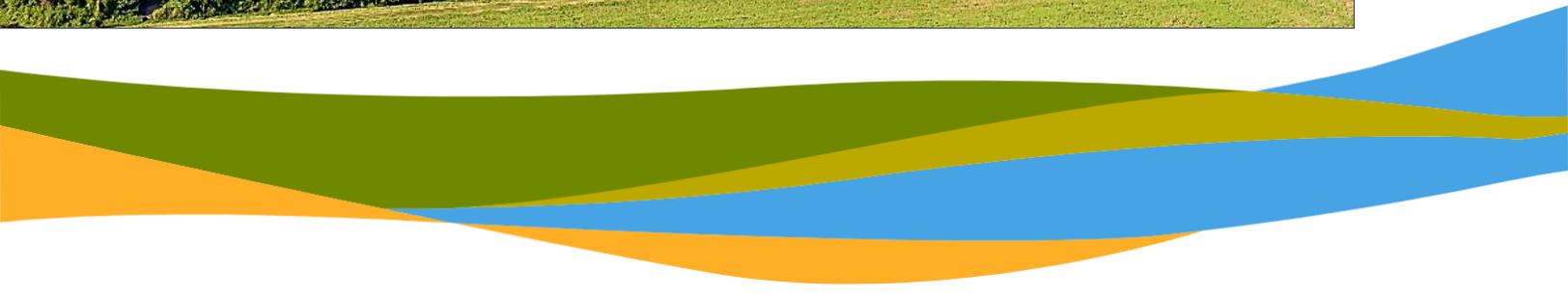




Town of Essex | Asset Management Plan

2022



This Asset Management Plan was prepared by:



Empowering your organization through advanced
asset management, budgeting & GIS solutions

Key Statistics

Replacement cost of core asset portfolio
\$621 million

Replacement cost of core infrastructure per household
\$74,003 (2021)

Percentage of core assets in fair or better condition
80%

Percentage of core assets with assessed condition data
35%

Annual capital core infrastructure deficit per household
\$1,217

Recommended timeframe for eliminating annual core infrastructure deficit
15 Years

Target reinvestment rate
2.8%

Actual reinvestment rate
1.2%

With the development of this AMP, the Town of Essex has achieved compliance with O. Reg. 588/17 to the extent of the requirements that must be completed by July 1, 2022. There are additional requirements concerning non-core asset categories, proposed levels of service and growth that must be met by July 1, 2024 and 2025

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Executive Summary

This asset management plan (AMP) for the Town of Essex was developed in accordance with Ontario Regulation 588/17 ("O. Reg"). It includes key elements of an industry-standard and regulation compliant AMP and provides a detailed overview and analysis of the Town's core infrastructure. Together, the five asset categories analyzed in this asset management plan have a total current replacement cost of **\$621 million**.

The Town's core asset portfolio comprises a road network of paved, unpaved, surface treated roadways and supporting roadside infrastructure; bridges and culverts; stormwater collection and conveyance infrastructure; water treatment and distribution network; wastewater collection and treatment infrastructure. At 33% of the total replacement cost of all infrastructure, roads and roadside assets form the largest share of the Town's asset portfolio and have a current replacement cost of more than \$205 million.

Based on both assessed condition and age-based analysis, 80% of the Town's infrastructure portfolio is in fair or better condition, with the remaining 20% in poor or worse condition. Typically, assets in poor or worse condition may require replacement or major rehabilitation in the immediate or short-term. Asset criticality and targeted condition assessments may help further refine the list of assets that may be candidates for immediate intervention.

Assets in fair condition should be monitored for disrepair over the medium term. Keeping assets in fair or better condition is typically more cost-effective than addressing asset needs when they enter the latter stages of their lifecycle or decline to a lower condition rating, e.g., poor, or worse.

We note that with the exception of the Town's roads, bridges, and culverts, which together comprise 35% of total asset value, no in-field condition assessment data was available for other assets. As such, an age-based deterioration curve was used as an approximation of condition for these assets.

Aging assets require maintenance, rehabilitation, and replacement. On average, \$17.4 million is required each year to remain current with capital replacement needs for the Town's core asset portfolio. This figure relies on age and available condition data. Although actual spending may fluctuate substantially from year to year, this figure is a useful benchmark for annual capital expenditure targets (or allocations to reserves) to ensure projects are not deferred and replacement needs are met as they arise.

Average annual funding available totals \$7.2 million for core assets. As a result, the Town is currently funding 41% of its annual capital requirements. This creates a total annual funding deficit of \$10.2 million. Addressing annual infrastructure funding shortfalls is a difficult and long-term endeavor for municipalities. Considering the Town's current funding position, it will require many years to reach full funding for current assets. Short phase-in periods to meet these funding targets may place too high a burden on taxpayers too quickly, whereas a phase-in period beyond 20 years may see a continued deterioration of infrastructure, leading to larger backlogs.

To close annual deficits for tax-funded assets, we recommend the Town review feasibility of implementing a 2.6% annual increase in revenues over a 15-year phase-in period. Similarly, water rate revenues would need to increase at 1.4% annually over a 15-year phase-in period and wastewater rate revenues would need to increase at 1.8% annually over a 15-year phase-in period to close respective funding gaps. Funding scenarios over longer time frames are also presented which may reduce these annual increases.

In addition to annual needs, there is also an infrastructure backlog of \$17.2 million, comprising assets that remain in service beyond their estimated useful life. It is highly unlikely that all such assets are in a state of disrepair, requiring immediate replacements or full reconstruction. This makes targeted and consistent condition assessments integral to refining long-term replacement and backlog estimates.

Risk frameworks and levels of service targets can then be used to prioritize projects and help select the right lifecycle intervention for the right asset at the right time—including replacement or full reconstruction. The Town has developed preliminary risk models which are integrated with its asset register. These models are capable of producing risk matrices that classify assets based on their risk profiles.

Most municipalities in Ontario, and across Canada, continue to struggle with meeting infrastructure demands. This challenge was created over many decades and will take many years to overcome. To this end, a number of recommendations should be considered, including:

- continuous and dedicated improvement to the Town's core and non-core infrastructure datasets, which form the foundation for all analysis, including financial projections and needs;
- continuous refinements to the Town's risk and lifecycle models as additional data becomes available. This will aid in implementing risk-based decision-making and result in more strategic long-term capital budgets that are better aligned with the Town's strategic objectives;
- the need for a full-time asset management coordinator that is focused on maintaining the Town's asset management systems, ensuring compliance with asset management regulations, coordinating multi-asset capital projects and ensuring that asset management principles are understood within the organization;
- the development of levels of service statements and associated key performance indicators for non-core infrastructure as well as the data review, consolidation, and refinement of non-core assets in order to meet 2024 O. Reg requirements;
- and establishing benchmark data to develop proposed levels of service for 2025 O. Reg requirements.

The Town has taken important steps in building its asset management program, including developing a more complete and accurate asset register—a substantial initiative. Continuous improvement to this inventory will be essential in maintaining momentum, supporting long-term financial planning, and delivering the highest affordable service levels to the Essex community.

About this document

This asset management plan (AMP) for the Town of Essex was developed in accordance with Ontario Regulation 588/17 ("O. Reg 588/17"). It contains a comprehensive analysis of the Town's core infrastructure portfolio. The AMP is a living document that should be updated regularly as additional asset and financial data becomes available.

Ontario Regulation 588/17

As part of the *Infrastructure for Jobs and Prosperity Act, 2015*, the Ontario government introduced Regulation 588/17 - Asset Management Planning for Municipal Infrastructure. Along with creating better performing organizations, more livable and sustainable communities, the regulation is a key, mandated driver of asset management planning and reporting. It places substantial emphasis on current and proposed levels of service and the lifecycle costs incurred in delivering them.

See *Appendix B* for a detailed checklist of O. Reg 588/17 requirements.

Table 1 Ontario Regulation 588/17 Requirements and Reporting Deadlines

Requirement	2019	2022	2024	2025
Asset Management Policy	●		●	
Asset Management Plans		●	●	●
State of infrastructure for core assets		●		
State of infrastructure for all assets			●	●
Current levels of service for core assets		●		
Current levels of service for all assets			●	
Proposed levels of service for all assets				●
Lifecycle costs associated with current levels of service		●	●	
Lifecycle costs associated with proposed levels of service				●
Growth impacts		●	●	●
Financial strategy				●

Scope

The scope of this AMP includes all requirements for the 2022 reporting deadline, and additional analysis as well as a financial strategy to address any identified annual infrastructure funding shortfalls. Core asset categories addressed in this AMP include roads and roadside, bridges and culverts, stormwater, water, and wastewater.

Overview of Asset Management

Municipalities are responsible for managing and maintaining a broad portfolio of infrastructure assets to deliver services to the community. The goal of asset management is to minimize the lifecycle costs of delivering infrastructure services, manage the associated risks, while maximizing the value and levels of service ratepayers receive from the asset portfolio.

Lifecycle costs can span decades, requiring planning and foresight to ensure financial responsibility is spread equitably across generations. An asset management plan is critical to this planning, and an essential element of broader asset management program. The industry-standard approach and sequence to developing a practical asset management program begins with a Strategic Plan, followed by an Asset Management Policy and an Asset Management Strategy, concluding with an Asset Management Plan.

This industry standard, defined by the Institute of Asset Management (IAM), emphasizes the alignment between the corporate strategic plan and various asset management documents. The strategic plan has a direct, and cascading impact on asset management planning and reporting.

Key Technical Concepts in Asset Management

Effective asset management integrates several key components, including lifecycle management, risk management, and levels of service. These concepts are applied throughout this asset management plan and are described below in greater detail.

Lifecycle Management Strategies

The condition or performance of most assets will deteriorate over time. This process is affected by a range of factors including an asset’s characteristics, location, utilization, maintenance history and environment. Asset deterioration has a negative effect on the ability of an asset to fulfill its intended function, and may be characterized by increased cost, risk and even service disruption.

To ensure that municipal assets are performing as expected and meeting the needs of customers, it is important to establish a lifecycle management strategy to proactively manage asset deterioration.

There are several field intervention activities that are available to extend the life of an asset. These activities can be generally placed into one of three categories: maintenance, rehabilitation, and replacement. The following table provides a description of each type of activity and the general difference in cost.

Depending on initial lifecycle management strategies, asset performance can be sustained through a combination of maintenance and rehabilitation, but at some point, replacement is required. Understanding what effect these activities will have on the lifecycle of an asset, and their cost, will enable staff to make better recommendations. Table 2 provides a description of each type of activity, the general difference in cost, and typical risks associated with each.

The Town’s approach to lifecycle management is described within each asset category outlined in this AMP. Developing and implementing a proactive lifecycle strategy will help staff to determine which activities to perform on an asset and when they should be performed to maximize useful life at the lowest total cost of ownership.

Table 2 Lifecycle Management: Typical Lifecycle Interventions

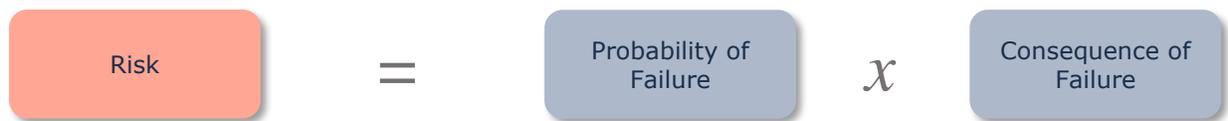
Lifecycle Activity	Description	Cost	Typical Associated Risks
Preventative Maintenance/ Maintenance	Activities that prevent defects or deteriorations from occurring	\$	<ul style="list-style-type: none"> • Balancing limited resources between planned maintenance and reactive, emergency repairs and interventions; • Diminishing returns associated with excessive maintenance activities, despite added costs; • Intervention selected may not be optimal and may not extend the useful life as expected, leading to lower payoff and potential premature asset failure;
Rehabilitation/ Renewal	Activities that rectify defects or deficiencies that are already present and may be affecting asset performance	\$\$	<ul style="list-style-type: none"> • Useful life may not be extended as expected; • May be costlier in the long run when assessed against full reconstruction or replacement; • Loss or disruption of service, particularly for underground assets;
Replacement/ Reconstruction	Asset end-of-life activities that often involve the complete replacement of assets	\$\$\$	<ul style="list-style-type: none"> • Incorrect or unsafe disposal of existing asset; • Costs associated with asset retirement obligations; • Substantial exposure to high inflation and cost overruns; • Replacements may not meet capacity needs for a larger population; • Loss or disruption of service, particularly for underground assets;

Risk and Criticality

Asset risk and criticality are essential building blocks of asset management, integral in prioritizing projects and distributing funds where they are needed most based on a variety of factors. Assets in disrepair may fail to perform their intended function, pose substantial risk to the community, lead to unplanned expenditures, and create liability for the municipality. In addition, some assets are simply more important to the community than others, based on their financial significance, their role in delivering essential services, the impact of their failure on public health and safety, and the extent to which they support a high quality of life for community stakeholders.

Risk is a product of two variables: the probability that an asset will fail, and the resulting consequences of that failure event. It can be a qualitative measurement, (low, medium, high) or quantitative measurement (1-5), that can be used to rank assets and projects, identify appropriate lifecycle strategies, optimize short- and long-term budgets, minimize service disruptions, and maintain public health and safety.

Figure 1 Risk Equation



The approach used in this AMP relies on a quantitative measurement of risk associated with each asset. The probability and consequence of failure are each scored from 1 to 5, producing a minimum risk index of 1 for the lowest risk assets, and a maximum risk index of 25 for the highest risk assets.

Probability of Failure

Several factors can help decision-makers estimate the probability or likelihood of an asset's failure, including its condition, age, previous performance history, and exposure to extreme weather events, such as flooding and ice jams—both a growing concern for municipalities in Canada.

Consequence of Failure

Estimating criticality also requires identifying the types of consequences that the organization and community may face from an asset's failure, and the magnitude of those consequences. Consequences of asset failure will vary across the infrastructure portfolio; the failure of some assets may result primarily in high direct financial cost but may pose limited risk to the community. Other assets may have a relatively minor financial value, but any downtime may pose significant health and safety hazards to residents.

Table 3 illustrates the various types of consequences that can be integrated in developing risk and criticality models for each asset category and segments within. We note that these consequences are common, but not exhaustive.

Table 3 Risk Analysis: Types of Consequences of Failure

Type of Consequence	Description
Direct Financial	Direct financial consequences are typically measured as the replacement costs of the asset(s) affected by the failure event, including interdependent infrastructure.
Economic	Economic impacts of asset failure may include disruption to local economic activity and commerce, business closures, service disruptions, etc. Whereas direct financial impacts can be seen immediately or estimated within hours or days, economic impacts can take weeks, months and years to emerge, and may persist for even longer.
Socio-political	Socio-political impacts are more difficult to quantify and may include inconvenience to the public and key community stakeholders, adverse media coverage, and reputational damage to the community and the Municipality.
Environmental	Environmental consequences can include pollution, erosion, sedimentation, habitat damage, etc.
Public Health and Safety	Adverse health and safety impacts may include injury or death, or impeded access to critical services.
Strategic	These include the effects of an asset’s failure on the community’s long-term strategic objectives, including economic development, business attraction, etc.

This AMP includes a preliminary evaluation of asset risk and criticality. Each asset has been assigned a probability of failure score and consequence of failure score based on available asset data. These risk scores can be used to prioritize maintenance, rehabilitation, and replacement strategies for critical assets.

These models have been built in Citywide for continuous review, updates, and refinements. Risk matrices are also generated using these models.

Levels of Service

A level of service (LOS) is a measure of the services that the Town is providing to the community and the nature and quality of those services. Within each asset category in this AMP, technical metrics and qualitative descriptions that measure both technical and community levels of service have been established and measured as data is available.

Two levels of service key performance indicators are provided: Community Levels of Service, and Technical Levels of Service. At this stage, LOS that are required under O. Reg. for core assets and any additional ones selected by the Town have been included.

Community Levels of Service

Community levels of service are a simple, plain language description or measure of the service that the community receives. For core asset categories, the province, through O. Reg. 588/17, has mandated qualitative descriptions that are required to be included in this AMP.

Technical Levels of Service

Technical levels of service are a measure of key technical attributes of the service being provided to the community. These include mostly quantitative measures and tend to reflect the impact of the Town's asset management strategies on the physical condition of assets or the quality/capacity of the services they provide.

For core asset categories, the province, through O. Reg. 588/17, has also prescribed technical metrics that are required to be included in this AMP.

Current and Proposed Levels of Service

This AMP focuses on measuring the current level of service provided to the community. Once current levels of service have been measured, the Town plans to establish proposed levels of service over a 10-year period, in accordance with O. Reg. 588/17.

Proposed levels of service should be realistic and achievable within the timeframe outlined by the Municipality. They should also be determined with consideration of a variety of community expectations, fiscal capacity, regulatory requirements, corporate goals and long-term sustainability. Once proposed levels of service have been established, and prior to July 2025, the Town must identify a lifecycle management and financial strategy which allows these targets to be achieved.

Reinvestment Rate

As assets age and deteriorate they require additional investment to maintain a state of good repair. The reinvestment of capital funds, through asset renewal or replacement, is necessary to sustain an adequate level of service. The reinvestment rate is a measurement of available or required funding relative to the total replacement cost. By comparing the actual vs. target reinvestment rate (TRR) the Town can determine the extent of any existing funding gap.

Asset Condition

An incomplete or limited understanding of asset condition can mislead long-term planning and decision-making. Accurate and reliable condition data helps to prevent premature and costly rehabilitation or replacement and ensures that lifecycle activities occur at the right time to maximize asset value and useful life.

A condition assessment rating system provides a standardized descriptive framework that allows comparative benchmarking across the Town’s asset portfolio. The table below outlines the condition rating system used in this AMP to determine asset condition. This rating system is aligned with the Canadian Core Public Infrastructure Survey which is used to develop the Canadian Infrastructure Report Card. When assessed condition data is not available, service life remaining is used to approximate asset condition.

Table 4 Standard Condition Rating Scale

Condition	Pavement Condition Index (PCI)	Bridge Condition Index (BCI)	Age-based (Service Life Remaining %)	Broad Description
Very Good	85-100	90-100	80-100	Fit for the future Well maintained, good condition, new or recently rehabilitated; no defects or minor defects
Good	70-85	70-90	60-80	Adequate for now Acceptable, signs of minor to defects and deterioration
Fair	55-70	50-70	40-60	Requires attention Signs of moderate deterioration and defects, some elements exhibit significant deficiencies
Poor	30-55	30-50	20-40	Increasing potential of affecting service Approaching end of service life, condition below standard, large portion of system exhibits significant deterioration; significant defects overall
Very Poor	0-30	0-30	0-20	Unfit for sustained service Near or beyond expected service life, widespread signs of advanced deterioration, some assets may be unusable

Appendix C includes additional information on the role of asset condition data and provides basic guidelines for the development of a condition assessment program.

Age Profile

An asset's age profile comprises two key values: estimated useful life (EUL), or design life; and the percentage of EUL consumed. The EUL is the serviceable lifespan of an asset during which it can continue to fulfil its intended purpose and provide value to users, safely and efficiently. As assets age, their performance diminishes, often more rapidly as they approach the end of their design life.

In conjunction with condition data, an asset's age profile provides a more complete summary of the state of infrastructure. It can help identify assets that may be candidates for further review through condition assessment programs; inform the selection of optimal lifecycle strategies; and improve planning for potential replacement spikes.

A comparison of the weighted average useful life of all segments and their weighted average age has been provided for all categories.

Foundational Documents in Asset Management

In the municipal sector, 'asset management strategy' and 'asset management plan' are often used interchangeably. Other concepts such as 'asset management framework', 'asset management system', and 'strategic asset management plan' further add to the confusion; lack of consistency in the industry on the purpose and definition of these elements offers little clarity. We make a clear distinction between the policy, strategy, and the plan.

Asset Management Policy

An asset management policy represents a statement of the principles guiding the Municipality's approach to asset management activities. It aligns with the organizational strategic plan and provides clear direction to municipal staff on their roles and responsibilities as part of the asset management program. All municipalities were required to develop and adopt an asset management policy in 2019 in compliance with O. Reg 588/17.

The Town's asset management policy (CORP-2019-0004) was approved by Council on June 17th, 2019 in accordance with O. Reg 588/17.

The policy provides a foundation for the development of an asset management program within the town. It covers the key components that define a comprehensive asset management policy:

- The policy's principles dictate the use of asset management practices to ensure all assets meet the agreed levels of service in the most efficient and effective manner;
- the policy commits to, where appropriate, integrating the principles found in certain official documents into the asset management plan;
- there are formally defined roles and responsibilities of internal staff and stakeholders;
- the policy principles and guidelines include the use of a long-term view and effective prioritization in the management of infrastructure; and
- the policy principles and guidelines are well defined.

As per Ontario Regulation 588/17, the Town will be required to review and update its Strategic Asset Management Policy in 2024.

Asset Management Strategy

An asset management strategy is typically a higher-level document, focusing on business processes and organizational practices. It is a roadmap that includes key initiatives with recommended timelines that lead to higher state of asset management maturity. It is intended to convert the asset management policy from a set of formal, institutionalized, but philosophical commitments into specific actions.

While not a static document, the strategy should not evolve and change frequently—unlike the asset management plan. The strategy provides a long-term outlook on the overall asset management program development and strengthening key elements of its framework.

The Town's asset management policy contains many of the key components of an asset management strategy and may be expanded on in future revisions or as part of a separate strategic document.

Asset Management Plan

The asset management plan is often identified as a key output within the strategy. The AMP has a sharp focus on the current state of the Town's asset portfolio, and its approach to managing and funding individual service areas or asset groups. It is tactical in nature and provides a snapshot in time.

The strategic plan has a direct, and cascading impact on asset management planning and reporting, making it a foundational element. Many municipalities begin with an asset management plan. However, without the preceding documents, the AMP operates in a vacuum.

The Town's last iteration of the AMP was completed in 2015. Since then, the asset inventory has undergone consolidation of critical asset data and refinements to its core assets. This document is an AMP that uses the updated asset data and has been prepared in accordance with O. Reg. 588/17

Climate Change

Climate change can cause severe impacts on human and natural systems around the world. The effects of climate change include increasing temperatures, higher levels of precipitation, droughts, and extreme weather events. In 2019, Canada's Changing Climate Report (CCCR 2019) was released by Environment and Climate Change Canada (ECCC).

The report revealed that between 1948 and 2016, the average temperature increase across Canada was 1.7°C; moreover, during this time period, Northern Canada experienced a 2.3°C increase. The temperature increase in Canada has doubled that of the global average. If emissions are not significantly reduced, the temperature could increase by 6.3°C in Canada by the year 2100 compared to 2005 levels. Observed precipitation changes in Canada include an increase of approximately 20% between 1948 and 2012. By the late 21st century, the projected increase could reach an additional 24%. During the summer months, some regions in Southern Canada are expected to experience periods of drought at a higher rate. Extreme weather events and climate conditions are more common across Canada. Recorded events include droughts, flooding, cold extremes, warm extremes, wildfires, and record minimum arctic sea ice extent.

The changing climate poses a significant risk to the Canadian economy, society, environment, and infrastructure. The impacts on infrastructure are often a result of climate-related extremes such as droughts, floods, higher frequency of freeze-thaw cycles, extended periods of high temperatures, high winds, and wildfires. Physical infrastructure is vulnerable to damage and increased wear when exposed to these extreme events and climate variabilities. Canadian Municipalities are faced with the responsibility to protect their local economy, citizens, environment, and physical assets.

Essex's Climate Profile

The Town of Essex is expected to experience notable effects of climate change which include higher average annual temperatures, an increase in total annual precipitation, and an increase in the frequency and severity of extreme events. According to Climatedata.ca – a collaboration supported by Environment and Climate Change Canada (ECCC) – the Town of Essex will likely experience the following trends:

Higher Average Annual Temperature:

1. Between the years 1981 to 2010 the annual average temperature was 9.9 °C
2. Under a high emissions scenario, the annual average temperatures are projected to be 11.7 °C by the year 2050 and around 15.1 °C by the end of the century.

Increase in Average Annual Precipitation:

3. Under a high emissions scenario, Essex is projected to experience a 8% increase in precipitation by 2050 and a 13% increase by the end of the century.

Increase in Frequency of Extreme Weather Events:

4. It is expected that the frequency and severity of extreme weather events will change.
5. In some areas, extreme weather events will occur with greater frequency and severity than others.

Integrating Climate Change into Asset Management

Asset management practices aim to deliver sustainable service delivery - the delivery of services to residents today without compromising the services and well-being of future residents. Climate change threatens sustainable service delivery by reducing the useful life of an asset and increasing the risk of asset failure. Desired levels of service can be more difficult to achieve as a result of climate change impacts such as flooding, high heat, drought, and more frequent and intense storms.

In order to achieve the sustainable delivery of services, climate change considerations should be incorporated into asset management practices. The integration of asset management and climate change adaptation observes industry best practices and enables the development of a holistic approach to risk management.

In 2020 and 2021, the Town of Essex developed a comprehensive Climate Change Adaptation Plan (CCAP) for 2021 to 2026. The plan will help the municipality plan and adapt to the impacts of climate change.

The development of the CCAP has been supported by the Essex Climate Adaptation Team (ECAT), which is a team of citizens and stakeholders that assist in identifying measures to improve adaptation, reducing vulnerability, enhance community resilience and protect resources while recognizing potential cost-savings and economic opportunities.

Limitations and Constraints

This AMP required substantial effort by staff. It was developed based on best-available data, and was subject to the following broad limitations, constraints, and assumptions:

- 1.** The analysis in this AMP is highly sensitive to several critical data fields, including an asset's estimated useful life, replacement cost, quantity, and in-service date. Inaccuracies or imprecisions in any of these fields can have substantial and cascading impacts on all reporting and analytics.
- 2.** User-defined and unit cost estimates, based typically on staff judgment, recent projects, or established through completion of technical studies, offer the most precise approximations of current replacement costs. When this isn't possible, historical costs incurred at the time of asset acquisition or construction can be inflated to present day. This approach, while sometimes necessary, and deployed in this AMP for some asset groups, can produce highly inaccurate estimates.
- 3.** In the absence of condition assessment data, age was used to estimate asset condition ratings. This approach can result in an over- or understatement of asset needs. As a result, financial requirements generated through this approach can differ from those produced by staff.
- 4.** Water and wastewater treatment facilities are not effectively componentized into their individual elements, major components, and minor components. These facilities contain thousands of individual assets, including the substructures, shell, interior assets, various electrical, plumbing, HVAC systems, and other complex equipment and furnishings. Each of these assets has its own useful life and replacement cost, and individual condition rating, as well as installation history. Without componentization, the value of condition ratings, age profiles, and long- and short-term forecasts remains limited.
- 5.** The risk models are designed to support objective project prioritization and selection. However, in addition to the inherent limitations that all models face, they also require availability of important asset attribute data to ensure that asset risk ratings are valid, and assets are properly stratified within the risk matrix. Missing attribute data can misclassify assets.

These limitations have a direct impact on most of the analysis presented in this AMP, including condition summaries, age profiles, long-term replacement and rehabilitation forecasts, and shorter term, 10-year forecasts that are generated from Citywide, the Town's primary asset management system.

These challenges are quite common among municipalities and require long-term commitment and sustained effort by staff. As the Town's asset management program evolves and advances, the quality of future AMPs and other core documents that support asset management will continue to increase.

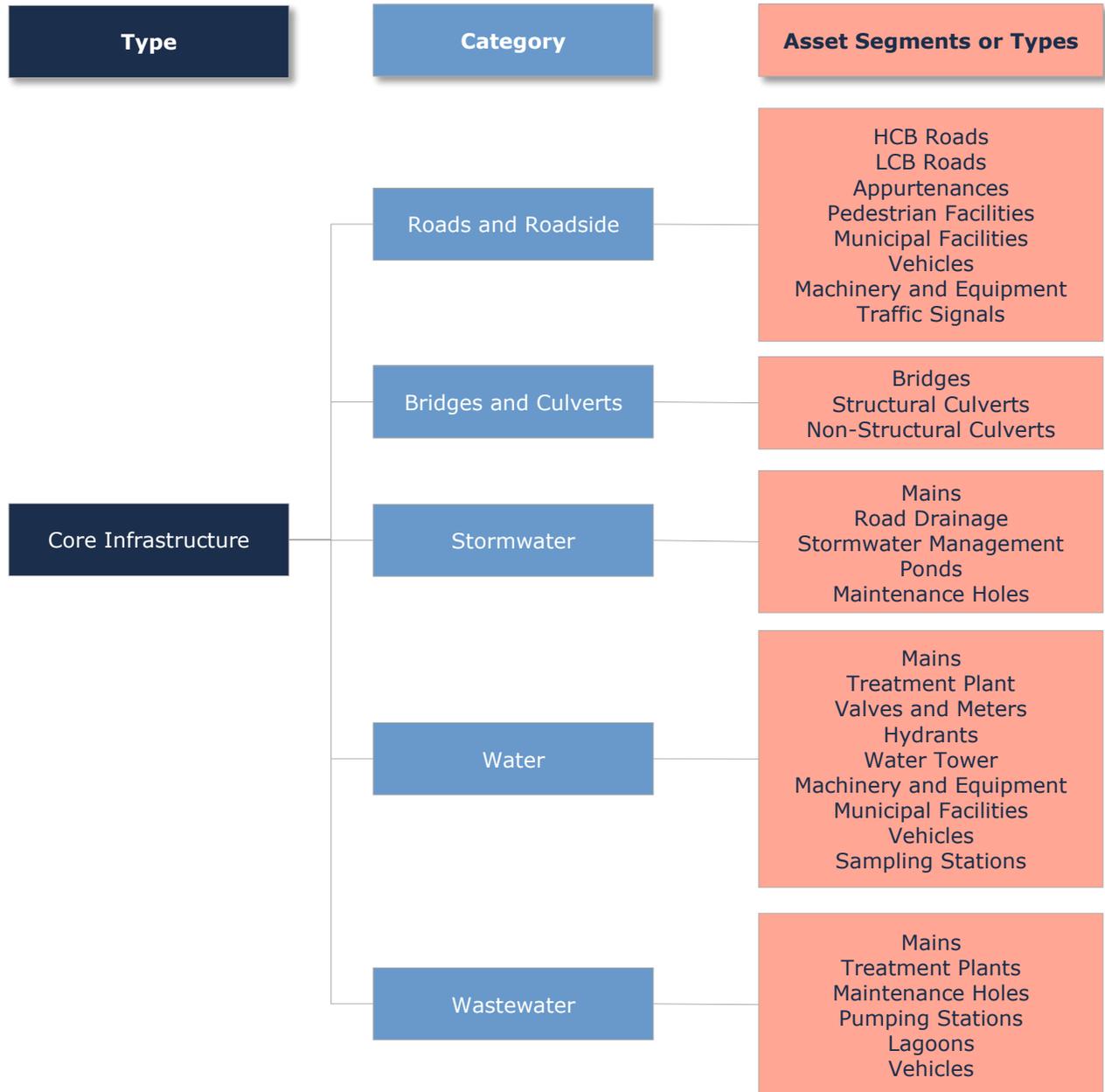
State of the Infrastructure

The state of the infrastructure (SOTI) summarizes the inventory, condition, age profiles, and other key performance indicators for the Town's infrastructure portfolio. Figure 2 illustrates how assets were classified within the infrastructure data hierarchy. Most reporting and analysis is presented at the segment level.

Asset Hierarchy and Data Classification

Asset hierarchy illustrates the relationship between individual assets and their components, and a wider, more expansive network and system. How assets are grouped in a hierarchy structure can impact how data is interpreted. Assets were structured to support meaningful, efficient reporting and analysis. Key category details are summarized at the asset segment level.

Figure 2 Asset Hierarchy and Data Classification

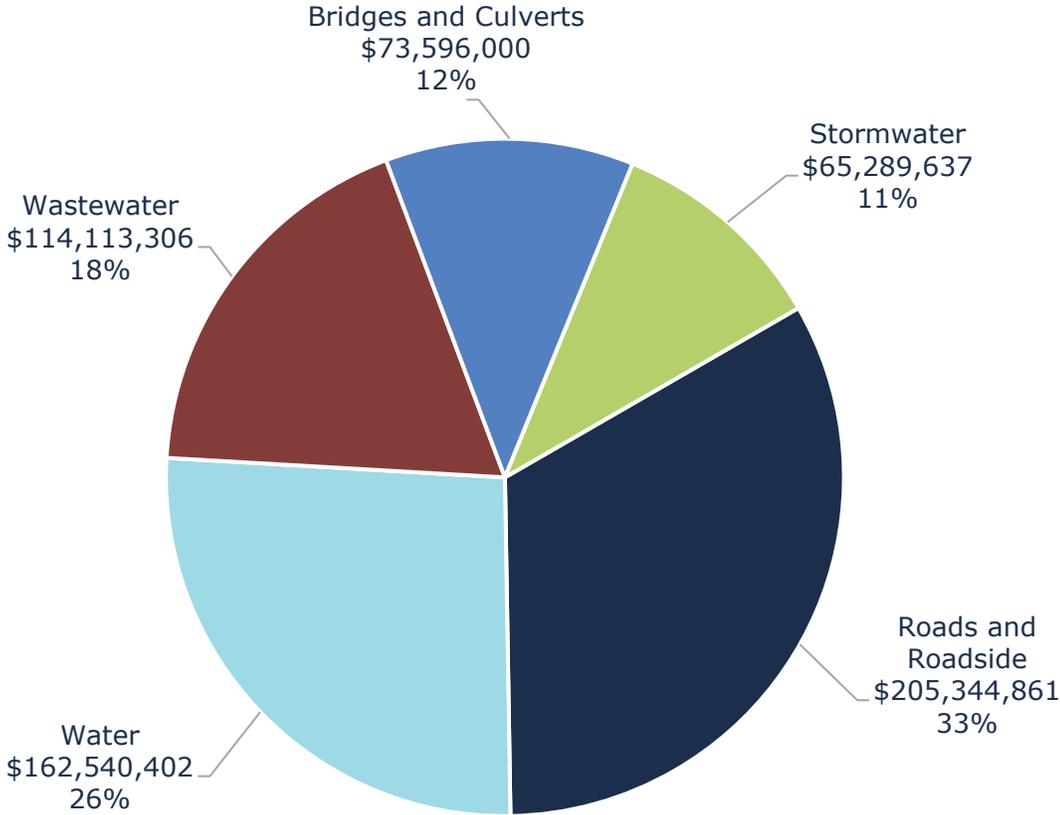


Portfolio Overview

The five core asset categories analyzed in this asset management plan have a total current replacement cost of \$621 million. This estimate was calculated using user-defined costing, as well as inflation of historical or original costs to current date. See Appendix A for a summary of critical data for each core asset category.

Figure 3 illustrates the replacement cost of each asset category; at 33% of the total portfolio and with a current replacement cost of around \$205 million, roads and roadside assets form the largest share of the Town’s asset portfolio, followed by water assets at 26%.

Figure 3 Current Replacement Cost by Asset Category



Total Current Replacement Cost: \$620,884,206

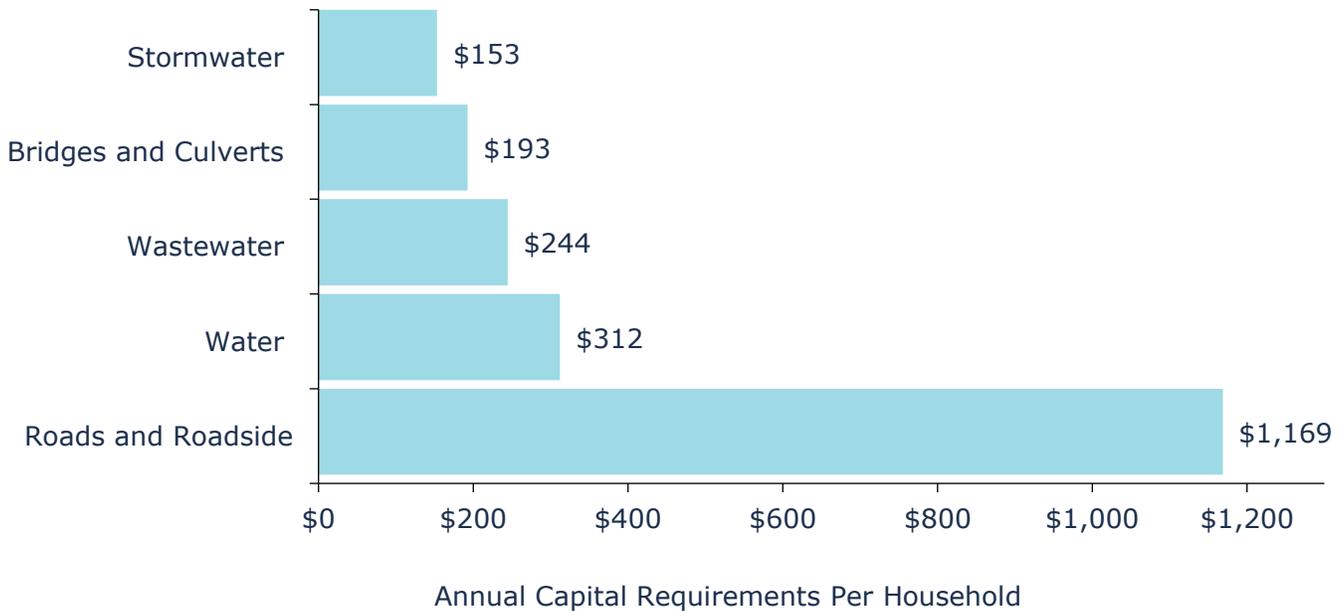
The table below identifies the replacement cost method and sources used throughout this AMP.

Table 5 Replacement Cost Method and Source

Asset Category	Replacement Cost Method		
	Defined Replacement Cost	Historical Cost Inflation	Defined Replacement Cost Source
Roads and Roadside	93%	7%	Municipal Staff
Bridges and Culverts	100%	0%	2022 OSIM report
Stormwater	99%	1%	
Water	90%	10%	Municipal Staff
Wastewater	68%	32%	
Total	89%	11%	

Error! Reference source not found.4 summarizes the average annual capital requirements per household. Household data was retrieved from the 2021 Statistics Canada Census. The total number of households used to calculate the annual capital requirements per household values was 8,390 for all categories.

Figure 4 Average Annual Capital Infrastructure Requirements Per Household



Condition Data

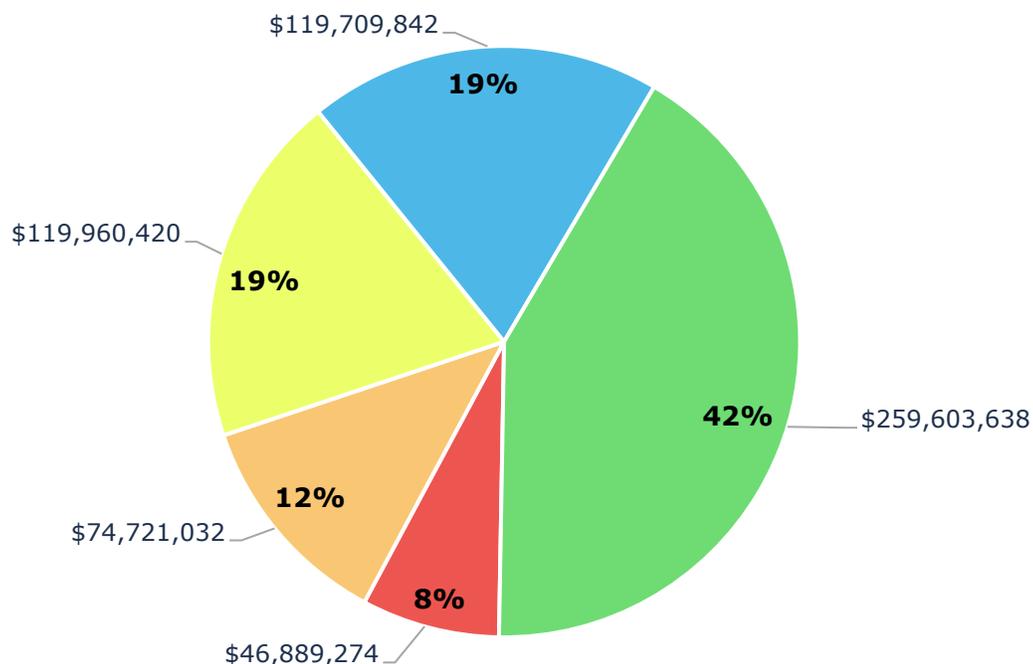
Figure and Figure summarize asset condition at the portfolio and category levels, respectively. Based on both assessed condition and age-based analysis, 80% of the Town's infrastructure portfolio is in fair or better condition, with the remaining 20% in poor or worse condition. Typically, assets in poor or worse condition may require replacement or major rehabilitation in the immediate or short-term. Targeted condition assessments may help further refine the list of assets that may be candidates for immediate intervention, including potential replacement or reconstruction.

Similarly, assets in fair condition should be monitored for disrepair over the medium term. Keeping assets in fair or better condition is typically more cost-effective than addressing asset needs when they enter the latter stages of their lifecycle or decline to a lower condition rating, e.g., poor or worse.

We note that with the exception of the Town's roads, bridges, and culverts, which together comprise 35% of total asset value, no in-field condition assessment data was available for other assets. As such, age was used as an approximation of condition for these assets.

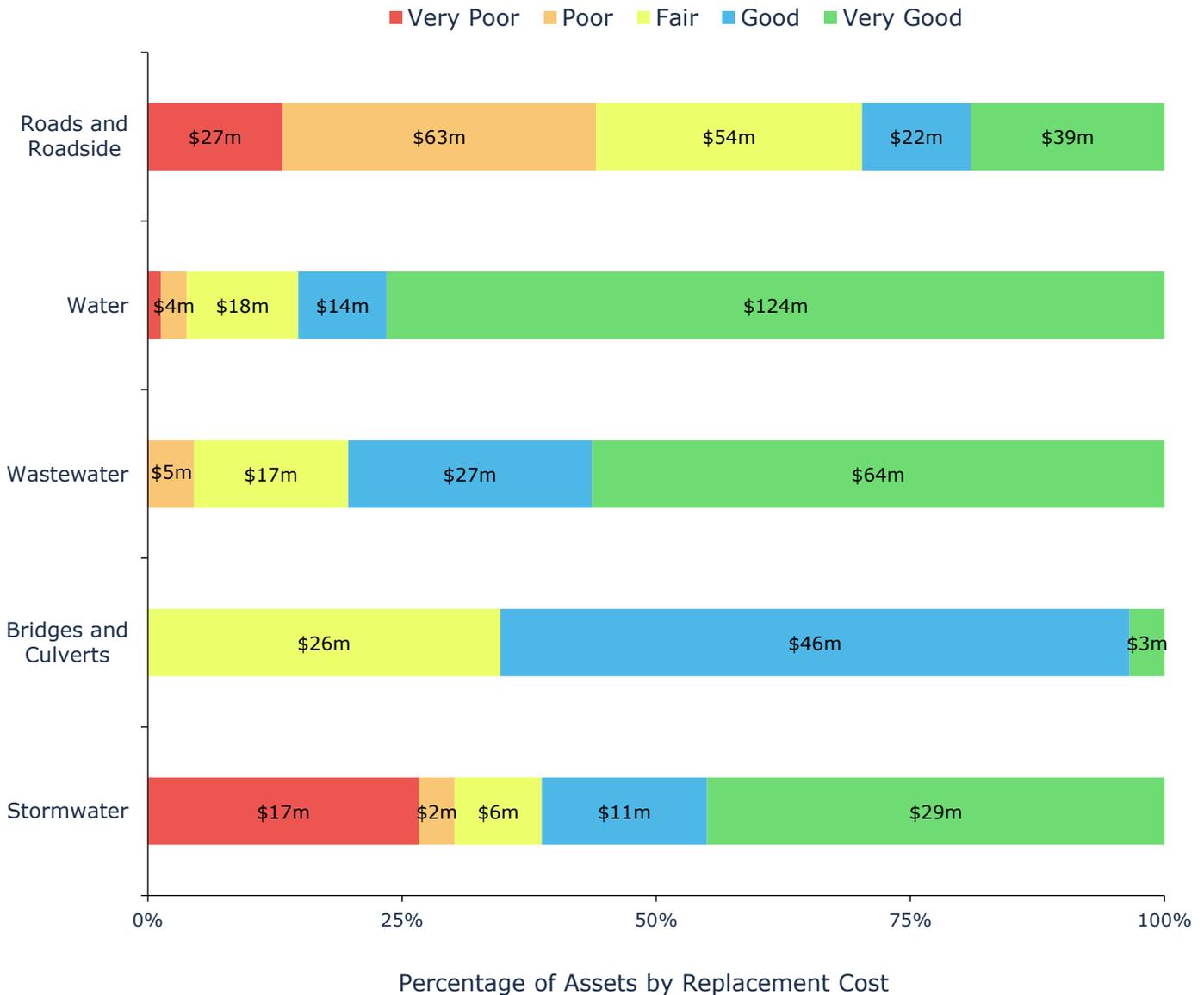
Further, when assessed condition data was available, it was projected to current year (2022). This 'projected condition' can generate lower condition ratings than those established at the time of the condition assessment. The rate of this deterioration will also depend on lifecycle curves used to project condition over time.

Figure 5 Asset Condition – Portfolio Overview



As further illustrated in Figure , the majority of major, core infrastructure is in fair or better condition, based on in-field condition assessment data for roads, bridges, and culverts. However, as no condition data was available for other essential assets such as stormwater, water, and wastewater, age was used to approximate asset condition. See [Table 6 Source of Condition Data](#) for details on how condition data was derived for each asset segment.

Figure 6 Asset Condition – By Asset Category



Source of Condition Data

This asset management plan relies on assessed condition for 35% of assets, based on and weighted by replacement cost. For the remaining assets, aged is used as an approximation of condition. Assessed condition data is invaluable in asset management planning as it reflects the true condition of the asset and its ability to perform its functions. The table below identifies the source of condition data used throughout this AMP.

Table 6 Source of Condition Data

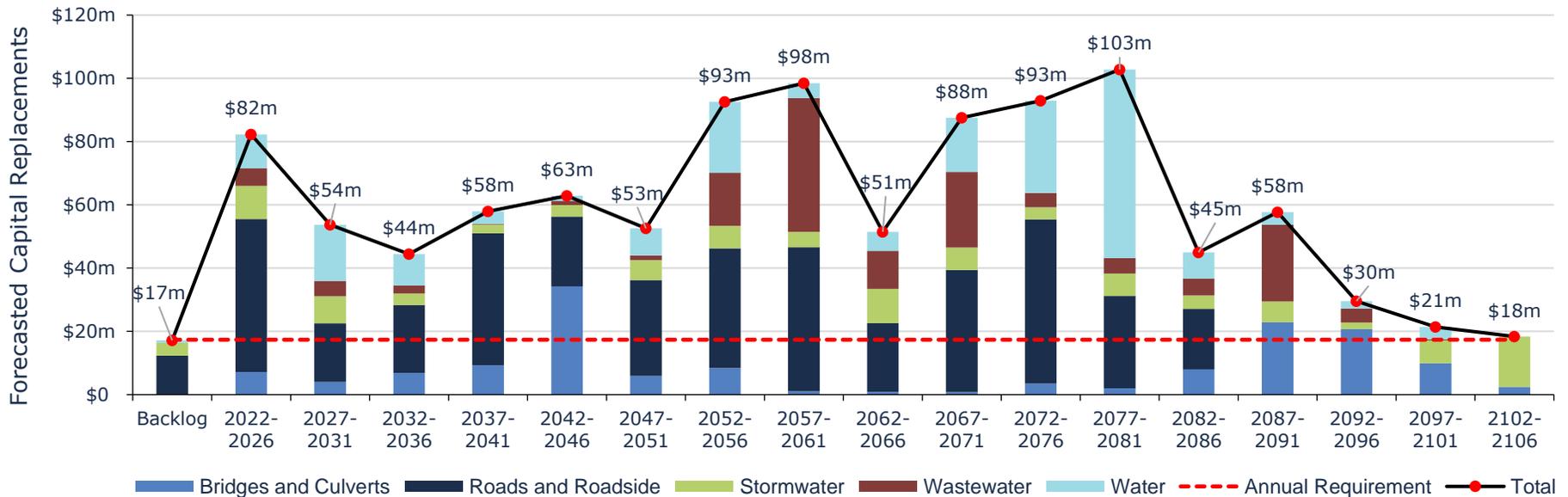
Asset Category	Segment	% Of Assets with Assessed Condition	Source
Roads and Roadside	HCB Roads	88%	2018-2020 PCI-based condition assessments
	LCB Roads	95%	
	All other segments	0%	Age-based estimates only
Bridges and Culverts	Bridges	100%	2022 Keystone OSIM Reports (BCI-based)
	Non-Structural Culverts	100%	
	Structural Culverts	100%	
Stormwater	All segments	0%	Age-based estimates only
Water	All segments	0%	Age-based estimates only
Wastewater	All segments	0%	Age-based estimates only
Total		35%	

Forecasted Long-term Replacement Needs

Aging assets require maintenance, rehabilitation, and replacement. Figure below illustrates the cyclical short-, medium- and long-term infrastructure replacement requirements for all asset categories analyzed in this AMP. On average, \$17 million is required each year to remain current with capital replacement needs for the Town’s core asset portfolio (red dotted line). Although actual spending may fluctuate substantially from year to year, this figure is a useful benchmark for annual capital expenditure targets (or allocations to reserves) to ensure projects are not deferred and replacement needs are met as they arise. This figure relies on age and available condition data. Based on the current replacement cost of the portfolio, estimated at \$621 million, this represents an annual target reinvestment rate of 2.8%.

The chart also illustrates a backlog of \$17 million, comprising assets that remain in service beyond their estimated useful life. It is unlikely that all such assets are in a state of disrepair, requiring immediate replacements or major renewals. This makes targeted and consistent condition assessments integral. Risk frameworks, proactive lifecycle strategies, and levels of service targets can then be used to prioritize projects, continuously refine estimates for both backlogs and ongoing capital needs and help select the right treatment for each asset.

Figure 7 Capital Replacement Needs – Portfolio Overview 2022-2106



Risk Matrix

Using the risk equation and preliminary risk models, **Error! Reference source not found.** shows how assets across the different asset categories are stratified within a risk matrix.

Figure 8 Risk Matrix: All Assets

Consequence	5 Severe	4 Assets \$5,141,685	5 Assets \$33,705,784	2 Assets \$3,865,250	1 Asset \$2,234,638	1 Asset \$1,449,960
	4 Major	11 Assets \$6,687,835	8 Assets \$13,363,536	16 Assets \$25,979,690	9 Assets \$12,828,141	3 Assets \$1,241,786
	3 Moderate	112 Assets \$37,867,237	31 Assets \$16,053,348	56 Assets \$31,681,488	46 Assets \$24,980,911	18 Assets \$6,762,624
	2 Minor	450 Assets \$61,036,607	190 Assets \$31,596,050	126 Assets \$24,306,154	94 Assets \$10,075,353	89 Assets \$6,940,696
	1 Insignificant	3,155 Assets \$91,863,756	2,629 Assets \$73,969,565	2,742 Assets \$46,728,559	2,368 Assets \$30,380,966	4,936 Assets \$20,142,587
		1 Rare	2 Unlikely	3 Possible	4 Likely	5 Almost Certain
		Probability				

The analysis shows that based on current risk models, 5% of the Town’s assets, with a current replacement cost of approximately \$28.4 million, carry a risk rating of 15 or higher (red) out of 25. Assets in this group may have a high probability of failure based on available condition data and age-based estimates and were considered to be most essential to the Town.

As new asset attribute information and condition assessment data are integrated with the asset register, asset risk ratings will evolve, resulting in a redistribution of assets within the risk matrix. Staff should also continue to calibrate risk models.

We caution that since risk ratings rely on many factors beyond an asset’s physical condition or age, assets in a state of disrepair can sometimes be classified as low-risk, despite their poor condition rating. In such cases, although the probability of failure for these assets may be high, their consequence of failure ratings were determined to be low based on the attributes used and the data available.

Similarly, assets with very high condition ratings can receive a moderate to high-risk rating despite a low probability of failure. These assets may be deemed as highly critical to the Town based on their costs, economic importance, social significance, and other factors. Continued calibration of an asset’s criticality and regular data updates are needed to ensure these models more accurately reflect an asset’s actual risk profile.

Roads and Roadside

The Town’s roads and roadside assets comprises the largest share of its infrastructure portfolio, with a current replacement cost of more than \$205 million, distributed primarily between High Class Bituminous (HCB), and Low Class Bituminous (LCB) roads. The Town also owns and manages other supporting infrastructure, including pedestrian facilities, roadside appurtenances, traffic signals as well as municipal facilities, vehicles, machinery and equipment that support staff in the delivery of transportation services.

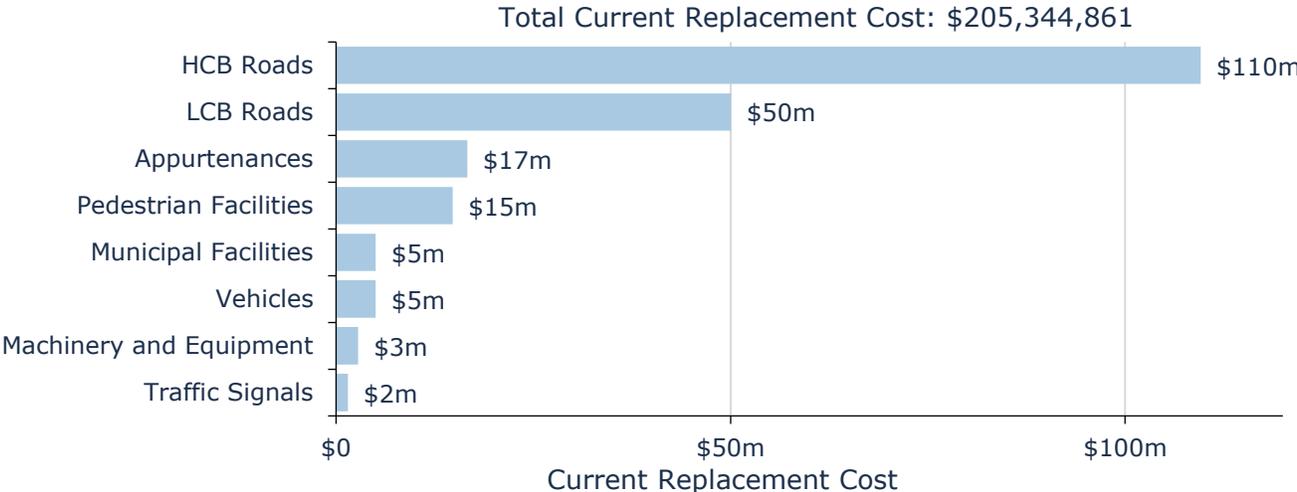
Inventory and Valuation

Table summarizes the quantity and current replacement cost of the Town’s various roads and roadside assets as managed in its primary asset management register, Citywide.

Table 7 Detailed Asset Inventory – Roads and Roadside

Segment	Quantity	Unit of Measure	Replacement Cost
Roads	324	km	\$159,625,295
Paved - HCB	124	km	\$109,569,461
Surface Treated - LCB	152	km	\$50,055,834
Unpaved - Gravel	48	km	Not Planned for Replacement
Appurtenances	4,663	Assets	\$16,621,925
Pedestrian Facilities	401	Assets	\$14,771,745
Municipal Facilities	4	Assets	\$5,025,477
Vehicles	20	Assets	\$5,019,563
Machinery and Equipment	78	Assets	\$2,773,499
Traffic Signals	5	Assets	\$1,507,358
Total			\$205,344,861

Figure 9 Category Valuation – Roads and Roadside



Asset Condition

Figure summarizes the replacement cost-weighted condition of the Town's roads and roadside assets. Based on a combination of field inspection data and age, 56% of assets are in fair or better condition; the remaining 44% of assets are in poor or worse condition. Condition assessments were available for 91% of roads, based on replacement cost.

This condition data was projected from inspection date to current year to estimate their condition today. No condition data was available for the remaining asset types, requiring age-based approximations.

Assets in poor or worse condition may be candidates for replacement in the short term; similarly, assets in fair condition may require rehabilitation or replacement in the medium term and should be monitored for further degradation in condition. As illustrated in Figure , the majority of the Town's roads and roadside assets are in poor or worse condition.

Figure 10 Asset Condition – Roads and Roadside: Overall

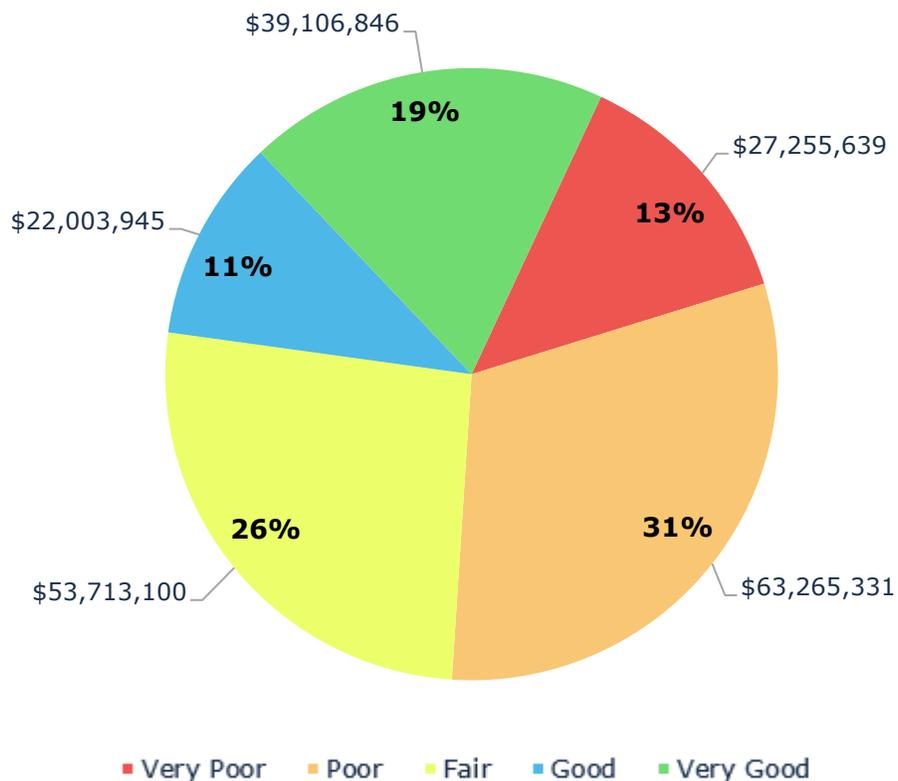


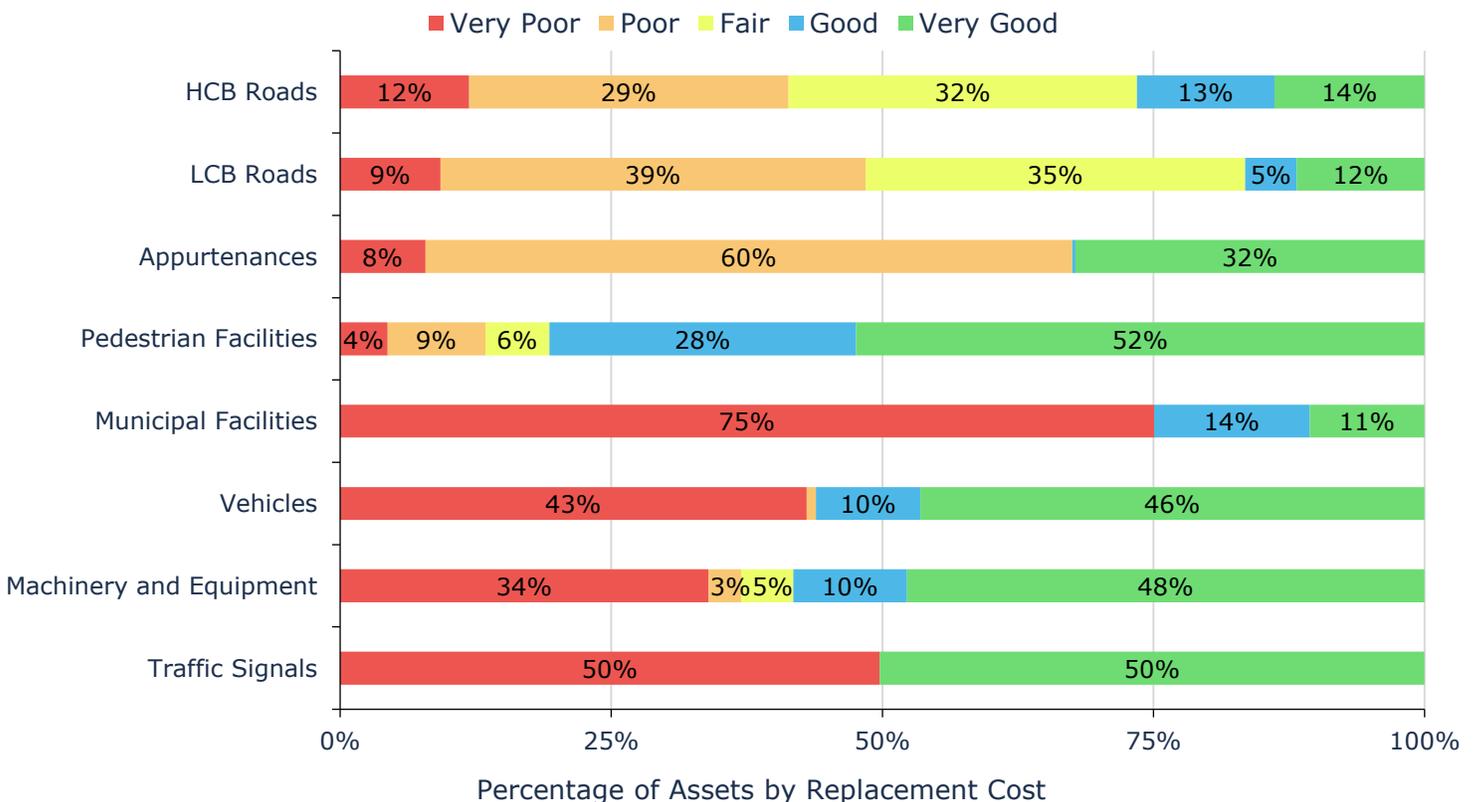
Table 8 summarizes the current average condition, the average service life remaining and the estimated useful life for each asset segment. The average condition is a weighted value based on the current replacement cost.

Table 8 Asset Condition by Segment – Roads and Roadside

Segment	Estimated Useful Life (Years)	Service Life Remaining (Years)	Average Condition
Roads	7 - 25	13.6	55% (Fair)
Paved - HCB	25 (surface)	12.8	56% (Fair)
Surface Treated - LCB	7 (surface)	16.9	53% (Poor)
Appurtenances	20 - 75	4.8	51% (Fair)
Pedestrian Facilities	15 - 40	14.3	74% (Good)
Municipal Facilities	20 - 50	6.7	21% (Poor)
Vehicles	10 - 25	2.9	51% (Fair)
Machinery and Equipment	3 - 50	2.8	56% (Fair)
Traffic Signals	20	-1.8	48% (Fair)
Overall		6.4	55% (Fair)

As illustrated in Figure 4, based on condition assessments, the majority of the Town’s HCB and LCB roads are in fair condition.

Figure 4 Asset Condition – Roads and Roadside: By Segment



Age Profile

Figure 5 illustrates the average current age of each asset type and its estimated useful life. Both values are weighted by the replacement cost of individual assets.

Figure 5 Estimated Useful Life vs. Asset Age – Roads and Roadside



The analysis shows that, based on in-service dates, LCB roads continue to remain in operation beyond their expected useful life, with an average age of 18 years against an average expected serviceable life of 7 years for the surface layer. Age analysis also revealed that, on average, HCB roads and Municipal Facilities have entered the latter stages of their useful life. Condition assessments should be used to identify potential candidates for potential repair, renewal, or replacements.

Although age analysis is important, we do note that roads needs studies and pavement condition reports provide a much more accurate summary of road condition than average age, which is influenced by in-service dates, how road assets are treated within an accounting and financial reporting framework, and the useful life assigned.

Current Approach to Lifecycle Management

This section outlines the Town's current approach to managing its road assets. Key data was collected through staff discussions. As applicable, lifecycle models were also built in Citywide. These can be used by staff for ongoing reference and planning within the Town's asset management program. These models should be continuously refined and updated with new data as it becomes available.

Roads

A roads needs study (RNS) is completed by an external consultant every four years for all paved and unpaved road sections. The most recent RNS was completed in 2018, and as part of the study, a pavement condition index (PCI) was calculated based on distress quantity, type, and severity. Recommended treatment, ranging from preventative maintenance to rehabilitation and reconstruction, was developed for each road section along with cost estimates. Staff regularly update the PCI on road sections that undergo maintenance, rehabilitation, or reconstruction.

Condition assessments, staff judgment, traffic loads, and opportunity to bundle projects with sub-surface asset requirements (stormwater, wastewater, water) help inform the optimal lifecycle intervention that range from pothole repairs to potential rehabilitation.

A crack sealing program is in place and conducted annually on selected road sections. Rehabilitative activities include cold in-place recycling, mill and paving, asphalt overlaying, single and double surface treatments.

Summer maintenance activities include grading, re-gravelling, applying dust suppressant, ditching, roadside mowing, tree trimming, brush cleanup, road sign maintenance, and line painting. Winter maintenance activities include snow plowing, salting, and snow removal.

Road reconstruction projects (base and surface layers) are prioritized through road condition, risk, sub-surface asset requirements, and consideration of growth, health and safety and social impact.

Table summarizes the Town’s current lifecycle strategy for its HCB roads and includes the state of the asset that may trigger the event (i.e., condition or age). Major rehabilitation and replacements are guided by both ride condition ratings and sub-surface asset requirements.

Table 9 Current Lifecycle Management Strategies – HCB Roads

Event Name	Event Class	Event Range / Trigger
General Maintenance	Maintenance	As needed
Crack Sealing	Preventative Maintenance	Condition: 60 - 100
Mill and Pave	Rehabilitation	Condition: 40 - 60
Asphalt Full Depth Removal	Rehabilitation	Condition: 30 - 40
Asset Reconstruction	Replacement	Condition: 30

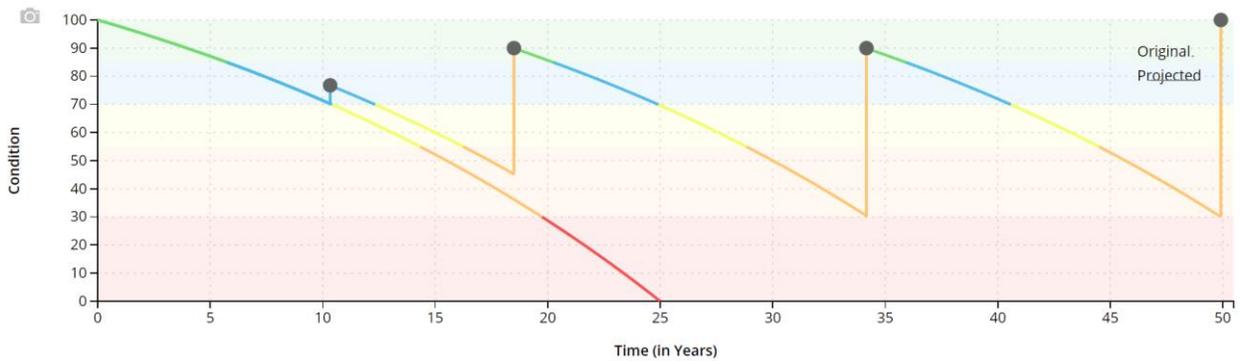


Table summarizes the Town’s current lifecycle strategy for its LCB roads and includes the state of the asset that may trigger the event (i.e., condition or age). Major rehabilitation and replacements are guided by both ride condition ratings and sub-surface asset requirements.

Table 10 Current Lifecycle Management Strategies – LCB Roads

Event Name	Event Class	Event Range / Trigger
General Maintenance	Maintenance	As needed
Single Surface Treatment	Maintenance	Condition: 70 - 85
Rehabilitative Activity	Rehabilitation	Condition: 30 - 69
Asset Reconstruction	Replacement	Condition: 30

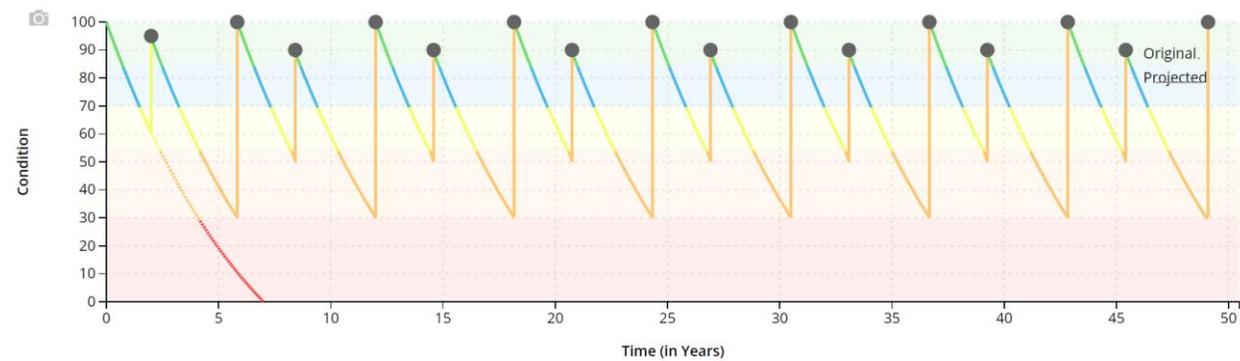
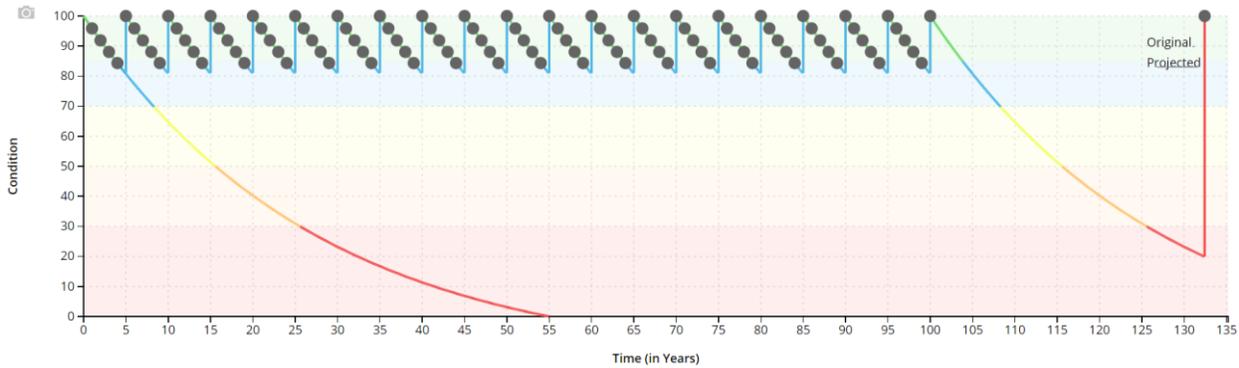


Table summarizes the Town’s current lifecycle strategy for its gravel roads and includes the state of the asset that may trigger the event (i.e., condition or age). Major rehabilitation and replacements are guided by both ride condition ratings and sub-surface asset requirements.

Table 11 Current Lifecycle Management Strategies – Gravel Roads

Event Name	Event Class	Event Range / Trigger
General Maintenance	Maintenance	As needed
Dust Control/Suppressant	Maintenance	Annually (localized)
Grading with Stone	Rehabilitation	Annually (localized)
Asset Reconstruction and/or Asset Surface Upgrade	Replacement	Condition: 0



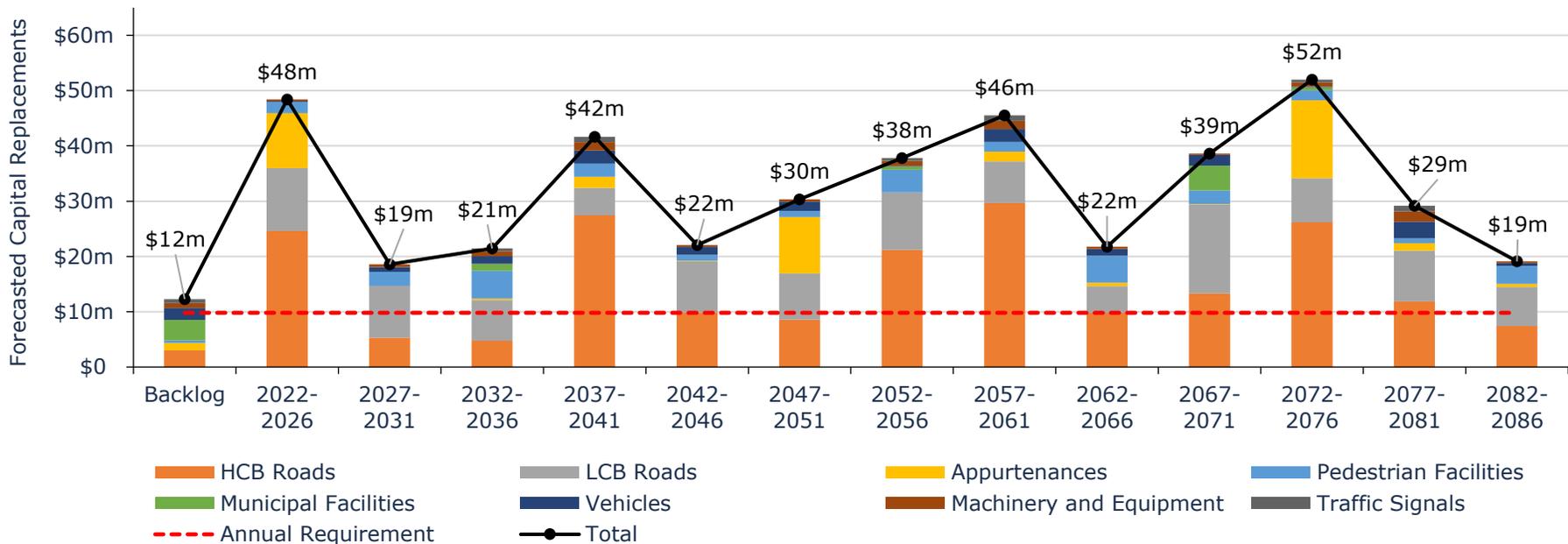
The above noted strategies illustrate the importance of maintenance and rehabilitation, extending the serviceable life of both HCB and LCB surfaces. Although staff indicated that each activity is typically completed only once before the next, more invasive treatment is applied, the strategy may benefit from integration of planned or forecasted replacements of stormwater, wastewater, and/or water mains. This may require multiple applications of a maintenance or rehabilitation treatment to bundle and synchronize the road section’s eventual replacement with sub-surface asset requirements.

Forecasted Long-term Replacement Needs

Figure 6 illustrates the cyclical short-, medium- and long-term infrastructure rehabilitation and replacement requirements for the Town’s roads and roadside. This analysis was run until 2086 to capture at least one iteration of replacement for the longest-lived asset in the asset register. The Town’s average annual requirements (red dotted line) total \$9.8 million for all assets in the road corridor. Although actual spending may fluctuate substantially from year to year, this figure is a useful benchmark value for annual capital expenditure targets (or allocations to reserves) to ensure projects are not deferred and replacement needs are met as they arise. The chart illustrates substantial capital needs through the forecast period, remaining above \$15 million for all 5-year intervals.

It also shows a backlog \$12 million, comprising assets that have reached the end of their useful life. The projections are designed to provide a long-term, portfolio-level overview of capital needs and should be used to support improved financial planning over several decades. They are based on asset replacement costs, age analysis, condition data when available, as well as lifecycle modeling (roads only). The lifecycle modeling included preventative maintenance, general maintenance, and rehabilitative activities.

Figure 6 Forecasted Capital Replacement Requirements – Roads and Roadside 2022-2101



Often, the magnitude of capital needs is substantially higher than most municipalities can afford to fund. It is also unlikely that all assets will need to be rehabilitated or fully reconstructed as forecasted above. However, quantifying and monitoring these spikes is essential for long-term financial planning, including establishing dedicated reserves. Regular pavement condition assessments and a robust risk framework will ensure that high-criticality assets receive proper and timely lifecycle intervention, including replacements.

System-generated 10-Year Replacement Forecast

The table below summarizes the projected cost of capital lifecycle activities (rehabilitation and replacements) that may be undertaken over the next 10 years to support current levels of service. These projections are generated in Citywide and rely on the data available in the asset register. They can be different from actual capital forecasts. Consistent data updates, particularly condition, replacement costs, and regular upkeep of lifecycle models, will improve the alignment between the system generated expenditure requirements, and the Town’s capital expenditure forecasts.

Table 12 System-generated 10-Year Capital Replacement Forecast – Roads and Roadside

Segment	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
HCB Roads	\$9.1m	\$4.6m	\$5.3m	\$2.0m	\$3.7m	\$1.6m	\$772k	\$354k	\$1.0m	\$1.6m
LCB Roads	\$4.1m	\$3.4m	\$1.2m	\$1.7m	\$950k	\$1.8m	\$375k	\$3.1m	\$3.4m	\$655k
Appurtenances	\$0	\$0	\$9.9m	\$0	\$0	\$500	\$0	\$8k	\$32k	\$8k
Pedestrian Facilities	\$202k	\$363k	\$969k	\$321k	\$157k	\$799k	\$290k	\$452k	\$318k	\$640k
Municipal Facilities	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Vehicles	\$0	\$43k	\$0	\$0	\$109k	\$375k	\$0	\$47k	\$320k	\$104k
Machinery and Equipment	\$114k	\$60k	\$31k	\$46k	\$79k	\$86k	\$30k	\$223k	\$83k	\$78k
Traffic Signals	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Total	\$13.5m	\$8.4m	\$17.4m	\$4.1m	\$5.0m	\$4.6m	\$1.5m	\$4.2m	\$5.2m	\$3.0m

Risk Analysis

The risk matrix below is generated using available asset data, including condition, service life remaining, replacement costs, traffic data (volume and speed limit), land use, and road class. The risk ratings for assets without useful attribute data were calculated using only condition, service life remaining, and their replacement costs.

These risk models have been built into the Town’s Asset Management Database (CityWide Asset Manager). See *Risk and Criticality* section for further details on approach used to determine asset risk ratings and classifications.

Figure 7 Risk Matrix – Roads and Roadside

Consequence	5 Severe	0 Assets \$0	1 Asset \$1,209,177	0 Assets \$0	0 Assets \$0	1 Asset \$1,449,960
	4 Major	9 Assets \$5,281,263	3 Assets \$1,295,991	8 Assets \$6,338,075	7 Assets \$8,651,888	3 Assets \$1,241,786
	3 Moderate	31 Assets \$13,151,727	19 Assets \$8,816,279	46 Assets \$21,999,840	45 Assets \$24,859,835	17 Assets \$6,211,723
	2 Minor	131 Assets \$8,869,528	93 Assets \$6,343,148	66 Assets \$10,861,721	71 Assets \$9,241,051	52 Assets \$4,920,720
	1 Insignificant	791 Assets \$11,805,579	175 Assets \$7,484,665	154 Assets \$15,333,931	1,477 Assets \$26,291,535	2,621 Assets \$3,685,442
		1 Rare	2 Unlikely	3 Possible	4 Likely	5 Almost Certain
		Probability				

In addition to asset level risk, the Town may also face risk associated with not executing key lifecycle activities, including repairs, rehabilitation, and replacement of critical assets. These include:

- missed opportunities for cost savings and increases in lifecycle costs;
- misallocation of funds leading to over- or under-investments;
- deferral of vital projects, or further lending and borrowing;
- accelerated asset deterioration and premature failure, which may lead to public health and safety hazards, and disruption of services to the Town’s residential and commercial base;
- a decline in public satisfaction with the Town’s service standards and the resulting reputational damage;

Figure 15 provides an overview of the different data points and allocations utilized to determine the risk rating for each road and roadside asset.

Figure 15 Risk Rating Criteria – Roads and Roadside

Probability of Failure (POF)		Consequence of Failure (COF)	
HCB and LCB Roads			
POF Criteria	Asset Data Point	COF Criteria	Asset Data Point
Performance (85%)	Asset Condition	Direct Financial (70%)	Asset Replacement Cost
Operational (15%)	Service Life Remaining	Operational (15%)	Road Class
		Strategic (10%)	AADT
		Health and Safety (5%)	Speed Limit (km/h)
Unpaved Roads			
POF Criteria	Asset Data Point	COF Criteria	Asset Data Point
Performance (85%)	Asset Condition	Direct Financial (70%)	Asset Replacement Cost
Operational (15%)	Service Life Remaining	Operational (15%)	Road Class
		Strategic (10%)	AADT
		Health and Safety (5%)	Speed Limit (km/h)
All Other Assets			
POF Criteria	Asset Data Point	COF Criteria	Asset Data Point
Performance (85%)	Asset Condition	Direct Financial (80%)	Asset Replacement Cost
Operational (15%)	Service Life Remaining	Strategic (20%)	Asset Type

Levels of Service

The tables that follow summarize the Town’s current levels of service with respect to prescribed KPIs under Ontario Regulation 588/17.

Table 13 Ontario Regulation 588/17 Community Levels of Service – Roads and Roadside

Service Attribute	Qualitative Description	Current Level of Service (2021)												
Scope	Description, which may include maps, of the road network in the Municipality and its level of connectivity	<p>The Town’s road network spans a total of 324 km primarily within a rural setting, with areas of urban and semi-urban development. The road network consists of approximately 124 km of high class bituminous (HCB) roads, 152 km of low class bituminous (LCB) roads and 48 km of unpaved roads.</p> <p>The road network also contains other roadside appurtenances such as sidewalks, streetlights, traffic signals and pedestrian crossings.</p>												
Quality	Description or images that illustrate the different levels of road class pavement condition.	<p>Every road section receives a pavement condition index (PCI) rating (0-100).</p> <p>The rating incorporates pavement roughness measurements and surface distresses (type, quantity, severity).</p> <p>Ratings are categorized into 5 general qualitative descriptors as detailed below:</p> <table border="1" data-bbox="846 1087 1437 1417"> <thead> <tr> <th data-bbox="846 1087 1128 1140">PCI Label</th> <th data-bbox="1128 1087 1437 1140">PCI Range</th> </tr> </thead> <tbody> <tr> <td data-bbox="846 1140 1128 1192">Excellent</td> <td data-bbox="1128 1140 1437 1192">85-100</td> </tr> <tr> <td data-bbox="846 1192 1128 1245">Good</td> <td data-bbox="1128 1192 1437 1245">70-85</td> </tr> <tr> <td data-bbox="846 1245 1128 1297">Fair</td> <td data-bbox="1128 1245 1437 1297">55-70</td> </tr> <tr> <td data-bbox="846 1297 1128 1350">Poor</td> <td data-bbox="1128 1297 1437 1350">30-55</td> </tr> <tr> <td data-bbox="846 1350 1128 1417">Very Poor</td> <td data-bbox="1128 1350 1437 1417">0-30</td> </tr> </tbody> </table>	PCI Label	PCI Range	Excellent	85-100	Good	70-85	Fair	55-70	Poor	30-55	Very Poor	0-30
PCI Label	PCI Range													
Excellent	85-100													
Good	70-85													
Fair	55-70													
Poor	30-55													
Very Poor	0-30													

Table 5 Ontario Regulation 588/17 Technical Levels of Service – Roads and Roadside

Service Attribute	Qualitative Description	Current Level of Service (2021)
Scope	Lane-km of arterial roads per land area (km/km ²)	0.11 (km/km ²)
	Lane-km of collector roads per land area (km/km ²)	1.17 (km/km ²)
	Lane-km of local roads per land area (km/km ²)	0.58 (km/km ²)
Quality	Average pavement condition for paved roads in the Municipality	55% - Fair
Performance	Average surface condition for unpaved roads in the Municipality (e.g., excellent, good, fair, poor)	Very Poor
	Actual capital reinvestment rate	1.7%
	Target capital reinvestment rate	4.8%
	Operating costs for unpaved (loose top) roads per Lane-km	\$7,500 / year

Bridges and Culverts

The Town’s transportation network also includes bridges and culverts, with a current replacement cost of \$73.6 million. Based on the requirements outlined by the Ministry of Transportation, the most recent Ontario Structure Inspection (OSIM) was conducted in 2022 by Keystone Bridge Management Corp.

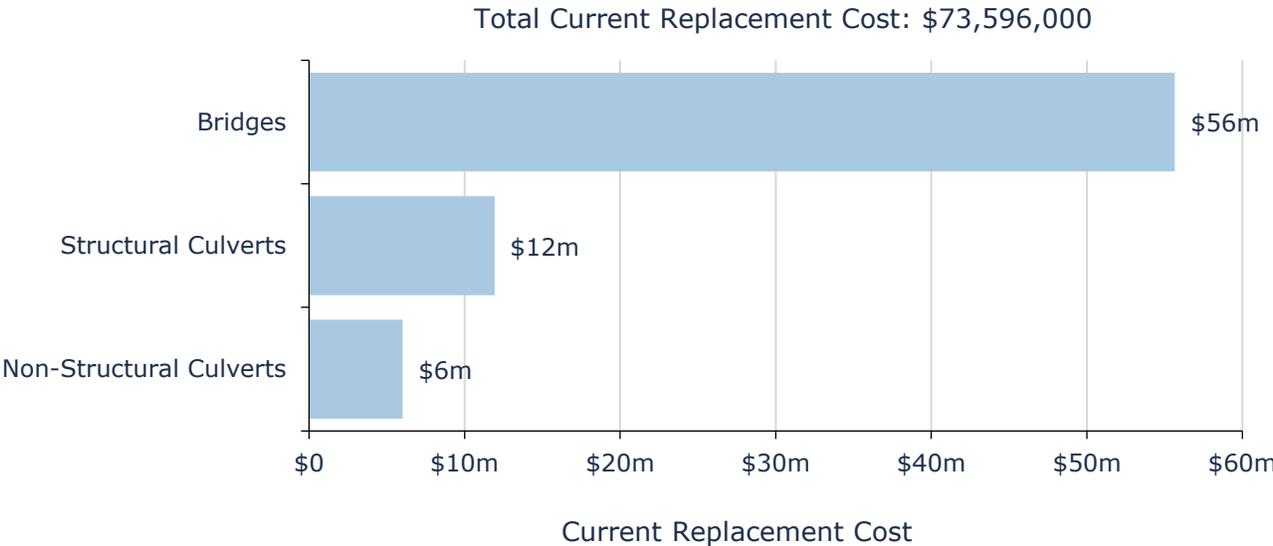
Inventory and Valuation

Table 6 summarizes the quantity and current replacement cost of bridges and culverts assets as managed in the Town’s asset register.

Table 6 Detailed Asset Inventory – Bridges and Culverts

Segment	Quantity	Unit of Measure	Replacement Cost
Bridges	58	Assets	\$55,652,000
Structural Culverts	19	Assets	\$11,923,000
Non-Structural Culverts	20	Assets	\$6,021,000
Total			\$73,596,000

Figure 8 Category Valuation – Bridges and Culverts



Asset Condition

Figure 9 summarizes the replacement cost-weighted condition of the Town’s bridges and culverts. Based on the Town’s 2022 OSIM assessments, 100% of all bridges and culverts are in fair or better condition. Some elements or components of these structures may be candidates for replacement or rehabilitation in the medium term and should be monitored for further degradation in condition.

Figure 9 Asset Condition – Bridges and Culverts: Overall

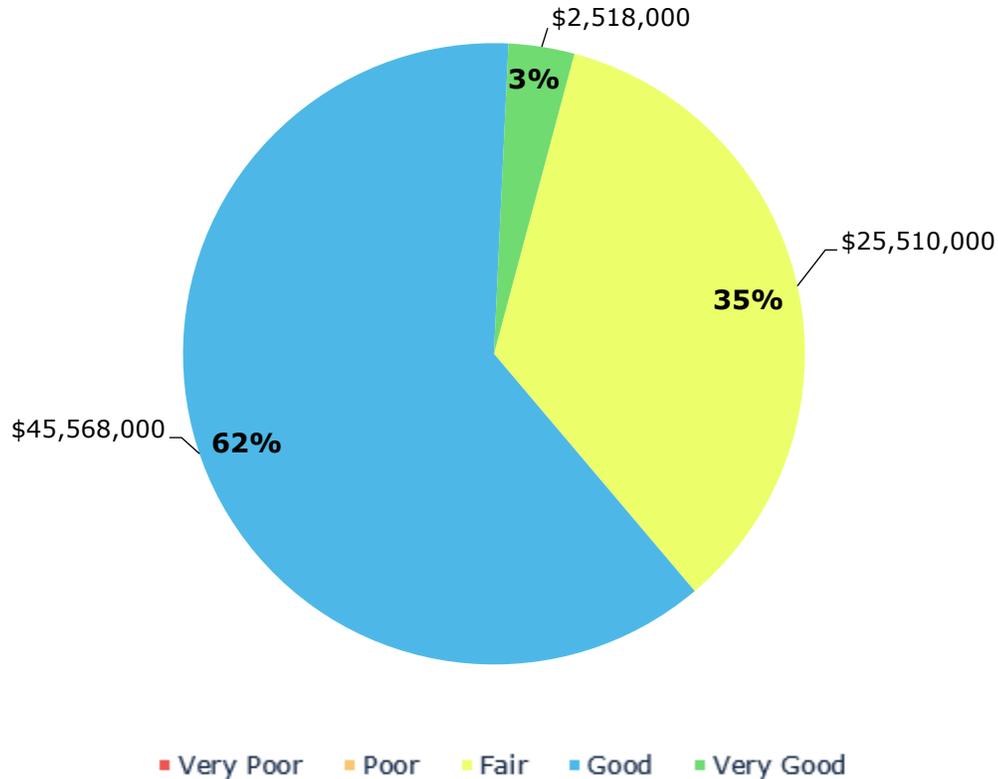


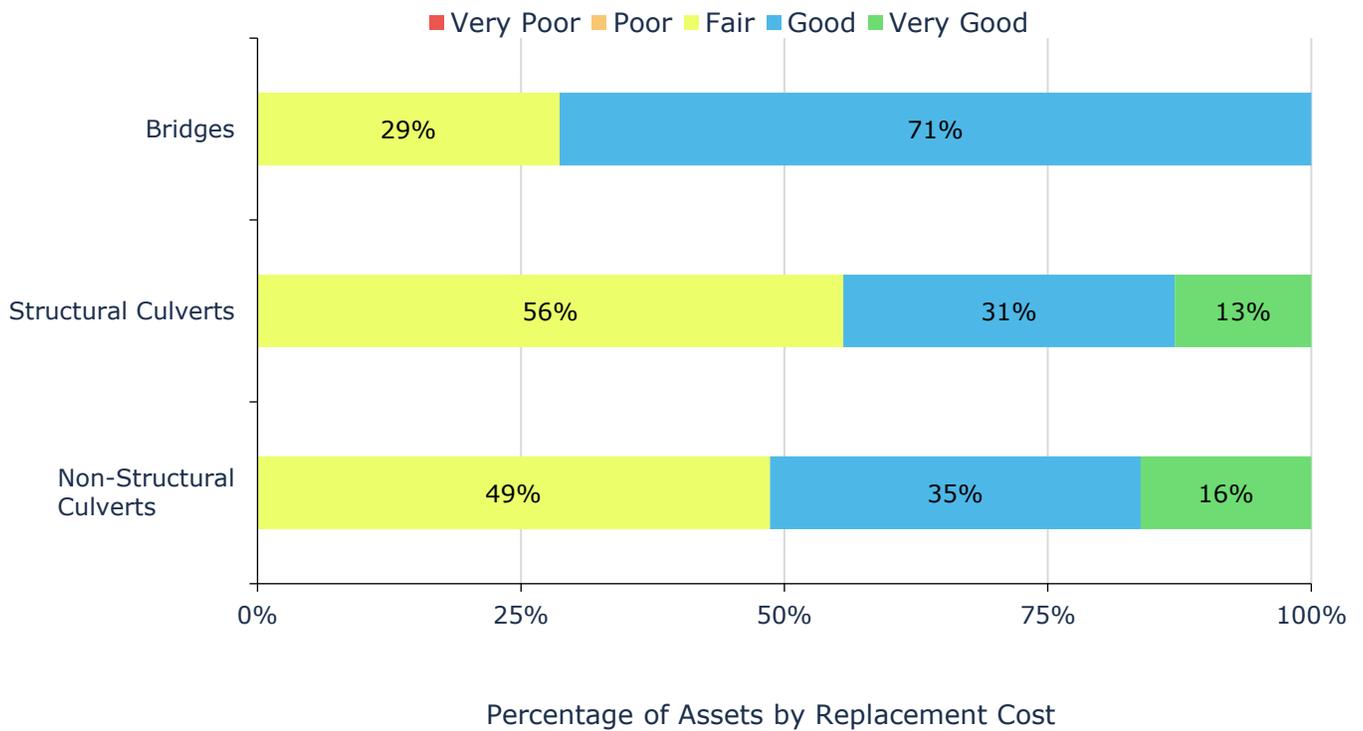
Table 16 summarizes the current average condition, the average service life remaining and the estimated useful life for each asset segment. The average condition is a weighted value based on the current replacement cost.

Table 16 Asset Condition by Segment – Bridges and Culverts

Segment	Estimated Useful Life (Years)	Service Life Remaining (Years)	Average Condition
Bridges	50 - 80	25.0	71% (Good)
Structural Culverts	50	32.1	75% (Good)
Non-Structural Culverts	50 - 70	32.7	75% (Fair)
Overall		28.0	72% (Good)

As further detailed in Figure 10, based on in-field condition assessments, none of the bridges and culverts that were assessed are in poor or worse condition. Bridges and structures with a poor or worse rating (i.e., a bridge condition index of less than 60) are not necessarily unsafe for regular use. The OSIM ratings are designed to identify repairs needed to elevate condition ratings to a fair or higher.

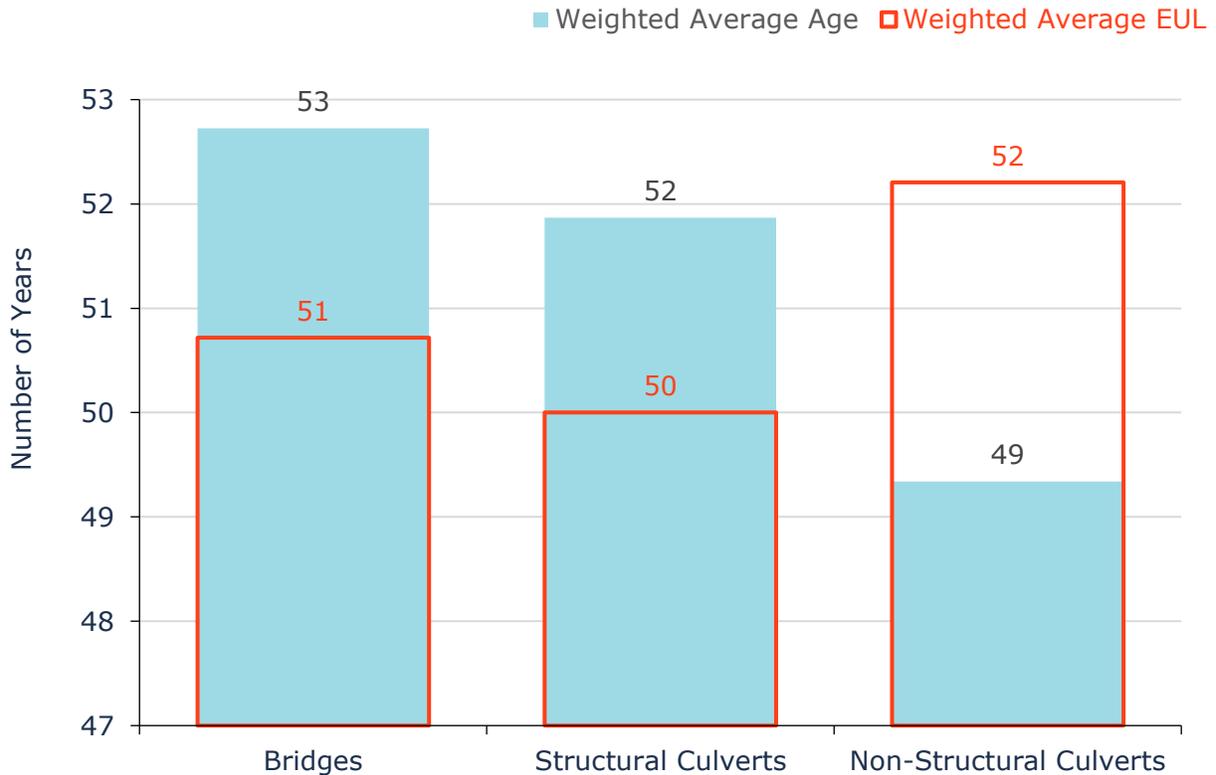
Figure 10 Asset Condition – Bridges and Culverts: By Segment



Age Profile

Figure 11 illustrates the average current age of each asset type and its estimated useful life. Both values are weighted by the replacement cost of individual assets.

Figure 11 Estimated Useful Life vs. Asset Age – Bridges and Culverts



Age analysis reveals that on average, bridges and culverts continue to remain in operation beyond their expected useful life due to the rehabilitative activities that are prescribed in the 2022 OSIM report. On average, bridges have a weighted average age of 53 years against a weighted average estimated useful life of 51 years. Similarly, culverts have an average age of 52 years against an average weight EUL of 50 years.

OSIM assessments should continue to be used in conjunction with age and asset criticality to prioritize capital and maintenance expenditures, and to identify potential candidates for further review and analysis.

Current Approach to Lifecycle Management

The condition of bridges and culverts is assessed biennially in compliance with OSIM inspections. The most recent inspection report was completed in 2022. The bridge condition index (BCI) is used to guide and prioritize capital investment, unless health and safety concerns warrant a different, more immediate intervention.

Staff also undergo regular maintenance of bridges and culverts that includes obstruction removal, cleaning and sweeping, erosion control, brush and tree removal.

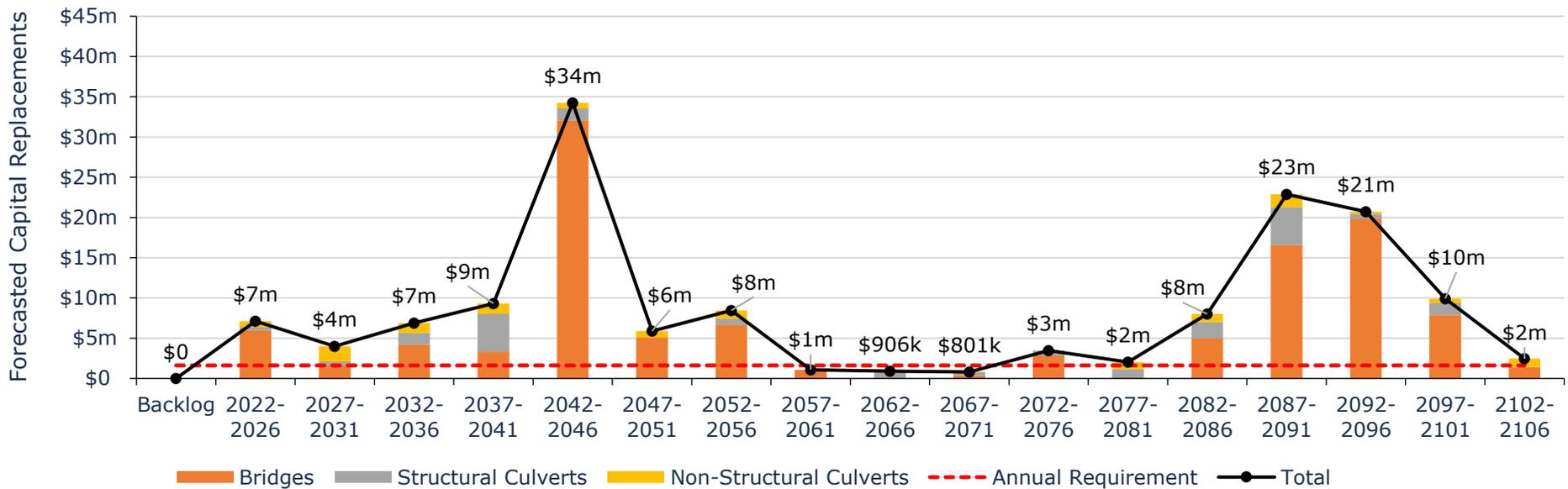
The OSIM inspections also include a maintenance and capital needs list that identifies assets requiring specific maintenance, rehabilitation and replacement activities with estimated costs and schedule.

Forecasted Long-term Replacement Needs

Figure 12 illustrates the cyclical short-, medium- and long-term infrastructure rehabilitation and replacement requirements for the Town’s bridges and culverts. These projections are based on asset replacement costs, age analysis, and condition data. They are designed to provide a long-term, portfolio-level overview of capital needs and should be used to support improved financial planning over several decades.

The analysis was run until 2106 to capture at least one iteration of replacement for the longest-lived asset in the asset register. The Town’s average annual requirements (red dotted line) for bridges and culverts total \$1.6 million. Although actual spending may fluctuate substantially from year to year, this figure is a useful benchmark value for annual capital expenditure targets (or allocations to reserves) to ensure projects are not deferred and replacement needs are met as they arise.

Figure 12 Forecasted Capital Replacement Requirements – Bridges and Culverts 2022-2106



There are major replacement spikes on the horizon for the next 15 years as assets reach the end of their useful life. It is highly unlikely that all assets will require full reconstruction or replacement. With proactive lifecycle management, the life of most assets can be extended by many years in a cost-effective manner. However, quantifying and monitoring these spikes is essential for long-term financial planning, including establishing dedicated reserves. OSIM condition assessments and a robust risk framework will ensure that high-criticality assets receive proper and timely lifecycle intervention, including replacements.

System-generated 10-Year Replacement Forecast

The table below summarizes the projected cost of capital lifecycle activities that will need to be undertaken over the next 10 years to support current levels of service as per the 2022 OSIM report.

Table 7 System-generated 10-Year Capital Replacement Forecast – Bridges and Culverts

Segment	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Bridges	\$0	\$3.1m	\$771k	\$411k	\$1.7m	\$1.6m	\$0	\$0	\$0	\$0
Structural Culverts	\$0	\$168k	\$0	\$126k	\$108k	\$0	\$132k	\$0	\$0	\$395k
Non-Structural Culverts	\$0	\$0	\$210k	\$262k	\$275k	\$345k	\$256k	\$0	\$1.3m	\$0
Total	\$0	\$3.3m	\$981k	\$799k	\$2.1m	\$1.9m	\$388k	\$0	\$1.3m	\$395k

These projections are generated in Citywide and rely on the data available in the asset register. Assessed condition data and replacement costs were used to assist in forecasting replacement needs for bridges and structural culverts. These projections may be different from actual capital forecasts as outlined in OSIM inspections and recommended workplans. Consistent data updates, especially condition, will improve the alignment between the system generated expenditure requirements, and the Town’s capital expenditure forecasts, including long-term capital plans.

Risk Analysis

The risk matrix below is generated using available asset data, including condition, service life remaining, replacement costs, traffic data (volume and speed limit), and the length of each structure.

These risk models have been built into the Town’s Asset Management Database (CityWide Asset Manager). See *Risk and Criticality* section for further details on approach used to determine asset risk ratings and classifications.

Figure 13 Risk Matrix – Bridges & Culverts

Consequence	5 Severe	0 Assets \$0	0 Assets \$0	1 Asset \$1,977,000	0 Assets \$0	0 Assets \$0
	4 Major	0 Assets \$0	4 Assets \$11,430,000	1 Asset \$2,281,000	0 Assets \$0	0 Assets \$0
	3 Moderate	1 Asset \$718,000	5 Assets \$5,081,000	5 Assets \$8,563,000	0 Assets \$0	0 Assets \$0
	2 Minor	8 Assets \$3,729,000	28 Assets \$16,625,000	27 Assets \$11,439,000	0 Assets \$0	0 Assets \$0
	1 Insignificant	1 Asset \$305,000	15 Assets \$10,953,000	1 Asset \$495,000	0 Assets \$0	0 Assets \$0
		1 Rare	2 Unlikely	3 Possible	4 Likely	5 Almost Certain
		Probability				

In addition to asset level risk, the Town may also face risk associated with not executing key lifecycle activities, including repairs, rehabilitation, and replacement of critical assets. These include:

- missed opportunities for cost savings and increases in lifecycle costs;
- deferral of vital projects, or further lending and borrowing;
- accelerated asset deterioration and premature failure, which may lead to public health and safety hazards, and disruption of services to the Town’s residential and commercial base;
- a decline in public satisfaction with the Town’s service standards and the resulting reputational damage;
- bridges are inherently vital to the Town’s transportation infrastructure, and their failures can disconnect communities, lead to public health and safety incidents, and can impede the efficient flow of residential and commercial traffic.

Figure 22 provides an overview of the different data points and allocations utilized to determine the risk rating for each bridge and culvert asset.

Figure 22 Risk Rating Criteria – Bridges and Culverts

Probability of Failure (POF)		Consequence of Failure (COF)	
Bridges			
POF Criteria	Asset Data Point	COF Criteria	Asset Data Point
Performance (85%)	Asset Condition	Direct Financial (85%)	Asset Replacement Cost
Operational (15%)	Service Life Remaining	Strategic (15%)	Speed Limit (km/h) (30%) Total Deck Length (m) (70%)
Structural Culverts			
POF Criteria	Asset Data Point	COF Criteria	Asset Data Point
Performance (85%)	Asset Condition	Direct Financial (70%)	Asset Replacement Cost
Operational (15%)	Service Life Remaining	Strategic (15%)	Speed Limit (km/h) (30%) Total Deck Length (m) (70%)
Non-Structural Culverts			
POF Criteria	Asset Data Point	COF Criteria	Asset Data Point
Performance (85%)	Asset Condition	Direct Financial (70%)	Asset Replacement Cost
Operational (15%)	Service Life Remaining	Strategic (15%)	Speed Limit (km/h) (30%) Total Deck Length (m) (70%)

An asset’s criticality rating, determined by the nature and magnitude of the consequences of its potential failure should be used to prioritize projects, particularly lifecycle management strategies. Using risk in conjunction with levels of service, and the recommended workplans in OSIM inspections, can assist in optimizing limited funds.

Levels of Service

The tables that follow summarize the Town’s current levels of service with respect to prescribed KPIs under Ontario Regulation 588/17.

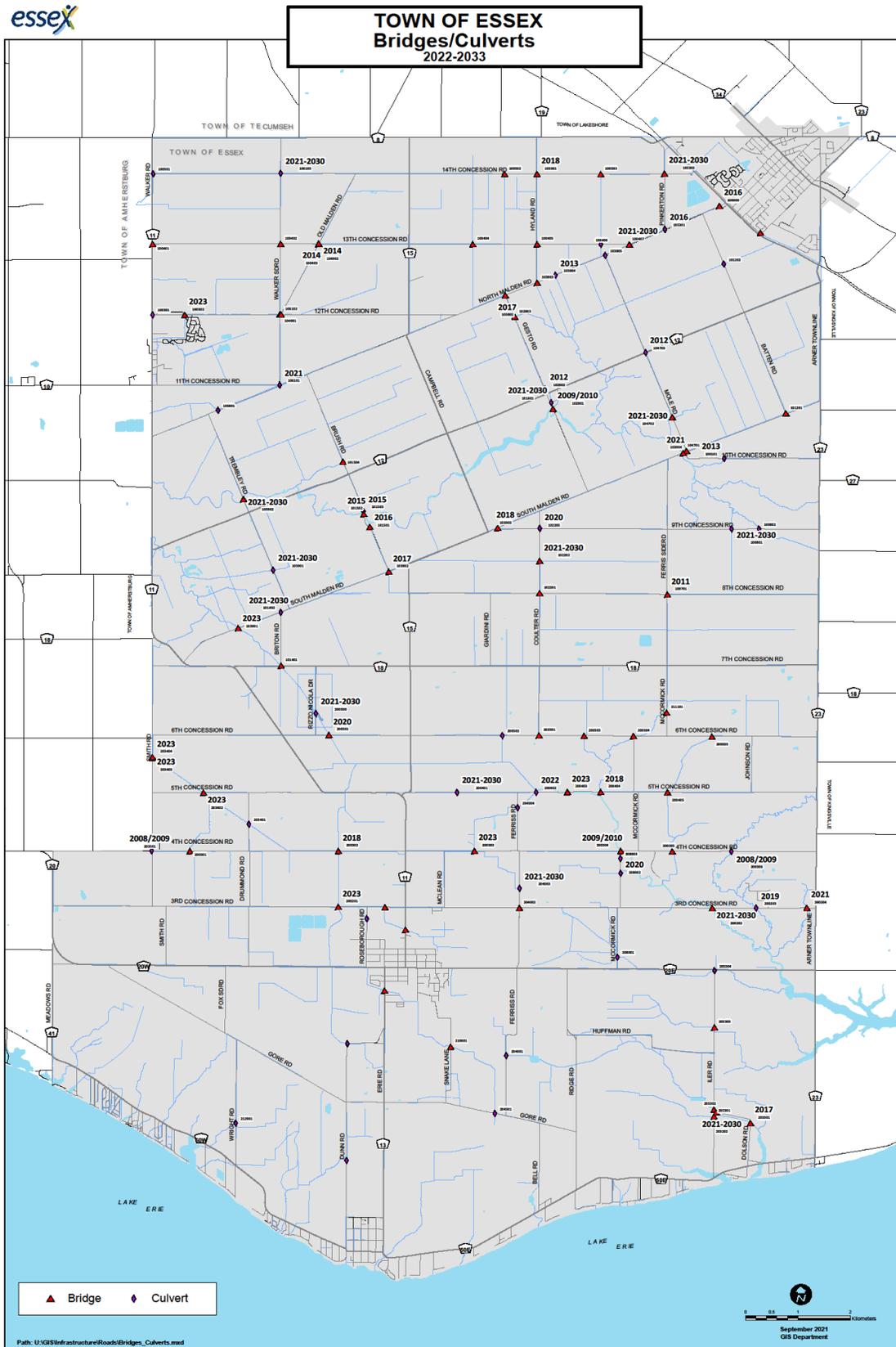
Table 8 Ontario Regulation 588/17 Community Levels of Service – Bridges and Culverts

Service Attribute	Qualitative Description	Current Level of Service (2021)
Scope	Description of the traffic that is supported by municipal bridges (e.g., heavy transport vehicles, motor vehicles, emergency vehicles, pedestrians, cyclists).	Bridges and Culverts are a critical component of the Town’s transportation network. None of the Town’s structures have loading or dimensional restrictions meaning that most types of vehicles, including heavy transport, motor vehicles, emergency vehicles, pedestrians, and cyclists can cross them without restriction. See Figure 23 for all bridge and culvert structures throughout the Town
Quality	1. Description or images of the condition of bridges and how this would affect use of the bridges.	Good (BCI 70-100): Generally considered to be in good-excellent condition, and repair or rehabilitation work is not usually required within the next 5 years. Routine maintenance, such as sweeping, cleaning, and washing are still recommended. Fair (BCI 50-70): Generally considered to be in good-fair condition. Repair or rehabilitation work recommended is ideally scheduled to be completed within the next 5 years.
	2. Description or images of the condition of culverts and how this would affect use of the culverts.	Poor (BCI Less than 50): Generally considered poor with lower numbers representing structures nearing the end of their service life. The repair or rehabilitation of these structures is ideally best scheduled to be completed within approximately 1 year. However, if it is determined that the replacement of the structure would be a more viable, the structure can be identified for continued monitoring and scheduled for replacement within the short-term.

Table 9 Ontario Regulation 588/17 Technical Levels of Service – Bridges and Culverts

Service Attribute	Qualitative Description	Current Level of Service (2021)
Scope	Percentage of bridges in the Town with loading restrictions.	0%
Quality	1. For bridges in the Town, the average bridge condition index value.	71%
	2. For structural culverts in the Town, the average bridge condition index value.	75%
Performance	Actual capital reinvestment rate	0.8%
	Target capital reinvestment rate	2.2%
	Average duration of unplanned bridge closure	TBD

Figure 14 Bridges and Culverts



Stormwater

The Town is responsible for owning and maintaining a stormwater infrastructure of approximately 94 kilometers of stormwater mains, 6 stormwater management ponds, 605 maintenance holes and road drainage assets like catch basins and curb and gutter.

Stormwater infrastructure generally poses the greatest uncertainty for municipalities. The 2019 Canadian Infrastructure Report Card noted that the condition of a large portion of stormwater infrastructure was unknown because historically, collecting data about their condition was a low-priority activity.

Town staff are committed to working towards improving the accuracy and reliability of the stormwater inventory to assist with long-term asset management planning.

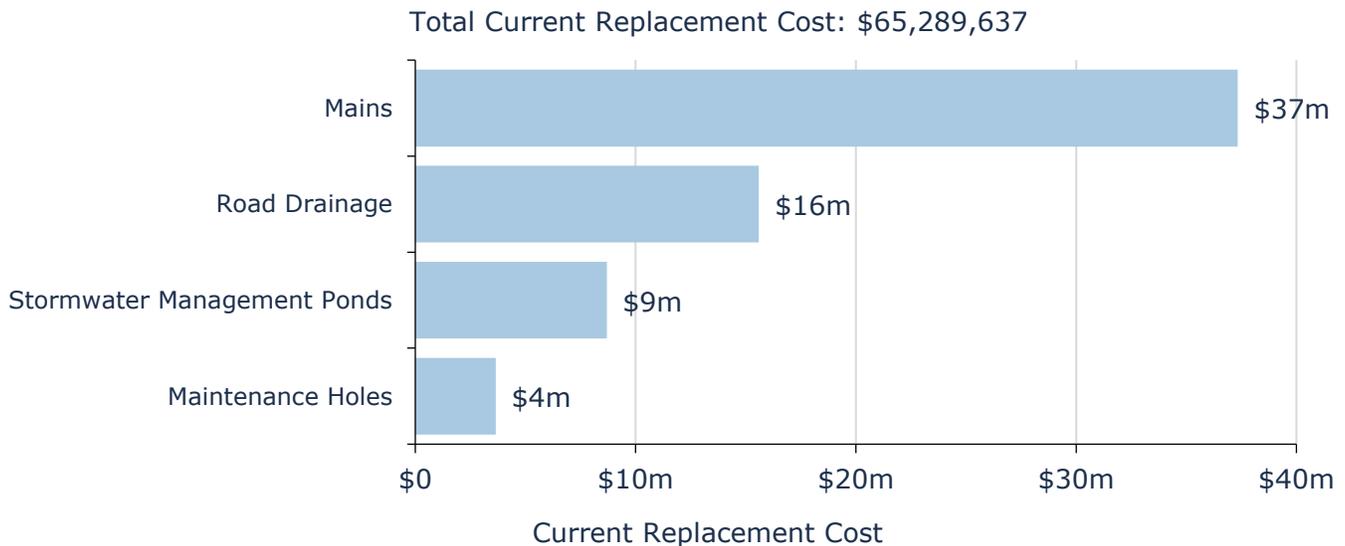
Inventory and Valuation

Table 0 summarizes the quantity and current replacement cost of all stormwater management assets available in the Town’s asset register.

Table 20 Detailed Asset Inventory – Stormwater

Segment	Quantity	Unit of Measure	Replacement Cost
Mains	94	Kilometers	\$37,334,862
Road Drainage	3,015	Assets	\$15,599,205
Stormwater Management Ponds	6	Assets	\$8,697,570
Maintenance Holes	605	Assets	\$3,658,000
Total			\$65,289,637

Figure 15 Category Valuation – Stormwater



Asset Condition

Figure summarizes the replacement cost-weighted condition of the Town's stormwater assets. Based on age data only, approximately 70% of are in fair or better condition, with the remaining in poor to very poor condition.

Figure 25 Asset Condition – Stormwater

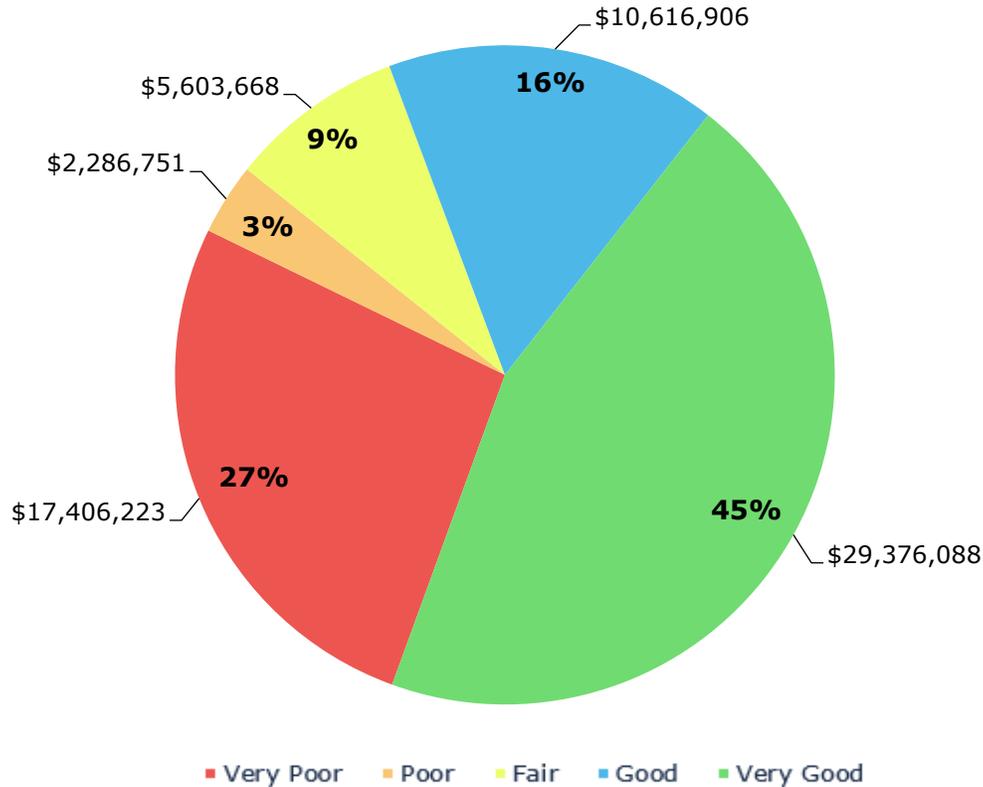


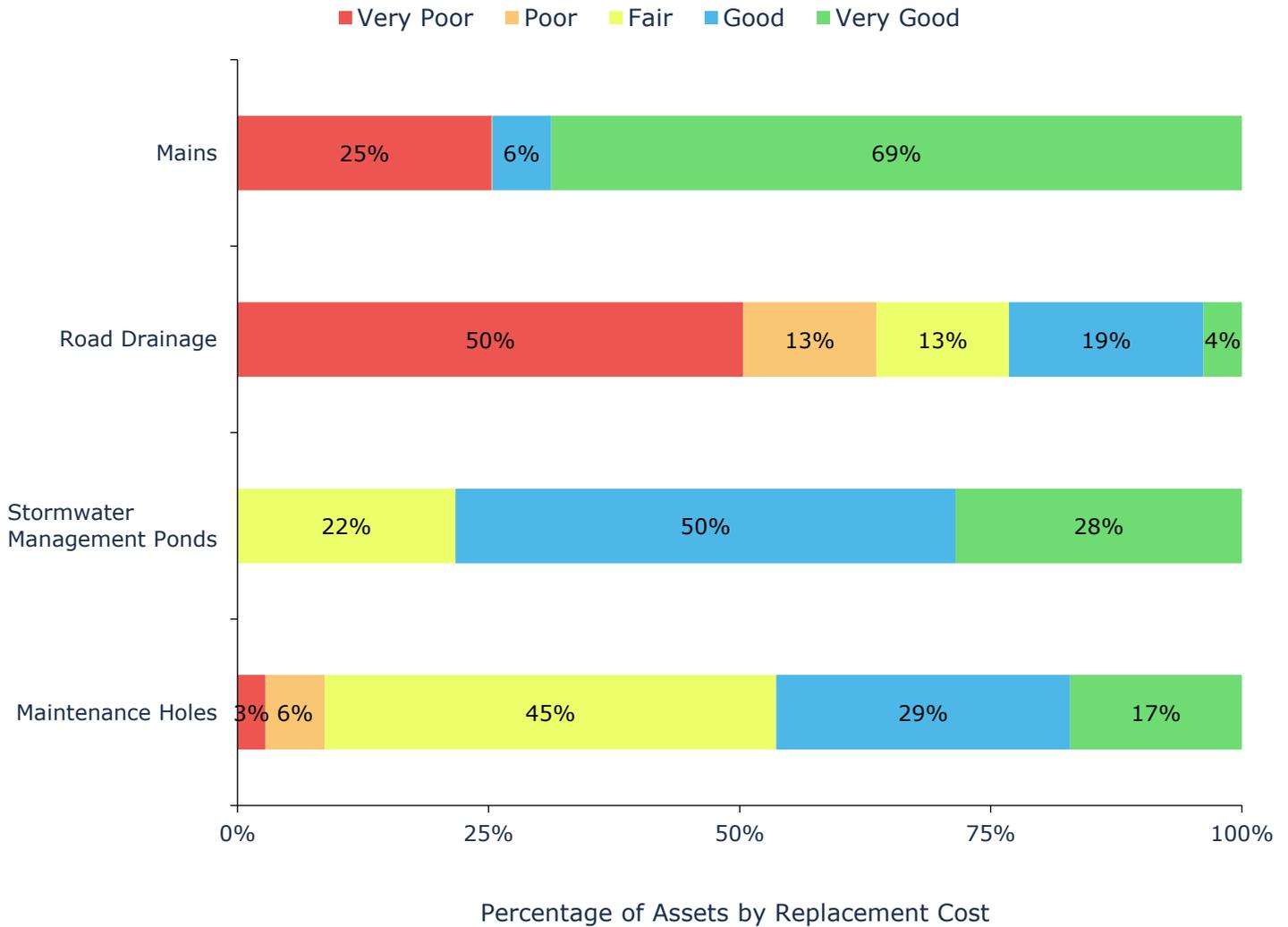
Table 21 summarizes the current average condition, the average service life remaining and the estimated useful life for each asset segment. The average condition is a weighted value based on the current replacement cost.

Table 21 Asset Condition by Segment – Stormwater

Segment	Estimated Useful Life (Years)	Service Life Remaining (Years)	Average Condition
Mains	40, 80	38.9	66% (Good)
Maintenance Holes	80	51.0	60% (Good)
Road Drainage	30 - 80	1.3	30% (Poor)
Stormwater Management Ponds	50, 100	49.7	72% (Good)
Overall		15.5	58% (Fair)

As further detailed in Figure 26, based on age-based condition, the majority of stormwater assets are in fair or better condition. Staff have indicated that 25% of known storm mains are made up of clay tile and were installed in the 1950s. These pipes have a higher susceptibility to root intrusion and leaks as they deteriorate.

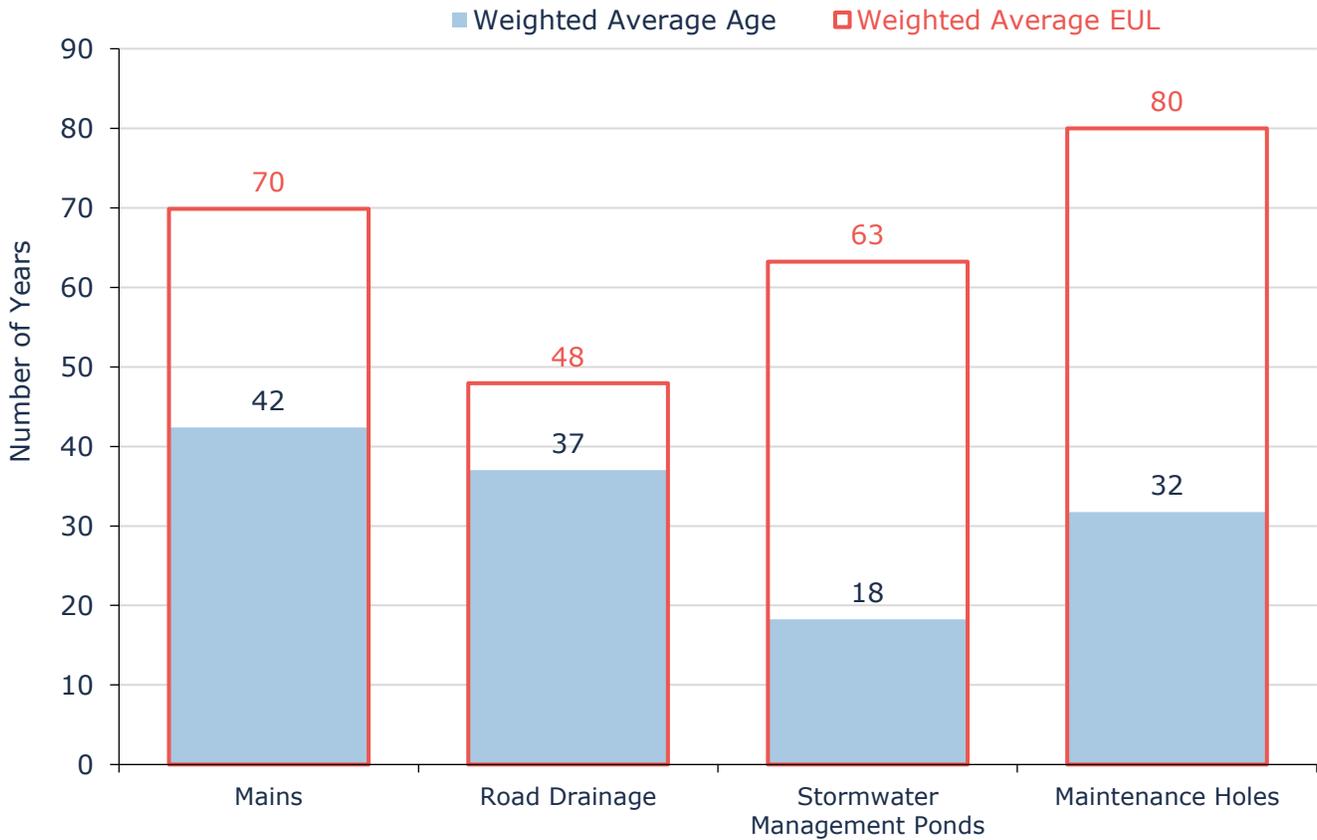
Figure 26 Asset Condition – Stormwater: By Segment



Age Profile

Figure 27 illustrates the average current age of each asset type and its estimated useful life. Both values are weighted by the replacement cost of individual assets.

Figure 167 Estimated Useful Life vs. Asset Age – Stormwater



Age profiles and inspections will help to identify stormwater assets in need of replacements and/or upgrades. A review of EULs for mains may also be considered based on performance history to date and staff's professional judgement.

Current Approach to Lifecycle Management

This section outlines the Town’s current approach to managing its stormwater assets. Key data was collected through staff discussions. As applicable, lifecycle models were also built in Citywide. These can be used by staff for ongoing reference and planning within the Town’s asset management program. These models should be continuously refined and updated with new data as it becomes available.

Mains

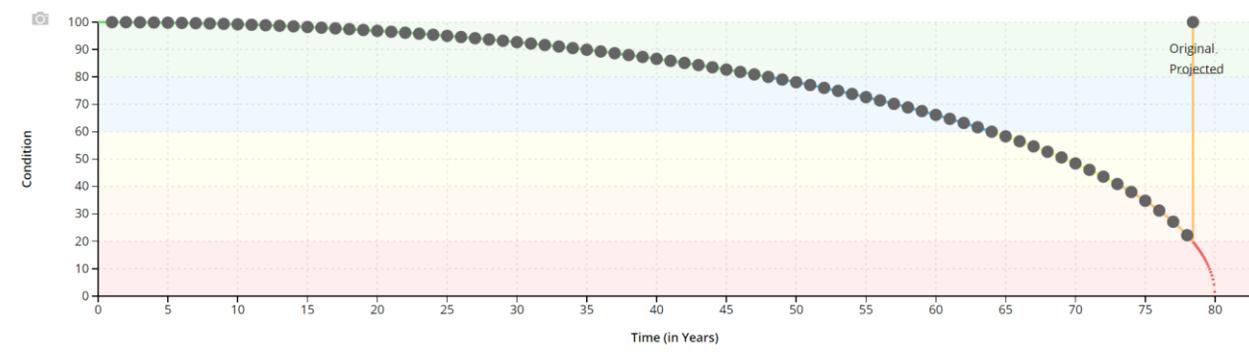
Stormwater mains are assessed on a 5-year cycle, and Closed-Circuit Television Camera (CCTV) inspections do occur but are reactive in nature and conducted through complaints by residents or as identified by staff. Staff have also identified specific areas that require additional inspections and monitoring.

Rehabilitation activities such as trenchless re-lining and spot repairs are dependent on the size and scale of the system. As such, most mains are replaced at the end of their life. Main replacement is generally aligned with road reconstruction priorities, but also factors in the main location, age, pipe diameter and material.

Table 22 summarizes the Town’s current lifecycle strategy for its stormwater mains and includes the state of the asset that may trigger the event (i.e., condition or age). Capital replacements are guided by a multitude of factors, including but not limited to the coordination between road reconstruction and other sub-surface asset requirements.

Table 22 Current Lifecycle Management Strategies – Stormwater Mains

Event Name	Event Class	Event Range / Trigger
CCTV Inspections	Preventative Maintenance	As needed
Flushing and Cleaning (33% of network each year)	Preventative Maintenance	Annually
Asset Replacement	Replacement	Condition: 20



Maintenance Holes

Maintenance holes are assessed on a 5-year cycle and undergo routine maintenance.

Road Drainage

Catch basin assets are assessed on a 3-year cycle, while curb and gutter assets are inspected during routine road patrols.

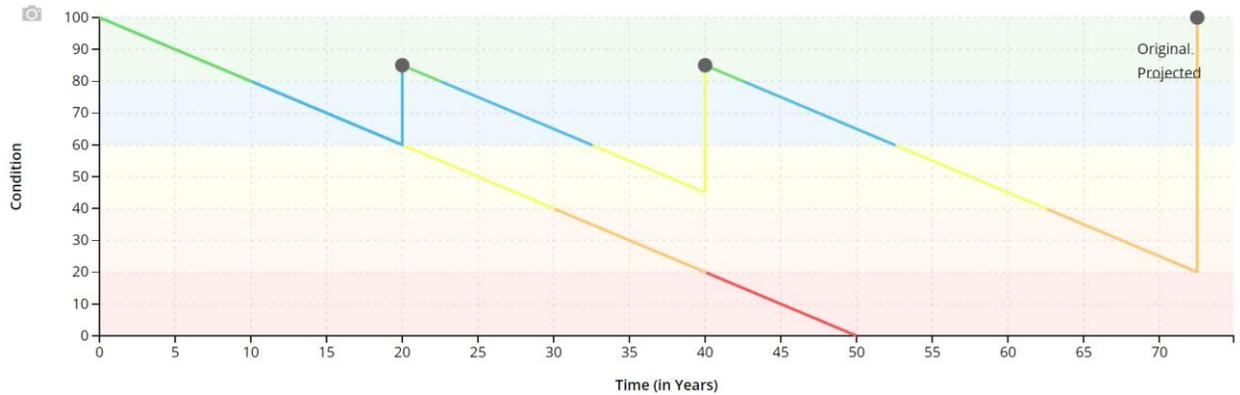
Stormwater Management Ponds

Stormwater management ponds are assessed every 2-years. While all ponds undergo routine maintenance, wet ponds also go through 2 cycles of pond cleanout which includes sediment cleanout, earthworks, and general structure repair.

Table 23 summarizes the Town’s current lifecycle strategy for its wet ponds and includes the state of the asset that may trigger the event (i.e., condition or age).

Table 23 Current Lifecycle Management Strategies – Stormwater Management Ponds (Wet)

Event Name	Event Class	Event Range / Trigger
Pond Cleanout - 1 st Cycle	Maintenance/Rehabilitation	Age: 20 Years
Pond Cleanout - 2 nd Cycle	Maintenance/Rehabilitation	Age: 40 Years
Asset Replacement	Replacement	Condition: 20

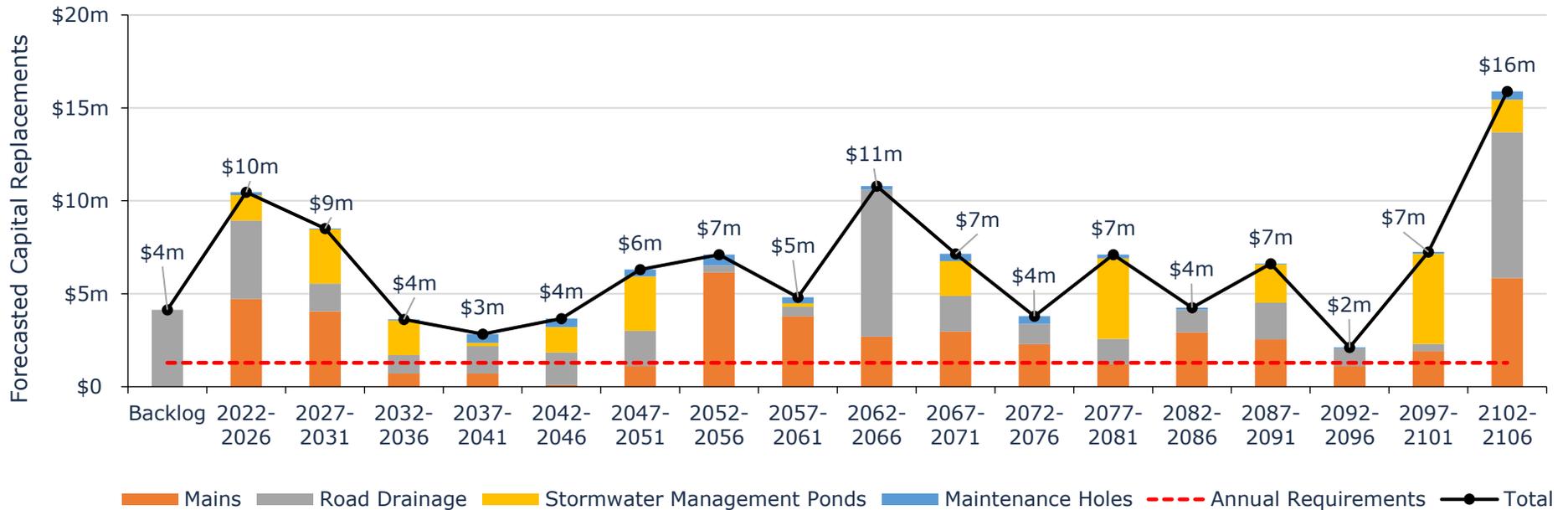


Forecasted Long-term Replacement Needs

Figure 17 illustrates the cyclical short-, medium- and long-term infrastructure replacement requirements for the Town’s stormwater infrastructure. This analysis was run until 2106 to capture at least one iteration of replacement for the longest-lived asset in the asset register. Essex’s average annual requirements (red dotted line) total \$1.3 for all stormwater assets. Although actual spending may fluctuate substantially from year to year, this figure is a useful benchmark value for annual capital expenditure targets (or allocations to reserves) to ensure projects are not deferred and replacement needs are met as they arise.

The largest replacement spike is forecasted in the 2100s as mains reach the end of their useful life. These projections and estimates are based on asset replacement costs and age analysis. They are designed to provide a long-term, portfolio-level overview of capital needs and should be used to support improved financial planning over several decades.

Figure 17 Forecasted Capital Replacement Requirements – Stormwater 2022-2106



Often, the magnitude of replacement needs is substantially higher than most municipalities can afford to fund. In addition, most assets may not need to be replaced as forecasted, while others may be replaced as part of coordinated roadwork. However, quantifying and monitoring these spikes is essential for long-term financial planning, including establishing dedicated reserves, and identifying assets that may be candidates for further inspections. CCTV inspections may also help reduce long-term projections by providing more accurate condition data for mains than age. In addition, a robust risk framework will ensure that high-criticality assets receive proper and timely lifecycle intervention, including replacements.

System-generated 10-Year Replacement Forecast

The table below summarizes the projected cost of lifecycle activities (capital replacement only) that may be undertaken over the next 10 years to support current levels of service. These projections are generated in Citywide and rely on the data available in the asset register. As no assessed condition data was available for the stormwater assets, only age and pipe material were used to determine forthcoming replacement needs. These projections can be different from actual capital forecasts. Consistent data updates, especially condition, will improve the alignment between the system generated expenditure requirements.

Table 24 System-generated 10-Year Replacement Forecast – Stormwater

Segment	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Mains	\$541k	\$1.1m	\$1.1m	\$1.0m	\$984k	\$968k	\$1.8m	\$313k	\$443k	\$498k
Road Drainage	\$3.7m	\$90k	\$219k	\$122k	\$80k	\$287k	\$102k	\$616k	\$360k	\$126k
Stormwater Management Ponds	\$0	\$0	\$1.4m	\$0	\$0	\$2.9m	\$0	\$0	\$0	\$0
Maintenance Holes	\$102k	\$12k	\$36k	\$0	\$0	\$0	\$0	\$48k	\$0	\$0
Total	\$4.4m	\$1.2m	\$2.7m	\$1.2m	\$1.1m	\$4.2m	\$1.9m	\$977k	\$803k	\$624k

Risk Analysis

The risk matrix below is generated using available asset data, including service life remaining, replacement costs, pipe material, and diameter.

These risk models have been built into the Town’s Asset Management Database (Citywide Asset Manager). See *Risk and Criticality* section for further details on approach used to determine asset risk ratings and classifications.

Figure 189 Risk Matrix - Stormwater

Consequence	5 Severe	16 Assets \$4,706,798	2 Assets \$4,330,525	1 Asset \$1,888,250	0 Assets \$0	0 Assets \$0
	4 Major	47 Assets \$5,344,237	8 Assets \$1,017,007	0 Assets \$0	0 Assets \$0	0 Assets \$0
	3 Moderate	178 Assets \$10,206,315	13 Assets \$736,920	0 Assets \$0	0 Assets \$0	44 Assets \$4,930,845
	2 Minor	270 Assets \$7,227,237	20 Assets \$625,207	2 Assets \$58,081	2 Assets \$71,792	88 Assets \$2,922,774
	1 Insignificant	389 Assets \$2,432,571	747 Assets \$3,949,769	657 Assets \$3,614,815	428 Assets \$2,214,959	1,697 Assets \$9,011,535
		1 Rare	2 Unlikely	3 Possible	4 Likely	5 Almost Certain
		Probability				

In addition to asset level risk, the Town may also face risk associated with not executing key lifecycle activities, including repairs, rehabilitation, and replacement of critical assets. These include:

- missed opportunities for cost savings and increases in lifecycle costs associated with more frequent asset maintenance;
- deferral of vital projects, or further lending and borrowing;
- accelerated asset deterioration and premature failure, which may lead to public health and safety hazards, and disruption of services to the Town’s residential and commercial base;
- a decline in public satisfaction with the Town’s service standards and the resulting reputational damage;
- failure of stormwater assets can be particularly detrimental, causing excessive flooding, erosion, backups, road and bridge closures, environmental damage, and substantial property damage. Water quality may also be jeopardized, further exacerbating public health and safety challenges.

- increased frequency of extreme weather events has made some communities even more vulnerable to flooding. These events can also create legal liabilities for the Town in the event of asset failure.

Figure 30 provides an overview of the different data points and allocations utilized to determine the risk rating for each stormwater asset.

Figure 30 Risk Rating Criteria – Stormwater

Probability of Failure (POF)		Consequence of Failure (COF)	
Stormwater Linear Assets			
POF Criteria	Asset Data Point	COF Criteria	Asset Data Point
Performance (80%)	Asset Condition	Direct Financial (85%)	Asset Replacement Cost
Operational (20%)	Service Life Remaining (80%)	Operational (15%)	Pipe Diameter (mm)
	Pipe Material (20%)		
Stormwater Non-Linear Assets			
POF Criteria	Asset Data Point	COF Criteria	Asset Data Point
Performance (80%)	Asset Condition	Direct Financial (80%)	Asset Replacement Cost
Operational (20%)	Service Life Remaining	Strategic (20%)	Asset Type

An asset’s criticality rating, determined by the nature and magnitude of the consequences of its potential failure should be used to prioritize projects, particularly lifecycle management strategies. Using risk in conjunction with levels of service, and findings from standard CCTV inspections will assist in optimizing limited funds.

Levels of Service

The tables that follow summarize the Town’s current levels of service with respect to prescribed KPIs under Ontario Regulation 588/17.

Table 25 Ontario Regulation 588/17 Community Levels of Service – Stormwater

Service Attribute	Qualitative Description	Current Level of Service (2021)
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.	See Figure 31

Table 106 Ontario Regulation 588/17 Technical Levels of Service – Stormwater

Service Attribute	Qualitative Description	Current Level of Service (2021)
Scope	1. Percentage of properties in municipality resilient to a 100-year storm.	Relevant information not available at this time; staff will have this ready for the next iteration of the AMP
	2. Percentage of the municipal stormwater management system resilient to a 5-year storm.	
Performance	Actual annual capital reinvestment rate	0.7%
	Target annual capital reinvestment rate	2.0%
	O&M Cost/km of urban drainage system	Relevant information not available at this time; staff will have this ready for the next iteration of the AMP

Figure 19 Stormwater Service Areas



Water

The Town’s water assets include mains, hydrants, treatment facilities, a water tower, sampling station, as well as municipal facilities, vehicles, and various machinery and equipment, that comprise a total current replacement cost of more than \$163 million. It is the second highest value category in the Town’s asset portfolio.

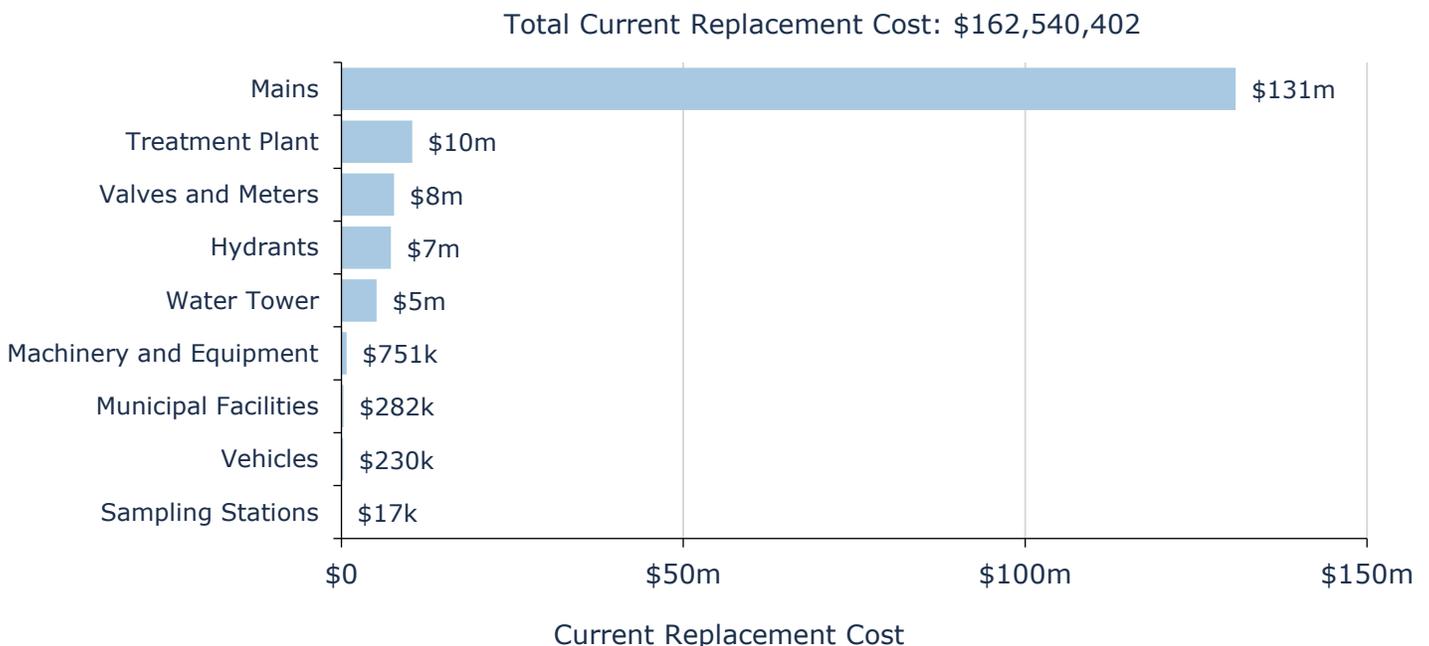
Inventory and Valuation

Table 11 summarizes the quantity and current replacement cost of all water distribution and treatment assets available in the Town’s asset register. At 85% of the portfolio, water mains comprise the largest share of water assets.

Table 11 Detailed Asset Inventory – Water

Segment	Quantity	Unit of Measure	Replacement Cost
Mains	328	Kilometers	\$130,795,041
Treatment Plant	48	Assets	\$10,368,257
Valves and Meters	1,992	Assets	\$7,703,500
Hydrants	725	Assets	\$7,250,000
Water Tower	2	Assets	\$5,143,674
Machinery and Equipment	448	Assets	\$750,799
Municipal Facilities	2	Assets	\$282,484
Vehicles	5	Assets	\$230,147
Sampling Stations	11	Assets	\$16,500
Total			\$162,540,402

Figure 32 Category Valuation – Water



Asset Condition

Figure 3 summarizes the replacement cost-weighted condition of the Town’s water infrastructure portfolio. Based only on age data, less than 8% of assets are in poor or worse condition. These assets may be candidates for replacement in the short term; similarly, assets in fair condition may require rehabilitation or replacement in the medium term and should be monitored for further degradation in condition.

Figure 33 Asset Condition – Water Infrastructure: Overall

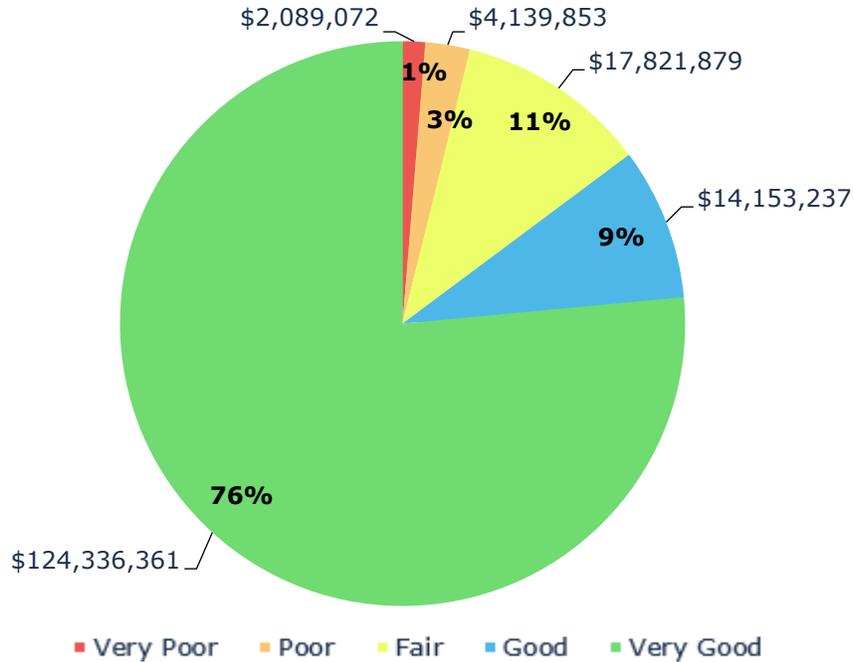


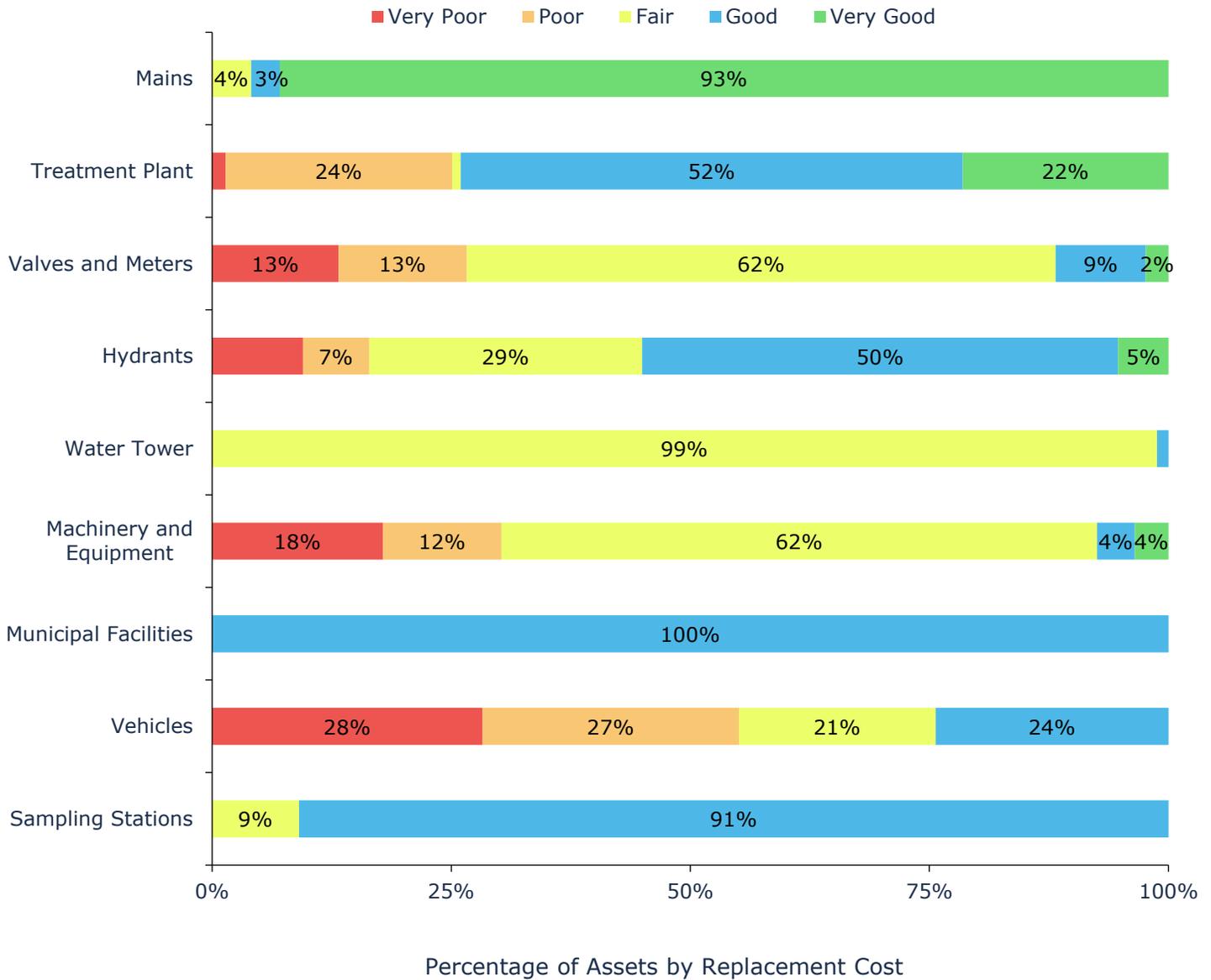
Table 28 summarizes the current average condition, the average service life remaining and the estimated useful life for each asset segment. The average condition is a weighted value based on the current replacement cost.

Table 28 Asset Condition by Segment – Water

Segment	Estimated Useful Life (Years)	Service Life Remaining (Years)	Average Condition
Mains	80	49.3	91% (Very Good)
Treatment Plant	7 - 80	11.6	68% (Good)
Valves and Meters	30 - 50	19.1	44% (Fair)
Hydrants	40 - 80	41.3	54% (Fair)
Water Tower	80	53.8	45% (Fair)
Machinery and Equipment	3 - 30	4.8	39% (Poor)
Municipal Facilities	50	37.1	74% (Good)
Vehicles	8 - 10	5.2	38% (Poor)
Sampling Stations	25 - 30	15.0	64% (Good)
Overall		35.3	84% (Very Good)

Figure 3 summarizes the age-based condition of water infrastructure by each segment. The analysis shows that the majority of each water infrastructure segment is in fair or better condition. We note that water treatment facilities and pumping stations are not componentized. Without sufficient componentization, condition data for major components and elements of various facilities may remain hidden.

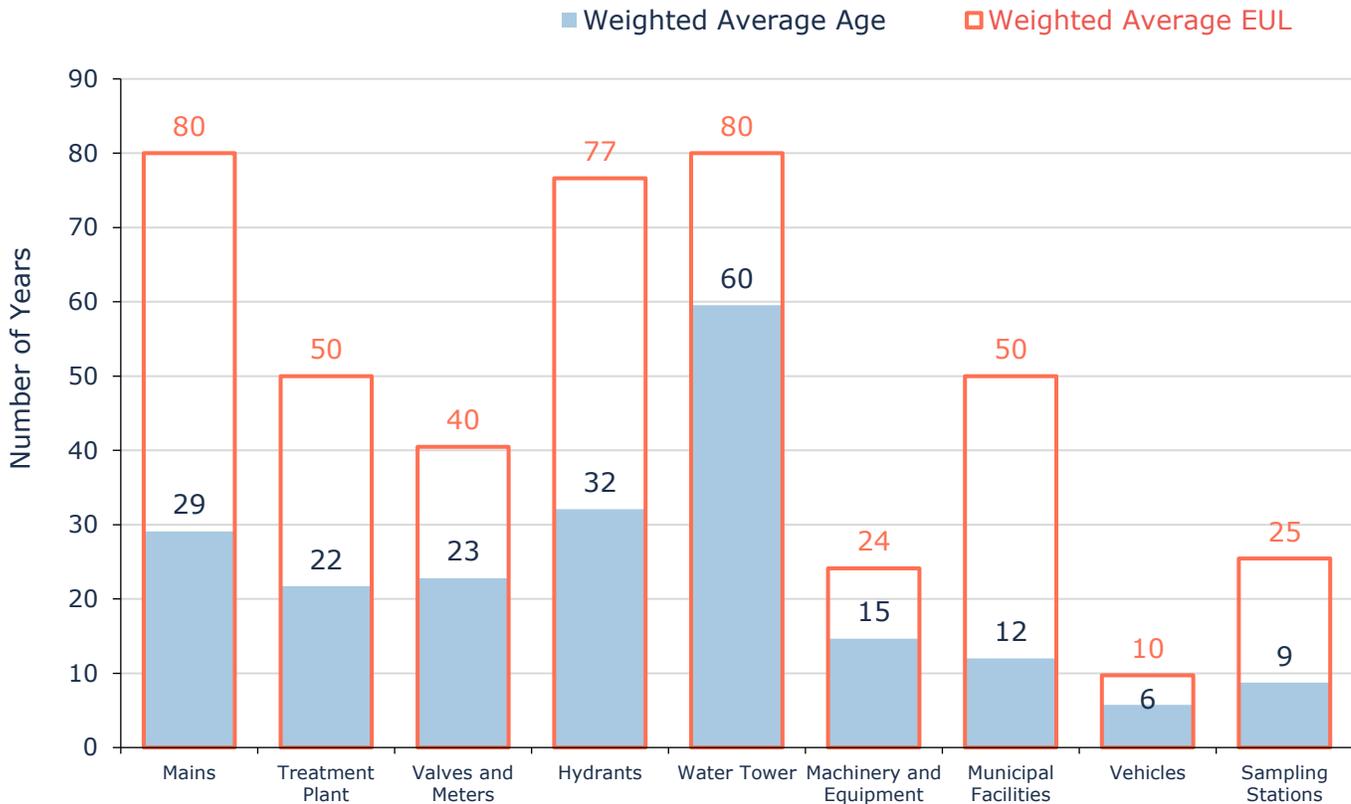
Figure 34 Asset Condition – Water Infrastructure: By Segment



Age Profile

Figure 20 illustrates the average current age of each asset type and its estimated useful life. Both values are weighted by the replacement cost of individual assets.

Figure 20 Estimated Useful Life vs. Asset Age – Water Infrastructure



Age analysis reveals that, on average, water mains are in the earlier stages of their life. However, as with storm mains, these findings are impacted by the accuracy of in-service dates, and useful life estimates for various main types. On average, water mains are 29 years old, against a weighted average EUL of 80 years.

Facilities have hundreds to thousands of individual element and components. As noted previously, water treatment and municipal facilities are not componentized. In the absence of componentization, age analysis was only possible at the site level, rather than at the major element or component level.

Current Approach to Lifecycle Management

The condition or performance of most assets will deteriorate over time. To ensure that municipal assets are performing as expected and meeting the needs of customers, it is important to establish a lifecycle management strategy to proactively manage asset deterioration.

Apart from the inspections required under O. Reg. 170/03: Drinking Water Systems, the Town also conducts an annual inspection of all water assets.

Mains

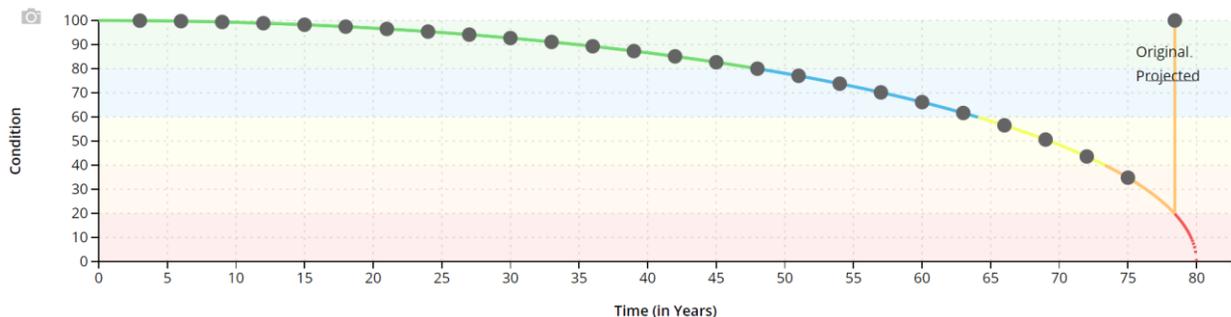
Water mains are assessed on as-needed basis and often in coordination with road and/or sub-surface construction projects. Staff rely on asset age, pipe material and diameter, location, and available CCTV assessments to determine the projected condition of water mains. The Ontario Clean Water Agency (OCWA) also provides the Town with multi-year forecasts on recommended maintenance, rehabilitative and replacement activities that are further reviewed by staff.

The Town conducts directional flushing that covers the entire water network over a 3-year period. Water mains also undergo spot repair and main replacement is generally coordinated with road and/or sub-surface capital projects, but critical asset data like main breaks, main location, age, pipe material and diameter are also factored into the prioritization process.

Table 29 summarizes the Town’s current lifecycle strategy for its water mains and includes the state of the asset that may trigger the event (i.e., condition or age). Capital replacements are guided by a multitude of factors, including but not limited to the coordination between road reconstruction and other sub-surface asset requirements.

Table 29 Current Lifecycle Management Strategies – Water Mains

Event Name	Event Class	Event Range / Trigger
Valve Turning	Maintenance	Every 3 Years
Directional Flushing	Maintenance	Every 3 Years
Asset Replacement	Replacement	Condition: 20



Hydrants, Valves and Meters

Hydrants undergo routine maintenance that includes inspections and flushing. Fire hydrants are typically painted every 3-5 years. Valves undergo routine maintenance that includes inspections, cleaning, and valve exercising. Water meters are inspected routinely to identify and replace outdated or malfunctioning water meters.

Treatment Plant, Water Tower, Sampling Stations

Water facilities are managed in partnership with OCWA, who conduct annual inspections and provide the Town with multi-year capital and operating forecasts. Every year the Town discusses capital budget needs for capital repairs to items such as pump replacements, facility repairs, and pump station repairs.

The Town also utilizes the Supervisory Control and Data Acquisition (SCADA) system to inspect facility components under an established schedule and document any deficiencies.

Vehicles

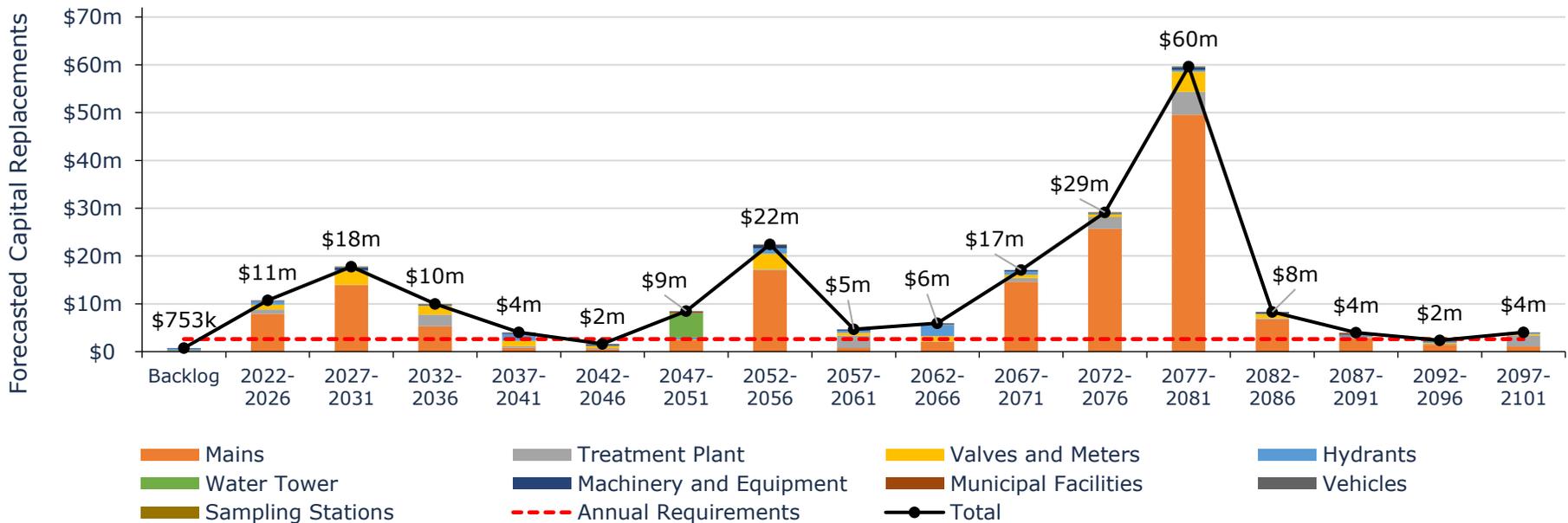
Vehicles are inspected regularly by staff to ensure they are in an adequate state of repair prior to operation. Annual preventative maintenance activities include system components check and additional detailed inspections. The mileage of vehicles is used as proxy to determine remaining useful life and relative vehicle condition, that along with vehicle age and departmental usage, dictate the prioritization of asset replacement.

Forecasted Long-term Replacement Needs

Figure 21 illustrates the cyclical short-, medium- and long-term infrastructure replacement requirements for the Town’s water distribution portfolio. This analysis was run until 2101 to capture at least one iteration of replacement for the longest-lived asset in the asset register. The Town’s average annual requirements (red dotted line) total \$2.6 million for all water assets. Although actual spending may fluctuate substantially from year to year, this figure is a useful benchmark value for annual capital expenditure targets (or allocations to reserves) to ensure projects are not deferred and replacement needs are met as they arise.

Given the lengthy useful life for watermains, replacement needs are forecasted to remain relatively flat, and below \$20 million per 5-year interval until the 2050s. At this point, replacement needs will rise rapidly, peaking at more than \$60 million between 2077 and 2081. The chart also illustrates an age-based backlog of \$0.77 million, dominated by hydrants. These projections and estimates are based on current asset records, their replacement costs, and age analysis only. They are designed to provide a long-term, portfolio-level overview of capital needs and should be used to support improved financial planning over several decades.

Figure 216 Forecasted Capital Replacement Requirements – Water 2022-2101



It is highly unlikely that all assets will require replacements as forecasted, particularly given the potential for coordinating projects with road work. However, a review of useful life estimates, break histories, as well as componentization and condition assessment of water facilities may help uncover hidden needs and help refine backlog estimates.

System-generated 10-Year Replacement Forecast

The table below summarizes the projected cost of lifecycle activities (capital replacement only) that will need to be undertaken over the next 10 years to support current levels of service. These projections are generated in Citywide and rely on the data available in the asset register, which was limited to asset age, replacement cost, and useful life. In addition, as treatment facilities are not componentized, no element- or component-level replacement needs could be forecasted.

Table 12 System-generated 10-Year Replacement Forecast – Water

Segment	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Mains	\$1.0m	\$1.3m	\$1.6m	\$1.8m	\$2.2m	\$2.6m	\$3.2m	\$3.7m	\$4.4m	\$0
Treatment Plant	\$283k	\$218k	\$224k	\$160k	\$58k	\$9k	\$16k	\$0	\$51k	\$0
Valves and Meters	\$883k	\$5k	\$0	\$35k	\$28k	\$55k	\$151k	\$390k	\$789k	\$1.5m
Hydrants	\$290k	\$230k	\$50k	\$0	\$50k	\$0	\$20k	\$110k	\$0	\$0
Water Tower	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Machinery and Equipment	\$18k	\$0	\$21k	\$3k	\$94k	\$0	\$49k	\$8k	\$377k	\$187k
Municipal Facilities	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Vehicles	\$65k	\$0	\$62k	\$0	\$47k	\$0	\$89k	\$0	\$32k	\$0
Sampling Stations	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$2k	\$0
Total	\$2.6m	\$1.7m	\$1.9m	\$2.0m	\$2.5m	\$2.7m	\$3.5m	\$4.2m	\$5.6m	\$1.7m

Risk Analysis

The risk matrix below is generated using available asset data for linear water assets, including service life remaining, replacement costs, asset location, pipe material, and diameter. The risk ratings for non-linear assets were calculated using only age, service life remaining, asset type, and replacement costs.

These risk models have been built into the Town's Asset Management Database (CityWide Asset Manager). See

Table 2 Lifecycle Management: Typical Lifecycle Interventions

Lifecycle Activity	Description	Cost	Typical Associated Risks
Preventative Maintenance/ Maintenance	Activities that prevent defects or deteriorations from occurring	\$	<ul style="list-style-type: none"> Balancing limited resources between planned maintenance and reactive, emergency repairs and interventions; Diminishing returns associated with excessive maintenance activities, despite added costs; Intervention selected may not be optimal and may not extend the useful life as expected, leading to lower payoff and potential premature asset failure;
Rehabilitation/ Renewal	Activities that rectify defects or deficiencies that are already present and may be affecting asset performance	\$\$	<ul style="list-style-type: none"> Useful life may not be extended as expected; May be costlier in the long run when assessed against full reconstruction or replacement; Loss or disruption of service, particularly for underground assets;
Replacement/ Reconstruction	Asset end-of-life activities that often involve the complete replacement of assets	\$\$\$	<ul style="list-style-type: none"> Incorrect or unsafe disposal of existing asset; Costs associated with asset retirement obligations; Substantial exposure to high inflation and cost overruns; Replacements may not meet capacity needs for a larger population; Loss or disruption of service, particularly for underground assets;

Risk and Criticality section for further details on approach used to determine asset risk ratings and classifications.

Figure 227 Risk Matrix – Water



Figure 38 provides an overview of the different data points and allocations utilized to determine the risk rating for each water asset.

Figure 38 Risk Rating Criteria – Water

Probability of Failure (POF)		Consequence of Failure (COF)	
Water Linear Assets			
POF Criteria	Asset Data Point	COF Criteria	Asset Data Point
Performance (80%)	Asset Condition	Direct Financial (85%)	Asset Replacement Cost
Operational (20%)	Number of Line Breaks (40%)	Operational (15%)	Pipe Diameter (mm)
	Pipe Material (60%)		
Water Non-Linear Assets			
POF Criteria	Asset Data Point	COF Criteria	Asset Data Point
Performance (80%)	Asset Condition	Direct Financial (80%)	Asset Replacement Cost
Operational (20%)	Service Life Remaining	Strategic (20%)	Asset Type

Levels of Service

The tables that follow summarize the Town's current levels of service with respect to prescribed KPIs under Ontario Regulation 588/17.

Table 31 Ontario Regulation 588/17 Community Levels of Service – Water

Service Attribute	Qualitative Description	Current Level of Service (2021)
Scope	1. Description, which may include maps, of the user groups or areas of the municipality that are connected to the municipal water system.	See Figure 39
	2. Description, which may include maps, of the user groups or areas of the municipality that have fire flow.	See Figure 40 for areas of the municipality that have hydrant coverage which can be used to determine areas of the municipality that have fire flow.
Reliability	Description of boil water advisories and service interruptions.	The Town has not experienced recent boil water advisories and interruptions.

Table 32 Ontario Regulation 588/17 Technical Levels of Service – Water

Service Attribute	Qualitative Description	Current Level of Service (2021)
Scope	1. Percentage of properties connected to the municipal water system.	81%
	2. Percentage of properties where fire flow is available.	6% ¹
Reliability	1. The number of connection-days per year where a boil water advisory notice is in place compared to the total number of properties connected to the municipal water system.	0
	2. The number of connection-days per year due to water main breaks compared to the total number of properties connected to the municipal water system.	0
Performance	Actual annual capital reinvestment rate	1.2%
	Target annual capital reinvestment rate	1.6%

¹ Percentage of Municipality area with Fire Hydrant Coverage - 90m of radius from hydrant

Figure 239 Water Service Areas

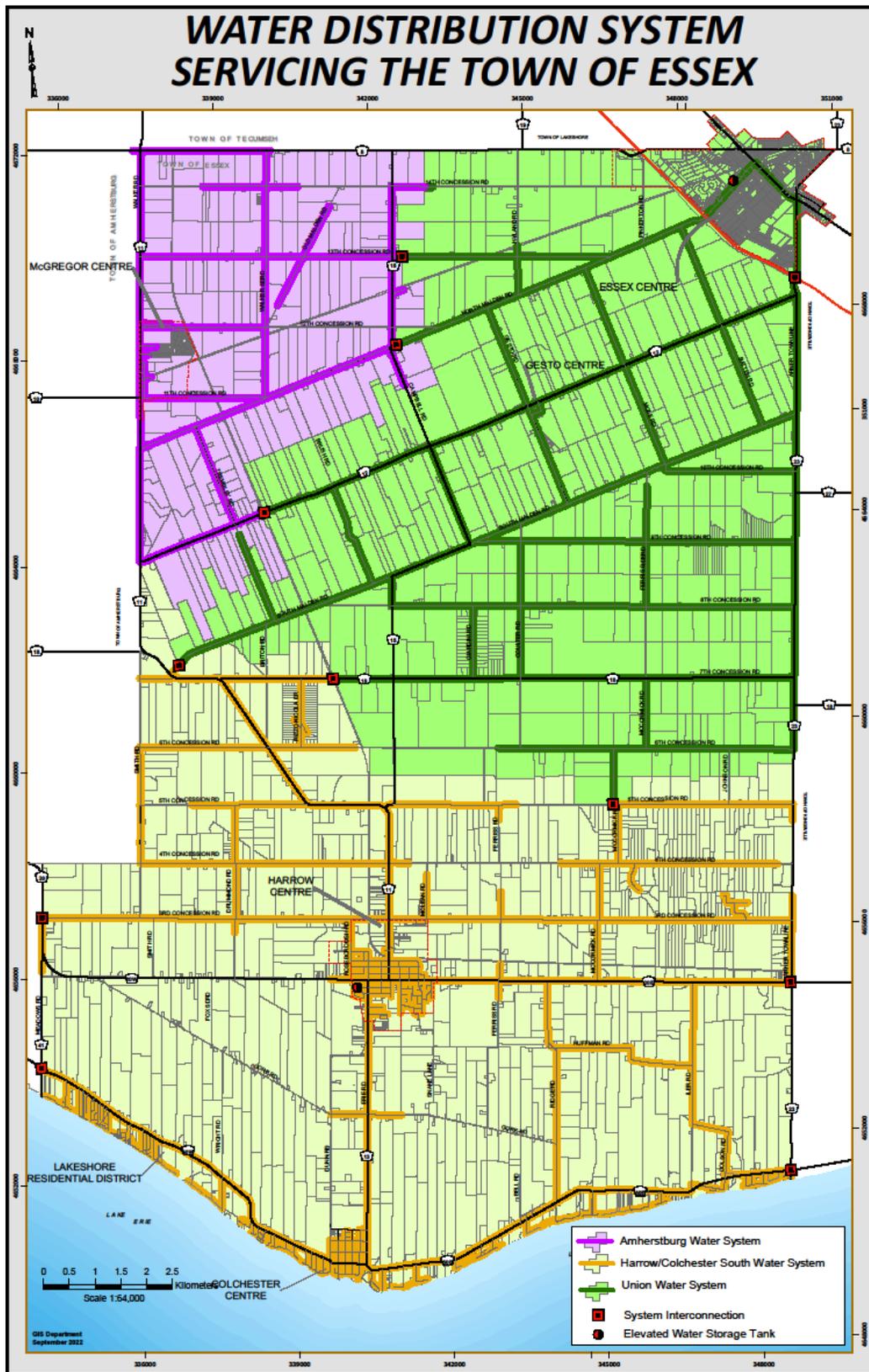
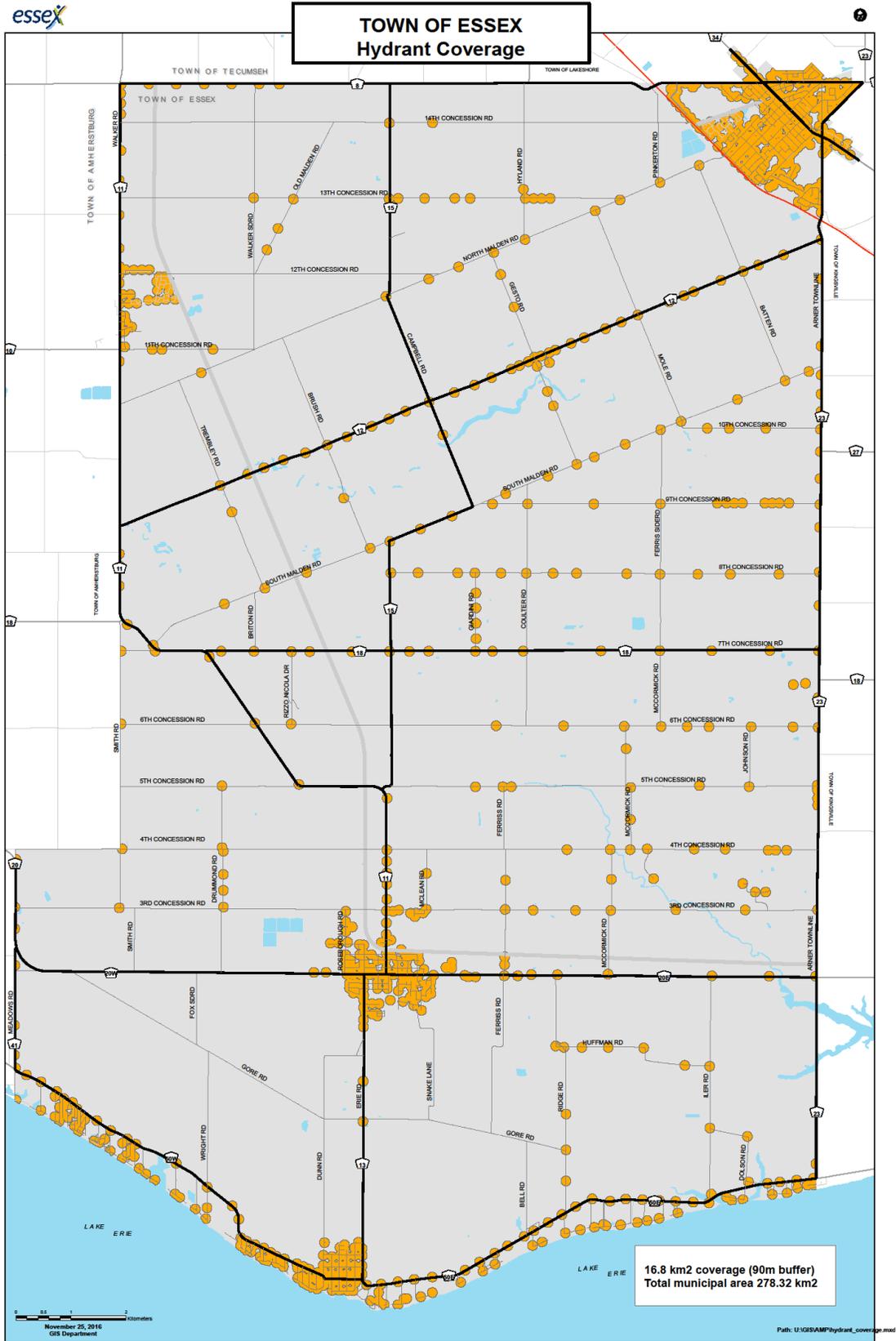


Figure 40 Hydrant Coverage - Areas with Fire Flow



Wastewater

The Town of Essex’s wastewater infrastructure includes wastewater mains, treatment facilities, lagoons and pumping stations, maintenance holes and vehicles. The total current replacement of the Town’s wastewater collection and treatment infrastructure is estimated at \$114 million.

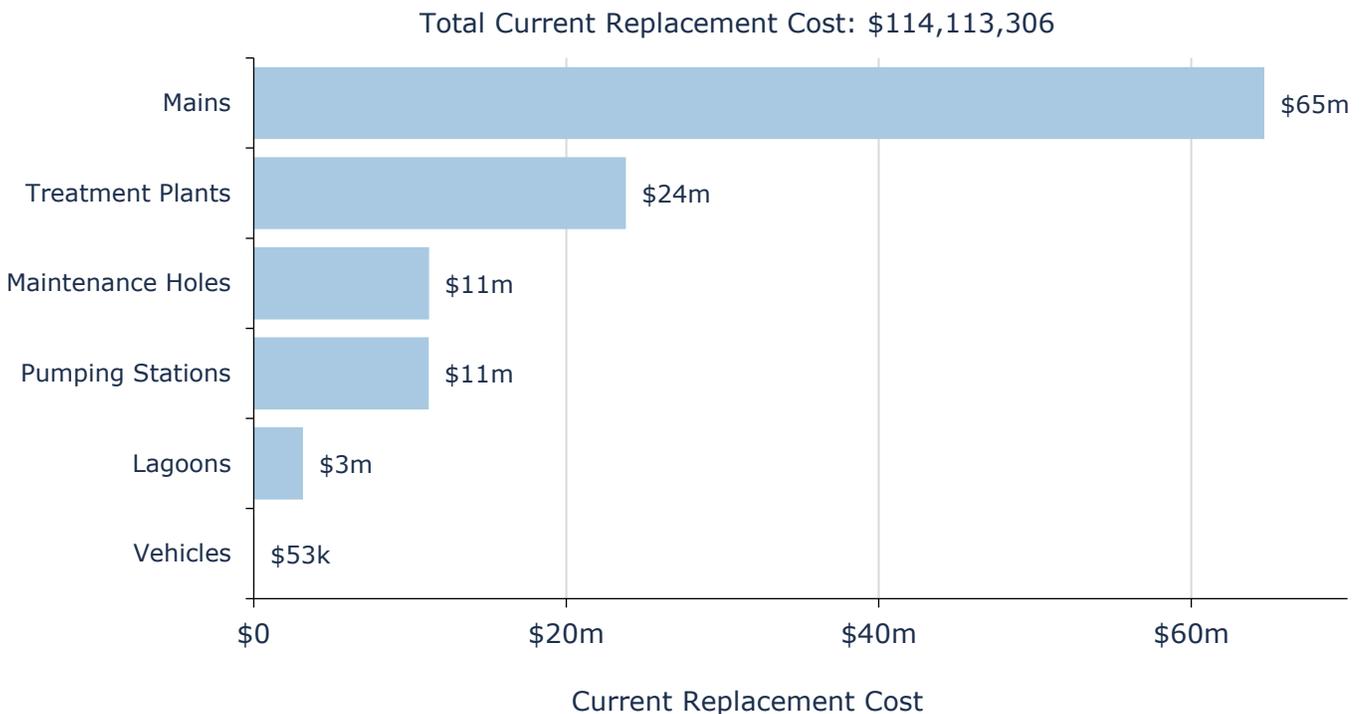
Inventory and Valuation

Table summarizes the quantity and current replacement cost of all wastewater collection and treatment assets.

Table 33 Detailed Asset Inventory – Wastewater

Segment	Quantity	Unit of Measure	Replacement Cost
Mains	99.7	Kilometers	\$64,681,110
Treatment Plants	24	Assets	\$23,814,561
Maintenance Holes	1,121	Assets	\$11,210,000
Pumping Stations	13	Assets	\$11,196,686
Lagoons	3	Assets	\$3,157,675
Vehicles	2	Assets	\$53,274
Total			\$114,113,306

Figure 41 Category Valuation – Wastewater



Asset Condition

Figure 2 summarizes the replacement cost-weighted condition of the Town’s wastewater infrastructure. Based on age data only, 93% of assets are in fair or better condition; the remaining 7% are in poor or worse condition. These assets may be candidates for replacement in the short term; similarly, assets in fair condition may require rehabilitation or replacement in the medium term and should be monitored for further degradation in condition.

As with water infrastructure, we note that treatment facilities are not currently componentized, obscuring element- or component-level condition details.

Figure 42 Asset Condition – Wastewater: Overall

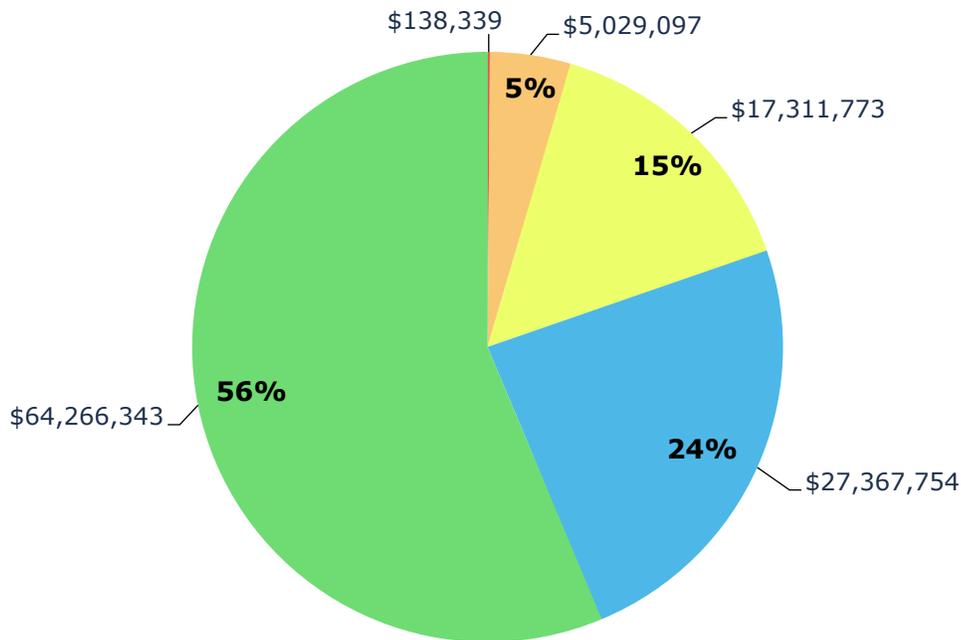


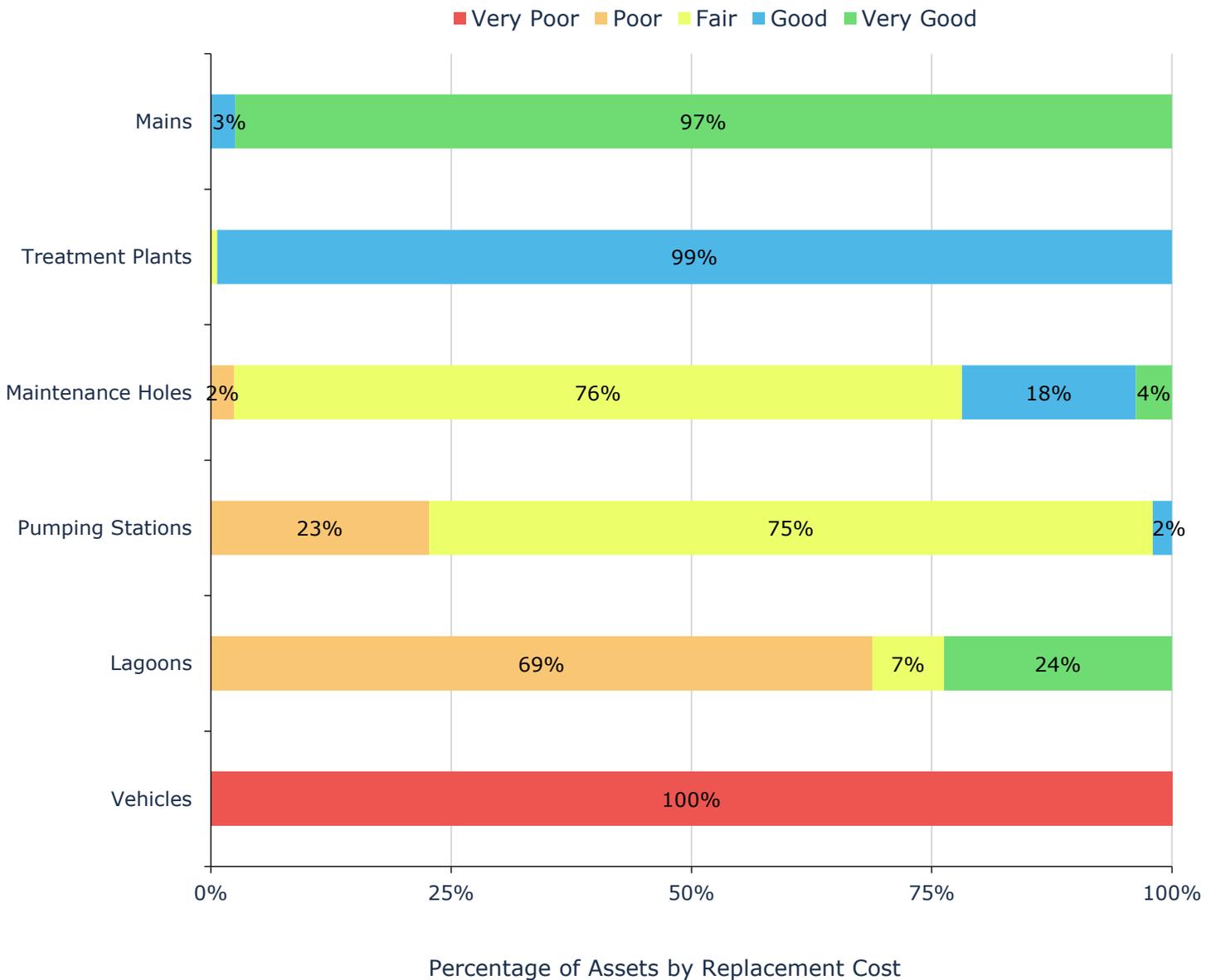
Table 34 summarizes the current average condition, the average service life remaining and the estimated useful life for each asset segment. The average condition is a weighted value based on the current replacement cost.

Table 34 Asset Condition by Segment – Wastewater

Segment	Estimated Useful Life (Years)	Service Life Remaining (Years)	Average Condition
Mains	30 - 50	44.8	89% (Very Good)
Treatment Plants	80	5.6	71% (Good)
Maintenance Holes	80	44.7	56% (Fair)
Pumping Stations	15 - 70	20.4	47% (Fair)
Lagoons	3 - 30	24.0	51% (Fair)
Vehicles	8 - 10	0.2	2% (Very Poor)
Overall		44.2	77% (Good)

Figure summarizes the age-based condition of wastewater assets by segment. The data suggests that 97% of sewer mains are in fair or better condition; however, wastewater vehicles and lagoons are in poor or worse condition. As before, we note again that these estimates are based on age; further, for facilities, condition is represented primarily at the site-level. Without componentization, illustrating condition of individual element or component was not possible.

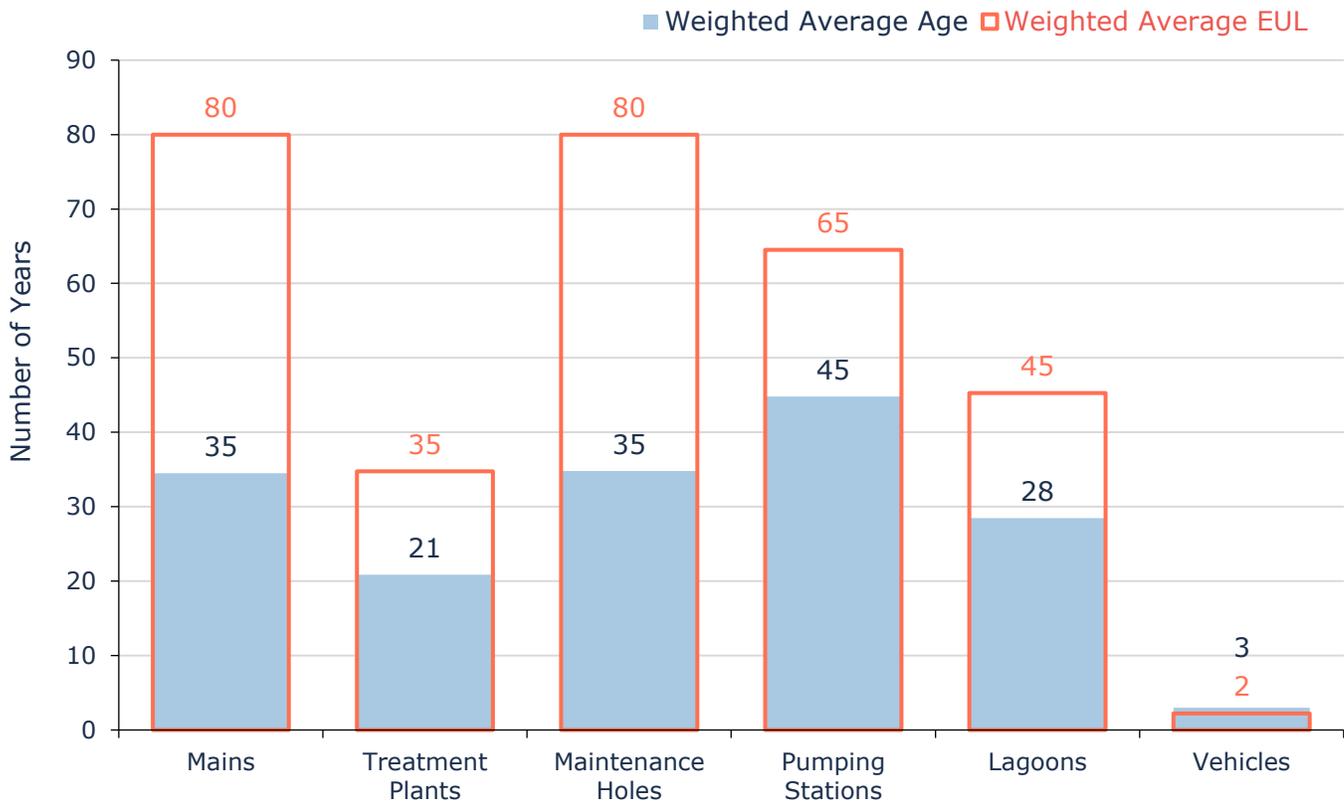
Figure 43 Asset Condition – Wastewater: By Segment



Age Profile

Figure 4 illustrates the average current age of each asset type and its estimated useful life. Both values are weighted by the replacement cost of individual assets.

Figure 44 Estimated Useful Life vs. Asset Age – Wastewater



Age analysis reveals that, on average, major infrastructure including mains and maintenance holes are in the earlier stages of their useful life. Wastewater mains have an average age of 35 years against an average EUL of 80 years. Maintenance holes have an average age of 35 years against an average EUL of 80 years. Assets that represent the wastewater treatment facilities have an average age of 21 years against an average EUL of 35 years. However, the reliability of this analysis is limited given the lack of sufficient componentization.

Although age indicates wastewater mains have more than 40 years remaining before replacement needs arise, these estimates are directly impacted by the accuracy of in-service dates and the useful life benchmarks established for sewer mains. Periodically, these should be reviewed to better reflect in-field asset performance.

Current Approach to Lifecycle Management

The condition or performance of most assets will deteriorate over time. To ensure that municipal assets are performing as expected and meeting the needs of customers, it is important to establish a lifecycle management strategy to proactively manage asset deterioration.

Mains

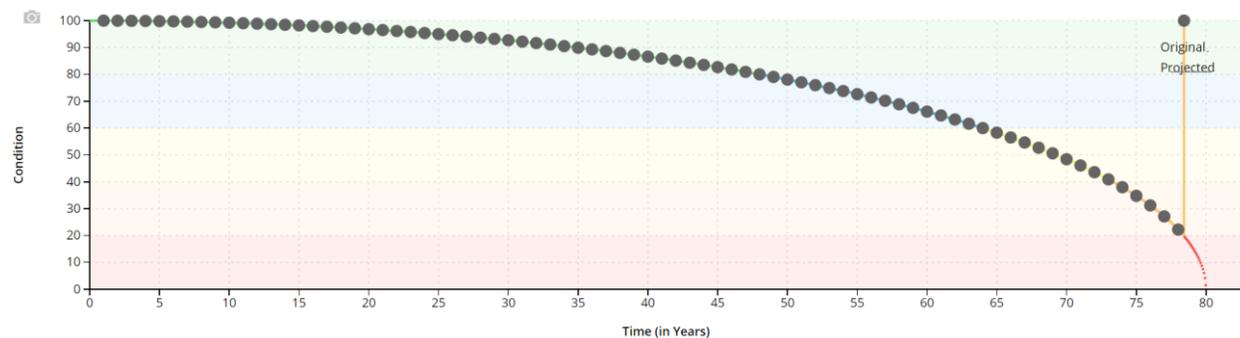
Mains are assessed every 5 years internally, and often times in coordination with road and/or sub-surface construction projects. Staff rely on asset age, pipe material and diameter, location, and available CCTV assessments to determine the projected condition of wastewater mains. OCWA provides the Town with multi-year forecasts on recommended wastewater capital and maintenance activities that are further reviewed by staff.

Wastewater mains also undergo spot repairs and trenchless re-lining has been utilized in the past but in specific locations. In general wastewater main replacement is coordinated with road and/or sub-surface capital projects, but critical asset data like main location, age, pipe material and diameter are also factored into the prioritization process.

Table 35 summarizes the Town’s current lifecycle strategy for its wastewater mains and includes the state of the asset that may trigger the event (i.e., condition or age). Capital replacements are guided by a multitude of factors, including but not limited to the coordination between road reconstruction and other sub-surface asset requirements.

Table 35 Current Lifecycle Management Strategies – Wastewater Mains

Event Name	Event Class	Event Range / Trigger
CCTV Inspection	Maintenance	As needed
Flushing and Cleaning (33% of the network annually)	Maintenance	Annually
Asset Replacement	Replacement	Condition: 20



Maintenance Holes

Maintenance holes undergo annual maintenance that consists of an inspection, possible lid replacement and lining and grouting.

Treatment Plants, Lagoons, Pumping Stations

Wastewater facilities are managed in partnership with OCWA, who conduct annual inspections and provide the Town with multi-year capital and operating forecasts. Every year the Town discusses capital budget needs for capital repairs to items such as pump replacements, facility repairs, pump station repairs, collection mains.

Vehicles

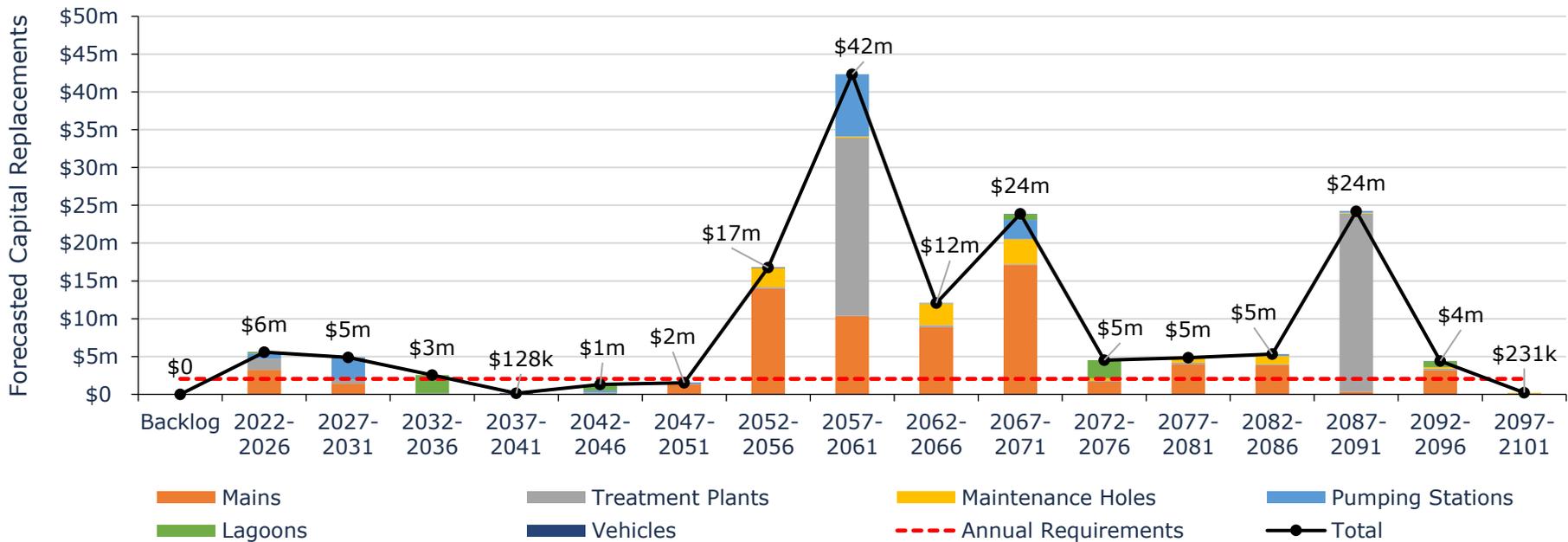
Vehicles are inspected regularly by staff to ensure they are in an adequate state of repair prior to operation. Annual preventative maintenance activities include system components check and additional detailed inspections. The mileage of vehicles is used as proxy to determine remaining useful life and relative vehicle condition, that along with vehicle age and departmental usage, dictate the prioritization of asset replacement.

Forecasted Long-term Replacement Needs

Figure 5 illustrates the cyclical short-, medium- and long-term infrastructure replacement requirements for the Town’s wastewater infrastructure. This analysis was run until 2101 to capture at least one iteration of replacement for the longest-lived asset in the asset register. The Town’s average annual requirements (red dotted line) total \$2.0 million for all wastewater assets. Although actual spending may fluctuate substantially from year to year, this figure is a useful benchmark value for annual capital expenditure targets (or allocations to reserves) to ensure projects are not deferred and replacement needs are met as they arise.

Replacement needs are forecasted to fluctuate over the 80+ year time horizon, totaling more than \$10 million in the current decade, and peaking at \$42 million between 2057 and 2061 as a substantial portion of wastewater treatment plant assets reach the end of their useful life. These projections and estimates are based on asset replacement costs and age analysis. They are designed to provide a long-term, portfolio-level overview of capital needs and should be used to support improved financial planning over several decades.

Figure 45 Forecasted Capital Replacement Requirements – Wastewater 2022-2101



As noted previously, treatment facilities and other assets are not componentized, limiting the accuracy of these projections. In addition, similar to storm and water assets, particularly mains, it is unlikely that all mains will need to be replaced as forecasted. Coordinated projects, along with CCTV inspection data, may drive replacements and rehabilitations.

System-generated 10-Year Replacement Forecast

The table below summarizes the projected cost of lifecycle activities (capital replacement only) that will need to be undertaken over the next 10 years to support current levels of service. These projections are generated in Citywide and rely on the data available in the asset register. For wastewater assets, no condition information was available. As a result, this system-generated 10-year forecast relies only on asset age and replacement cost. These projections can be different from actual capital forecasts. Consistent data updates, especially condition, will improve the alignment between the system generated expenditure requirements, and the Town’s capital expenditure forecasts.

Table 36 System-generated 10-Year Replacement Forecast – Wastewater Assets

Segment	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Mains	\$461k	\$572k	\$374k	\$1.5m	\$375k	\$344k	\$349k	\$358k	\$364k	\$0
Treatment Plants	\$190k	\$242k	\$112k	\$797k	\$107k	\$85k	\$87k	\$88k	\$325k	\$0
Maintenance Holes	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Pumping Stations	\$89k	\$114k	\$52k	\$375k	\$50k	\$40k	\$41k	\$42k	\$2.7m	\$0
Lagoons	\$25k	\$32k	\$15k	\$106k	\$14k	\$11k	\$11k	\$12k	\$12k	\$0
Vehicles	\$343	\$11k	\$201	\$1k	\$193	\$154	\$156	\$160	\$43k	\$10k
Total	\$766k	\$971k	\$553k	\$2.8m	\$547k	\$481k	\$488k	\$500k	\$3.4m	\$10k

Risk Analysis

The risk matrix below is generated using available asset data for linear water assets, including service life remaining, replacement costs, asset location, pipe material, and diameter. The risk ratings for non-linear assets were calculated using only age, service life remaining, asset type, and replacement costs.

These risk models have been built into the Town's Asset Management Database (CityWide Asset Manager). See

Table 2 Lifecycle Management: Typical Lifecycle Interventions

Lifecycle Activity	Description	Cost	Typical Associated Risks
Preventative Maintenance/ Maintenance	Activities that prevent defects or deteriorations from occurring	\$	<ul style="list-style-type: none"> • Balancing limited resources between planned maintenance and reactive, emergency repairs and interventions; • Diminishing returns associated with excessive maintenance activities, despite added costs; • Intervention selected may not be optimal and may not extend the useful life as expected, leading to lower payoff and potential premature asset failure;
Rehabilitation/ Renewal	Activities that rectify defects or deficiencies that are already present and may be affecting asset performance	\$\$	<ul style="list-style-type: none"> • Useful life may not be extended as expected; • May be costlier in the long run when assessed against full reconstruction or replacement; • Loss or disruption of service, particularly for underground assets;
Replacement/ Reconstruction	Asset end-of-life activities that often involve the complete replacement of assets	\$\$\$	<ul style="list-style-type: none"> • Incorrect or unsafe disposal of existing asset; • Costs associated with asset retirement obligations; • Substantial exposure to high inflation and cost overruns; • Replacements may not meet capacity needs for a larger population; • Loss or disruption of service, particularly for underground assets;

Risk and Criticality section for further details on approach used to determine asset risk ratings and classifications.

Figure 46 Risk Matrix – Wastewater

Consequence	5 Severe	0 Assets \$0	1 Asset \$23,478,938	0 Assets \$0	0 Assets \$0	0 Assets \$0
	4 Major	1 Asset \$748,962	0 Assets \$0	1 Asset \$8,226,925	2 Assets \$4,176,253	0 Assets \$0
	3 Moderate	4 Assets \$1,157,260	1 Asset \$848,699	2 Assets \$313,153	0 Assets \$0	0 Assets \$0
	2 Minor	14 Assets \$1,789,582	18 Assets \$2,363,058	12 Assets \$281,695	6 Assets \$582,844	12 Assets \$95,370
	1 Insignificant	272 Assets \$10,866,997	896 Assets \$38,349,828	1,090 Assets \$20,520,775	27 Assets \$270,000	1 Asset \$42,969
		1 Rare	2 Unlikely	3 Possible	4 Likely	5 Almost Certain
		Probability				

Figure 47 provides an overview of the different data points and allocations utilized to determine the risk rating for each wastewater asset.

Figure 47 Risk Rating Criteria – Wastewater

Probability of Failure (POF)		Consequence of Failure (COF)	
Water Linear Assets			
POF Criteria	Asset Data Point	COF Criteria	Asset Data Point
Performance (80%)	Asset Condition	Direct Financial (85%)	Asset Replacement Cost
Operational (20%)	Service Life Remaining (40%)	Operational (15%)	Pipe Diameter (mm)
	Pipe Material (60%)		
Water Non-Linear Assets			
POF Criteria	Asset Data Point	COF Criteria	Asset Data Point
Performance (80%)	Asset Condition	Direct Financial (80%)	Asset Replacement Cost
Operational (20%)	Service Life Remaining	Strategic (20%)	Asset Type

Levels of Service

The tables that follow summarize the Town’s current levels of service with respect to prescribed KPIs under Ontario Regulation 588/17.

Table 37 Ontario Regulation 588/17 Community Levels of Service – Wastewater

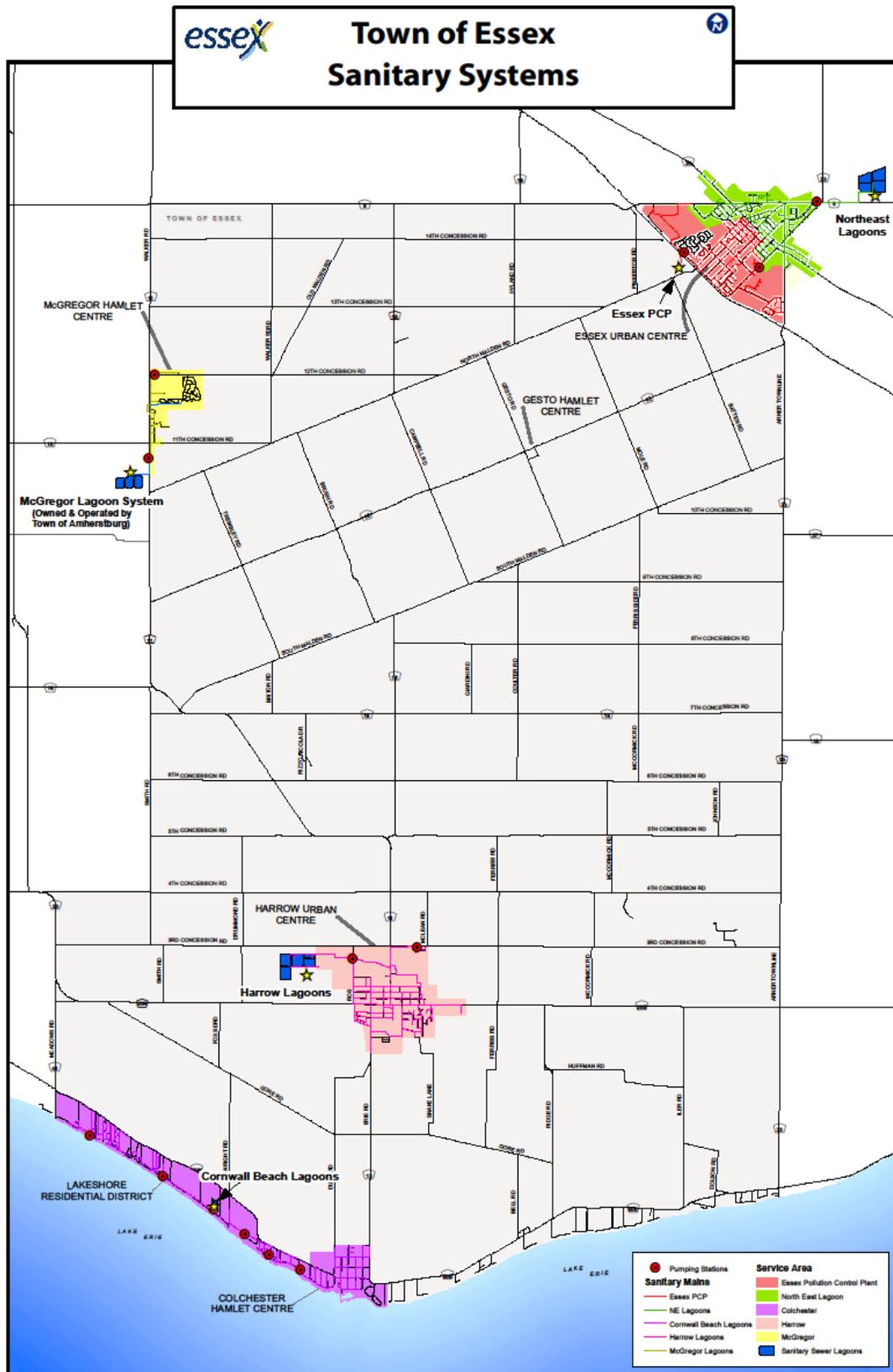
Service Attribute	Qualitative Description	Current Level of Service (2021)
Scope	Description, which may include maps, of the user groups or areas of the municipality that are connected to the municipal wastewater system.	See Figure 48
Reliability	1. Description of how combined sewers in the municipal wastewater systems are designed with overflow structures in place which allows overflow during storm events to prevent backups into homes.	The Town does not own any combined sewers.
	2. Description of the frequency and volume of overflows in combined sewers in the municipal wastewater system that occur in habitable areas or beaches.	
	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.	<p>Stormwater can enter into sanitary sewers due to damaged sanitary mains or through indirect connections (e.g., weeping tiles). In the case of heavy rainfall events, sanitary sewers may experience a volume of water and sewage that exceeds its designed capacity. In some cases, this can cause water and/or sewage to overflow backup into homes. the disconnection of weeping tiles from sanitary mains and the use of sump pumps and pits directing stormwater to the storm drain system can help to reduce the chance of this occurring.</p> <p>The Town follows a series of design standards that integrate servicing requirements and land use considerations when constructing or replacing sanitary sewers. These standards have been determined with consideration of the minimization of sewage overflows and backups.</p>

	4. Description of how sanitary sewers in the municipal wastewater system are designed to be resilient to avoid events described in paragraph 3.	The design and construction of sanitary and storm sewers is in accordance with the latest design standards issued by the MECP to eliminate or minimize inflow and infiltration within the sanitary sewer system.
	5. Description of the effluent that is discharged from sewage treatment plants in the municipal wastewater system.	Effluent refers to water pollution that is discharged from a wastewater treatment plant, and may include suspended solids, total phosphorous and biological oxygen demand. The Environmental Compliance Approval (ECA) identifies the effluent criteria for municipal wastewater treatment plants.

Table 13 Ontario Regulation 588/17 Technical Levels of Service – Wastewater

Service Attribute	Qualitative Description	Current Level of Service (2021)
Scope	Percentage of properties connected to the municipal wastewater system.	60%
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.	N/A
	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.	N/A
	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.	0
Performance	Actual annual capital reinvestment rate	0.6%
	Target annual capital reinvestment rate	1.8%

Figure 48 Wastewater Service Area



Financial Strategy

Each year, the Town of Essex makes important investments in its infrastructure's maintenance, renewal, rehabilitation, and replacement to ensure assets remain in a state of good repair. However, spending needs typically exceed fiscal capacity. In fact, most municipalities continue to struggle with annual infrastructure deficits. Achieving full-funding for infrastructure programs will take many years and should be phased-in gradually to reduce burden on taxpayers.

This financial strategy is designed for the Town's existing asset portfolio and is premised on two key inputs: the average annual capital requirements and the average annual funding typically available for capital purposes. The annual requirements are based on the replacement cost of assets and their serviceable life, and where available, lifecycle modeling. This figure is calculated for each individual asset and aggregated to develop category-level values.

The annual funding typically available is determined by averaging historical capital expenditures on infrastructure, inclusive of any allocations to reserves for capital purposes.

Only reliable and predictable sources of funding are used to benchmark funds that may be available on any given year. For the purpose of this AMP, these funding sources include:

- revenue from taxation spent on capital works;
- revenue from taxation and urban levy allocated to reserves for capital purposes;
- revenue from the Essex-Windsor Solid Waste Authority;
- revenue from water and wastewater rates allocated to capital reserves;
- the Canada Community Benefits Fund (CCBF), formerly the federal Gas Tax Fund; and,
- the Ontario Community Infrastructure Fund (OCIF).

Although provincial and federal infrastructure programs can change with evolving policy, CCBF, OCIF, and OMPF are considered as permanent and predictable.

Annual Capital Requirements

Table 14 outlines the total average annual capital requirements for existing assets in each asset category. Based on a replacement cost of \$621 million, annual capital requirements total more than \$17 million for the five core asset categories analyzed in this document. The table also illustrates the system-generated, equivalent target reinvestment rate (TRR), calculated by dividing the annual capital requirements by the total replacement cost of each category. The cumulative target reinvestment for these five categories is estimated at 2.8%.

Table 14 Average Annual Capital Requirements

Asset Category	Replacement Cost	Annual Capital Requirements	Equivalent Target Reinvestment Rate
Roads and Roadside	\$205,344,861	\$9,806,651	4.8%
Bridges and Culverts	\$73,596,000	\$1,615,165	2.2%
Stormwater	\$65,289,637	\$1,285,993	2.0%
Water	\$162,540,402	\$2,618,458	1.6%
Wastewater	\$114,113,306	\$2,049,622	1.8%
Total	\$620,884,206	\$17,375,889	2.8%

Although there is no industry standard guide on optimal annual investment in infrastructure, the TRRs above provide a useful benchmark for organizations. In 2016, the Canadian Infrastructure Report Card (CIRC) produced an assessment of the health of municipal infrastructure as reported by cities and communities across Canada. The CIRC remains a joint project produced by several organizations, including the Federation of Canadian Municipalities (FCM), the Canadian Society of Civil Engineers (CSCE), the Canadian Network of Asset Managers (CNAM), and the Canadian Public Works Association (CPWA).

The 2016 version of the report card also contained recommended reinvestment rates that can also serve as benchmarks for municipalities. The CIRC suggest that, if increased, these reinvestment rates can “stop the deterioration of municipal infrastructure.” The report card contains both a range for reinvestment rates that outlines the lower and upper recommended levels, as well as current municipal averages.

Table 15 provides the CIRC lower and upper reinvestment rate targets for relevant asset groups. The table shows that, on average, municipalities are well below the recommended target reinvestment rates.

Table 15 Canadian Infrastructure Report Card (CIRC) Reinvestment Rate Targets

Asset Category	Lower Target	Upper Target	Municipal Average in 2016
Road Network (inc. sidewalks)	2.0%	3.0%	1.1%
Bridges & Culverts	1.0%	1.5%	0.8%
Stormwater Network (linear)	1.0%	1.3%	0.3%
Water Network (linear)	1.0%	1.5%	0.9%
Water Network (non-linear)	1.7%	2.5%	1.1%
Wastewater Network (linear)	1.0%	1.3%	0.7%
Wastewater Network (non-linear)	1.7%	2.5%	1.4%

Current Infrastructure Funding Framework

Figure 24 shows the Town’s own-source funding that has historically been available for capital infrastructure purposes for 2020, 2021, and 2022 (budget). Based only on this data, average funding available to the five categories analyzed in this AMP totals \$4.5 million. This figure excludes development charges that may be used for growth-related infrastructure.

Figure 24 Historical Funding Available for Capital Infrastructure Purposes: Own-source Revenues Only

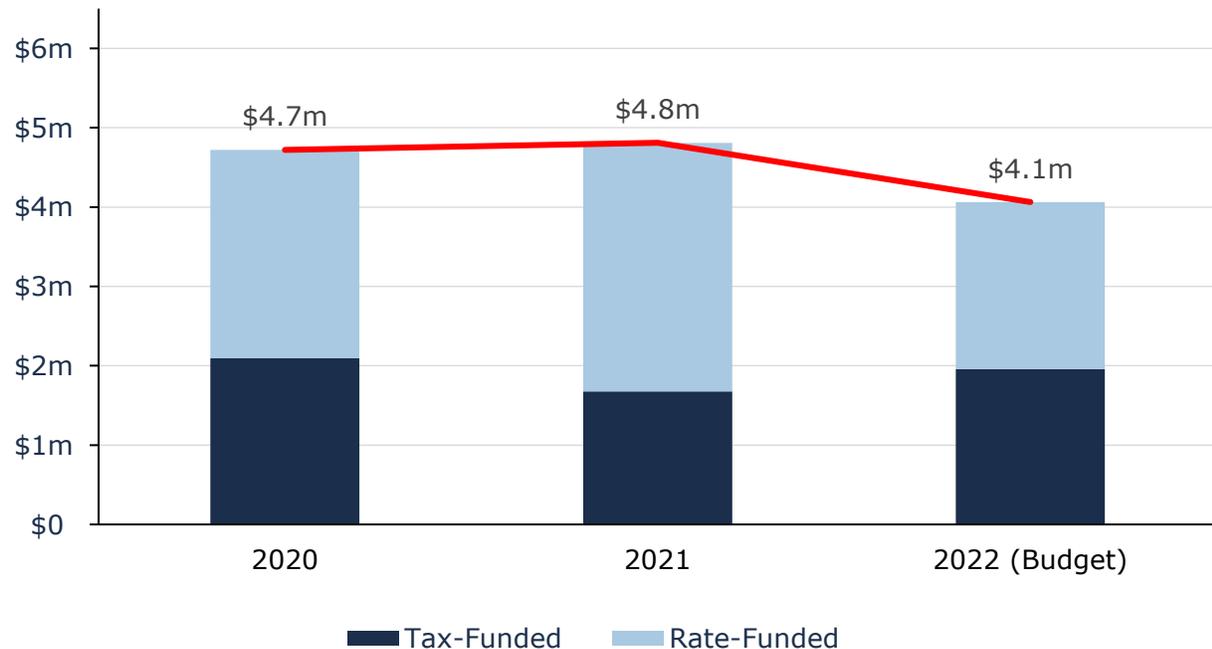


Table details how average funding is distributed across the five asset categories, and the various sources used to support spending. In addition to own-source revenue streams, namely property taxation and utility rates, the table also includes CCBF, OCIF, and Landfill Transfers as these revenue sources are considered sustainable.

We note that water and wastewater revenues used a 3-year average to determine the figures due to fluctuations year over year, while the other core asset categories relied on 2022 figures.

The inclusion of these funding sources increases available funding for tax-funded assets by more than \$3.0 million, and results in a total average annual funding of \$4.5 million. We use this total funding, inclusive of OCIF and CCBF, as a baseline and to determine funding deficits.

Table 41 Allocation of Average Annual Infrastructure Capital Funding by Asset Category

Asset Category	Taxes/ User-Rates	CCBF	OCIF	Taxes to Reserves	Annual Landfill Transfers	Average Annual Funding Available
Roads and Roadside	\$88,000	\$875,000	\$859,000	\$637,000	\$1,082,000	\$3,541,000
Bridges and Culverts	\$0	\$144,000	\$142,000	\$105,000	\$178,000	\$569,000
Stormwater	\$0	\$0	\$0	\$430,000	\$0	\$430,000
Water	\$1,963,000	\$0	\$0	\$0	\$0	\$1,963,000
Wastewater	\$660,000	\$0	\$0	\$0	\$0	\$660,000
Total	\$2,711,000	\$1,019,000	\$1,001,000	\$1,172,000	\$1,260,000	\$7,163,000

Current Funding Levels and Infrastructure Deficits

Table 16 summarizes how current funding levels compare with funding required for each asset category. At existing levels, the Town is funding 41% of its annual capital requirements for all infrastructure analyzed in this asset management plan. This creates a total annual funding deficit of \$10.2 million.

Table 16 Current Funding Position vs. Required Funding

Asset Category	Annual Capital Requirements	Average Annual Funding Available	Annual Infrastructure Deficit	Funding Level
Roads and Roadside	\$9,806,651	\$3,541,000	\$6,265,651	36%
Bridges and Culverts	\$1,615,165	\$569,000	\$1,046,165	35%
Stormwater	\$1,285,993	\$430,000	\$855,993	33%
Water	\$2,618,458	\$1,963,000	\$655,458	75%
Wastewater	\$2,049,622	\$660,000	\$1,389,622	32%
Total	\$17,375,889	\$7,163,000	\$10,212,889	41%

Table compares the Town's target vs. actual reinvestment rates. It shows that, while the Town's reinvestment rates are below target, they are higher or in line with other municipalities based on CIRC's 2016 average. The exceptions are bridges, culverts, and wastewater assets.

Table 43 Target vs. Actual Reinvestment Rates

Asset Category	Target Reinvestment Rate	Actual Reinvestment Rate	CIRC 2016 Municipal Average
Roads and Roadside	4.8%	1.7%	1.1%
Bridges and Culverts	2.2%	0.8%	0.8%
Stormwater	2.0%	0.7%	0.3%
Water	1.6%	1.2%	0.9% - 1.1%
Wastewater	1.8%	0.6%	0.7% - 1.4%
Total	2.8%	1.2%	N/A

Closing Funding Gaps

Eliminating annual infrastructure funding shortfalls is a difficult and long-term endeavour for municipalities. Considering the Town’s current funding position, it will require many years to reach full funding for current assets.

This section outlines how the Town of Essex can close annual funding deficits using own-source revenue streams, i.e., property taxation and utility rates, and without the use of additional debt for existing assets. Separate analysis is provided for tax- and rate-funded assets.

Tax-Funded Assets

For 2022, the Town of Essex’s forecasted property tax revenue totals \$17,472,000. Annual capital requirements for tax-funded core assets total \$12,707,809 against available funding of \$4,540,000. This creates a funding deficit of \$8,167,809. To close this annual gap, the Town’s property tax revenue would need to increase by 47%. This will allow the Town to meet its average annual requirements of \$12.7 million for tax-funded categories.

Table 174 Increase Needed in Property Taxation Revenue to Meet Annual Infrastructure Needs

2022 Property Taxation Revenue	Additional Revenue Needed for Infrastructure	% Increase Needed
\$17,472,000	\$8,176,896	47%

To achieve this increase, several scenarios have been developed using phase-in periods ranging from five to 20 years. Shorter phase-in periods may place too high a burden on taxpayers, whereas a phase-in period beyond 20 years may see a continued deterioration of infrastructure, leading to larger backlogs.

Table 45 Phasing in Tax Increases

Total % Increase Needed in Annual Property Taxation Revenues	Phase-in Period			
	5 Years	10 Years	15 Years	20 Years
47%	7.9%	3.8%	2.6%	1.9%

Funding 100% of annual capital requirements ensures that major capital events, including replacements, are completed as required. Under this scenario, projects are unlikely to be deferred to future years. This delivers the highest asset performance and customer levels of service.

Rate-Funded Assets

For 2022, the Town of Essex’s forecasted water rate revenues total \$2,991,376. Annual capital requirements for water assets totals \$2,618,458 against a 3-year average capital funding of \$1,963,000. This creates a funding deficit of \$655,458. To close this annual gap, the Town’s water revenues would need to increase by 22%. This will allow the Town to meet its average annual requirements of \$2.6 million.

Similarly, wastewater rate revenues are forecasted to be \$2,235,633 in 2022. Average annual requirements for the Town’s wastewater assets total \$2,049,622 against a 3-year average funding of \$660,000, creating an annual deficit of \$1,383,622. Wastewater rate revenues would need to increase by 62% to close this funding gap and allow the Town to meet its average annual requirements of \$2.0 million.

Table 46 Increase Needed in Water and Wastewater Rate Revenues to Meet Annual Infrastructure Needs

Category	2022 Rate Revenues	Additional Revenue Needed for Infrastructure	% Increase Needed
Water	\$2,991,376	\$693,999	22%
Wastewater	\$2,235,633	\$1,383,857	62%

To achieve these increases, several scenarios have been developed using phase-in periods ranging from five to 20 years. As with tax-funded assets, short phase-in periods may require excessive rate increases, whereas more protracted timeframes may lead to larger backlogs and more unpredictable spending on emergency repairs and replacements.

Table 47 Phasing in Rate Increases

Category	Total % Increase Required in Rate Revenues	Phase-in Period			
		5 Years	10 Years	15 Years	20 Years
Water	22%	4.1%	2.1%	1.4%	1.0%
Wastewater	62%	9.9%	3.8%	1.8%	1.4%

Lowering Target Funding Levels

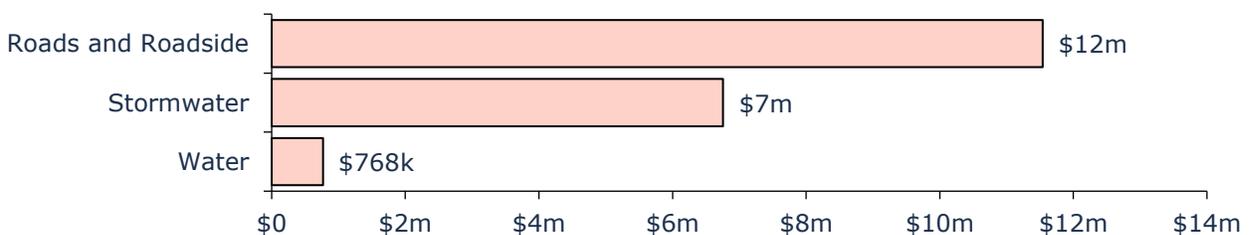
The above scenarios assume that the Town should target full funding for all asset classes. That is, it should strive to meet 100% of its average annual capital requirements of \$17.4 million. If this target funding level is reduced, the total tax revenue and rate increases required would also decrease. However, this approach is not desirable as it reduces the Town’s financial capacity to maintain its infrastructure in a state of good repair, yielding the following potential consequences:

- reduced asset performance and increased rate of asset failures; with a longer replacement cycle, assets may remain in service beyond their useful life;
- continuation of the ‘worst-first’ or reactive approach to infrastructure management and project selection;
- reduced customer service levels and increases in citizen complaints;
- potential reputational damage;
- increased risk to public health and safety;
- project deferrals or cancellations, leading to further accumulation of existing infrastructure backlogs

Infrastructure Backlogs

The annual tax and rate increases proposed are designed to eliminate annual infrastructure deficits. However, they do not address existing backlogs. Figure 25 shows that the current infrastructure backlog totals approximately \$17.2 million across all asset categories analyzed in this AMP. However, as many assets did not have condition assessment data available, age was used to estimate backlog figures. As a result, the figure below may be an under- or overstatement of actual asset needs. Condition assessment data will be essential in developing more accurate and credible estimates.

Figure 25 Current Infrastructure Backlog by Asset Category



Eliminating backlogs will require prioritizing projects, ideally through continuous improvements and application of the Town’s risk models to augment staff judgement. This risk-based approach will ensure that project selection is objective, supports delivery of the Town’s service level targets, and is in line with long-term strategic objectives.

Reserve Levels and Use of Debt

Table 18 summarizes the size of current infrastructure reserves for the five core asset categories. Across all asset categories in this AMP, infrastructure reserves total \$38 million, or 6% of the total current replacement value of assets. These reserves are available for use for various infrastructure-related expenditures as needed and for potential tax stabilization.

Table 18 Infrastructure Reserve Levels

Reserve	Category	Closing Balance on December 31, 2021
Water Reserve	Water	\$21,923,000
Sanitary Sewer Reserve	Wastewater	\$7,073,000
AMP Reserve	Roads and Roadside	\$5,238,000
AMP Reserve	Bridges and Culverts	\$827,000
AMP Reserve and Urban Levy	Stormwater	\$2,895,000
Total		\$37,956,000

There is considerable debate in the municipal sector on the appropriate level of reserves that an organization should have on hand. No clear guideline has gained widespread acceptance.

Factors that the Town should consider when determining its capital reserve requirements include breadth of services provided; age and condition of infrastructure; use and level of debt; economic condition and outlook; and internal reserve and debt policies.

Growth

The Town of Essex is a growing community. Based on Census 2021, the community’s current population is 21,216 residents, an increase of 3.9% from 2016 and close to the mid-2029 population forecast as summarized in the 2019 Development Charges Background Study. The study also forecasts the employment base to reach 6,175 by 2031— although, given recent population trends, the increase may be larger. To support anticipated growth and ensure service levels are adequately maintained, the Town will continue to invest in critical infrastructure. Table provides a summary of the population and employment forecast as outlined in the 2019 Development Charges Background Study.

Table 49 Population and Employment Forecast

	Mid 2006	Mid 2011	Mid 2016	Mid 2019	Mid 2029	Mid 2031
Population	20,032	19,600	20,427	20,711	21,986	22,150
Employment	6,200	5,655	5,670	5,768	6,709	6,885

As a requirement of the Development Charges Act under subsection 10(2)(c), an analysis must be undertaken to assess the long-term capital and operating cost impacts for the capital infrastructure projects identified within the Development Charges.

The background study must also include an asset management plan that deals with all assets proposed to be funded, in whole or in part, by D.C.s. The asset management plan must show that the assets are financially sustainable over their full lifecycle.

Impact of Growth on Lifecycle Activities

By July 1, 2025, the Town's asset management plan must include a discussion of how the assumptions regarding future changes in population and economic activity informed the preparation of the lifecycle management and financial strategy.

Planning for forecasted population growth may require the expansion of existing infrastructure and services. As growth-related assets are constructed or acquired, they should be integrated into the Town's AMP and the primary asset inventory. While the addition of residential units will add to the existing assessment base and offset some of the costs associated with growth, the Town will need to review the lifecycle costs of growth-related infrastructure. These costs should be considered in long-term funding strategies that are designed to, at a minimum, maintain the current level of service.

Recommendations & Considerations

Financial Strategies

1. Review feasibility of adopting a full-funding scenario that achieve 100% of average annual requirements for the asset categories analyzed in this AMP. This involves:
 - a. implementing a 2.6% annual tax increase over a 15-year phase-in period and allocating the full increase in revenue toward tax-funded asset categories;
 - b. implementing a 1.4% rate increase for water over a 15-year phase-in period, and a 1.8% increase for wastewater over a 15-year phase-in period;
 - c. continued allocation of OCIF, CCBF, and Landfill Transfer funding as previously outlined in Table ;
 - d. using risk frameworks and staff judgement to prioritize projects, particularly to aid in elimination of existing infrastructure backlogs;

Although difficult to capture, inflation costs, supply chain issues, and fluctuations in commodity prices will also influence capital expenditures.

Better Asset Management Through Better Asset Data

1. Ensure the development of a centralized asset inventory, with a high level of data maturity and integrity, in the Citywide database in order to use database functionality and operationalize asset management.
2. Componentize water and wastewater facilities data using Uniformat II Code standard for building classifications. This can be accomplished during building condition assessments. This will improve long-term replacement projections and better align system-generated forecasts with capital budgets.
3. Continuously review, refine, and calibrate lifecycle and risk strategies to better reflect actual practices and improve capital projections. In particular:
 - a. the timing of various lifecycle events, the triggers for treatment, anticipated impacts of each treatment, and costs;
 - b. the various attributes used to estimate the likelihood and consequence of asset failures, and their respective weightings.
4. Asset management planning is highly sensitive to replacement costs. Periodically update replacement costs based on recent projects, invoices, or estimates, as well as condition assessments, or any other technical reports and studies. Material and labour costs can fluctuate due to local, regional, and broader market trends, and substantially so during major world events. As a result, accurately estimating the replacement cost of like-for-like assets can be challenging. Ideally, several recent projects over multiple years should be used. Staff judgement and historical data can help attenuate extreme and temporary fluctuations in cost estimates and keep them realistic.

5. Similar to replacement costs, an asset's established serviceable life can have dramatic impacts on all projections and analyses, including condition, long-range forecasting, and financial recommendations. Periodically reviewing and updating these values to better reflect in-field performance and staff judgement is recommended.

Risk and Levels of Service

1. Risk models and matrices can play an important role in identifying high-value assets, and developing an action plan which may include repair, rehabilitation, replacement, or further evaluation through condition assessments. As a result, project selection and the development of multi-year capital plans can become more strategic and objective. Initial models have been built into Citywide for all asset groups. These models reflect current data, which was limited. As the data evolves and new attribute information is obtained, these models should also be refined and updated.
2. Although Ontario Regulation 588/17 requires reporting on specific, prescribed KPIs for the Town's core assets, municipalities have discretion on the KPIs they select to track the performance of their non-core assets, such as buildings and vehicles. This information will be required for the 2024 iteration of the AMP. KPIs should be established for all non-core asset groups to support regulatory compliance. Further, as available, data on current performance should be centralized and tracked to support any calibration of service levels ahead of O. Reg's 2025 requirements on proposed levels of service.
3. Staff should monitor evolving local, regional, and environmental trends to identify factors that may shape the demand and delivery of infrastructure programs. These can include population growth, and the nature of population growth; climate change and extreme weather events; and economic conditions and the local tax base. This data can also be used to revise service level targets.

Appendix A: Infrastructure Report Card

The table below services as an infrastructure report card, providing the key data points from each asset category.

Table 50 - Core Infrastructure Report Card

Asset Category	Replacement Cost (millions)	Asset Condition	Financial Capacity	
Roads and Roadside	\$205	Good	Annual Requirement:	\$9,806,651
			Funding Available:	\$3,541,000
			Annual Deficit:	\$6,265,651
Bridges and Culverts	\$74	Fair	Annual Requirement:	\$1,615,165
			Funding Available:	\$569,000
			Annual Deficit:	\$1,046,165
Stormwater	\$65	Fair	Annual Requirement:	\$1,285,993
			Funding Available:	\$430,000
			Annual Deficit:	\$855,993
Water	\$163	Very Good	Annual Requirement:	\$2,618,458
			Funding Available:	\$1,963,000
			Annual Deficit:	\$655,458
Wastewater	\$114	Good	Annual Requirement:	\$2,049,622
			Funding Available:	\$666,000
			Annual Deficit:	\$1,383,622
Asset Portfolio	\$621	Good	Annual Requirement:	\$17,375,889
			Funding Available:	\$7,163,000
			Annual Deficit:	\$10,212,889

Appendix B: O. Reg. 588/17 Compliance

The following table identifies the requirements outlined in Ontario Regulation 588/17 for municipalities to meet for each of the 3 years.

Table 51 - Ontario Regulation 588/17 Compliance Snapshot

O. Reg. Requirement	2022 Compliance		2024 Compliance		2025 Compliance
	Core	Non-Core	Core	Non-Core	Core and Non-Core
1.0 Asset Inventory					
1.1 Asset Summary	Yes	N/A	Yes	No	No
1.2 Replacement Cost	Yes		Yes	No	No
1.3 Average Age	Yes		Yes	No	No
1.4 Condition	Yes		Yes	No	No
1.5 Condition Assessment Approach	Yes		Yes	No	No
2.0 Lifecycle Activities					
2.1 Identify Full Asset Lifecycle	Yes	N/A	Yes	No	No
2.2 Document Lifecycle Activities	Yes		Yes	No	No
2.3 Quantify Asset Risk	Yes		Yes	No	No
2.4 Lifecycle Cost Analysis	Yes		Yes	No	No
3.0 Growth					
3.1 Population and Economic assumptions	Yes	N/A	No	No	No
3.2 Document impact of growth on capital planning	N/A		No	No	No
4.0 Current Level of Service					
4.1 Define and document current LOS metrics	Yes	N/A	No	No	No
5.0 Proposed Level of Service					
5.1 Define Proposed LOS	N/A	N/A	N/A	N/A	No
5.2 Difference b/w Current and Proposed LOS					No
5.3 Required Lifecycle Activities and associated Risk					No
5.4 Achievability of Proposed LOS					No
5.5 Affordability of Proposed LOS					No
5.6 Lifecycle activities and risk associated with potential funding shortfall					No

Appendix C: Condition Assessment Guidelines

The foundation of good asset management practice is accurate and reliable data on the current condition of infrastructure. Assessing the condition of an asset at a single point in time allows staff to have a better understanding of the probability of asset failure due to deteriorating condition.

Condition data is vital to the development of data-driven asset management strategies. Without accurate and reliable asset data, there may be little confidence in asset management decision-making which can lead to premature asset failure, service disruption and suboptimal investment strategies. To prevent these outcomes, the Town's condition assessment strategy should outline several key considerations, including:

- The role of asset condition data in decision-making
- Guidelines for the collection of asset condition data
- A schedule for how regularly asset condition data should be collected

Role of Asset Condition Data

The goal of collecting asset condition data is to ensure that data is available to inform maintenance and renewal programs required to meet the desired level of service. Accurate and reliable condition data allows municipal staff to determine the remaining service life of assets, and identify the most cost-effective approach to deterioration, whether it involves extending the life of the asset through remedial efforts or determining that replacement is required to avoid asset failure.

In addition to the optimization of lifecycle management strategies, asset condition data also impacts the Town's risk management and financial strategies. Assessed condition is a key variable in the determination of an asset's probability of failure. With a strong understanding of the probability of failure across the entire asset portfolio, the Town can develop strategies to mitigate both the probability and consequences of asset failure and service disruption. Furthermore, with condition-based determinations of future capital expenditures, the Town can develop long-term financial strategies with higher accuracy and reliability.

Guidelines for Condition Assessment

Whether completed by external consultants or internal staff, condition assessments should be completed in a structured and repeatable fashion, according to consistent and objective assessment criteria. Without proper guidelines for the completion of condition assessments there can be little confidence in the validity of condition data and asset management strategies based on this data.

Condition assessments must include a quantitative or qualitative assessment of the current condition of the asset, collected according to specified condition rating criteria, in a format that can be used for asset management decision-making. As a result, it is important that staff adequately define the condition rating criteria that should be used and the assets that require a discrete condition rating. When engaging with external consultants to complete condition assessments, it is critical that these details are communicated as part of the contractual terms of the project. There are many options available to the Town to complete condition assessments. In some cases, external consultants may need to be engaged to complete detailed technical assessments of infrastructure. In other cases, internal staff may have sufficient expertise or training to complete condition assessments.

Developing a Condition Assessment Schedule

Condition assessments and general data collection can be both time-consuming and resource intensive. It is not necessarily an effective strategy to collect assessed condition data across the entire asset inventory. Instead, the Town should prioritize the collection of assessed condition data based on the anticipated value of this data in decision-making. The International Infrastructure Management Manual (IIMM) identifies four key criteria to consider when making this determination:

1. **Relevance:** every data item must have a direct influence on the output that is required
2. **Appropriateness:** the volume of data and the frequency of updating should align with the stage in the assets life and the service being provided
3. **Reliability:** the data should be sufficiently accurate, have sufficient spatial coverage and be appropriately complete and current
4. **Affordability:** the data should be affordable to collect and maintain