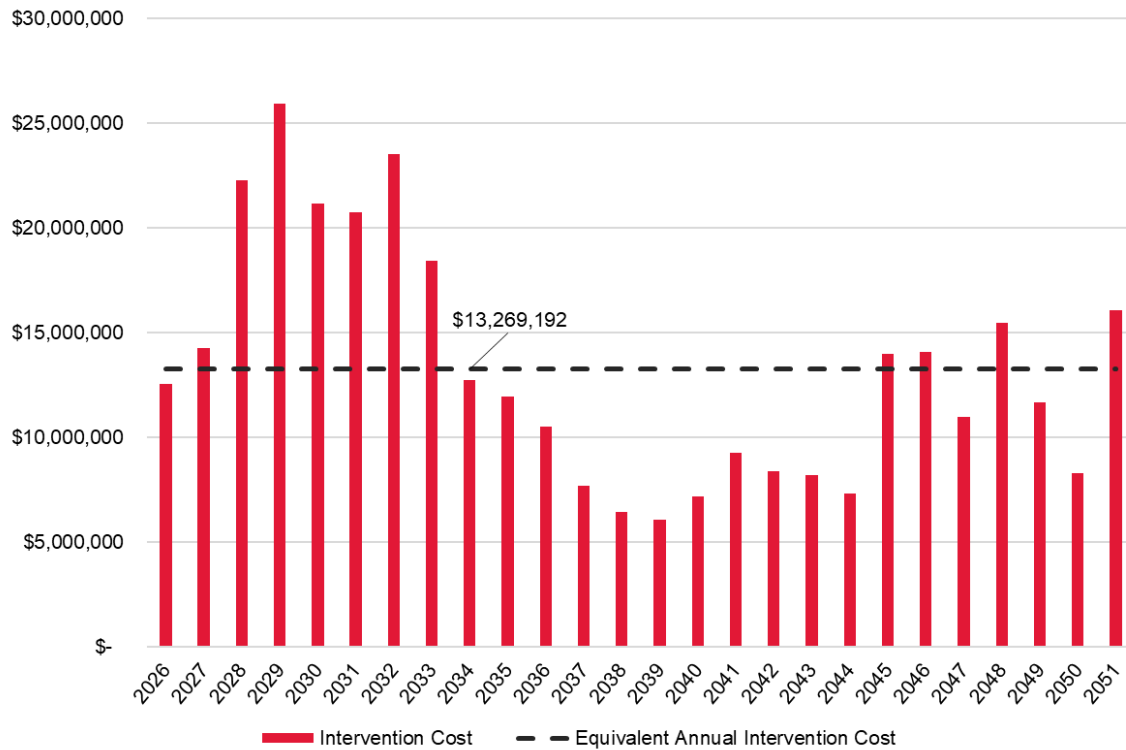


Figure D - 18: Maintain 70% of roads in good or better condition intervention costs.

Figure D - 19 and Figure D - 20 illustrate the performance and financial forecasts to achieve PLoS for all Vehicular Transportation assets. The forecast analysis identified a total of **\$498.4M** (or an equivalent average annual of **\$19.2M**) that is anticipated to be spent over the next 26 years to maintain current performance. This represents funding gap of **\$108.9M** over the planning horizon, or an equivalent average annual amount of **\$4.2M** average annual spending identified attempts to maintain this percentage over the next 26 years. Note that there is a significant expenditure forecasted in 2031, which represents a significant amount of asset renewal needs that are forecasted to occur in or near that timeframe.

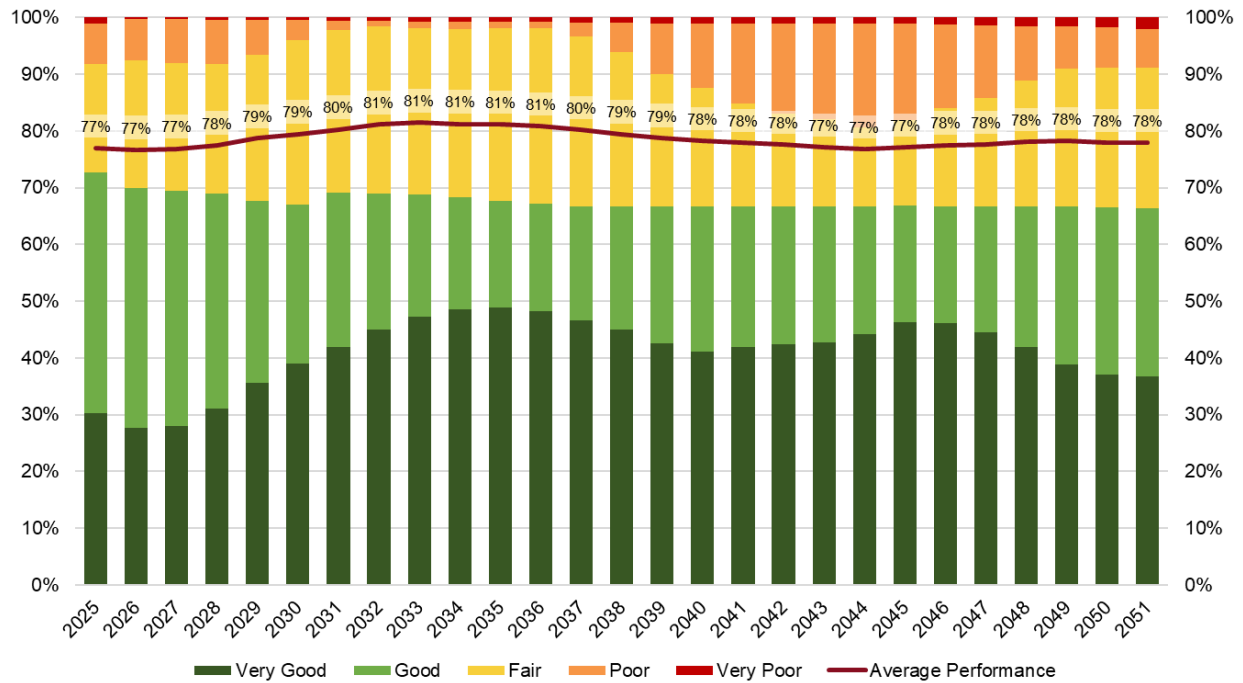


Figure D - 19: Performance distribution – maintain current performance for Vehicular Transportation assets (including roads).

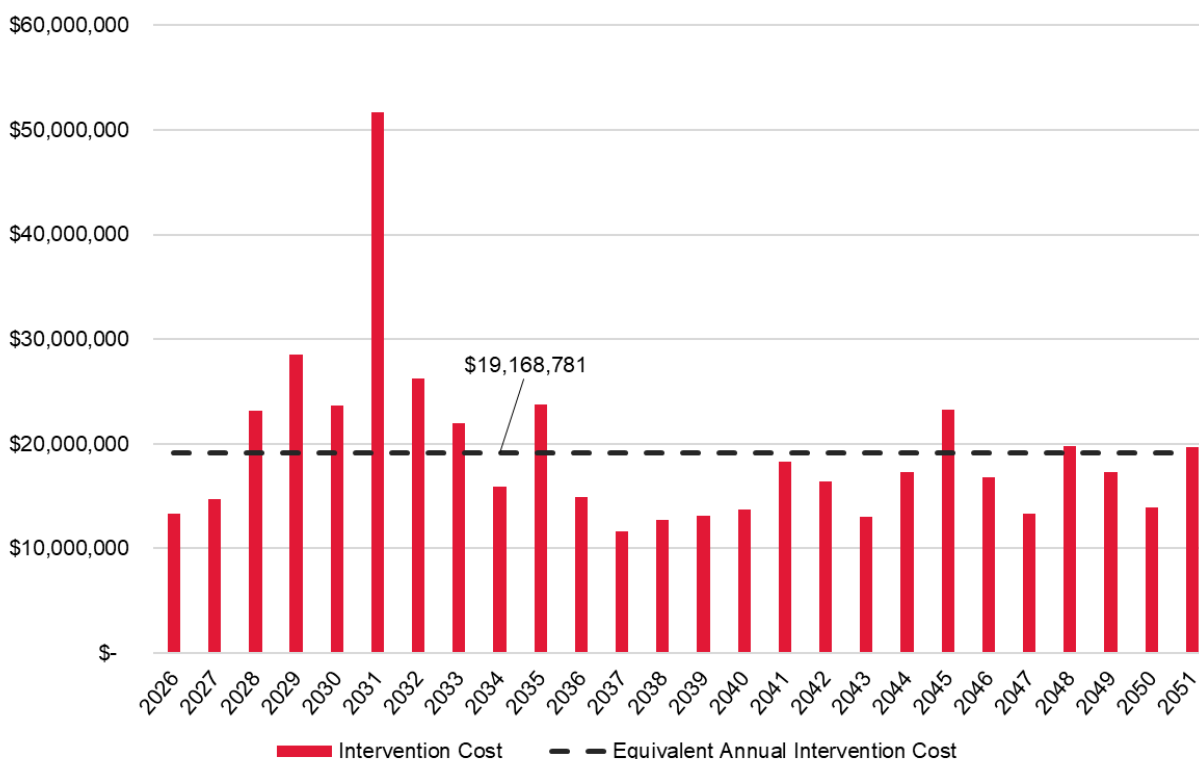


Figure D - 20: Maintain current performance intervention costs for Vehicular Transportation assets.

D.2 Active Transportation

D.2.1 State of the Infrastructure

Figure D - 21 shows the replacement value of Active Transportation assets while Figure D - 22 illustrates the replacement value of Active Transportation assets by asset class. The total replacement value for Active Transportation assets is \$224.8M.

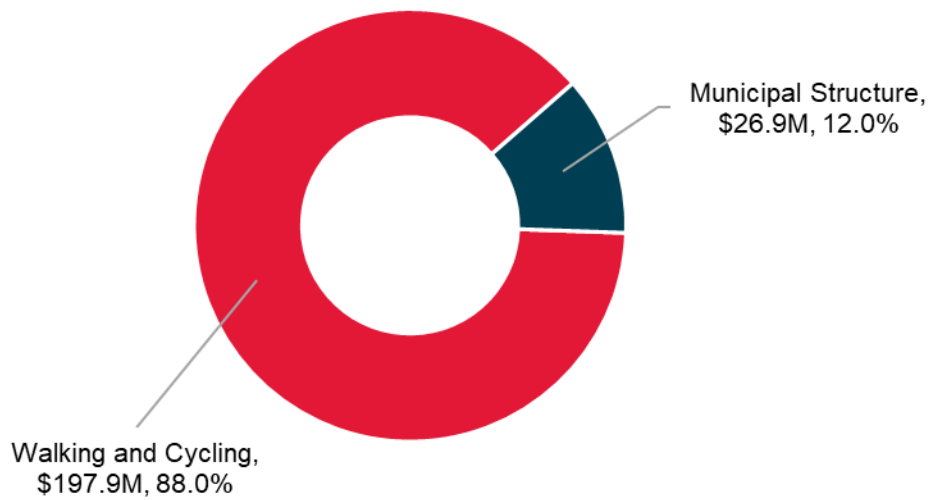


Figure D - 21: Replacement value distribution of Active Transportation assets.

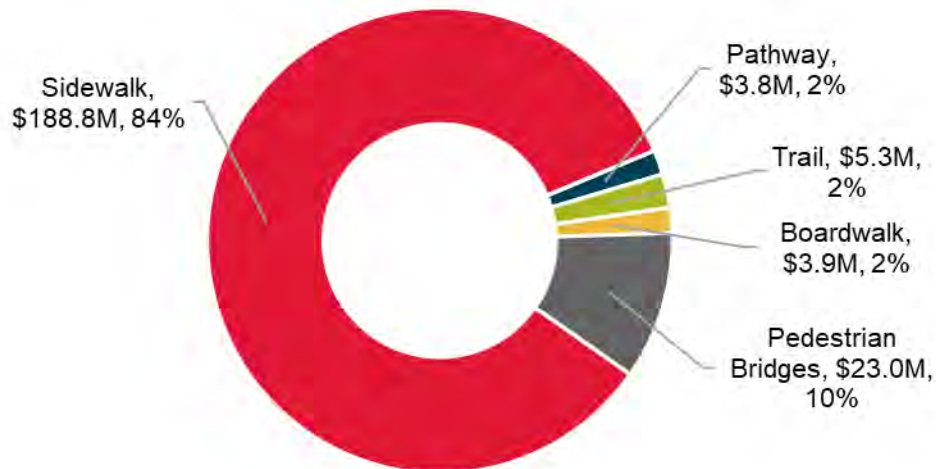


Figure D - 22: Replacement value of Active Transportation assets by asset class.

D.2.1.1 Asset Inventory and Valuation

Table D - 20 below summarizes the asset valuation, quantities, and performance for each asset category of Active Transportation assets.

Table D - 20: Inventory and valuation for Active Transportation assets.

Asset Category	Asset Class	Replacement Cost	Inventory	Average Condition
Municipal Structure	Boardwalk	\$3,893,914	20 Assets	Good
Municipal Structure	Pedestrian Bridges	\$23,034,164	84 Assets	Good
Walking and Cycling	Pathway	\$3,833,608	19,018 m	Very Poor
Walking and Cycling	Sidewalk	\$188,758,324	936,394 m	Fair
Walking and Cycling	Trail	\$5,264,118	26,114 m	Good
Total	-	\$224,784,129	-	-

D.2.1.2 Age and Estimated Service Life

Figure D - 23 illustrates the age of Active Transportation assets as a proportion of their estimated service life. Figure D - 24 illustrates the value of Active Transportation assets acquired by decade. Pathways are the only asset group with an average age past the average ESL.

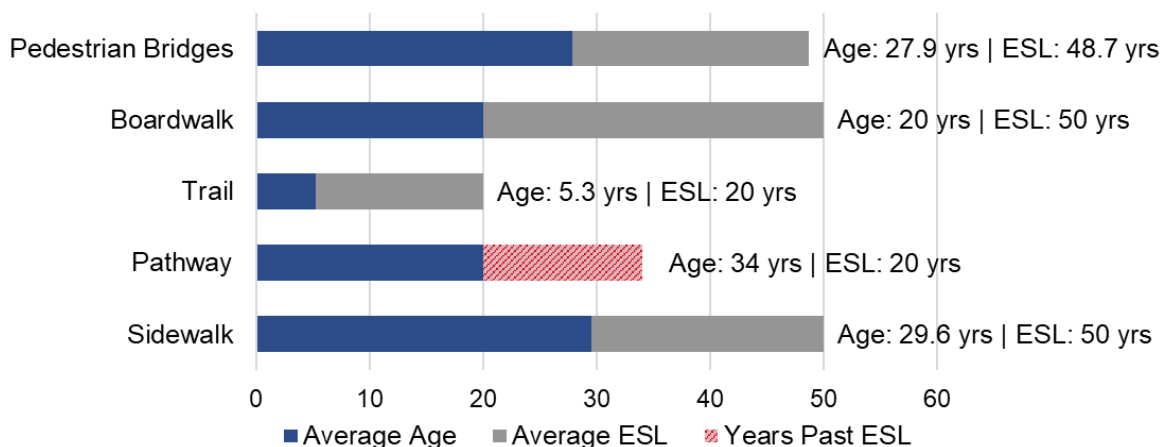


Figure D - 23: Age as a proportion of estimated service life (ESL) of Active Transportation assets.

The installation profile of transportation assets illustrates that the majority of sidewalks were installed from the 1970s to 2000s, in line with decades that experienced significant growth and corresponding development in the City.

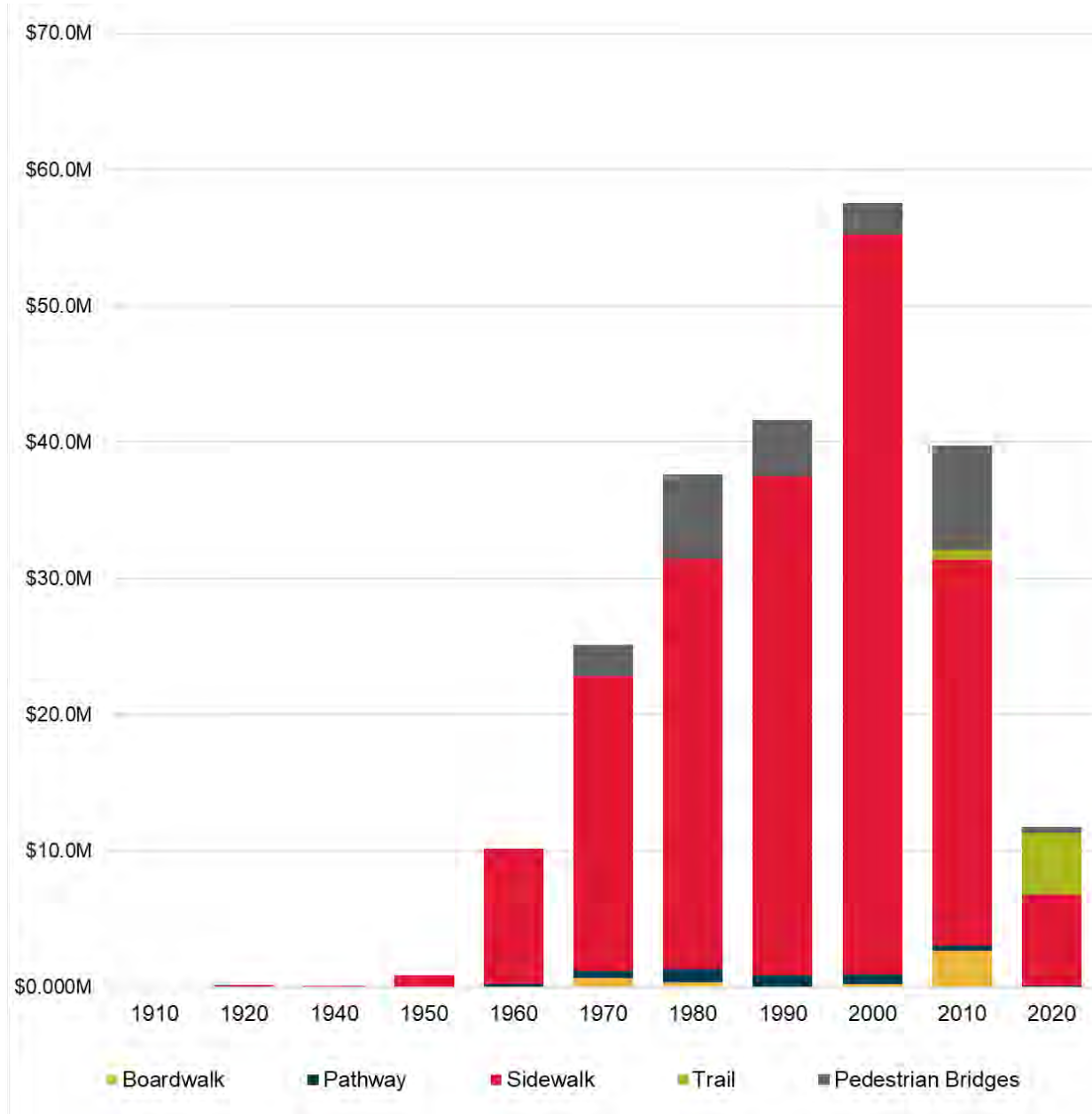


Figure D - 24: Age distribution by installation decade of Active Transportation assets.

D.2.1.3 Asset Performance

Table D - 21 details the approaches that the City utilizes to understand the performance of Active Transportation assets.

Table D - 21: Performance assessment approaches to Active Transportation assets.

Asset Class	Condition Rating Metric	Approach to Assessing Condition
Sidewalks, Trails, and Pathways	Age/ESL	The City understand the condition of these assets based on asset age and estimated service life.
Pedestrian Bridges and Boardwalks	BCI	OSIM inspections and BCI recorded into the City's database per MTO standards. BCI is used to understand asset condition.

Figure D - 25 illustrates the performance distribution of the Active Transportation services asset portfolio, while Figure D - 26 shows the performance distribution of Active Transportation assets by asset class. Table D - 22 summarizes the relationship between the performance categories and how performance ratings are determined.

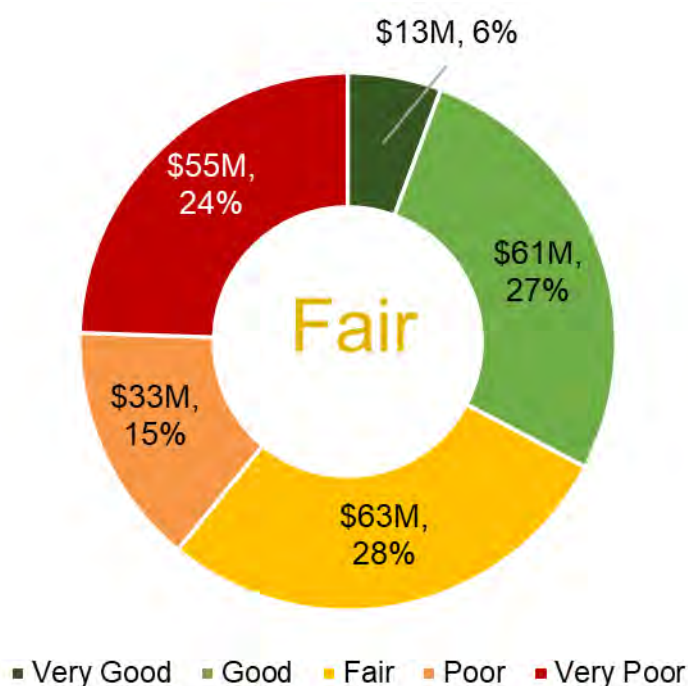


Figure D - 25: Condition distribution of Active Transportation assets.

Table D - 22: Performance rating of Active Transportation assets.

Condition Category	Age/ESL	Bridge Condition Index (BCI)
Very Good	0% - 20%	100% - 85%
Good	20% - 40%	85% - 70%
Fair	40% - 60%	70% - 60%
Poor	60% - 80%	60% - 50%
Very Poor	>80%	50% - 0%

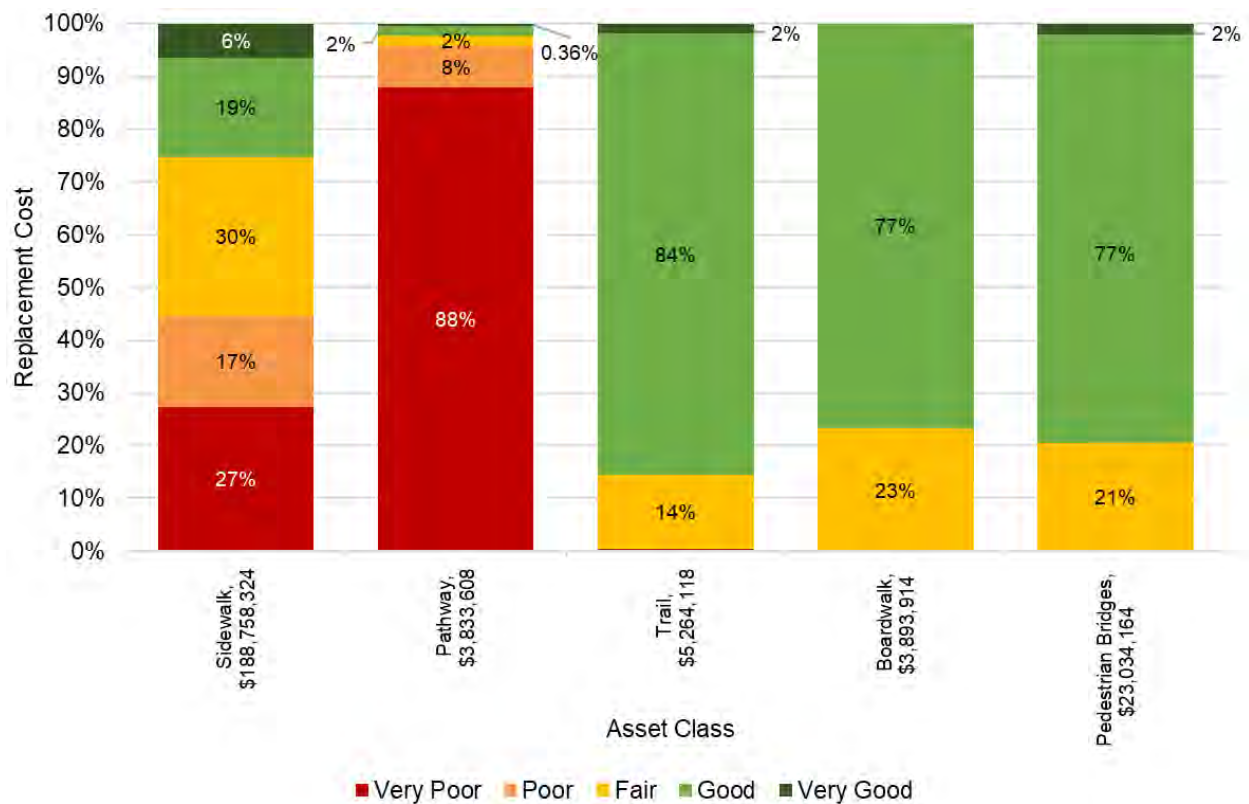


Figure D - 26: Condition distribution of Active Transportation assets by asset class.

D.2.2 Levels of Service

Customer values, customer levels of service and technical levels of service for Active Transportation assets can be found in Table D - 23 to Table D - 28.

D.2.2.1 Customer Values

Table D - 23: Transportation customer values.

Customer Satisfaction Measure		Current Feedback & Expected Trend Based on Planned Budget
Transportation services assets are safe and reliable to use		
Assets are maintained in a state of good repair, are adequate for use, and in overall good working condition.		Future Iterations ¹⁸
Assets can support all types of traffic.		Future Iterations ¹⁸
Traffic controls have been installed to increase commuter safety, reduce injury and overall number of incidents.		Future Iterations ¹⁸
Transportation services assets are convenient to use		
The quality of assets does not negatively affect the travelling experience		Future Iterations ¹⁸
Transportation services assets are accessible and easy to access.		Future Iterations ¹⁸
Aesthetic Quality		
Transportation services assets meet aesthetic expectations.		Future Iterations ¹⁸
Environmentally sustainable		
Environmental impacts are minimized.		Future Iterations ¹⁸

¹⁸ The City is currently reviewing the data that supports this metric, which will be reported in future iterations of the City's AMP.

D.2.2.2 Customer and Technical Levels of Service

Table D - 24: Municipal structures (boardwalks) customer LoS.

Type of Measure	Level of Service	Performance Measure	Current Performance	Confidence Levels
Condition	Condition of Boardwalks	Bridge Condition Index (BCI) - Aggregated into 5-point rating scale	73	High – condition assessments are performed to determine BCI scores
Condition	Individual element/element group condition.	Percentage of all elements/element groups in very poor to poor condition	0%	High – condition assessments are performed to determine BCI scores
Function	Measure of whether the service is appropriate for its intended use	Future Iterations ¹⁹	Future Iterations ¹⁹	Future Iterations ¹⁹
Capacity	Measure of whether the service is adequate to meet traffic needs	Future Iterations ¹⁹	Future Iterations ¹⁹	Future Iterations ¹⁹
Accessibility	Service interruptions	Future Iterations ¹⁹	Future Iterations ¹⁹	Future Iterations ¹⁹

¹⁹ The City is currently reviewing and selecting measures for this category, which will be developed and integrated into future iterations of the City's AMP.

Table D - 25: Municipal structures (pedestrian bridges) customer LoS.

Type of Measure	Level of Service	Performance Measure	Current Performance	Confidence Levels
Condition	Condition of Pedestrian Bridges	Bridge Condition Index (BCI) - Aggregated into 5-point rating scale	73	High – condition assessments are performed to determine BCI scores
Condition	Individual element/element group condition.	Percentage of all elements/element groups in poor and very poor condition	0%	High – condition assessments are performed to determine BCI scores
Function	Measure of whether the service is appropriate for its intended use	Future Iterations ¹⁹	Future Iterations ¹⁹	Future Iterations ¹⁹
Capacity	Measure of whether the service is adequate to meet traffic needs	Future Iterations ¹⁹	Future Iterations ¹⁹	Future Iterations ¹⁹
Accessibility	Service interruptions	Future Iterations ¹⁹	Future Iterations ¹⁹	Future Iterations ¹⁹

Table D - 26: Walking and cycling (sidewalks) customer LoS.

Type of Measure	Level of Service	Performance Measure	Current Performance	Confidence Levels
Condition	Condition of Sidewalks	Condition - Aggregated into 5-point rating scales	Fair	Confidence Levels: Low – age and remaining service life are used to determine condition in place of condition data
Condition	Individual element/element group condition.	Percentage of all elements/element groups in very poor to poor condition	45%	Confidence Levels: Low – age and remaining service life are used to determine condition in place of condition data
Function	Measure of whether the service is appropriate for its intended use	Future Iterations ¹⁹	Future Iterations ¹⁹	Future Iterations ¹⁹
Capacity	Measure of whether the service is adequate to meet traffic needs	Future Iterations ¹⁹	Future Iterations ¹⁹	Future Iterations ¹⁹
Accessibility	Service interruptions	Future Iterations ¹⁹	Future Iterations ¹⁹	Future Iterations ¹⁹

Table D - 27: Walking and cycling (trails and pathways) customer LoS.

Type of Measure	Level of Service	Performance Measure	Current Performance	Confidence Levels
Condition	Condition of Trails	Condition - Aggregated into 5-point rating scales	Fair	Confidence Levels: Low – age and remaining service life are used to determine condition in place of condition data
Condition	Condition of Pathways	See above	See above	See above
Condition	Individual element/element group condition.	Percentage of all elements/element groups in very poor to poor condition	41%	Confidence Levels: Low – age and remaining service life are used to determine condition in place of condition data
Function	Measure of whether the service is appropriate for its intended use	Future Iterations ¹⁹	Future Iterations ¹⁹	Future Iterations ¹⁹
Capacity	Measure of whether the service is adequate to meet traffic needs	Future Iterations ¹⁹	Future Iterations ¹⁹	Future Iterations ¹⁹
Accessibility	Service interruptions	Future Iterations ¹⁹	Future Iterations ¹⁹	Future Iterations ¹⁹

Table D - 28: Active Transportation technical LoS.

Lifecycle Activity	Purpose of Activity	Frequency	Current Performance (\$, 2025 Budget)	Recommended Performance
Acquisition	Growth Expansion Development	Projects developed in transportation master plans and DC study	\$649,700	Growth Planning Horizon: 2026-2051 Total Acquisition Value Range: \$157.4M - \$208.1M City Funded Acquisition Value Range: \$116.9M - \$140.4M
Operation	Inspections	Annual programs	\$28,000 The City's 2025 operating budget for all services was \$495.8M.	Maintain current performance for assets in service. Anticipated operating budget increase ranges from \$4.2M to \$5.5M over the growth planning horizon: 2026-2051.
Operation	Regular Operations	As required	See above	See above
Maintenance	Minor repairs	As needed	\$27,900	Maintain current performance for assets in service. Anticipated maintenance budget increases are included in the operating or renewal budget forecasts.
Maintenance	Regular Maintenance	Annual programs	See above	See above

Lifecycle Activity	Purpose of Activity	Frequency	Current Performance (\$, 2025 Budget)	Recommended Performance
Maintenance	Major maintenance (holding strategies)	As needed	See above	See above
Renewal	Major rehabilitation or replacement	As needed	\$2,281,600 (City's LCRS)	PLoS Maintain Current Performance requires \$4.51M or \$2.23M per year on average of additional funds from 2026 to 2051.
Disposal	Disposal of replaced assets	As required	Included in renewal costs	Maintain current performance for assets in service.
Service Improvement	Upgrades to improve LoS to benefit existing serviced areas	As required	\$186,000	Maintain Current Performance

D.2.3 Risk Management Strategy

The criteria used to determine the consequence of failure for Active Transportation assets can be found in Table D - 29 below.

Table D - 29: COF criteria used for Active Transportation assets.

Direct Financial	Socio-Economic	Environmental
Replacement cost	- Asset Type - Land Use (Multiuse Paths and Pathways) - Associated Facility Type (Trails) - Road Class (Sidewalks)	N/A

Table D - 30 displays the risk score for Active Transportation assets with the proportion of assets within each risk score, likelihood of failure and consequence of failure.

Table D - 30: Risk score distribution of Active Transportation assets.

	COF 1	COF 2	COF 3	COF 4	COF 5	Subtotal
LOF 1	\$7.9M (3.5%)	\$4.3M (1.9%)	\$468.6K (0.2%)	None	None	\$12.7M (5.6%)
LOF 2	\$25.3M (11.2%)	\$14.8M (6.6%)	\$20.8M (9.2%)	None	None	\$60.9M (27.1%)
LOF 3	\$42.0M (18.7%)	\$15.7M (7.0%)	\$5.6M (2.5%)	None	None	\$63.4M (28.2%)
LOF 4	\$21.6M (9.6%)	\$11.3M (5.0%)	None	None	None	\$32.8M (14.6%)
LOF 5	\$30.1M (13.4%)	\$25.0M (11.1%)	None	None	None	\$55.0M (24.5%)
Subtotal	\$126.9M (56.4%)	\$71.1M (31.6%)	\$26.9M (12.0%)	None	None	\$224.8

Table D - 31: Risk score mapping legend.

Risk	Risk Score	Risk Description	Total Replacement Cost
Very Low	1 – 5	Fit for the Future	\$146,493,030 (65.2%)
Low	6 – 10	Adequate for Now	\$78,291,099 (34.8%)
Moderate	11 – 15	Requires Attention	None
High	16 – 20	At Risk	None
Very High	21 – 25	Unfit for Sustained Service	None

D.2.4 Lifecycle Management Activities

The City's lifecycle management activities for Active Transportation assets are listed in Table D - 28. These activities include the acquisition of assets and service improvements, operations and maintenance, major asset renewals (including rehabilitations and replacements), and disposals.

These lifecycle management activities in conjunction with the lifecycle forecasting are used to determine the funding required for the City to continue performing these lifecycle activities to extend asset life, reduce overall costs, and minimize risk while providing the proposed service levels.

D.2.5 Lifecycle Forecasting

The following section outlines the funding required for the entire lifecycle of Active Transportation assets. The expenditures were determined using the lifecycle activities outlined in Table D - 28 and the LoS established. Required funding for PLoS was determined using the following parameter:

- Proposed LoS – Maintain Current Performance:** funding required to maintain a similar asset performance over a 26-year period. The City has established this LoS as the proposed LoS for Active Transportation assets. It focuses on maintaining the percentage of assets in backlog in a similar state. Backlog is defined as assets that are in need of renewal work (either significant rehabilitation or replacement). For example, if 20% of assets are past their service life, or are in need of renewal work, then the forecast model will determine the funding to maintain 20% of assets in this state over the forecast period.

The following table summarizes the anticipated funding from the LCRS for renewal activities for Active Transportation assets. A total of **\$23.5M** over the next 26 years (an equivalent average annual of **\$902.7k**) for renewals is anticipated to be spent.

Table D - 32: Forecasted capital renewal expenditures (Life Cycle Reserve Study) Active Transportation assets.

Year	Capital Expenditures (Renewals)
2026	\$1,428,804
2027	\$1,760,201
2028	\$603,431
2029	\$510,502
2030	\$4,555,680
2031	\$897,242
2032	\$417,902

Year	Capital Expenditures (Renewals)
2033	\$1,007,228
2034	\$339,034
2035	\$1,686,405
2036	\$261,235
2037	\$865,621
2038	\$373,755
2039	\$187,879
2040	\$561,611
2041	\$325,257
2042	\$300,175
2043	\$232,759
2044	\$2,387,258
2045	\$1,298,990
2046	\$539,861
2047	\$798,148
2048	\$1,061,411
2049	\$214,331
2050	\$736,600
2051	\$120,051
Total	\$23,471,371
Equivalent Average Annual	\$902,745

Figure D - 27 and Figure D - 28 illustrate the performance and financial forecasts to achieve PLoS for all Active Transportation assets. The forecast analysis identified a total of **\$117.2M** (or an equivalent average annual of **\$4.5M**) that is anticipated to be spent over the next 26 years to maintain current performance. This represents funding gap of **\$93.8M** over the planning horizon, or an equivalent average annual amount of **\$3.6M**.

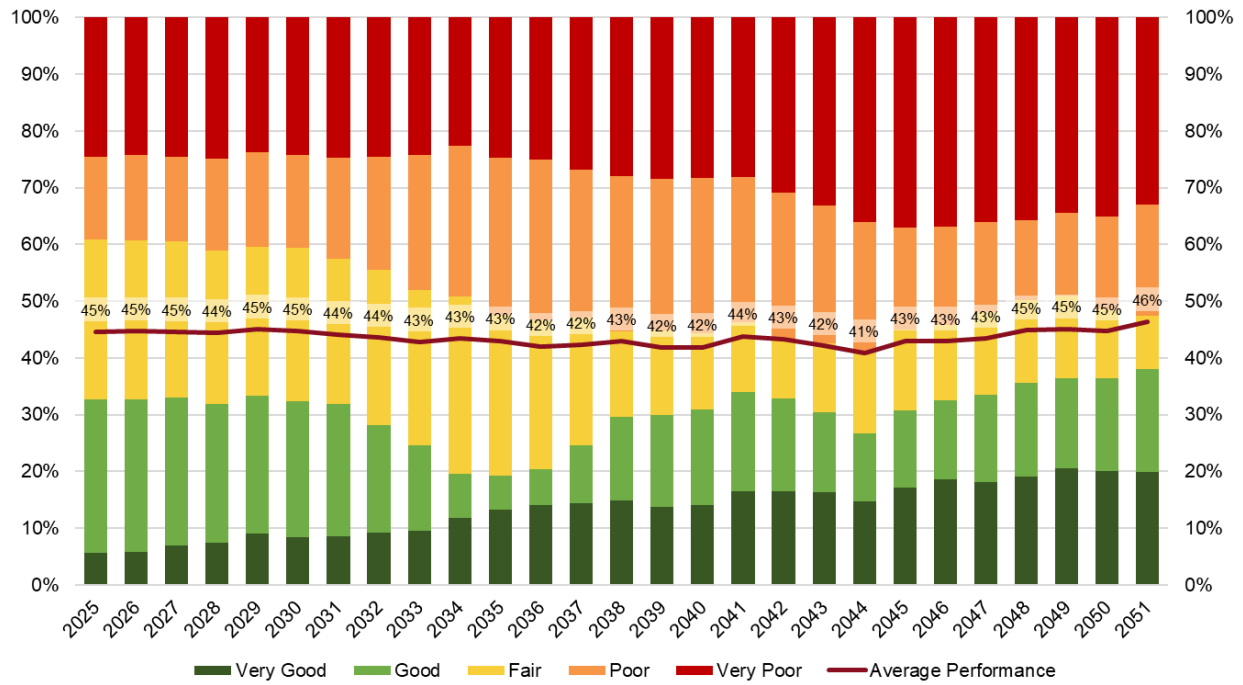


Figure D - 27: Performance distribution – maintain current performance for Active Transportation assets.

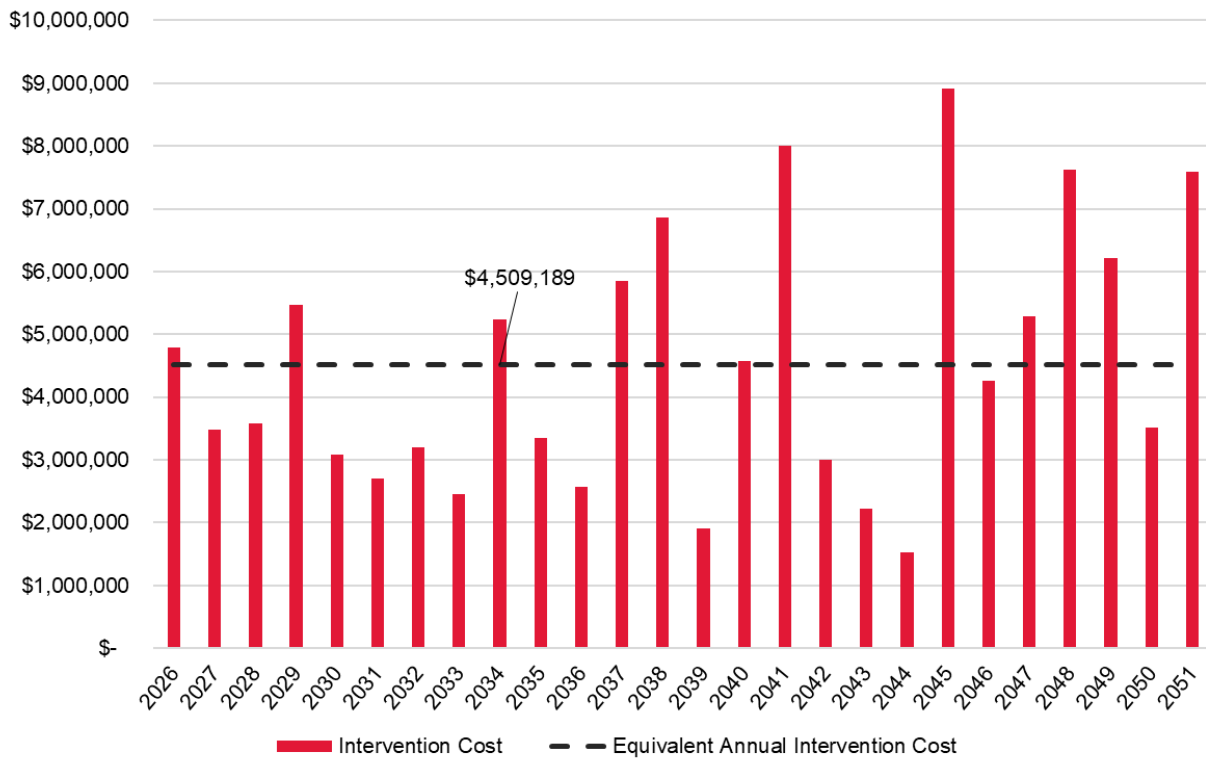


Figure D - 28: Maintain current performance intervention costs for Active Transportation assets.

D.3 Proposed Levels of Service Themes & Future Challenges

The customer values and customer LoS were discussed with stakeholders. The following summarizes the feedback from the stakeholders related to service delivery, customer expectations, and challenges faced by the City, particularly challenges that may be encountered in the future:

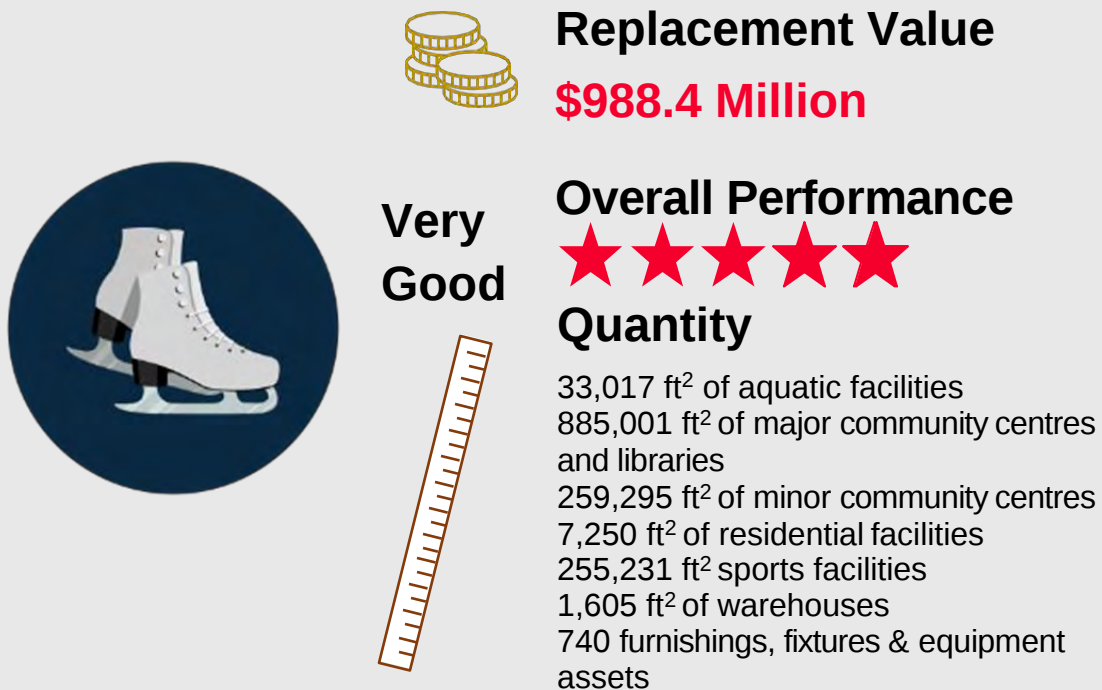
Table D - 33: Proposed LoS themes for Transportation assets

Challenge	Discussion
Customer Expectations	• Roads need to be safe and reliable. • Customers expect the City to keep traffic signals functioning. • Aesthetic quality should be considered.
Traffic and Accessibility	• Promote the use of public transportation and other modes of travel where road widening isn't a viable option.
Technology	• The City is exploring emerging technologies being used for road operations.

The insight from this discussion will be considered and incorporated into the City's AM processes and future iterations of the AMP. As the City continues to grow, it is important that current and future challenges are addressed in order to maintain service levels and achieve proposed service levels.

Appendix E.Recreation

Service Summary



The City's Recreation services contain assets that provide affordable, accessible, safe and reliable community recreation and library programs for the residents of Markham. By doing so, the City promotes healthy and active lifestyles to citizens.

The City is responsible for assets such as various facilities, furnishings, fixtures and equipment, as detailed in Figure E - 1.



Figure E - 1: Recreation asset hierarchy

More information on recreation such as state of infrastructure, levels of service, risk management strategies and lifecycle management strategies and forecasting can be found in the following sections.

E.1 State of the Infrastructure

Figure E - 2 illustrates the replacement value distribution of the recreation service asset portfolio, while Figure E - 3 shows the replacement value distribution of recreation facilities and Figure E - 4 captures the replacement value of recreation equipment, furnishings and fixtures.

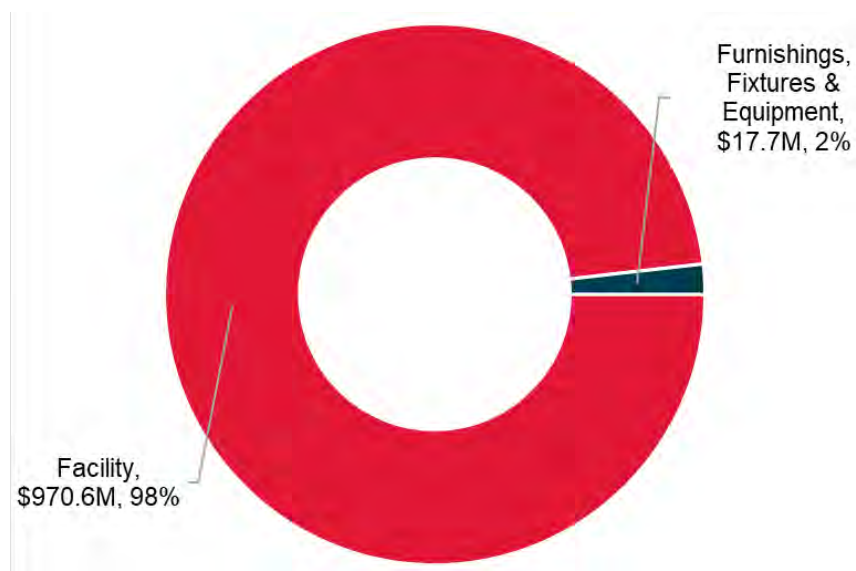


Figure E - 2: Replacement value distribution of Recreation assets.

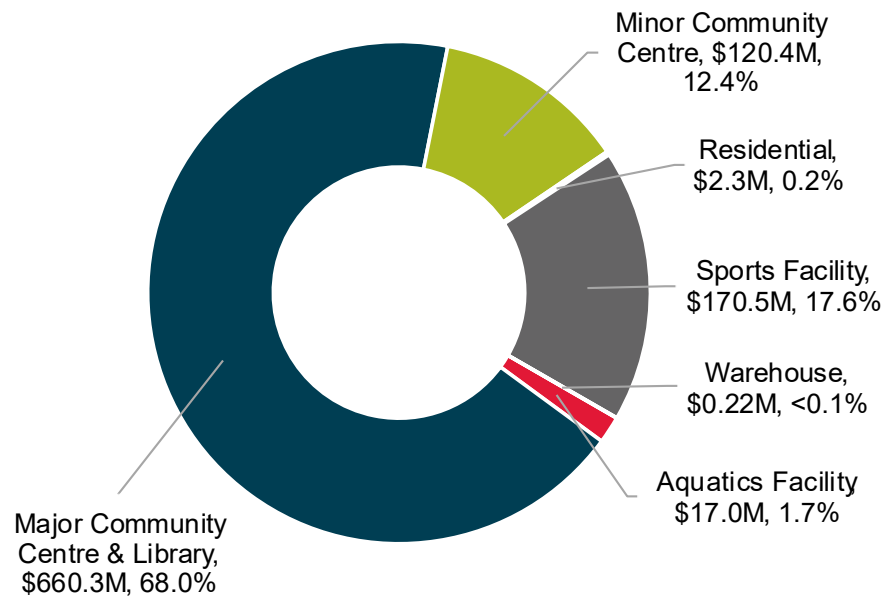


Figure E - 3: Replacement value distribution of Recreation assets by asset class (facilities).

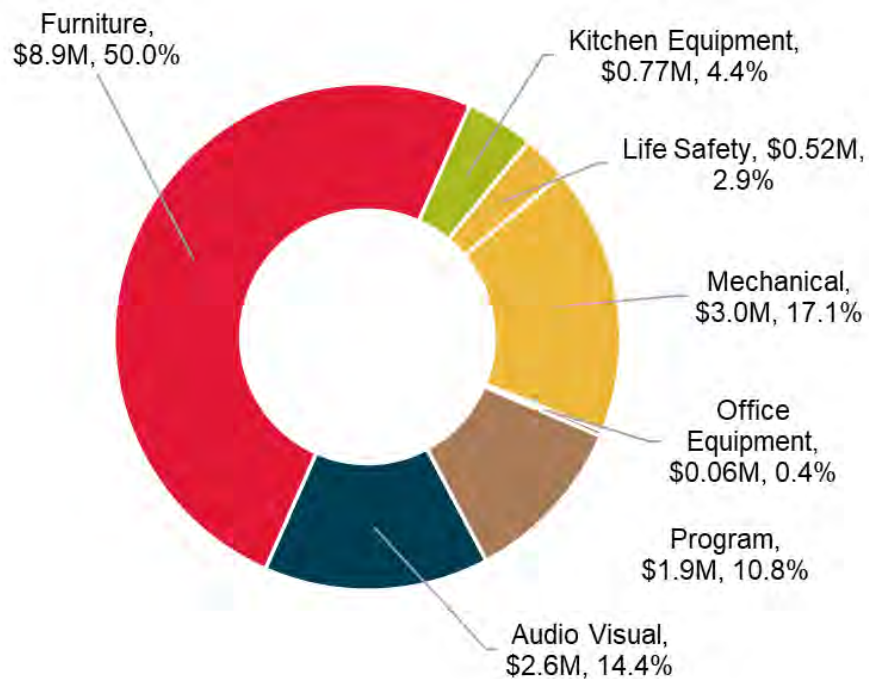


Figure E - 4: Replacement value distribution of Recreation assets by asset class (furnishings, fixtures and equipment).

E.1.1 Asset Inventory and Valuation

Table E - 1 below summarizes the asset valuation, quantities, and performance for each asset category of recreation assets.

Table E - 1: Inventory and valuation for Recreation assets.

Asset Category	Asset Class	Replacement Cost	Inventory	Average Performance
Facility	Aquatics Facility	\$16,958,235	33,017 sq ft	Good
Facility	Major Community Centre & Library	\$660,313,516	885,001 sq ft	Very Good
Facility	Minor Community Centre	\$120,417,923	259,295 sq ft	Very Good
Facility	Residential	\$2,258,801	7,250 sq ft	Good
Facility	Sports Facility	\$170,472,491	255,231 sq ft	Very Good
Facility	Warehouse	\$218,311	1,605 sq ft	Fair
Furnishing, Fixtures & Equipment	Audio Visual	\$2,550,512	235 Assets	Very Poor
Furnishing, Fixtures & Equipment	Furniture	\$8,873,598	220 Assets	Poor
Furnishing, Fixtures & Equipment	Kitchen Equipment	\$774,555	97 Assets	Poor
Furnishing, Fixtures & Equipment	Life Safety	\$519,803	17 Assets	Poor
Furnishing, Fixtures & Equipment	Mechanical	\$3,038,258	78 Assets	Poor
Furnishing, Fixtures & Equipment	Office Equipment	\$62,828	6 Assets	Very Poor
Furnishing, Fixtures & Equipment	Program	\$1,916,913	87 Assets	Poor
Total	-	\$988,375,744	-	-

E.1.2 Age and Estimated Service Life

Figure E - 5 illustrates the age of recreation assets as a proportion of their estimated service life. Figure E - 6 illustrates the value of recreation assets acquired by decade. Generally, recreation assets are on average between a quarter to halfway through their estimated service life.

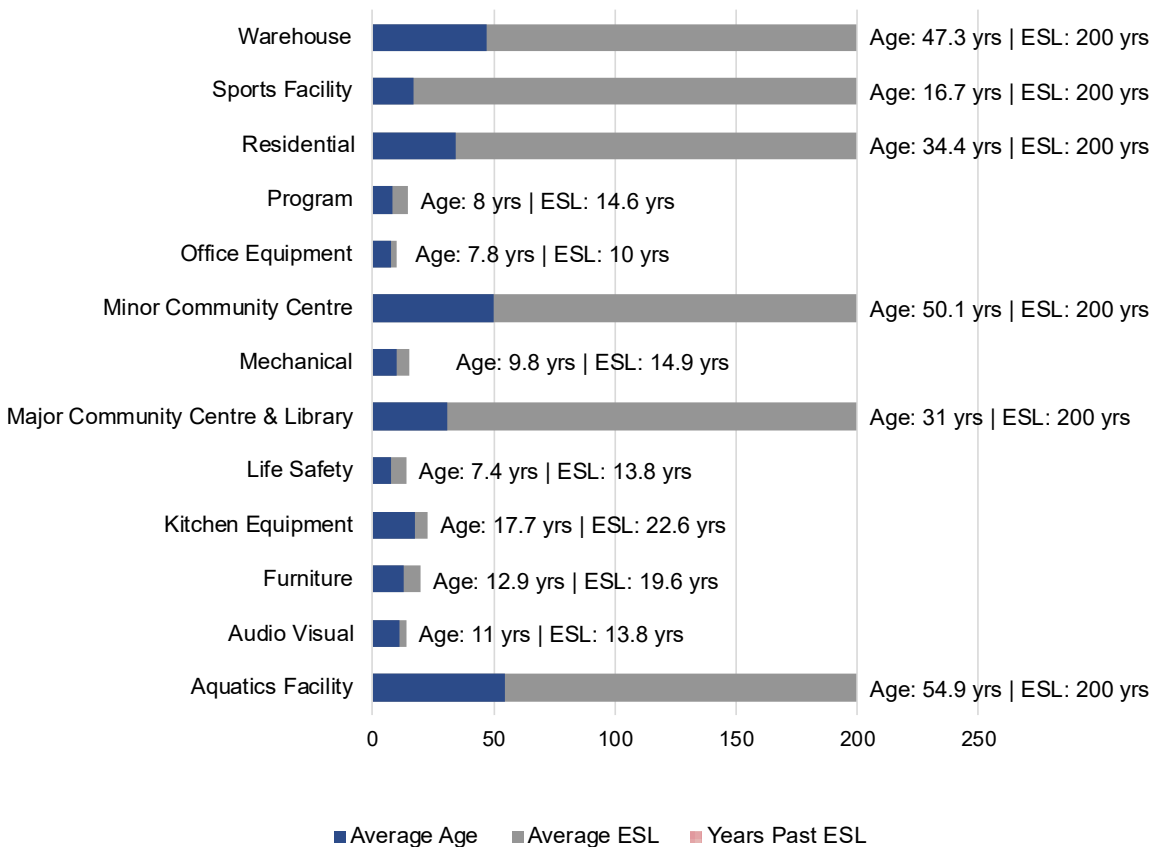


Figure E - 5: Age distribution by installation decade of Recreation assets.

The installation profile of recreation assets illustrates that the majority of major community centres and libraries were constructed in the 1970s, 2000s, and 2010s, in line with some of the decades where the City experienced significant growth and development.

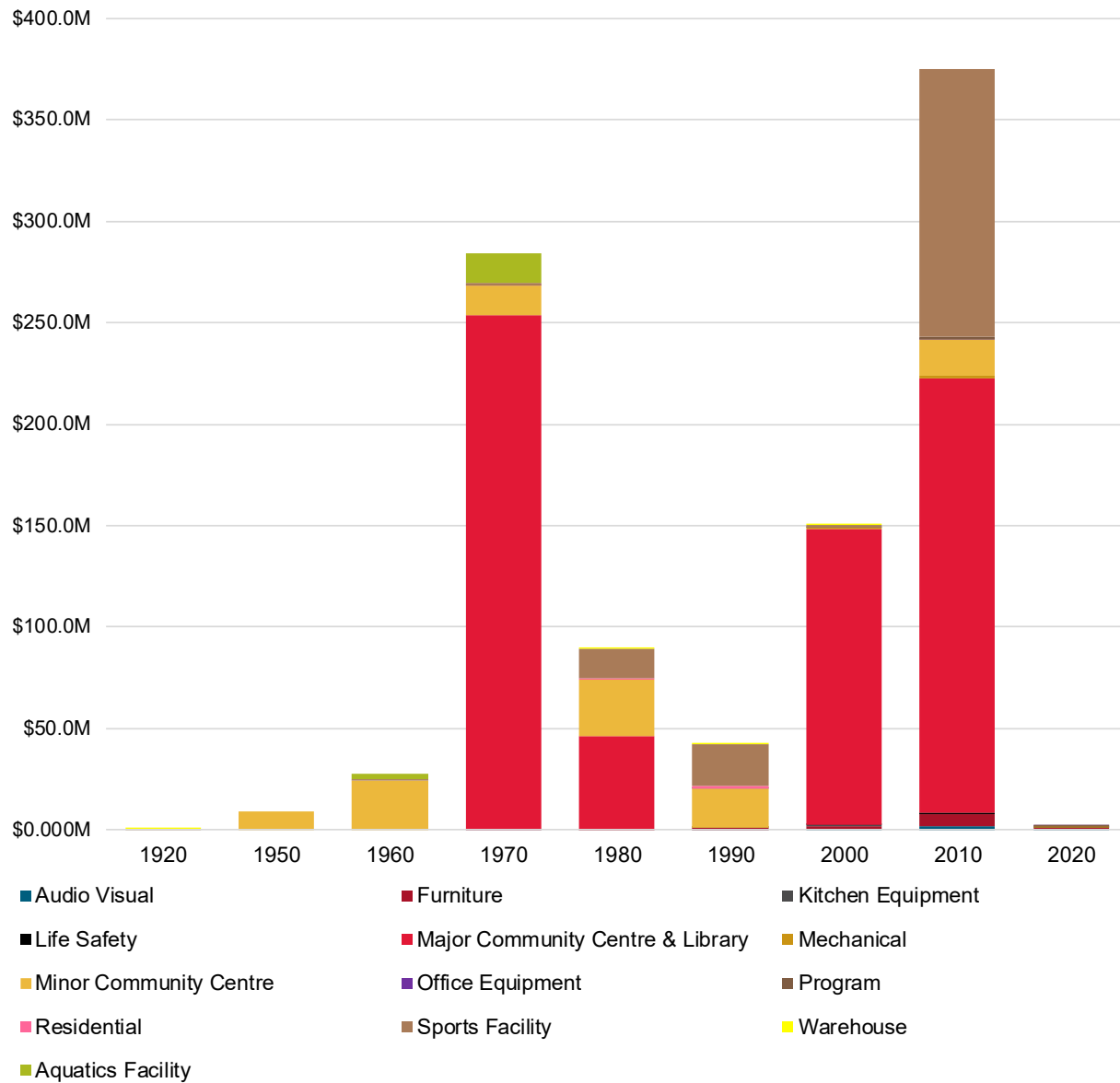


Figure E - 6: Age distribution by installation decade of Recreation assets.

E.1.3 Asset Performance

Table E - 2 below details the approaches that the City utilizes to understand the performance of each asset class in recreation services and the approaches used to assess performance.

Table E - 2: Performance assessment approaches to Recreation assets.

Asset Class	Condition Rating Metric	Approach to Assessing Condition
Aquatics Facility	FCI	Facilities are inspected and the inspection results are recorded in City's database annually. The results are used to understand facility renewal needs and calculate the FCI rating.
Major Community Centre & Library	FCI	See above
Minor Community Centre	FCI	See above
Residential	FCI	See above
Sports Facility	FCI	See above
Warehouse	FCI	See above
Audio Visual	Age/ESL	The City understand the condition of these assets based on asset age and estimated service life.
Furniture	Age/ESL	See above
Kitchen Equipment	Age/ESL	See above
Life Safety	Age/ESL	See above
Mechanical	Age/ESL	See above
Office Equipment	Age/ESL	See above
Program	Age/ESL	See above

Table E - 3 summarizes the relationship between the performance categories and how performance ratings are determined. Figure E - 7 illustrates the performance distribution of all recreation assets, while Figure E - 8 and Figure E - 9 show the performance distribution of recreation assets by asset class.

Table E - 3: Performance ratings of Recreation assets.

Condition Category	Age/ESL	Facility Condition Index (FCI)
Very Good	0% - 20%	0% - 5%
Good	20% - 40%	5% - 10%
Fair	40% - 60%	10% - 30%
Poor	60% - 80%	30% - 60%
Very Poor	80% - 100%	60 - 100%

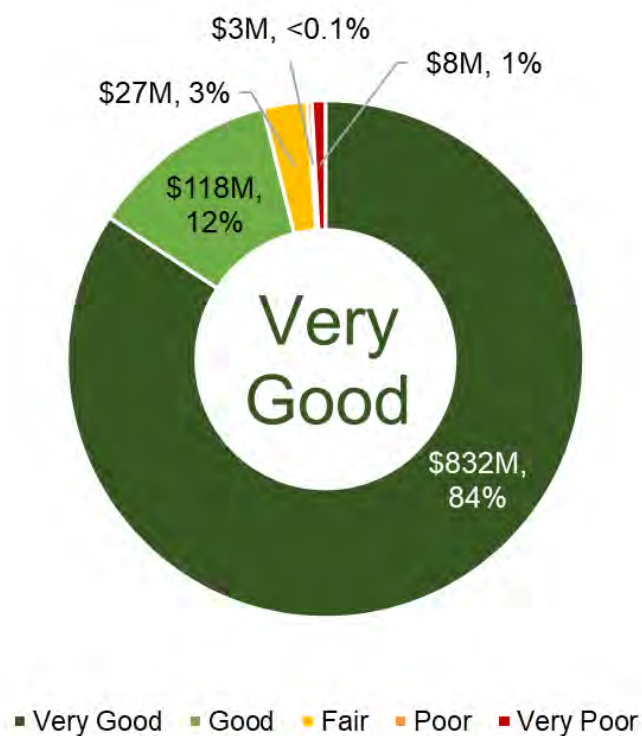


Figure E - 7: Condition distribution of Recreation assets.

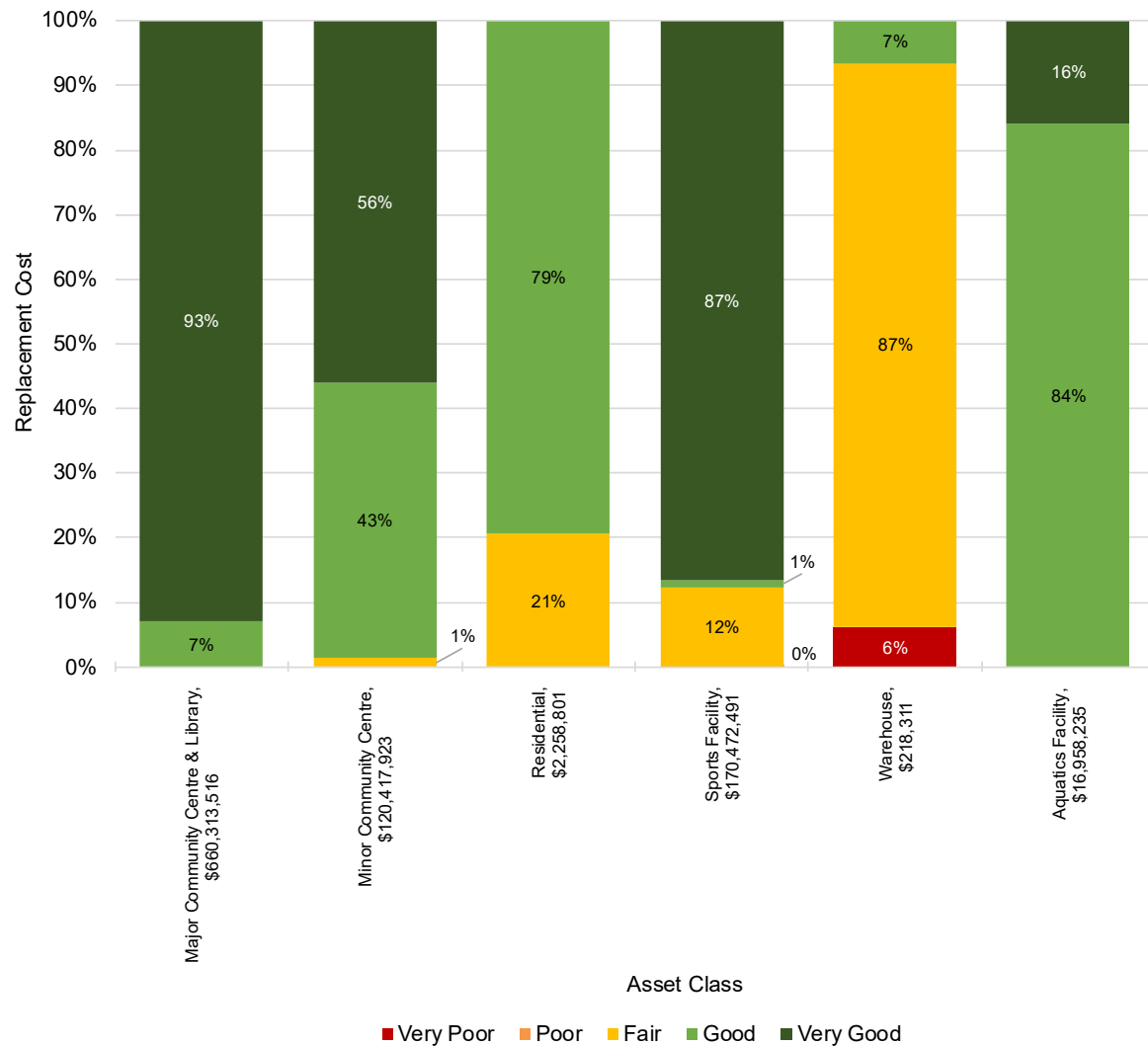


Figure E - 8: Condition distribution of Recreation assets by asset class (facilities).

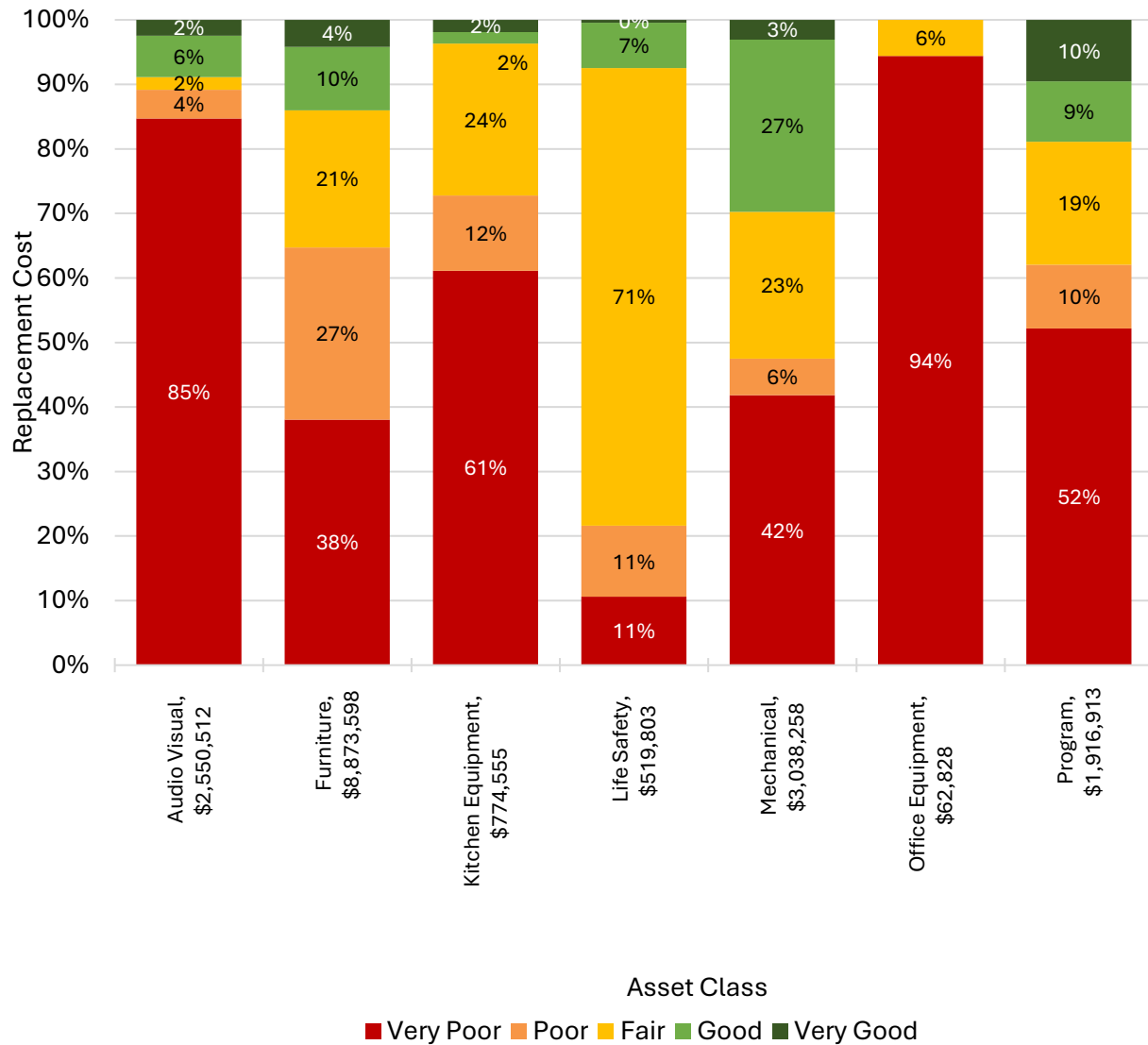


Figure E - 9: Condition distribution of Recreation assets by asset class (furnishings, fixtures & equipment).

E.2 Levels of Service

Customer values, customer levels of service and technical levels of service for Recreation can be found in Table E - 4 to Table E - 7.

E.2.1 Customer Values

Table E - 4: Recreation customer values.

Customer Satisfaction Measure		Current Feedback & Expected Trend Based on Planned Budget
Recreation assets are safe and reliable to use		
Assets are maintained in a state of good repair, are adequate for use, and in overall good working condition.		Future Iterations ²⁰
Recreation services are convenient to use		
The quality of assets does not negatively affect the customer.		Future Iterations ²⁰
There are sufficient and appropriate amenities available for all customers.		Future Iterations ²⁰
Recreation services are accessible.		Future Iterations ²⁰
Environmentally sustainable		
Environmental impacts are minimized.		Future Iterations ²⁰

²⁰ The City is currently reviewing the data that supports this metric, which will be reported in future iterations of the City's AMP. These metrics are subject to change as data is reviewed and incorporated into future AMPs.

E.2.2 Customer and Technical Levels of Service

Table E - 5: Recreation – Facilities customer LoS.

Type of Measure	Level of Service	Performance Measure	Current Performance	Confidence Levels
Condition	Condition of Facilities	Average FCI rating of facilities.	0.03	High – condition assessments are performed on facilities to determine condition
Condition	Individual element/element group condition.	Percentage of all elements/element groups in very poor to poor condition.	0%	See above
Condition	Individual element/element group condition.	Percentage of assets that have not exceeded their ESL.	100%	See above
Function	Measure of whether the service is appropriate for its intended use	Future Iterations ²¹	Future Iterations ²¹	Future Iterations ²¹

²¹ The City is currently reviewing and selecting measures for this category, which will be developed and integrated into future iterations of the City's AMP.

Type of Measure	Level of Service	Performance Measure	Current Performance	Confidence Levels
Capacity	Integrated Leisure Master Plan defines measures of whether the service is adequate to meet customer needs	1 major community centre per 60,000 population 1 minor community centre per 25,000 population	- Major community centres: 94% (or 56,417 population per community centre)* - Minor community centres: 97% (24,179 population per community centre)* *Based on a 2021 census population of 338,503.	High – the Integrated Leisure Master Plan determines growth needs and targets for community centres to accommodate existing and future populations
Accessibility	Service interruptions	Future Iterations ²¹	Future Iterations ²¹	Future Iterations ²¹

Table E - 6: Recreation – Furnishings, Fixtures & Equipment customer LoS.

Type of Measure	Level of Service	Performance Measure	Current Performance	Confidence Levels
Condition	Condition of assets	Percentage of assets that have not exceeded their ESL.	97%	Low – age and remaining service life are used to determine condition in place of condition data
Condition	Individual element/element group condition.	Percentage of all elements/element groups in very poor to poor condition.	64%	See above
Function	Measure of whether the service is appropriate for its intended use	Future Iterations ²¹	Future Iterations ²¹	Future Iterations ²¹
Capacity	Measure of whether the service is adequate to meet customer needs	Future Iterations ²¹	Future Iterations ²¹	Future Iterations ²¹
Accessibility	Service interruptions	Future Iterations ²¹	Future Iterations ²¹	Future Iterations ²¹

Table E - 7: Recreation technical LoS.

Lifecycle Activity	Purpose of Activity	Frequency	Current Performance (\$, 2025 Budget)	Recommended Performance
Acquisition	Growth Expansion Development	Projects developed in Integrated Leisure Master Plan	-	Growth Planning Horizon: 2026-2051 Total Acquisition Value Range: \$311.49M - \$443.40M City Funded Acquisition Value Range: \$311.49M - \$443.40M
Operation	Inspections	Annual programs	\$154,957 The City's 2025 operating budget for all services was \$495.8M.	Maintain current performance for assets in service. Anticipated operating budget increase ranges from \$8.3M to \$11.8M over the growth planning horizon: 2026-2051. These costs may vary year over year depending on asset needs.
Operation	Regular Operations	As required	See above	See above
Maintenance	Minor repairs	As required	\$23,314	Maintain Current Performance for assets in service. Anticipated maintenance budget increases are included in the operating or renewal budget forecasts.
Maintenance	Regular Maintenance	Annual programs	See above	See above

Lifecycle Activity	Purpose of Activity	Frequency	Current Performance (\$, 2025 Budget)	Recommended Performance
Maintenance	Major maintenance (holding strategies)	As required	See above	See above
Renewal	Major rehabilitation or replacement	As required	\$4,704,857	PLoS Maintain Current Performance requires \$6,57M or \$1.86M per year on average of additional funds from 2026 to 2051.
Disposal	Disposal of replaced assets	As required	Included in renewal costs	Maintain current performance for assets in service.
Service Improvement	Upgrades to improve LoS to benefit existing serviced areas	As required	\$40,000	Maintain current performance

E.3 Risk Management Strategy

The criteria used to determine the consequence of failure for Recreation assets can be found in Table E - 8 below:

Table E - 8: COF criteria used for Recreation assets.

Direct Financial	Socio-Economic	Environmental
Replacement cost	- Asset Class - Asset Detail	N/A

Table E - 9 displays the risk score for Recreation assets along with the proportion of assets within each risk score, likelihood of failure and consequence of failure.

Table E - 9: Risk score distribution of Recreation assets.

	COF 1	COF 2	COF 3	COF 4	COF 5	Subtotal
LOF 1	None	\$1,644,656 (0.2%)	\$830,796,759 (84.1%)	None	None	\$832,441,415 (84.2%)
LOF 2	\$12,636 (0.0%)	\$1,158,392 (0.1%)	\$116,428,453 (11.8%)	None	None	\$117,599,482 (11.9%)
LOF 3	\$208,400 (0.0%)	\$3,003,514 (0.3%)	\$23,716,672 (2.4%)	None	None	\$26,928,587 (2.7%)
LOF 4	\$146,450 (0.0%)	\$2,682,364 (0.3%)	\$169,494 (0.0%)	None	None	\$2,998,308 (0.3%)
LOF 5	\$365,944 (0.0%)	\$5,035,145 (0.5%)	\$3,006,841 (0.3%)	None	None	\$8,407,930 (0.9%)
Subtotal	\$733,431 (0.1%)	\$13,524,071 (1.4%)	\$974,118,219 (98.6%)	None	None	\$988,375,721 (100.0%)

Table E - 10: Risk score mapping legend.

Risk	Risk Score	Risk Description	Total Replacement Cost
Very Low	1 – 5	Fit for the Future	\$834,333,238 (84.4%)
Low	6 – 10	Adequate for Now	\$150,866,149 (15.3%)
Moderate	11 – 15	Requires Attention	\$3,176,335 (0.3%)
High	16 – 20	At Risk	None
Very High	21 – 25	Unfit for Sustained Service	None

E.4 Lifecycle Management Activities

The City's lifecycle management activities for Recreation assets are listed in Table E - 7. These activities include the acquisition of assets and service improvements, operations and maintenance, major asset renewals (including rehabilitations and replacements), and disposals.

These lifecycle management activities in conjunction with the lifecycle forecasting are used to determine the funding required for the City to continue performing these lifecycle activities to extend asset life, reduce overall costs, and minimize risk while providing the proposed service levels.

E.5 Lifecycle Forecasting

The following section outlines the funding required for the entire lifecycle of Recreation assets. The expenditures were determined using the lifecycle activities outlined in Table E - 7 and the PLoS established. Required funding for PLoS was determined using the following parameter:

- Proposed LoS – Maintaining Performance:** funding required to maintain a similar asset performance over a 26-year period. The City has established this LoS as the PLoS for Recreation assets. It focuses on maintaining the percentage of assets in backlog in a similar state. Backlog is defined as assets that are in need of renewal work (either significant rehabilitation or replacement). For example, if 20% of assets are past their service life, or are in need of renewal work, then the forecast model will determine the funding to maintain 20% of assets in this state over the forecast period.

The following table summarizes the anticipated funding from the LCRS for renewal activities for Recreation assets. A total of **\$184.8M** over the next 26 years (or an equivalent annual average of **\$7.1M**) for renewals is anticipated to be spent.

Table E - 11: Forecasted capital renewal expenditures (Life Cycle Reserve Study) for Recreation assets.

Year	Capital Expenditures (Renewals)
2026	\$12,640,058
2027	\$15,280,831
2028	\$6,028,352
2029	\$5,745,321
2030	\$9,918,384
2031	\$3,838,699
2032	\$9,203,450

Year	Capital Expenditures (Renewals)
2033	\$6,100,758
2034	\$4,552,043
2035	\$9,962,060
2036	\$6,110,890
2037	\$12,248,486
2038	\$5,476,729
2039	\$4,741,364
2040	\$9,550,026
2041	\$5,613,852
2042	\$10,545,364
2043	\$5,721,004
2044	\$3,972,901
2045	\$5,563,143
2046	\$3,430,419
2047	\$14,721,478
2048	\$3,331,385
2049	\$3,617,813
2050	\$3,445,946
2051	\$3,418,286
Total	\$184,779,042
Equivalent Average Annual	\$7,106,886

Figure E - 10 illustrates the performance and financial forecasts to achieve PLoS for all Recreation assets. The forecast analysis identified a total of **\$170.8M** (or an equivalent average annual of **\$6.6M**) that is anticipated to be spent over the next 26 years to maintain current performance. The City plans to spend a total of **\$184.8M** (or an equivalent average annual of **\$7.1M**). This shows that the City's forecasted capital renewal expenditures (LCRS) are appropriate to maintain assets in a SOGR, and funding levels are adequate.

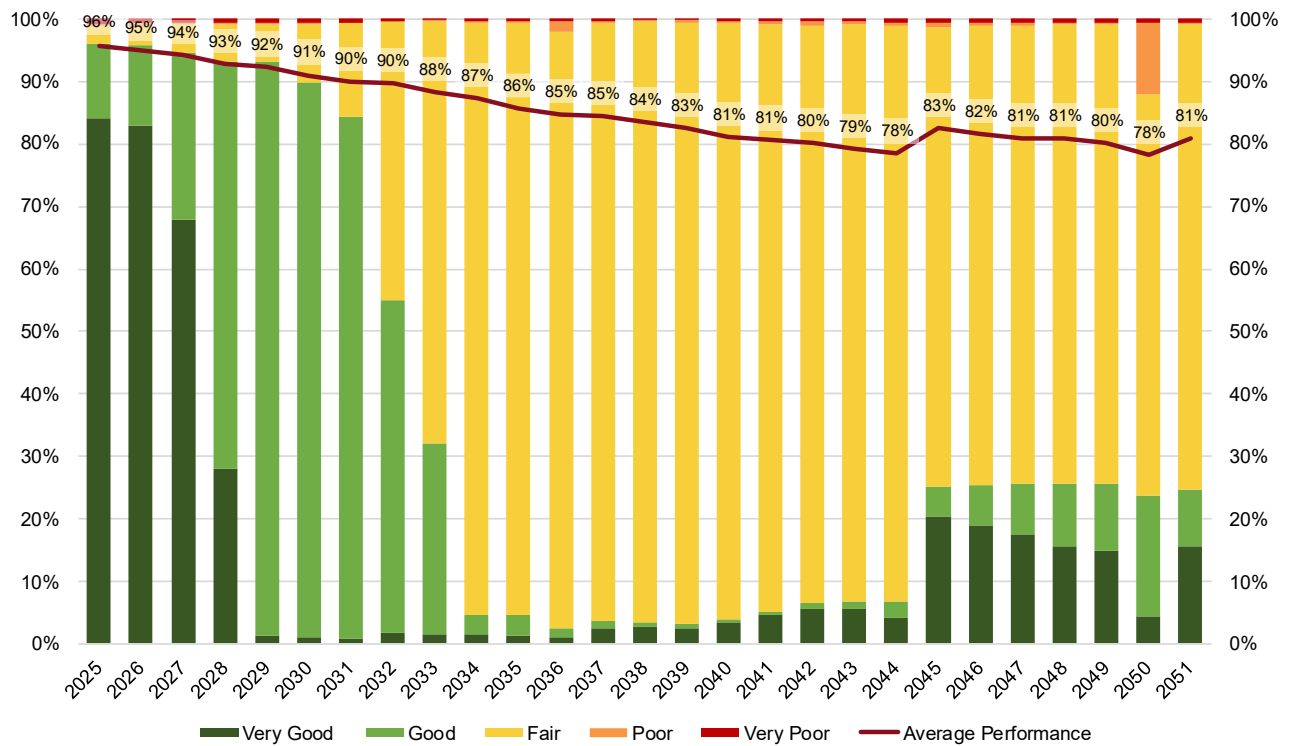


Figure E - 10: Performance distribution – maintain current performance for Recreation assets.

E.6 Proposed Levels of Service Themes & Future Challenges

The customer values and customer LoS were discussed with stakeholders. The following summarizes the feedback from the stakeholders related to service delivery, customer expectations, and challenges faced by the City, particularly challenges that may be encountered in the future:

Table E - 12: Proposed LoS themes for Recreation assets.

Challenge	Discussion
Safe and Reliable	• Additional staffing will be required to support program and service delivery. As Markham's population and demographics evolve, ongoing staff training will be necessary to ensure programs remain relevant and responsive to community needs. • Enhance accessibility within community centres and adapting facilities will help address the needs of older residents, reinforcing age-friendly practices. • Recreation facilities must be consistently updated, well-maintained, and equipped with innovative solutions to ensure long-term reliability. • All Recreation environments should remain safe, inclusive, and inviting for every resident.
Convenience	• In high-density neighbourhoods, recreation planning will require more precise tools to determine the location, type, and mix of amenities in future community centres. • As the city urbanizes, recreation programs and facilities must adapt to serve both suburban and urban contexts effectively. • Parking requirements and access strategies must be reevaluated for intensified areas to balance convenience with land use efficiency.
Sustainability	• Continuous improvement to Recreation's registration and facility booking system will be essential in helping residents easily find and access programs and services. • Tools that effectively supports proactive facility and asset management practices such as Enterprise Asset Management systems will provide valuable insights and trends. • Ongoing awareness of demographic shifts, including the aging population and growing demand for inclusive services, will be essential for long-term sustainability.

Challenge	Discussion
Function	- Recreation spaces should accommodate a wide range of age groups and adapt to changing community compositions. - Community Centres and associated amenities should support both active and passive programming, with layouts that can be divided, expanded, or modified as needs evolve. - Flexibility in design will ensure recreation spaces remain relevant, versatile, and resilient over time.

The insight from this discussion will be considered and incorporated into the City's AM processes and future iterations of the AMP. As the City continues to grow, it is important that current and future challenges are addressed in order to maintain service levels and achieve proposed service levels.

Appendix F. Solid Waste Management



The City's Solid Waste Management services lead in waste diversion and environmental strategies like clear garbage bags, e-waste drop-offs, and textile recycling. They promote public awareness and participation in waste reduction, aiming to create a sustainable community and protect natural resources for future generations.

The City's Solid Waste Management Services are responsible for assets such as various facilities, fleet, furnishings, fixtures and equipment detailed in Figure F - 1.



Figure F - 1: Solid Waste Management Hierarchy.

More information on Solid Waste Management such as state of infrastructure, levels of service, risk management strategies and lifecycle management strategies and forecasting can be found in the following sections.

F.1 State of the Infrastructure

Figure F - 2 shows the replacement value of all Solid Waste Management assets while Figure F - 3 illustrates the replacement value breakdown of solid waste management assets by asset class. The total replacement value for Solid Waste Management assets is \$1.8M, where facilities account for 73.2% of the Solid Waste Management portfolio at \$1.4M.

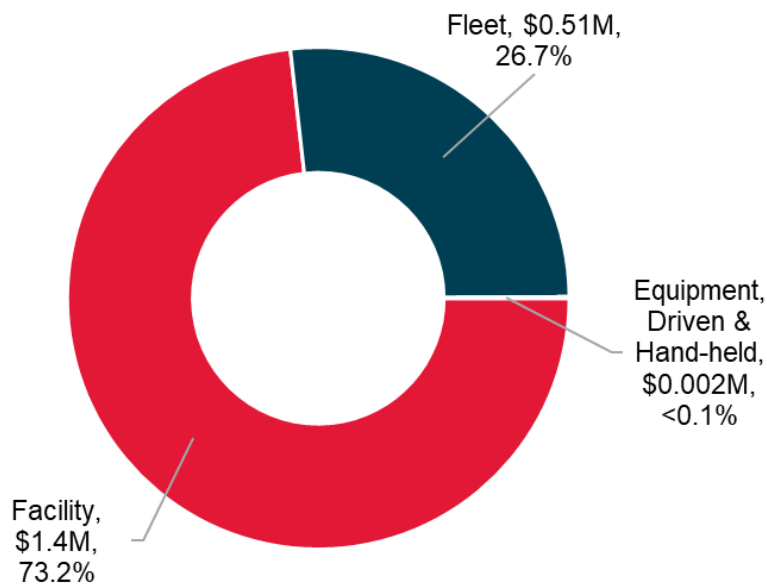


Figure F - 2: Replacement value distribution of Solid Waste Management assets.

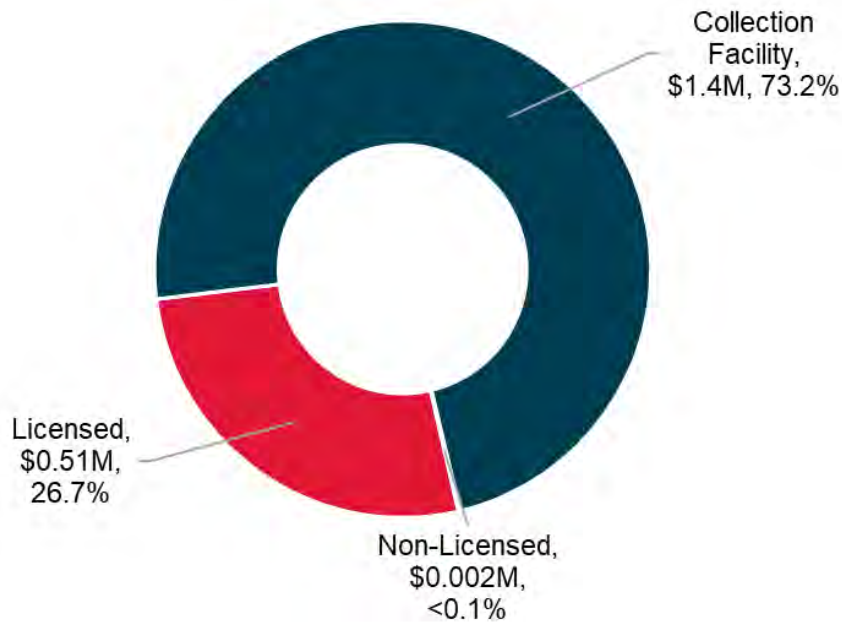


Figure F - 3: Replacement value distribution of Solid Waste Management assets by asset class.

F.1.1 Asset Inventory and Valuation

Table F - 1 below summarizes the asset valuation, quantities, and performance for each asset category of Solid Waste Management assets.

Table F - 1: Inventory and valuation of Solid Waste Management assets.

Asset Category	Asset Class	Replacement Cost	Inventory	Average Performance
Facility	Collection Facility	\$1,389,826.07	6,229 sq ft	Very Good
Fleet	Licensed	\$506,637.00	5 Assets	Good
Equipment, Driven & Hand-held	Non-Licensed	\$1,808.79	2 Assets	Poor
Total	-	\$1,898,272	-	-

F.1.2 Age and Estimated Service Life

Figure F - 4 illustrates the age of solid waste assets as a proportion of their estimated service life and Figure F - 5 illustrates the value of solid waste management assets acquired by decade.

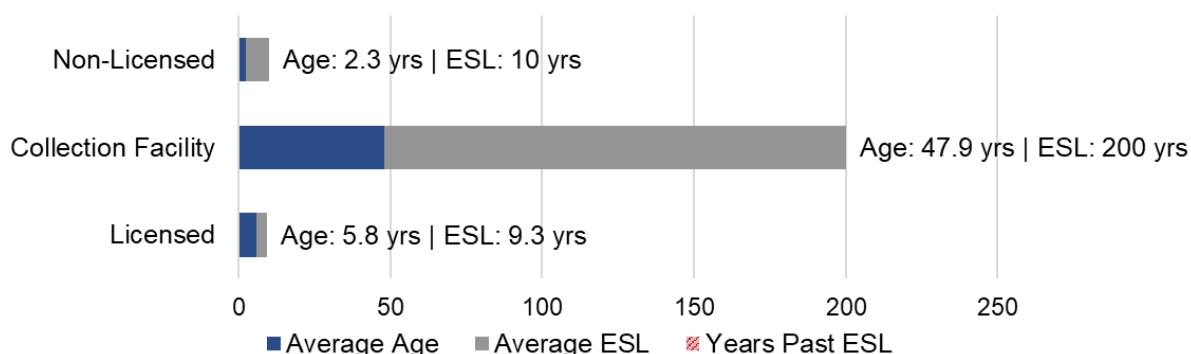


Figure F - 4: Age as a proportion of estimated service life (ESL) of Solid Waste Management assets.

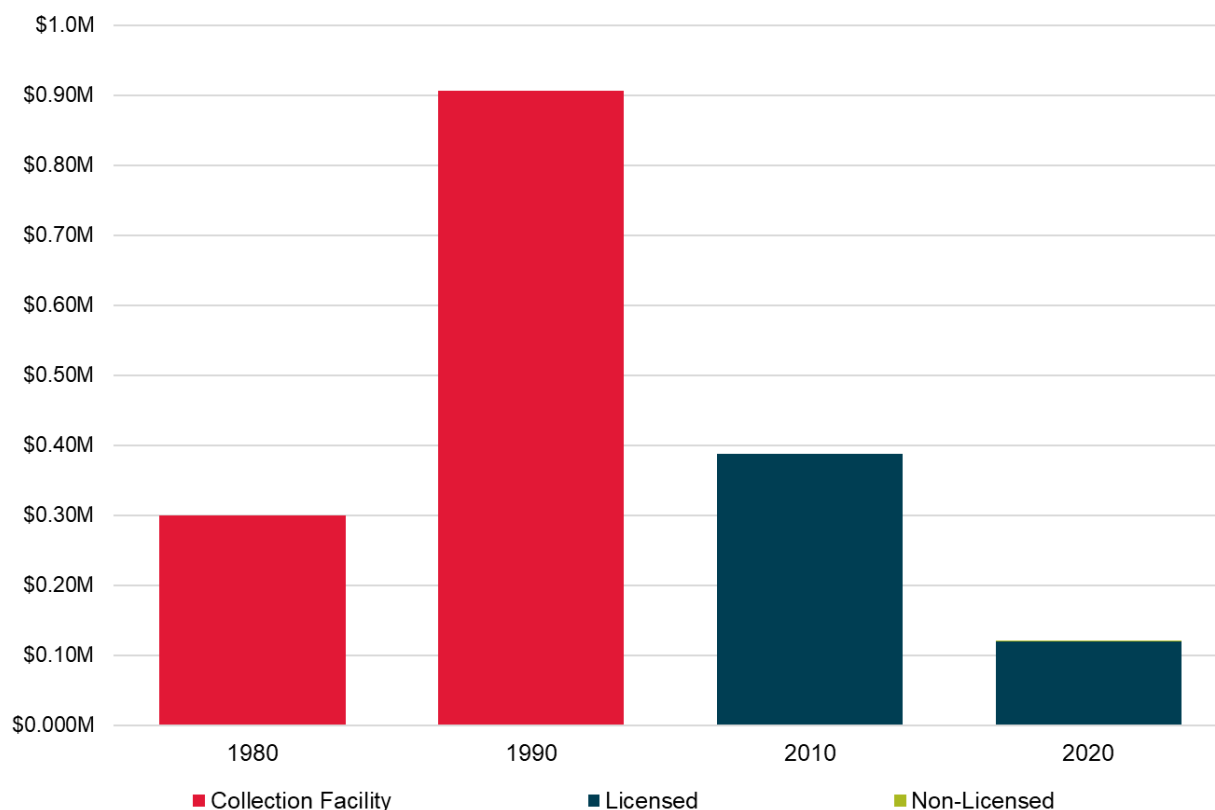


Figure F - 5: Age distribution by installation decade of Solid Waste Management assets.

The installation profile illustrates that the majority of solid waste management facilities were constructed in the 1980s and 1990s, in line with decades that experienced significant growth and corresponding development in the City.

F.1.3 Asset Performance

Table F - 2 details the approaches that the City utilizes to understand the performance of solid waste management assets.

Table F - 2: Performance assessment approaches to Solid Waste Management assets.

Asset Class	Condition Rating Metric	Approach to Assessing Condition
Facility	FCI	Facilities are inspected and the inspection results are recorded in City's database annually. The results are used to understand facility renewal needs and calculate the FCI rating.

Asset Class	Condition Rating Metric	Approach to Assessing Condition
Fleet	Remaining Life/ESL	Reviewed upon arrival of new asset, inspected monthly and upon completion of maintenance then recorded into City's database. The performance of fleet assets also considers age and runtime consumption.
Equipment, Driven & Hand-held	Remaining Life/ESL	Reviewed upon arrival of new asset, inspected monthly and upon completion of maintenance then recorded into City's database

Figure F - 6 and Figure F - 7 illustrate the condition distribution of all solid waste management assets.

Table F - 3 summarizes the relationship between the condition categories and how condition ratings are determined.

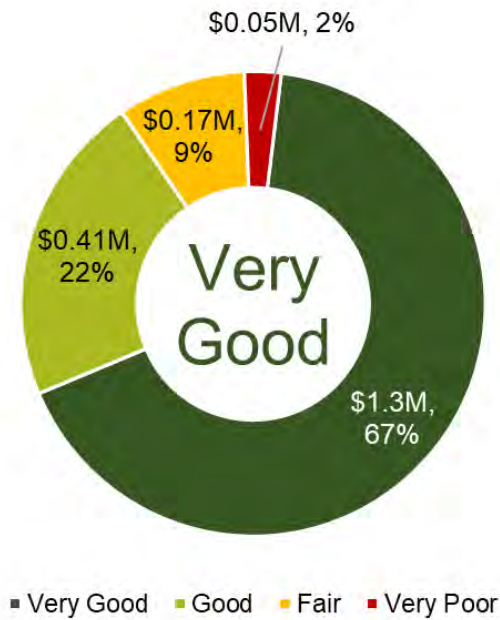


Figure F - 6: Condition distribution of Solid Waste Management assets.

Table F - 3: Condition ratings of Solid Waste Management assets.

Condition Category	Age/ESL	Facility Condition Index (FCI)
Very Good	0% - 20%	0% - 5%
Good	20% - 40%	5% - 10%
Fair	40% - 60%	10% - 30%
Poor	60% - 80%	30% - 60%
Very Poor	80% - 100%	60 - 100%



Figure F - 7: Condition distribution of Solid Waste Management assets by asset class.

F.2 Levels of Service

Customer values, customer levels of service and technical levels of service for Solid Waste Management can be found in Table F - 4 to Table F - 8.

F.2.1 Customer Values

Table F - 4: Solid Waste Management customer values.

Customer Satisfaction Measure	Current Feedback & Expected Trend Based on Planned Budget
Solid waste management services are safe and reliable to use	
Assets are maintained in a state of good repair, are adequate for use, and in overall good working condition.	Future Iterations ²²
Solid waste management services are convenient to use	
The quality of assets does not negatively affect the customer.	Future Iterations ²²
There are sufficient and appropriate facilities and services available for all customers.	Future Iterations ²²
Solid waste management services are accessible.	Future Iterations ²²
Environmentally sustainable	
Environmental impacts are minimized.	Future Iterations ²²

²² The City is currently reviewing the data that supports this metric, which will be reported in future iterations of the City's AMP. These metrics are subject to change as data is reviewed and incorporated into future AMPs.

F.2.2 Customer and Technical Levels of Service

Table F - 5: Solid Waste Management – Facilities customer LoS.

Type of Measure	Level of Service	Performance Measure	Current Performance	Confidence Levels
Condition	Condition of Facilities	Average FCI rating of facilities.	0.025	Medium – building condition assessments are performed on facilities to determine investment needs but data requires refinement.
Condition	Individual element/element group condition.	Percentage of all elements/element groups in poor or very poor condition.	0%	Medium – building condition assessments are performed on facilities to determine investment needs but data requires refinement.
Condition	Individual element/element group condition.	Percentage of assets that have not exceeded their ESL.	100%	Medium – building condition assessments are performed on facilities to determine investment needs but data requires refinement.
Function	Measure of whether the service is appropriate for its intended use	Future Iterations ²³	Future Iterations ²³	Future Iterations ²³
Capacity	Measure of whether the service is adequate to meet customer needs	Future Iterations ²³	Future Iterations ²³	Future Iterations ²³
Accessibility	Service interruptions	Future Iterations ²³	Future Iterations ²³	Future Iterations ²³

²³ The City is currently reviewing and selecting measures for this category, which will be developed and integrated into future iterations of the City's AMP.

Table F - 6: Solid Waste Management – Fleet customer LoS.

Type of Measure	Level of Service	Performance Measure	Current Performance	Confidence Levels
Condition	Condition of assets	Condition or Age/Remaining Useful Life - Aggregated into 5-point rating scale	Very Good: \$60.1k (11.9%) Good: \$229.4k (45.3%) Fair: \$170.0k (33.6%) Poor: \$0 (0%) Very Poor: \$47.1k (9.3%)	Moderate – age and ESL are used to assess for condition. Condition data is not typically collected for this asset type.
Condition	Condition of assets	Percentage of assets that have not exceeded their ESL.	80%	Moderate – age and ESL are used to assess for condition. Condition data is not typically collected for this asset type.
Function	Measure of whether the service is appropriate for its intended use	Future Iterations ²³	Future Iterations ²³	Future Iterations ²³
Capacity	Measure of whether the service is adequate to meet customer needs	Future Iterations ²³	Future Iterations ²³	Future Iterations ²³
Accessibility	Service interruptions	Future Iterations ²³	Future Iterations ²³	Future Iterations ²³

Table F - 7: Solid Waste Management – Equipment, Driven and Hand-held assets customer LoS.

Type of Measure	Level of Service	Performance Measure	Current Performance	Confidence Levels
Condition	Condition of assets	Percentage of assets that have not exceeded their ESL.	100%	Low to medium – age and ESL are used to assess for condition. Condition data is unavailable.
Function	Measure of whether the service is appropriate for its intended use	Future Iterations ²³	Future Iterations ²³	Future Iterations ²³
Capacity	Measure of whether the service is adequate to meet customer needs	Future Iterations ²³	Future Iterations ²³	Future Iterations ²³
Accessibility	Service interruptions	Future Iterations ²³	Future Iterations ²³	Future Iterations ²³

Table F - 8: Solid Waste Management technical LoS.

Lifecycle Activity	Purpose of Activity	Frequency	Current Performance (\$, 2025 Budget)	Recommended Performance
Acquisition	Growth Expansion Development	Projects developed in solid waste management related growth studies	-	Growth Planning Horizon: 2026-2051 Total Acquisition Value Range: \$2.8M - \$3.6M City Funded Acquisition Value Range: \$2.8M - \$3.6M
Operation	Inspections	Annual programs	Operating costs are funded through the operating budget and may also be funded through the capital budget depending on asset needs. In 2025, there are no operating costs funded through the 2025 capital budget. The City's 2025 operating budget for all services was \$495.8M.	Maintain current performance for assets in service. Anticipated operating budget increase ranges from \$0.07M to \$0.1M over the growth planning horizon: 2026-2051.
Operation	Regular Operations	As required	See above	See above

Lifecycle Activity	Purpose of Activity	Frequency	Current Performance (\$, 2025 Budget)	Recommended Performance
Maintenance	Minor repairs	As required	Maintenance costs are funded through the operating budget and may also be funded through the capital budget depending on asset needs. In 2025, there are no maintenance costs funded through the 2025 capital budget.	Maintain current performance for assets in service. Anticipated maintenance budget increases are included in the operating or renewal budget forecasts.
Maintenance	Regular Maintenance	Annual programs	See above	See above
Maintenance	Major maintenance (holding strategies)	As required	See above	See above
Renewal	Major rehabilitation or replacement	As required	-	PLoS Maintain Current Performance requires \$66.37k per year on average from 2026 to 2051.
Disposal	Disposal of replaced assets	As required	Included with renewal costs	Maintain current performance for assets in service.
Service Improvement	Upgrades to improve LoS to benefit existing serviced areas	As required	-	Maintain LoS – The City continues to assess needs annually to determine and balance appropriate funding levels to support service improvement activities.

F.3 Risk Management Strategy

The criteria used to determine COF of Solid Waste Management Assets can be found in Table F - 9 below:

Table F - 9: COF criteria used for Solid Waste Management assets.

Direct Financial	Socio-Economic	Environmental
• Replacement cost	• Asset Class	• Asset Class

Table F - 10 displays the risk score for Solid Waste Management assets along with the proportion of assets within each risk score, likelihood of failure and consequence of failure.

Table F - 10: Risk score distribution of Solid Waste Management assets.

	COF 1	COF 2	COF 3	COF 4	COF 5	Subtotal
LOF 1	\$618 (<0.1%)	\$60,135 (3.2%)	\$1,206,201 (63.5%)	None	None	\$1,266,954 (66.7%)
LOF 2	None	\$229,380 (12.1%)	\$183,625 (9.7%)	None	None	\$413,006 (21.8%)
LOF 3	None	\$170,035 (9.0%)	None	None	None	\$170,035 (9.0%)
LOF 4	None	None	None	None	None	None
LOF 5	\$48,277 (2.5%)	None	None	None	None	\$48,277 (2.5%)
Subtotal	\$48,895 (2.6%)	\$459,551 (24.2%)	\$1,389,826 (73.2%)	None	None	\$1,898,272 (100.0%)

Table F - 11: Risk score mapping legend.

Risk	Risk Score	Risk Description	Total Replacement Cost
Very Low	1 – 5	Fit for the Future	\$1,544,611 (81.4%)
Low	6 – 10	Adequate for Now	\$353,661 (18.6%)
Moderate	11 – 15	Requires Attention	None
High	16 – 20	At Risk	None
Very High	21 – 25	Unfit for Sustained Service	None

F.4 Lifecycle Management Activities

The City's lifecycle management activities for Solid Waste Management assets are listed in Table F - 8. These activities include the acquisition of assets and service improvements, operations and maintenance, major asset renewals (including rehabilitations and replacements), and disposals.

These lifecycle management activities in conjunction with the lifecycle forecasting are used to determine the funding required for the City to continue performing these lifecycle activities to extend asset life, reduce overall costs, and minimize risk while providing the proposed service levels.

F.5 Lifecycle Forecasting

The following section outlines the funding required for the entire lifecycle of solid waste management assets. The expenditures were determined using the lifecycle activities outlined in Table F - 8 and the LoS established.

Required funding was determined using the following forecasting analysis scenario:

- Proposed LoS – Maintain Current Performance: funding required to maintain a similar asset performance over a 26-year period. The City has established this LoS as the PLoS for solid waste management assets. It focuses on maintaining the percentage of assets in backlog in a similar state. Backlog is defined as assets that are in need of renewal work (either significant rehabilitation or replacement). For example, if 20% of assets are past their service life, or are in need of renewal work, then the forecast model will determine the funding to maintain 20% of assets in this state over the forecast period.

The following table summarizes the anticipated funding from the City's Life Cycle Reserve Study for renewal activities for Solid Waste Management assets. A total of **\$1.6M** over the next 26 years (or an equivalent average annual of **\$63.3k**) for renewals is anticipated to be spent.

Table F - 12: Forecasted capital renewal expenditures (Life Cycle Reserve Study) for Solid Waste Management assets.

Year	Capital Expenditures (Renewals)
2026	\$1,916
2027	\$35,384
2028	\$190,616
2029	\$203,110
2030	\$25,090

Year	Capital Expenditures (Renewals)
2031	\$125,759
2032	\$1,596
2033	\$2,298
2034	\$1,519
2035	\$54,908
2036	\$10,589
2037	\$14,911
2038	\$183,306
2039	\$265,755
2040	\$5,788
2041	\$12,931
2042	\$5,302
2043	\$49,267
2044	\$25,203
2045	\$13,038
2046	\$51,436
2047	\$113,252
2048	\$111,133
2049	\$107,867
2050	\$5,992
2051	\$28,847
Total	\$1,646,812
Equivalent Average Annual	\$63,339

Figure F - 8 and Figure F - 9 illustrate the performance and financial forecasts for Maintaining the Current Performance (PLoS). The forecast analysis identified a total of **\$1.7M** (or an equivalent average annual of **\$66.4k**) that is anticipated to be spent over the next 26 years to maintain current performance. This represents funding gap of **\$78.9k** over the planning horizon, or an equivalent average annual amount of **\$3.0k**.

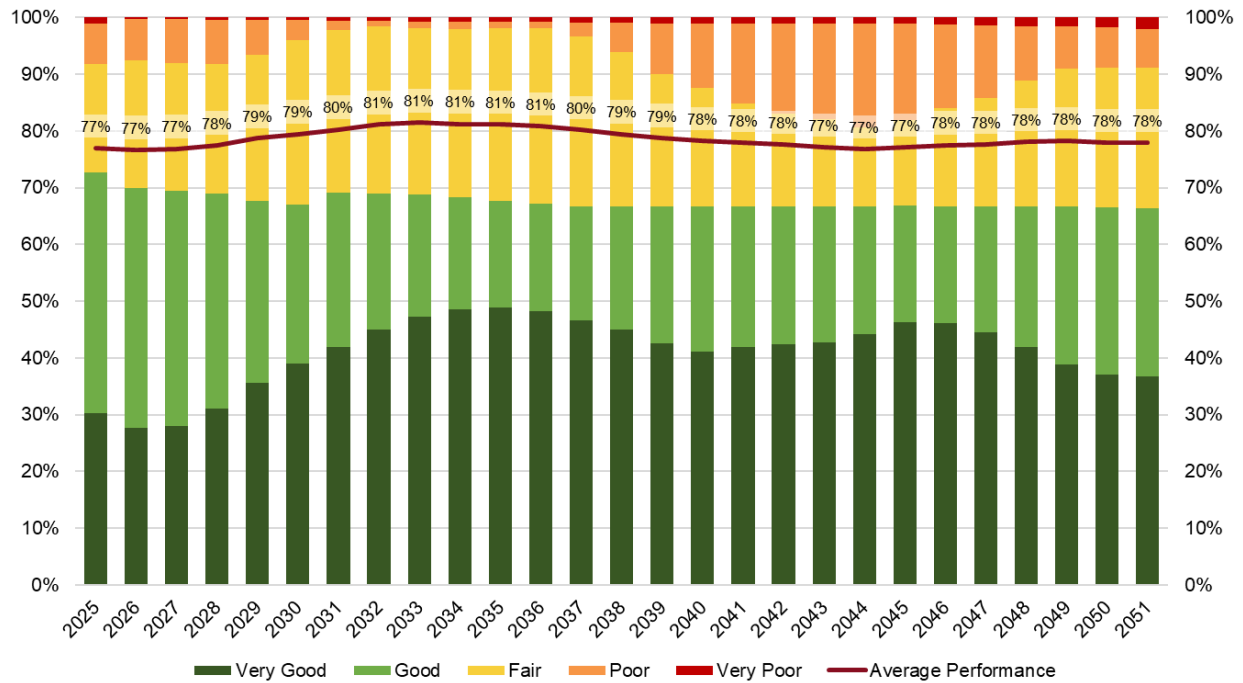


Figure F - 8: Performance distribution – maintain current performance for Solid Waste Management assets.

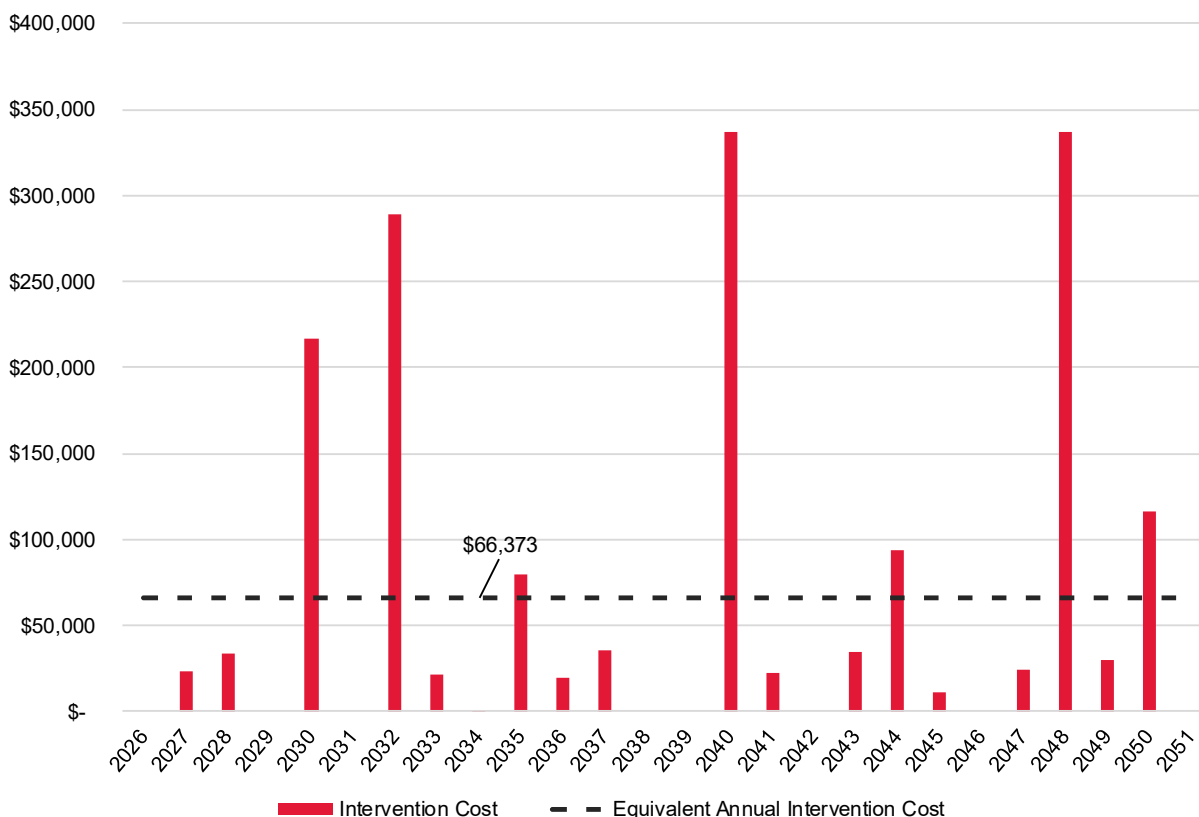


Figure F - 9: Maintain current performance intervention costs for Solid Waste Management assets.

F.6 Proposed Levels of Service Themes & Future Challenges

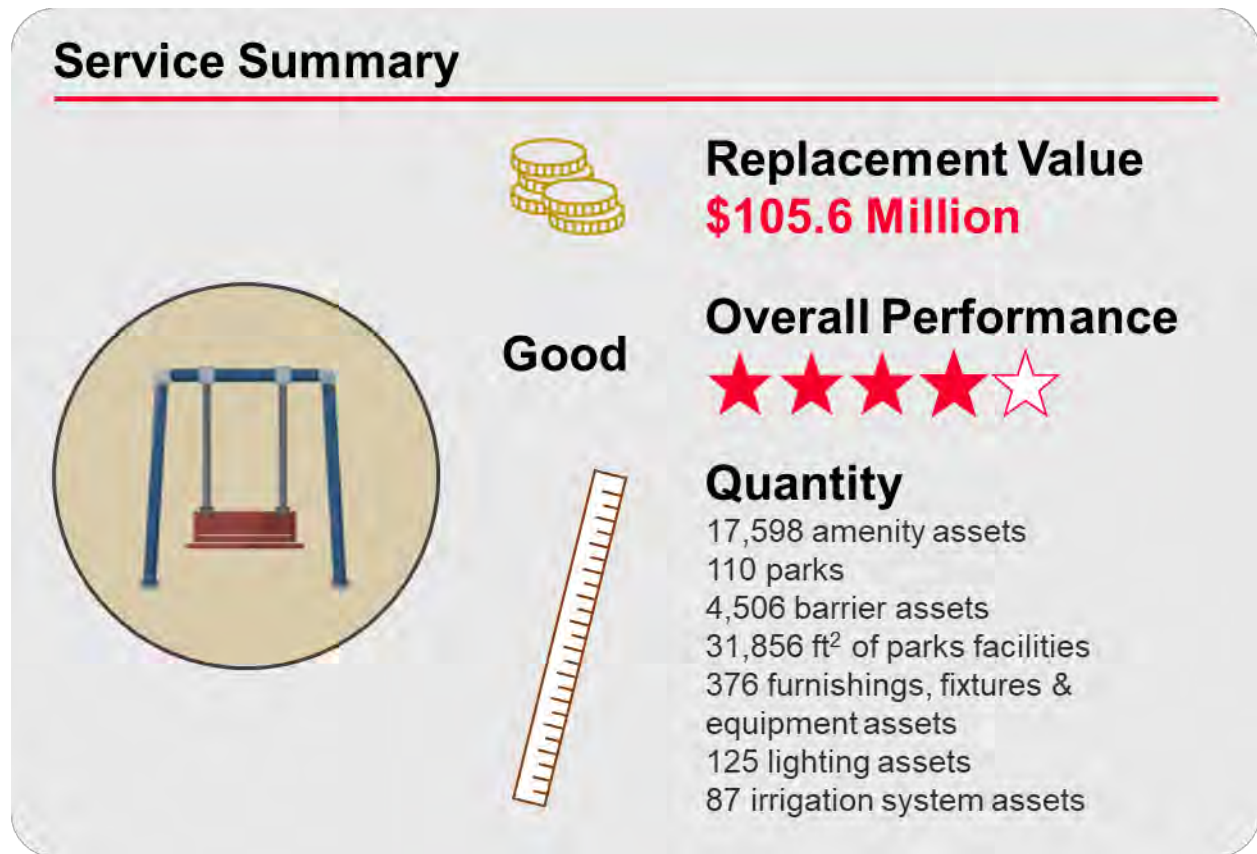
The customer values and customer LoS were discussed with stakeholders. The following summarizes the feedback from the stakeholders related to service delivery, customer expectations, and challenges faced by the City, particularly challenges that may be encountered in the future:

Table F - 13: Proposed LoS themes for Solid Waste Management assets.

Challenge	Discussion
Environmental Sustainability	- The following needs to be considered with respect to environmental impacts: - Acquiring green fleet assets - Retrofitting current buildings/building new shops to meet the demands of the new green fleet - Condition assessments for fleet - The most optimal time to sell and purchase fleet - Determining the type of fleet needed based on needs
Growth & Sustainability	- Bigger facilities are needed to support the growth and fleet. - Staffing and cost of land is a challenge due to increased costs related to construction, the economic climate, and materials. - It is difficult to find good candidates to backfill vacancies. - The policies in place today that affect the future are not stable and will change. - Sustainability includes having better energy efficient technology.
Technology	- Technology will continue to evolve, affecting how challenges are addressed. - Modernization through the acquisition of the best available technology.

The insight from this discussion will be considered and incorporated into the City's AM processes and future iterations of the AMP. As the City continues to grow, it is important that current and future challenges are addressed in order to maintain service levels and achieve proposed service levels.

Appendix G. Parks



The City of Markham's Parks Services promote a safe, active and healthy outdoor experience for residents and visitors. The City and its residents take pride in keeping their parks beautiful and encourage all users of outdoor spaces to do their part.

Markham is responsible for assets such as various amenities, facilities, lighting, barriers, site servicing, furnishings, fixtures and equipment, as detailed in Figure G - 1.



Figure G - 1: Parks hierarchy.

More information on Parks such as state of infrastructure, levels of service, risk management strategies and lifecycle management strategies and forecasting can be found in the following sections.

G.1 State of the Infrastructure

Figure G - 2 provides the replacement value for all parks assets, while Figure G - 3 illustrates the replacement value distribution of amenities and Figure G - 4 shows the replacement value distribution of facilities, furnishings, fixtures and equipment.

The total replacement value for parks is \$105.6M, where amenities account for 61.1% of the parks portfolio at \$64.6M.

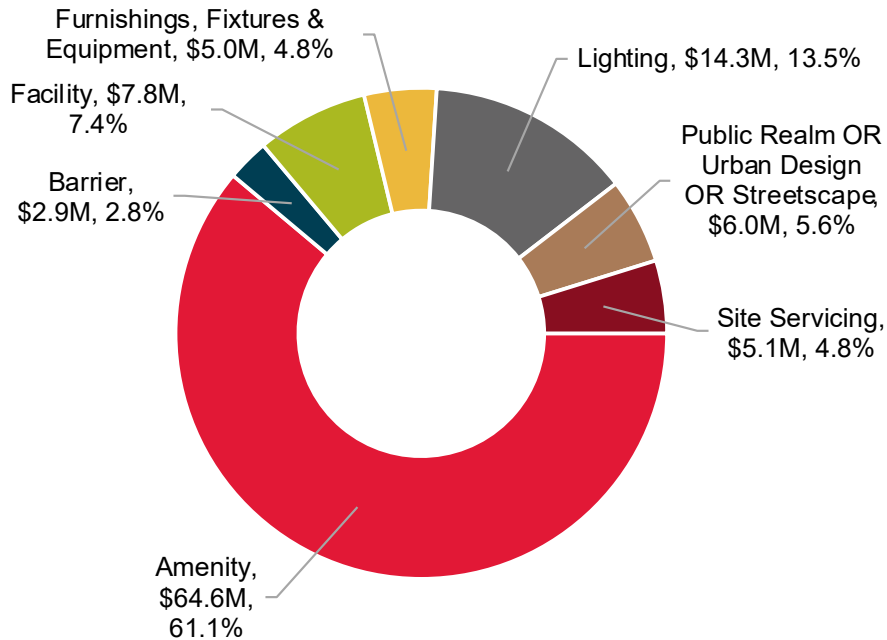


Figure G - 2: Replacement value distribution of Parks assets.

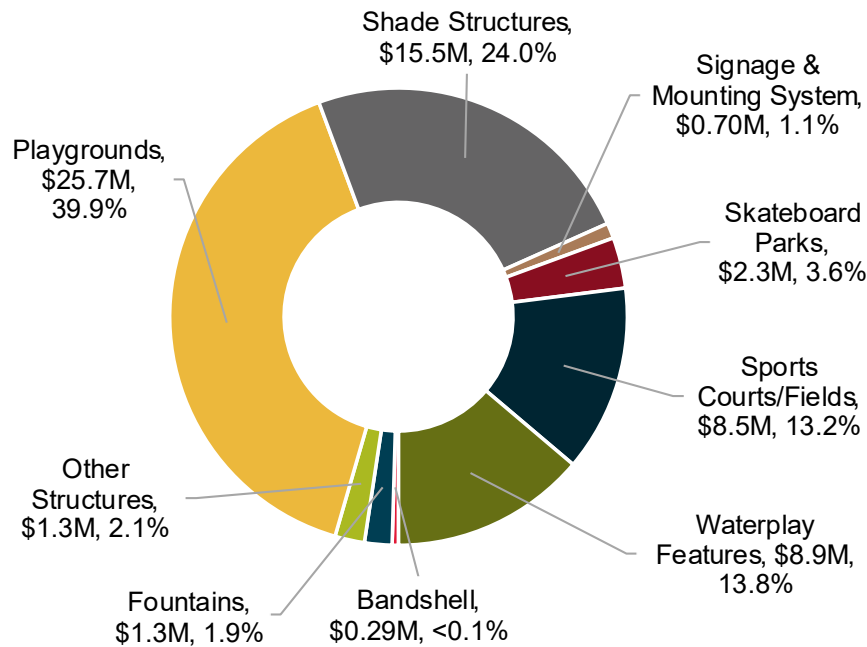


Figure G - 3: Replacement value of Parks assets by asset class (Amenities only).

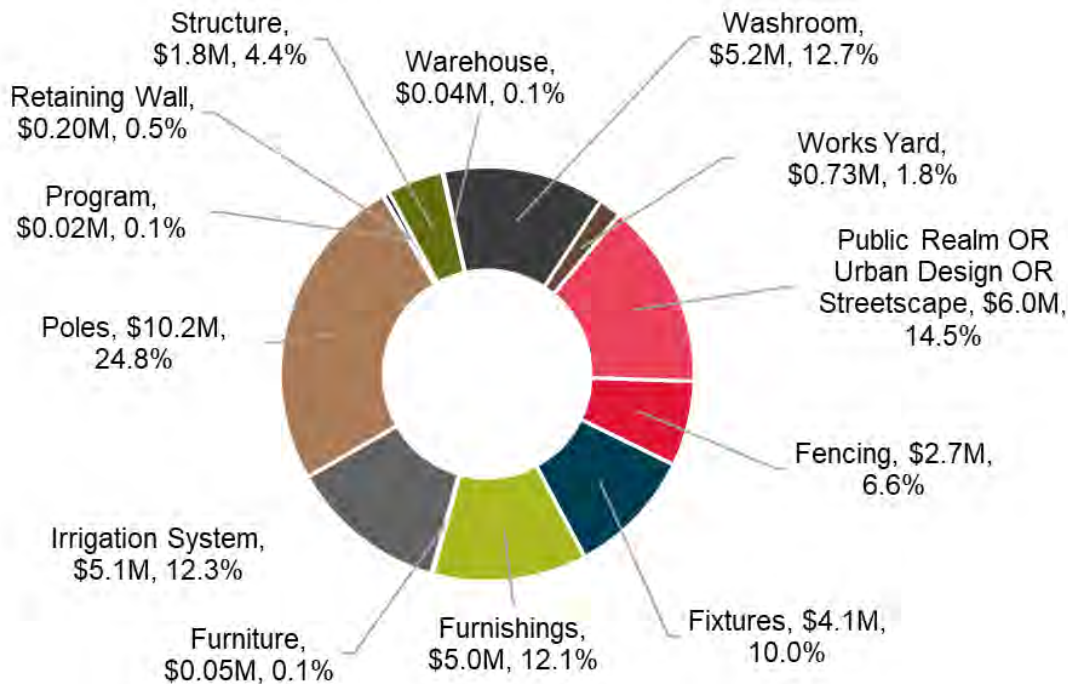


Figure G - 4: Replacement value of Parks assets by asset class (Facilities, Barriers, FFE, Lighting, Streetscapes, and Site Servicing).

G.1.1 Asset Inventory and Valuation

Table G - 1 below summarizes the asset valuation, quantities, and performance for each asset category of parks assets.

Table G - 1: Inventory and valuation for Parks assets.

Asset Category	Asset Class	Replacement Cost	Inventory	Average Performance
Amenity	Bandshell	\$289,959	11 Assets	Good
Amenity	Fountains	\$1,253,352	7 Assets	Fair
Amenity	Other Structures	\$1,348,156	6 Assets	Fair
Amenity	Playgrounds	\$25,730,790	16,641 Assets	Fair
Amenity	Shade Structures	\$15,479,125	153 Assets	Good
Amenity	Signage & Mounting System	\$699,626	495 Assets	Fair
Amenity	Skateboard Parks	\$2,321,694	8 Assets	Fair
Amenity	Sports Courts/Fields	\$8,513,713	246 Assets	Good
Amenity	Waterplay Features	\$8,915,984	31 Assets	Fair
Barrier	Fencing	\$2,730,198	4,502 Assets	Good
Barrier	Retaining Wall	\$195,632	4 Assets	Good
Facility	Structure	\$1,805,794	13,147 sq ft	Good
Facility	Warehouse	\$40,806	300 sq ft	Fair
Facility	Washroom	\$5,197,735	16,683 sq ft	Very Good
Facility	Works Yard	\$734,217	1,726 sq ft	Very Good
Furnishings, Fixtures & Equipment	Furnishings	\$4,954,777	361 Assets	Fair
Furnishings, Fixtures & Equipment	Furniture	\$53,346	11 Assets	Fair
Furnishings, Fixtures & Equipment	Program	\$21,000	4 Assets	Very Poor
Lighting	Fixtures	\$4,102,844	75 Assets	Fair

Asset Category	Asset Class	Replacement Cost	Inventory	Average Performance
Lighting	Poles	\$10,206,982	50 Assets	Good
Public Realm OR Urban Design OR Streetscape	Public Realm OR Urban Design OR Streetscape	\$5,963,162	158 Assets	Good
Site Servicing	Irrigation System	\$5,068,921	87 Assets	Fair
Total	-	\$105,627,813	-	-

G.1.2 Age and Estimated Service Life

Figure G - 5 illustrates the age of parks assets as a proportion of their estimated service life. Figure G - 6 illustrates the value of State of the Infrastructure assets acquired by decade. Generally, parks assets are on average a third through their estimate service life. Program assets have average ages that exceed their average ESLs.

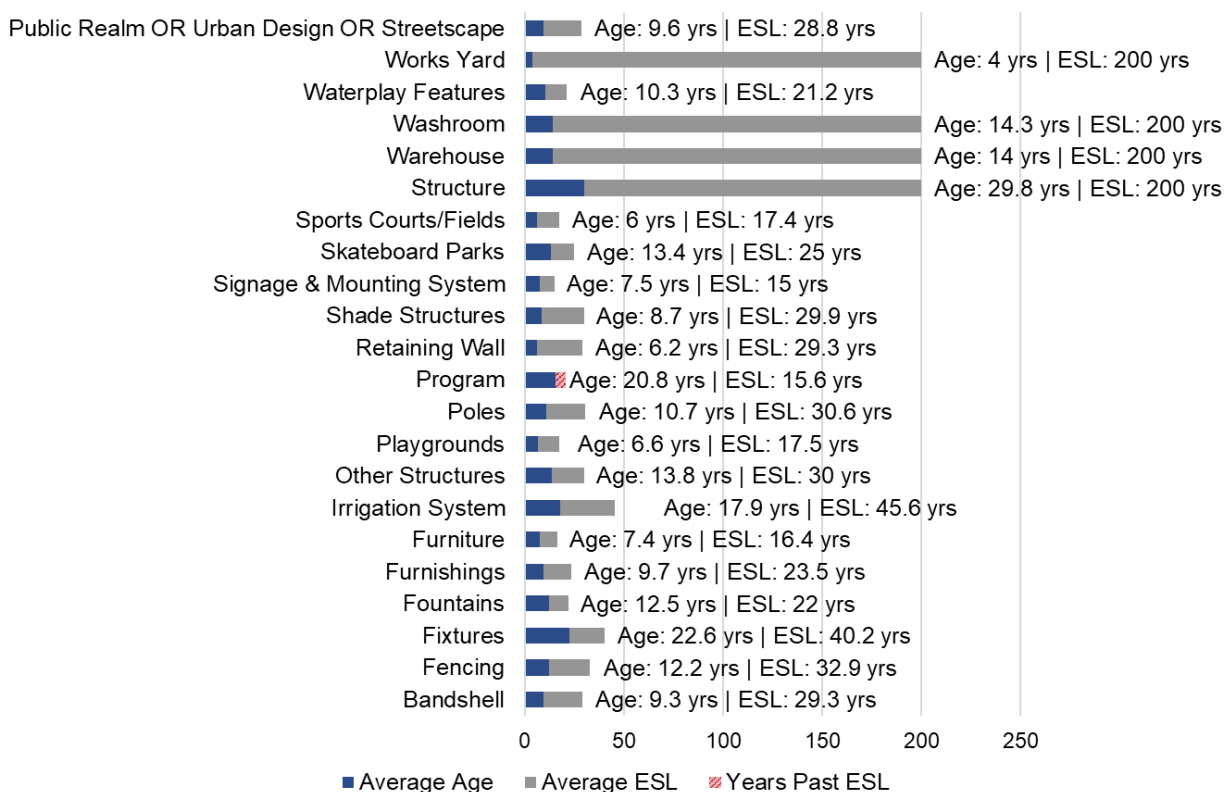


Figure G - 5: Age as a proportion of estimated service life (ESL) of Parks assets.

The installation profile of parks assets illustrates that the majority of assets were installed from the 2010s through to the 2020s, due to significant growth and development in the City.

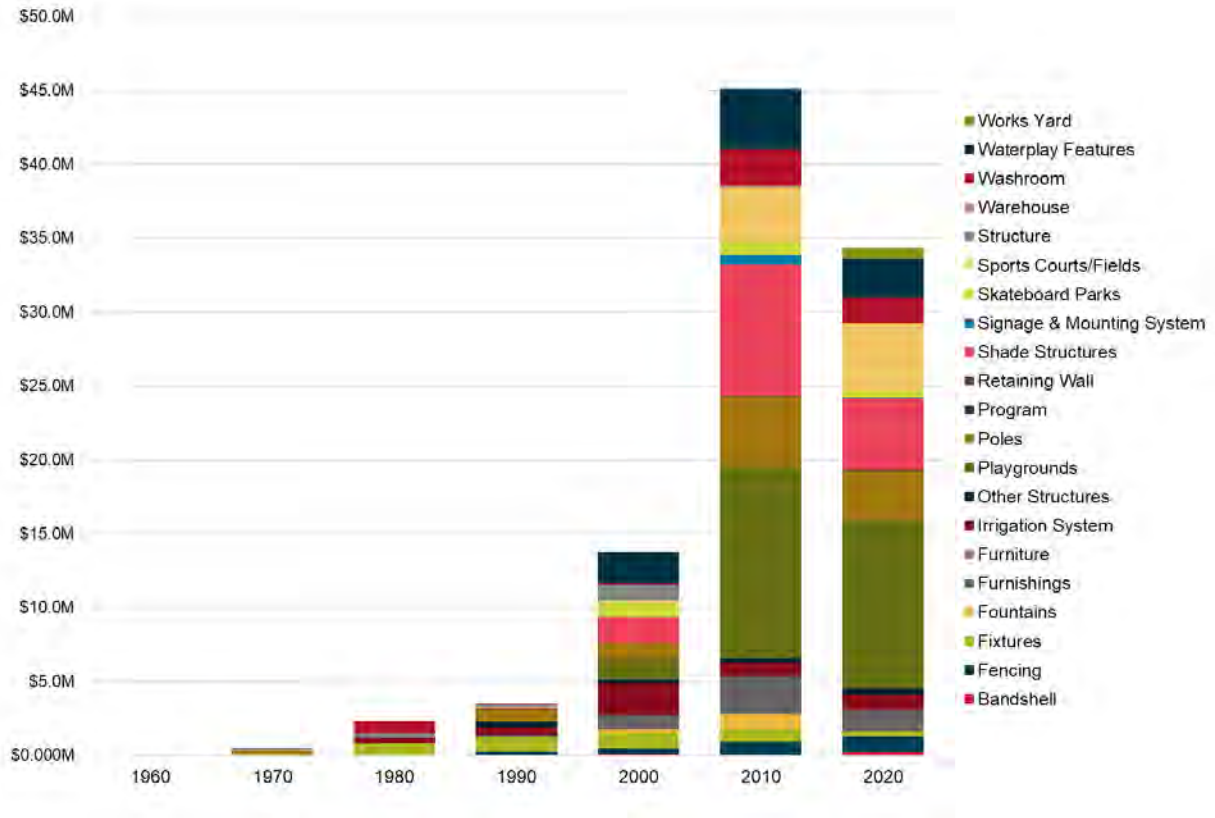


Figure G - 6: Age distribution by installation decade of Parks assets.

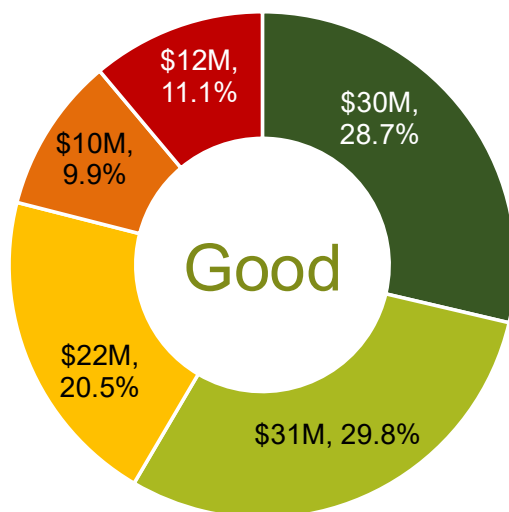
G.1.3 Asset Performance

Table G - 2 details the approaches that the City utilizes to understand the performance of parks assets.

Table G - 2: Performance assessment approaches to Park assets.

Asset Class	Condition Rating Metric	Approach to Assessing Condition
Structure, Warehouse, Washroom, and Works Yard	FCI	Facilities are inspected and the inspection results are recorded in City's database annually. The results are used to understand facility renewal needs and calculate the FCI rating.
Fencing, Fixtures, Shade Structures, Other Structures, Waterplay Features, Sports Courts/Fields, Furnishings, Public Realm/Urban Design/Streetscape, Retaining Wall, Poles, Irrigation System, Signage & Mounting System, Playgrounds, Skateboard Parks, Fountains, Bandshell, Furniture, and Program	Age/ESL	The City understands the condition of these assets based on asset age and estimated service life.

Figure G - 7 captures the performance of all Park assets. Figure G - 8 and Figure G - 9 show the performance distribution of park assets by asset class. Table G - 3 summarizes the relationship between the performance categories and how performance ratings are determined.



■ Very Good ■ Good ■ Fair ■ Poor ■ Very Poor

Figure G - 7: Performance distribution of Parks assets.

Table G - 3: Performance rating of Parks assets.

Condition Category	Age/ESL	Facility Condition Index (FCI)
Very Good	0% - 20%	0% - 5%
Good	20% - 40%	5% - 10%
Fair	40% - 60%	10% - 30%
Poor	60% - 80%	30% - 60%
Very Poor	>80%	60 - 100%

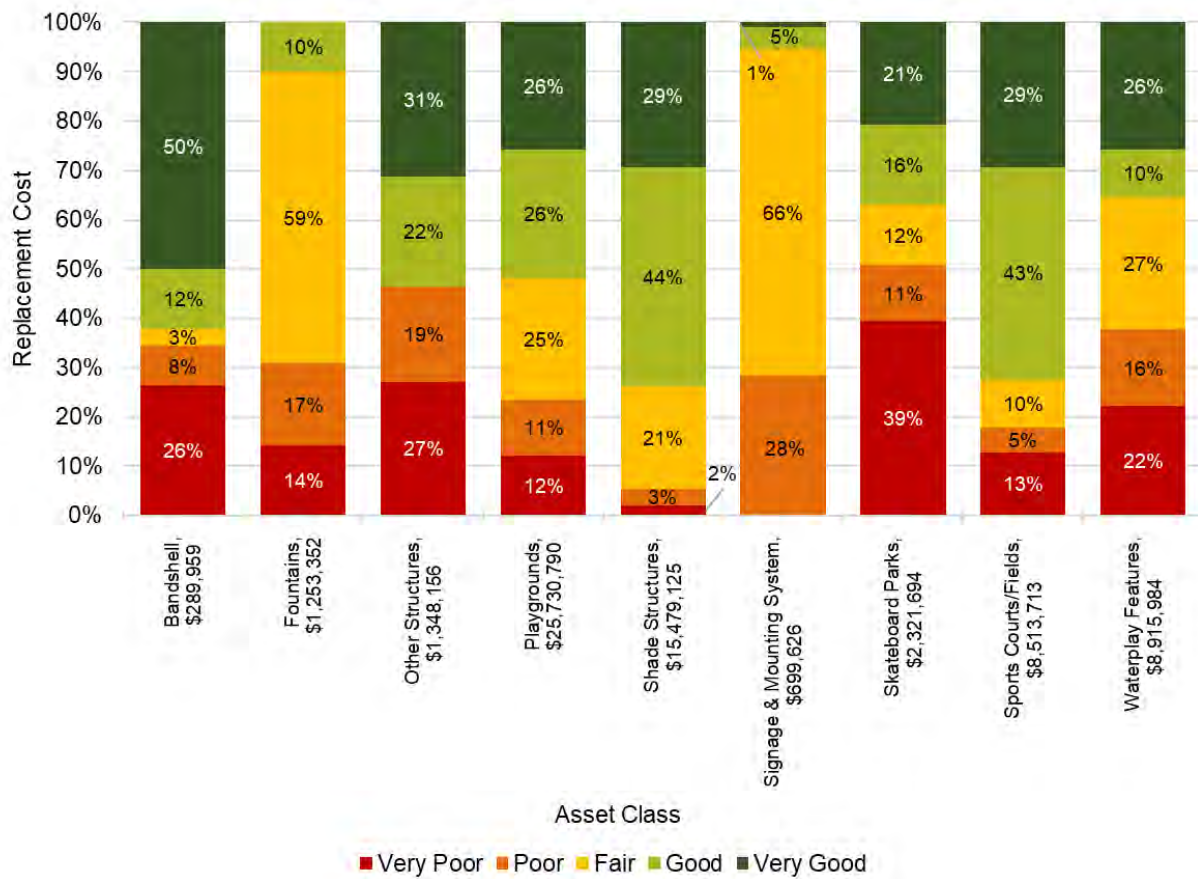


Figure G - 8: Condition distribution of Parks assets (Amenities only).

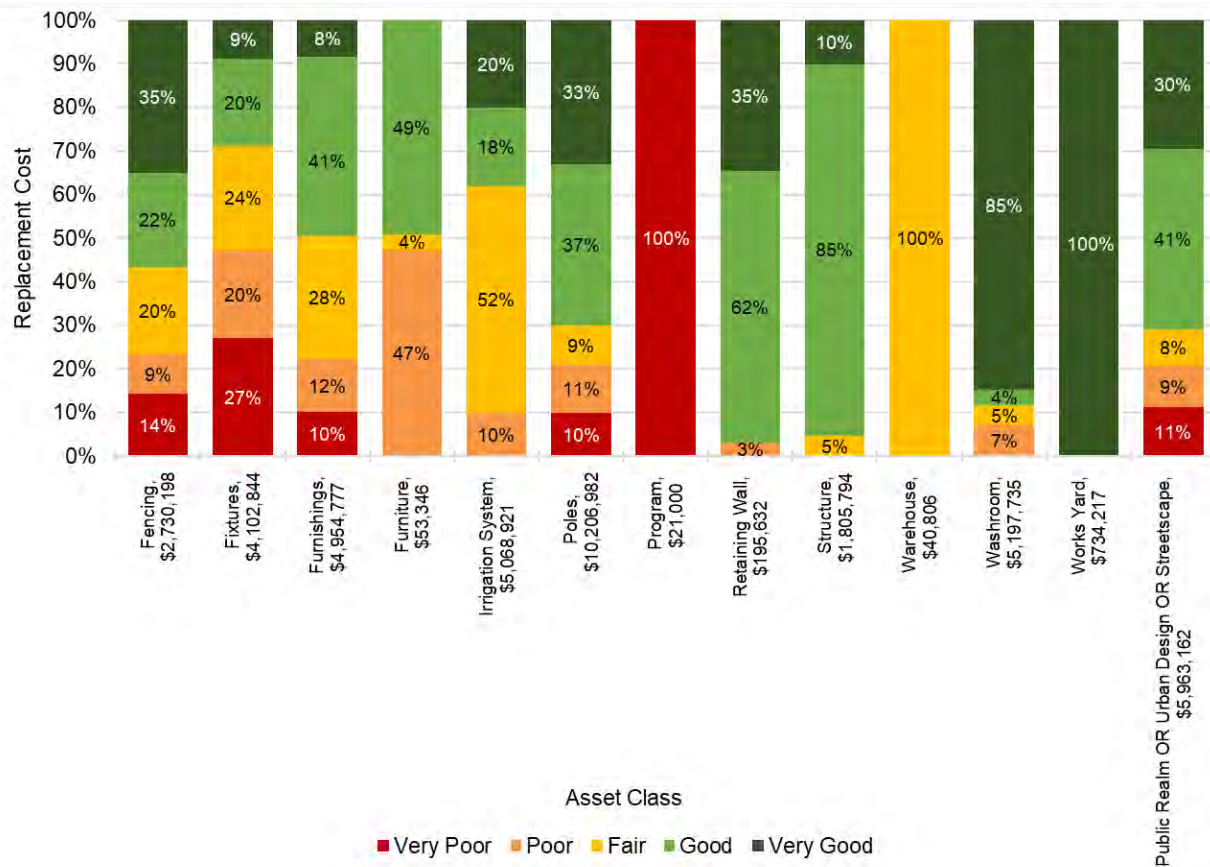


Figure G - 9: Condition distribution of Parks assets (Facilities, Barrier, FF&E, Lighting, Streetscapes, and Site Servicing).

G.2 Levels of Service

Customer values, customer levels of service and technical levels of service for parks assets can be found in Table G - 4 to Table G - 9.

G.2.1 Customer Values

Table G - 4: Parks customer values.

Customer Satisfaction Measure		Current Feedback & Expected Trend Based on Planned Budget
Park assets are safe and reliable to use		
Assets are maintained in a state of good repair, are adequate for use, and in overall good working condition.		Future Iterations ²⁴
Park assets offer convenience to the customer		
The quality of assets does not negatively affect the customer.		Future Iterations ²⁴
Park assets are accessible.		Future Iterations ²⁴
Aesthetic Quality		
Park assets meet aesthetic expectations.		Future Iterations ²⁴

²⁴ The City is currently reviewing the data that supports this metric, which will be reported in future iterations of the City's AMP. These metrics are subject to change as data is reviewed and incorporated into future AMPs.

G.2.2 Customer and Technical Levels of Service

Table G - 5: Parks – Amenities, Barriers, and Lighting customer LoS.

Type of Measure	Level of Service	Performance Measure	Current Performance	Confidence Levels
Condition	Condition of Amenities/Park Components	Condition or Age/Remaining Useful Life - Aggregated into 5-point rating scale	Very Good: \$21.8M (26.6%) Good: \$24.3M (29.7%) Fair: \$16.8M (20.5%) Poor: \$8.4M (10.3%) Very Poor: \$10.5M (12.9%)	Low to medium – age and ESL are used to assess for condition. Condition data is unavailable.
Condition	Individual element/element group condition.	Percentage of all elements/element groups in very poor to poor condition	23%	Low to medium – age and ESL are used to assess for condition. Condition data is unavailable.
Function	Measure of whether the service is appropriate for its intended use	Future Iterations ²⁵	Future Iterations ²⁵	Future Iterations ²⁵
Capacity	Measure of whether the service is adequate to meet customer needs	Future Iterations ²⁵	Future Iterations ²⁵	Future Iterations ²⁵
Accessibility	Service interruptions	Future Iterations ²⁵	Future Iterations ²⁵	Future Iterations ²⁵

²⁵ The City is currently reviewing and selecting measures for this category, which will be developed and integrated into future iterations of the City's AMP.

Table G - 6: Parks – Facilities customer LoS.

Type of Measure	Level of Service	Performance Measure	Current Performance	Confidence Levels
Condition	Condition of Facilities	Average FCI rating of facilities.	0.04	Medium – condition assessments are performed to determine FCI scores
Condition	Individual element/element group condition.	Percentage of all elements/element groups in very poor to poor condition	5%	Medium – building condition assessments are performed on facilities to determine investment needs but data requires refinement.
Condition	Individual element/element group condition.	Percentage of assets that have not exceeded their ESL.	100%	Medium – building condition assessments are performed on facilities to determine investment needs but data requires refinement.
Function	Measure of whether the service is appropriate for its intended use	Future Iterations ²⁵	Future Iterations ²⁵	Future Iterations ²⁵
Capacity	Measure of whether the service is adequate to meet traffic needs	Future Iterations ²⁵	Future Iterations ²⁵	Future Iterations ²⁵
Accessibility	Service interruptions	Future Iterations ²⁵	Future Iterations ²⁵	Future Iterations ²⁵
Accessibility	Comfort/AODA	Future Iterations ²⁵	Future Iterations ²⁵	Future Iterations ²⁵

Table G - 7: Parks – Furnishings, Fixtures, and Equipment customer LoS.

Type of Measure	Level of Service	Performance Measure	Current Performance	Confidence Levels
Condition	Condition of assets	Percentage of assets that have not exceeded their ESL.	97%	N/A
Condition	Individual element/element group condition.	Percentage of all elements/element groups in poor or very poor condition.	23%	Low to medium – age and ESL are used to assess for condition. Condition data is unavailable.
Function	Measure of whether the service is appropriate for its intended use	Future Iterations ²⁵	Future Iterations ²⁵	Future Iterations ²⁵
Capacity	Measure of whether the service is adequate to meet traffic needs	Future Iterations ²⁵	Future Iterations ²⁵	Future Iterations ²⁵
Accessibility	Service interruptions	Future Iterations ²⁵	Future Iterations ²⁵	Future Iterations ²⁵
Accessibility	Comfort/AODA	Future Iterations ²⁵	Future Iterations ²⁵	Future Iterations ²⁵

Table G - 8: Public Realm or Urban Design or Streetscape and Site Servicing customer LoS.

Type of Measure	Level of Service	Performance Measure	Current Performance	Confidence Levels
Condition	Condition of assets	Percentage of assets that have not exceeded their ESL.	100%	N/A
Condition	Individual element/element group condition.	Percentage of all elements/element groups in very poor to poor condition	21%	Low to medium – age and ESL are used to assess for condition. Condition data is unavailable.
Function	Measure of whether the service is appropriate for its intended use.	Future Iterations ²⁵	Future Iterations ²⁵	Future Iterations ²⁵
Capacity	Measure of whether the service is adequate to meet traffic needs.	Future Iterations ²⁵	Future Iterations ²⁵	Future Iterations ²⁵
Accessibility	Service interruptions	Future Iterations ²⁵	Future Iterations ²⁵	Future Iterations ²⁵
Accessibility	Comfort/AODA	Future Iterations ²⁵	Future Iterations ²⁵	Future Iterations ²⁵

Table G - 9: Parks technical LoS.

Lifecycle Activity	Purpose of Activity	Frequency	Current Performance (\$, 2025 Budget)	Recommended Performance
Acquisition	Growth Expansion Development	Projects developed in Integrated Leisure MP	\$3,029,100	Growth Planning Horizon: 2026-2051 Total Acquisition Value Range: \$203.8M - \$296.4M City Funded Acquisition Value Range: \$203.8M - \$296.4M
Operation	Inspections	Frequency	\$138,457 The City's 2025 operating budget for all services was \$495.8M.	Maintain current performance for assets in service. Anticipated operating budget increase ranges from \$5.4M to \$7.9M over the growth planning horizon: 2026-2051.
Operation	Regular Operations	Frequency	See above	See above
Maintenance	Minor repairs	As required	\$319,614	Maintain current performance for assets in service. Anticipated maintenance budget increases are included in the operating or renewal budget forecasts.
Maintenance	Regular Maintenance	Frequency	See above	See above
Maintenance	Major maintenance (holding strategies)	As required	See above	See above

Lifecycle Activity	Purpose of Activity	Frequency	Current Performance (\$, 2025 Budget)	Recommended Performance
Renewal	Major rehabilitation or replacement	As required	\$6,349,957 (City's LCRS)	PLoS Maintain Current Performance requires \$4.20M per year on average from 2026 to 2051.
Disposal	Disposal of replaced assets	Each	Included with renewal costs	Maintain current performance for assets in service.
Service Improvement	Upgrades to improve LoS to benefit existing serviced areas	As required	\$1,172,300	Maintain Current Performance

G.3 Risk Management Strategy

The criteria used to determine the consequence of failure for Risk Management Strategy assets can be found in Table G - 10 below.

Table G - 10: COF criteria used for Parks assets.

Direct Financial	Socio-Economic	Environmental
• Replacement cost	• Asset Class	Not expected to have significant consequences on the environment

Table G - 11 displays the risk score for Parks assets along with the proportion of assets within each risk score, likelihood of failure and consequence of failure.

Table G - 11: Risk score distribution of Parks assets.

	COF 1	COF 2	COF 3	COF 4	COF 5	Subtotal
LOF 1	\$254,081 (0.2%)	\$18,565,999 (17.6%)	\$11,459,536 (10.8%)	None	None	\$30,279,615 (28.7%)
LOF 2	\$922,057 (0.9%)	\$20,704,961 (19.6%)	\$9,840,896 (9.3%)	None	None	\$31,467,914 (29.8%)
LOF 3	\$1,181,516 (1.1%)	\$16,413,526 (15.5%)	\$4,076,586 (3.9%)	None	None	\$21,671,628 (20.5%)
LOF 4	\$230,231 (0.2%)	\$9,234,272 (8.7%)	\$1,012,512 (1.0%)	None	None	\$10,477,016 (9.9%)
LOF 5	\$24,740 (<0.1%)	\$10,010,049 (9.5%)	\$1,696,851 (1.6%)	None	None	\$11,731,640 (11.1%)
Subtotal	\$2,612,626 (2.5%)	\$74,928,806 (70.9%)	\$28,086,381 (26.6%)	None	None	\$105,627,813 (100.0%)

Table G - 12: Risk score mapping legend.

Risk	Risk Score	Risk Description	Total Replacement Cost
Very Low	1 – 5	Fit for the Future	\$53,343,121 (50.5%)
Low	6 – 10	Adequate for Now	\$49,575,329 (46.9%)
Moderate	11 – 15	Requires Attention	\$2,709,363 (2.6%)
High	16 – 20	At Risk	None
Very High	21 – 25	Unfit for Sustained Service	None

G.4 Lifecycle Management Activities

The City's lifecycle management activities for Parks assets are listed in Table G - 9. These activities include the acquisition of assets and service improvements, operations and maintenance, major asset renewals (including rehabilitations and replacements), and disposals.

These lifecycle management activities in conjunction with the lifecycle forecasting are used to determine the funding required for the City to continue performing these lifecycle activities to extend asset life, reduce overall costs, and minimize risk while providing the proposed service levels.

G.5 Lifecycle Forecasting

The following section outlines the funding required for the entire lifecycle of parks assets. The expenditures were determined using the lifecycle activities outlined in Table G - 9 and the PLoS established. Required funding was determined using the following forecasting analysis scenario:

- Proposed LoS – Maintain Current Performance:** funding required to maintain a similar asset performance over a 26-year period. The City has established this LoS as the PLoS for parks assets. It focuses on maintaining the percentage of assets in backlog in a similar state. Backlog is defined as assets that are in need of renewal work (either significant rehabilitation or replacement). For example, if 20% of assets are past their service life, or are in need of renewal work, then the forecast model will determine the funding to maintain 20% of assets in this state over the forecast period.

The following table summarizes the anticipated funding from the City's Life Cycle Reserve Study for renewal activities for parks assets. A total of **\$114.1M** over the next 26 years (or an equivalent average annual of **\$4.4M**) for renewals is anticipated to be spent.

Table G - 13: Forecasted capital renewal expenditures (Life Cycle Reserve Study) for Parks assets.

Year	Capital Expenditures (Renewals)
2026	\$4,294,174
2027	\$3,464,015
2028	\$3,738,495
2029	\$5,388,807
2030	\$3,717,946
2031	\$4,846,171

Year	Capital Expenditures (Renewals)
2032	\$4,402,560
2033	\$5,963,670
2034	\$4,199,219
2035	\$6,080,668
2036	\$4,975,391
2037	\$5,716,518
2038	\$4,889,635
2039	\$5,541,117
2040	\$4,565,300
2041	\$3,601,782
2042	\$4,747,129
2043	\$4,187,023
2044	\$4,237,130
2045	\$3,197,573
2046	\$4,558,978
2047	\$4,838,725
2048	\$2,812,598
2049	\$4,388,102
2050	\$2,698,195
2051	\$3,096,134
Total	\$114,147,055
Equivalent Average Annual	\$4,390,271

Table G - 10 and Figure G - 11 illustrate the performance and financial forecasts to achieve PLoS for all Parks assets. The forecast analysis identified a total of **\$109.2M** (or an equivalent average annual of **\$4.2M**) that is anticipated to be spent over the next 26 years to maintain current performance. The City plans to spend a total of **\$114.1M** (or an equivalent average annual of **\$4.4M**). This shows that the City's forecasted capital renewal expenditures (LCRS) are appropriate to maintain assets in a SOGR, and funding levels are adequate.

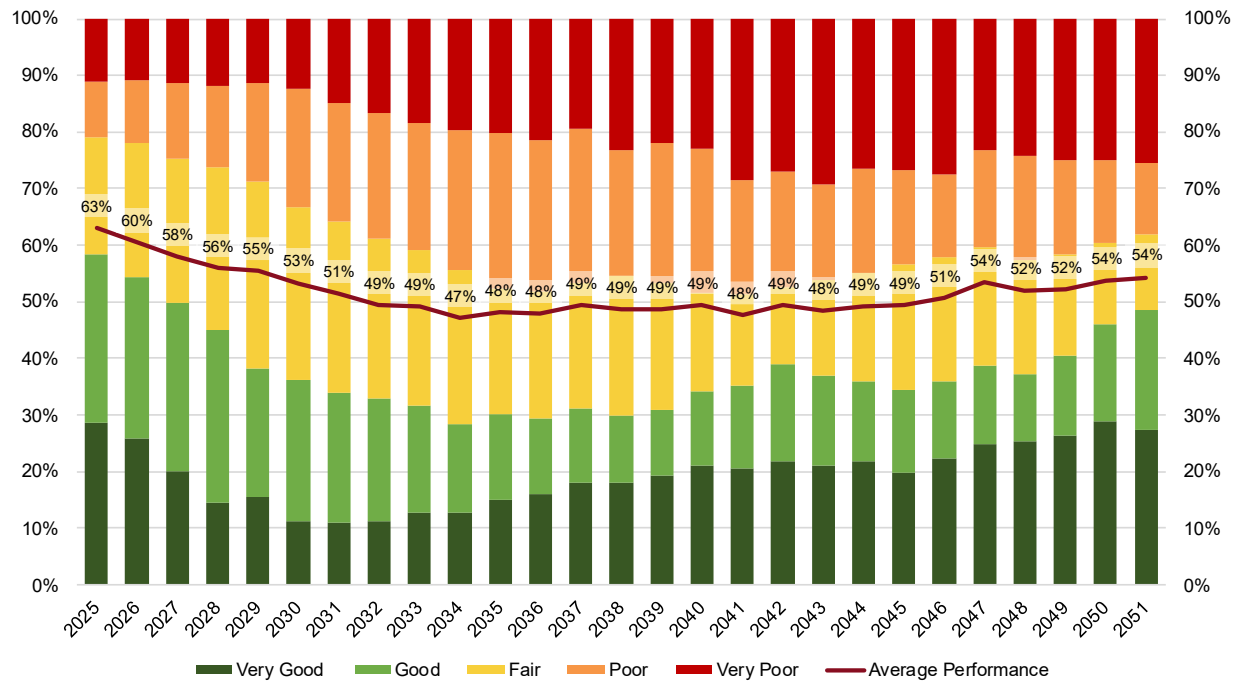


Figure G - 10: Performance distribution – maintain current performance for Parks assets.

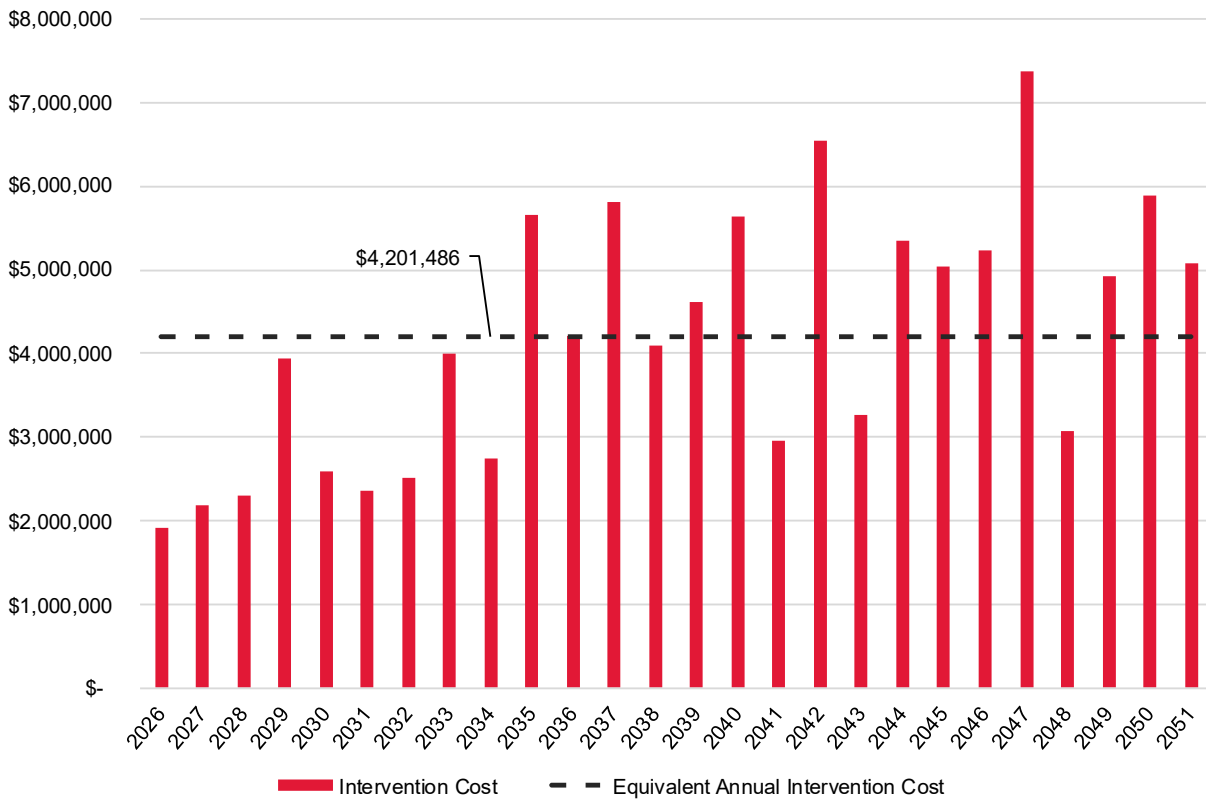


Figure G - 11: Maintain current performance intervention costs for Parks assets.

G.6 Proposed Levels of Service Themes & Future Challenges

The customer values and customer LoS were discussed with stakeholders. The following summarizes the feedback from the stakeholders related to service delivery, customer expectations, and challenges faced by the City, particularly challenges that may be encountered in the future:

Table G - 14: Proposed LoS themes for Parks assets.

Challenge	Discussion
Customer Expectations	- Convenient parks have appropriate layouts. - Aesthetic quality is extended to functional value and perceived community value (equitable distribution). Some parks are filled with many different amenities. - Changing neighbourhoods will result in maturing demographics. Older parks should be modernized to reflect the needs of today's residents.
Growth & Sustainability	- The City needs to prepare for the future impact of new strataparks. - The Parks Redevelopment Strategy will change how older parks are dealt with. There will be a different funding method and new financial pressures. - More traditional shade structures like gazebos are being installed which provide more shade but cost more.
Trails	- Paving more trails will require establishing LoS for clearing them in the winter and performing inspections which will cause an increase in operating costs. - There is a balance between maintaining a pathway network for all residents but not paving everything to keep a natural approach.

The insight from this discussion will be considered and incorporated into the City's AM processes and future iterations of the AMP. As the City continues to grow, it is important that current and future challenges are addressed in order to maintain service levels and achieve proposed service levels.

Appendix H. Library

Service Summary



Replacement Value
\$51.1 Million

Fair

Overall Performance
★★★★☆



Quantity
55,523 ft² of libraries (3 libraries)
764,176 collections assets

The City of Markham's Library promotes to enrich, inspire, empower and link the community through the many resources and services. It proudly works to promote literacy, a lifelong love of learning, and a culture of reading.

Markham is responsible for assets such as various facilities, furnishings, fixtures and equipment, as detailed in Figure H - 1.



Figure H - 1: Library hierarchy.

More information on Library such as state of infrastructure, levels of service, risk management strategies and lifecycle management strategies and forecasting can be found in the following sections.

H.1 State of the Infrastructure

Figure H - 2 shows the replacement value of Library assets while Figure H - 3 illustrates the replacement value of Library Furnishings, Fixtures & Equipment assets by asset class. The total replacement value for Library assets is \$51.1M.

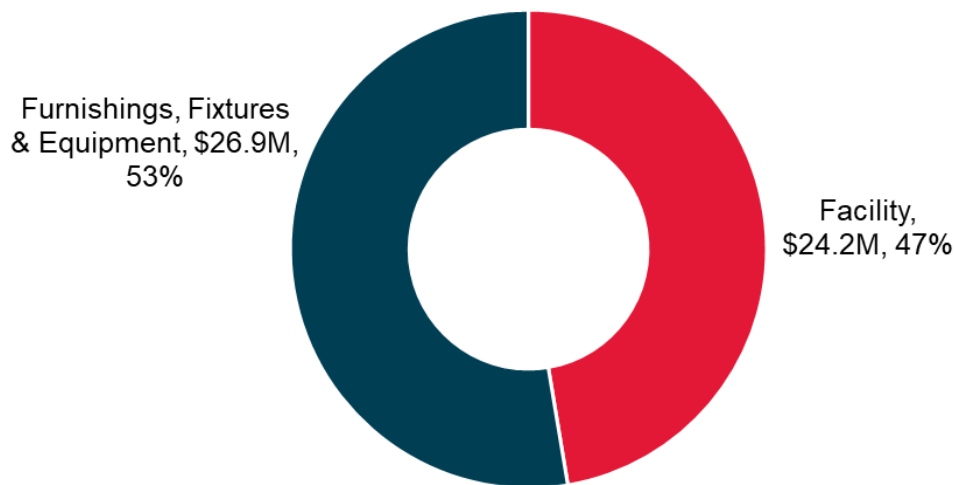


Figure H - 2: Replacement value distribution of Library assets.

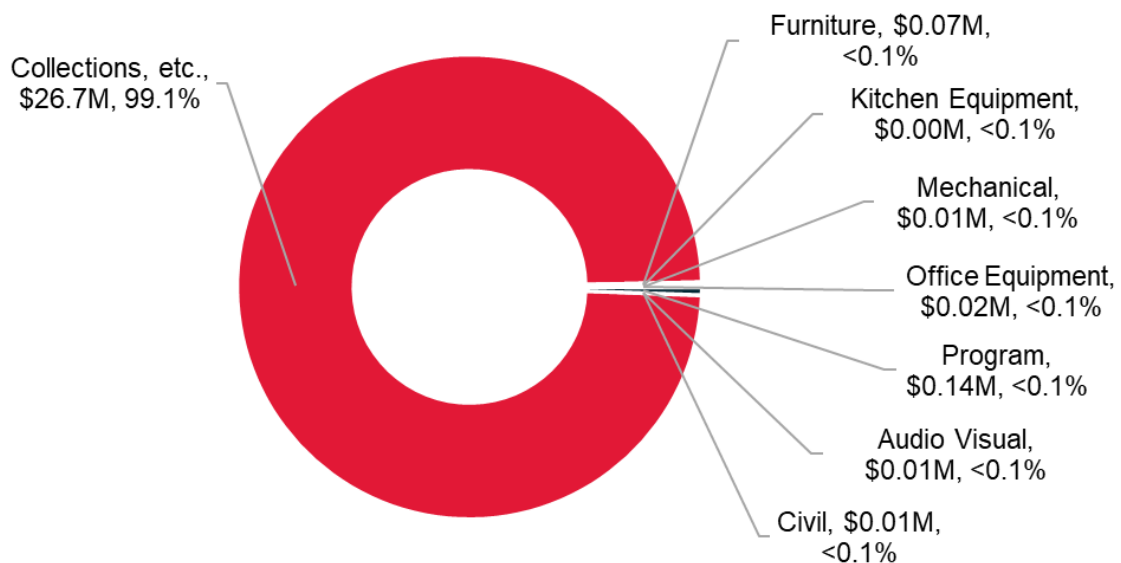


Figure H - 3: Replacement value of Library Furnishings, Fixtures, and Equipment by asset class.

H.1.1 Asset Inventory and Valuation

Table H - 1 below summarizes the asset valuation, quantities, and performance for each asset category of Library assets.

Table H - 1: Inventory and valuation for Library assets.

Asset Category	Asset Class	Replacement Cost	Inventory	Average Condition
Facility	Library Facility	\$24,214,323	55,523 sq ft	Very Good
Furnishing, Fixtures, and Equipment	Audio Visual	\$5,500	1 Asset	Poor
Furnishing, Fixtures, and Equipment	Civil	\$6,000	1 Asset	Very Poor
Furnishing, Fixtures, and Equipment	Collections, etc.	\$26,663,987	764,176 Assets	Poor
Furnishing, Fixtures, and Equipment	Furniture	\$71,393	11 Assets	Fair
Furnishing, Fixtures, and Equipment	Kitchen Equipment	\$4,035	5 Assets	Very Poor
Furnishing, Fixtures, and Equipment	Mechanical	\$10,000	1 Asset	Very Poor
Furnishing, Fixtures, and Equipment	Office Equipment	\$17,196	1 Asset	Good
Furnishing, Fixtures, and Equipment	Program	\$135,227	11 Assets	Fair
Total	-	\$51,127,662	-	-

The overall performance for library assets has changed from the 2024 AMP. The decline in performance from very good to fair is as a result of the asset inventory data used to develop this AMP, specifically for library collections, has been updated and their

performance evaluation based upon age and estimated service life. Age and estimated service life methodology is typically used as a proxy in the absence of actual physical condition ratings.

H.1.2 Age and Estimated Service Life

Figure H - 4 illustrates the age of Library assets as a proportion of their estimated service life. Figure H - 5 illustrates the value of Library assets acquired by decade.

Collections, etc., is the only asset group with an average age past the average ESL. While the estimated service life of collection assets is 7 years, staff regularly review their condition to determine whether they require replacement in the near-term future. Budget allocation and their replacement are considered when their physical condition state deteriorates to a point where these assets can no longer serve their intended purpose.

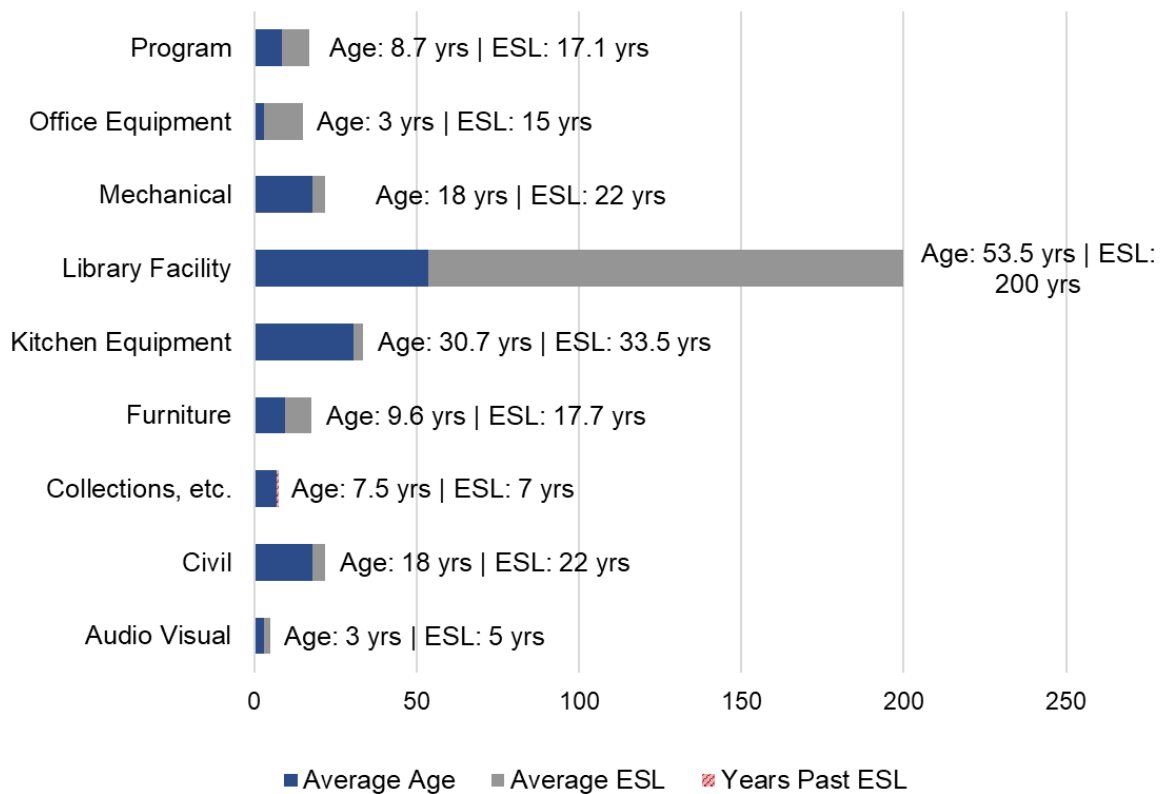


Figure H - 4: Age as a proportion of estimated service life (ESL) of Library assets.

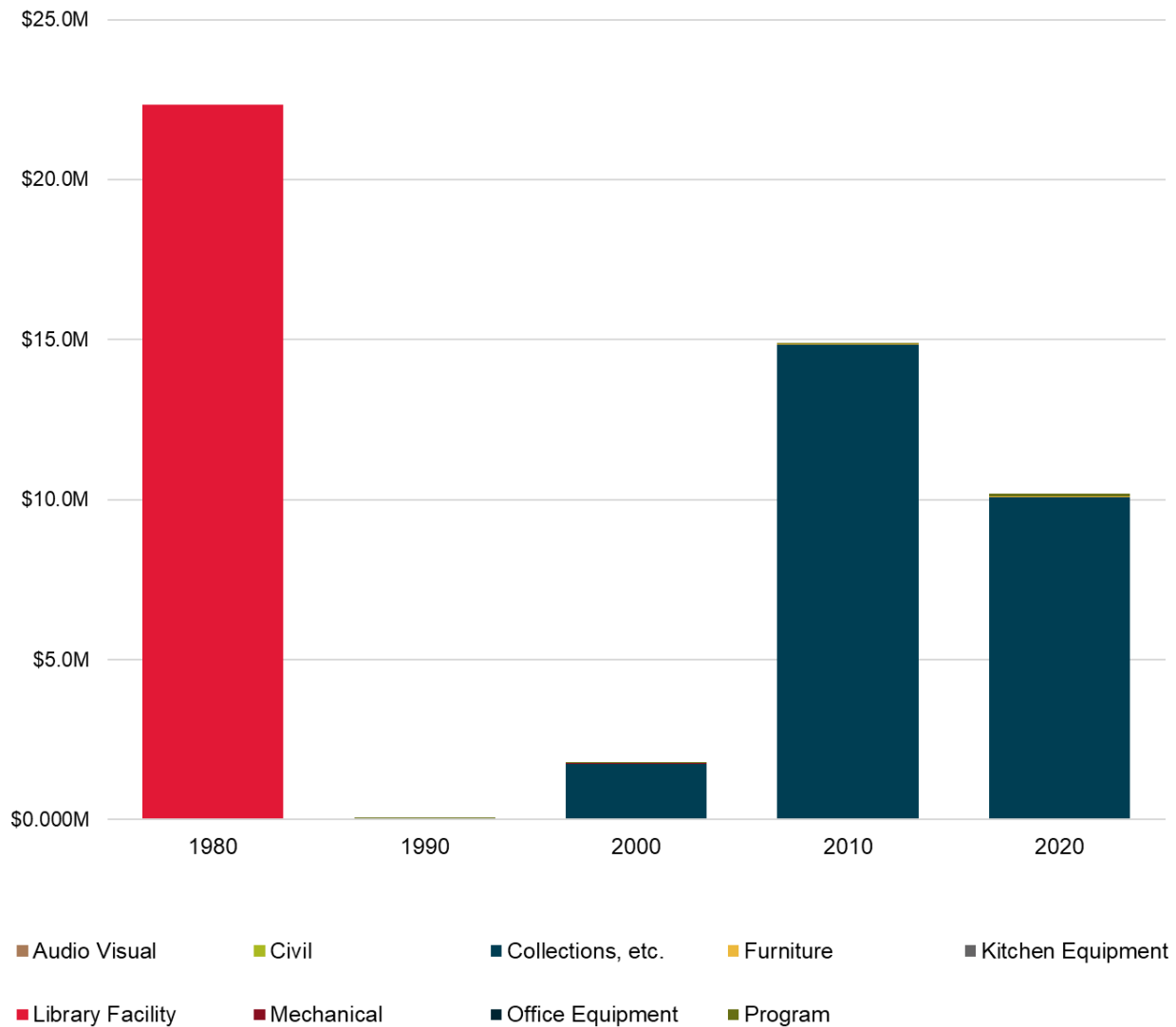


Figure H - 5: Age distribution by installation decade of Library assets.

H.1.3 Asset Performance

Figure H - 5 details the approaches that the City utilizes to understand the performance of Library assets.

Figure H - 5: Performance assessment approaches to Library assets.

Asset Class	Condition Rating Metric	Approach to Assessing Condition
Library Facility	FCI	Facilities are inspected and the inspection results are recorded in City's database annually. The results are used to understand facility renewal needs and calculate the FCI rating.
Collections, etc.	Age/ESL	Material being returned is assessed constantly to ensure it is fit to re-enter circulation, collection maintenance is ongoing for currency and accuracy.
Furniture	Age/ESL	The City understands the condition of these assets based on asset age and estimated service life
Audio Visual	Age/ESL	See above
Mechanical	Age/ESL	See above
Program	Age/ESL	See above
Civil	Age/ESL	See above
Office Equipment	Age/ESL	See above
Kitchen Equipment	Age/ESL	See above

Figure H - 6 illustrates the performance distribution of the Library services asset portfolio, while Figure H - 7 shows the performance distribution of Library assets by asset class. Table H - 2 summarizes the relationship between the performance categories and how performance ratings are determined.

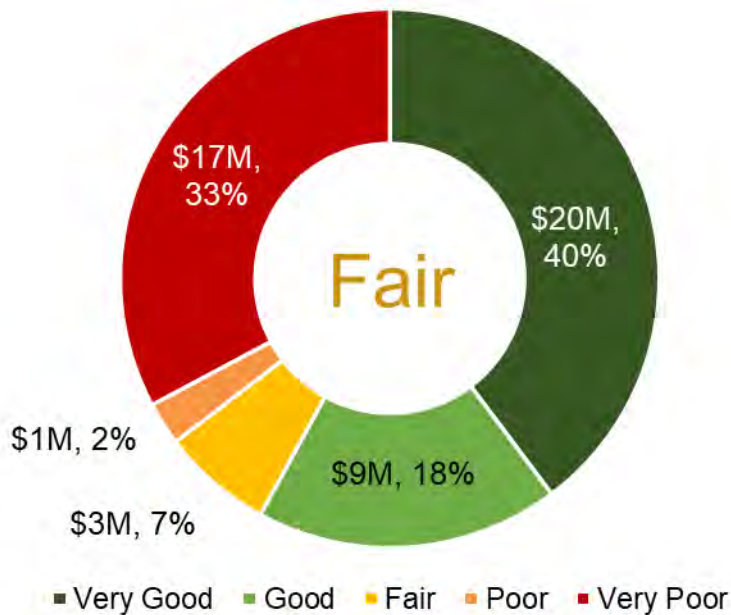


Figure H - 6: Condition distribution of Library assets.

Table H - 2: Performance rating of Library assets.

Condition Category	Age/ESL	Facility Condition Index (FCI)
Very Good	0% - 20%	0% - 5%
Good	20% - 40%	5% - 10%
Fair	40% - 60%	10% - 30%
Poor	60% - 80%	30% - 60%
Very Poor	>80%	60 - 100%

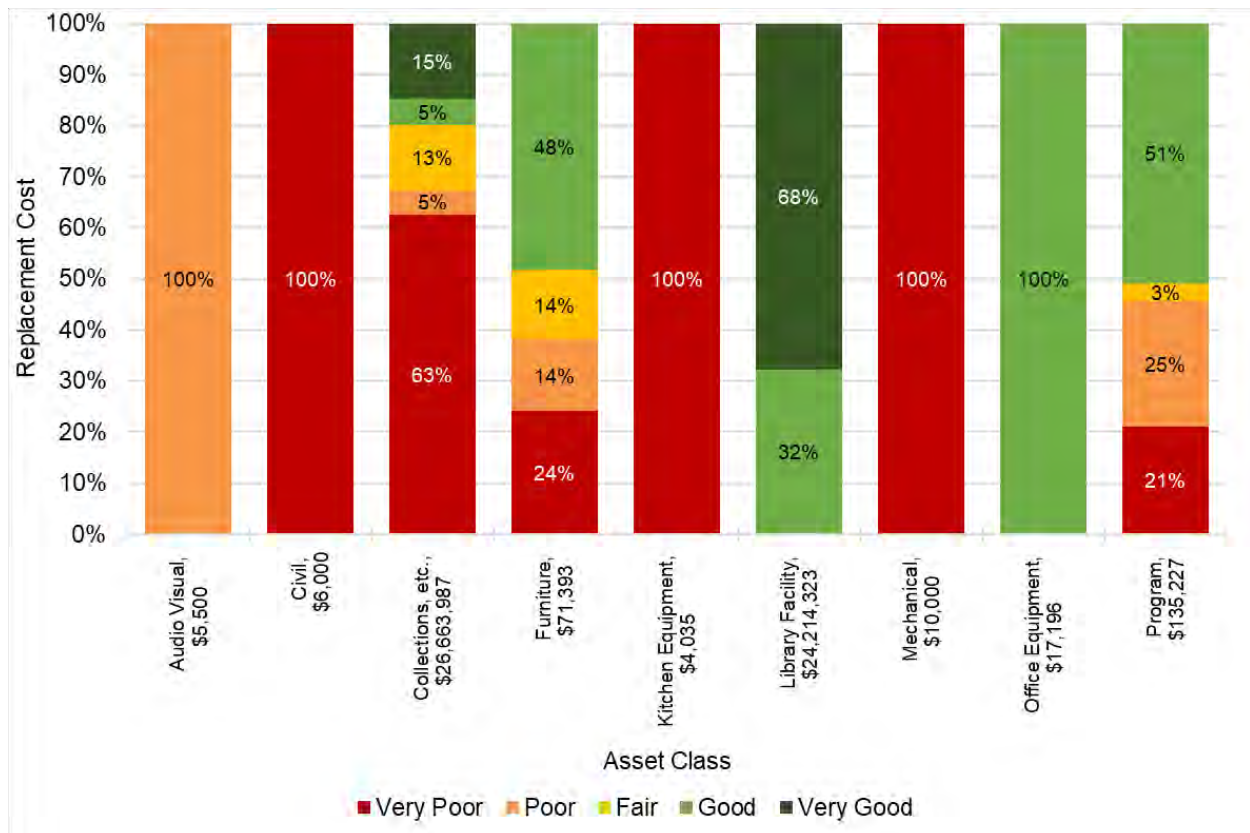


Figure H - 7: Condition distribution of Library assets by asset class.

H.2 Levels of Service

Customer values, customer levels of service and technical levels of service for Library assets can be found in Table H - 3 to Table H - 6.

H.2.1 Customer Values

Table H - 3: Library customer values.

Customer Satisfaction Measure		Current Feedback & Expected Trend Based on Planned Budget
Library assets are safe and reliable to use		
Assets are maintained in a state of good repair, are adequate for use, and in overall good working condition.		Future Iterations ²⁶
Library services are convenient to use		
The quality of assets does not negatively affect the customer.		Future Iterations ²⁶
There are sufficient and appropriate amenities available for all customers.		Future Iterations ²⁶
Library services are accessible.		Future Iterations ²⁶
Aesthetic Quality		
Recreation assets meet aesthetic expectations.		Future Iterations ²⁶
Environmentally sustainable		
Environmental impacts are minimized.		Future Iterations ²⁶

²⁶ The City is currently reviewing the data that supports this metric, which will be reported in future iterations of the City's AMP. These metrics are subject to change as data is reviewed and incorporated into future AMPs.

H.2.2 Customer and Technical Levels of Service

Table H - 4: Facilities customer LoS.

Type of Measure	Level of Service	Performance Measure	Current Performance	Confidence Levels
Condition	Condition of Facilities	Average FCI rating of facilities.	0.04	Confidence Levels: Medium – building condition assessments are performed on facilities to determine investment needs but data requires refinement.
Condition	Individual element/element group condition.	Percentage of all elements/element groups in poor condition.	0%	Confidence Levels: Medium – building condition assessments are performed on facilities to determine investment needs but data requires refinement.
Function	Measure of whether the service is appropriate for its intended use	Future Iterations ²⁷	Future Iterations ²⁷	Future Iterations ²⁷
Capacity	Measure of whether the service is adequate to meet customer needs	Future Iterations ²⁷	Future Iterations ²⁷	Future Iterations ²⁷
Accessibility	Service interruptions	Future Iterations ²⁷	Future Iterations ²⁷	Future Iterations ²⁷

²⁷ The City is currently reviewing and selecting measures for this category, which will be developed and integrated into future iterations of the City's AMP.

Table H - 5: Furnishings, Fixtures & Equipment customer LoS.

Type of Measure	Level of Service	Performance Measure	Current Performance	Confidence Levels
Condition	Condition of assets	Percentage of assets that have not exceeded their ESL.	53%	Confidence Levels: High – condition assessments are performed regularly on furnishings, machinery and equipment to determine if assets are still fit for service
Condition	Individual element/element group condition.	Percentage of all elements/element groups in poor or very poor condition	67%	Confidence Levels: High – condition assessments are performed regularly on furnishings, machinery and equipment to determine if assets are still fit for service
Function	Measure of whether the service is appropriate for its intended use	Future Iterations ²⁷	Future Iterations ²⁷	Future Iterations ²⁷
Capacity	Measure of whether the service is adequate to meet customer needs	Future Iterations ²⁷	Future Iterations ²⁷	Future Iterations ²⁷
Accessibility	Service interruptions	Future Iterations ²⁷	Future Iterations ²⁷	Future Iterations ²⁷

Table H - 6: Library technical LoS.

Lifecycle Activity	Purpose of Activity	Frequency	Current Performance (\$, 2025 Budget)	Recommended Performance
Acquisition	Growth Expansion Development	Projects developed in Integrated Leisure Master Plan and Library Strategic Plan	-	Growth Planning Horizon: 2026-2051 Total Acquisition Value Range: \$86.23 - \$118.85M City Funded Acquisition Value Range: \$86.23 - \$118.85M
Operation	Inspections	Annual programs	\$13,157 The City's 2025 operating budget for all services was \$495.8M.	Maintain current performance for assets in service. Anticipated operating budget increase ranges from \$2.3M to \$3.2M over the growth planning horizon: 2026-2051.
Operation	Regular Operations	As required	See above	See above
Maintenance	Minor repairs	As required	\$23,314	Maintain Current Performance for assets in service. Anticipated maintenance budget increases are included in the operating or renewal budget forecasts.
Maintenance	Regular Maintenance	Annual programs	See above	See above

Lifecycle Activity	Purpose of Activity	Frequency	Current Performance (\$, 2025 Budget)	Recommended Performance
Maintenance	Major maintenance (holding strategies)	As required	See above	See above
Renewal	Major rehabilitation or replacement	As required	\$3,850,657 (City's LCRS)	PLoS Maintain Current Performance requires \$2.17M per year on average from 2026 to 2051.
Disposal	Disposal of replaced assets	As required	Included in renewal costs	Maintain current performance for assets in service.
Service Improvement	Upgrades to improve LoS to benefit existing serviced areas	As required	-	Maintain LoS – The City continues to assess needs annually to determine and balance appropriate funding levels to support service improvement activities.

H.3 Risk Management Strategy

The criteria used to determine the consequence of failure for Library assets can be found in Table H - 7 below.

Table H - 7: COF criteria used for Library assets.

Direct Financial	Socio-Economic	Environmental
Replacement Cost	- Facility Size - Asset Class	N/A

Table H - 8 displays the risk score for Library assets along with the proportion of assets within each risk score, likelihood of failure and consequence of failure.

Table H - 8: Risk score distribution of Library assets.

	COF 1	COF 2	COF 3	COF 4	COF 5	Subtotal
LOF 1	\$3,925,448 (7.7%)	None	\$16,397,863 (32.1%)	None	None	\$20,323,311 (39.8%)
LOF 2	\$1,453,510 (2.8%)	\$1,919,463 (3.8%)	\$5,948,587 (11.6%)	None	None	\$9,321,559 (18.2%)
LOF 3	\$3,388,571 (6.6%)	\$9,800 (<0.1%)	None	None	None	\$3,398,371 (6.6%)
LOF 4	\$1,311,305 (2.6%)	\$15,500 (<0.1%)	None	None	None	\$1,326,805 (2.6%)
LOF 5	\$16,724,416 (32.7%)	\$33,200 (0.1%)	None	None	None	\$16,757,616 (32.8%)
Subtotal	\$26,803,249 (52.4%)	\$1,977,963 (3.9%)	\$22,346,450 (43.7%)	None	None	\$51,127,662

Table H - 9: Risk score mapping legend.

Risk	Risk Score	Risk Description	Total Replacement Cost
Very Low	1 – 5	Fit for the Future	\$45,120,575 (88.3%)
Low	6 – 10	Adequate for Now	\$6,007,087 (11.7%)
Moderate	11 – 15	Requires Attention	None
High	16 – 20	At Risk	None
Very High	21 – 25	Unfit for Sustained Service	None

H.4 Lifecycle Management Activities

The City's lifecycle management activities for Library assets are listed in Table H - 6. These activities include the acquisition of assets and service improvements, operations and maintenance, major asset renewals (including rehabilitations and replacements), and disposals.

These lifecycle management activities in conjunction with the lifecycle forecasting are used to determine the funding required for the City to continue performing these lifecycle activities to extend asset life, reduce overall costs, and minimize risk while providing the proposed service levels.

H.5 Lifecycle Forecasting

The following section outlines the funding required for the entire lifecycle of Library assets. The expenditures were determined using the lifecycle activities outlined in Table H - 6 and the LoS established. Required funding for PLoS was determined using the following parameter:

- Proposed LoS – Maintain Current Performance** – funding required to maintain a similar asset performance over a 26-year period. The City has established this LoS as the PLoS for Library assets. It focuses on maintaining the percentage of assets in backlog in a similar state. Backlog is defined as assets that are in need of renewal work (either significant rehabilitation or replacement). For example, if 20% of assets are past their service life, or are in need of renewal work, then the forecast model will determine the funding to maintain 20% of assets in this state over the forecast period.

The following table summarizes the anticipated funding from the LCRS for renewal activities for Library assets. A total of **\$75.0M** over the next 26 years (or an equivalent average annual of **\$2.9M**) for renewals is anticipated to be spent.

Table H - 10: Forecasted capital renewal expenditures (Life Cycle Reserve Study) for Library assets.

Year	Capital Expenditures (Renewals)
2026	\$3,416,234
2027	\$3,499,316
2028	\$3,817,226
2029	\$3,330,071
2030	\$3,514,446
2031	\$3,285,366
2032	\$3,563,329

Year	Capital Expenditures (Renewals)
2033	\$3,411,606
2034	\$3,158,147
2035	\$3,080,255
2036	\$3,331,078
2037	\$3,160,020
2038	\$2,848,505
2039	\$2,858,355
2040	\$2,771,202
2041	\$3,034,003
2042	\$2,613,685
2043	\$2,601,309
2044	\$2,737,526
2045	\$2,403,517
2046	\$2,449,649
2047	\$2,331,706
2048	\$2,014,624
2049	\$2,205,060
2050	\$1,809,638
2051	\$1,708,989
Total	\$74,954,863
Equivalent Average Annual	\$2,882,879

Figure H - 8 and Figure H - 9 illustrate the performance and financial forecasts for Maintaining the Current Performance (Proposed LoS). The forecast analysis identified a total of **\$56.4M** (or an equivalent average annual of **\$2.2M**) that is anticipated to be spent over the next 26 years to maintain current performance. The City plans to spend a total of **\$75.0M** (or an equivalent average annual of **\$2.9M**). This shows that the City's forecasted capital renewal expenditures (LCRS) are appropriate to maintain assets in a SOGR, and funding levels are adequate.

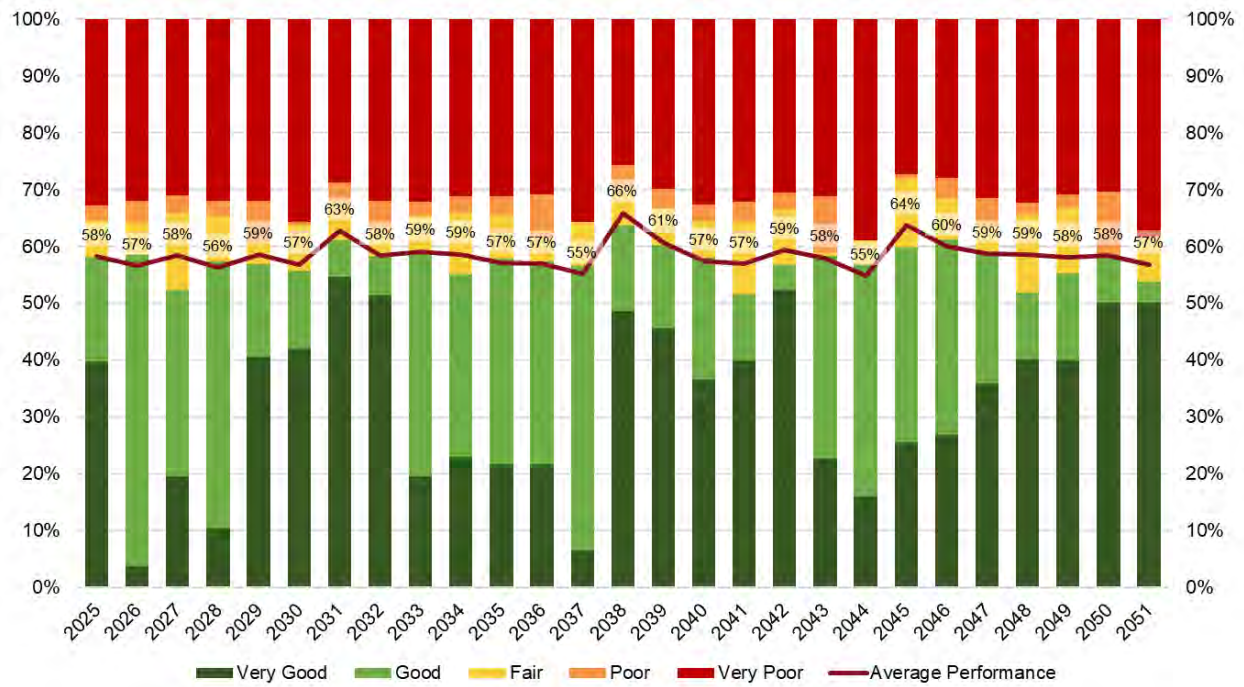


Figure H - 8: Performance distribution – maintain current performance for Library assets.

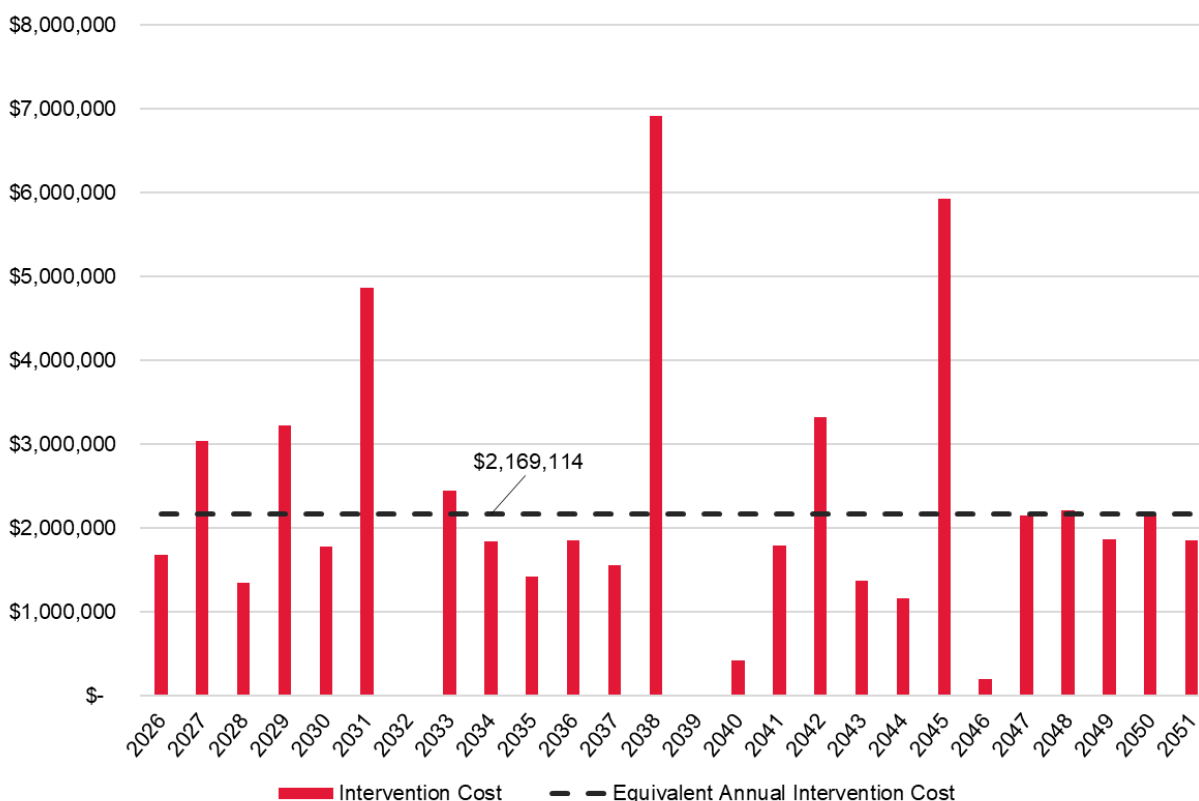


Figure H - 9: Maintain current performance intervention costs for Library assets.

H.6 Proposed Levels of Service Themes & Future Challenges

The customer values and customer LoS were discussed with stakeholders. The following summarizes the feedback from the stakeholders related to service delivery, customer expectations, and challenges faced by the City, particularly challenges that may be encountered in the future:

Table H - 11: Proposed LoS themes for Library assets.

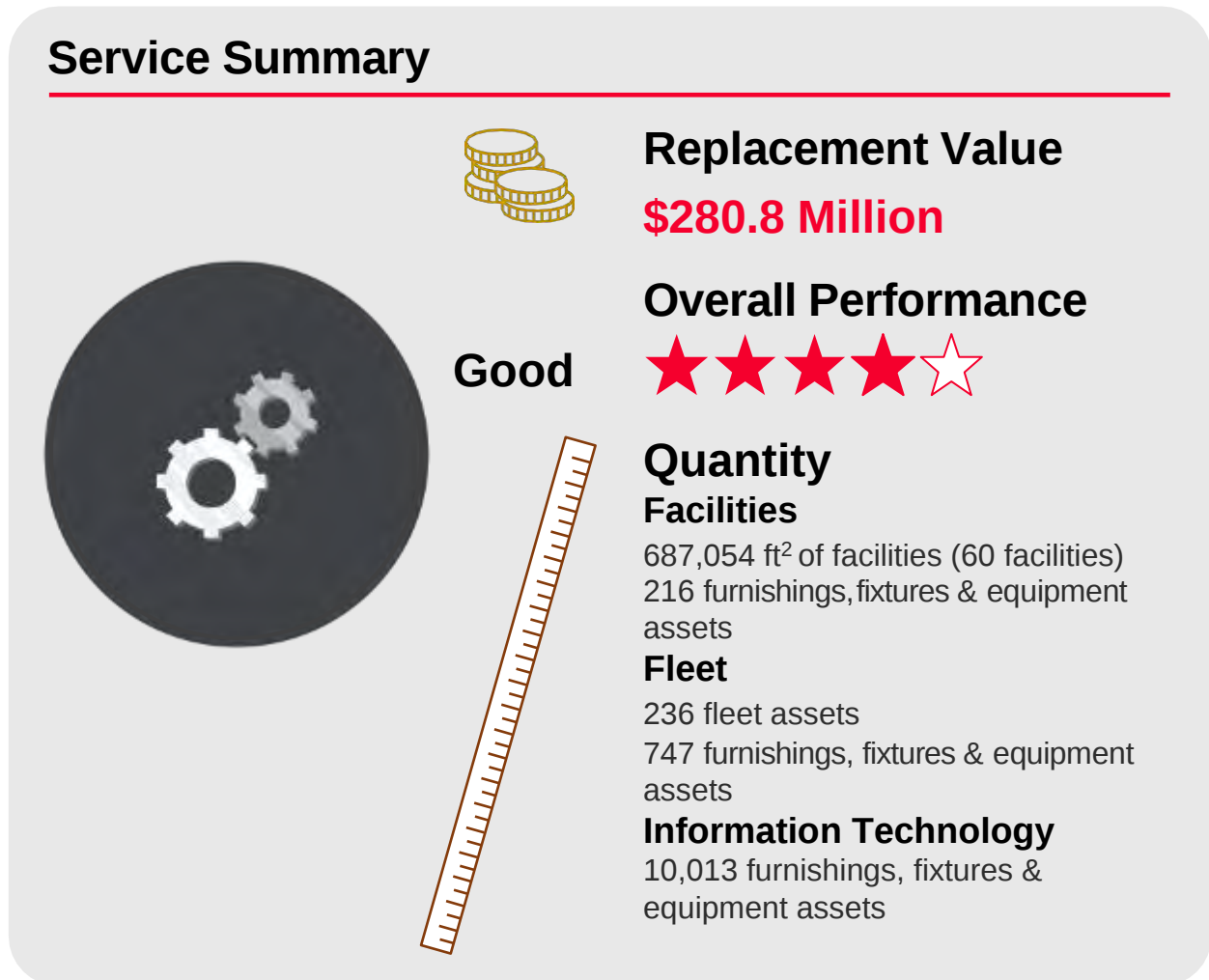
Challenge	Discussion
Reliable	- Libraries should have up to date information. - Reliability is an extension of safety and ensures that staff are well-trained. - Equipment and furnishings function well and are ergonomic.

Challenge	Discussion
Safe	- Both customers and staff want safe spaces (e.g., no violence, health and safety training is provided, etc.). - The shelves are stocked with dependable and valid information. - Ensuring there are no hidden safety hazards.
Convenience	- The right kind of technology is provided and using technology for routine day-to-day operations like self-checkout machines and RFID tagging materials. - Lower shelving is used to make it easier for customers to access materials and remove safety hazards.
Aesthetic Quality	- Providing libraries that are inviting, playful for kids and suited for family time. - A place for all cultures and as the municipality changes, so do libraries.
Sustainability	- Offering services that continue to evolve with the community to meet needs. - Providing materials that can be shared amongst the community to reduce consumption. - Buildings are climate responsible. - The UN mandate for protecting the environment and promoting green building materials is followed.

The insight from this discussion will be considered and incorporated into the City's AM processes and future iterations of the AMP. As the City continues to grow, it is important that current and future challenges are addressed in order to maintain service levels and achieve proposed service levels.

Appendix I. General Support Services

Service Summary



The City of Markham's General Support Service provides support to the municipal government's function while also providing the tools and resources necessary to maintain the City's various assets. Markham is responsible for assets such as various facilities, fleet, furnishings, fixtures and equipment, as detailed in Figure I - 1.

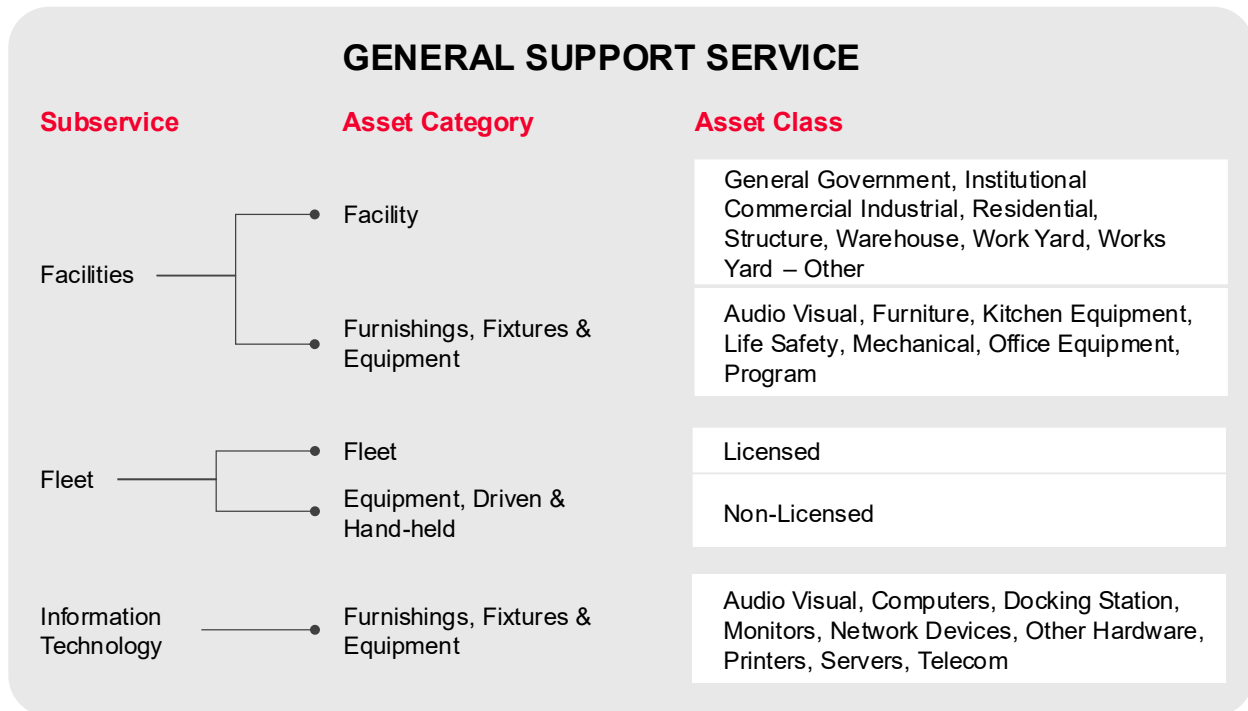


Figure I - 1: General Support Services hierarchy.

More information on General Support Services such as state of infrastructure, levels of service, risk management strategies, lifecycle management strategies and forecasting can be found in the following sections. The sections are split by the major subservices: Facilities, Fleet and Information Technology.

I.1 Facilities

I.1.1 State of the Infrastructure

Figure I - 2 shows the replacement value of Facilities assets while Figure I - 3 and Figure I - 4 illustrate the replacement value of Facilities assets by asset class. The total replacement value for Facilities assets is \$238.4M.



Figure I - 2: Replacement value distribution of Facilities assets.

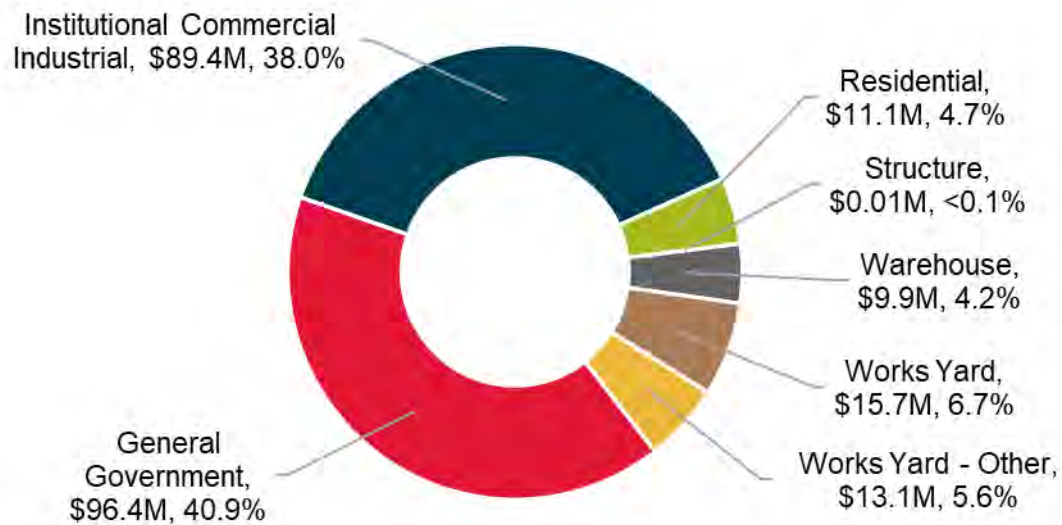


Figure I - 3: Replacement value of Facilities by asset class.

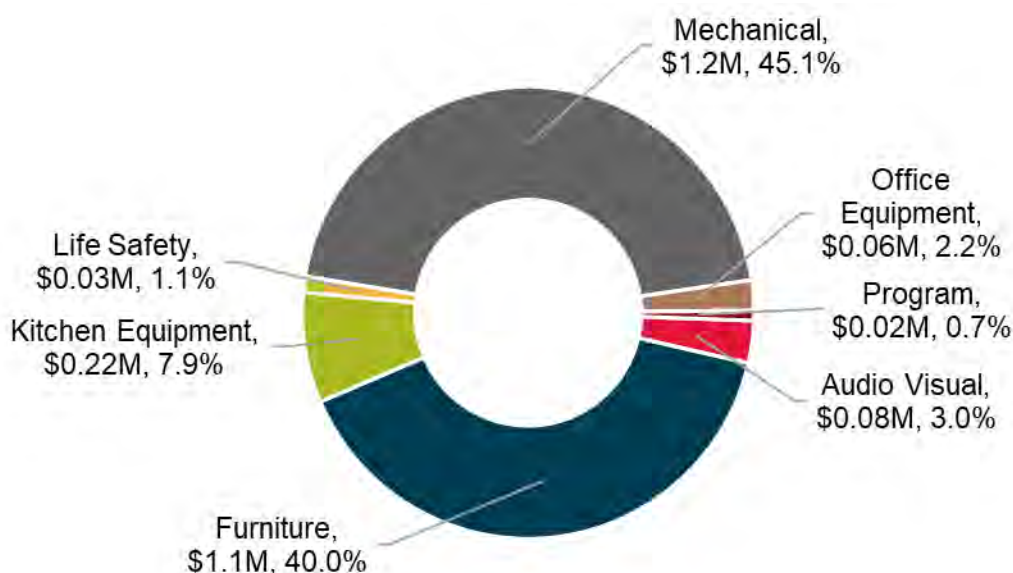


Figure I - 4: Replacement value of Facilities by asset class (Furnishings, Fixtures and Equipment).

I.1.1.1 Asset Inventory and Valuation

Table I - 1 below summarizes the asset valuation, quantities, and performance for each asset category of Facilities assets.

Table I - 1: Inventory and valuation for Facilities assets.

Asset Category	Asset Class	Replacement Cost	Inventory	Average Condition
Facility	General Government	\$96,358,714	227,515 sq ft	Fair
Facility	Institutional Commercial Industrial	\$89,443,865	249,005 sq ft	Good
Facility	Residential	\$11,136,358	35,744 sq ft	Fair
Facility	Structure	\$13,602	100 sq ft	Poor
Facility	Warehouse	\$9,870,344	72,566 sq ft	Very Good
Facility	Works Yard	\$15,712,507	36,937 sq ft	Very Good
Facility	Works Yard - Other	\$13,105,393	65,187 sq ft	Good

Asset Category	Asset Class	Replacement Cost	Inventory	Average Condition
Furnishings, Fixtures and Equipment	Audio Visual	\$83,962	34 Assets	Fair
Furnishings, Fixtures and Equipment	Furniture	\$1,105,950	70 Assets	Very Poor
Furnishings, Fixtures and Equipment	Kitchen Equipment	\$218,244	43 Assets	Very Poor
Furnishings, Fixtures and Equipment	Life Safety	\$31,700	7 Assets	Fair
Furnishings, Fixtures and Equipment	Mechanical	\$1,247,570	56 Assets	Fair
Furnishings, Fixtures and Equipment	Office Equipment	\$60,000	1 Assets	Good
Furnishings, Fixtures and Equipment	Program	\$19,500	5 Assets	Very Poor
Total	-	\$238,407,707	-	-

I.1.1.2 Age and Estimated Service Life

Figure I - 5 illustrates the age of Facilities assets as a proportion of their estimated service life. Figure I - 6 illustrates the value of Facilities assets acquired by decade. Pathways are the only asset group with an average age past the average ESL.

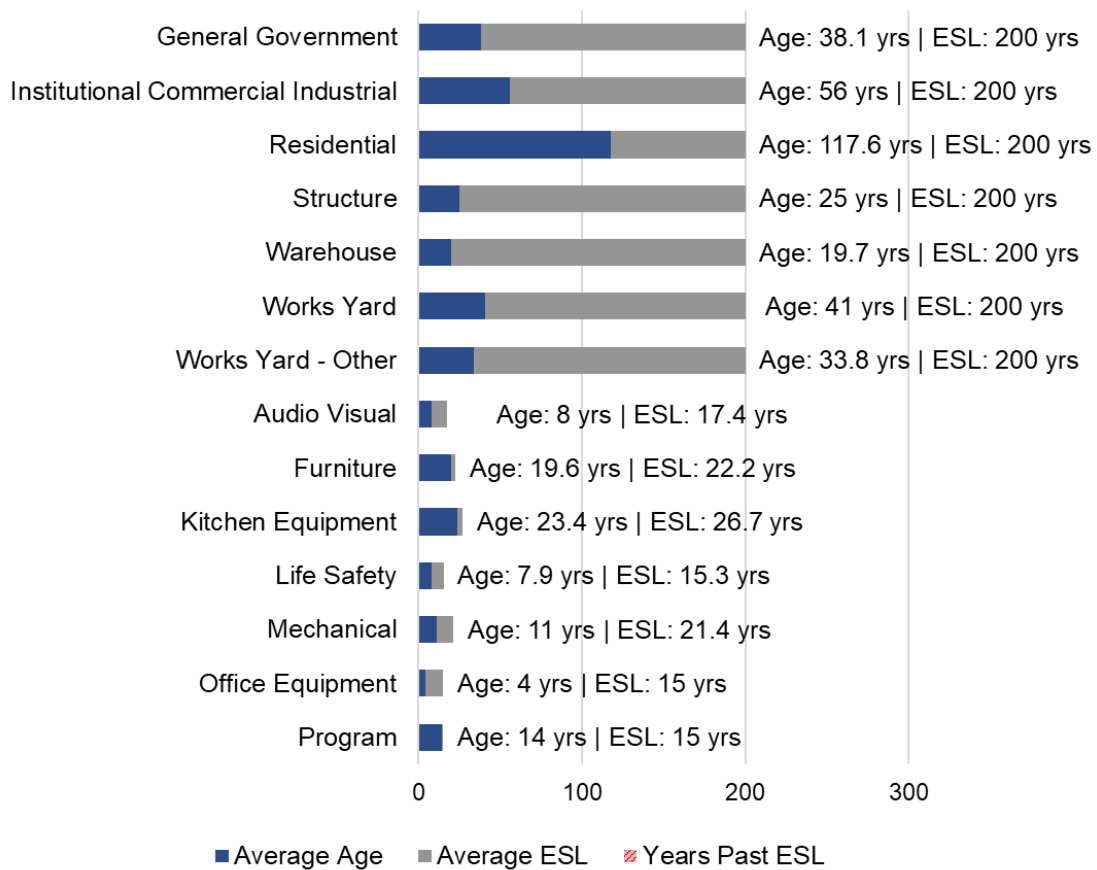


Figure I - 5: Age as a proportion of estimated service life (ESL) of Facilities assets.

The installation profile of facilities assets illustrates that the majority of general government and institutional commercial industrial assets were installed in the 1980s and 1990s, in line with decades that experienced significant growth and corresponding development in the City.

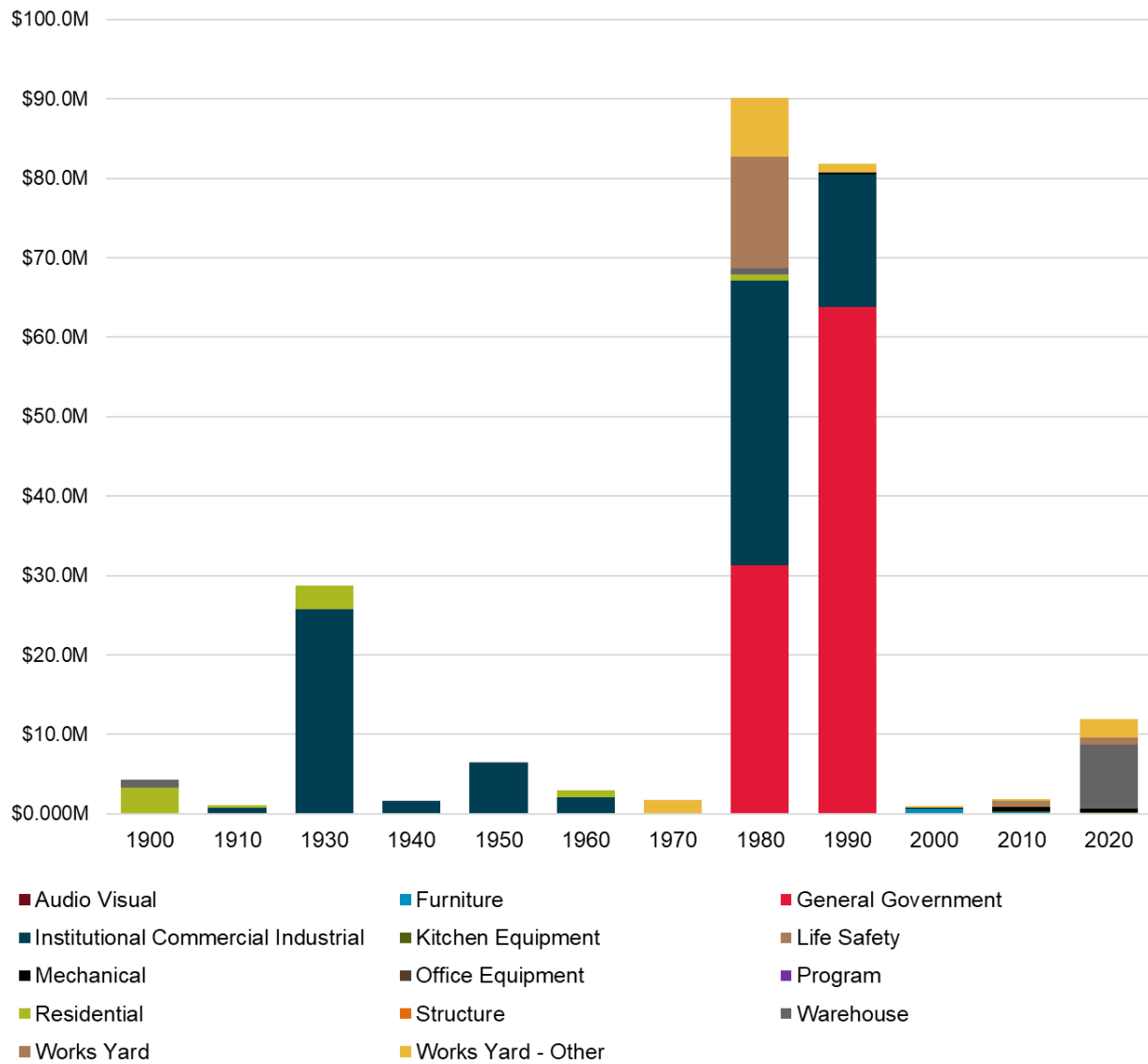


Figure I - 6: Age distribution by installation decade of Facilities assets.

I.1.1.3 Asset Performance

Table I - 2 details the approaches that the City utilizes to understand the performance of Facilities assets.

Table I - 2: Performance assessment approaches to Facilities assets.

Asset Category	Condition Rating Metric	Approach to Assessing Condition
Facility	FCI	Facilities are inspected and the inspection results are recorded in City's database annually. The results are and used to understand facility renewal needs and calculate the FCI rating.
Furnishings, Fixtures and Equipment	Age/ESL	The City understands the performance of these assets based on asset age and estimated service life

Figure I - 7 illustrates the performance distribution of the Facilities services asset portfolio, while Figure I - 8 shows the performance distribution of Facilities assets by asset class. Table I - 3 summarizes the relationship between the performance categories and how performance ratings are determined.

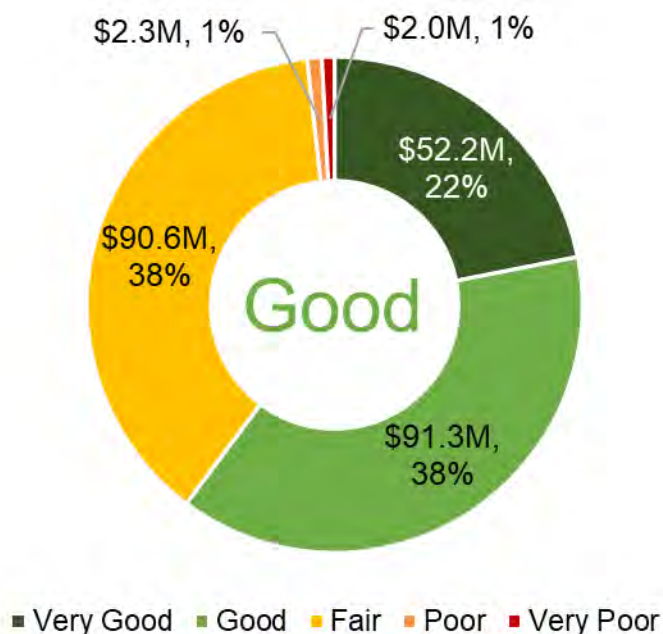


Figure I - 7: Condition distribution of Facilities assets.

Table I - 3: Performance rating of Facilities assets.

Condition Category	Facility Condition Index (FCI)	Age/ESL
Very Good	0% - 5%	0% - 20%
Good	5% - 10%	20% - 40%
Fair	10% - 30%	40% - 60%
Poor	30% - 60%	60% - 80%
Very Poor	60 - 100%	>80%

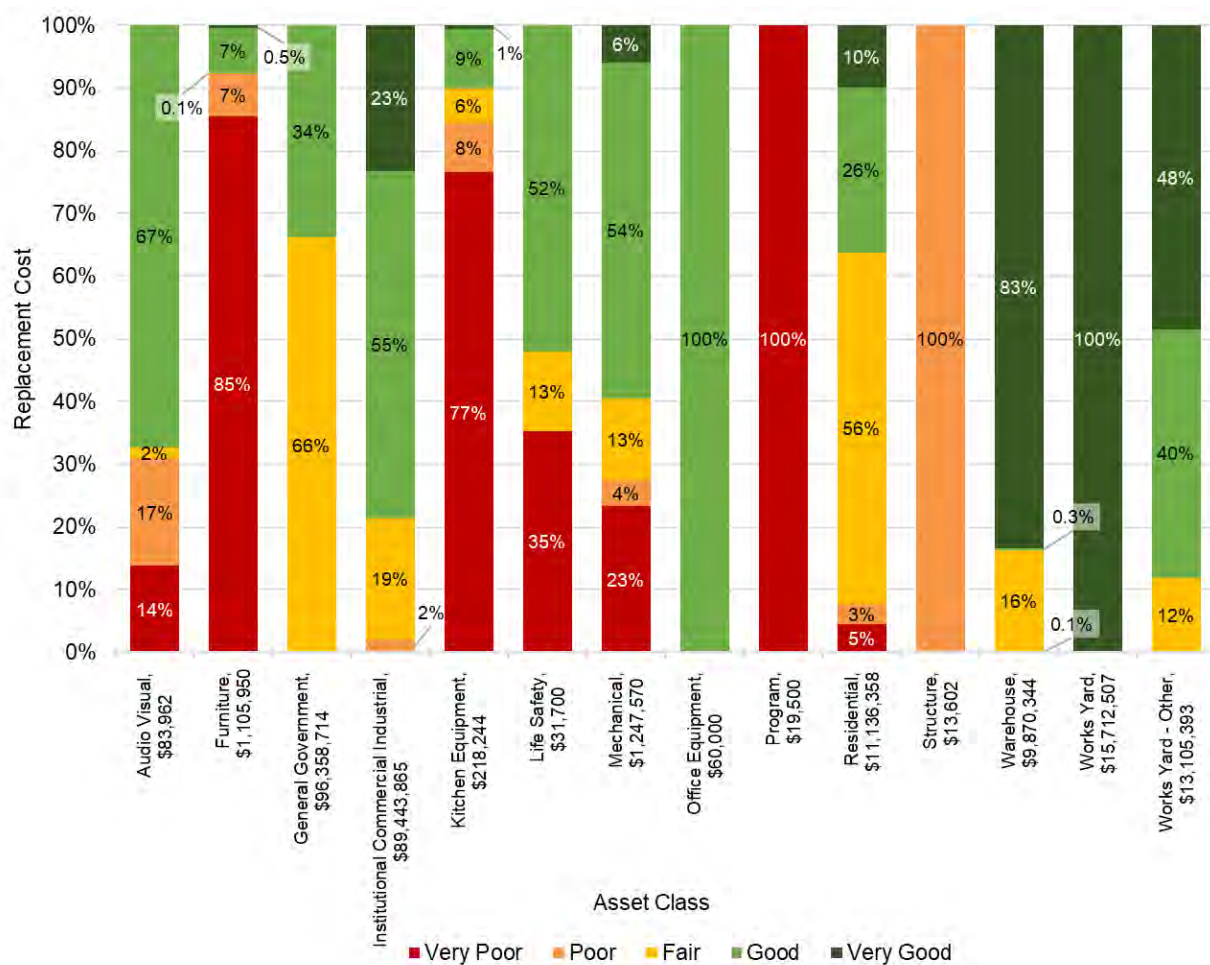


Figure I - 8: Condition distribution of Facilities assets by asset class.

I.1.2 Levels of Service

Customer values, customer levels of service and technical levels of service for Facilities assets can be found in Table I - 4 to Table I - 7.

I.1.2.1 Customer Values

Table I - 4: General Support Services customer values.

Customer Satisfaction Measure	Current Feedback and Expected Trend Based on Planned Budget
General Support Service assets are safe and reliable to use	
Assets are maintained in a state of good repair, are adequate for use, and in overall good working condition.	Future Iterations ²⁸
General Support Service are convenient to use	
The quality of assets do not negatively affect the customer.	Future Iterations ²⁸
General Support Service is accessible.	Future Iterations ²⁸
Environmentally sustainable	
Environmental impacts are minimized.	Future Iterations ²⁸

²⁸ The City is currently reviewing the data that supports this metric, which will be reported in future iterations of the City's AMP. These metrics are subject to change as data is reviewed and incorporated into future AMPs.

I.1.2.2 Customer and Technical Levels of Service

Table I - 5: Facilities customer LoS.

Type of Measure	Level of Service	Performance Measure	Current Performance	Confidence Levels
Condition	Condition of Facilities	Average FCI rating of facilities.	0.09	Confidence Levels: Medium – building condition assessments are performed on facilities to determine investment needs but data requires refinement.
Condition	Individual element/element group condition.	Percentage of all elements/element groups in poor or very poor condition.	1%	Confidence Levels: Medium – building condition assessments are performed on facilities to determine investment needs but data requires refinement.
Condition	Individual element/element group condition.	Percentage of assets that have not exceeded their ESL.	100%	Confidence Levels: Medium – building condition assessments are performed on facilities to determine investment needs but data requires refinement.
Function	Measure of whether the service is appropriate for its intended use	Future Iterations ²⁹	Future Iterations ²⁹	Future Iterations ²⁹
Capacity	Measure of whether the service is adequate to meet customer needs	Future Iterations ²⁹	Future Iterations ²⁹	Future Iterations ²⁹

²⁹ The City is currently reviewing and selecting measures for this category, which will be developed and integrated into future iterations of the City's AMP.

Type of Measure	Level of Service	Performance Measure	Current Performance	Confidence Levels
Accessibility	Service interruptions	Future Iterations ²⁹	Future Iterations ²⁹	Future Iterations ²⁹

Table I - 6: Furnishings, Fixtures, and Equipment customer LoS.

Type of Measure	Level of Service	Performance Measure	Current Performance	Confidence Levels
Condition	Condition of assets	Percentage of assets that have not exceeded their ESL.	91%	Confidence Levels: Low to medium – age and ESL are used to assess for condition. Condition data is unavailable.
Function	Measure of whether the service is appropriate for its intended use	Future Iterations ²⁹	Future Iterations ²⁹	Future Iterations ²⁹
Capacity	Measure of whether the service is adequate to meet customer needs	Future Iterations ²⁹	Future Iterations ²⁹	Future Iterations ²⁹
Accessibility	Service interruptions	Future Iterations ²⁹	Future Iterations ²⁹	Future Iterations ²⁹

Table I - 7: Facilities technical LoS.

Lifecycle Activity	Purpose of Activity	Frequency	Current Performance (\$, 2025 Budget)	Recommended Performance
Acquisition	Growth Expansion Development	Projects developed in Corporate Energy Management Plan, Digital Markham Strategy, and additional growth studies	-	Growth Planning Horizon: 2026-2051 Total Acquisition Value Range: \$382.5M - \$623.6M City Funded Acquisition Value Range: \$382.5M - \$623.6
Operation	Inspections	Annual programs	\$13,157 The City's 2025 operating budget for all services was \$495.8M.	Maintain current performance for assets in service. Anticipated operating budget increase ranges from \$10.2M to \$16.6M over the growth planning horizon: 2026-2051.
Operation	Regular Operations	As required	See above	See above
Maintenance	Minor repairs	As required	\$23,314	Maintain current performance for assets in service. Anticipated maintenance budget increases are included in the operating or renewal budget forecasts.
Maintenance	Regular Maintenance	Annual programs	See above	See above

Lifecycle Activity	Purpose of Activity	Frequency	Current Performance (\$, 2025 Budget)	Recommended Performance
Maintenance	Major maintenance (holding strategies)	As required	See above	See above
Renewal	Major rehabilitation or replacement	As required	\$1,548,057 (City's LCRS)	PLoS Maintain Current Performance requires \$2.97M or \$1.42M per year on average of additional funds from 2026 to 2051.
Disposal	Disposal of replaced assets	As required	Included in renewal costs	Maintain current performance for assets in service.
Service Improvement	Upgrades to improve LoS to benefit existing serviced areas	As required	-	Maintain LoS – The City continues to assess needs annually to determine and balance appropriate funding levels to support service improvement activities.

I.1.3 Risk Management Strategy

The criteria used to determine the consequence of failure for Facilities assets can be found in Table I - 8 below.

Table I - 8: COF criteria used for Facilities assets.

Direct Financial	Socio-Economic	Environmental
• Replacement cost	• Asset Class	N/A

Table I - 9 displays the risk score for Facilities assets along with the proportion of assets within each risk score, likelihood of failure and consequence of failure.

Table I - 9: Risk score distribution of Facilities assets.

	COF 1	COF 2	COF 3	COF 4	COF 5	Subtotal
LOF 1	\$6,200 (<0.1%)	\$21,565,118 (9.0%)	\$30,658,230 (12.9%)	None	None	\$52,229,549 (21.9%)
LOF 2	\$101,362 (<0.1%)	\$51,400,212 (21.6%)	\$39,806,396 (16.7%)	None	None	\$91,307,970 (38.3%)
LOF 3	\$15,178 (<0.1%)	\$20,002,007 (8.4%)	\$70,605,544 (29.6%)	None	None	\$90,622,729 (38.0%)
LOF 4	\$106,394 (<0.1%)	\$2,174,705 (0.9%)	\$13,602 (<0.1%)	None	None	\$2,294,702 (1.0%)
LOF 5	\$554,520 (0.2%)	\$814,396 (0.3%)	\$583,841 (0.2%)	None	None	\$1,952,757 (0.8%)
Subtotal	\$783,655 (0.3%)	\$95,956,439 (40.2%)	\$141,667,613 (59.4%)	None	None	\$238,407,707

Table I - 10: Risk score mapping legend.

Risk	Risk Score	Risk Description	Total Replacement Cost
Very Low	1 – 5	Fit for the Future	\$104,407,215 (43.8%)
Low	6 – 10	Adequate for Now	\$133,403,049 (56.0%)
Moderate	11 – 15	Requires Attention	\$597,443 (0.3%)
High	16 – 20	At Risk	None
Very High	21 – 25	Unfit for Sustained Service	None

I.1.4 Lifecycle Management Activities

The City's lifecycle management activities for Facilities assets are listed in Table I - 7. These activities include the acquisition of assets and service improvements, operations and maintenance, major asset renewals (including rehabilitations and replacements), and disposals.

These lifecycle management activities in conjunction with the lifecycle forecasting are used to determine the funding required for the City to continue performing these lifecycle activities to extend asset life, reduce overall costs, and minimize risk while providing the proposed service levels.

I.1.5 Lifecycle Forecasting

The following section outlines the funding required for the entire lifecycle of Facilities assets. The expenditures were determined using the lifecycle activities outlined in Table I - 7 and the LoS established. Required funding for PLoS was determined using the following parameter:

- **Proposed LoS – Maintain Current Performance** – funding required to maintain a similar asset performance over a 26-year period. The City has established this LoS as the PLoS for Facilities assets. It focuses on maintaining the percentage of assets in backlog in a similar state. Backlog is defined as assets that are in need of renewal work (either significant rehabilitation or replacement). For example, if 20% of assets are past their service life, or are in need of renewal work, then the forecast model will determine the funding to maintain 20% of assets in this state over the forecast period.

The following table summarizes the anticipated funding from the LCRS for renewal activities for Facilities assets. A total of **\$68.0M** over the next 26 years (or an equivalent average annual of **\$2.6M**) for renewals is anticipated to be spent.

Table I - 11: Forecasted capital renewal expenditures (Life Cycle Reserve Study)
Facilities assets.

Year	Capital Expenditures (Renewals)
2026	\$10,136,497
2027	\$3,395,157
2028	\$4,604,722
2029	\$1,487,112
2030	\$8,699,510
2031	\$1,754,581
2032	\$2,561,672

Year	Capital Expenditures (Renewals)
2033	\$816,383
2034	\$1,215,669
2035	\$1,393,082
2036	\$1,582,847
2037	\$1,776,063
2038	\$1,530,782
2039	\$2,341,808
2040	\$2,346,101
2041	\$1,352,780
2042	\$3,897,177
2043	\$2,719,459
2044	\$968,853
2045	\$727,605
2046	\$1,216,501
2047	\$3,037,078
2048	\$2,959,426
2049	\$1,470,908
2050	\$2,945,745
2051	\$1,014,484
Total	\$67,952,004
Equivalent Average Annual	\$2,613,539

Figure I - 9 and Figure I - 10 illustrate the performance and financial forecasts for Maintaining the Current Performance (PLoS). The forecast analysis identified a total of **\$77.2M** (or an equivalent average annual of **\$3.0M**) that is anticipated to be spent over the next 26 years to maintain current performance. This represents funding gap of **\$9.2M** over the planning horizon, or an equivalent average annual amount of **\$354.6k**.

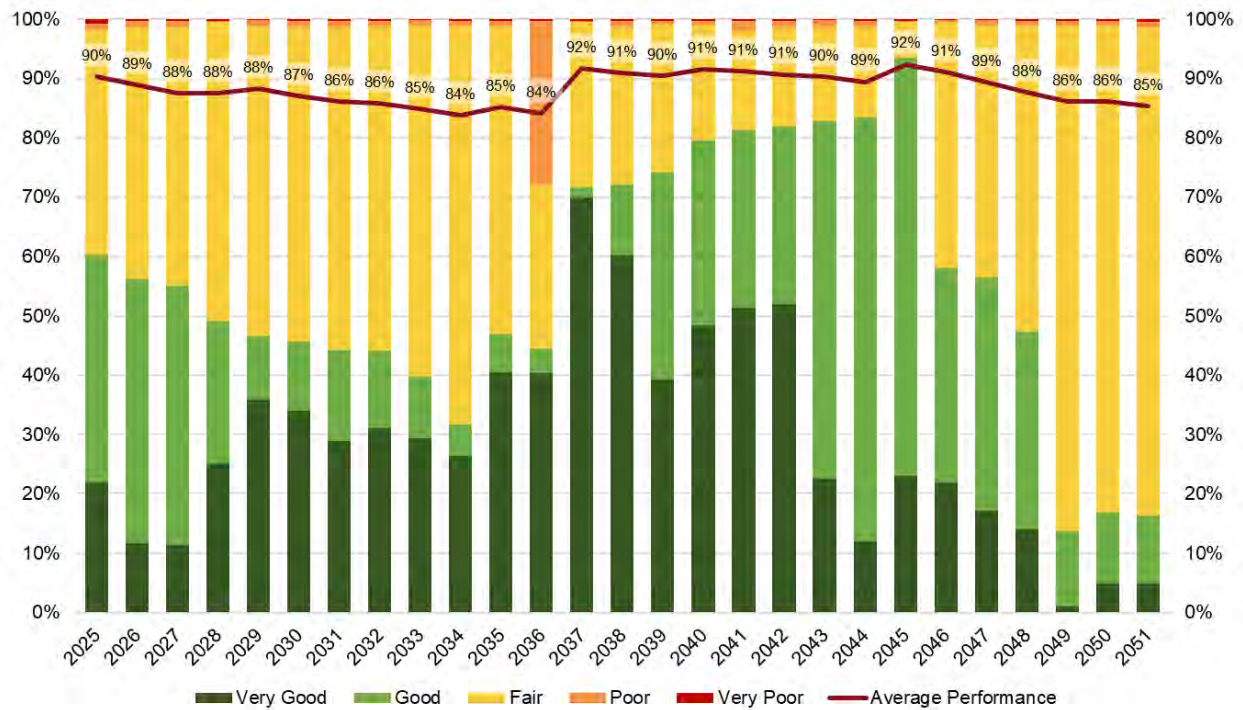


Figure I - 9: Performance distribution – maintain current performance distribution for Facilities assets.

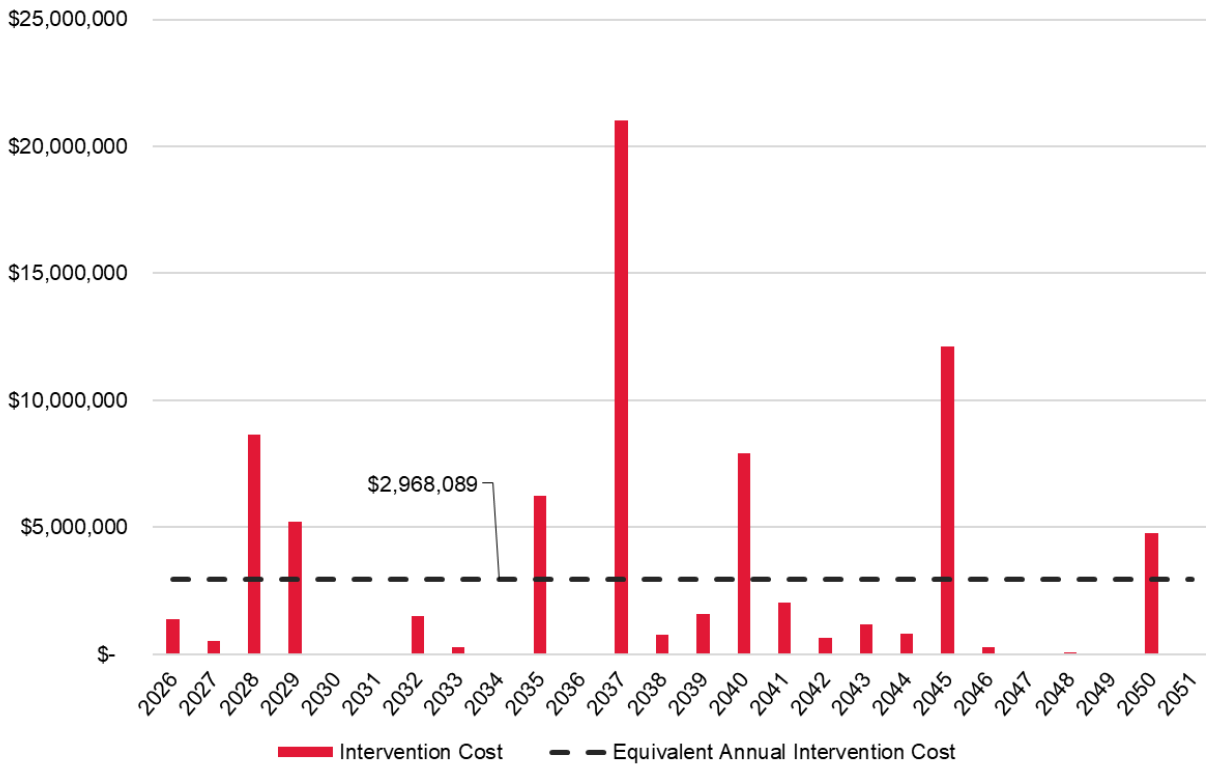


Figure I - 10: Maintain current performance intervention costs for Facilities assets.

I.2 Fleet

I.2.1 State of the Infrastructure

Figure I - 11 shows the replacement value of Fleet assets while Figure I - 12 illustrates the replacement value of Fleet assets by asset class. The total replacement value for Fleet assets is \$34.8M.

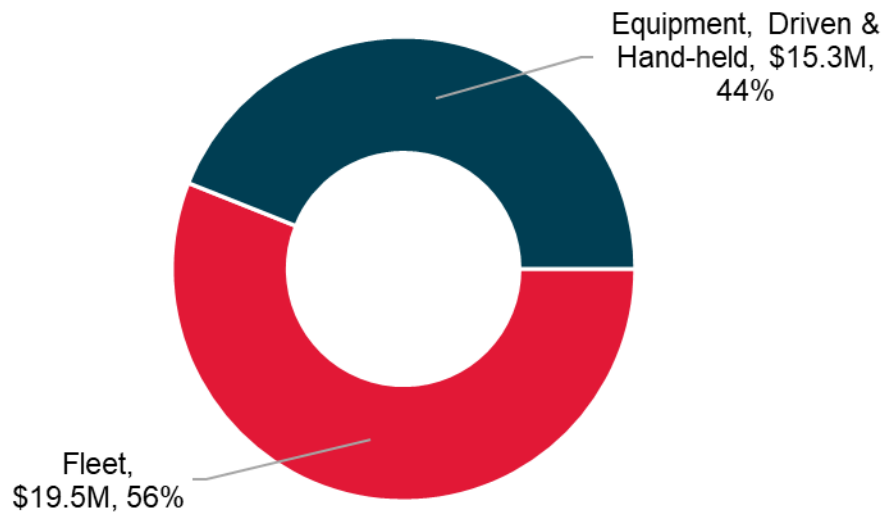


Figure I - 11: Replacement value distribution of Fleet assets.

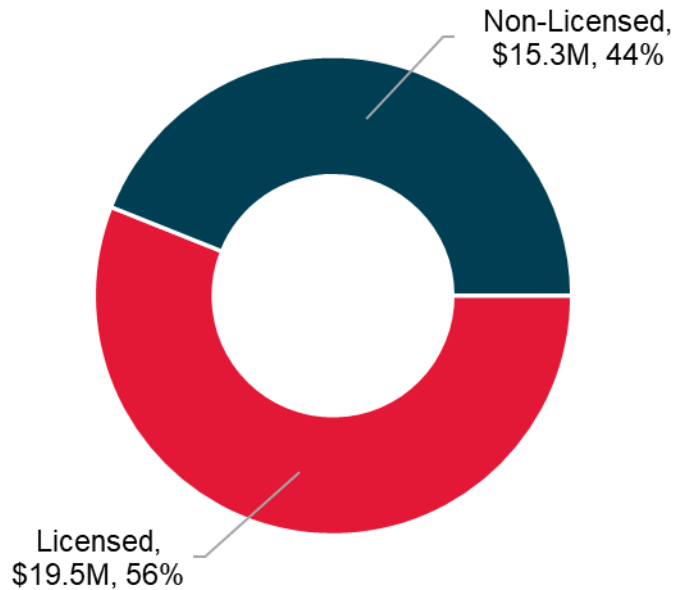


Figure I - 12: Replacement value of Fleet assets by asset class.

I.2.1.1 Asset Inventory and Valuation

Table I - 12 below summarizes the asset valuation, quantities, and performance for each asset category of Fleet assets.

Table I - 12: Inventory and valuation for Fleet assets.

Asset Category	Asset Class	Replacement Cost	Inventory	Average Condition
Fleet	Licensed	\$19,516,709	236	Fair
Equipment, Driven and Hand-held	Non-Licensed	\$15,312,216	747	Fair
Total	-	\$34,828,925	-	-

I.2.1.2 Age and Estimated Service Life

Figure I - 13 illustrates the age of Fleet assets as a proportion of their estimated service life. Figure I - 14 illustrates the value of Fleet assets acquired by decade. Pathways are the only asset group with an average age past the average ESL.

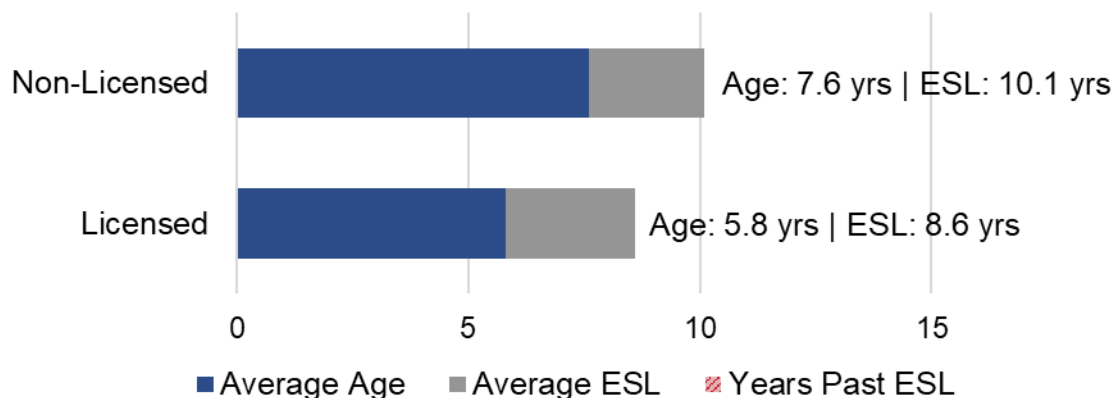


Figure I - 13: Age as a proportion of estimated service life (ESL) of Fleet assets.

The installation profile of fleet assets illustrates that the majority of assets were installed in the 2010s to present, in line with decades that experienced significant growth and corresponding development in the City.

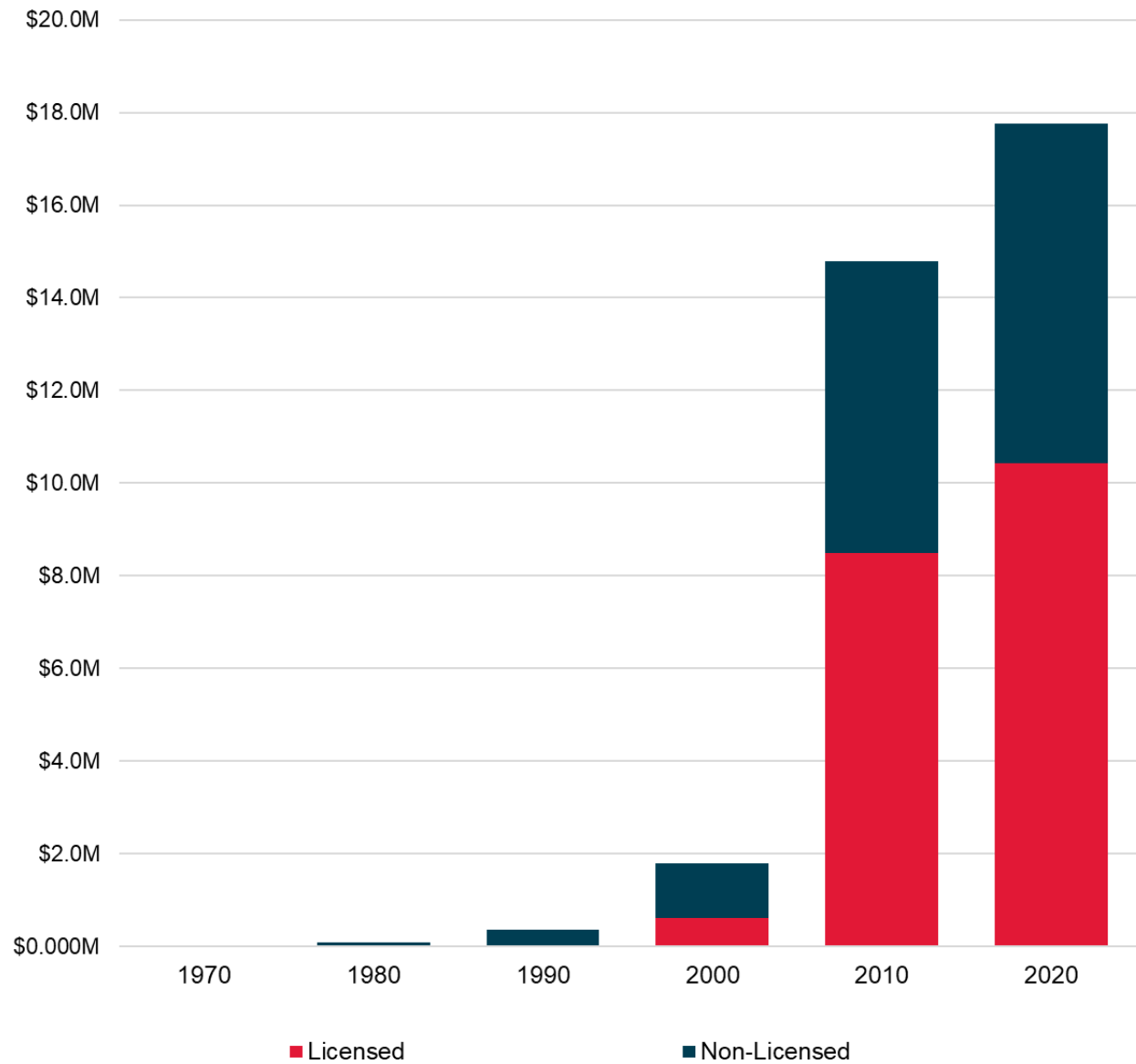


Figure I - 14: Age distribution by installation decade of Fleet assets.

I.2.1.3 Asset Performance

Table I - 13 details the approaches that the City utilizes to understand the performance of Fleet assets.

Table I - 13: Performance assessment approaches to Fleet assets.

Asset Class	Condition Rating Metric	Approach to Assessing Condition
Fleet	Performance Rating: Average of years in service (%) and the runtime consumption (%) where: - Years in service is based on the age of the asset and available usable hours per year - Runtime consumption is based on the most previous meter reading and the maximum meter reading	The City understands the condition of these assets based on asset age, estimated service life, and runtime consumption.
Equipment, Driven and Hand-held	See above	See above

Figure I - 15 illustrates the performance distribution of the Fleet services asset portfolio, while Figure I - 16 shows the performance distribution of Fleet assets by asset class. Table I - 14 summarizes the relationship between the performance categories and how performance ratings are determined.

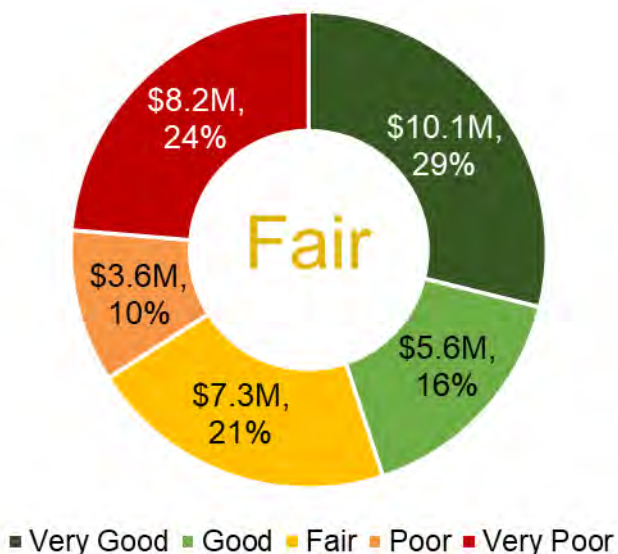


Figure I - 15: Condition distribution of Fleet assets.

Table I - 14: Performance rating of Fleet assets.

Condition Category	Performance Rating
Very Good	0% - 20%
Good	20% - 40%
Fair	40% - 60%
Poor	60% - 80%
Very Poor	>80%

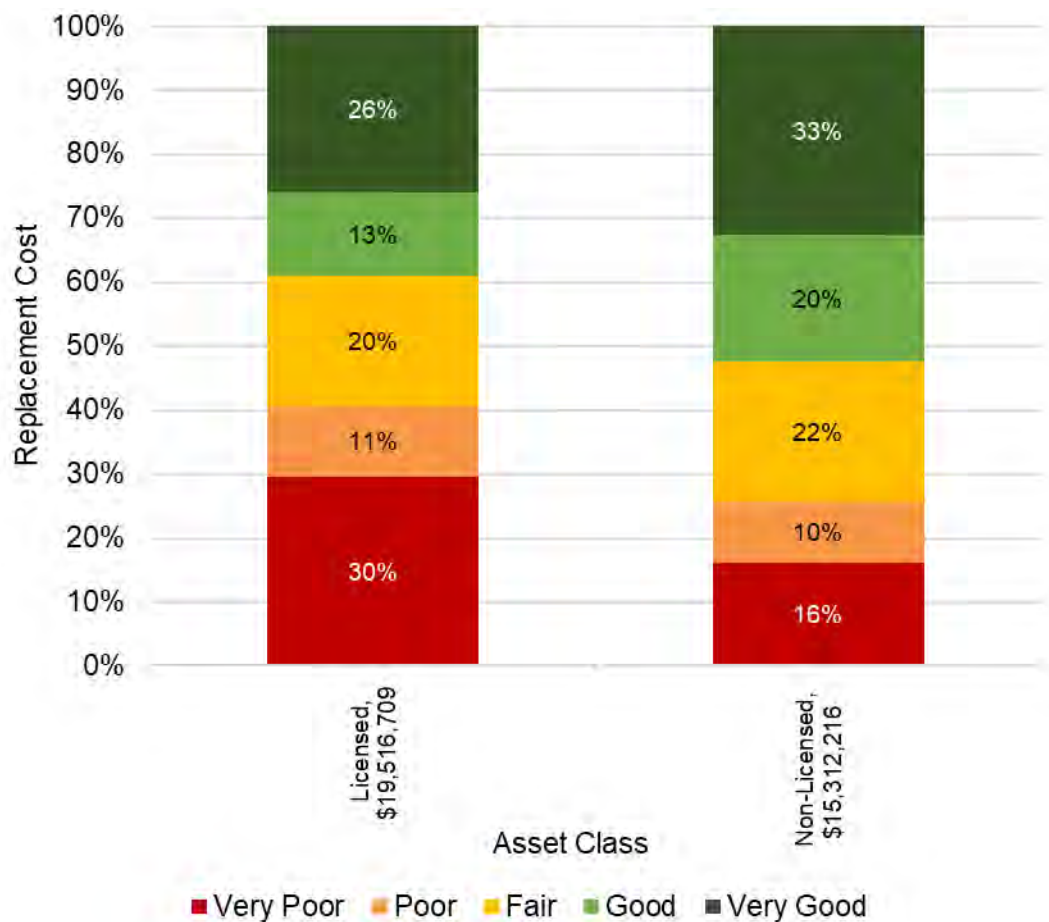


Figure I - 16: Condition distribution of Fleet assets by asset class.

I.2.2 Levels of Service

Customer values, customer levels of service and technical levels of service for Fleet assets can be found in Table I - 15 to Table I - 17.

I.2.2.1 Customer Values

Table I - 15: General Support Services customer values.

Customer Satisfaction Measure		Current Feedback and Expected Trend Based on Planned Budget
General Support Service assets are safe and reliable to use		
Assets are maintained in a state of good repair, are adequate for use, and in overall good working condition.		Future Iterations ³⁰
General Support Service are convenient to use		
The quality of assets does not negatively affect the customer.		Future Iterations ³⁰
General Support Service is accessible.		Future Iterations ³⁰
Environmentally sustainable		
Environmental impacts are minimized.		Future Iterations ³⁰

³⁰ The City is currently reviewing the data that supports this metric, which will be reported in future iterations of the City's AMP. These metrics are subject to change as data is reviewed and incorporated into future AMPs.

I.2.2.2 Customer and Technical Levels of Service

Table I - 16: Fleet customer LoS.

Type of Measure	Level of Service	Performance Measure	Current Performance	Confidence Levels
Condition	Condition of assets	Condition or Age/Remaining Useful Life - Aggregated into 5-point rating scale	Fair	Confidence Levels: Medium – age, ESL, and runtime consumption are used to assess for condition.
Condition	Individual element/element group condition.	Percentage of assets that have not exceeded their ESL.	73%	Confidence Levels: Medium – age, ESL, and runtime consumption are used to assess for condition.
Function	Measure of whether the service is appropriate for its intended use	Future Iterations ³¹	Future Iterations ³¹	Future Iterations ³¹
Capacity	Measure of whether the service is adequate to meet customer needs	Future Iterations ³¹	Future Iterations ³¹	Future Iterations ³¹
Accessibility	Service interruptions	Future Iterations ³¹	Future Iterations ³¹	Future Iterations ³¹

³¹ The City is currently reviewing and selecting measures for this category, which will be developed and integrated into future iterations of the City's AMP.

Table I - 17: Fleet technical LoS.

Lifecycle Activity	Purpose of Activity	Frequency	Current Performance (\$, 2025 Budget)	Recommended Performance
Acquisition	Growth Expansion Development	Projects developed in Corporate Energy Management Plan, Digital Markham Strategy, and additional growth studies	\$2,603,200	Growth Planning Horizon: 2026-2051 Total Acquisition Value Range: \$14.0M - \$20.6M City Funded Acquisition Value Range: \$14.0M - \$20.6M
Operation	Inspections	Annual programs	Operating costs are funded through the operating budget and may also be funded through the capital budget depending on asset needs. In 2025, there are no operating costs funded through the 2025 capital budget. The City's 2025 operating budget for all services was \$495.8M.	Maintain current performance for assets in service. Anticipated operating budget increase ranges from \$0.37M to \$0.55M over the growth planning horizon: 2026-2051.
Operation	Regular Operations	As required	See above	See above

Lifecycle Activity	Purpose of Activity	Frequency	Current Performance (\$, 2025 Budget)	Recommended Performance
Maintenance	Minor repairs	As required	\$496,700	Maintain current performance for assets in service. Anticipated maintenance budget increases are included in the operating or renewal budget forecasts.
Maintenance	Regular Maintenance	Annual programs	See above	See above
Maintenance	Major maintenance (holding strategies)	As required	See above	See above
Renewal	Major rehabilitation or replacement	As required	\$1,759,800 (City's LCRS)	PLoS Maintain Current Performance requires \$3.31M or \$1.55M per year on average of additional funds from 2026 to 2051.

Lifecycle Activity	Purpose of Activity	Frequency	Current Performance (\$, 2025 Budget)	Recommended Performance
Disposal	Disposal of replaced assets	As required	Included in renewal costs	Maintain current performance for assets in service.
Service Improvement	Upgrades to improve LoS to benefit existing serviced areas	As required	-	Maintain LoS – The City continues to assess needs annually to determine and balance appropriate funding levels to support service improvement activities.

I.2.3 Risk Management Strategy

The criteria used to determine the consequence of failure for Fleet assets can be found in Table I - 18 below.

Table I - 18: COF criteria used for Fleet assets.

Direct Financial	Socio-Economic	Environmental
• Replacement cost	• Asset Type	N/A

Table I - 19 displays the risk score for Fleet assets along with the proportion of assets within each risk score, likelihood of failure and consequence of failure.

Table I - 19: Risk score distribution of Fleet assets.

	COF 1	COF 2	COF 3	COF 4	COF 5	Subtotal
LOF 1	\$149,470 (0.4%)	\$9,587,514 (27.5%)	\$315,553 (0.9%)	None	None	\$10,052,537 (28.9%)
LOF 2	\$248,126 (0.7%)	\$5,233,490 (15.0%)	\$121,232 (0.3%)	None	None	\$5,602,849 (16.1%)
LOF 3	\$314,639 (0.9%)	\$5,524,628 (15.9%)	\$1,476,344 (4.2%)	None	None	\$7,315,611 (21.0%)
LOF 4	\$132,480 (0.4%)	\$3,266,029 (9.4%)	\$213,353 (0.6%)	None	None	\$3,611,862 (10.4%)
LOF 5	\$213,848 (0.6%)	\$7,160,735 (20.6%)	\$871,485 (2.5%)	None	None	\$8,246,067 (23.7%)
Subtotal	\$1,058,563 (3.0%)	\$30,772,395 (88.4%)	\$2,997,967 (8.6%)	None	None	\$34,828,925

Table I - 20: Risk score mapping legend.

Risk	Risk Score	Risk Description	Total Replacement Cost
Very Low	1 – 5	Fit for the Future	\$16,195,120 (46.5%)
Low	6 – 10	Adequate for Now	\$17,548,968 (50.4%)
Moderate	11 – 15	Requires Attention	\$1,084,838 (3.1%)
High	16 – 20	At Risk	None
Very High	21 – 25	Unfit for Sustained Service	None

I.2.4 Lifecycle Management Activities

The City's lifecycle management activities for Fleet assets are listed in Table I - 17. These activities include the acquisition of assets and service improvements, operations and maintenance, major asset renewals (including rehabilitations and replacements), and disposals.

These lifecycle management activities in conjunction with the lifecycle forecasting are used to determine the funding required for the City to continue performing these lifecycle activities to extend asset life, reduce overall costs, and minimize risk while providing the proposed service levels.

I.2.5 Lifecycle Forecasting

The following section outlines the funding required for the entire lifecycle of Fleet assets. The expenditures were determined using the lifecycle activities outlined in Table I - 17 and the LoS established. Required funding for PLoS was determined using the following parameter:

- **Proposed LoS – Maintain Current Performance:** funding required to maintain a similar asset performance over a 26-year period. The City has established this LoS as the PLoS for Fleet assets. It focuses on maintaining the percentage of assets in backlog in a similar state. Backlog is defined as assets that are in need of renewal work (either significant rehabilitation or replacement). For example, if 20% of assets are past their service life, or are in need of renewal work, then the forecast model will determine the funding to maintain 20% of assets in this state over the forecast period.

The following table summarizes the anticipated funding from the LCRS for renewal activities for Fleet assets. A total of **\$64.2M** over the next 26 years (or an equivalent average annual of **\$2.5M**) for renewals is anticipated to be spent.

Table I - 21: Forecasted capital renewal expenditures (Life Cycle Reserve Study) Fleet assets.

Year	Capital Expenditures (Renewals)
2026	\$1,604,097
2027	\$1,558,477
2028	\$3,696,666
2029	\$1,929,310
2030	\$2,173,868
2031	\$3,460,229
2032	\$3,852,502

Year	Capital Expenditures (Renewals)
2033	\$2,954,285
2034	\$3,879,921
2035	\$2,884,450
2036	\$3,027,739
2037	\$1,480,663
2038	\$2,080,479
2039	\$3,435,964
2040	\$4,395,763
2041	\$2,277,164
2042	\$1,090,364
2043	\$1,239,438
2044	\$4,072,385
2045	\$2,273,856
2046	\$1,107,864
2047	\$2,609,040
2048	\$3,384,667
2049	\$1,700,045
2050	\$1,264,837
2051	\$731,041
Total	\$64,165,113
Equivalent Average Annual	\$2,467,889

Figure I - 17 and Figure I - 18 illustrate the performance and financial forecasts to achieve PLoS for all Fleet assets. The forecast analysis identified a total of **\$86.1M** (or an equivalent average annual of **\$3.3M**) that is anticipated to be spent over the next 26 years to maintain current performance. This represents funding gap of **\$21.9M** over the planning horizon, or an equivalent average annual amount of **\$841.9k**.

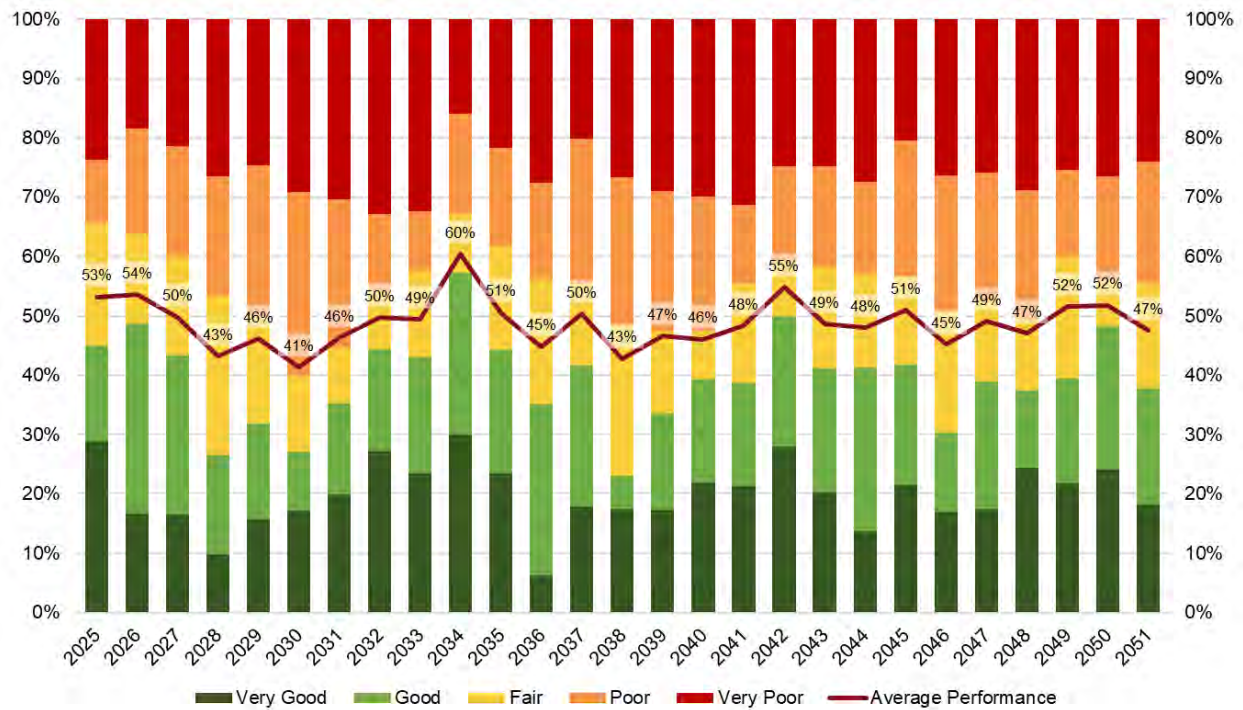


Figure I - 17: Performance distribution – maintain current performance for Fleet assets.

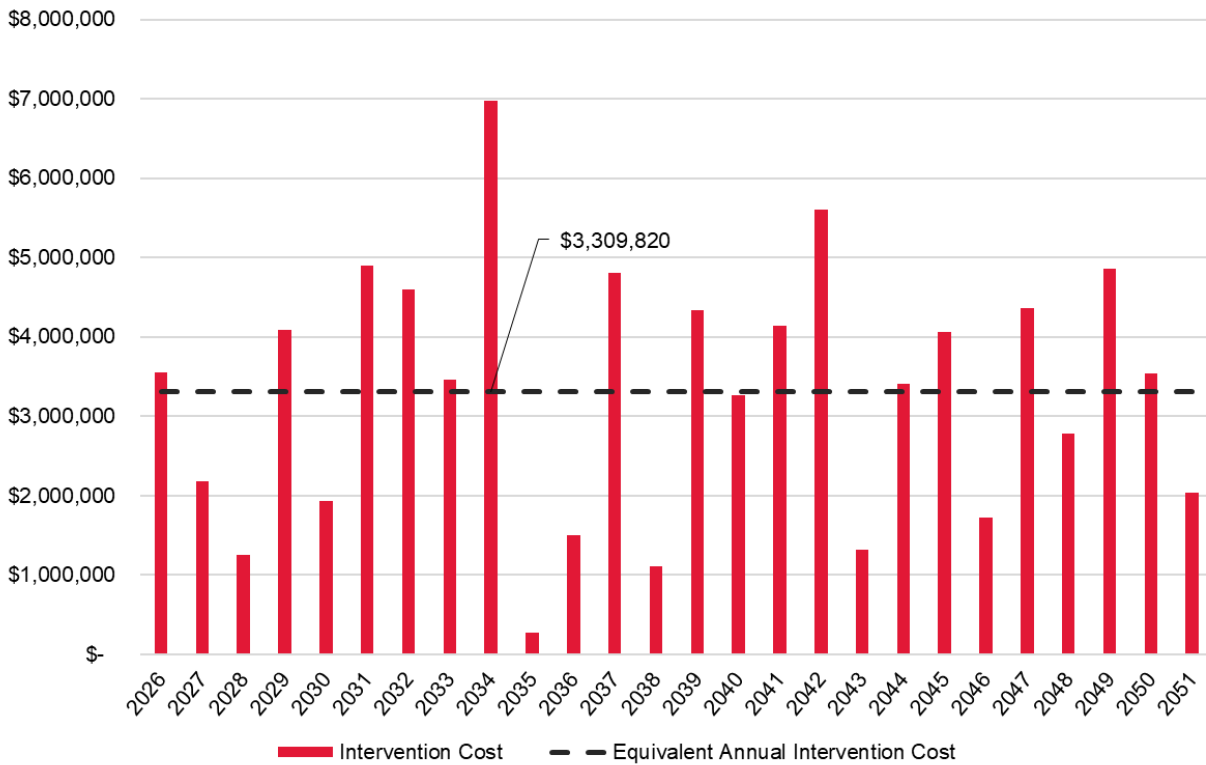


Figure I - 18: Maintain current performance intervention costs for Fleet assets.

I.3 Information Technology

I.3.1 State of the Infrastructure

Figure I - 19 shows the replacement value of Information Technology assets while Figure I - 20 illustrates the replacement value of Information Technology assets by asset class. The total replacement value for Information Technology assets is \$7.5M.

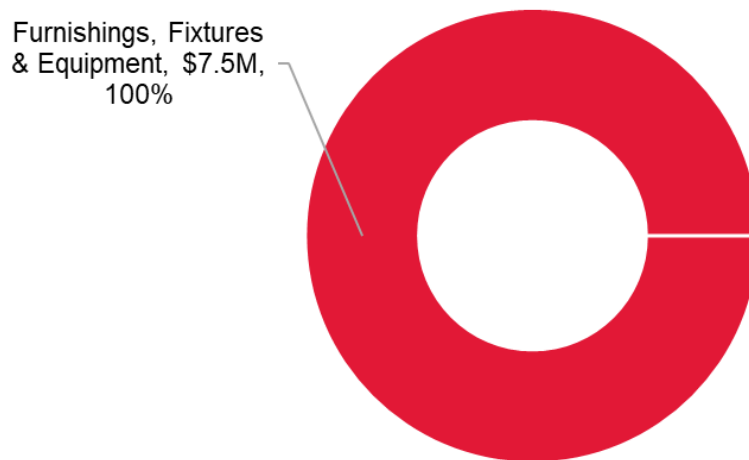


Figure I - 19: Replacement value distribution of Information Technology assets.

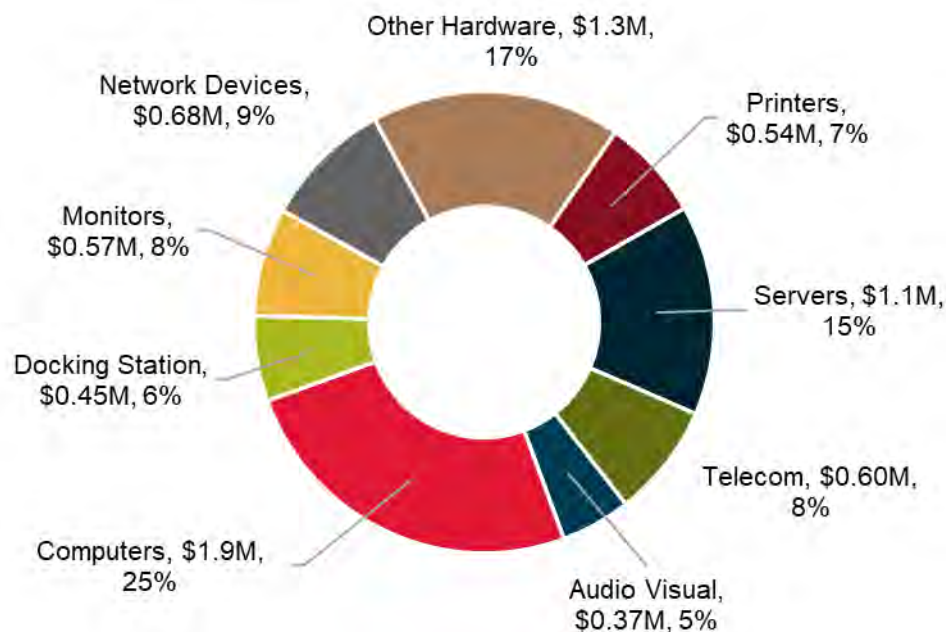


Figure I - 20: Replacement value of Information Technology assets by asset class.

I.3.1.1 Asset Inventory and Valuation

Table I - 22 below summarizes the asset valuation, quantities, and performance for each asset category of Information Technology assets.

Table I - 22: Inventory and valuation for Information Technology assets.

Asset Category	Asset Class	Replacement Cost	Inventory	Average Condition
Furnishings, Fixtures and Equipment	Audio Visual	\$371,511	312 Assets	Very Poor
Furnishings, Fixtures and Equipment	Computers	\$1,894,699	2,268 Assets	Good
Furnishings, Fixtures and Equipment	Docking Station	\$450,831	1,665 Assets	Good
Furnishings, Fixtures and Equipment	Monitors	\$573,360	2,057 Assets	Good
Furnishings, Fixtures and Equipment	Network Devices	\$683,521	525 Assets	Very Poor
Furnishings, Fixtures and Equipment	Other Hardware	\$1,323,413	351 Assets	Poor
Furnishings, Fixtures and Equipment	Printers	\$538,491	318 Assets	Good
Furnishings, Fixtures and Equipment	Servers	\$1,109,709	415 Assets	Fair
Furnishings, Fixtures and Equipment	Telecom	\$599,865	2,102 Assets	Fair
Total	-	\$7,545,401	-	-

I.3.1.2 Age and Estimated Service Life

Figure I - 21 illustrates the age of Information Technology assets as a proportion of their estimated service life. Figure I - 22 illustrates the value of Information Technology assets acquired by decade. Audio visual, network devices, and other hardware assets have average ages past their average ESLs.

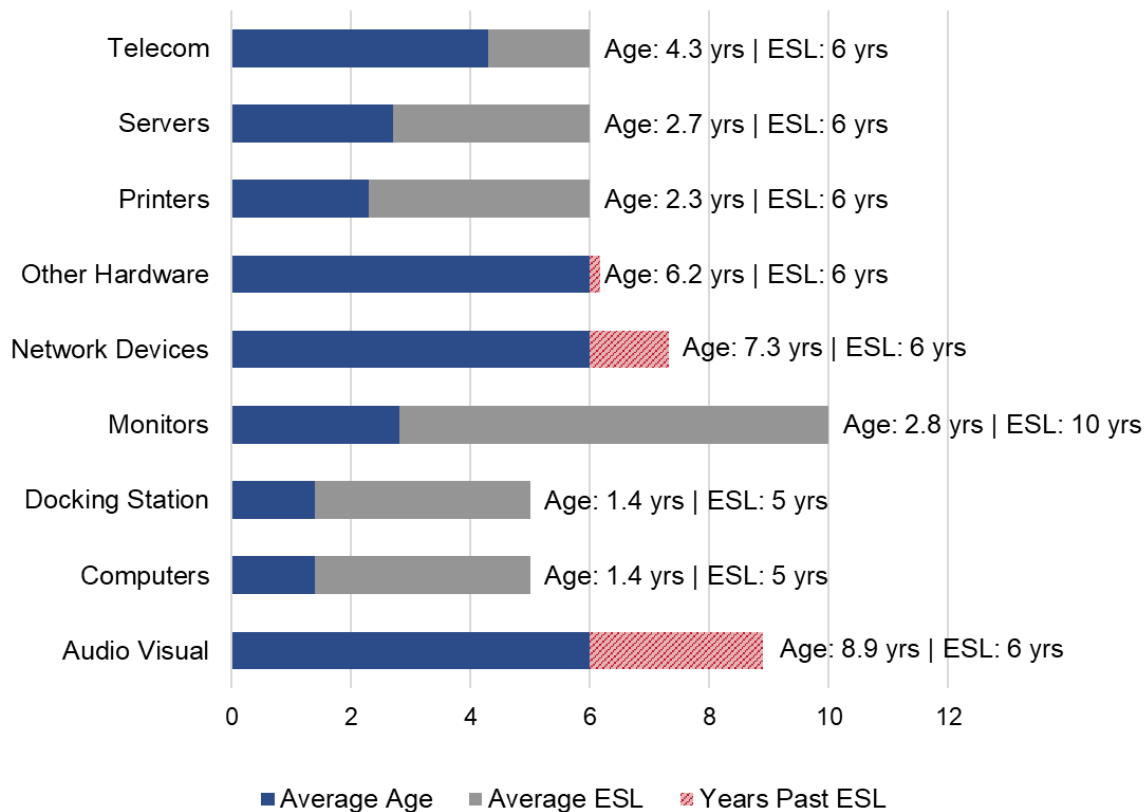


Figure I - 21: Age as a proportion of estimated service life (ESL) of Information Technology assets.

The installation profile of Information Technology assets illustrates that the majority of assets were installed in the 2010 and 2020s, in line with decades that experienced significant growth in the use of technology and how technology supports service delivery.

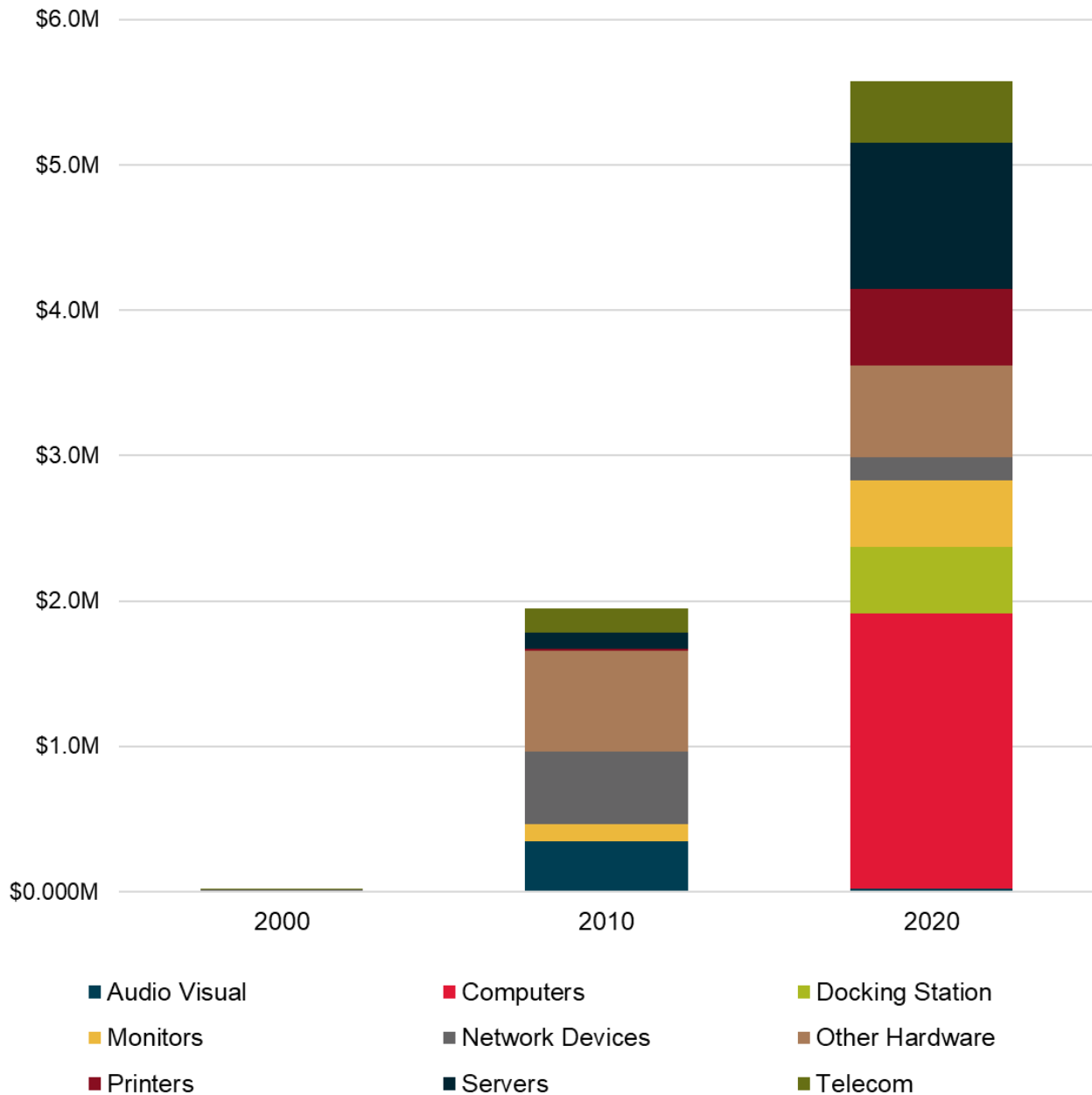


Figure I - 22: Age distribution by installation decade of Information Technology assets.

I.3.1.3 Asset Performance

Table I - 23 details the approaches that the City utilizes to understand the performance of Information Technology assets.

Table I - 23: Performance assessment approaches to Information Technology assets.

Asset Class	Condition Rating Metric	Approach to Assessing Condition
Office Equipment	Age/ESL	The City understands the performance of these assets based on asset age and estimated service life.
Computers	Age/ESL	See above
Docking Station	Age/ESL	See above
Servers	Age/ESL	See above
Telecom	Age/ESL	See above
Monitors	Age/ESL	See above
Printers	Age/ESL	See above
Other Hardware	Age/ESL	See above
Network Devices	Age/ESL	See above
Audio Visual	Age/ESL	See above

Figure I - 23 illustrates the performance distribution of the Information Technology services asset portfolio, while Figure I - 24 shows the performance distribution of Information Technology assets by asset class. Table I - 24 summarizes the relationship between the performance categories and how performance ratings are determined.

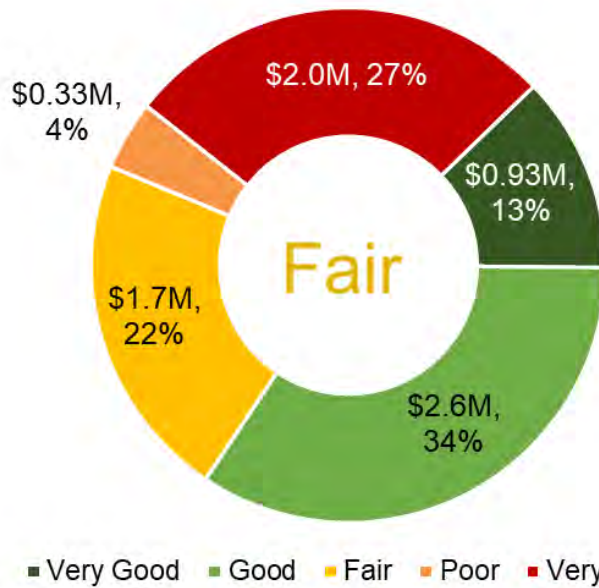


Figure I - 23: Condition distribution of Information Technology assets.

Table I - 24: Performance rating of Information Technology assets.

Condition Category	Age/ESL
Very Good	0% - 20%
Good	20% - 40%
Fair	40% - 60%
Poor	60% - 80%
Very Poor	>80%

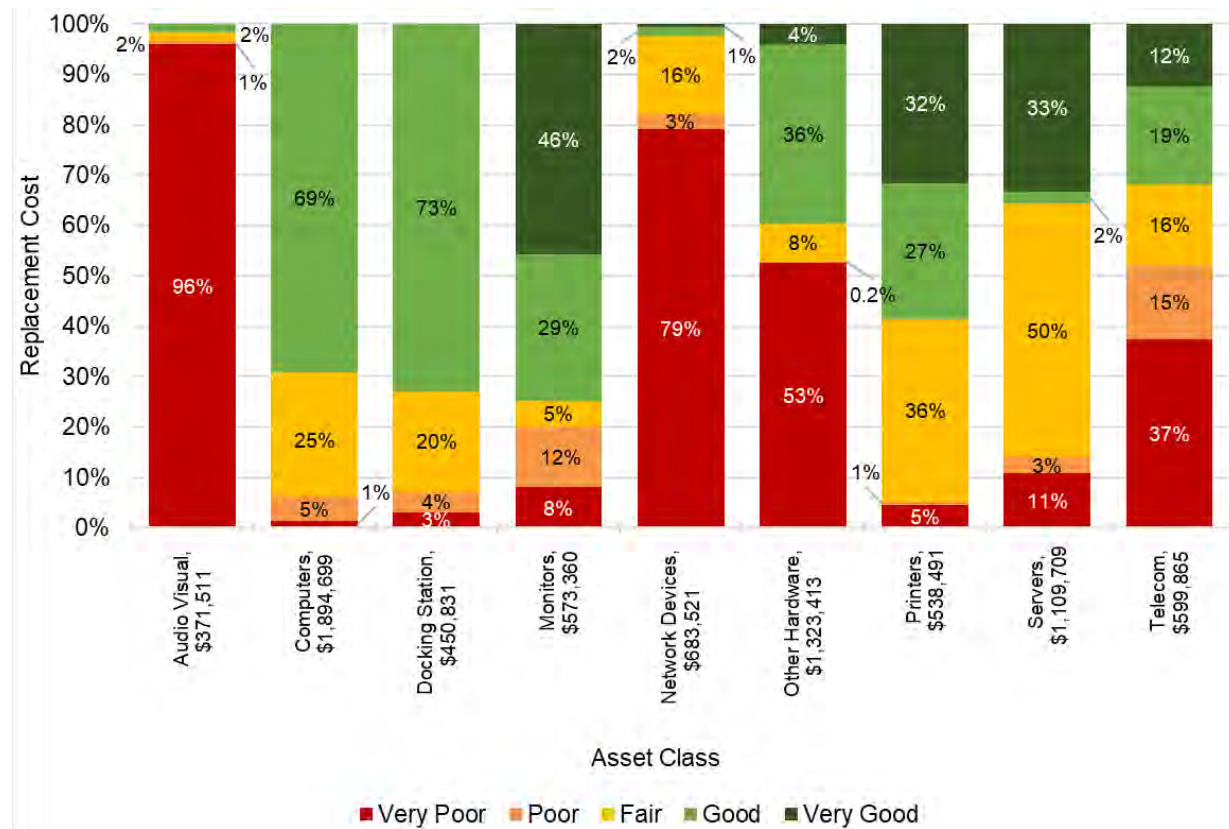


Figure I - 24: Condition distribution of Information Technology assets by asset class.

I.3.2 Levels of Service

Customer values, customer levels of service and technical levels of service for Information Technology assets can be found in Table I - 25 to Table I - 27.

I.3.2.1 Customer Values

Table I - 25: General Support Services customer values.

Customer Satisfaction Measure		Current Feedback and Expected Trend Based on Planned Budget
General Support Service assets are safe and reliable to use		
Assets are maintained in a state of good repair, are adequate for use, and in overall good working condition.		Future Iterations ³²
General Support Service are convenient to use		
The quality of assets do not negatively affect the customer.		Future Iterations ³²
General Support Service is accessible.		Future Iterations ³²
Environmentally sustainable		
Environmental impacts are minimized.		Future Iterations ³²

³² The City is currently reviewing the data that supports this metric, which will be reported in future iterations of the City's AMP. These metrics are subject to change as data is reviewed and incorporated into future AMPs.

I.3.2.2 Customer and Technical Levels of Service

Table I - 26: Information Technology customer LoS.

Type of Measure	Level of Service	Performance Measure	Current Performance	Confidence Levels
Condition	Condition of assets	Percentage of assets that have not exceeded their ESL.	82%	Confidence Levels: Low to medium – age and ESL are used to assess for condition. Condition data is unavailable.
Function	Measure of whether the service is appropriate for its intended use	Future Iterations ³³	Future Iterations ³³	Future Iterations ³³
Capacity	Measure of whether the service is adequate to meet customer needs	Future Iterations ³³	Future Iterations ³³	Future Iterations ³³
Accessibility	Service interruptions	Future Iterations ³³	Future Iterations ³³	Future Iterations ³³

³³ The City is currently reviewing and selecting measures for this category, which will be developed and integrated into future iterations of the City's AMP.

Table I - 27: Information Technology technical LoS.

Lifecycle Activity	Purpose of Activity	Frequency	Current Performance (\$, 2025 Budget)	Recommended Performance
Acquisition	Growth Expansion Development	Projects developed in Corporate Energy Management Plan, Digital Markham Strategy, and additional growth studies	\$3,713,900	Growth Planning Horizon: 2026-2051 Total Acquisition Value Range: \$3.8M - \$5.4M City Funded Acquisition Value Range: \$3.8M - \$5.4M
Operation	Inspections	Annual programs	Operating costs are funded through the operating budget and may also be funded through the capital budget depending on asset needs. In 2025, there are no operating costs funded through the 2025 capital budget. The City's 2025 operating budget for all services was \$495.8M.	Maintain current performance for assets in service. Anticipated operating budget increase ranges from \$0.10M to \$0.14M over the growth planning horizon: 2026-2051.
Operation	Regular Operations	As required	See above	See above

Lifecycle Activity	Purpose of Activity	Frequency	Current Performance (\$, 2025 Budget)	Recommended Performance
Maintenance	Minor repairs	As required	Maintenance costs are funded through the operating budget and may also be funded through the capital budget depending on asset needs. In 2025, there are no maintenance costs funded through the 2025 capital budget.	Maintain current performance for assets in service. Anticipated maintenance budget increases are included in the operating or renewal budget forecasts.
Maintenance	Regular Maintenance	Annual programs	See above	See above
Maintenance	Major maintenance (holding strategies)	As required	See above	See above
Renewal	Major rehabilitation or replacement	As required	\$2,135,500 (City's LCRS)	PLoS Maintain Current Performance requires \$956.2k per year on average from 2026 to 2051.
Disposal	Disposal of replaced assets	As required	Included in renewal costs	Maintain current performance for assets in service.
Service Improvement	Upgrades to improve LoS to benefit existing serviced areas	As required	\$62,464	Maintain Current Performance

I.3.3 Risk Management Strategy

The criteria used to determine the consequence of failure for Information Technology assets can be found in Table I - 28 below.

Table I - 28: COF criteria used for Information Technology assets.

Direct Financial	Socio-Economic	Environmental
• Replacement cost	• Asset Class	N/A

Table I - 29 displays the risk score for Information Technology assets along with the proportion of assets within each risk score, likelihood of failure and consequence of failure.

Table I - 29: Risk score distribution of Information Technology assets.

	COF 1	COF 2	COF 3	COF 4	COF 5	Subtotal
LOF 1	\$314,036 (4.2%)	\$620,011 (8.2%)	None	None	None	\$934,047 (12.4%)
LOF 2	\$1,956,597 (25.9%)	\$625,286 (8.3%)	None	None	None	\$2,581,882 (34.2%)
LOF 3	\$789,655 (10.5%)	\$861,530 (11.4%)	None	None	None	\$1,651,185 (21.9%)
LOF 4	\$167,954 (2.2%)	\$161,752 (2.1%)	None	None	None	\$329,705 (4.4%)
LOF 5	\$399,471 (5.3%)	\$1,649,110 (21.9%)	None	None	None	\$2,048,581 (27.2%)
Subtotal	\$3,627,712 (48.1%)	\$3,917,689 (51.9%)	None	None	None	\$7,545,401

Table I - 30: Risk score mapping legend.

Risk	Risk Score	Risk Description	Total Replacement Cost
Very Low	1 – 5	Fit for the Future	\$4,873,009 (64.6%)
Low	6 – 10	Adequate for Now	\$2,672,392 (35.4%)
Moderate	11 – 15	Requires Attention	None
High	16 – 20	At Risk	None
Very High	21 – 25	Unfit for Sustained Service	None

I.3.4 Lifecycle Management Activities

The City's lifecycle management activities for Information Technology assets are listed in Table I - 27. These activities include the acquisition of assets and service improvements, operations and maintenance, major asset renewals (including rehabilitations and replacements), and disposals.

These lifecycle management activities in conjunction with the lifecycle forecasting are used to determine the funding required for the City to continue performing these lifecycle activities to extend asset life, reduce overall costs, and minimize risk while providing the proposed service levels.

I.3.5 Lifecycle Forecasting

The following section outlines the funding required for the entire lifecycle of Information Technology assets. The expenditures were determined using the lifecycle activities outlined in Table I - 27 and the LoS established. Required funding for PLoS was determined using the following parameter:

- **Proposed LoS – Maintain Current Performance:** funding required to maintain a similar asset performance over a 26-year period. The City has established this LoS as the PLoS for Information Technology assets. It focuses on maintaining the percentage of assets in backlog in a similar state. Backlog is defined as assets that are in need of renewal work (either significant rehabilitation or replacement). For example, if 20% of assets are past their service life, or are in need of renewal work, then the forecast model will determine the funding to maintain 20% of assets in this state over the forecast period.

The following table summarizes the anticipated funding from the LCRS for renewal activities for Information Technology assets. A total of **\$52.8M** over the next 26 years (or an equivalent average annual of **\$2.0M**) for renewals is anticipated to be spent.

Table I - 31: Forecasted capital renewal expenditures (Life Cycle Reserve Study) Information Technology assets.

Year	Capital Expenditures (Renewals)
2026	\$1,548,791
2027	\$368,122
2028	\$1,257,014
2029	\$5,086,305
2030	\$2,773,782
2031	\$3,080,375

Year	Capital Expenditures (Renewals)
2032	\$1,823,138
2033	\$950,953
2034	\$2,953,858
2035	\$2,533,628
2036	\$2,923,297
2037	\$1,939,454
2038	\$1,235,554
2039	\$3,674,622
2040	\$2,006,522
2041	\$1,092,794
2042	\$1,620,789
2043	\$2,166,915
2044	\$3,711,369
2045	\$1,515,063
2046	\$1,481,357
2047	\$655,217
2048	\$428,116
2049	\$3,075,421
2050	\$1,824,400
2051	\$1,086,088
Total	\$52,812,945
Equivalent Average Annual	\$2,031,267

Figure I - 25 and Figure I - 26 illustrate the performance and financial forecasts to achieve PLoS for Information Technology assets. The forecast analysis identified a total of **\$24.9M** (or an equivalent average annual of \$956.2k) that is anticipated to be spent over the next 26 years to maintain current performance. The City plans to spend a total of **\$52.8M** (or an equivalent average annual of **\$2.0M**). This shows that the City's forecasted capital renewal expenditures (LCRS) are appropriate to maintain assets in a SOGR, and funding levels are adequate.

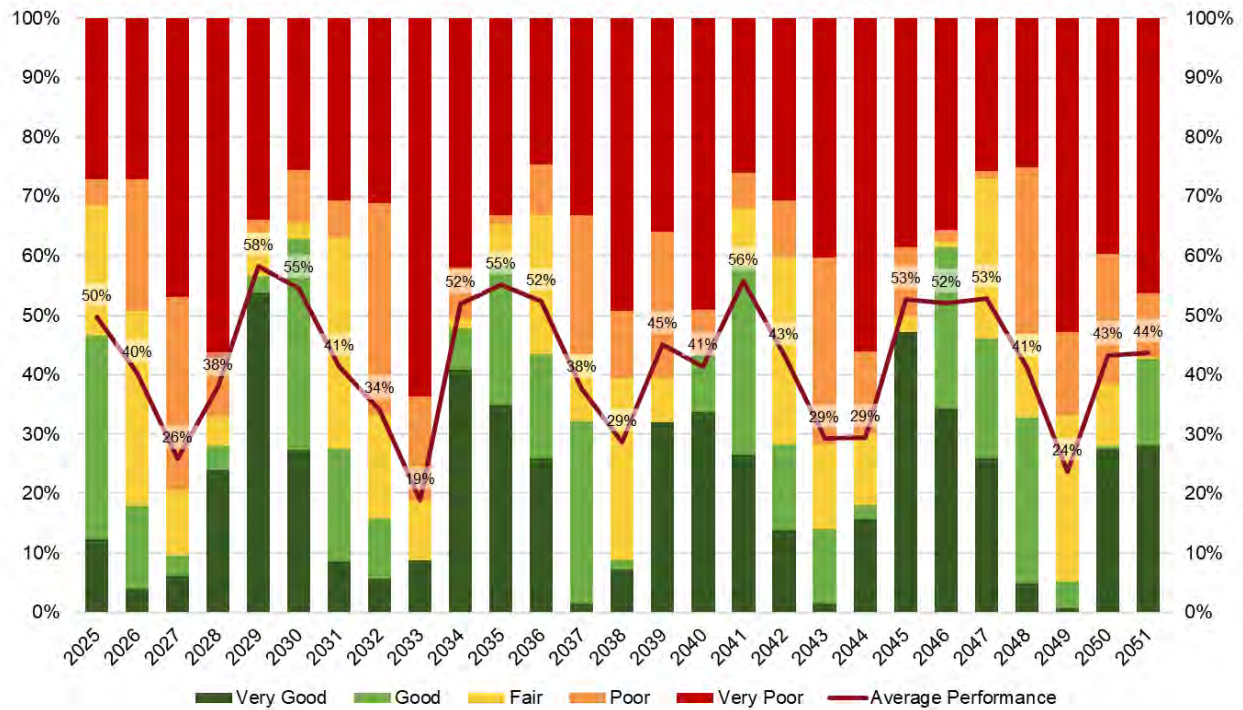


Figure I - 25: Performance Distribution – maintain current performance for Information Technology assets.



Figure I - 26: Maintain current performance intervention costs for Information Technology assets.

I.4 Proposed Levels of Service Themes and Future Challenges

The customer values and customer LoS were discussed with stakeholders. The following summarizes the feedback from the stakeholders related to service delivery, customer expectations, and challenges faced by the City, particularly challenges that may be encountered in the future:

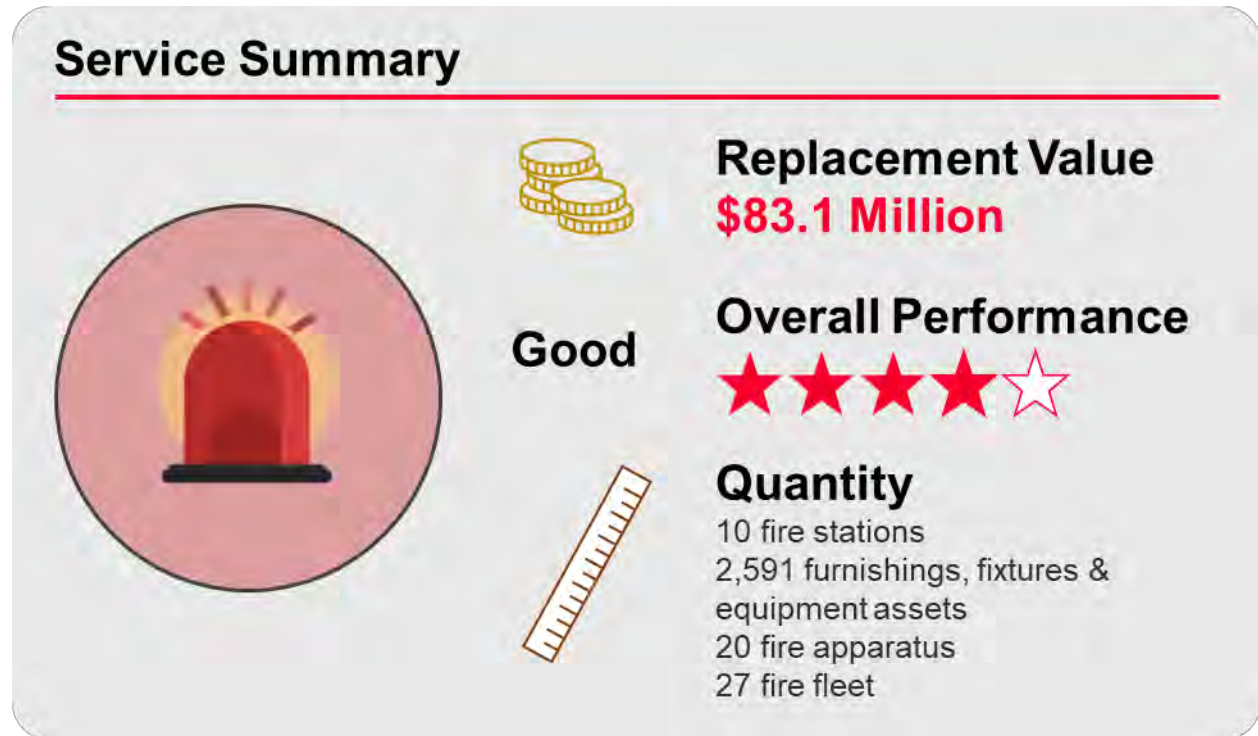
Table I - 32: Proposed LoS themes for General Support Services assets

Challenge	Discussion
Safe	Information Technology • Cyber security and ensuring that systems receive timely updates like security patches. • Proper agents are running on endpoints to avoid threats. • Monitoring systems are in place.
Reliable	Fleet • Availability is encompassed with safety and reliability. Information Technology • Related to how assets are performing to meet user needs with minimal downtime. • Ensuring that the ITS department can support the City by having enough funding and resources. • Making sure that assets are standardized (to ensure compatibility). • Good lifecycle management. Having proper backup and recovery.
Convenience	Facilities • The assets are well-maintained and modern. • Increasing levels of accessibility is required. • It is important to shift from reactive to proactive accessibility upgrades. Information Technology • Customer satisfaction (both staff and the public). • People can use technology and tools easily. • The currency and usability of user interfaces (e.g., CRM). • Implementing tools like single sign-on and providing flexibility (e.g., types of devices, having a showcase of devices to see when choosing devices). • Up to date hardware to access data in a timely fashion.

Challenge	Discussion
Sustainability	Facilities • Have more energy efficient technology for facilities. Fleet • Acquiring green fleet assets. • Retrofitting current buildings/building new shops to meet the demands of the new green fleet. Information Technology • Retaining recycling vendors when old equipment is decommissioned/disposed. • Hardware is energy efficient.

The insight from this discussion will be considered and incorporated into the City's AM processes and future iterations of the AMP. As the City continues to grow, it is important that current and future challenges are addressed in order to maintain service levels and achieve proposed service levels.

Appendix J. Fire and Emergency Services



The City's Fire and Emergency Services provides protection to the community, learning and education resources in order to keep residents informed all while responding to local needs and circumstances.

The City is responsible for assets such as various fire station facilities, fleet, furnishings, fixtures and equipment, as detailed in Figure J - 1.



Figure J - 1: Fire and Emergency Services asset hierarchy

More information on fire and emergency services such as state of infrastructure, levels of service, risk management strategies and lifecycle management strategies and forecasting can be found in the following sections. The sections are split by the major subservices: Fire and Emergency Services Facilities (Section J.1) and Fire and Emergency Services Fleet (Section J.2).

J.1 Fire & Emergency Services - Facilities

J.1.1 State of the Infrastructure

Figure J - 2 illustrates the replacement value distribution all fire and emergency service assets, while Figure J - 3 shows the replacement value distribution of fire and emergency service assets by asset class.

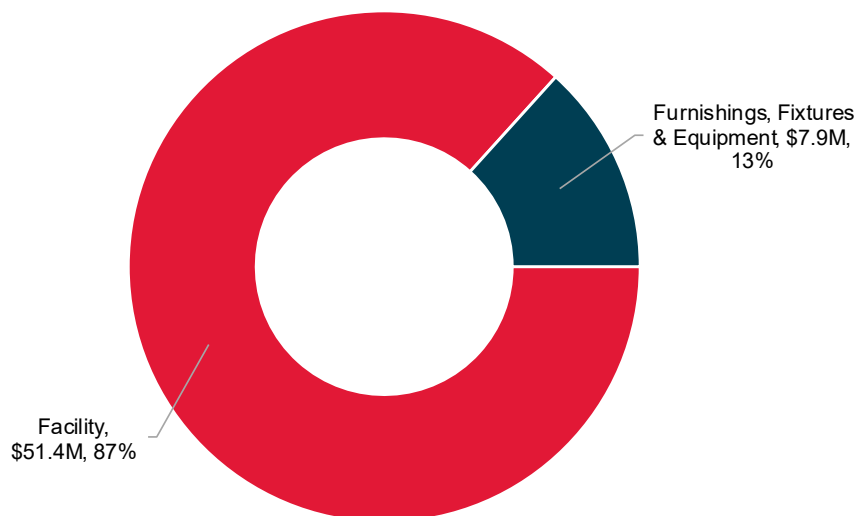


Figure J - 2: Replacement value distribution of Fire and Emergency Services assets.

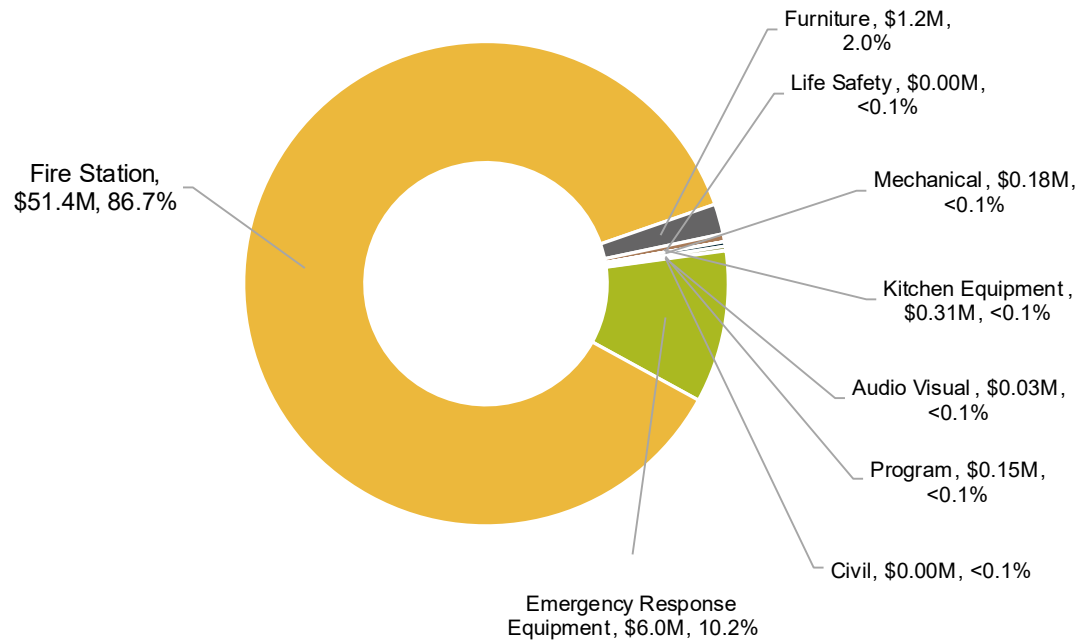


Figure J - 3: Replacement value distribution of Fire and Emergency Service assets by asset class.

J.1.1.1 Asset Inventory and Valuation

Table J - 1 below summarizes the asset valuation, quantities, and performance for each asset category of Fire and Emergency Services assets.

Table J - 1: Inventory and valuation for Fire and Emergency Service assets.

Asset Category	Asset Class	Replacement Cost	Inventory	Average Performance
Facility	Fire Station	\$51,355,598	103,865 sq ft	Very Good
Furnishing, Fixtures & Equipment	Audio Visual	\$25,696	6 Assets	Poor
Furnishing, Fixtures & Equipment	Civil	\$3,000	2 Assets	Fair
Furnishing, Fixtures & Equipment	Emergency Response Equipment	\$6,018,136	2,431 Assets	Fair
Furnishing, Fixtures & Equipment	Furniture	\$1,192,760	70 Assets	Poor
Furnishing, Fixtures & Equipment	Kitchen Equipment	\$309,536	18 Assets	Fair
Furnishing, Fixtures & Equipment	Life Safety	\$3,000	3 Assets	Very Poor
Furnishing, Fixtures & Equipment	Mechanical	\$177,376	27 Assets	Poor
Furnishing, Fixtures & Equipment	Program	\$152,127	34 Assets	Poor
Total	-	\$59,237,231	-	-

J.1.1.2 Age and Estimated Service Life

Figure J - 4 illustrates the age of fire and emergency service assets as a proportion of their estimated service life. Figure J - 5 illustrates the value of fire and emergency service assets acquired by decade. All fire and emergency service assets, with the exception of fire stations, are on average more than halfway through their ESL. Fire stations on average are only 15% through their ESL.

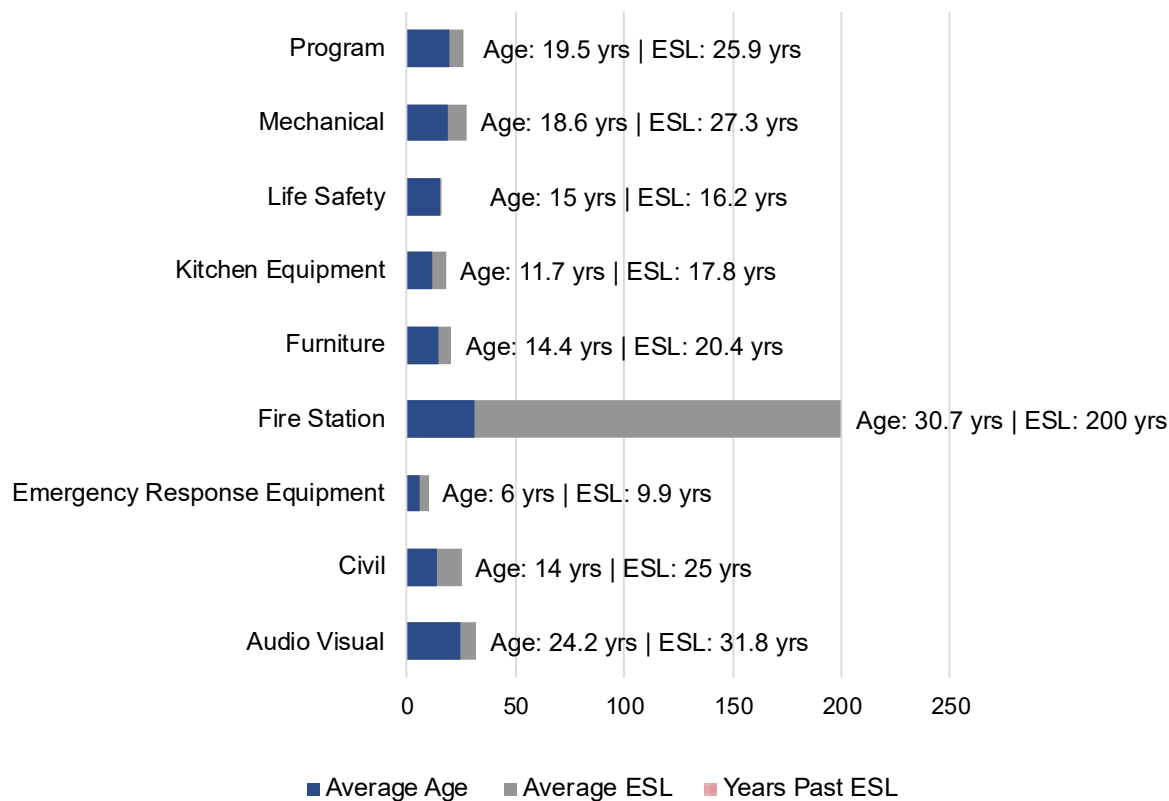


Figure J - 4: Age distribution by installation decade of Fire and Emergency Services assets.

The installation profile of fire and emergency service assets illustrates that the majority of fire stations were constructed from the 1970s to 2010s, in line with decades that experienced significant growth and corresponding development in the City.

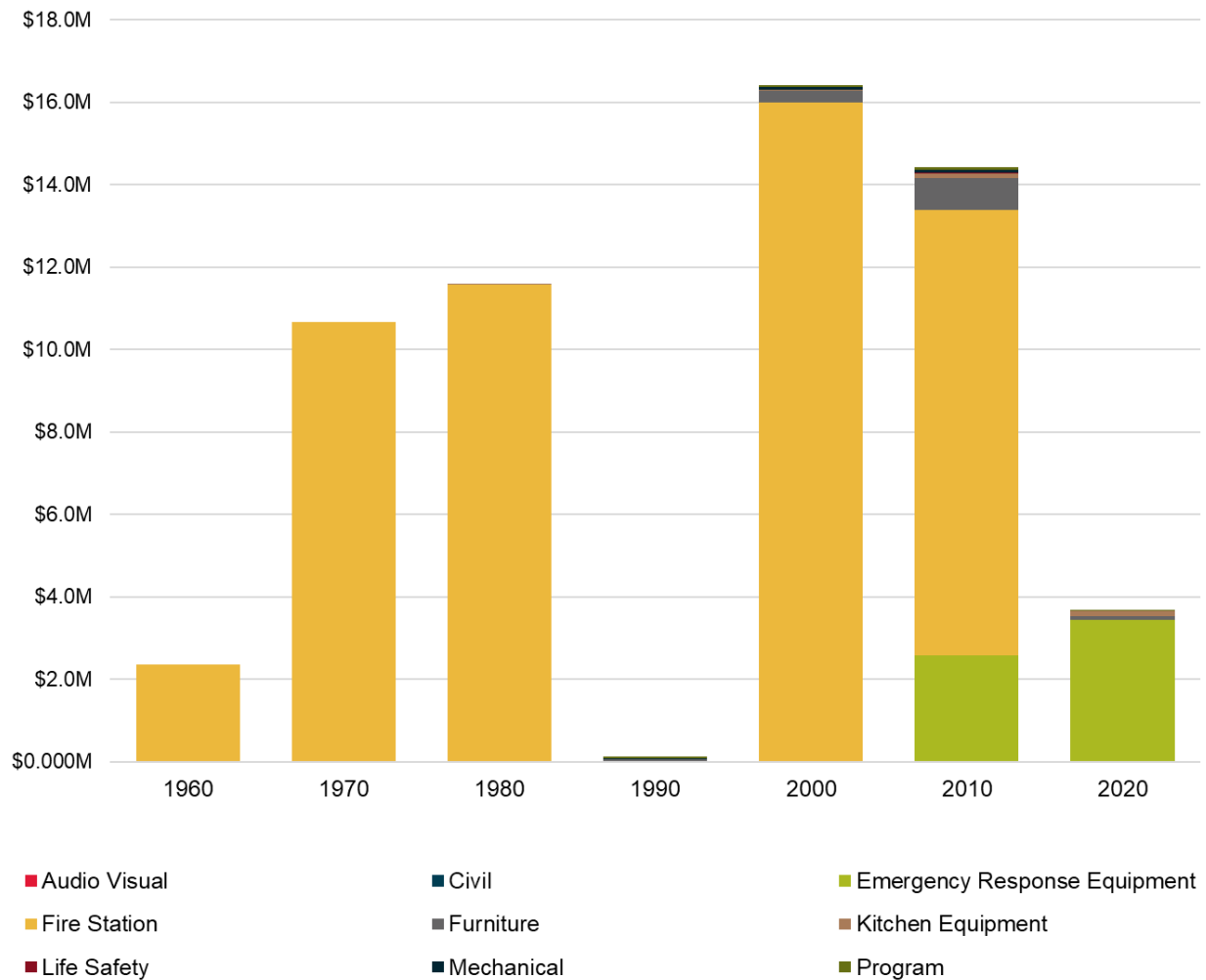


Figure J - 5: Age distribution by Installation decade of Fire and Emergency Services assets.

J.1.1.3 Asset Performance

Table J - 2 below details the approaches that the City utilizes to understand the performance of each asset class in fire and emergency services and the approaches used to assess performance.

Table J - 2: Performance assessment approaches to Fire and Emergency Services assets.

Asset Class	Condition Rating Metric	Approach to Assessing Condition
Fire Station	FCI	Facilities are inspected and the inspection results are recorded in City's database annually. The results are used to understand facility renewal needs and calculate the FCI rating.
Emergency Response Equipment	Age/ESL	The City understands the condition of these assets based on asset age and estimated service life.
Audio Visual	Age/ESL	See above
Civil	Age/ESL	See above
Furniture	Age/ESL	See above
Kitchen Equipment	Age/ESL	See above
Life Safety	Age/ESL	See above
Mechanical	Age/ESL	See above
Program	Age/ESL	See above

Table J - 3 summarizes the relationship between the performance categories and how performance ratings are determined. Figure J - 6 illustrates the performance distribution of all fire and emergency service assets, while Figure J - 7 shows the performance distribution of fire and emergency service assets by asset class.

Table J - 3: Performance ratings of Fire and Emergency Services assets.

Condition Category	Age/ESL	Facility Condition Index (FCI)
Very Good	0% - 20%	0% - 5%
Good	20% - 40%	5% - 10%
Fair	40% - 60%	10% - 30%

Poor	60% - 80%	30% - 60%
Very Poor	80% - 100%	60 - 100%

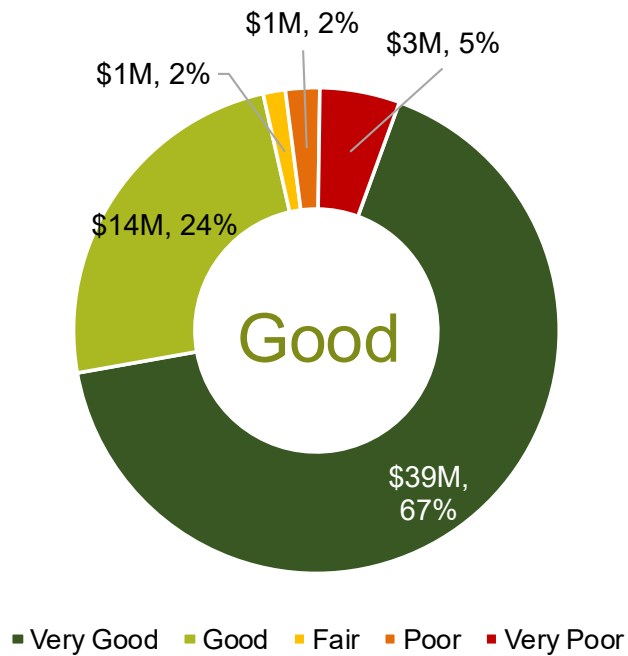


Figure J - 6: Condition distribution of Fire and Emergency Services assets.

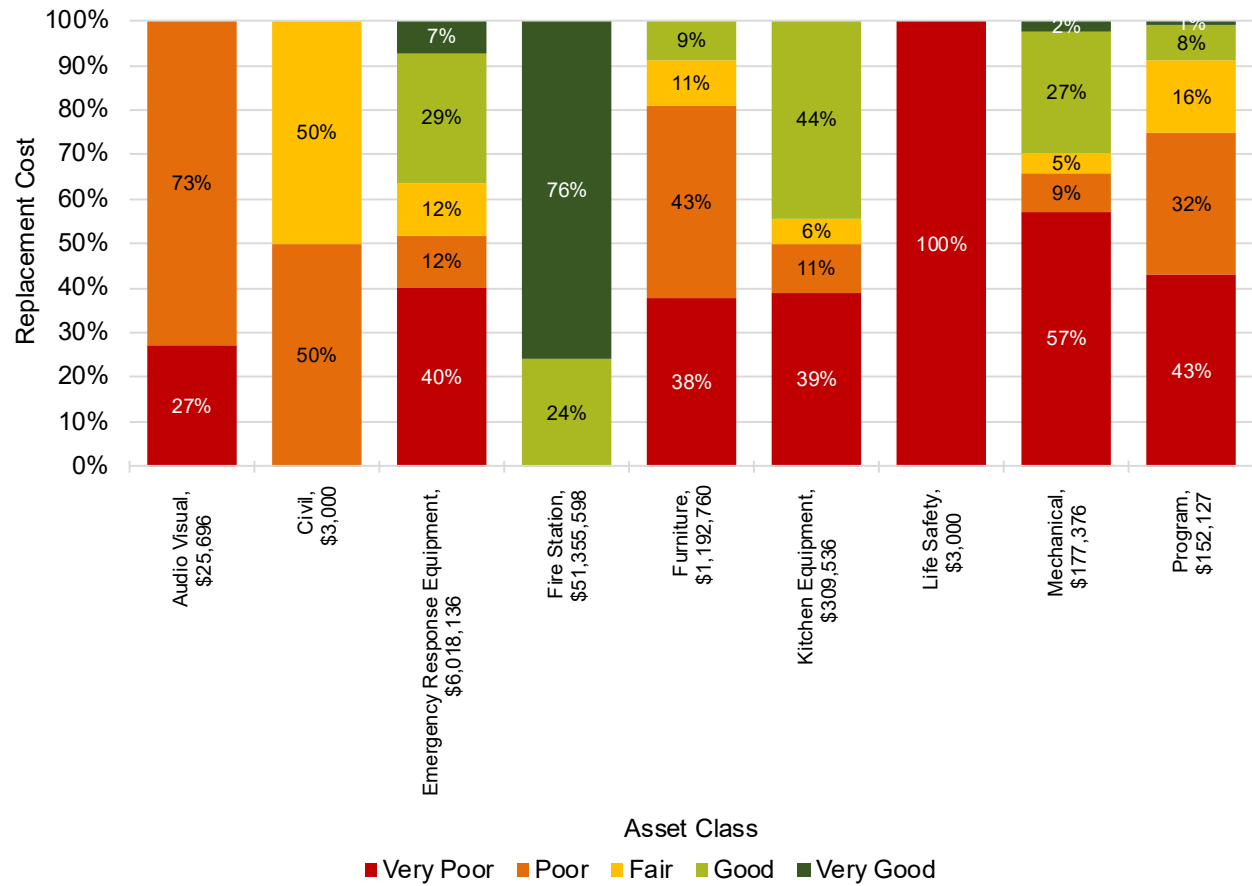


Figure J - 7: Condition distribution of Fire and Emergency Services assets by asset class.

J.1.2 Levels of Service

Customer values, customer levels of service and technical levels of service for Fire and Emergency Services can be found in Table J - 4 to Table J - 7.

J.1.2.1 Customer Values

Table J - 4: Fire and Emergency Services customer values.

Customer Satisfaction Measure		Current Feedback & Expected Trend Based on Planned Budget
Fire and emergency services assets are safe and reliable to use		
Assets are maintained in a state of good repair, are adequate for use, and in overall good working condition.		Future Iterations ³⁴
Fire and emergency services responds to incidents in a timely manner.		Future Iterations ³⁴
Fire and emergency services assets are available to the customer		
Fire and emergency services are actively working towards preventing fires.		Future Iterations ³⁴
Fire and emergency services are actively educating the public.		Future Iterations ³⁴
Fire services surpass the minimum requirement for rural communities.		Future Iterations ³⁴
Environmentally sustainable		
Environmental impacts are minimized		Future Iterations ³⁴

³⁴ The City is currently reviewing the data that supports this metric, which will be reported in future iterations of the City's AMP. These metrics are subject to change as data is reviewed and incorporated into future AMPs.

J.1.2.2 Customer and Technical Levels of Service

Table J - 5: Fire and Emergency Services – Facilities customer LoS.

Type of Measure	Level of Service	Performance Measure	Current Performance	Confidence Levels
Condition	Condition of Fire Stations	Average FCI rating of facilities.	0.04	High – building condition assessments are performed on facilities to determine investment needs.
Condition	Individual element/element group condition.	Percentage of all elements/element groups in poor condition.	0%	High – building condition assessments are performed on facilities to determine investment needs.
Condition	Individual element/element group condition.	Percentage of assets that have not exceeded their ESL.	100%	High – building condition assessments are performed on facilities to determine investment needs.
Function	Measure of whether the service is appropriate for its intended use.	Future Iterations ³⁵	Future Iterations ³⁵	Future Iterations ³⁵
Capacity	Measure of whether the service is adequate to meet customer needs.	Future Iterations ³⁵	Future Iterations ³⁵	Future Iterations ³⁵
Accessibility	Service interruptions	Future Iterations ³⁵	Future Iterations ³⁵	Future Iterations ³⁵

³⁵ The City is currently reviewing and selecting measures for this category, which will be developed and integrated into future iterations of the City's AMP.

Table J - 6: Fire and Emergency Services – Furnishings, Fixtures & Equipment customer LoS.

Type of Measure	Level of Service	Performance Measure	Current Performance	Confidence Levels
Condition	Condition of Audio Visual	Condition or Age/Remaining Useful Life - Aggregated into 5- point rating scale	Poor	Low to medium – age and ESL are used to assess for condition. Condition data is unavailable.
Condition	Condition of Civil	Condition or Age/Remaining Useful Life - Aggregated into 5- point rating scale	Poor	Low to medium – age and ESL are used to assess for condition. Condition data is unavailable.
Condition	Condition of Emergency Response Equipment	Condition or Age/Remaining Useful Life - Aggregated into 5- point rating scale	Fair	Low to medium – age and ESL are used to assess for condition. Condition data is unavailable.
Condition	Condition of Furniture	Condition or Age/Remaining Useful Life - Aggregated into 5- point rating scale	Poor	Low to medium – age and ESL are used to assess for condition. Condition data is unavailable.
Condition	Condition of Kitchen Equipment	Condition or Age/Remaining Useful Life - Aggregated into 5- point rating scale	Fair	Low to medium – age and ESL are used to assess for condition. Condition data is unavailable.
Condition	Condition of Life Safety	Condition or Age/Remaining Useful Life - Aggregated into 5- point rating scale	Very Poor	Low to medium – age and ESL are used to assess for condition. Condition data is unavailable.
Condition	Condition of Mechanical	Condition or Age/Remaining Useful Life - Aggregated into 5- point rating scale	Poor	Low to medium – age and ESL are used to assess for condition. Condition data is unavailable.

Type of Measure	Level of Service	Performance Measure	Current Performance	Confidence Levels
Condition	Condition of Program	Condition or Age/Remaining Useful Life - Aggregated into 5- point rating scale	Poor	Low to medium – age and ESL are used to assess for condition. Condition data is unavailable.
Condition	Individual element/element group condition.	Percentage of all elements/element groups in poor or very poor condition.	57%	Low to medium – age and ESL are used to assess for condition. Condition data is unavailable.
Condition	Individual element/element group condition.	Percentage of assets that have not exceeded their ESL.	97%	Low to medium – age and ESL are used to assess for condition. Condition data is unavailable.
Function	Measure of whether the service is appropriate for its intended use	Future Iterations ³⁵	Future Iterations ³⁵	Future Iterations ³⁵
Capacity	Measure of whether the service is adequate to meet customer needs	Future Iterations ³⁵	Future Iterations ³⁵	Future Iterations ³⁵
Accessibility	Service interruptions	Future Iterations ³⁵	Future Iterations ³⁵	Future Iterations ³⁵

Table J - 7: Fire & Emergency Services - Facilities technical LoS

Lifecycle Activity	Purpose of Activity	Frequency	Current Performance (\$, 2025 Budget)	Recommended Performance
Acquisition	Growth Expansion Development	Projects developed in City of Markham Emergency Response Plan, Master Fire Plan and the Council Endorsed Deployment Plan	\$396,500	Growth Planning Horizon: 2026-2051 Total Acquisition Value Range: \$21.1M - \$31.5M City Funded Acquisition Value Range: \$21.1M - \$31.5M
Operation	Inspections	Annual programs	\$79,957 The City's 2025 operating budget for all services was \$495.8M.	Maintain current performance for assets in service. Anticipated operating budget increase ranges from \$0.56M to \$0.84M over the growth planning horizon: 2026-2051.
Operation	Regular Operations	As required	See above	See above
Maintenance	Minor repairs	As needed	\$23,314	Maintain current performance for assets in service. Anticipated maintenance budget increases are included in the operating or renewal budget forecasts.
Maintenance	Regular Maintenance	Annual programs	See above	See above

Lifecycle Activity	Purpose of Activity	Frequency	Current Performance (\$, 2025 Budget)	Recommended Performance
Maintenance	Major maintenance (holding strategies)	As required	See above	See above
Renewal	Major rehabilitation or replacement	As required	\$1,759,257 (City's LCRS)	PLoS Maintain Current Performance requires \$1.28M per year on average from 2026 to 2051.
Disposal	Disposal of replaced assets	As required	Included in renewal costs	Maintain current performance for assets in service.
Service Improvement	Upgrades to improve LoS to benefit existing serviced areas	As required	-	Maintain LoS – The City continues to assess needs annually to determine and balance appropriate funding levels to support service improvement activities.

J.1.3 Risk Management Strategy

The criteria used to determine COF of fire and emergency service assets can be found in Table J - 8 below:

Table J - 8: COF criteria used for Fire & Emergency Services - Facilities assets.

Direct Financial	Socio-Economic	Environmental
Replacement cost	- Asset Class - Asset Detail	N/A

Table J - 9 displays the risk score for Fire & Emergency Services - Facilities assets along with the proportion of assets within each risk score, likelihood of failure and consequence of failure.

Table J - 9: Risk score distribution of Fire & Emergency Services - Facilities assets.

	COF 1	COF 2	COF 3	COF 4	COF 5	Subtotal
LOF 1	\$5,200 (<0.1%)	None	\$6,621,483 (11.2%)	\$32,852,905 (55.5%)	None	\$39,479,588 (66.6%)
LOF 2	\$105,179 (0.2%)	\$205,211 (0.3%)	\$14,067,726 (23.7%)	None	None	\$14,378,115 (24.3%)
LOF 3	\$148,470 (0.3%)	\$40,482 (0.1%)	\$687,719 (1.2%)	None	None	\$876,671 (1.5%)
LOF 4	\$554,986 (0.9%)	\$83,253 (0.1%)	\$710,187 (1.2%)	None	None	\$1,348,426 (2.3%)
LOF 5	\$484,897 (0.8%)	\$270,855 (0.5%)	\$2,398,679 (4.0%)	None	None	\$3,154,430 (5.3%)
Subtotal	\$1,298,731 (2.2%)	\$599,800 (1.0%)	\$24,485,794 (41.3%)	\$32,852,905 (55.5%)	None	\$59,237,231 (100.0%)

Table J - 10: Risk score mapping legend.

Risk	Risk Score	Risk Description	Total Replacement Cost
Very Low	1 – 5	Fit for the Future	\$40,978,330 (69.2%)
Low	6 – 10	Adequate for Now	\$15,150,034 (25.6%)
Moderate	11 – 15	Requires Attention	\$3,108,866 (5.2%)
High	16 – 20	At Risk	None
Very High	21 – 25	Unfit for Sustained Service	None

J.1.4 Lifecycle Management Activities

The City's lifecycle management activities for Fire and Emergency Services assets are listed in Table J - 11. These activities include the acquisition of assets and service improvements, operations and maintenance, major asset renewals (including rehabilitations and replacements), and disposals.

These lifecycle management activities in conjunction with the lifecycle forecasting are used to determine the funding required for the City to continue performing these lifecycle activities to extend asset life, reduce overall costs, and minimize risk while providing the proposed service levels.

J.1.5 Lifecycle Forecasting

The following section outlines the funding required for the entire lifecycle of Fire & Emergency Services - Facilities assets. The expenditures were determined using the lifecycle activities outlined in Table J - 11 and the PLoS established.

Required funding was determined for PLoS using the following forecasting analysis parameters:

- Proposed LoS – Maintaining Current Performance: funding required to maintain a similar asset performance over a 26-year period. The City has established this LoS as the PLoS for Fire & Emergency Services assets. It focuses on maintaining the percentage of assets in backlog in a similar state. Backlog is defined as assets that are in need of renewal work (either significant rehabilitation or replacement). For example, if 20% of assets are past their service life, or are in need of renewal work, then the forecast model will determine the funding to maintain 20% of assets in this state over the forecast period.

The following table summarizes the anticipated funding from the City's Life Cycle Reserve Study for renewal activities for Fire & Emergency Services - Facilities assets. A total of **\$89.0M** over the next 26 years (or an equivalent average annual of **\$3.4M**) for renewals is anticipated to be spent.

Table J - 11: Forecasted capital renewal expenditures (Life Cycle Reserve Study).

Year	Capital Expenditures (Renewals)
2026	\$3,901,722
2027	\$7,223,114
2028	\$1,383,204

Year	Capital Expenditures (Renewals)
2029	\$6,427,788
2030	\$4,055,273
2031	\$1,555,470
2032	\$2,581,842
2033	\$4,788,724
2034	\$4,988,571
2035	\$4,175,179
2036	\$3,216,295
2037	\$4,200,048
2038	\$1,435,945
2039	\$7,468,292
2040	\$2,486,530
2041	\$1,747,776
2042	\$1,894,304
2043	\$3,932,960
2044	\$3,697,715
2045	\$3,522,424
2046	\$2,735,526
2047	\$2,688,267
2048	\$1,191,699
2049	\$3,319,675
2050	\$2,685,846
2051	\$1,706,096
Total	\$89,010,284
Equivalent Average Annual	\$3,423,472

Figure J - 8 and Figure J - 9 illustrate the performance and financial forecasts to achieve PLoS for all Fire & Emergency Services - Facilities assets. The forecast analysis identified a total of **\$33.3M** (or an equivalent average annual of **\$1.3M**) that is anticipated to be spent over the next 26 years to maintain current performance. The City plans to spend a total of **\$89.0M** (or an equivalent average annual of **\$3.4M**). This shows that the City's forecasted capital renewal expenditures (LCRS) are appropriate to maintain assets in a SOGR, and funding levels are adequate.

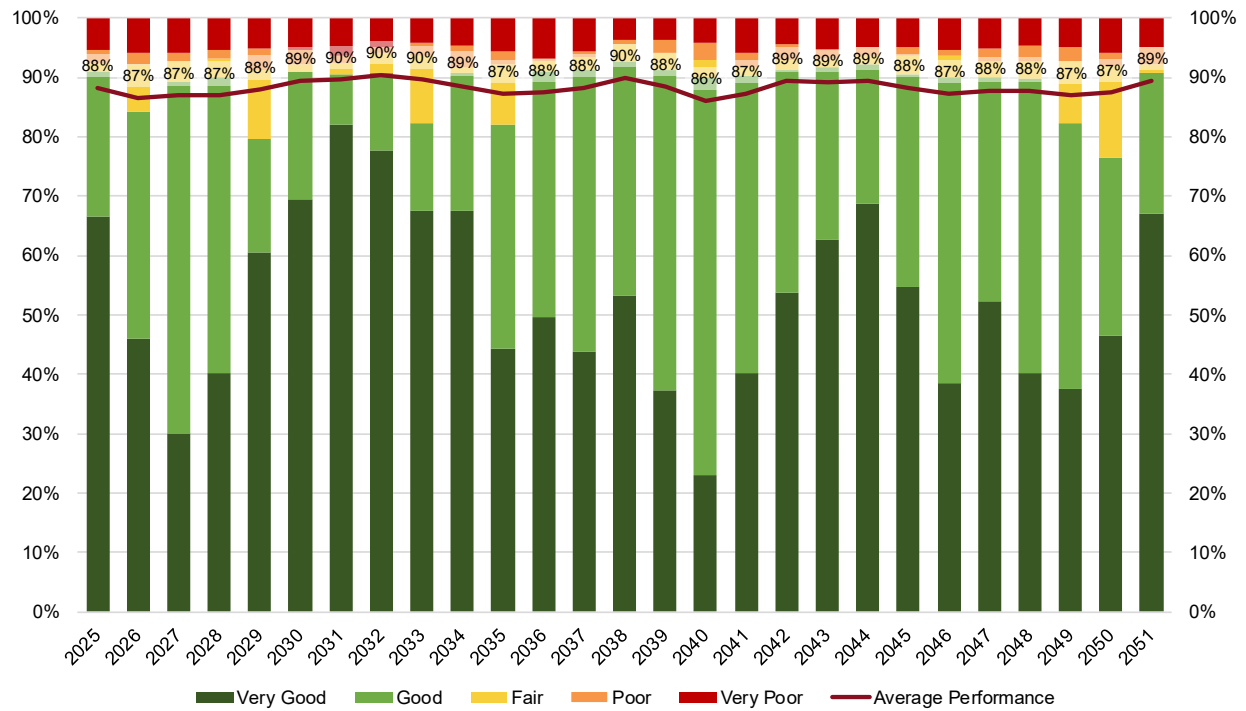


Figure J - 8: Performance distribution – maintain current performance for Fire & Emergency Services - Facilities assets.

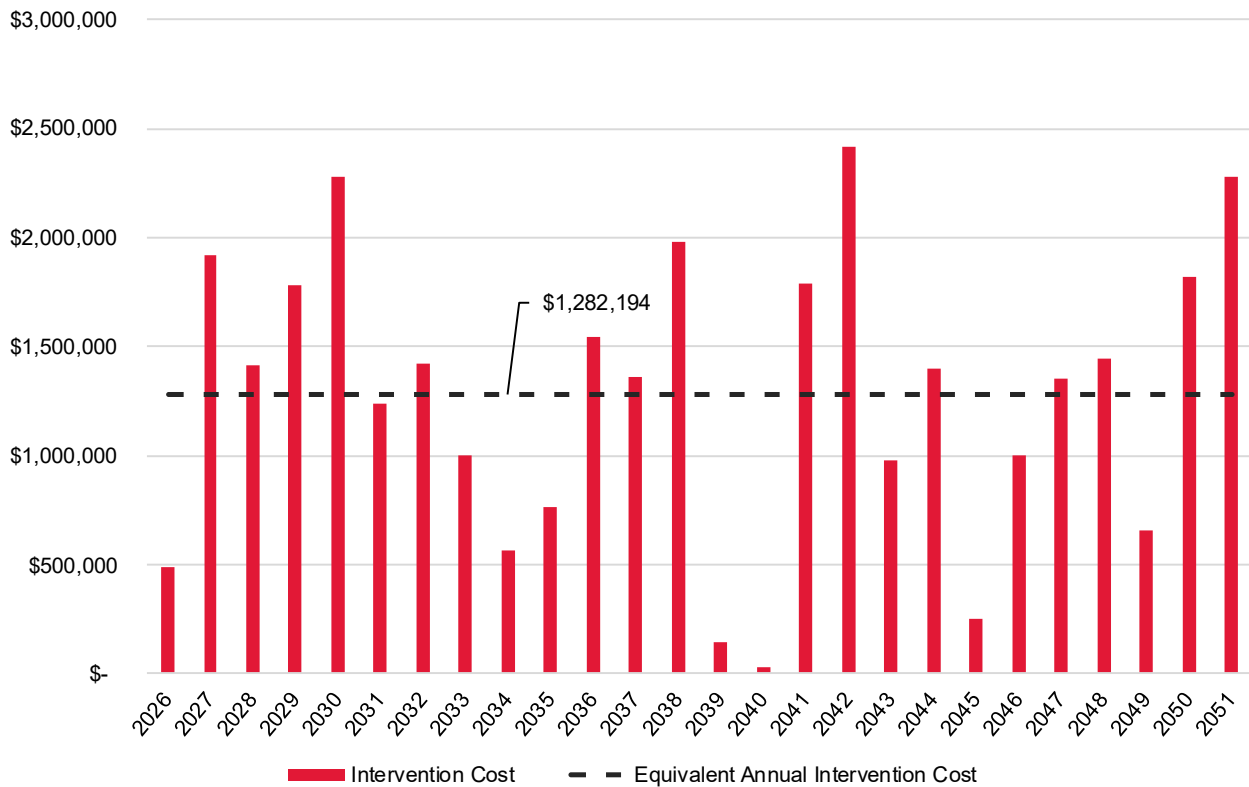


Figure J - 9: Maintain current performance intervention costs for Fire & Emergency Services - Facilities assets.

J.2 Fire & Emergency Services - Fleet

J.2.1 State of the Infrastructure

Figure J - 10 illustrates the replacement value distribution of the fleet asset portfolio, while Figure J - 11 shows the replacement value distribution of fleet assets by asset class.

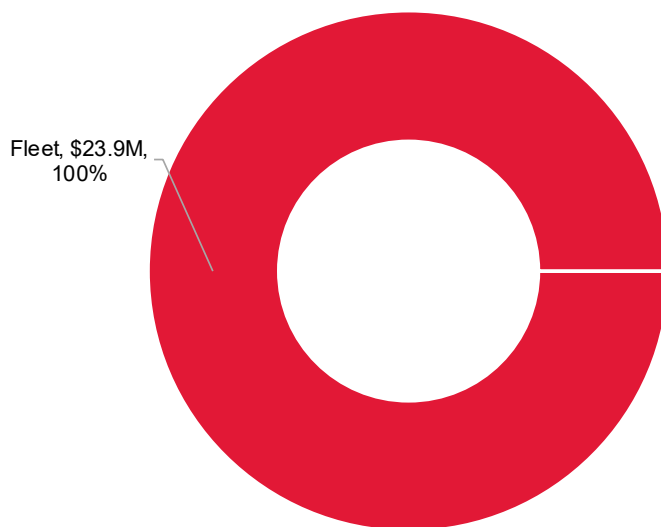


Figure J - 10: Replacement value distribution of Fleet assets.

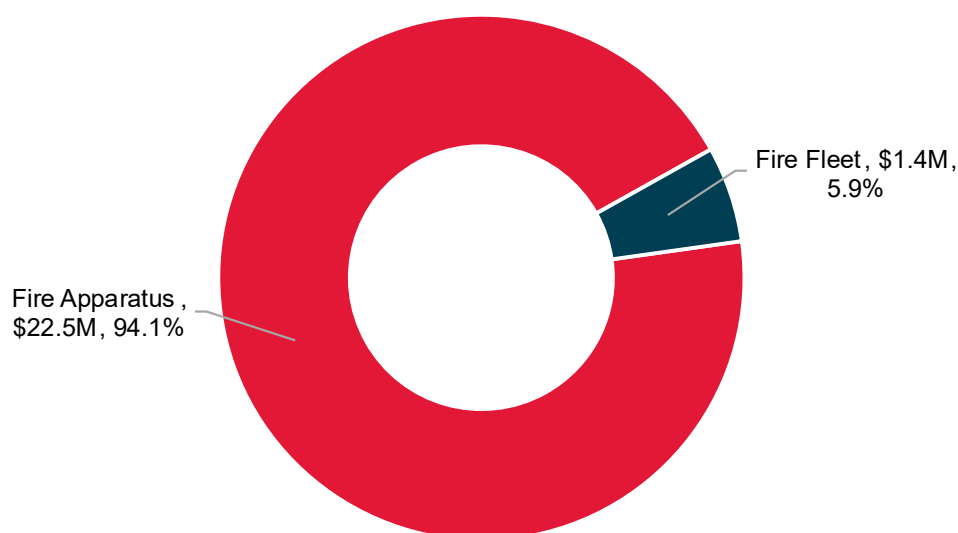


Figure J - 11: Replacement value distribution of Fleet assets by asset class.

J.2.1.1 Asset Inventory and Valuation

Table J - 12 below summarizes the asset valuation, quantities, and performance for each asset category of fleet assets.

Table J - 12: Inventory and valuation for Fleet assets.

Asset Category	Asset Class	Replacement Cost	Inventory	Average Performance
Fleet	Fire Apparatus	\$22,495,960	20 Assets	Poor
Fleet	Fire Fleet	\$1,409,159	27 Assets	Poor
Total	-	\$23,905,119	-	-

J.2.1.2 Age and Estimated Service Life

Figure J - 12 illustrates the age of fleet assets as a proportion of their estimated service life. Figure J - 13 illustrates the value of fleet assets acquired by decade. All fire fleet and fire apparatus assets are on average more than halfway through their ESL.

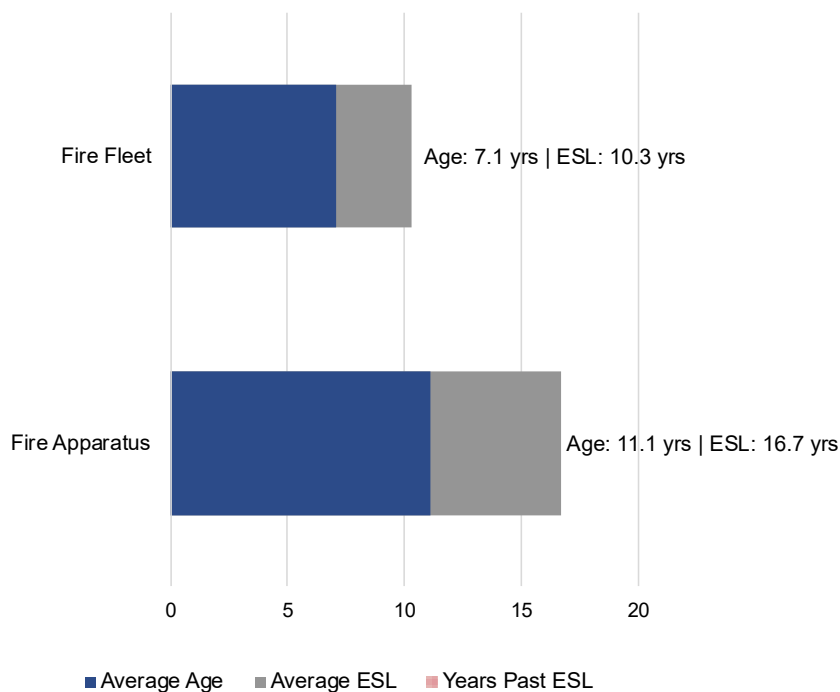


Figure J - 12: Age distribution by installation decade of Fleet assets.

The installation profile of fleet assets illustrates that the majority of fire apparatus were acquired in the 2010s, in line with decades that experienced significant growth and corresponding development in the City.

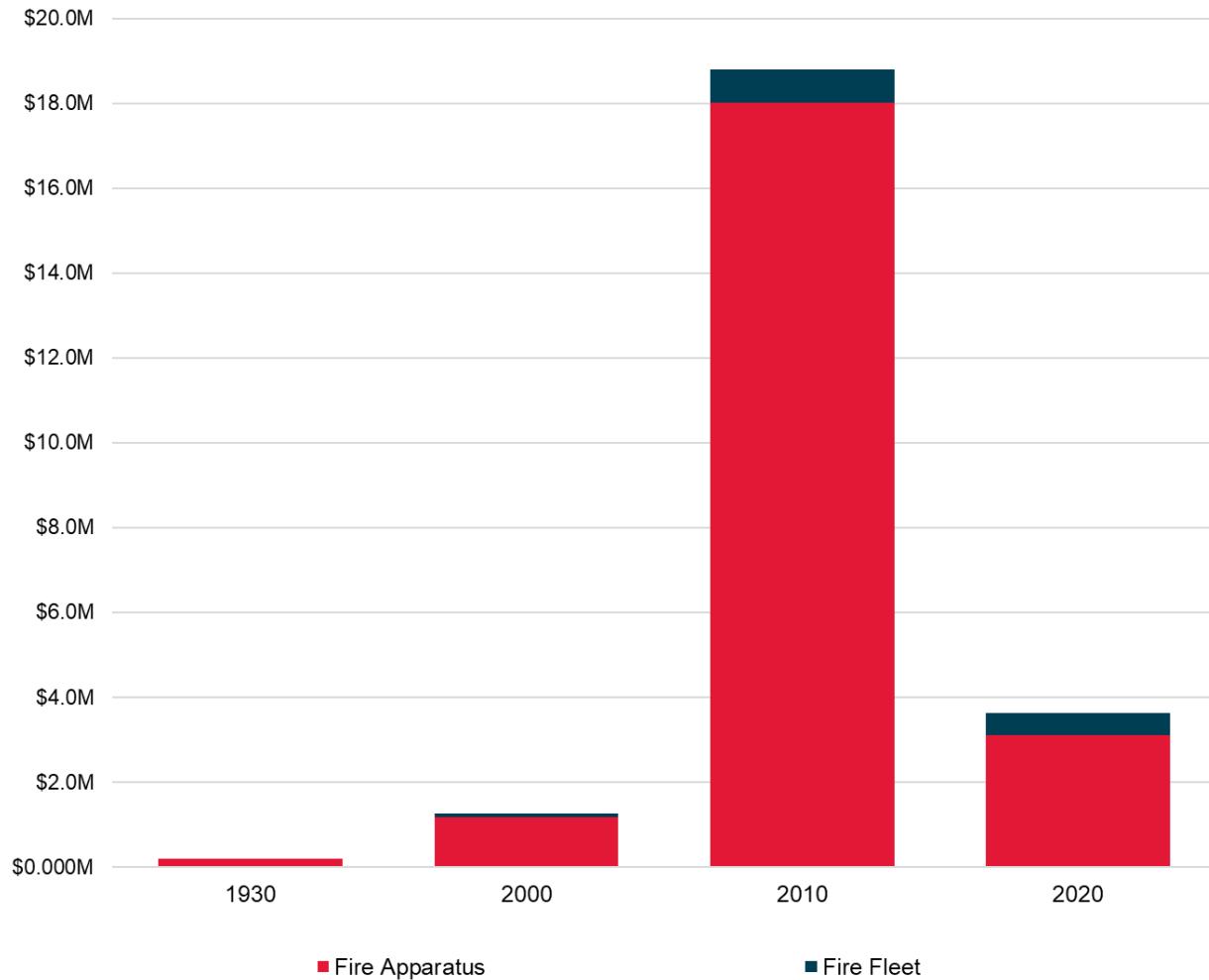


Figure J - 13: Age distribution by installation decade of Fleet assets.

J.2.1.3 Asset Performance

Table J - 13 below details the approaches that the City utilizes to understand the performance of each asset class in fleet and the approaches used to assess performance.

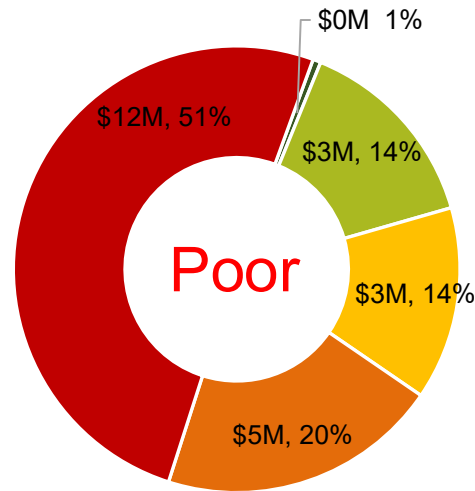
Table J - 13: Performance assessment approaches to Fleet Assets.

Asset Class	Condition Rating Metric	Approach to Assessing Condition
Fire Fleet	Age/ESL	The City understands the condition of these assets based on asset age and estimated service life.
Fire Apparatus	Age/ESL	See above

Table J - 14 summarizes the relationship between the performance categories and how performance ratings are determined. Figure J - 14 illustrates the performance distribution of all fleet assets, while Figure J - 15 shows the performance distribution of fleet assets by asset class.

Table J - 14: Performance ratings of Fleet Assets.

Condition Category	Age/ESL
Very Good	0% - 20%
Good	20% - 40%
Fair	40% - 60%
Poor	60% - 80%
Very Poor	80% - 100%



Very Good Good Fair Poor Very Poor

Figure J - 14: Condition distribution of Fleet assets.

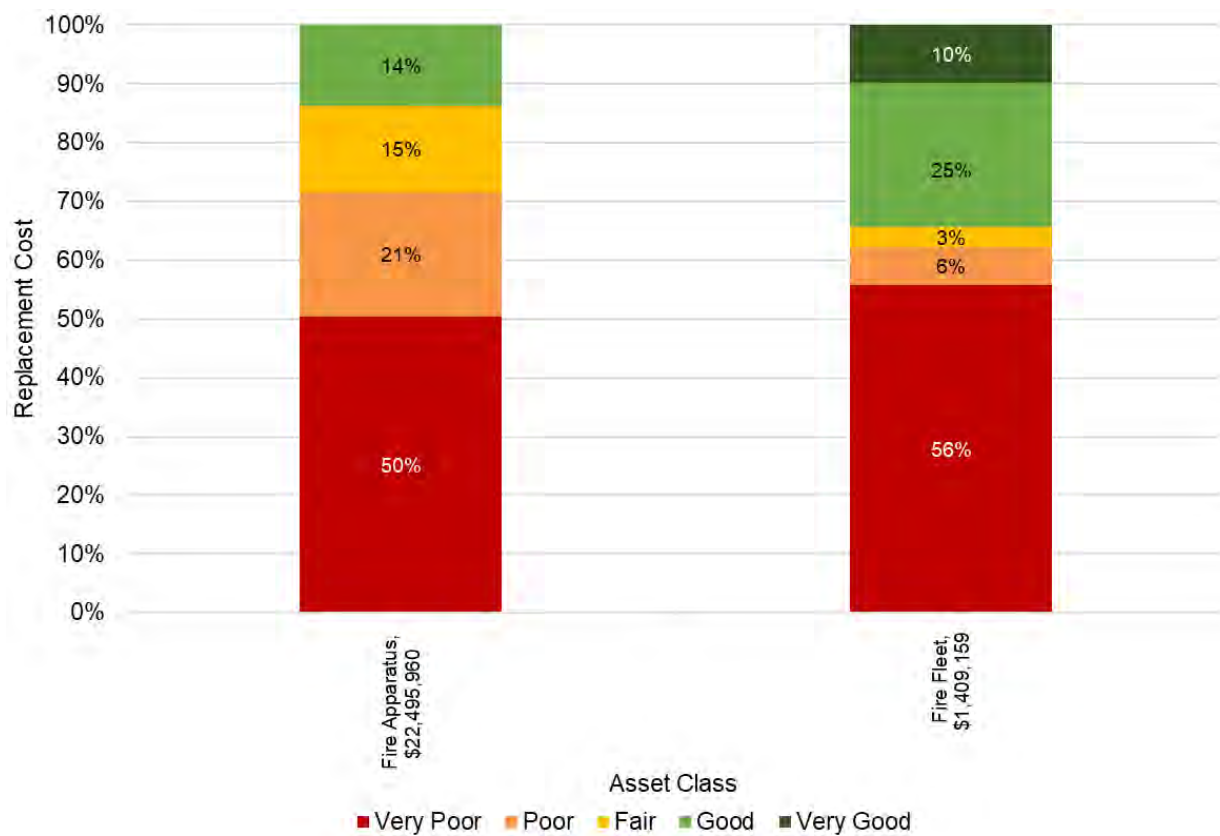


Figure J - 15: Condition distribution of Fleet assets by asset class.

J.2.2 Levels of Service

Customer values, customer levels of service and technical levels of service for fleet can be found in Table J - 15 to Table J - 17.

J.2.2.1 Customer Values

Table J - 15: Fleet customer values.

Customer Satisfaction Measure	Current Feedback & Expected Trend Based on Planned Budget
Fire and emergency services assets are safe and reliable to use	
Assets are maintained in a state of good repair, are adequate for use, and in overall good working condition.	Future Iterations ³⁶
Fire and emergency services responds to incidents in a timely manner.	Future Iterations ³⁶
Fire and emergency services assets are available to the customer	
Fire and emergency services are actively working towards preventing fires.	Future Iterations ³⁶
Fire and emergency services are actively educating the public.	Future Iterations ³⁶
Fire services surpass the minimum requirement for rural communities.	Future Iterations ³⁶
Environmentally sustainable	
Environmental impacts are minimized	Future Iterations ³⁶

³⁶ The City is currently reviewing the data that supports this metric, which will be reported in future iterations of the City's AMP. These metrics are subject to change as data is reviewed and incorporated into future AMPs.

J.2.2.2 Customer and Technical Levels of Service

Table J - 16: Fleet customer LoS.

Type of Measure	Level of Service	Performance Measure	Current Performance	Confidence Levels
Condition	Condition of Fire Fleet	Condition or Age/Remaining Useful Life - Aggregated into 5-point rating scale	Poor	Low to medium – age and ESL are used to assess for condition. Condition data is unavailable.
Condition	Condition of Fire Apparatus	Condition or Age/Remaining Useful Life - Aggregated into 5-point rating scale	Poor	Low to medium – age and ESL are used to assess for condition. Condition data is unavailable.
Condition	Individual element/element group condition.	Percentage of all elements/element groups in poor or very poor condition.	71%	Low to medium – age and ESL are used to assess for condition. Condition data is unavailable.
Condition	Individual element/element group condition.	Percentage of assets that have not exceeded their ESL.	83%	Low to medium – age and ESL are used to assess for condition. Condition data is unavailable.
Function	Measure of whether the service is appropriate for its intended use	Future Iterations ³⁷	Future Iterations ³⁷	Future Iterations ³⁷

³⁷ The City is currently reviewing and selecting measures for this category, which will be developed and integrated into future iterations of the City's AMP.

Type of Measure	Level of Service	Performance Measure	Current Performance	Confidence Levels
Capacity	Measure of whether the service is adequate to meet customer needs	Future Iterations ³⁷	Future Iterations ³⁷	Future Iterations ³⁷
Accessibility	Service interruptions	Future Iterations ³⁷	Future Iterations ³⁷	Future Iterations ³⁷

Table J - 17: Fire & Emergency Services - Fleet technical LoS.

Lifecycle Activity	Purpose of Activity	Frequency	Current Performance (\$, 2025 Budget)	Recommended Performance
Acquisition	Growth Expansion Development	Projects developed in City of Markham Emergency Response Plan, Master Fire Plan and the Council Endorsed Deployment Plan	-	Growth Planning Horizon: 2026-2051 Total Acquisition Value Range: \$6.1M - \$9.6M City Funded Acquisition Value Range: \$6.1M - \$9.6M
Operation	Inspections	Annual programs	Operating costs are funded through the operating budget and may also be funded through the capital budget depending on asset needs. In 2025, there are no operating costs funded through the 2025 capital budget. The City's 2025 operating budget for	Maintain current performance for assets in service. Anticipated operating budget increase ranges from \$0.16M to \$0.25M over the growth planning horizon: 2026-2051.

Lifecycle Activity	Purpose of Activity	Frequency	Current Performance (\$, 2025 Budget)	Recommended Performance
			all services was \$495.8M.	
Operation	Regular Operations	As required	See above	See above
Maintenance	Minor repairs	As needed	Maintenance costs are funded through the operating budget and may also be funded through the capital budget depending on asset needs. In 2025, there are no maintenance costs funded through the 2025 capital budget.	Maintain current performance for assets in service. Anticipated maintenance budget increases are included in the operating or renewal budget forecasts.
Maintenance	Regular Maintenance	Annual programs	See above	See above
Maintenance	Major maintenance (holding strategies)	As required	See above	See above
Renewal	Major rehabilitation or replacement	As required	-	PLoS Maintain Current Performance requires \$1.8M per year on average from 2026 to 2051.

Lifecycle Activity	Purpose of Activity	Frequency	Current Performance (\$, 2025 Budget)	Recommended Performance
Disposal	Disposal of replaced assets	As required	Included in renewal costs	Maintain current performance for assets in service.
Service Improvement	Upgrades to improve LoS to benefit existing serviced areas	As required	-	Maintain LoS – The City continues to assess needs annually to determine and balance appropriate funding levels to support service improvement activities.

J.2.3 Risk Management Strategy

The criteria used to determine COF of Fleet Assets can be found in Table J - 18 below:

Table J - 18: COF Criteria used for Fire & Emergency Services - Fleet Assets.

Direct Financial	Socio-Economic	Environmental
Replacement cost	- Asset Class - Asset Detail	N/A

Table J - 19 displays the risk score for Fire & Emergency Services - Fleet assets along with the proportion of assets within each risk score, likelihood of failure and consequence of failure.

Table J - 19: Risk Score Distribution of Fire & Emergency Services - Fleet Assets.

	COF 1	COF 2	COF 3	COF 4	COF 5	Subtotal
LOF 1	None	\$44,573 (0.2%)	\$94,676 (0.4%)	None	None	\$139,249 (0.6%)
LOF 2	None	\$111,791 (0.5%)	\$3,334,252 (13.9%)	None	None	\$3,446,043 (14.4%)
LOF 3	None	\$47,487 (0.2%)	\$3,300,082 (13.8%)	None	None	\$3,347,569 (14.0%)
LOF 4	None	\$77,321 (0.3%)	\$4,795,567 (20.1%)	None	None	\$4,872,888 (20.4%)
LOF 5	None	\$769,055 (3.2%)	\$11,330,315 (47.4%)	None	None	\$12,099,370 (50.6%)
Subtotal	None	\$1,050,227 (4.4%)	\$22,854,892 (95.6%)	None	None	\$23,905,119 (100.0%)

Table J - 20: Risk score mapping legend.

Risk	Risk Score	Risk Description	Total Replacement Cost
Very Low	1 – 5	Fit for the Future	\$251,040 (1.1%)
Low	6 – 10	Adequate for Now	\$7,528,197 (31.5%)
Moderate	11 – 15	Requires Attention	\$16,125,882 (67.5%)
High	16 – 20	At Risk	None
Very High	21 – 25	Unfit for Sustained Service	None

J.2.4 Lifecycle Management Activities

The City's lifecycle management activities for Fleet assets are listed in Table J - 21. These activities include the acquisition of assets and service improvements, operations and maintenance, major asset renewals (including rehabilitations and replacements), and disposals.

These lifecycle management activities in conjunction with the lifecycle forecasting are used to determine the funding required for the City to continue performing these lifecycle activities to extend asset life, reduce overall costs, and minimize risk while providing the proposed service levels.

J.2.5 Lifecycle Forecasting

The following section outlines the funding required for the entire lifecycle of Fire & Emergency Services - Fleet assets. The expenditures were determined using the lifecycle activities outlined in Table J - 21 and the PLoS established.

Required funding was determined for PLoS using the following forecasting analysis parameters:

- Proposed LoS – Maintaining Current Performance:** funding required to maintain a similar asset performance over a 26-year period. The City has established this LoS as the PLoS for Fleet assets. It focuses on maintaining the percentage of assets in backlog in a similar state. Backlog is defined as assets that are in need of renewal work (either significant rehabilitation or replacement). For example, if 20% of assets are past their service life, or are in need of renewal work, then the forecast model will determine the funding to maintain 20% of assets in this state over the forecast period.

The following table summarizes the anticipated funding from the City's Life Cycle Reserve Study for renewal activities for Fire & Emergency Services - Fleet assets. A total of **\$55.5M** over the next 26 years (or an equivalent average annual of **\$2.1M**) for renewals is anticipated to be spent.

Table J - 21: Forecasted capital renewal expenditures (Life Cycle Reserve Study).

Year	Capital Expenditures (Renewals)
2026	\$2,350,343
2027	\$5,532,774
2028	\$0
2029	\$4,646,725
2030	\$2,405,963
2031	\$241,972

Year	Capital Expenditures (Renewals)
2032	\$312,726
2033	\$3,780,801
2034	\$3,888,419
2035	\$1,458,231
2036	\$2,253,678
2037	\$2,876,235
2038	\$40,260
2039	\$6,467,588
2040	\$1,636,978
2041	\$123,390
2042	\$656,668
2043	\$3,034,702
2044	\$2,505,562
2045	\$1,796,702
2046	\$1,745,305
2047	\$2,224,570
2048	\$170,501
2049	\$2,798,092
2050	\$1,314,726
2051	\$1,227,512
Total	\$55,490,423
Equivalent Average Annual	\$2,134,247

Figure J - 16 and Figure J - 17 illustrate the performance and financial forecasts to achieve PLoS for all Fire & Emergency Services - Fleet assets. The forecast analysis identified a total of **\$47.5M** (or an equivalent average annual of **\$1.8M**) that is anticipated to be spent over the next 26 years to maintain current performance. The City plans to spend a total of **\$55.5M** (or an equivalent average annual of **\$2.1M**). This shows that the City's forecasted capital renewal expenditures (LCRS) are appropriate to maintain assets in a SOGR, and funding levels are adequate.

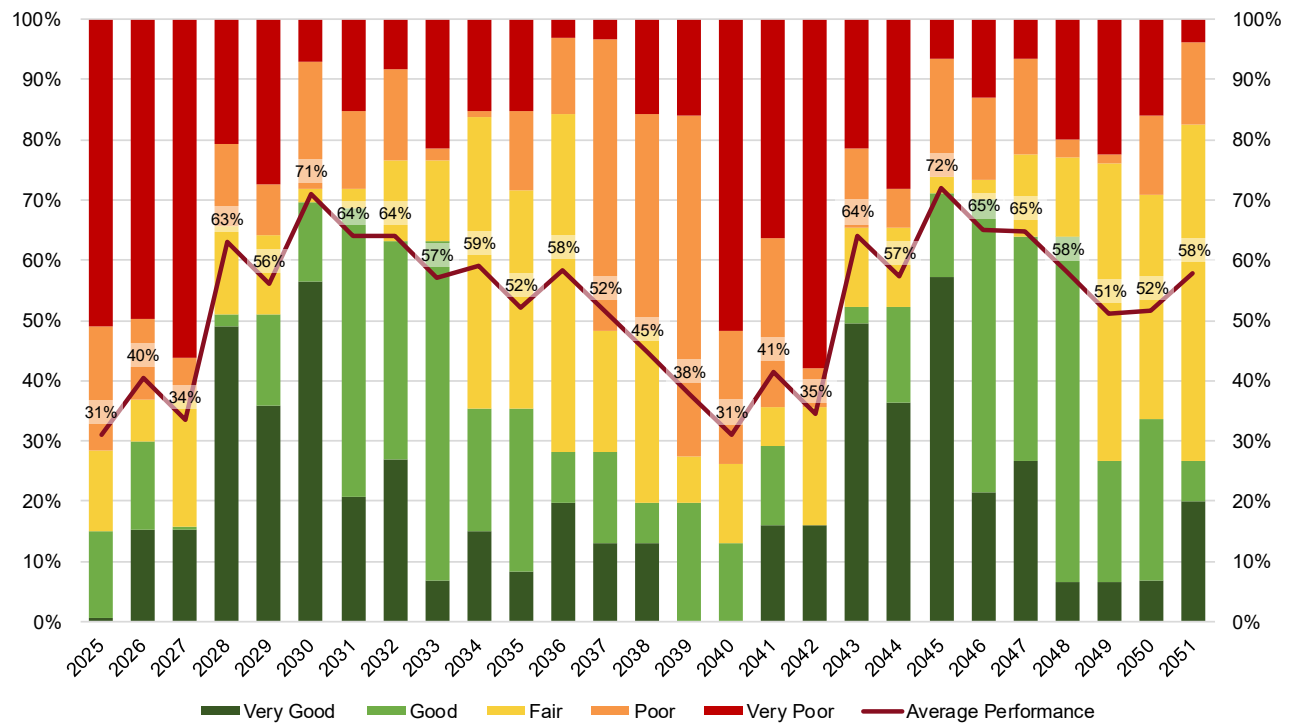


Figure J - 16: Performance distribution – maintain current performance for Fire & Emergency Services - Fleet assets.

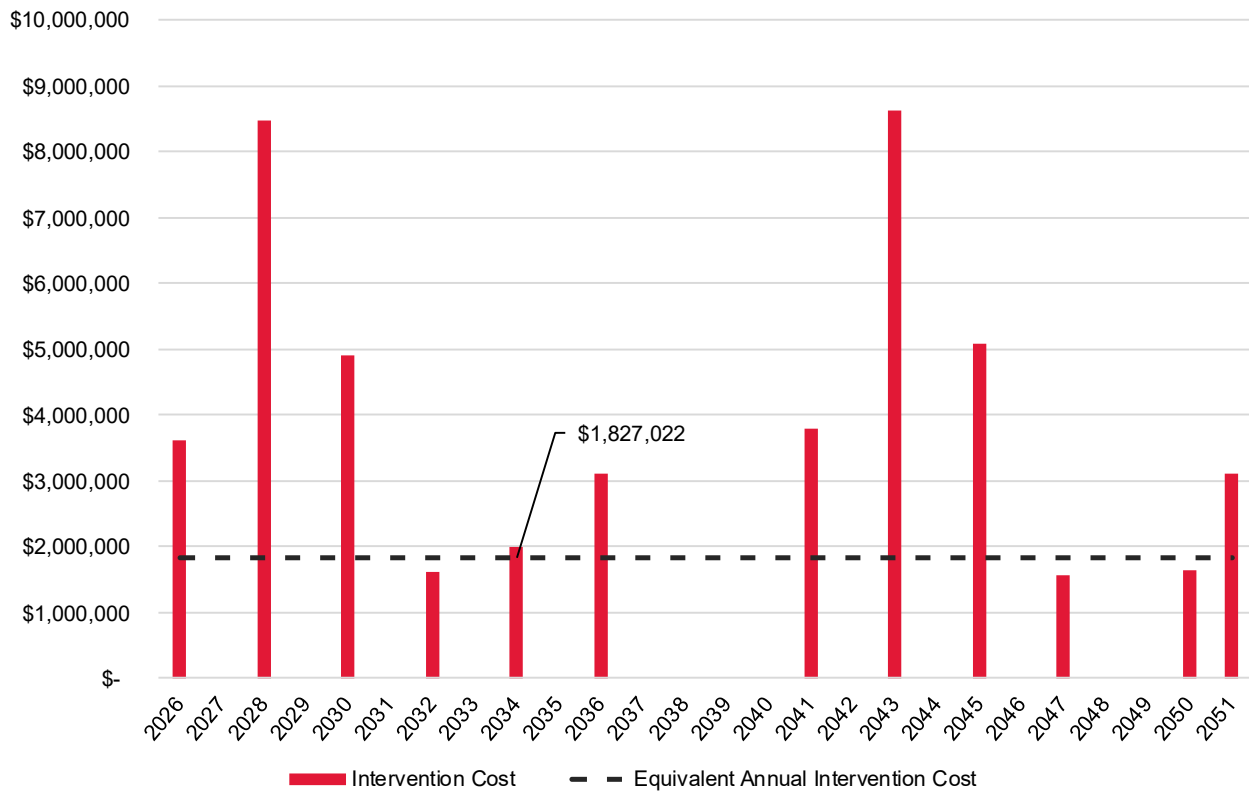


Figure J - 17: Maintain current performance Intervention costs for Fire & Emergency Services - Fleet assets.

J.3 Proposed Levels of Service Themes & Future Challenges

The customer values and customer LoS were discussed with stakeholders. The following summarizes the feedback from the stakeholders related to service delivery, customer expectations, and challenges faced by the City, particularly challenges that may be encountered in the future:

Table J - 22: Proposed LoS themes for Fire and Emergency Services assets.

Challenge	Discussion
Safe and Reliable	Fleet Fleet assets are maintained in a SOGR to ensure safety, reliability, and availability.
Convenience	Fire & Emergency Services Potential future opportunities for partnerships with other facilities, such as combining library/recreation centres with fire stations due to increased land and construction costs.
Sustainability	Fleet - Acquiring green fleet assets. - Retrofitting current buildings and/or building new shops to meet the demands of the new green fleet.
Function	Fire & Emergency Services There may be opportunities with private partners, e.g., 100-year leases for a fire station.

The insight from this discussion will be considered and incorporated into the City's AM processes and future iterations of the AMP. As the City continues to grow, it is important that current and future challenges are addressed in order to maintain service levels and achieve proposed service levels.

Appendix K.Arts and Culture

Service Summary



The City of Markham's Arts and Culture Services provide residents with exposure to various arts forms and culture via facilities such as art galleries, theatres, museums and historical artifacts.

Markham is responsible for assets such as various facilities, furnishings, fixtures and equipment, as detailed in Figure K - 1.

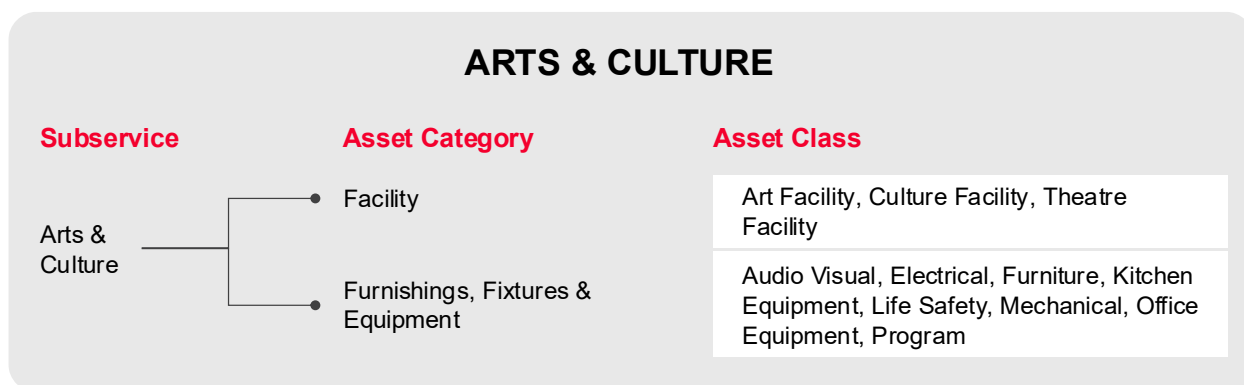


Figure K - 1: Arts and Culture hierarchy.

More information on Arts and Culture such as state of infrastructure, levels of service, risk management strategies and lifecycle management strategies and forecasting can be found in the following sections.

K.1 State of the Infrastructure

Figure K - 2 illustrates the replacement value distribution of all Arts and Culture assets, while Figure K - 3 and Figure K - 4 display the replacement value distribution of arts and cultural facilities and furnishings, fixtures and equipment, respectively.

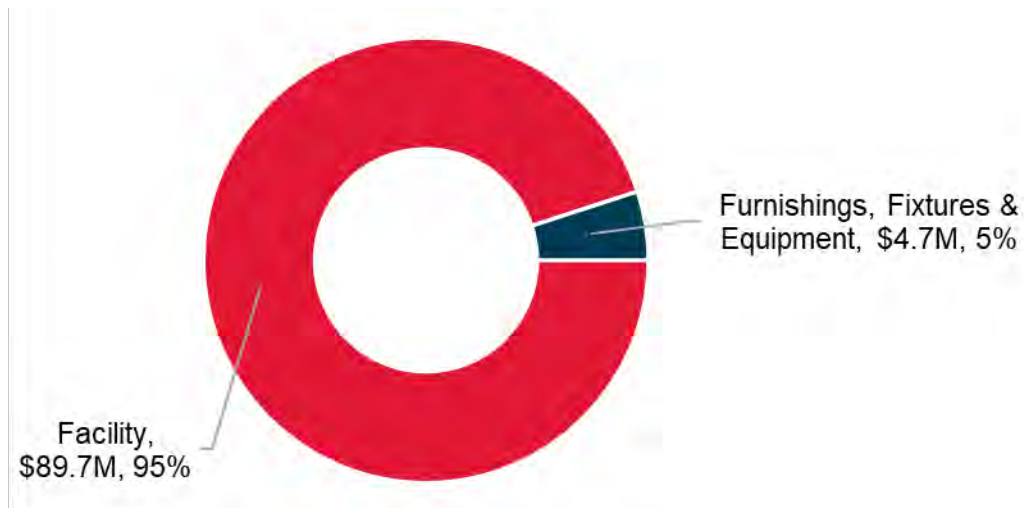


Figure K - 2: Replacement value distribution of Arts and Culture assets.

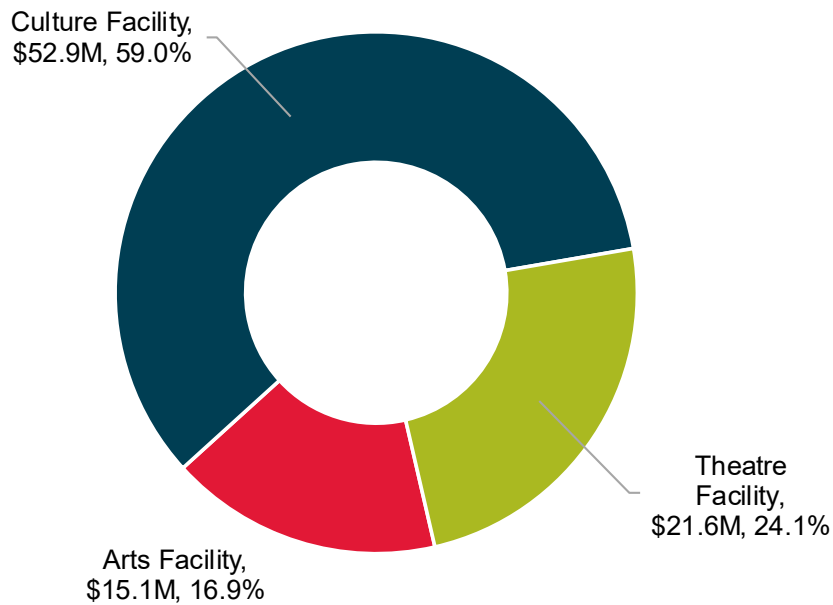


Figure K - 3: Replacement value of distribution of Arts and Culture facilities.

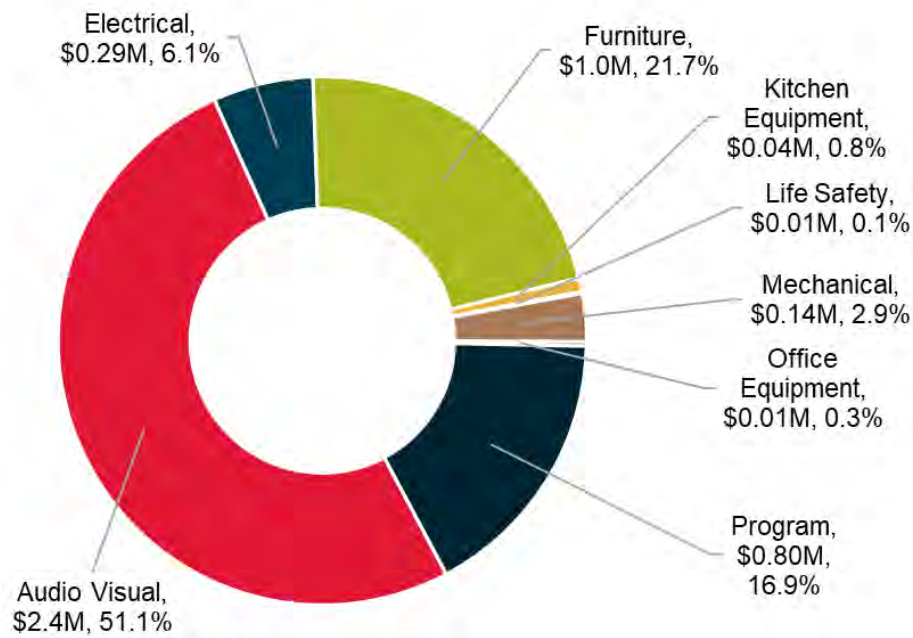


Figure K - 4: Replacement value distribution of Arts and Culture furnishings, fixtures, and equipment.

K.1.1 Asset Inventory and Valuation

Table K - 1 below summarizes the asset valuation, quantities, and performance for each asset category of arts and culture assets.

Table K - 1: Inventory and valuation for parks assets.

Asset Category	Asset Class	Replacement Cost	Inventory	Average Performance
Facility	Arts Facility	\$15,139,060	22,918 sq ft	Good
Facility	Culture Facility	\$52,905,342	111,187 sq ft	Very Good
Facility	Theatre Facility	\$21,612,855	30,200 sq ft	Fair
Furnishings, Fixtures, and Equipment	Audio Visual	\$2,410,825	111 Assets	Poor
Furnishings, Fixtures, and Equipment	Electrical	\$290,000	3 Assets	Poor
Furnishings, Fixtures, and Equipment	Furniture	\$1,026,537	118 Assets	Poor
Furnishings, Fixtures, and Equipment	Kitchen Equipment	\$39,440	13 Assets	Fair
Furnishings, Fixtures, and Equipment	Life Safety	\$5,000	1 Asset	Very Poor
Furnishings, Fixtures, and Equipment	Mechanical	\$138,781	15 Assets	Poor
Furnishings, Fixtures, and Equipment	Office Equipment	\$12,460	5 Assets	Very Poor
Furnishings, Fixtures, and Equipment	Program	\$797,565	49 Assets	Poor
Total	-	\$94,377,864	-	-

K.1.2 Age and Estimated Service Life

Figure K - 5 illustrates the age of parks assets as a proportion of their estimated service life. Figure K - 6 illustrates the value of Arts and Culture assets acquired by decade. The facilities on average are less than a third through their ESL. All other assets, with the exception of life safety and office equipment assets, are between halfway and approaching the end of their ESL. Life safety and office equipment assets on average have exceeded their ESL.

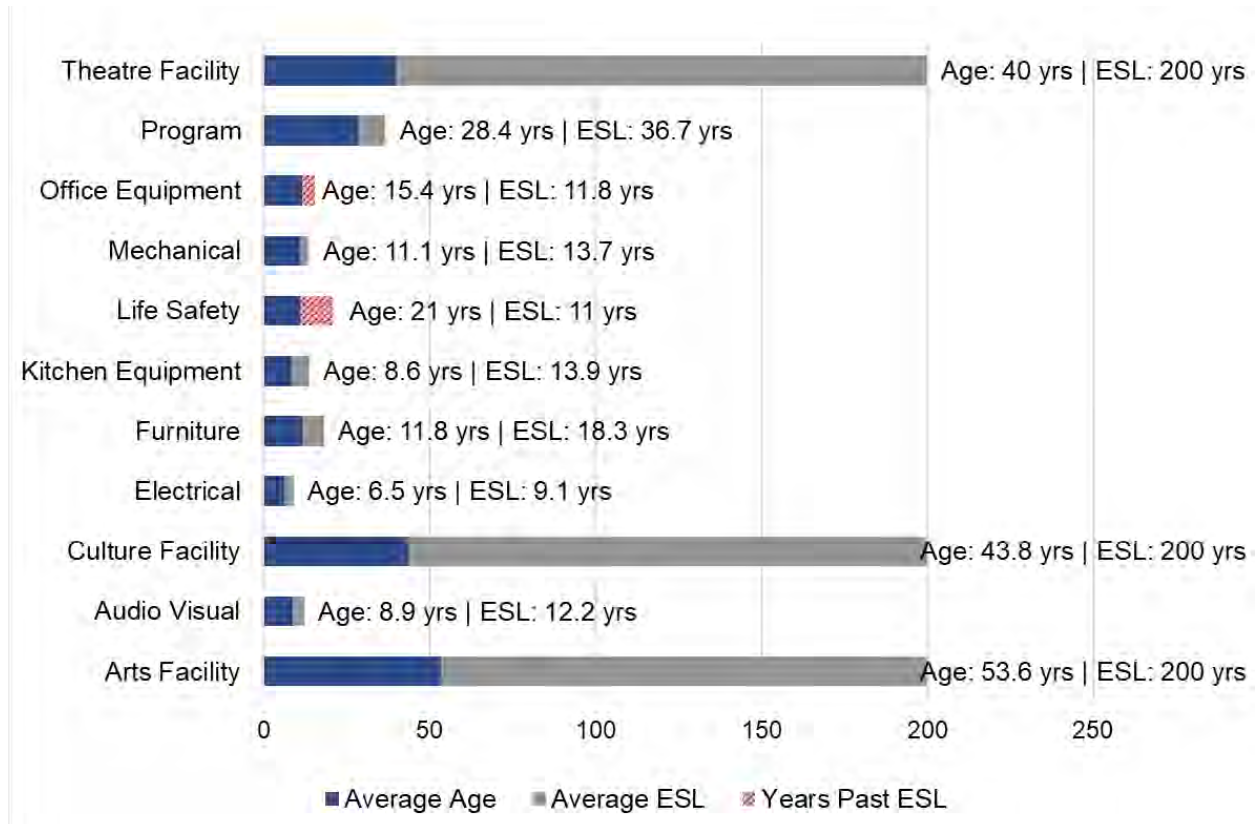


Figure K - 5: Age as a proportion of estimated service life (ESL) of Arts and Culture assets.

The installation profile of Arts and Culture assets illustrates that the majority of facilities were installed from the 1980s to 2010s, in line with decades that experienced significant growth and corresponding development in the City.

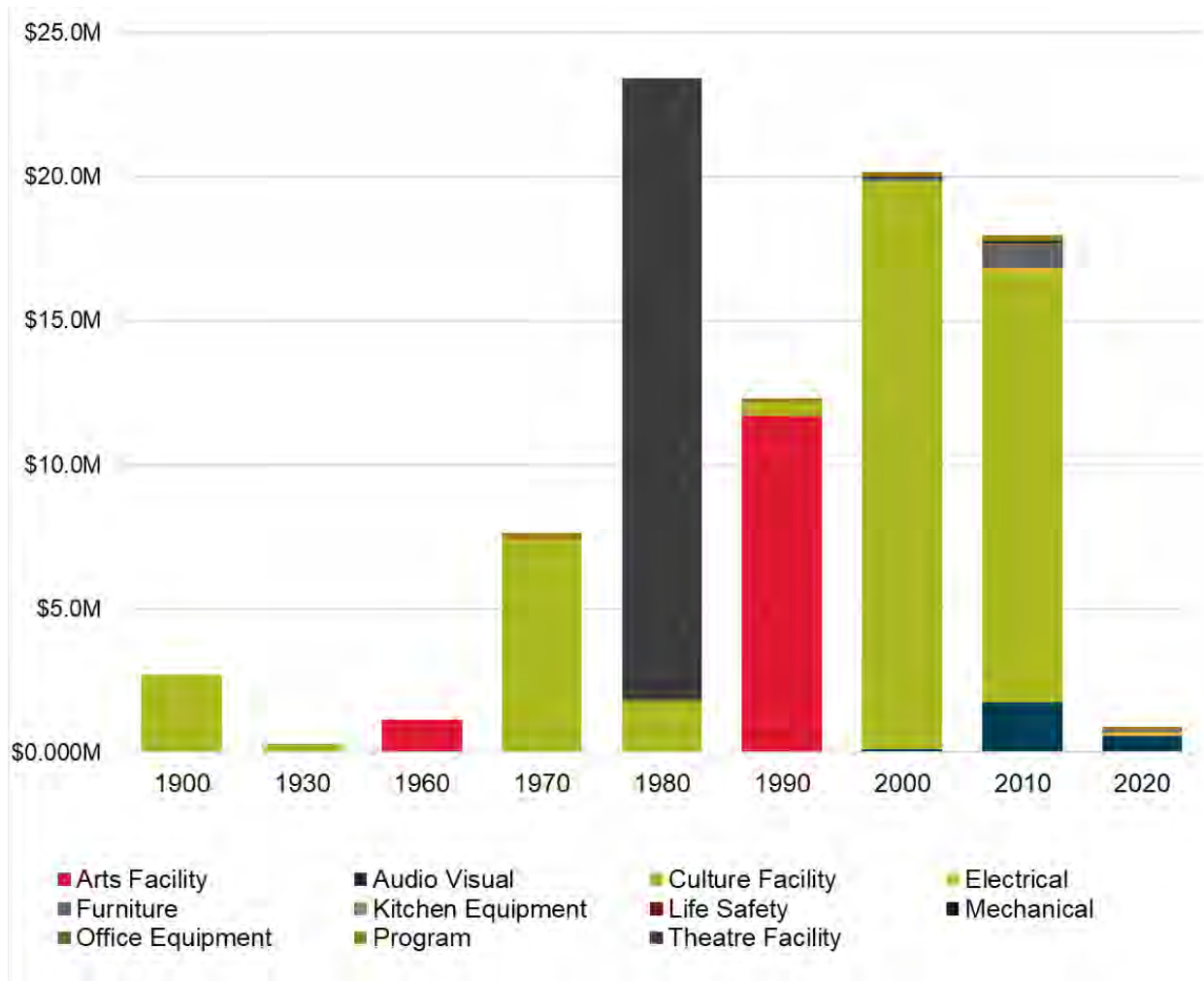


Figure K - 6: Age distribution by installation decade of Arts and Culture assets.

K.1.3 Asset Performance

Table K - 2 details the approaches that the City utilizes to understand the performance of Arts and Culture assets.

Table K - 2: Performance assessment approaches to Arts and Culture assets.

Asset Class	Condition Rating Metric	Approach to Assessing Condition
Arts Facility, Culture Facility, Theatre Facility	FCI	Facilities are inspected and the inspection results are recorded in City's database annually. The results are used to understand facility renewal needs and calculate the FCI rating.
Audio Visual, Electrical, Furniture, Kitchen Equipment, Life Safety, Mechanical, Office Equipment, Program	Age/ESL	The City understand the condition of these assets based on asset age and estimated service life

Figure K - 7 captures the performance of all Arts and Culture assets. Figure K - 8 shows the performance distribution of assets by asset class. Table K - 3 summarizes the relationship between the performance categories and how performance ratings are determined.

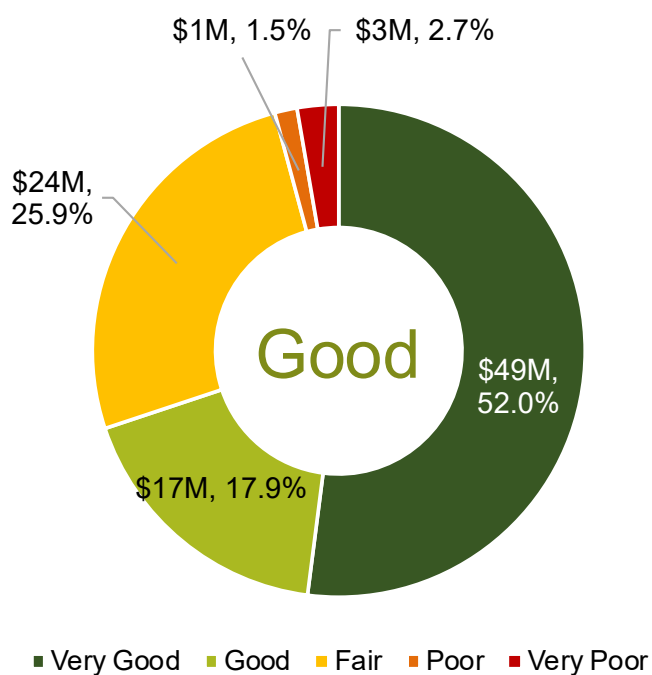


Figure K - 7: Performance distribution of Arts and Culture assets.

Table K - 3: Performance rating of Arts and Culture assets.

Condition Category	Age/ESL	Facility Condition Index (FCI)
Very Good	0% - 20%	0% - 5%
Good	20% - 40%	5% - 10%
Fair	40% - 60%	10% - 30%
Poor	60% - 80%	30% - 60%
Very Poor	>80%	60 - 100%

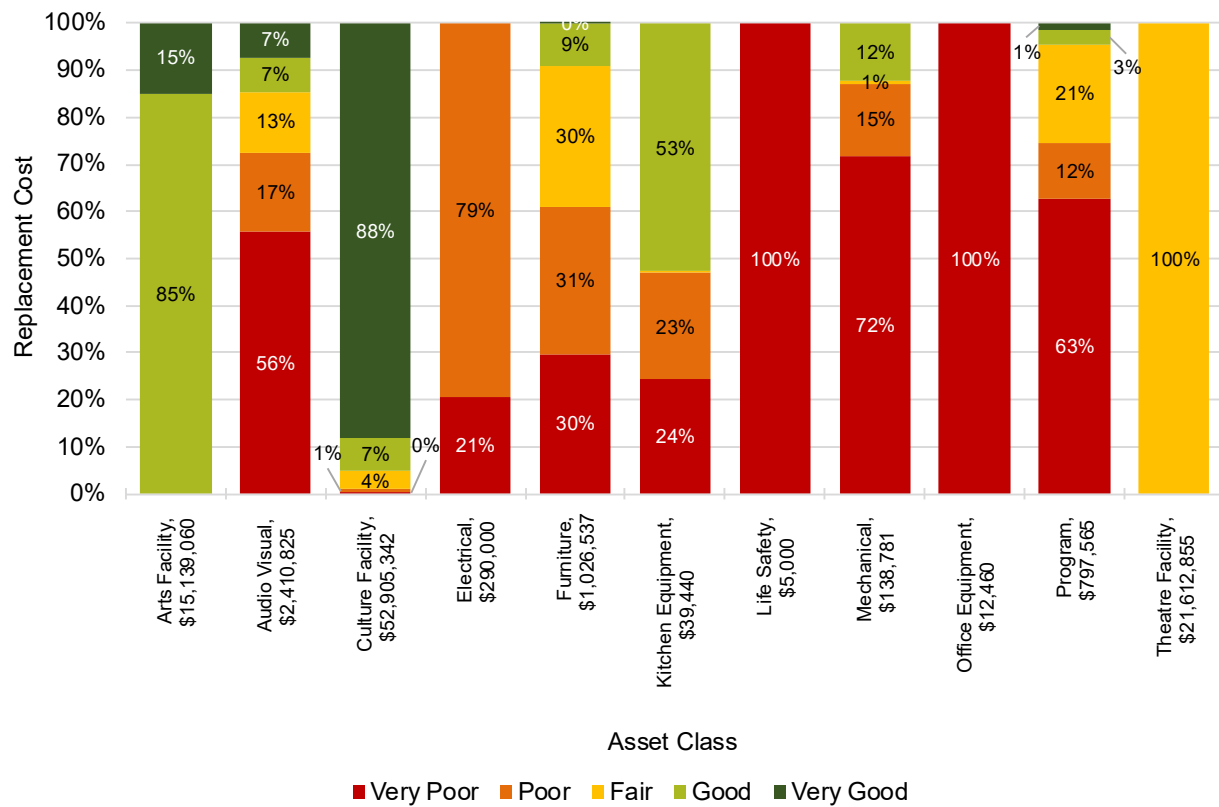


Figure K - 8: Performance distribution of Arts and Culture assets by asset class.

K.2 Levels of Service

Customer values, customer levels of service and technical levels of service for Arts and Culture assets can be found in Table K - 4 to Table K - 7.

K.2.1 Customer Values

Table K - 4: Arts and Culture customer values.

Customer Satisfaction Measure		Current Feedback & Expected Trend Based on Planned Budget
Arts & Culture assets are safe and reliable to use		
Assets are maintained in a state of good repair, are adequate for use, and in overall good working condition.		Future Iterations ³⁸
Arts & Culture services are convenient to use		
The quality of assets does not negatively affect the customer.		Future Iterations ³⁸
There are sufficient and appropriate amenities available for all customers.		Future Iterations ³⁸
Arts & Culture services are accessible.		Future Iterations ³⁸
Aesthetic Quality		
Arts & Culture assets meet aesthetic expectations.		Future Iterations ³⁸

³⁸ The City is currently reviewing the data that supports this metric, which will be reported in future iterations of the City's AMP. These metrics are subject to change as data is reviewed and incorporated into future AMPs.

K.2.2 Customer and Technical Levels of Service

Table K - 5: Arts and Culture – Facilities customer LoS.

Type of Measure	Level of Service	Performance Measure	Current Performance	Confidence Levels
Condition	Condition of facilities	Average FCI rating of facilities.	0.08	Medium – building condition assessments are performed on facilities to determine investment needs but data requires refinement.
Condition	Individual element/element group condition.	Percentage of all elements/element groups in very poor to poor condition	0.6%	Medium – building condition assessments are performed on facilities to determine investment needs but data requires refinement.
Condition	Individual element/element group condition.	Percentage of assets that have not exceeded their ESL.	94%	Medium – building condition assessments are performed on facilities to determine investment needs but data requires refinement.
Function	Measure of whether the service is appropriate for its intended use	Future Iterations ³⁹	Future Iterations ³⁹	Future Iterations ³⁹
Capacity	Measure of whether the service is adequate to meet customer needs	Future Iterations ³⁹	Future Iterations ³⁹	Future Iterations ³⁹
Accessibility	Service interruptions	Future Iterations ³⁹	Future Iterations ³⁹	Future Iterations ³⁹

³⁹ The City is currently reviewing and selecting measures for this category, which will be developed and integrated into future iterations of the City's AMP.

Table K - 6: Arts and Culture – Furnishings, Fixtures, and Equipment customer LoS.

Type of Measure	Level of Service	Performance Measure	Current Performance	Confidence Levels
Condition	Condition of facilities	Percentage of assets that have not exceeded their ESL.	90%	Low to medium – age and ESL are used to assess for condition. Condition data is unavailable.
Condition	Individual element/element group condition.	Percentage of all elements/element groups in very poor to poor condition	72.3%	Medium – building condition assessments are performed on facilities to determine investment needs but data requires refinement.
Function	Measure of whether the service is appropriate for its intended use	Future Iterations ³⁹	Future Iterations ³⁹	Future Iterations ³⁹
Capacity	Measure of whether the service is adequate to meet customer needs	Future Iterations ³⁹	Future Iterations ³⁹	Future Iterations ³⁹
Accessibility	Service interruptions	Future Iterations ³⁹	Future Iterations ³⁹	Future Iterations ³⁹

Table K - 7: Arts and Culture technical LoS.

Lifecycle Activity	Purpose of Activity	Frequency	Current Performance (\$, 2025 Budget)	Recommended Performance
Acquisition	Growth Expansion Development	Projects developed in Integrated Leisure MP	-	Maintain current performance – the City should consider developing a master plan for Arts and Culture assets which will include growth directions.
Operation	Inspections	Annual programs	\$27,557 The City's 2025 operating budget for all services was \$495.8M.	Maintain current performance – the City should consider developing a master plan for Arts and Culture assets which will include growth directions.
Operation	Regular Operations	As required	See above	See above
Maintenance	Minor repairs	As required	\$980,714	Maintain current performance for assets in service. Anticipated maintenance budget increases are included in the operating or renewal budget forecasts.
Maintenance	Regular Maintenance	Annual programs	See above	See above
Maintenance	Major maintenance (holding strategies)	As required	See above	See above

Lifecycle Activity	Purpose of Activity	Frequency	Current Performance (\$, 2025 Budget)	Recommended Performance
Renewal	Major rehabilitation or replacement	As required	\$1,313,957 (City's LCRS)	PLoS Maintain Current Performance requires \$1.78M or \$464.4k per year on average of additional funds from 2026 to 2051.
Disposal	Disposal of replaced assets	As required	Included with renewal costs	Maintain current performance for assets in service.
Service Improvement	Upgrades to improve LoS to benefit existing serviced areas	As required	-	Maintain LoS – The City continues to assess needs annually to determine and balance appropriate funding levels to support service improvement activities.

K.3 Risk Management Strategy

The criteria used to determine the consequence of failure for Arts and Culture assets can be found in Table K - 8 below.

Table K - 8: COF criteria used for Arts and Culture assets.

Direct Financial	Socio-Economic	Environmental
- Replacement cost - Revenue loss	Asset Class	Not expected to have significant consequences on the environment

Table K - 9 displays the risk score for Arts and Culture assets along with the proportion of assets within each risk score, likelihood of failure and consequence of failure.

Table K - 9: Risk score distribution of Arts and Culture assets.

	COF 1	COF 2	COF 3	COF 4	COF 5	Subtotal
LOF 1	\$250 (<0.1%)	\$2,267,868 (2.4%)	\$5,083,771 (5.4%)	\$41,752,744 (44.2%)	None	\$49,104,633 (52.0%)
LOF 2	\$59,333 (0.1%)	\$1,232,121 (1.3%)	\$15,568,744 (16.5%)	None	None	\$16,860,197 (17.9%)
LOF 3	\$8,554 (<0.1%)	\$319,730 (0.3%)	\$24,135,793 (25.6%)	None	None	\$24,464,077 (25.9%)
LOF 4	\$15,579 (<0.1%)	\$364,006 (0.4%)	\$1,004,303 (1.1%)	None	None	\$1,383,888 (1.5%)
LOF 5	\$87,221 (0.1%)	\$365,921 (0.4%)	\$2,111,927 (2.2%)	None	None	\$2,565,069 (2.7%)
Subtotal	\$170,937 (0.2%)	\$4,549,646 (4.8%)	\$47,904,538 (50.8%)	\$41,752,744 (44.2%)	None	\$94,377,864 (100.0%)

Table K - 10: Risk score mapping legend.

Risk	Risk Score	Risk Description	Total Replacement Cost
Very Low	1 – 5	Fit for the Future	\$50,507,440 (53.5%)
Low	6 – 10	Adequate for Now	\$40,754,194 (43.2%)
Moderate	11 – 15	Requires Attention	\$3,116,230 (3.3%)
High	16 – 20	At Risk	None
Very High	21 – 25	Unfit for Sustained Service	None

K.4 Lifecycle Management Activities

The City's lifecycle management activities for Arts and Culture assets are listed in Table K - 7. These activities include the acquisition of assets and service improvements, operations and maintenance, major asset renewals (including rehabilitations and replacements), and disposals.

These lifecycle management activities in conjunction with the lifecycle forecasting are used to determine the funding required for the City to continue performing these lifecycle activities to extend asset life, reduce overall costs, and minimize risk while providing the proposed service levels.

K.5 Lifecycle Forecasting

The following section outlines the funding required for the entire lifecycle of parks assets. The expenditures were determined using the lifecycle activities outlined in Table K - 7 and the PLoS established. Required funding was determined using the following forecasting analysis scenario:

- Proposed LoS – Maintain Current Performance** – funding required to maintain a similar asset performance over a 26-year period. The City has established this LoS as the PLoS for Arts and Culture assets. It focuses on maintaining the percentage of assets in backlog in a similar state. Backlog is defined as assets that are in need of renewal work (either significant rehabilitation or replacement). For example, if 20% of assets are past their service life, or are in need of renewal work, then the forecast model will determine the funding to maintain 20% of assets in this state over the forecast period.

The following table summarizes the anticipated funding from the City's Life Cycle Reserve Study for renewal activities for Arts and Culture assets. A total of **\$34.2M** over the next 26 years (or an equivalent average annual of **\$1.3M**) for renewals is anticipated to be spent.

Table K - 11: Forecasted capital renewal expenditures (Life Cycle Reserve Study).

Year	Capital Expenditures (Renewals)
2026	\$3,722,979
2027	\$1,504,637
2028	\$1,783,547
2029	\$949,533
2030	\$1,989,557
2031	\$954,896
2032	\$756,540

Year	Capital Expenditures (Renewals)
2033	\$1,351,850
2034	\$696,889
2035	\$1,782,817
2036	\$1,831,362
2037	\$1,060,715
2038	\$1,540,479
2039	\$1,238,847
2040	\$1,047,394
2041	\$1,416,518
2042	\$838,414
2043	\$1,786,676
2044	\$1,281,318
2045	\$1,114,680
2046	\$860,474
2047	\$1,024,063
2048	\$764,354
2049	\$456,512
2050	\$1,016,755
2051	\$1,443,493
Total	\$34,215,297
Equivalent Average Annual	\$1,315,973

Figure K - 9 and Figure K - 10 illustrate the performance and financial forecasts to achieve PLoS for all Arts and Culture assets. The forecast analysis identified a total of **\$46.2M** (or an equivalent average annual of **\$1.8M**) that is anticipated to be spent over the next 26 years to maintain current performance. This represents funding gap of **\$12.0M** over the planning horizon, or an equivalent average annual amount of **\$462.4k**.

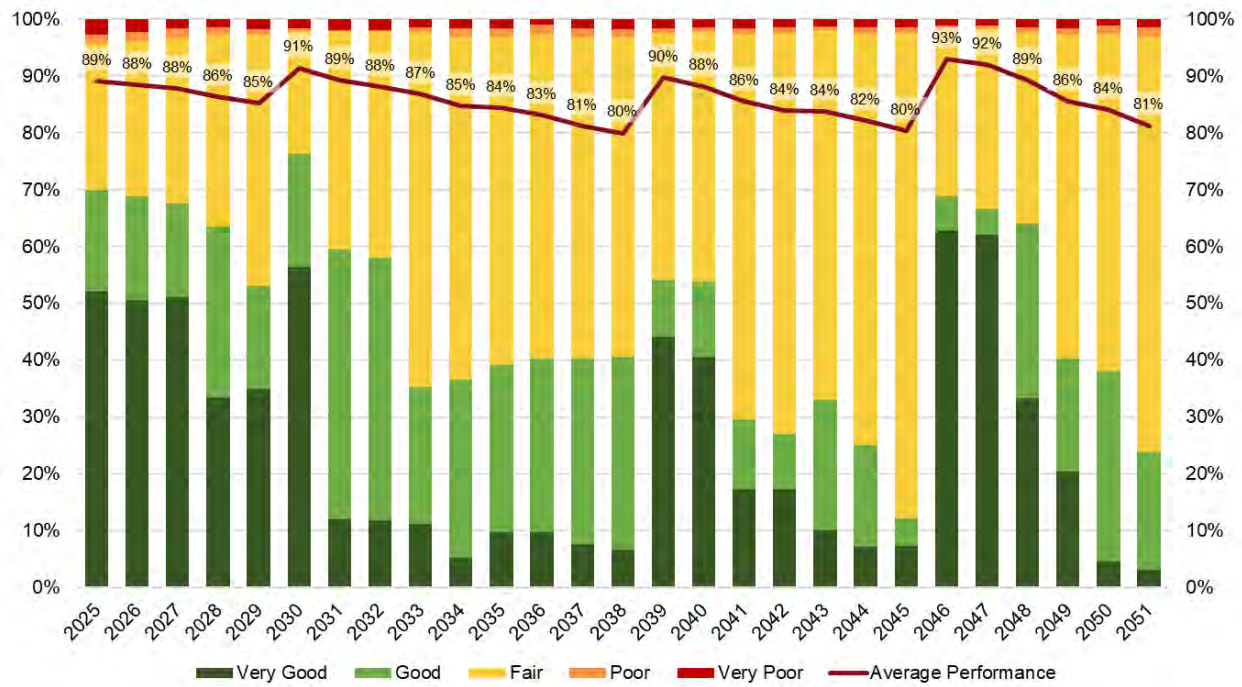


Figure K - 9: Performance distribution – maintain current performance for Arts and Culture assets.

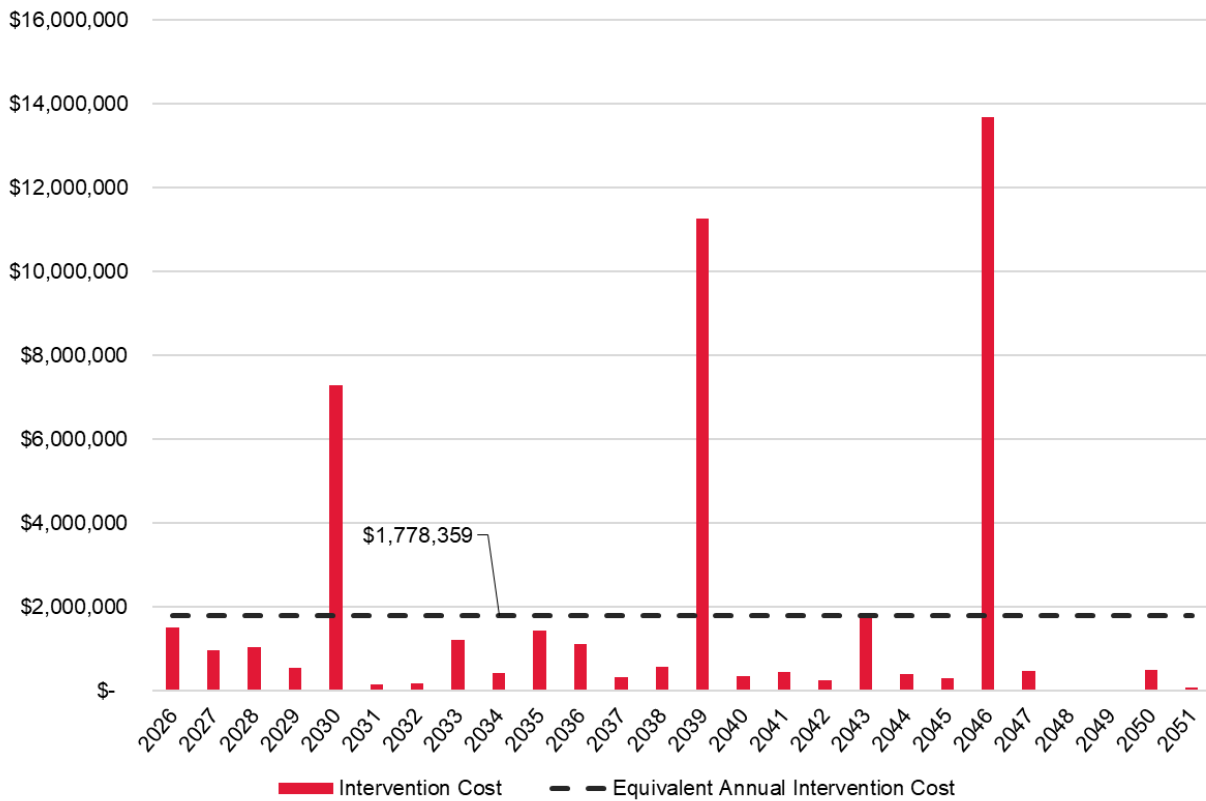


Figure K - 10: Maintain current performance intervention costs for Arts and Culture assets.

K.6 Proposed Levels of Service Themes & Future Challenges

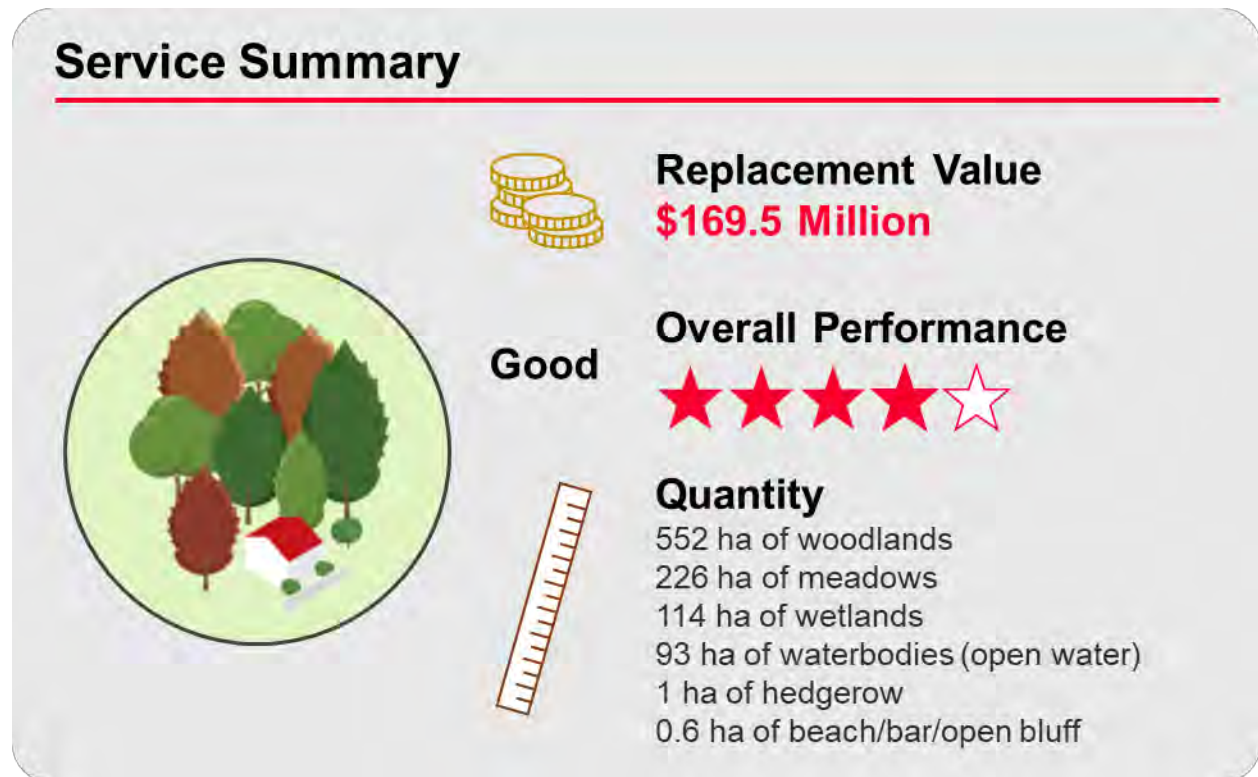
The customer values and customer LoS were discussed with stakeholders. The following summarizes the feedback from the stakeholders related to service delivery, customer expectations, and challenges faced by the City, particularly challenges that may be encountered in the future:

Table K - 12: Proposed LoS themes for Arts and Culture assets.

Challenge	Discussion
Customer Expectations	- Facilities should have a “wow” factor. - Assets are well-maintained and modern. - The technology within the facilities can be easily used.
Growth & Sustainability	- Data is kept up to date to enable growth projections. - Survey feedback is used for planning. - The City continues to explore new technologies and acquire modern technology. - Sustainability includes having better energy efficient technology.
Accessibility	- Increasing levels of accessibility is required. Many buildings are not readily accessible as the City has a mix of modern and historic sites. - Accessibility upgrades are currently done when assets are replaced but this is an issue for assets that are never replaced.

The insight from this discussion will be considered and incorporated into the City’s AM processes and future iterations of the AMP. As the City continues to grow, it is important that current and future challenges are addressed in order to maintain service levels and achieve proposed service levels.

Appendix L. Natural Assets



The City of Markham's natural assets support a diversity of natural habitats and ecosystems, help mitigate climate change and build resilience to climate change impacts, and provide public natural areas and other greenspaces for passive recreation and cultural activities.

The City's natural assets include woodlands, meadows, wetlands, waterbodies, hedgerows, and beaches/bars/open bluffs, as detailed in Figure L - 1.



Figure L - 1: Green Space & Agricultural Land asset hierarchy.

In 2022, the City completed their first comprehensive natural assets inventory and evaluation which is detailed in the City's Natural Assets Inventory and Evaluation Study report. This study included developing an inventory, assessing the performance of each natural asset, completing a risk assessment, establishing levels of service and management activities, and determining required funding based on various management scenarios. The information presented in this subsection was derived from the City's Natural Assets Inventory and Evaluation Study report.

L.1 State of the Infrastructure

Figure L - 2 shows the replacement value of Natural Assets by asset class. The total replacement value for Natural Assets is \$169.5M.

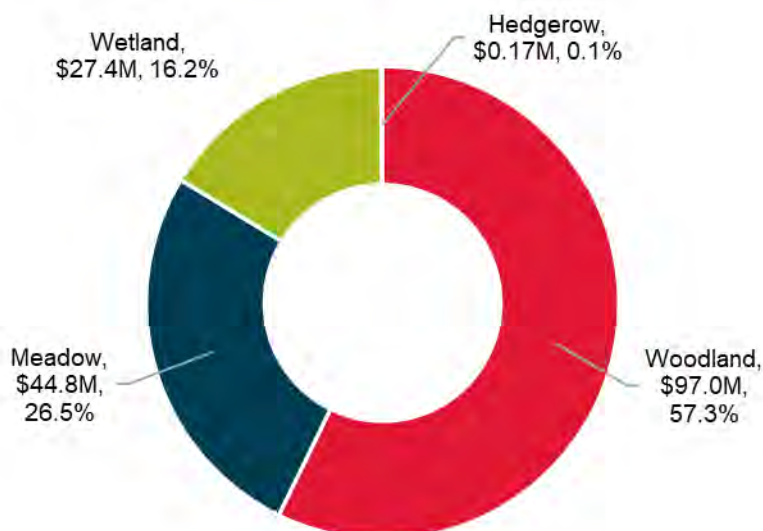


Figure L - 2: Replacement value distribution of Natural Assets.

L.1.1 Asset Inventory and Valuation

Table L - 1 below summarizes the asset valuation, quantities, and performance for each asset category of Natural Assets.

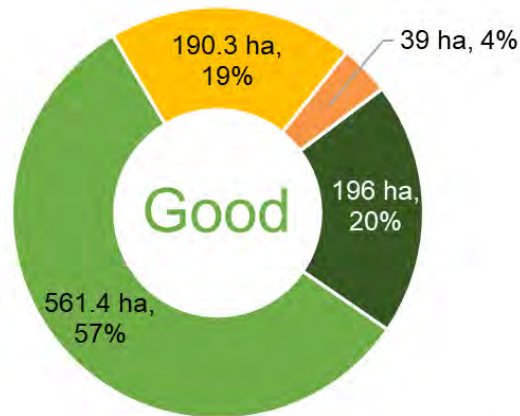
Table L - 1: Inventory and valuation for Natural Assets.

Asset Class / Asset Attribute	Area Owned by Markham (ha)	Unit Replacement Cost (\$/ha)	Total Replacement Costs for City-Owned Assets
Woodland	552.26	-	\$97,017,018
Coniferous Forest	11.61	\$173,847	-
Cultural Savannah	41.93	\$188,545	-
Cultural Thicket	32.24	\$188,546	-
Cultural Woodland	90.12	\$173,847	-
Deciduous Forest	277.07	\$173,847	-

Asset Class / Asset Attribute	Area Owned by Markham (ha)	Unit Replacement Cost (\$/ha)	Total Replacement Costs for City-Owned Assets
Mixed Forest	74.01	\$173,847	-
Plantation	24.94	\$173,847	-
Treed Bluff	0.34	-	-
Meadow	226.29		\$44,828,726
Cultural Meadow	226.13	\$198,144	-
Open Tallgrass Prairie	0.16	\$198,144	-
Wetland	113.71		\$27,434,367
Coniferous Swamp	1.55	\$268,404	-
Deciduous Swamp	29.40	\$268,404	-
Meadow Marsh	42.46	\$224,816	-
Mixed Swamp	9.20	\$268,404	-
Shallow Marsh	21.27	\$224,816	-
Thicket Swamp	9.49	\$245,945	-
Treed Fen	0.00	\$268,404	-
Floating-leaved Shallow Aquatic	0.00	-	-
Submerged Shallow Aquatic	0.33	-	-
Hedgerow	1.00	\$173,847	\$174,596
Open Water	92.82		-
Beach / Bar / Bluff	0.60		-
Open Beach / Bar	0.60	-	-
Open Bluff	0.00	-	-
Shrub Beach / Bar	0.00	-	-
Total	-	-	\$169,454,706

L.1.2 Asset Performance

Figure L - 3 illustrates the performance distribution of the Natural Assets portfolio, while Figure L - 4 shows the performance distribution of Natural Assets by asset class. For more information on how the performance of natural assets were determined, refer to the [City's Natural Assets Inventory and Evaluation Study report](#).



■ Very Good ■ Good ■ Fair ■ Poor ■ Very Poor

Figure L - 3: Condition distribution of Natural Assets.

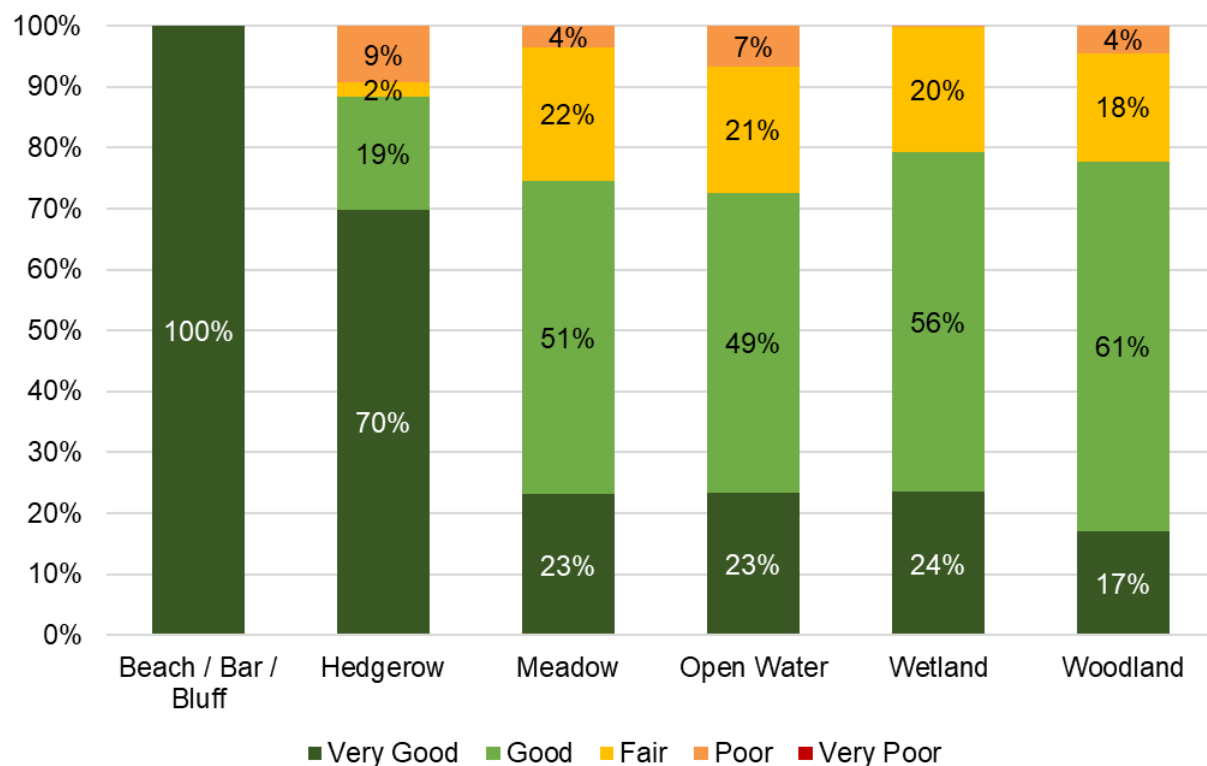


Figure L - 4: Condition distribution of Natural Assets by asset class.

L.2 Risk Management Strategy

The risk scores for Natural Assets differ from the scores reported in the City's 2024 AMP. For the 2025 AMP update, the City undertook further assessment to better align and calibrate the risk scoring for Natural Assets with the Corporate Risk Framework. This assessment is documented in the Natural Asset Risk Assessment Update (Addendum to the Natural Asset Inventory; and Evaluation Study) Report (February 24, 2025).

Three types of failure for natural assets were defined:

- **Functional failure** occurs when an asset experiences a physical failure or stops from performing its target functions, such as when invasive species degrade an ecosystem via vegetation mortality.
- **Capacity failure** occurs when a natural asset has function but not the required capacity such as when precipitation exceeds the absorption capacity of a forest.
- **Service failure** occurs when a natural asset is not providing appropriate service flows, for instance when forest soils are compacted limiting infiltration.

The criteria used to determine the consequence of failure for Natural Assets can be found in Table A - 11 below.

Table L - 2: COF criteria used for Natural Assets.

Direct Financial	Socio-Economic	Environmental
• Replacement cost	• Value of ecosystem services	• Ecological Land Classification

Table A - 12 displays the risk score for Natural Assets along with the proportion of assets within each risk score, likelihood of failure and consequence of failure.

Table L - 3: Risk score distribution of Natural Assets.

	COF 1	COF 2	COF 3	COF 4	COF 5	Subtotal
LOF 1	\$57,723 (4.6 ha)	\$223,092 (37.4 ha)	\$10,096 (25.4 ha)	None	None	\$290,911 (67.4 ha)
LOF 2	\$1,492,865 (9.9 ha)	\$29,394,227 (168.7 ha)	\$41,429,982 (207.2 ha)	\$23,071,451 (113.9 ha)	None	\$95,388,525 (499.8 ha)
LOF 3	\$509,484 (2.9 ha)	\$15,332,360 (86.0 ha)	\$29,897,116 (169.5 ha)	\$21,892,596 (126.0 ha)	\$2,831,182 (16.3 ha)	\$70,462,738 (400.6 ha)
LOF 4	\$62,345 (0.4 ha)	\$853,735 (4.8 ha)	\$2,396,452 (13.7 ha)	None	None	\$3,312,532 (18.9 ha)
LOF 5	None	None	None	None	None	None
Subtotal	\$2,122,417 (17.8 ha)	\$45,803,414 (296.9 ha)	\$73,733,645 (415.8 ha)	\$44,964,047 (239.9 ha)	\$2,831,182 (16.3 ha)	\$169,454,706

Table L - 4: Risk score mapping legend.

Risk	Risk Score	Risk Description	Total Replacement Cost
Very Low	1 – 5	Fit for the Future	\$31,749,832 (18.7%)
Low	6 – 10	Adequate for Now	\$110,584,643 (65.3%)
Moderate	11 – 15	Requires Attention	\$27,120,231 (16.0%)
High	16 – 20	At Risk	None
Very High	21 – 25	Unfit for Sustained Service	None

L.3 Lifecycle Forecasting

The City's Natural Assets Inventory and Evaluation Study report provides an analysis on the funding required to support the various lifecycle activities that continue to provide services to the community through natural assets. The assessment completed a financial forecast for the following three (3) scenarios,

- **Current Management:** the baseline scenario based on performing current ongoing management activities to 2051
- **Enhanced Management:** includes current management activities and additional activities to adapt to climate change risks
- **Target Management:** includes current activities, enhanced activities and additional anticipated activities to meet the City's target LoS by 2051

The City's 2024 AMP has focused on a forecasting analysis that understands the costs associated with maintaining current service levels. From the scenarios completed for the Natural Assets Inventory and Evaluation Study report, the most similar to the analysis completed in this AMP is the "Current Management" scenario. The results of this scenario were incorporated into the financial forecast within the 2024 AMP.

The following table outlines the funding required for the various lifecycle activities for the "Current Management" Scenario.

Table L - 5: Average annual estimate capital and staff cost of management scenarios.

Lifecycle Activity	Supporting Level of Service	Scenario 1: Capital	Scenario 1: Staff	Scenario 1: Total
Acquisition/Expansion	Land Acquisition	\$0	\$35,128	\$35,128
Acquisition/Expansion	Land Securement	\$0	\$0	\$0
Maintenance	Natural Areas Monitoring	\$53,571	\$21,108	\$74,679
Maintenance	Stewardship Activities	\$62,500	\$23,072	\$85,572
Maintenance	Invasive Plant management	\$35,000	\$30,932	\$65,932
Maintenance	Meadow (Invasive/Woody Plant) Management	\$0	\$1,972	\$1,972
Maintenance	Basic Natural Areas Maintenance	\$0	\$78,579	\$78,579
Maintenance	High Risk Tree Management	\$0	\$37,822	\$37,822
Rehabilitation and Renewal	Forest Restoration	\$462,500	\$41,510	\$504,010
Rehabilitation and Renewal	Wetland/Riparian Restoration	\$20,000	\$9,219	\$29,219
Total	-	\$633,571	\$279,342	\$912,913

L.4 Proposed Levels of Service Themes & Future Challenges

The customer values and customer LoS were discussed with stakeholders. Table L - 6 summarizes the feedback from the stakeholders related to service delivery, customer expectations, and challenges faced by the City, particularly challenges that may be encountered in the future:

Table L - 6: Proposed LoS themes for Natural Assets.

Challenge	Discussion
Canopy Cover & Sustainability	- There are demands to acquire more natural assets to increase canopy levels, but housing competes with the space available for natural assets. Achieving desired canopy levels is tied to land use. More public space is needed for trees to meet the City's 30% target. - More concrete/impervious surfaces result in more runoff which affects natural assets through erosion, resulting in natural asset loss. - Climate change, recreational activity and invasive species are placing strain on the condition of natural assets. Greater attention will be needed to better understand the spread and populations of invasive species, and methods to manage their spread.
Watershed Management	The Rouge River Watershed Plan update has been initiated by TRCA. This plan includes management scenarios such as increasing canopy cover and indigenous engagement.
Funding	It is important that funding and resources are accounted for to complete asset register and AMP updates for natural assets.

The insight from this discussion will be considered and incorporated into the City's AM processes and future iterations of the AMP. As the City continues to grow, it is important that current and future challenges are addressed in order to maintain service levels and achieve proposed service levels.