Asset Management Plan

Township of Hamilton

2021

This Asset Management Plan (AMP) was prepared by:

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

Overall Key Statistics

Replacement cost of asset portfolio
$207.8 million

Replacement cost of infrastructure per household
$44,000 (2021 Census)

Percentage of assets in fair or better condition
92%

Percentage of assets with assessed condition data
68%

Annual capital infrastructure deficit
$3.1 million

Recommended timeframe for eliminating annual infrastructure deficit
20 Years

Target reinvestment rate
2.78%

Actual reinvestment rate
1.26%

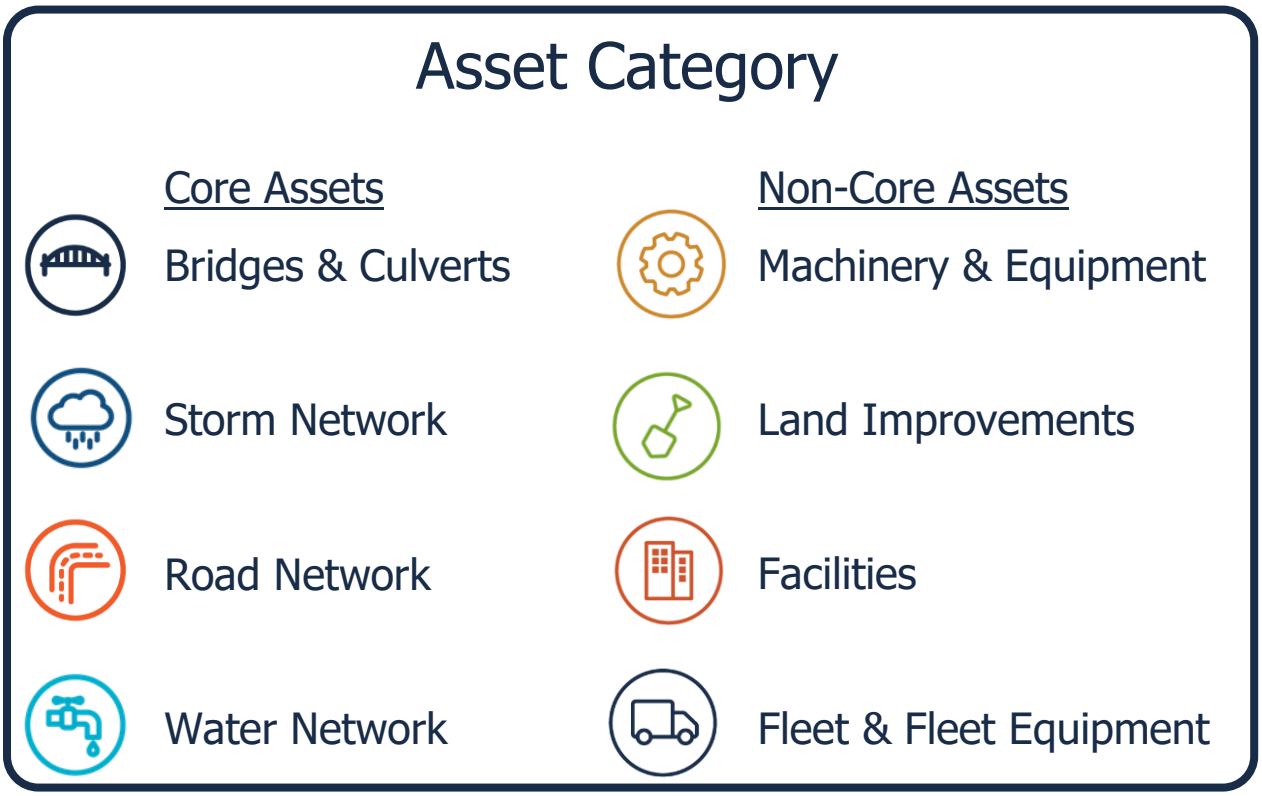
Executive Summary

Municipal infrastructure delivers critical services that are foundational to the economic, social, and environmental health and growth of a community. The goal of asset management is to deliver an adequate level of service in the most cost-effective manner. This involves the development and implementation of asset management strategies and long-term financial planning.

Scope

This Asset Management Plan (AMP) identifies the current practices and strategies that are in place to manage public infrastructure and makes recommendations where they can be further refined. Through the implementation of sound asset management strategies, the Township can ensure that public infrastructure is managed to support the sustainable delivery of municipal services.

This AMP include the following core and non-core asset categories:



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

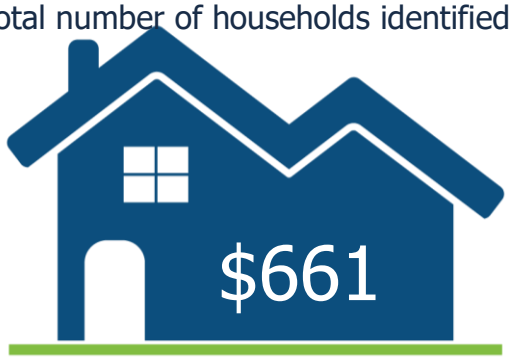
Findings

The overall replacement cost of the asset categories included in this AMP totals $207.8 million. Over 90% of all assets analysed in this AMP are in fair or better condition and assessed condition data was available for 68% of assets. For the remaining assets, assessed condition data was unavailable— a data gap that persists in most municipalities— and asset age was used to approximate condition. Generally, age misstates the true condition of assets, making condition assessments essential to effective asset management planning, and a recurring recommendation in this AMP.

The development of a long-term, sustainable financial plan requires an analysis of whole lifecycle costs. This AMP uses a combination of proactive lifecycle strategies (roads and bridges) and replacement only strategies to determine the lowest cost option to maintain the current level of service.

To meet capital replacement and rehabilitation needs for existing infrastructure, prevent infrastructure backlogs, and achieve long-term sustainability, the Township's average annual capital requirement totals $5.8 million. Based on a historical analysis of sustainable capital funding sources, the Township is committing approximately $2.61 million towards capital projects or reserves per year. As a result, there is currently an annual funding gap of $3.1 million. The Township of Hamilton is not alone in having an annual funding gap as this is a persistent issue among many municipalities across Canada. The illustration below portrays the annual capital increase required to maintain current levels of service per total number of households identified in the 2021 Canadian census.

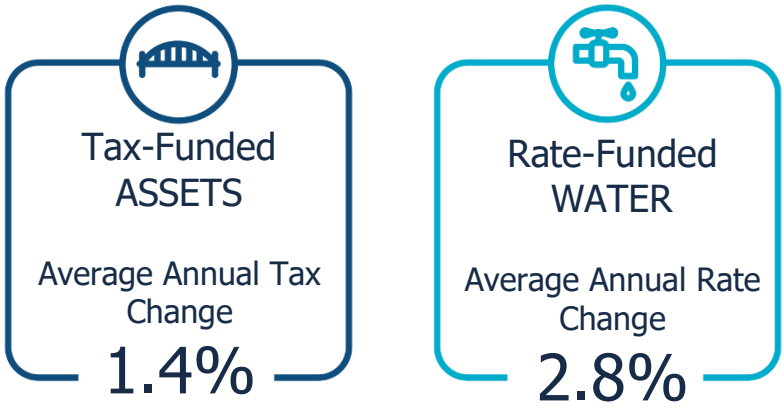
Annual Increase Per Household



It is important to note that this AMP represents a snapshot in time and is based on the best available processes, data, and information at the Township as of December 2021 (the data effective date). Strategic asset management planning is an ongoing and dynamic process that requires continuous improvement and dedicated resources.

Recommendations

A financial strategy was developed to address the annual capital funding gap. The following graphics shows annual tax/rate change required to eliminate the Township's infrastructure deficit based on a 20-year plan for Tax-Funded Assets and a 20-year plan for Rate-Funded Water Assets:



Recommendations to guide continuous refinement of the Township's asset management program. These include:

- Regularly review and update data to maintain a complete and accurate dataset. When procuring external studies on assets ensure there is clear reference to the Asset ID for ease of upload to the asset management software.
- Review the internal condition assessment process across all asset categories to ensure that condition parameters, considerations, and procedures are appropriate for each asset category, well-documented and uniformly applied.
- Review capital budgets for their appropriateness for the near and long-term based on confirmed asset requirements. Using long-term capital forecasting tools can assist the Municipality in determining required taxation rates and reserve fund contributions. Such financial planning strategies can assist in more phased in and sustainable revenue collection that enables asset interventions to occur when needed.
- Regularly evaluate lifecycle events and their associated schedule and costs. Such review may identify interventions identified in reports but not recorded in the asset management software and/or interventions that are not optimally scheduled (i.e., occur earlier or later than necessary) and could be adjusted so that asset life is extended for the lowest total cost.
- Measure and review current levels of service and begin to identify resourcing to support current level of service reporting and determination of proposed levels of service.

1 Introduction & Context

Key Insights

- The goal of asset management is to minimize the lifecycle costs of delivering infrastructure services, manage the associated risks, while maximizing the value ratepayers receive from the asset portfolio.

- The Township's asset management policy provides clear direction to staff on their roles and responsibilities regarding asset management.

- An asset management plan is a living document that should be updated regularly to inform long-term planning.

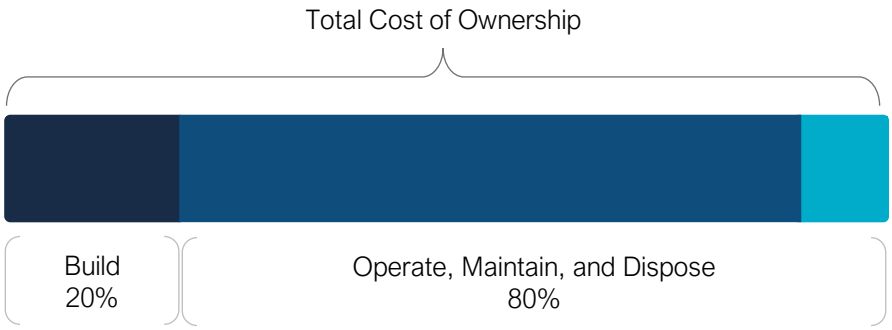
- Ontario Regulation 588/17 outlines several key milestone and requirements for asset management plans in Ontario between July 1, 2022, and 2025

1.1 An 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 ratepayers receive from the asset portfolio.

Managing assets involves various activities beginning with asset acquisition, transitioning to asset maintenance and rehabilitation decisions, and ending with disposal decisions.

The acquisition of infrastructure assets typically accounts for about 10-20% of their total cost of ownership. The remaining 80-90% of ownership costs are usually related to the asset's operations and maintenance. This AMP focuses its analysis on the capital costs which commonly represent rehabilitation and replacement of existing municipal infrastructure assets.



Asset lifecycle cost costs can (and often do) 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.

1.1.1 Asset Management Policy

An asset management policy represents a statement of the principles guiding the Township'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.

In March 2019, the Township adopted a Strategic Asset Management Policy in accordance with Ontario Regulation 588/17. The policy provides leadership and commitment to the development and implementation of the Township's asset management program to facilitate logical and evidence-based decision-making. It identifies the importance of linking service outcomes to infrastructure investment decisions to enable service focused rather than budget-driven asset management approaches. It also advances 13 principles for asset management decisions, including:

- Infrastructure planning and investment should take a *long-term view*, and decisionmakers should consider the needs of citizens by being mindful of, among other things, demographic, and economic trends.
- Infrastructure planning and investment should consider any *applicable budgets or fiscal plans*.
- Infrastructure planning and investment should *foster innovation* by creating opportunities to make use of innovative technologies, services and practices, particularly where doing so would utilize technology, techniques and practices developed in Ontario.

1.1.2 Alignment with Strategic Plan

The Township adopted a Strategic Plan on July 16th, 2019. The purpose of a Strategic Plan is to guide the decisions and actions of Council and the municipal administration in a way that will shape the direction of the community and be attuned to the needs of the Township's residents and businesses. The Strategic Plan has a major influence on the Township's course of action over a four-to-six-year period.

The Strategic Plan cites the following Vision and Mission Statements:

Vision: "Hamilton Township – making life better by supporting and enhancing a safe, healthy and active community."

Mission: "To provide professional, effective and efficient services within a collaborative governance model to promote the social and economic development of our community while creating an active and safe environment."

Council and staff identified four **major pillars** that need to be addressed to meet the Township's Vision and Mission Statements while supporting its core values:

1 Effective Governance: To deliver efficient and cost-effective governance in a timely manner through leadership and respect—administer with an unbiased view.
2 Environment: To provide sustainable growth while protecting the natural features of the Township.
3 Physical Assets: To acquire and maintain necessities used to provide services to the Township.
4 Recreation, Culture, and Social Well-being: To promote a social & healthy environment made available for a wide variety of activities in clean, efficient, functional facilities and parks.

The four pillars are supported directly (i.e., Physical Asset) or indirectly through the development of an asset management plan.

1.1.3 Asset Management Plan

The asset management plan (AMP) presents the outcomes of the Township's asset management program and identifies the resource requirements to maintain the current asset inventory. The AMP typically includes the following content:

- State of Infrastructure
- Asset Management Strategies
- Levels of Service
- Financial Strategies

The AMP is a living document that should be updated regularly as additional asset and financial data becomes available. This will allow the Township to re-evaluate the state of infrastructure and identify how the organization's asset management and financial strategies are progressing.

1.2 Key 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.

1.2.1 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.

Lifecycle Activity	Description	Example	Cost
Maintenance	Activities that prevent defects or deteriorations from occurring	Oil Change (Heavy Equipment) Crack Seal (Roads)	$
Rehabilitation/ Renewal	Activities that rectify defects or deficiencies that are already present and may be affecting asset performance	Engine Rebuild (Heavy Equipment) Mill & Resurface (Roads)	$$
Replacement/ Reconstruction	Asset end-of-life activities that often involve the complete replacement of assets	Full Reconstruction	$$$

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.

The Township'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.

1.2.2 Risk Management Strategies

Municipalities generally take a 'worst-first' approach to infrastructure spending. Rather than prioritizing assets based on their importance to service delivery, assets in the worst condition are fixed first, regardless of their criticality. However, not all assets are created equal. Some are more important than others, and their failure or disrepair poses more risk to the community than that of others. For example, a road with a high volume of traffic that provides access to critical services poses a higher risk than a low volume rural road. These high-value assets should receive funding before others.

By identifying the various impacts of asset failure and the likelihood that it will fail, risk management strategies can identify critical assets, and determine where maintenance efforts, and spending, should be focused.

This AMP includes a high-level 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.

1.2.3 Levels of Service

A level of service (LOS) is a measure of what the Township is providing to the community and the nature and quality of that service. 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.

These measures include a combination of those that have been outlined in O. Reg. 588/17 in addition to performance measures identified by the Township as worth measuring and evaluating. The Township measures the level of service provided at two levels: Community Levels of Service, and Technical Levels of Service.

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 (Roads, Bridges & Culverts, Water, Stormwater) the province, through O. Reg. 588/17, has provided qualitative descriptions that are required to be included in this AMP. For non-core asset categories, the Township has determined the qualitative descriptions that will be used to determine the community level of service provided. These descriptions can be found in the Levels of Service subsection within each asset category.

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 Township's asset management strategies on the physical condition of assets or the quality/capacity of the services they provide.

For core asset categories (Roads, Bridges & Culverts, Water, Stormwater) the province, through O. Reg. 588/17, has provided technical metrics that are required to be included in this AMP. For non-core asset categories, the Township has selected the technical Level of Service metrics.

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, and by the 2025 deadline, the Township 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 Township. 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, the Township must identify a lifecycle management and financial strategy which allows these targets to be achieved.

1.3 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 (O. Reg 588/17). Along with creating better performing organizations, more liveable 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.

The diagram below outlines key reporting requirements under O. Reg 588/17 and the associated timelines.

2019

Strategic Asset Management Policy

2022

Asset Management Plan for Core Assets with the following components:

1. Current levels of service
2. Inventory analysis
3. Lifecycle activities to sustain LOS.
4. Cost of lifecycle activities
5. Population and employment forecasts
6. Discussion of growth impacts

2024

Asset Management Plan for Core and Non-Core Assets

2025

Asset Management Policy Update and an Asset Management Plan for All Assets with the following additional components:

1. Proposed levels of service for next 10 years
2. Updated inventory analysis
3. Lifecycle management strategy
4. Financial strategy and addressing shortfalls.
5. Discussion of how growth assumptions impacted lifecycle and financial.

1.3.1 O. Reg. 588/17 Compliance Review

The following table identifies the requirements outlined in Ontario Regulation 588/17 for municipalities to meet by July 1, 2024. Next to each requirement a page or section reference is included in addition to any necessary commentary.

Requirement	O. Reg. Section	AMP Section
Summary of assets in each category	S.5(2), 3(i)	4.1.1 - 5.1.1
Replacement cost of assets in each category	S.5(2), 3(ii)	4.1.1 - 5.1.1
Average age of assets in each category	S.5(2), 3(iii)	4.1.3 - 5.1.3
Condition of core assets in each category	S.5(2), 3(iv)	4.1.2 – 5.1.2
Description of Township's approach to assessing the condition of assets in each category	S.5(2), 3(v)	4.1.2 – 5.1.2
Current levels of service in each category	S.5(2), 1(i-ii)	4.1.6 - 5.1.6
Current performance measures in each category	S.5(2), 2	4.1.6 - 5.1.6
Lifecycle activities needed to maintain current levels of service for 10 years	S.5(2), 4	4.1.4 - 5.1.4
Costs of providing lifecycle activities for 10 years	S.5(2), 4	Appendix B
Risks associated with lifecycle activities to maintain current levels of service	S.5(2), 4(iii)	4.1.1 - 5.1.
Growth assumptions	S.5(2), 5(i-ii) S.5(2), 6(i-vi)	6.1-6.2
AMP is publicly available	S.10	Pending
AMP is approved by Council	S.8 (b)	Pending
AMP is endorsed by executive lead at the Township	S.8 (a)	Pending

2 Scope and Methodology

Key Insights

- This asset management plan includes eight (8) asset categories and is divided between tax-funded and rate-funded categories.

- The source and recency of replacement costs impacts the accuracy and reliability of asset portfolio valuation.

- 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.

2.1 Asset Categories Included in this AMP

This asset management plan for the Township of Hamilton is produced in compliance with Ontario Regulation 588/17. The July 2024 deadline under the regulation—the second of three AMPs—requires analysis of core and non-core asset categories.

The AMP summarizes the state of the infrastructure for the Township's asset portfolio, establishes current levels of service and the associated technical and customer-oriented key metrics, outlines lifecycle strategies for optimal asset management and performance, and provides financial strategies to reach sustainability for the asset categories listed below.

Asset Category	Source of Funding
Road Network	Tax Levy
Bridges & Culverts	
Stormwater Network	
Facilities	
Fleet & Fleet Equipment	
Machinery & Equipment	
Land Improvements	
Water Network	User Rates

In this report, asset information is reported in a two-tier hierarchy: the category and segment level. Asset categories are the first tier of categorization and are based on the general function of the asset. Asset segments are the second tier of categorization and are typically grouped by similar function and/or department; this structure provides a more detailed and tailored level of analysis. As an example, the road network category and segment are detailed below:

Asset Category	Segment
Road Network	Curb & Gutter
	Guard Rails
	Paved Roads LCB
	Paved Roads HCB
	Small Culverts
	Streetlights

As per O. Reg. 588/17 requirements, assets reported must meet the municipality's Tangible Capital Asset (TCA) Policy threshold amounts. A municipality may have some smaller equipment, furnishings, or other built components that serve important functions but do not meet the TCA threshold amount and are therefore excluded from asset management reporting. For example, walking trails serve important functions but in some cases may not meet the TCA threshold and are therefore not included in the AMP.

2.2 Deriving Replacement Costs

There are a range of methods to determine the replacement cost of an asset, and some are more accurate and reliable than others. This AMP relies on two methodologies:

- **User-Defined Cost and Cost/Unit**: Based on costs provided by municipal staff which could include average costs from recent contracts; data from engineering reports and assessments; staff estimates based on knowledge and experience.
- **Cost Inflation/CPI Tables**: Historical cost of the asset is inflated based on Consumer Price Index or Non-Residential Building Construction Price Index

User-defined costs based on reliable sources are a reasonably accurate and reliable way to determine asset replacement costs. Cost inflation is typically used in the absence of reliable replacement cost data. It is a reliable method for recently purchased and/or constructed assets where the total cost is reflective of the actual costs that the Township incurred. As assets age, and new products and technologies become available, cost inflation becomes a less reliable method.

2.3 Data Effective Date

It is important to note that this report is based on ***data as of December 2021***; therefore, it represents a snapshot in time using the best available processes, data, and information at the Municipality. Strategic asset management planning is an ongoing and dynamic process that requires continuous data updates and dedicated data management resources. Future updates to asset information including replacement cost, condition, and planned capital events will be needed.

2.4 Estimated Useful Life

The estimated useful life (EUL) of an asset is the period over which the Township expects the asset to be available for use and remain in service before requiring replacement or disposal. The EUL for each asset in this AMP was assigned according to

the knowledge and expertise of municipal staff and supplemented by existing industry standards when necessary.

2.5 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 capital reinvestment rate is a measurement of available or required funding relative to the total replacement cost.

By comparing the actual vs. target reinvestment rate the Township can determine the extent of any existing funding gap. The reinvestment rate is calculated as follows:

$$Target\ Reinvestment\ Rate = \frac{Annual\ Capital\ Requirement}{Total\ Replacement\ Cost}$$

$$Actual\ Reinvestment\ Rate = \frac{Annual\ Capital\ Funding}{Total\ Replacement\ Cost}$$

2.6 Average Annual Requirement

This is the average amount of annual capital investment that is required. It accounts for all capital investments which may include asset rehabilitation activities. It is calculated by determining the total investment required over the life of an asset and then dividing this amount by the assets EUL. Average Annual requirement is most often reported at the category level; in this case, it is based on the total capital investment requirements over the life of all assets within the respective asset category.

2.7 Deriving 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 Township'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.

Condition	Description	Criteria	Service Life Remaining (%)
Very Good	Fit for the future	Well maintained, good condition, new or recently rehabilitated	80-100
Good	Adequate for now	Acceptable, generally approaching mid-stage of expected service life	60-80
Fair	Requires attention	Signs of deterioration, some elements exhibit significant deficiencies	40-60
Poor	Increasing potential of affecting service	Approaching end of service life, condition below standard, large portion of system exhibits significant deterioration	20-40
Very Poor	Unfit for sustained service	Near or beyond expected service life, widespread signs of advanced deterioration, some assets may be unusable	0-20

The analysis in this AMP is based on assessed condition data only as available. In the absence of assessed condition data, asset age is used as a proxy to determine asset condition. Appendix C includes additional information on the role of asset condition data and provides basic guidelines for the development of a condition assessment program.

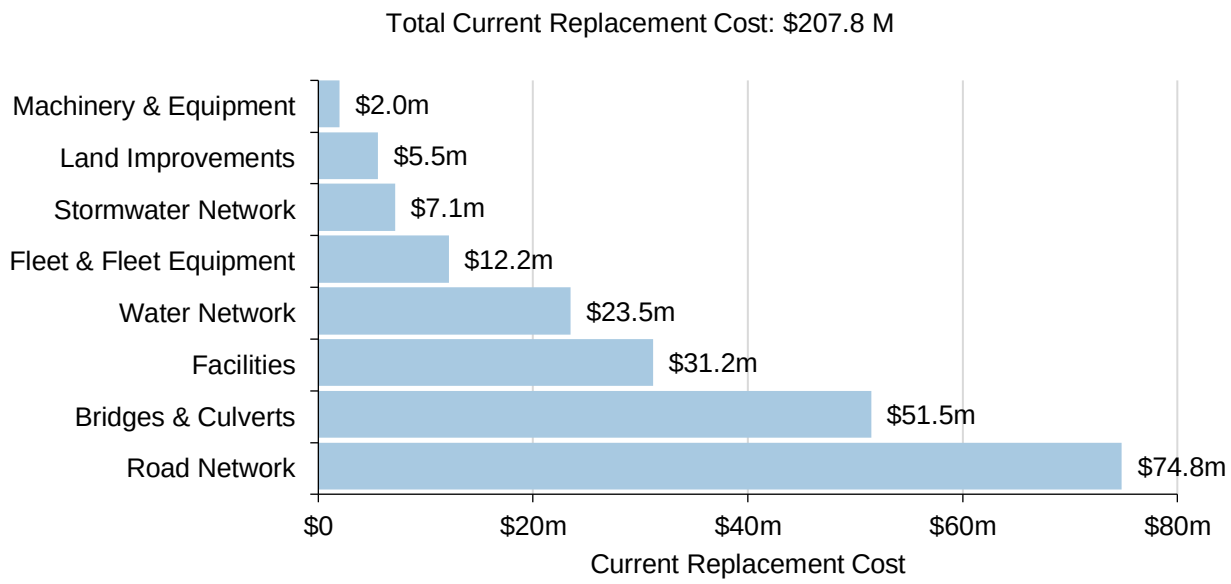
3 Portfolio Overview

Key Insights

- The total replacement cost of the Township's core asset portfolio is $207.8 million.
- The Township's target re-investment rate is 2.78%, and the actual re-investment rate is 1.26%, contributing to an expanding infrastructure deficit.
- 92% of all assets are in fair or better condition.
- Average annual capital requirements total $5.8 million per year across all assets.

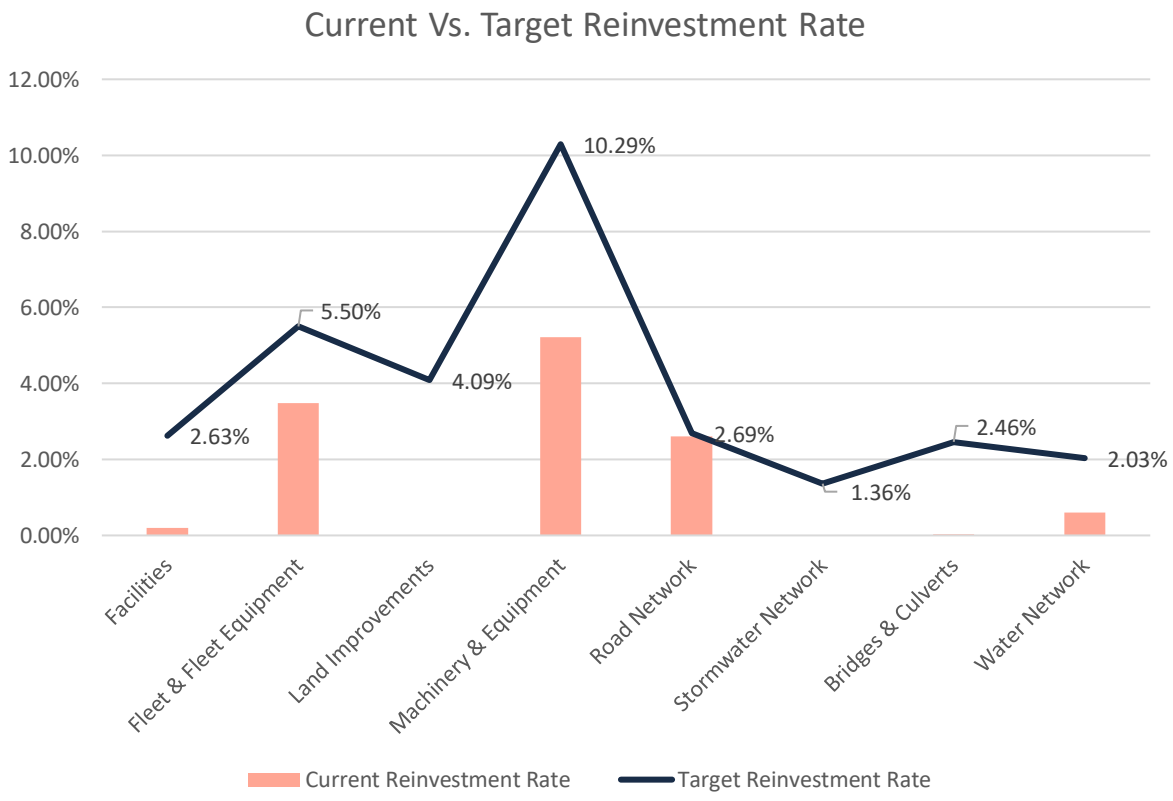
3.1 Total Replacement Cost of Asset Portfolio

The asset categories analysed in this AMP have a total replacement cost of $207.8 million based on inventory data from 2021. This total was determined based on a combination of user-defined costs and historical cost inflation. This estimate reflects replacement of historical assets with similar, not necessarily identical, assets available for procurement today.



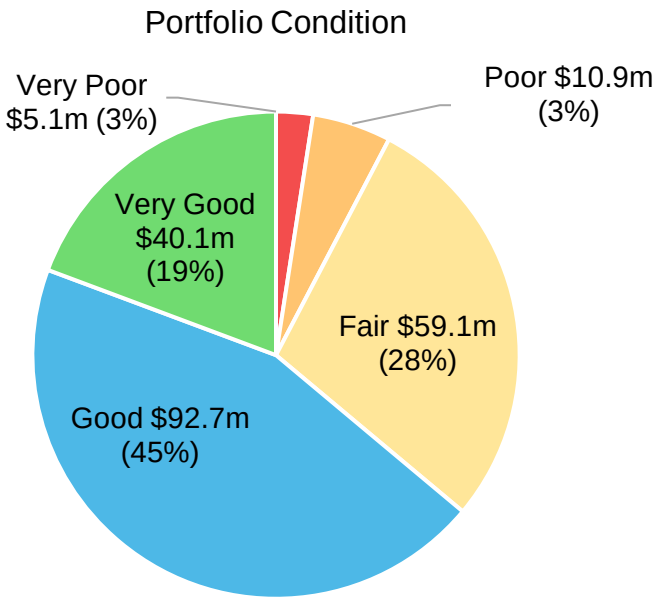
3.2 Target vs. Actual Reinvestment Rate

The graph below depicts funding gaps by comparing the target to the current reinvestment rate. To meet the existing long-term capital requirements, the Township requires an annual capital investment of $5.8 million, for a target portfolio reinvestment rate of 2.78%. Currently, annual investment from sustainable revenue source is $2.61 million, for a current portfolio reinvestment rate of 1.26%. Target and current re-investment rates by asset category are detailed below.



3.3 Condition of Asset Portfolio

The current condition of the assets is central to all asset management planning. Collectively, 92% of assets in Hamilton are in fair or better condition. This estimate relies on both age-based and field condition data. The following pie chart summarizes the condition of all assets in the portfolio as of the data effective date.



This AMP relies on assessed condition data for 68% of assets; for the remaining portfolio, asset age and estimated useful life 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.

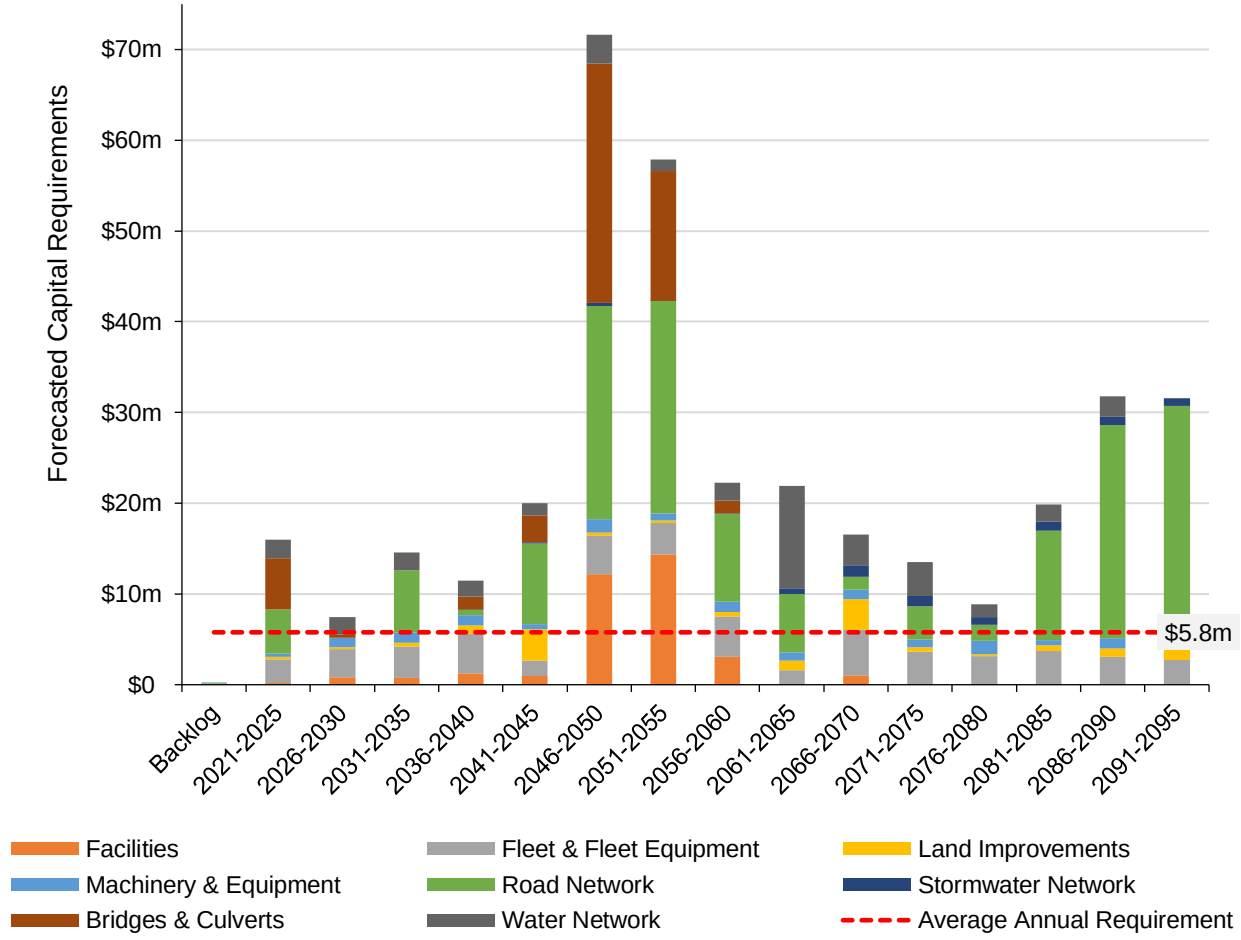
Asset Category	Asset Segment	% of Assets with Assessed Condition[1]	Source of Condition Data
Road Network	All	91%	2019 Road Appraisals
Bridges & Culverts	All	100%	2020/2021 OSIM Report
Stormwater Network	All	4%	Staff Assessments
Water Network	All	57%	2020 Water Systems Capital Needs Assessment Report
Facilities	All	100%	Staff Assessments
Land Improvements	All	96%	Staff Assessments
Machinery & Equipment	All	93%	Staff Assessments
Fleet & fleet Equipment	All	100%	Staff Assessments

[1] In the absence of physical inspection, staff expertise was used to provide condition assessment, where possible.

3.4 Forecasted Capital Requirements

The development of a long-term capital forecast should include both asset rehabilitation and replacement requirements. With the development of asset-specific lifecycle strategies that include the timing and cost of future capital events, the Township can produce an accurate long-term capital forecast.

The following graph identifies capital requirements until 2095. This projection is used as it ensures that every asset has gone through at least one full iteration of replacement. The forecasted requirements are aggregated into 5-year bins and the trend line represents the average annual capital requirements.



4 Analysis of Tax-funded Assets

Key Insights

- Overall, tax-funded assets are valued with a total replacement cost of $184.3 million.
- 94% of tax-funded assets are in fair or better condition.
- The average annual capital requirement to sustain the current level of service for tax-funded assets is approximately $5.3 million.
- Critical assets should be evaluated to determine appropriate risk mitigation activities and treatment options.

4.1 Road Network

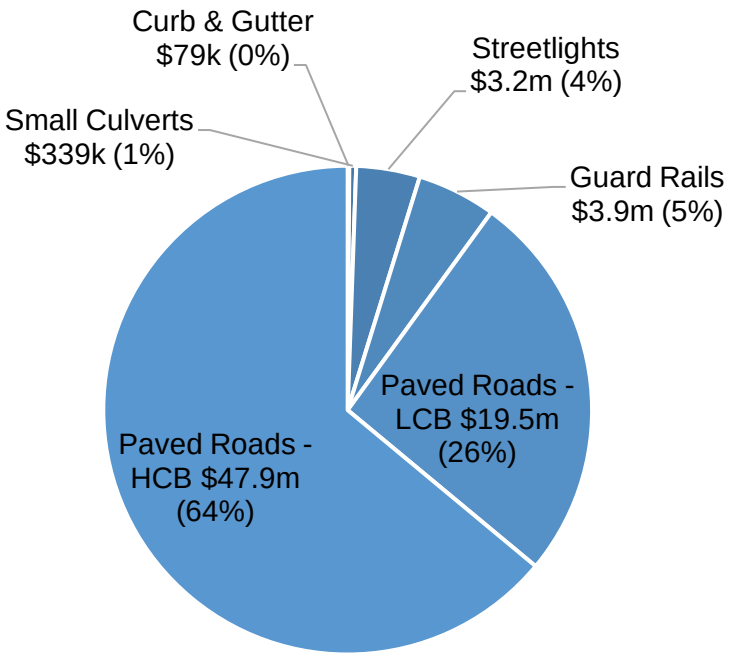
The Road Network is a critical component of the provision of safe and efficient transportation services and represents the highest value asset category in the Township's asset portfolio. The Township is responsible for the operations and capital upkeep of road network assets. Primarily this consists of paved roads, but also includes other roadside supportive infrastructure like streetlights, guard rails, curbs and gutters, and roadside culverts. The paved roads are broken into two categories: High Class Bituminous (HCB)—asphalt roads—and Low Class Bituminous (LCB)—surface treated roads. The Township's road network assets are maintained by the Public Works department.

4.1.1 Asset Inventory & Replacement Cost

The Township's road network assets are recorded in an asset management software system. The following table provides asset summary information.

Asset Segment	Quantity	Replacement Cost
Curb & Gutter	0.9 KM	$79,000
Guard Rails	9 KM	$3,908,000
Paved Roads - HCB	115 KM	$47,871,000
Paved Roads - LCB	146 KM	$19,482,000
Small Culverts	10 Assets	$339,000
Streetlights	407 Assets	$3,154,000
Unpaved Roads	32 KM	Not Planned for Replacement[2]
Total		**$74,834,000**

[2] Gravel roads undergo perpetual operating and maintenance activities. If maintained properly, they can theoretically have a limitless service life. Since this asset is not funded by capital dollars it is not included.



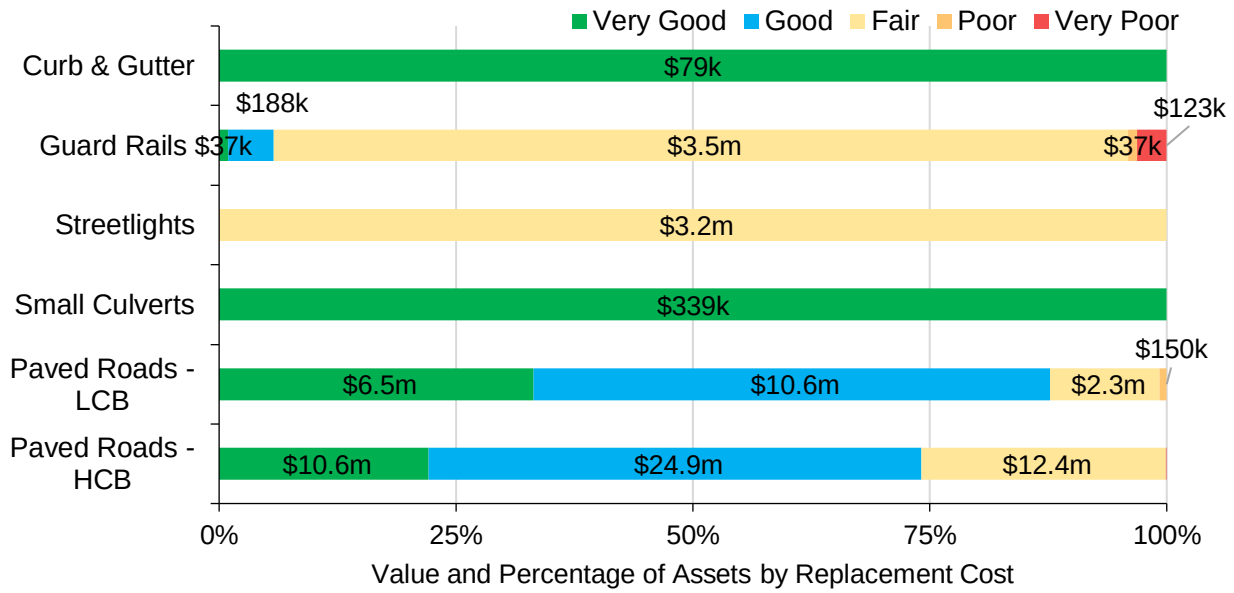
Total Current Replacement Cost: $74,834,000

Each asset's replacement cost should be reviewed periodically to determine whether adjustments are needed to more accurate represent realistic capital requirements.

4.1.2 Asset Data: Useful Life, Age & Condition

The table below identifies the average condition, estimated useful life and age for each road network segment. The Average Condition (%) is a weighted value based on replacement cost.

Asset Segment	Quantity	Average Age (Years)	Replacement Cost
Curb & Gutter	0.9 KM	2	$79,000
Guard Rails	9 KM	11	$3,908,000
Paved Roads – HCB	115 KM	22	$47,871,000
Paved Roads – LCB	146 KM	20	$19,482,000
Small Culverts	10 Assets	4	$339,000
Streetlights	407 Assets	12	$3,154,000
Unpaved Roads	32 KM	19	Not Planned for Replacement[3]
Total		**18.75**	**$74,834,000**



As indicated by the graph above, most road network assets are in fair or better condition. Condition information is more reliable for some asset classes than others. For example, streetlights and curb and gutters are represented by one pooled asset and

[3] Unpaved road (i.e., gravel) undergo perpetual operating and maintenance activities. If maintained properly, they can theoretically have a limitless service life. Since this asset is not funded by capital dollars it is not included.

condition is based on the pooled assets age relative to its expected service life. However, within the pool of assets, there is some level of condition variation. Conversely, paved road assets (which represent most of the segment's value) have very reliable assessed condition information based on a rigorous Road Needs Study.

To ensure that the Township's road network continue to provide an acceptable level of service, the condition of all assets would benefit from regular monitoring. If the average condition declines, staff should re-evaluate their lifecycle management strategy to determine what combination of maintenance, rehabilitation, and replacement activities is required to increase the overall condition of the Roads.

Each asset's Estimated Useful Life should also be reviewed periodically to determine whether adjustments need to be made to better align with the observed length of service life for each asset type.

Current Approach to Condition Assessment

Accurate and reliable condition data supports more accurate estimation of asset's remaining service life of assets. The following describes the Township's current approach:

- A Road Needs Study was completed in 2019 that included a detailed assessment of the condition of each road segment and a prioritized listing of all the maintenance, rehabilitation, and/or replacement needs.
- Condition results from the 2019 Road Needs Study have been projected to 2021. In instances where roads have been rehabilitated since the 2019 Road Needs Study, assessed condition is updated and based on staff assessments.
- Overall, 92% of assets (weighted by replacement value) were assessed for condition.
- Staff perform internal inspections of the roads and other roadside appurtenances during their road patrols to ensure compliance with Minimum Maintenance Standards (MMS)

In this AMP the following rating scale is used to determine the current condition of paved road segments (HCB and LCB) and forecast future capital requirements:

Condition	Rating
Very Good	8.1-10
Good	6.1-8
Fair	4.1-6
Poor	2.1-4
Very Poor	0-2

All other road assets use the following condition rating scale to determine current condition and forecast future capital requirement:

Condition	Rating
Very Good	100 or less
Good	80 or less
Fair	60 or less
Poor	40 or less
Very Poor	20 or less

4.1.3 Lifecycle Management Strategy

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. 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.

The following describes the current lifecycle activities that are typically conducted on road network assets.

Event Class	Description
Maintenance & Testing	• Sign reflectivity testing is performed annually in accordance with Minimum Maintenance Standards (MMS) Regulation 239/02 • Route and Seal, Slurry Seals, Micro-surfacing, and Pothole Patching maintenance activities are performed on an as-needed basis and in coordination with the County, where applicable. • The Municipality carries out road shouldering on an annual basis to re-gravel the shoulders and maintain the structural integrity of the road by preventing cracks originating from the sides. • The Municipality conducts several seasonal maintenance activities. Summer maintenance activities include ditching and clearing, grading, re-gravelling, dust control, and line painting. Winter maintenance activities include snow plowing and salting.
Rehabilitation	• Rehabilitation activities such as Pulverize & Pave, Mill & Overlay, Single Surface Treatment, and Double Surface Treatment are performed proactively to extend the life of the road surface until the road base requires full reconstruction also. Staff follow the strategies outlined within the 2019 Road Needs Study and supplement it with their own expertise.
Replacement	• Major road repair and reconstruction are prioritized by pavement condition, traffic volume, public input, recommendations from 2019 Road Needs Study, and staff judgement. • Asset replacements are coordinated with other underground assets renewal whenever reasonably possible.

Recommended Capital Rehabilitations

The 2019 Roads Need Study contained several asset rehabilitation recommendations tailored to specific roads, primarily based on their condition and traffic rating. Where Road Need Study recommendations could be attributed to an asset in the asset management software scheduled lifecycle activities were appended to each asset and incorporated into forecasted capital requirements. Costs are based on values provided by the 2019 study with inflationary adjustment to 2021. A general description of the lifecycle activities and their estimated impact are as follows:

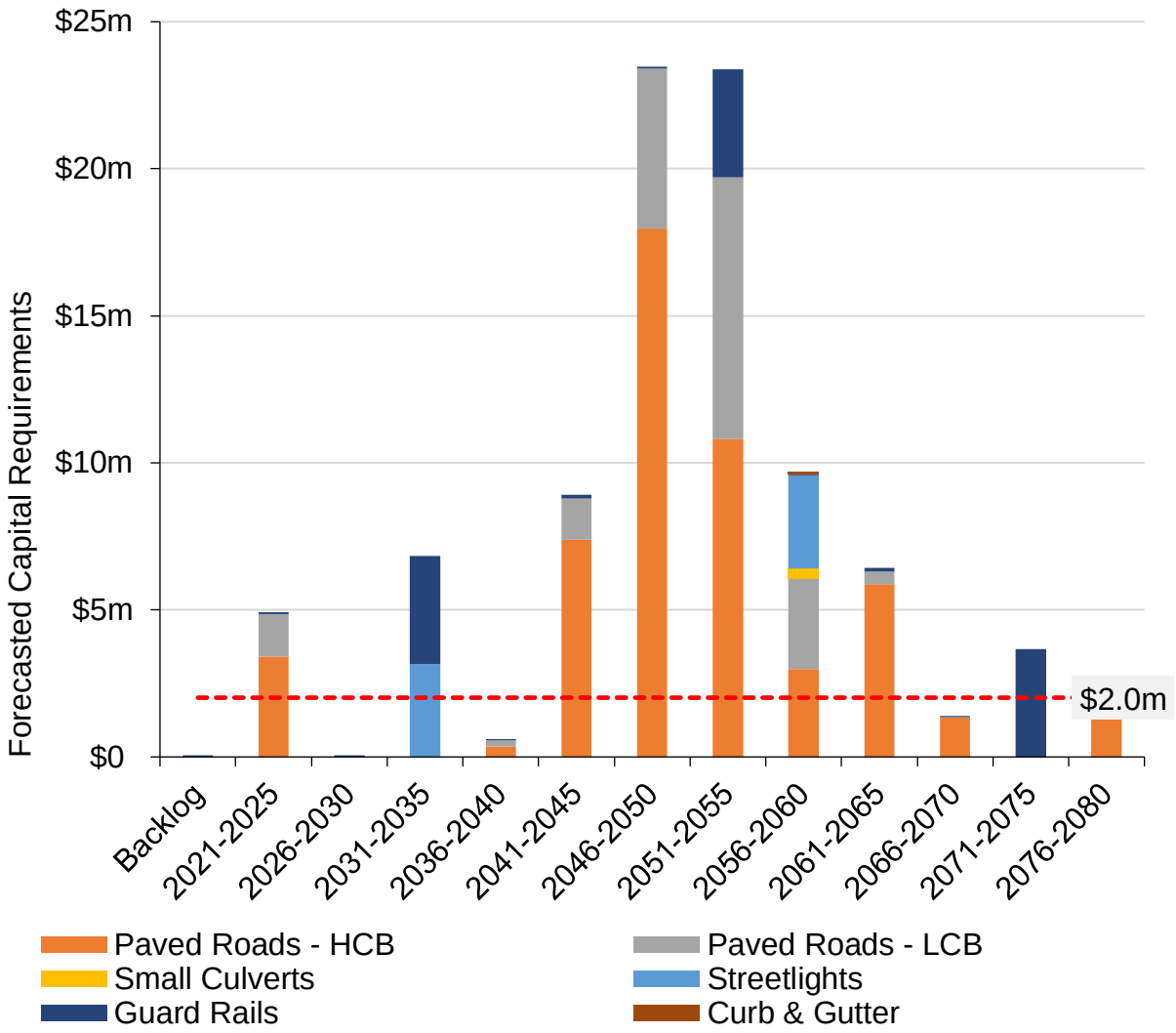
Surface Type	Intervention	Years Added (Impact)
LCB	• Double Surface Treatment	5
	• Single Surface Treatment	3
	• PP1 - Pulverize and Pave 1 Lift	8
HCB	• PP1 - Pulverize and Pave 1 Lift	20
	• Recon 1R - Full Reconstruction + 1 Lift	30

4.1.4 Forecasted Capital Requirements

Over the next 60 years, every existing road network asset will require rehabilitation (as described above) and/or replacement. This period was determined based on assets scheduled replacement and rehabilitation dates. Over this period, the total average annual capital requirement is $2,016,000. This is detailed by asset category in the table below and represents the average capital requirement per year, by asset category and cumulatively for the road network.

Asset Segment	Average Annual Capital Requirement
Guard Rails	$195,000
Paved Roads - HCB	$1,197,000
Paved Roads - LCB	$487,000
Small Culverts	$8,000
Streetlights	$126,000
Curb & Gutter	$2,000
Total	**$2,016,000**

Based on the identified lifecycle strategies for paved roads, and assuming the end-of-life replacement of all other assets in this category, the chart below summarizes the forecasted capital requirements by 5-year period and by asset segment.



As reflected above, capital requirements fluctuate over time, spiking significantly between 2046-2055. Most capital requirements are for HCB paved roads, followed by LCB roads. This is mostly due to the fact the HCB and LCB roads represent 90% of the road networks total replacement value. On an average annual basis, the road network requires a capital investment of $2.0 million, as represented by the red trend line.

The projected cost of lifecycle activities that will need to be undertaken over the next 10 years to maintain the current level of service can be found in Appendix B.

4.1.5 Risk & Criticality

For paved road assets (segments: Paved Roads – HCB, Paved Roads - LCB) risk is quantified based on the following probability and consequence of failure attributes and the corresponding model weight, as indicated in brackets.

Probability of Failure (PoF)	Consequence of Failure (CoF)
Condition (100%)	Replacement Cost (50%)
	Number of Lanes (25%)
	Road Class (25%)

For all other road network assets, risk is quantified based on the following probability and consequence of failure attributes and the corresponding model weight, as indicated in brackets.

Probability of Failure (PoF)	Consequence of Failure (CoF)
Condition (100%)	Replacement Cost (50%)

The following table summarizes probability and consequence of failure scores and overall risk score by asset segment. All reported figures are weighted by replacement value:

Asset Segment	PoF	CoF	Risk Rating
Curb & Gutter	1 / 5	1 / 5	1 / 25
Guard Rails	3.01 / 5	1.14 / 5	3.4 / 25
Paved Roads - HCB	2.04 / 5	3.73 / 5	7.49 / 25
Paved Roads - LCB	1.8 / 5	3.4 / 5	5.98 / 25
Small Culverts	1 / 5	1 / 5	1 / 25
Streetlights	3 / 5	5 / 5	15 / 25
Total	**2.06 / 5**	**3.55 / 5**	**7.17 / 25**

To gain a more detailed overview of risk distribution, we can also review a risk matrix which plots each asset's probability and consequence of failure and overall risk. This can better illustrate risk distribution and associated replacement costs.
In the matrix below risk scores for paved roads are illustrated. On the vertical axis is the consequence of failure and on the horizontal axis is the probability of failure. Each

asset's respective probability and consequence of failure score determines where it is plotted. For example, if its probability and consequence of failure are both 1, then its risk score is also 1 and it is located on the most bottom left box.

Taking a broader look at the table we can see that most paved road assets carry low risk (green boxes) with a small proportion carrying moderate risk (blue and yellow) and the remaining carry moderate to high risks (orange and red).

Risk Matrix: Paved Roads

The matrix below reports on risk for all other road network assets. Similarly, we can see that most asset carry a low risk (green boxes) since they have a low probability and/or consequence of failure. Some assets carry low or moderate risks (blue and yellow boxes), and one asset carries high risk (red box).

Matrix: Road Network Assets (Excluding Paved Roads)

This is a high-level model developed for the purposes of this AMP. As with any model, regular review and adjustment of the model is recommended. Such review should consider if there are any changes to the parameters that best indicate the probability and/or consequence of failure, or the asset data available to use for the risk model, alongside any regulatory or strategic changes that may affect the consequences of asset failure.

Risk scores can be an excellent tool to identify critical assets and determine appropriate risk treatment options based on the Township's risk appetite. Risk treatment may include asset-specific lifecycle interventions (i.e., double surface treatment), increased asset monitoring, or simply the need to collect better asset data. Please refer to Appendix A for an overview of risk specific terms, including risk appetite and risk treatment. Please refer to Appendix C for a detailed overview of the criteria used to determine the risk rating of each asset.

Qualitative Risks

Qualitative risks were identified through an interview-based discussion with Township staff. Through this exercise, the following risks were identified as relevant to the road network.

Fiscal Capacity

The present level of financial reinvestment does not adequately address maintenance and capital rehabilitation requirements to ensure municipal assets remain in an adequate state of repair and achieve their intended service life. Bridging the capital deficit is a constant challenge due to the small tax base of the Township and public pressures to not increase taxes. This challenging position may negatively impact service delivery and quality.

Based on a projection of the latest road condition assessment conducted by an external contractor, the Township's road assets are typically in fair or better condition. Staff expressed concern that the current level of financial reinvestment is insufficient. This sentiment is supported by the discrepancy between the average annual capital requirement of $2.1 million and historical (2019, 2020) and budgeted (2021) capital spending of $1.9 million. The funding deficit means that the infrastructure backlog will increase over time and the level of financial reinvestment will become increasingly insufficient. To maintain levels of service and ensure adequate condition of the road network, the capital deficit must be addressed.

Climate Change

An increase in the frequency and intensity of precipitation events can result in flooding of sections of the road network. As well, the drainage capacity on some of the roads is not sufficient to withstand heavy water flow, particularly on gravel roads. These flooding events often result in accelerated deterioration. To improve asset resiliency, staff should identify problem areas and, where possible through design (i.e., upsizing road culverts), reduce flooding intensity and improve drainage.

4.1.6 Levels of Service

The following tables identify the Township's current level of service for the road network. These metrics include the technical and community level of service metrics that are required as part of O. Reg. 588/17 as well as any additional performance measures that the Township has selected for this AMP.

Community Levels of Service

The following table outlines the qualitative descriptions that determine the community levels of service provided by the road network.

Service Attribute	Qualitative Description	Current LOS (2021)
Scope	Description, which may include maps, of the road network in the Township and its level of connectivity	See Appendix D
Quality	Description or images that illustrate the different levels of road class pavement condition	The Township completed a Road Needs Study in 2019 in coordination with D.M. Wills. Every road section received a surface condition rating (0-10) and a condition rating (0-100). The condition rating is derived from a mix of other point ratings that considers alignment, surface condition, surface width, level of service, structural adequacy, drainage, and maintenance demands.

Technical Levels of Service

The following table outlines the quantitative metrics that determine the technical level of service provided by the road network.

Service Attribute	Technical Metric	Current LOS (2021)
Scope	Lane-km of arterial roads (MMS classes 1 and 2) per land area (km/km^2)	49 lane-km / 256 km^2
	Lane-km of collector roads (MMS classes 3 and 4) per land area (km/km^2)	224 lane-km / 256 km^2
	Lane-km of local roads (MMS classes 5 and 6) per land area (km/km^2)	234 lane-km / 256 km^2
Quality	Average pavement condition index for paved roads in the Township	HCB: 68% LCB: 73%
	Average surface condition for unpaved roads in the Township (e.g., excellent, good, fair, poor)	Fair

4.1.7 Recommendations

Asset Inventory

- As a regular data practice, review the road network asset inventory for completeness; ensure every asset has basic attributes including asset length. Balance asset inventory information with other data verification reports, like Road Needs study. Work to improve data usability through the following database activities:
    - For each road asset, include the Street from and Street to information as an attribute; currently some asset names also include reference to street from and/or street to.
    - Identify data gaps like missing road width and quantities (e.g., asset 2555) and work to acquire data when completing other related studies and/or verification activities. Thereafter, complete database updates.
    - Continue to review and update the condition of roads over time and as capital projects are completed.

Condition Assessment Strategies

- When procuring external reports for any assets, particularly roads where there are many assets, require that reports be drafted based on the existing Asset management software inventory listing and structure, that data is collected with reference to the Asset ID and that data is provided in an excel format so that data uploads, sync, and other asset data activities can be most effectively conducted.

Lifecycle Management Strategies

- Ensure that all capital recommendations are appended to a specific asset and that recommendations includes at least details on the recommended intervention date, estimated cost of intervention, scope, estimated impact (i.e., increased condition or EUL) and a clear outline of the costing inclusions, exclusions, and other relevant assumptions. Ensure that these events are uploaded to the asset management software so that capital forecasts reflect these recommendations. This is crucially important to the accuracy of capital projections, the scoping of projects, and the ease of integrating report information into the asset management system.

Risk Management Strategies

- Risk results should be reviewed and considered when making investment prioritization decisions. Where there is high confidence in the asset information the risk models will generally be a more reliable tool for investment prioritization. Where there is low confidence in the accuracy of asset information, the results may be used with more discretion.

Levels of Service

- Clearly define roles and responsibility for data update, review, and LOS reporting. Consider developing a standard for reporting frequency and as neccesary for reviewing, and responding to LOS.
- By 2025, all municipalities AMP's must include proposed LOS each year over the next 10 years from when it is developed. Begin preparing for this requirement and consider what needs to be measured and reported, what information and tools are required to do so, and what staff resources are needed to manage the project.

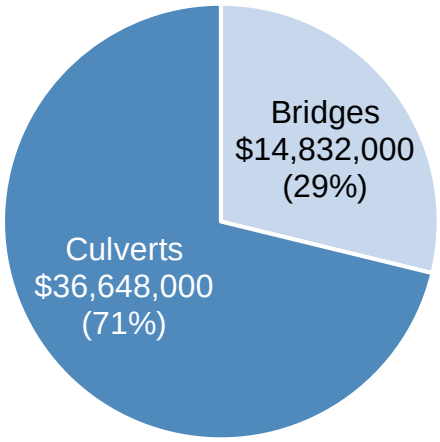
4.2 Bridges & Culverts

Bridges & Culverts represent a critical portion of the transportation services provided to the community. The Township is responsible for the operations and capital upkeep of bridge and culverts. There are a total of 94 structures in inventory as of December 2021. The Department of Public Works is responsible for the maintenance of all bridges and culverts located across municipal roads with the goal of keeping structures in an adequate state of repair and minimizing service disruptions.

4.2.1 Asset Inventory & Replacement Cost

Bridges and structural culverts are recorded in an asset management software system. The following table provides summary information based on a December 2021 effective date:

Asset Segment	Quantity	Average Age (Years)	Replacement Cost
Bridges	20	59	$14,832,000
Culverts	74	52	$36,648,000
Total	**94**	**53.25**	**$51,480,000**



Total Current Replacement Cost: $51,480,000

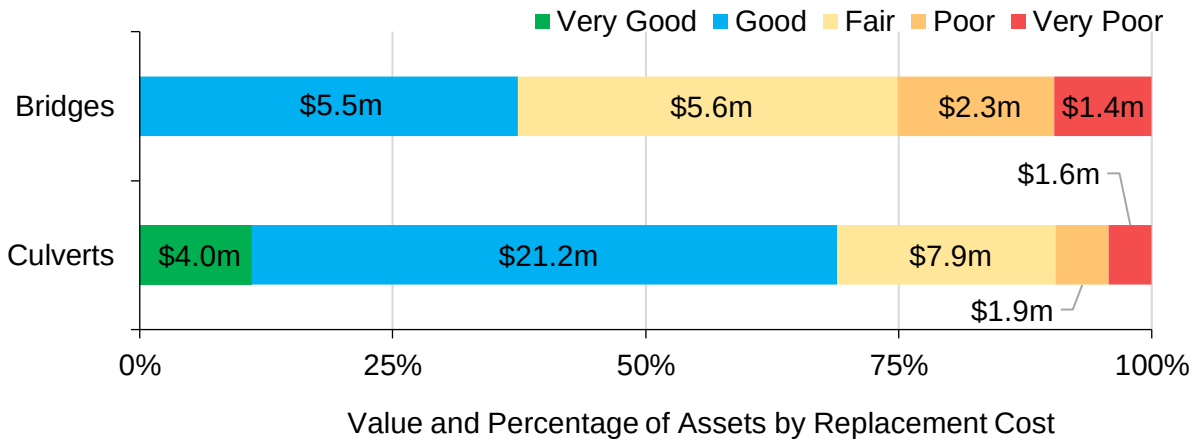
Each asset's replacement cost should be reviewed periodically to determine whether adjustments are needed to more accurate represent realistic capital requirements.

4.2.2 Asset Data: Useful Life, Age & Condition

The table below identifies the average condition and age, and the estimated useful life for each asset segment. The Average Condition (%) is a weighted value based on replacement cost.

Asset Segment	Estimated Useful Life (Years)	Average Age (Years)	Average Condition (%)
Bridges	40	59	65
Culverts	40	52	71
Average	**40**	**52.66**	**69**

Like with roads, bridge and structural culvert condition information is projected to December 2021 as required for the bridges with 2020 assessments. As indicated in the graph below, the condition of bridge and structural assets ranges from very poor to very good, however most assets (three quarters) are in fair or better condition.



Value and Percentage of Assets by Replacement Cost

To ensure that the Township's bridges and culverts continue to provide an acceptable level of service, the Township should monitor the average condition of all assets. If the average condition declines, staff should re-evaluate their lifecycle management strategy to determine what combination of maintenance, rehabilitation, and replacement activities is required to increase the overall condition of the bridges and culverts.

Each asset's Estimated Useful Life should also be reviewed periodically to determine whether adjustments need to be made to better align with the observed length of service life for each asset type.

Current Approach to Condition Assessment

Accurate and reliable condition data supports more accurate estimation of asset's remaining service life of assets which assists with effective capital planning. The following describes the Township's current approach:

- Each year condition assessments of half of all the bridges and culverts with a span greater than or equal to 3 meters are completed. This ensures that each bridge and culvert asset is assessed every 2 years in accordance with the Ontario Structure Inspection Manual (OSIM).
- Every structure is given a Bridge Condition Index (BCI) rating from 0-100 based on the condition and replacement value of each bridge component.
- This report utilizes inspection information from the 2020 and 2021 reports, both of which were completed by Jewell Engineering.
- Staff visually inspect bridges and culverts on a regular basis, between OSIM inspections, to ensure that the assets are structurally and functionally sound.

In this AMP, the following rating criteria is used to determine the current condition of bridges and culverts and forecast future capital requirements:

Condition	Rating
Very Good	75-100
Good	70-75
Fair	60-70
Poor	50-60
Very Poor	0-49

4.2.3 Lifecycle Management Strategy

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.

The following table outlines the Township's current lifecycle management strategy.

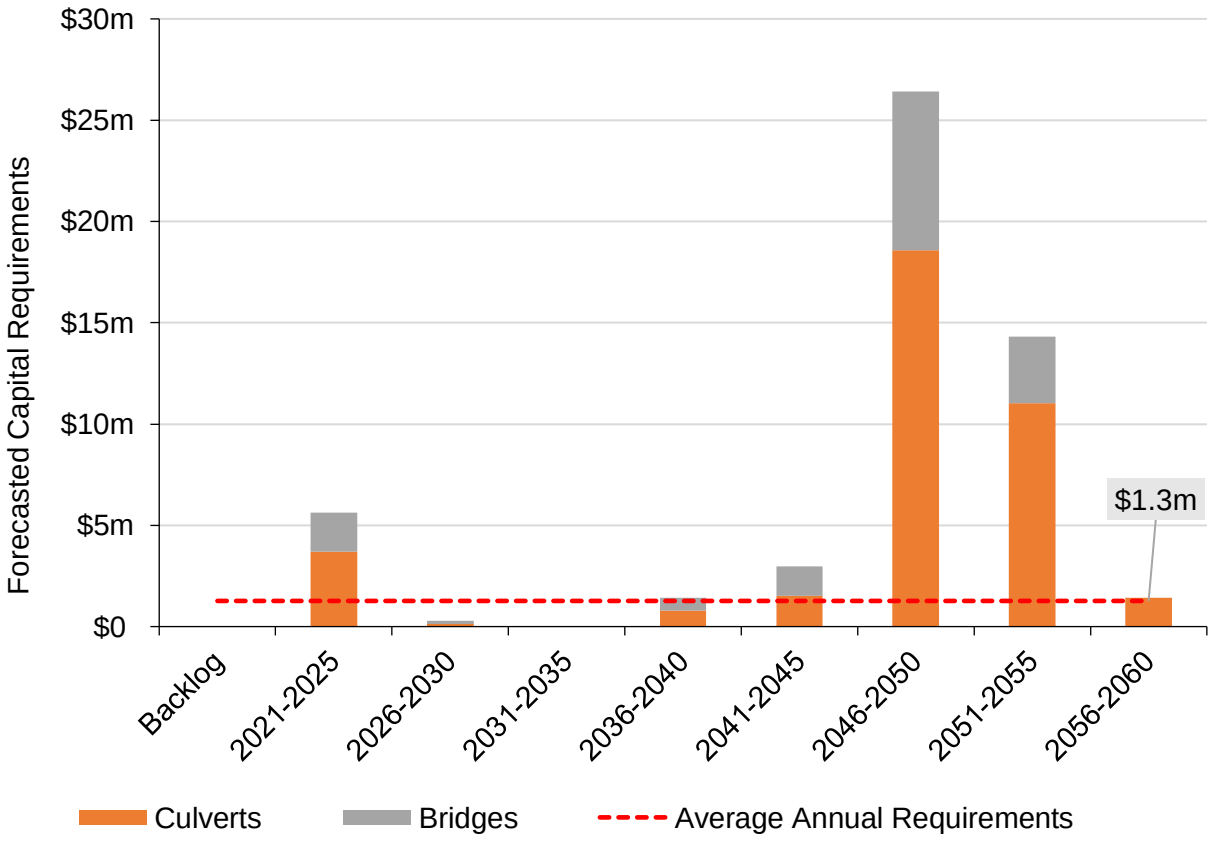
Event Class	Description
Maintenance, Rehabilitation & Replacement	• All lifecycle activities are driven by the results of mandated structural inspections completed according to the Ontario Structure Inspection Manual (OSIM). This includes recommended rehabilitations projects. Report recommendations are appended to assets in the asset management software and represented in this report's findings.
Rehabilitation	• Data, including recommended rehabilitation activities, dates, and estimated costs, in this report is as per OSIM reports completed in 2020 and 2021 by Jewell Engineering

4.2.4 Forecasted Capital Requirements

Over the next 40 years (until 2060) every bridge and structural culvert asset will require capital investment, including replacement. Using this period, the average annual capital requirement is $1,267,000. This is detailed in the table below and represents the average capital requirement per year, by asset segment and cumulatively.

Asset Segment	Average Annual Capital Requirement
Bridges	$371,000
Culverts	$896,000
Total	**$1,267,000**

The capital requirements, reported in 5-year cumulative bins, for bridges and structural culverts is summarized below. In this graph, capital requirements fluctuate over time. In the period of 2031-2035, there are no forecasted capital requirements while in other time periods, capital requirements are significant (i.e., 2046-2050, $26.4 M).



The projected cost of lifecycle activities that will need to be undertaken over the next 10 years to maintain the current level of service can be found in Appendix B.

4.2.5 Risk & Criticality

Risk is quantified based on the following probability and consequence of failure attributes and the corresponding model weight, as indicated in brackets.

Probability of Failure (PoF)	Consequence of Failure (CoF)
Assessed Condition (100%)	Replacement Cost (100%)

Using the risk model discussed above, the overall risk scores for all bridge and culvert assets are summarized in the table below.

Asset Segment	PoF	CoF	Risk Rating[4]
Bridges	2.97 / 5	4.55 / 5	13.53 / 25
Structural culverts	2.34 / 5	3.83 / 5	8.87 / 25
Total	**2.52 / 5**	**4.04 / 5**	**10.21 / 25**

However, it is important to note that these are weighted by replacement cost and some assets within each segment may carry significantly more or less risk than the average.

[4] Weighting is based on asset replacement value.

To gain a more detailed overview of risk distribution, we can also review a risk matrix which plots each asset's probability and consequence of failure and overall risk. This can better illustrate risk distribution and associated replacement costs. The following risk matrix provides a visual representation of the relationship between the probability of failure and the consequence of failure for bridge and culvert assets based on 2021 inventory data.

As indicated above, risk scores vary across bridge and structural culvert assets. Many assets hold low risk (green and blue), but some assets are identified as having moderate risk (blue and yellow) or high risk (orange and red). For most high-risk assets there is a high consequence of failure due to the significant replacement cost, but in one instance there is both a high probability of failure due to asset condition and a high replacement cost. Various risk treatments could be explored and would be of value particularly for higher risk assets. In select instances, risk treatments could include asset disposal where there is identified alternative route(s) (e.g., Asset 164).

As noted previously, risk is a time specific measure and over time, as asset condition declines, the risks held can be expected to increase. Therefore, it is important to regularly review data used to calculate risk and the resultant outputs, and then to apply appropriate risk treatments.

This is a high-level model developed for the purposes of this AMP. As with any model, regular review and adjustment of the model is recommended. Such review should consider if there are any changes to the parameters that best indicate the probability and/or consequence of failure, or the asset data available to use for the risk model.

Qualitative Risks

The following section summarizes key trends, challenges, and risks to service delivery that the Township is currently facing:

Fiscal Capacity

The present level of financial reinvestment does not adequately address capital investment requirements. The average annual capital requirement for bridges and structural culverts is $1.3 million. Based on a review of actuals (2019, 2020) and budgeted (2021) amounts bridges are severely underfunded. Bridging the capital deficit is a constant challenge due to the small tax base of the Township and public pressures to not increase taxes. This challenging position may negatively impact service delivery and quality.

The Township's inventory requires regular maintenance, assessment, and rehabilitation/replacement. Currently, grant funding is often relied on for major capital rehabilitation projects; where grant funding is not available projects may be deferred.

Aging Infrastructure

Like many Canadian Municipalities[5], Hamilton Township's bridge and culvert assets were constructed many years ago. As of Decembre 2021, the average age of a bridge or culvert was nearly 53 years, and the average EUL is 40 years. With aging infrastructure, their rehabilitation and/or replacement investment requirements are significant. This concentration of older assets may increase the need for increased capital investments in the coming years amid current, and likely also future, budgetary and staff resource constraints.

Organizational Change and Capacity

Staff identified organizational change as a relevant risk, as this is a constant in any organization. It was noted that retirements over the next ten years are anticipated. Turnover will continue to be a risk given the size of the municipality, the lack of internal opportunities for advancement and salary and benefit competitiveness given the proximity to neighboring larger municipalities. The Township mitigates this risk through regular compensation reviews to remain competitive.

[5] According to the 2019 Canadian Infrastructure Report Card only 20% of all municipally owned road and bridge assets in Canada were constructed in the last 20 years (page, 18). This indicates that across most Municipalities a large proportion of assets have reached, or are reaching, the end of their estimated useful life.

As with any organization, staff departures are a reality. Hamilton Township's existing use of asset management software to track asset attributes (i.e., road material, width, roadbed depth) and performance information reduces this risk. The Township also reduces this risk by ensuring each position has a trained backup.

The Township has a large inventory of bridges and culverts which require regular maintenance, assessment, and rehabilitation/replacement. Staff capacity and expertise are sometimes insufficient to deploy optimal maintenance and assessment strategies. The Township uses the OSIM reports that are completed bi-annually to minimize risk.

4.2.6 Levels of Service

The following tables identify the Township's current level of service for bridges and culverts. These metrics include the technical and community level of service metrics that are required as part of O. Reg. 588/17 as well as any additional performance measures that the Township has selected for this AMP.

Community Levels of Service

The following table outlines the qualitative descriptions that determine the community levels of service provided by bridges and culverts.

Service Attribute	Qualitative Description	Current LOS (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 structural culverts are a key component of the municipal transportation network. Only a few of the Township's structures have loading or dimensional restrictions meaning that most types of vehicles, including heavy transport, motor vehicles, emergency vehicles and cyclists can cross them without restriction.
Quality	Description or images of the condition of bridges & culverts and how this would affect use of the bridges & culverts	Every structure is given a condition rating from 0-100. On average, all Township bridges and culverts are in Good condition. **Very Good (75-100):** considered to be in excellent condition, and repair or rehabilitation work is rarely required within the next 5 years. Routine maintenance is still recommended. **Good (70-75):** considered to be in good condition, and repair or rehabilitation work is not usually required within the next 5 years. Routine maintenance is still recommended. **Fair (60-70):** Generally considered to be in good-fair condition. Repair work is ideally scheduled to be completed within the next 5 years. **Poor (50-60):** Generally considered poor and nearing the end of service life. The rehabilitation of these structures is ideally

Service Attribute	Qualitative Description	Current LOS (2021)
		best scheduled to be completed within 1 year. However, if the replacement of the structure is more viable, the structure can be scheduled for replacement within the short-term. **Very Poor (0-50):** Generally considered very poor and at the end of service life. The rehabilitation of these structures is ideally best scheduled immediately. However, if the replacement of the structure is more viable, the structure can be scheduled for replacement within the short-term.

Technical Levels of Service

The following table outlines the quantitative metrics that determine the technical level of service provided by bridges and culverts.

Service Attribute	Technical Metric	Current LOS (2021)
Scope	% of bridges in the Township with loading or dimensional restrictions	20%
Quality	Average bridge condition index value for bridges in the Township	Good: 65%
	Average bridge condition index value for structural culverts in the Township	Good: 71%

4.2.7 Recommendations

Asset Data Review/Validation

- When procuring OSIM reports, require that inspection information be appended to the asset's ID in the asset management software system. Consider providing the successful proponent an extract from the database with at least the asset name and ID. This will improve ease of updates to and reduce risk of incorrect matching of OSIM report information to the asset management software asset ID's.

Risk Management Strategies

- Implement risk-based decision-making as part of asset management planning and budgeting processes. This should include the regular review of high-risk assets to determine appropriate risk mitigation strategies.
- Review risk models on a regular basis and adjust according to an evolving understanding of the probability and consequences of asset failure.

Lifecycle Management Strategies

- Review the process of actioning OSIM report identified maintenance requirements (i.e., creation of work orders etc.) to ensure that maintenance activities are completed.
- Require that all reports detail what is included and excluded in any costing estimates. As necessary, adjust the estimated costs of capital events (i.e., add in overhead if not included). Clarity on costing inclusions and exclusions will improve the accuracy of budget projections and asset management analysis.
- Currently, OSIM reports include recommendations for rehabilitations but do not report on expected impact to asset condition or age. Consider requiring inclusion of the anticipated impact either for all rehabilitations, certain types of rehabilitations (i.e., major rehabs) or for rehabilitations above an estimated cost threshold (i.e., more significant in nature)
- Ensure that capital budgets are developed with clear reference to identified asset capital requirements as driven by OSIM, alongside an understanding of asset risk and expected asset performance impacts from underfunded or delayed investment.

Levels of Service

- To support LOS reporting, consider drafting budgets based on the asset management categorization to support asset management analysis and determination of investment allocations by asset category.

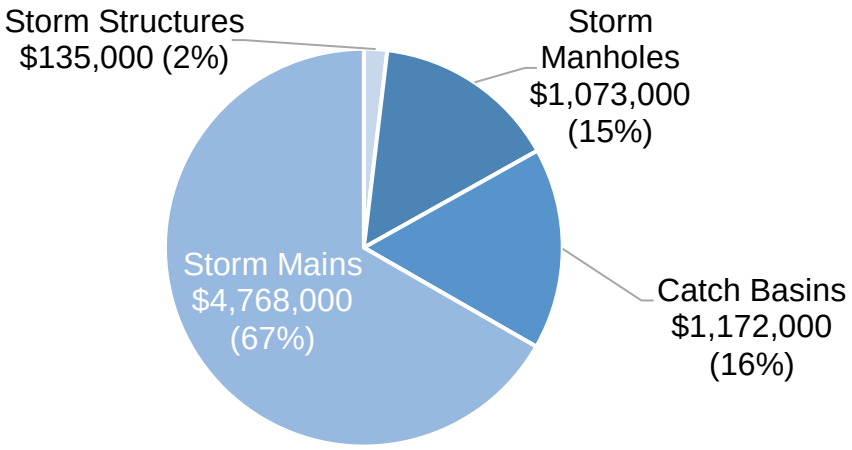
4.3 Stormwater Network

The Township is responsible for the operations and capital upkeep of the stormwater network which consists of storm mains, manholes, catch basins, and storm structures (storm management ponds, oil grit separators, and storm drains). Storm structure mostly consist of storm ceptors which are used to capture trash, debris, oils, and suspended solids from storm runoff. Staff are working towards improving the accuracy and reliability of their stormwater network asset information to improve long-term asset management planning.

4.3.1 Asset Inventory & Replacement Cost

Stormwater Network assets are recorded in an asset management software system. The following table summarizes the Stormwater Network inventory based on a December 2021 effective date:

Asset Segment	Quantity (assets)	Average Age (Years)	Replacement Cost
Catch Basins	316	24	$1,172,000
Storm Mains	15,661 m	22	$4,768,000
Storm Manholes	173	25	1,073,000
Storm Structures	4	12	$135,000
Total		**22 years 7 months**	**$7,148,000**



Total Current Replacement Cost: $7,148,000

Each asset's replacement cost should be reviewed periodically to determine whether adjustments are needed to more accurate represent realistic capital requirements.

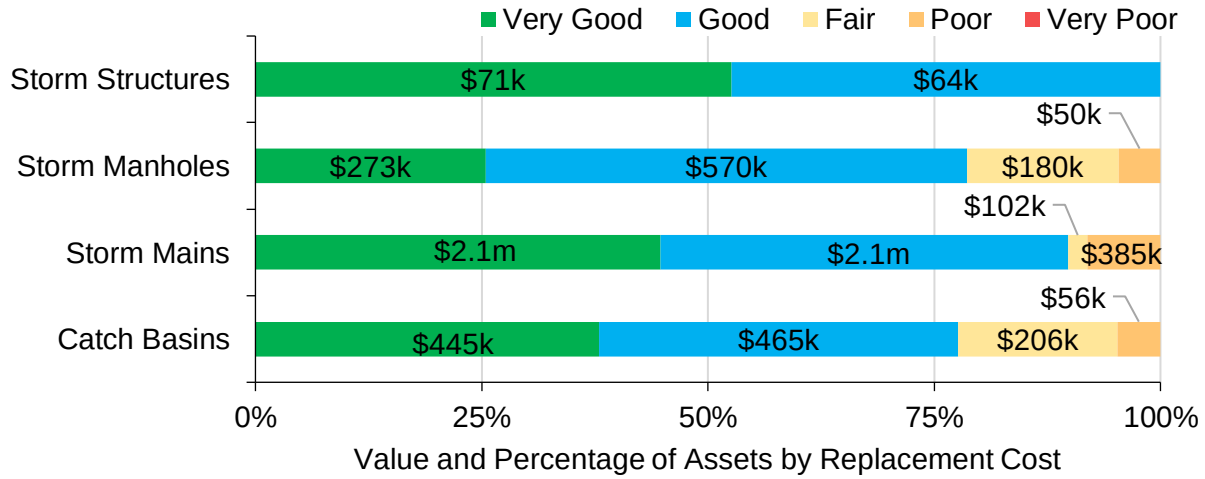
4.3.2 Asset Data: Useful Life, Age & Condition

The table below identifies the current average condition, the average age, and the estimated useful life for each asset segment. The Average Condition (%) is a weighted value based on replacement cost.

Asset Segment	Estimated Useful Life (Years)	Average Age (Years)	Average Condition (%)
Catch Basins	70.4	24	74
Storm Mains	75	22	74
Storm Manholes	70	25	70
Storm Structures	72.5	12	83
Average	**73**	**22.6**	**73**

At this time, most stormwater network assets (95%) use age-based condition, which is calculated based on the assets age relative to its expected service life. In the next few years, the Township hopes to procure CCTV assessments of their stormwater mains, so they have more accurate condition information.

Using age-based condition, 93% of all stormwater network assets are in fair or better condition. By asset segment condition varies, with storm structures having all assets in good or very good condition and all other segments with assets ranging from poor to very good condition. Based on the 2021 data effective date, no assets are in very poor condition.



To ensure that the Township's stormwater network continues to provide an acceptable level of service, the Township should monitor the average condition of all assets. If the average condition declines, staff should re-evaluate their lifecycle management strategy

to determine what combination of maintenance, rehabilitation, and replacement activities is required to increase the overall condition of the stormwater network.

Each asset's Estimated Useful Life should also be reviewed periodically to determine whether adjustments need to be made to better align with the observed length of service life for each asset type.

Current Approach to Condition Assessment

Accurate and reliable condition data supports more accurate estimation of asset's remaining service life of assets, which assist with producing more accurate capital projections and associated budgeting plans. The following describes the Township's current approach:

- There are no formal condition assessment programs in place for the Stormwater network. CCTV inspections are completed on an as-needed basis. Staff mostly rely on age, pipe material, diameter size, and location to determine a proxy of condition.
- Other stormwater network assets like catch basins and manholes are inspected on a regular basis through internal staff inspections.

In this AMP, the following rating criteria is used to determine the current condition of Stormwater Network and forecast future capital requirements:

Condition	Rating
Very Good	80-100
Good	60-80
Fair	40-60
Poor	20-40
Very Poor	0-20

4.3.3 Lifecycle Management Strategy

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.

The following table outlines the Township's current lifecycle management strategy.

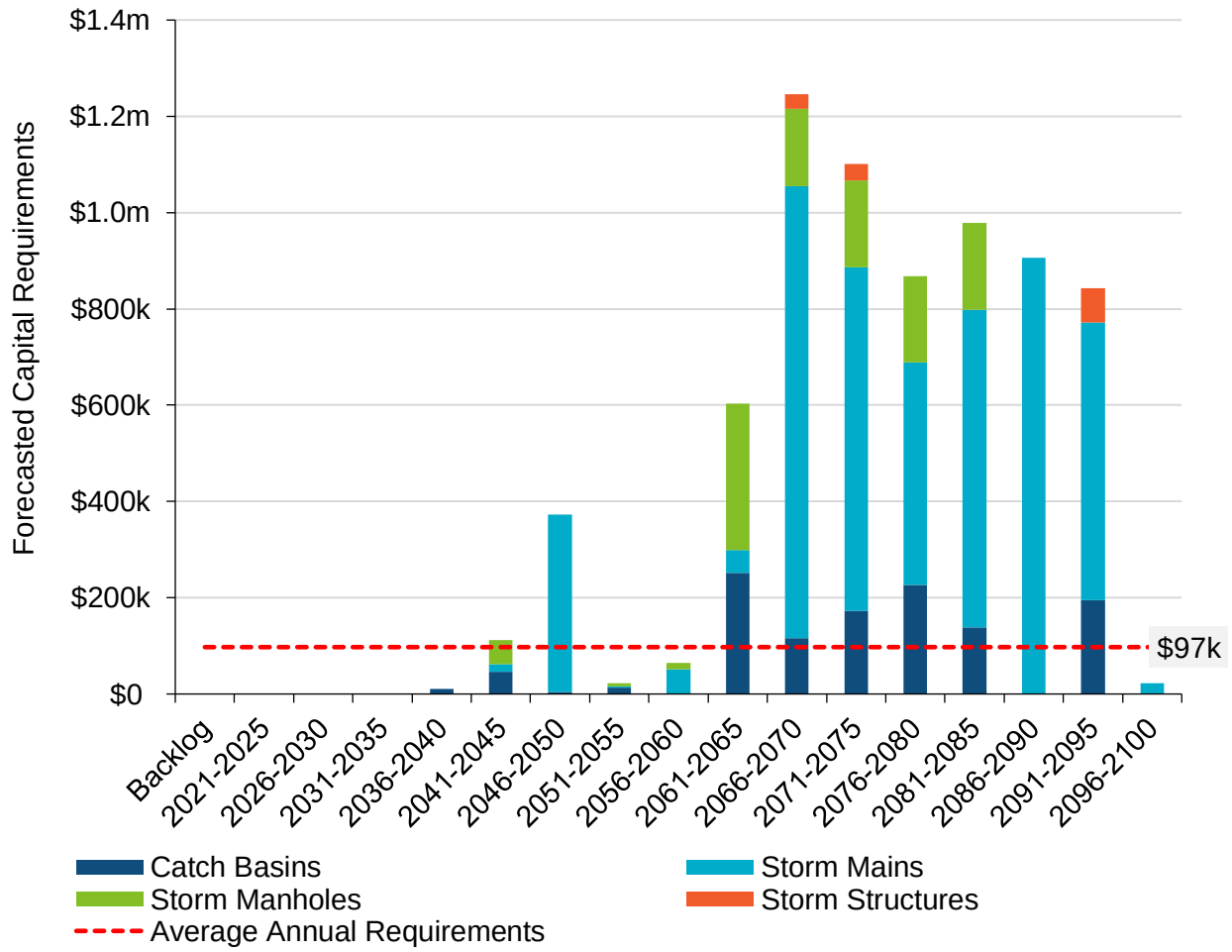
Event Class	Description
Maintenance	• Primary maintenance activities include catch basin cleaning and stormwater flushing. Staff are in the process of developing a dedicated program for their preventative maintenance and have recently increased their operating budget to do so effectively.
	• Closed Circuit Television Video (CCTV) inspections are completed on a project-by-project basis, and the information from those inspections is used to drive capital plans.
	• Storm structures such as stormwater management ponds undergo regular maintenance activities such as debris removal and clearing of vegetation.
Rehabilitation & Replacement	• Staff are currently in the process of developing a Stormwater Master Plan (for the Baltimore area) to identify flow patterns, drainage issues, and capacity issues.
	• Stormwater mains are typically replaced/reconstructed at end-of-life and/or in coordination with other asset replacements (road, water). Trenchless relining has not been a viable option for stormwater mains in the past.

4.3.4 Forecasted Capital Requirements

Stormwater Network assets are forecasted to all require replacement at some point until 2096. This was determined based on each assets in-service date, and it's estimated useful life. Over this period, the average annual capital requirement is $97,000. This represents the storm network's forecasted capital investment requirement on an average annual basis. This is detailed by asset segment as well in the table below.

Asset Segment	Average Annual Capital Requirement
Catch Basins	$17,000
Storm Mains	$64,000
Storm Manholes	$15,000
Storm Structures	$2,000
Total	**$97,000**

The capital requirements, however, fluctuate significantly by time-period. Reporting in 5-year cumulative bins, the chart below summarizes the forecasted capital requirements by period and asset segment. As indicated below, capital requirements slowly build between 2036 until 2056 after which point, they spike significantly until 2096-2100. Most capital requirements are for the storm main assets, which have the largest proportion of replacement value for the stormwater network category.



The projected cost of lifecycle activities that will need to be undertaken over the next 10 years to maintain the current level of service can be found in Appendix B.

4.3.5 Risk & Criticality

Risk for stormwater main assets is quantified based on the following probability and consequence of failure attributes and the corresponding model weight, as indicated in brackets.

Probability of Failure (PoF)	Consequence of Failure (CoF)
Condition (80%)	Replacement Cost (70%)
Asset Material (20%)	Pipe Diameter (30%)

Risk for all other stormwater network assets is quantified based on the following probability and consequence of failure attributes and the corresponding model weight, as indicated in brackets.

Probability of Failure (PoF)	Consequence of Failure (CoF)
Condition (100%)	Replacement Cost (100%)

Using the risk model discussed above, the overall risk scores for all stormwater network assets are summarized by segment in the table below.

Asset Segment	PoF	CoF	Risk Rating[6]
Catch Basins	1.89 / 5	1.09 / 5	1.98 / 25
Storm Mains	1.83 / 5	3.61 / 5	6.37 / 25
Storm Manholes	2.01 / 5	1 / 5	2.01 / 25
Storm Structures	1.47 / 5	1 / 5	1.47 / 25
Total	**1.86 / 5**	**2.75 / 5**	**4.91 / 25**

However, it is important to note that these are weighted by replacement cost and some assets within each segment may carry significantly more or less risk than the average.

[6] Weighting is based on asset replacement value.

To gain a more detailed overview of risk distribution, we can also review a risk matrix which plots each asset's probability and consequence of failure and overall risk. This can better illustrate risk distribution and associated replacement costs.

In the matrix below risk scores for stormwater main assets are illustrated. On the vertical axis is the consequence of failure and on the horizontal axis is the probability of failure. Each asset's respective probability and consequence of failure score determines where it is plotted. For example, if its probability and consequence of failure are both 1, then its risk score is also 1 and it is located on the most bottom left box.

Risk Matrix: Storm Main Assets

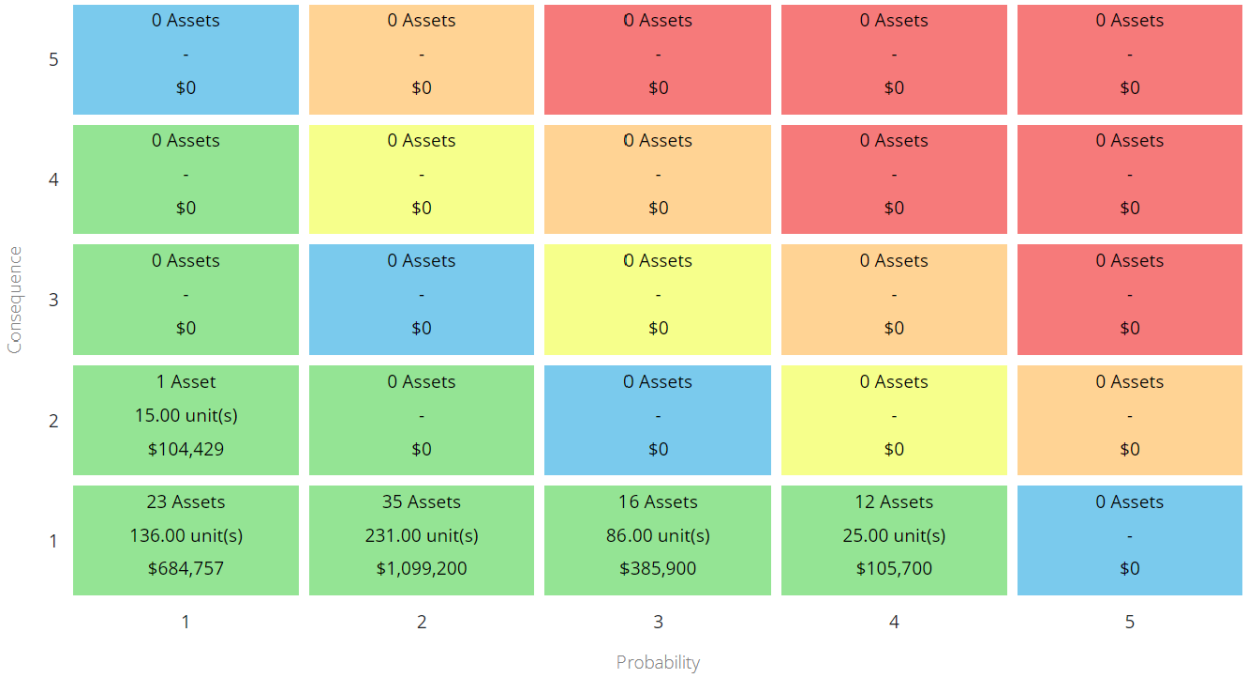
Consequence	1	2	3	4	5
5	3 Assets 2.00 unit(s) $576,119	0 Assets - $0	0 Assets - $0	0 Assets - $0	0 Assets - $0
4	3 Assets 1,349.10 m $483,718	4 Assets 893.00 m $515,430	0 Assets - $0	0 Assets - $0	0 Assets - $0
3	13 Assets 2,604.00 m $719,856	22 Assets 3,232.70 m $1,055,653	4 Assets 1,751.00 m $325,530	2 Assets 298.00 m $74,500	0 Assets - $0
2	13 Assets 1,897.80 m $323,283	21 Assets 2,521.43 m $485,157	1 Asset 290.00 m $44,080	0 Assets - $0	0 Assets - $0
1	7 Assets 154.10 m, unit(s) $31,306	20 Assets 492.00 m $93,263	2 Assets 45.00 m $16,110	6 Assets 131.00 m $24,062	0 Assets - $0

Probability

As indicated above, most stormwater main assets carry a low probability and a low consequence of failure and therefore are considered low risk and identified in green. Some stormwater mains carry slightly higher consequence of failure and/or probability of failure and are considered to have moderate risk. These assets are identified in blue and yellow. Two assets carry moderate to high risk (orange), in both cases these assets are in poor condition and are made of a material prone to failure which contributes to a high probability of failure. Their cost to replace and diameter as a measure of consequence of failure are moderate.

Risk Matrix: All Other Stormwater Network Assets:

The matrix below illustrates the risk score for all other stormwater network assets.



As indicated by the matrix the risk is overall low (green boxes) for stormwater network assets when excluding storm mains. This is largely due to the low replacement cost of these stormwater assets. Some assets, however, do have a higher probability of failure (3 and 4). These assets should be further investigated and considered when making replacement investment decisions since they are likely to fail. A more detailed investigation may also indicate that select assets have unique conditions like location and function which are not reflected in the risk model due to data limitations but are still crucial to consider when evaluating asset risk.

As with all risk models and results, these are reported as of a specific point in time (in this case, 2021 year-end). As a best practice, regular review of risk models and their outputs will help the Township more accurately understand the risks they hold and based on their risk appetite determine suitable risk treatments.

Qualitative Risks

The following section summarizes key trends, challenges, and risks to service delivery that the Township is currently facing:

Climate Change

More extreme rainfall events may also increase the risk of surface flooding if the system is not maintained and retrofitted adequately. Staff need a better sense of the impacts of climate change on the stormwater network to inform retrofitting and replacement planning. Further data will help address concerns with system capacity and the ability of the stormwater network to handle any potential increases in the intensity, frequency, and duration of rainfall events.

Asset Condition Information (Condition)

Asset information is crucially important to understanding the state of infrastructure, evaluating asset risks, and determining asset investments. This is particularly the case for underground assets which are not easily accessible and often have concealed deficiencies. While the Township's database is comprehensive, it has very limited condition assessment information for its stormwater network. This is a hinderance to the ability of staff to accurately understand the state of their infrastructure and effectively identify priorities for capital investment. This limited asset information poses a risk to the long-term effectiveness of the asset management program as it relates to stormwater network assets.

4.3.6 Levels of Service

The following tables identify the Township's current level of service for the stormwater network. These metrics include the technical and community level of service metrics that are required as part of O. Reg. 588/17 as well as any additional performance measures that the Township has selected for this AMP.

Community Levels of Service

The following table outlines the qualitative descriptions that determine the community levels of service provided by the stormwater network.

Service Attribute	Qualitative Description	Current LOS (2021)
Scope	Description, which may include map, of the user groups or areas of the Township that are protected from flooding, including the extent of protection provided by the municipal stormwater system	Most of the Township's landscape is comprised of rural countryside and agricultural land where stormwater runoff is conveyed through a series of rural ditches and culverts. Urban developments include commercial, industrial, and residential areas that are designed with an urban road right-of-way cross section and may be serviced by storm sewers and facilities.

Technical Levels of Service

The following table outlines the quantitative metrics that determine the technical level of service provided by the stormwater network.

Service Attribute	Technical Metric	Current LOS (2021)
Scope	% of properties in Township resilient to a 100-year storm	TBD
	% of the municipal stormwater management system resilient to a 5-year storm[7]	20 %

[7] The Ganaraska Region Conservation Authority (GRCA) works with municipalities, including the Township of Hamilton, to prevent, eliminate, or reduce the risk to life and property from flooding and erosion. In support of this, a Technical and Engineering Guidelines for Stormwater Management Submissions document was developed. This document outlines storm infrastructure design requirements including system sizing. It notes that all residential and industrial developments are to be sized for a 5-year flow. Based on this, it is assumed that all stormwater infrastructure constructed in 2014 or later, when the document was published, is sized to support a 5-year storm. The reported figure is based on the mains with an in-service date of 2014 or later. However, it is likely that the mains installed prior to this date are sized to a 5-year storm and that, therefore, a larger percentage of the stormwater management system is sized to a 5-year storm.

4.3.7 Recommendations

Asset Inventory

- As a Township, identify what asset information (i.e., pipe material and diameter) is most valuable to decision making and asset knowledge (i.e., calculation of risk). When completing projects, work to confirm and/or collect this information where possible.
- Review the cost of acquiring the identified valuable information for all stormwater assets against the expected benefit to determining if a larger data collection project is viable. To whatever extent data is collected, complete data updates to the asset management software with the collected and/or confirmed asset details.
- Append relevant asset information collected for the Stormwater Master Plan into the asset management database so that it can be leveraged to better support the Township's asset management program.

Condition Assessment Strategies

- Identify stormwater assets that are most critical and prioritize CCTV assessments[8] to these assets first. As condition information is obtained, ensure it is updated in the asset management database so that it can be incorporated into lifecycle management decision making and planning.

Risk Management Strategies

- Implement risk-based decision-making as part of asset management planning and budgeting processes. This should include the regular review of high-risk assets to determine appropriate risk mitigation strategies.
- Review risk models on a regular basis and adjust as new information (i.e., assessed condition) becomes available and/or as the understanding of the probability and consequences of asset failure changes.

Lifecycle Management Strategies

- Document and review lifecycle management strategies for the stormwater network on a regular basis to achieve the lowest total cost of ownership while maintaining adequate service levels.
- Ensure capital budget development considers the current and future forecasted

[8] CCTV inspections are a no-dig method of analysing the physical condition of mains. Instruments capture video and images which are connected to a computer that feeds real-time information back to the operator and is stored for future reference. Collectable information includes identification of internal corrosion, determination of leak locations, identification of blockages (impacting flow), and general data collection to materially aid in the determination of reliable condition assessment ratings.

capital requirements of stormwater network assets and how capital budget decisions may impact asset risk and performance.

Levels of Service

- Contact the Ganaraska Region Conservation Authority (GRCA) to request flood mapping for 100-year storms, as referenced on page 7 of the Technical and Engineering Guidelines for Stormwater Management report.
- Review current LOS at least on an annual basis to identify trends and as necessary adjust asset operations, investment decisions, or strategic plans. Consider historic LOS when informing proposed LOS[9].

[9] Reviewing LOS performance is recommended as a best practice.

4.4 Facilities

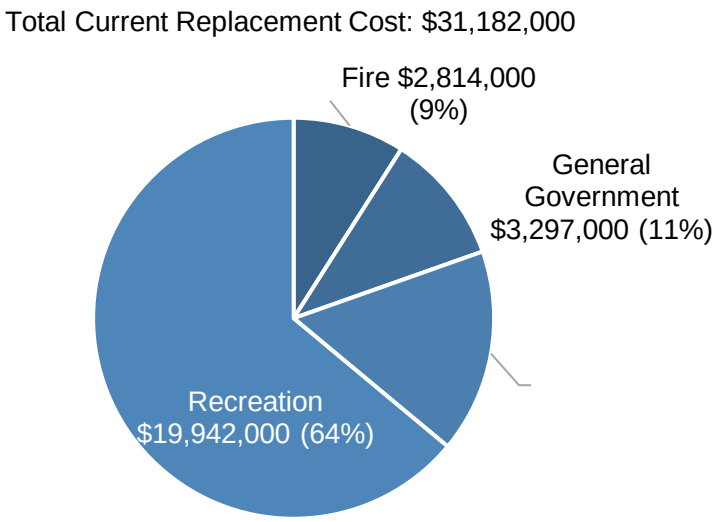
The Township is responsible for the operations and capital upkeep of several facilities used both for municipal operations and public services. Facilities include:

- Township Municipal Office
- Fire Halls
- Recreation and Community Centres
- Public Work Garages

4.4.1 Asset Inventory & Replacement Cost

The Township's facility assets are recorded in an asset management software system. The following table provides summary information about facility assets based on a December 2021 effective date:

Asset Segment	Quantity (# Facilities)	Average Age (Years)	Replacement Cost
Fire	4	26	$2,814,000
General Government	2	21	$3,297,000
Recreation	5 (33[10])	20.6	$19,942,000
Roadways	6	20	$5,130,000
Total	**46**	**20.6**	**$31,182,000**



[10] In most instances, facility assets are recorded as a single asset for each building. For recreation assets, however the Baltimore Recreation Centre is represented by multiple assets that each represent a various building component (i.e., lighting, floors etc.).

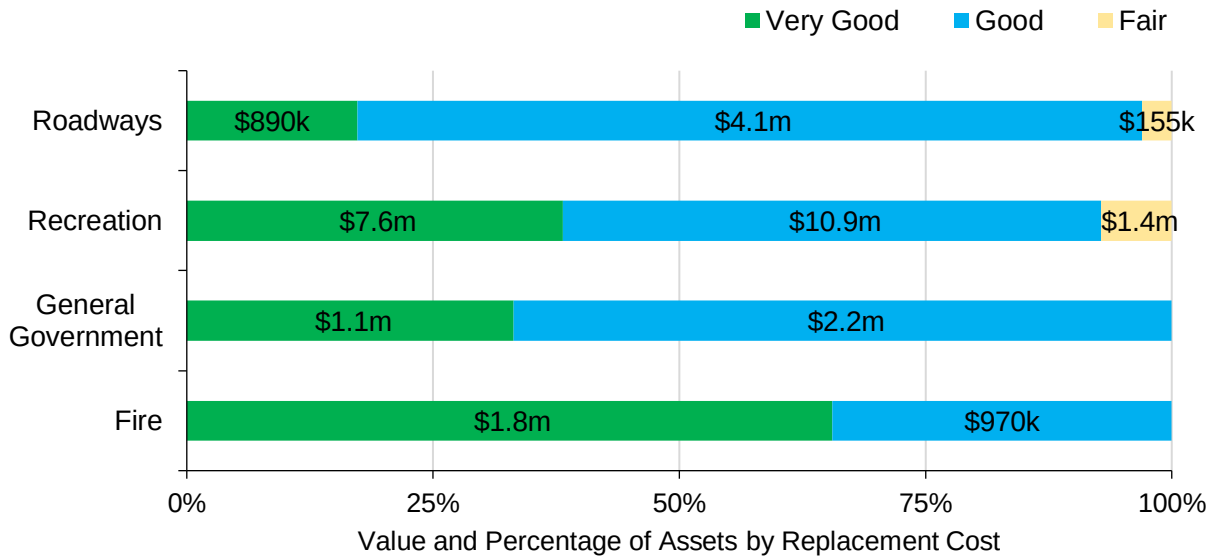
Each asset's replacement cost should be reviewed periodically to determine whether adjustments are needed to more accurate represent realistic capital requirements.

4.4.2 Asset Data: Useful Life, Age & Condition

The table below identifies the current average condition and age, and the estimated useful life for each asset segment. The Average Condition (%) is a weighted value based on replacement cost.

Asset Segment	Estimated Useful Life (Years)	Average Age (Years)	Average Condition (%)
Fire	40	26	80
General Government	40	21	80
Recreation	29.08	20.6	74
Roadways	40	20	74
Average	**32.15**	**20.6**	**75**

The following graph details the assessed condition of facility assets, reported by category, and weighted against asset replacement cost. All facility assets were assessed by Hamilton Township staff for condition, and all assets were as at least fair or better.



To ensure that the Township's facilities continue to provide an acceptable level of service, regular monitoring of asset condition is beneficial. If the average condition declines, staff should re-evaluate their lifecycle management strategy to determine

what combination and amount of maintenance, rehabilitation, and replacement activities is optimal.

Each asset's Estimated Useful Life should also be reviewed periodically to determine whether adjustments need to be made to better align with the observed length of service life for each asset type.

Current Approach to Condition Assessment

Accurate and reliable condition data allows staff to determine the remaining service life of assets and identify the most cost-effective approach to managing assets more confidently. The following describes the Township's current approach:

- Heating Ventilation and Air Conditioning (HVAC) units across the Township's facilities are inspected quarterly by Carmichael Engineering. Identified deficiencies are detailed in reports to the Township.
- Elevators across the Townships facilities are inspected semi-annually by Bruce Elevators and annually by the Technical Standards and Safety Association (TSSA). Bruce Elevators provides inspection reports which identify any found deficiencies and remediation recommendations.
- Fire Alarms and sprinklers are regularly inspected and tested.

In this AMP, the following rating criteria is used to determine the current condition of facilities and forecast future capital requirements:

Condition	Rating
Very Good	80-100
Good	60-80
Fair	40-60
Poor	20-40
Very Poor	0-20

4.4.3 Lifecycle Management Strategy

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.

The following table outlines the Township's current lifecycle management strategy:

Event Class	Description
Maintenance & Testing	• Heating Ventilation and Air Conditioning (HVAC) units across the Township's facilities are inspected quarterly by Carmichael Engineering. Identified deficiencies are detailed in reports to the Township. • Elevators across the Townships facilities are inspected semi-annually by Bruce Elevators and annually by the Technical Standards and Safety Association (TSSA). Bruce Elevators provides inspection reports which identify any found deficiencies and recommendations for their remediation. • Fire Alarms and sprinklers are regularly inspected and tested. • The Townships facilities are maintained primarily through the annual operating budget, which was $15,000 in 2021.
Rehabilitation	• The Township's Accessibility Advisory Committee[11] submits accessibility concerns and related improvement requests to the Township. These are reviewed and actioned as appropriate and feasible. In 2020 and 2021, the following accessibility upgrades occurred at facilities: ➢ Cold Springs Washroom renovated to have push button doors, tap handles, grabs bars, and widened doorways. ➢ Installation of emergency cardiac kits. ➢ Third-party funding received for four accessible doors at Township Office.

[11] The Accessibility committee is comprised of five to seven persons who work to advance and promote public awareness and understanding of the needs of disabled person and encourage improved services that enable persons with disabilities to live a full and productive life.

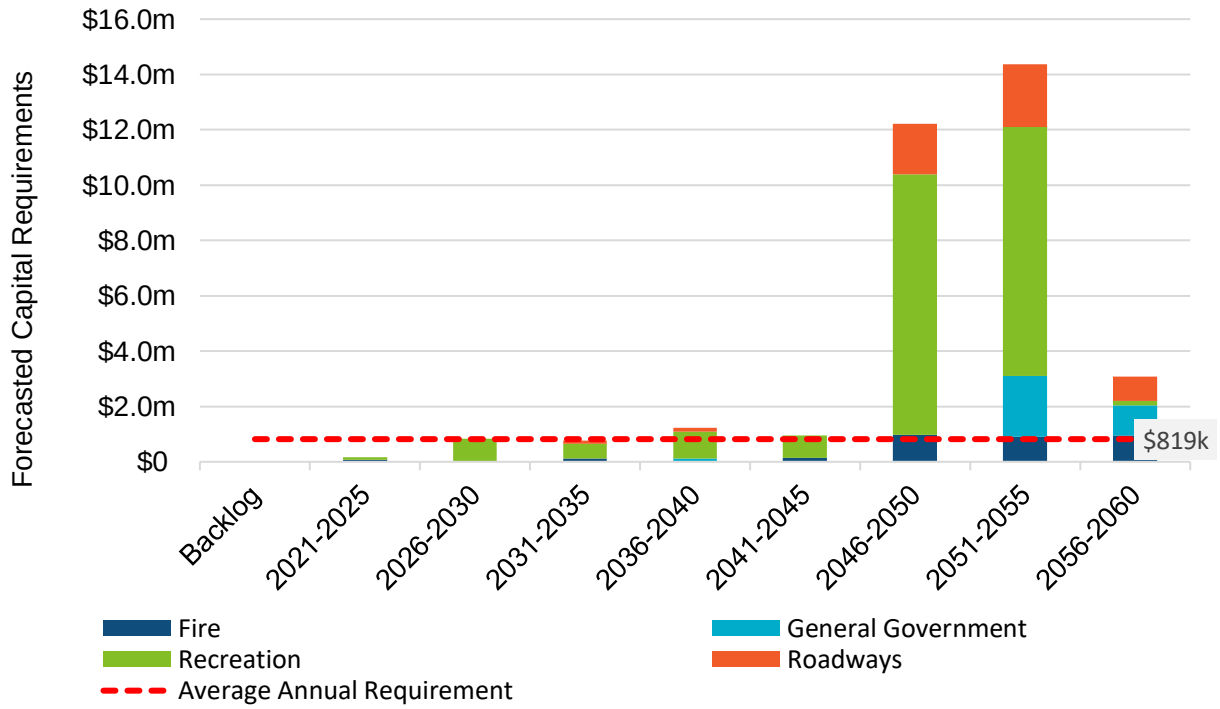
Event Class	Description
Replacement	• Within each Facility there are a variety of building components (i.e., windows, doors, roofs) which require replacement at different times due to varying in-service dates and estimated useful lives. When determining if replacement is appropriate, staff consider the asset's risk to occupant health and safety, legislative compliance, cost, and construction feasibility of rehabilitation as an alternative, and cost of replacement. • Most capital replacement projects are planned one year in advance. Capital budgets are determined annually. • The Capital budget for facilities varies by year based on asset specific capital requests. In 2020, the capital budget was $7,500, and in 2021 and 2022 there was no capital budget identified for building assets.

4.4.4 Forecasted Capital Requirements

The time over which every facility asset would be replaced was determined based on the existing data and data structure. Using this period, the total average annual capital requirement was determined to be $819,000. This is detailed by asset category in the table below and represents the average capital requirement per year, cumulatively and by asset category.

Asset Segment	Annual Capital Requirement
Fire	$70,000
General Government	$82,000
Recreation	$538,000
Roadways	$128,000
Total	**$819,000**

Reporting in 5-year cumulative bins, the chart below summarizes the forecasted capital requirements by period and by asset category. As indicated below, capital requirements are low until 2045 and then sharply spike from 2046 onwards. In line with recreation having the highest average annual capital requirement ($537,000), most of the cost associated with capital requirement in 2046-2055 are associated with recreation segment assets.



The projected cost of lifecycle activities that will need to be undertaken over the next 10 years to maintain the current level of service can be found in Appendix B.

4.4.5 Risk & Criticality

Risk for facility assets is quantified based on the following probability and consequence of failure attributes and the corresponding model weight, as indicated in brackets.

Probability of Failure (PoF)	Consequence of Failure (CoF)
Assessed Condition (75%)	Replacement Cost (75%)
Service Life Remaining (25%)	Function (25%)

Using the risk model discussed above, the overall risk scores for all facility assets is summarized by asset segment in the table below:

Asset Segment	PoF	CoF	Weighted[12] Average Risk Rating
Fire	2.02	3.23	6.59 / 25
General Government	2.07	3.25	6.99 / 25
Parks	2.7	1.25	3.38 / 25
Recreation	2.16	3.12	6.38 / 25
Roadways	2.15	2.92	6.54 / 25
Total	**2.13**	**3.11**	**6.49 / 25**

However, it is important to note that these are weighted by replacement cost and some assets within each segment may carry significantly more or less risk than the average.

[12] Weighting is based on asset replacement value.

To gain a more detailed overview of risk distribution we can also review a risk matrix which plots each asset's probability and consequence of failure and overall risk. This can better illustrate risk distribution and associated replacement costs. As indicated, most assets carry a low probability and a low consequence of failure and therefore are low risk and identified in green. Some assets carry a slightly higher consequence of failure and/or probability of failure and are considered to have moderate risk. These assets are identified in blue and yellow.

Please refer to Appendix C for a detailed overview of the criteria used to determine the risk rating of each asset.

As of 2021-year end data there are no facility assets identified as high risk, however risk is a time specific measure and over time as asset condition declines, and assuming there is insufficient investment, risks held by facility assets can be expected to increase. As well, asset risks could change following increased evaluation (i.e., Building Condition Assessments discussed in lifecycle strategies report). Therefore, it is important to regularly review data used to calculate risk and the resultant outputs, and then to treat identified risks appropriately.

This is a high-level model developed for the purposes of this AMP. As with any model, regular review and adjustment of the model is recommended. Such review should consider if there are any changes to the parameters that best indicate the probability and/or consequence of failure, or the asset data available to use for the risk model, alongside any regulatory or strategic changes that may affect the consequences of asset failure.

Qualitative Risks

The following section summarizes key trends, challenges, and risks to service delivery that the Township is currently facing:

Fiscal Capacity

The Township's current level of financial reinvestment does not sufficiently address maintenance and capital rehabilitation requirements for facilities. A tax change was recommended in 2016 to reach full funding requirements and the 2022 capital budget for parks and recreations (which contains many facilities) is $35,000. Based on surveys conducted for the 2022 Parks & Recreation Master Plan, the public at large is not in favor of increased taxation to fund recreational assets. Despite public preference to minimize taxes, assets will always require investment. Facility assets include essential services like the Fire Halls, one of which was identified as not having sufficient capacity for the force.

Aging Infrastructure

Some facilities, especially the fire halls, have original and aged components. Budgeting is often prioritized to public safety needs, and otherwise building components are often run until failure. This creates risks associated with unplanned asset failure alongside a ballooning investment requirement for the facility assets as they age and deteriorate with time.

4.4.6 Levels of Service

The following tables identify the Township's current level of service for facilities assets. These metrics include the technical and community level of service metrics that the Township has selected for this AMP.

Community Levels of Service

The following table outlines the qualitative descriptions that determine the community levels of service provided by facility assets.

Service Attribute	Qualitative Description	Current LOS (2021)
Quality	Appropriate actions and interventions are taken to ensure the regular safe use of Facilities assets. Facility assets are diverse and serve the needs of residents and the operations of the Municipality.	Using age-based condition facility assets range in condition from Very poor (16) to very good (92) and are in average in good (75) condition Recreation focused facility assets include recreation facilities, outdoor pavilions, halls, and park washrooms. Municipal operations facilities include fire halls, public works garage, and the Township Office.
Sustainable	There are long-term plans in place for the renewal and replacement of facilities assets.	Facility asset rehabilitation and replacement decisions are predominantly based on opportunities for accessibility improvement, risk to occupant health and safety, legislative compliance, and cost and construction feasibility. Currently, decisions to replace components of facilities through capital investment projects are forecasted ten (10) years in advance and formally planned one year in advance of project initiation.

Technical Levels of Service

The following table outlines the quantitative metrics that determine the technical level of service provided by facility assets.

Service Attribute	Technical Metric	Current LOS (2021)
Quality	Weighted Average Condition of Assets	Good: 75%
Sustainable	Current vs Target Capital Reinvestment Rate	0.21% vs. 2.63%

4.4.7 Recommendations

Asset Inventory Structure

- The Township would benefit from capturing more detailed building condition information and documenting it in a consistent manner across all facility assets. This process, known as a Building Condition Assessment (BCA), is most often completed to help asset owners better inventory their facility assets, more clearly and defensibly understand the near- and long-term requirements, and, as a result, facilitate requisite budgeting and planning. Following industry best practice, a BCA could be completed so that building components are categorized based on the standard format of ASTM UNIFORMAT II Standard E1557 classification of building elements.

Condition Assessment Strategies

- Should a BCA be conducted ensure that a condition assessment is provided at least for the most critical components, but ideally for all. Ensure that the data is collected in an appropriate format and that the information is promptly updated in the asset management software system.
- If an external BCA is not procured, review the internal condition assessment process across all asset categories to ensure that condition parameters, considerations, and procedures are appropriate for each asset category, well-documented and uniformly applied. In the event of staff retirements and turnover, this will be especially valuable to the municipality. Condition assessment guidelines are included for reference in Appendix E.

Risk Management Strategies

- Implement risk-based decision-making as part of asset management planning and budgeting processes. This should include the regular review of high-risk assets to determine appropriate risk mitigation strategies.
- Review risk models on a regular basis and adjust according to an evolving understanding of the probability and consequences of asset failure.
- The Township would benefit from the development of a Risk Management Policy and Framework. Such a policy works to establish the scope of risk management, identify, and incorporate relevant principle and objectives, and effectively consider and account for the municipality's specific context (i.e., budget process, election cycles, staffing scale and structure). It seeks to demonstrate the organization's commitment to an established set of principles and objectives that are applied to risks in a consistent manner.

Lifecycle Management Strategies

- Recommendations and findings from the Recreation Master plan should be considered and, to the extent possible, incorporated into asset investment

decisions. For example, if an asset is deemed less critical to the Township, its priority for replacement may be lower than a comparable asset deemed more critical to the Township.
- The capital budget should consider the current and future forecasted capital requirements of facility assets; dedicated and consistent capital funding is needed to maintain facility assets and prolonged deferral of work is likely to reduce the expected life and/or the performance of facility assets.

Levels of Service

- Clearly define roles and responsibility for data update, review, and LOS reporting. Consider developing a standard for reporting frequency and as neccesary for reviewing, and responding to LOS.
- To support LOS reporting, consider drafting budgets based on the asset management categorization to support asset management analysis and determination of investment allocations by asset category.

4.5 Fleet & Fleet Equipment

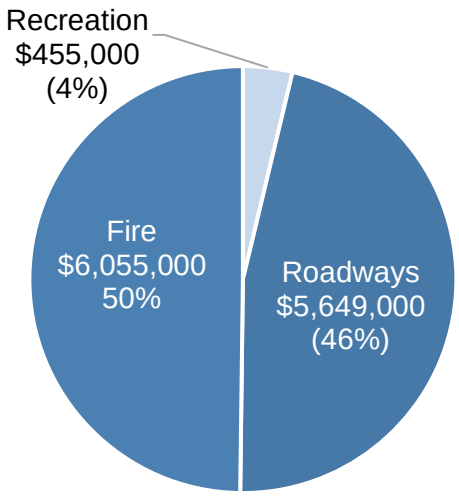
The Township owns a variety of fleet and fleet equipment assets that are central to the Townships daily operations. For reporting purposes these assets have been segmented based on similar function.

4.5.1 Asset Inventory & Replacement Cost

These segments, and examples of common assets included in them, is detailed below:

- Roadways: predominately comprised of pick-up and dump trucks and trailers and various small utility vehicles including excavators and tractors.
- Recreation: ice resurfacing machines and trucks used specifically to support recreational programs.
- Fire: a variety of assets used in the delivery of fire protection services; asset include pumpers, pumpers/tankers, and Emergency Support Units (ESUs)

Asset Segment	Quantity	Average Age (Years)	Replacement Cost
Recreation	7	11.58	$455,000
Roadways	33	9.5	$5,649,000
Fire	18	9.5	$6,055,000
Total	**58**	**9.75**	**$12,159,000**



Total Current Replacement Cost: $12,159,000

Each asset's replacement cost should be reviewed periodically to determine whether adjustments are needed to more accurate represent realistic capital requirements.

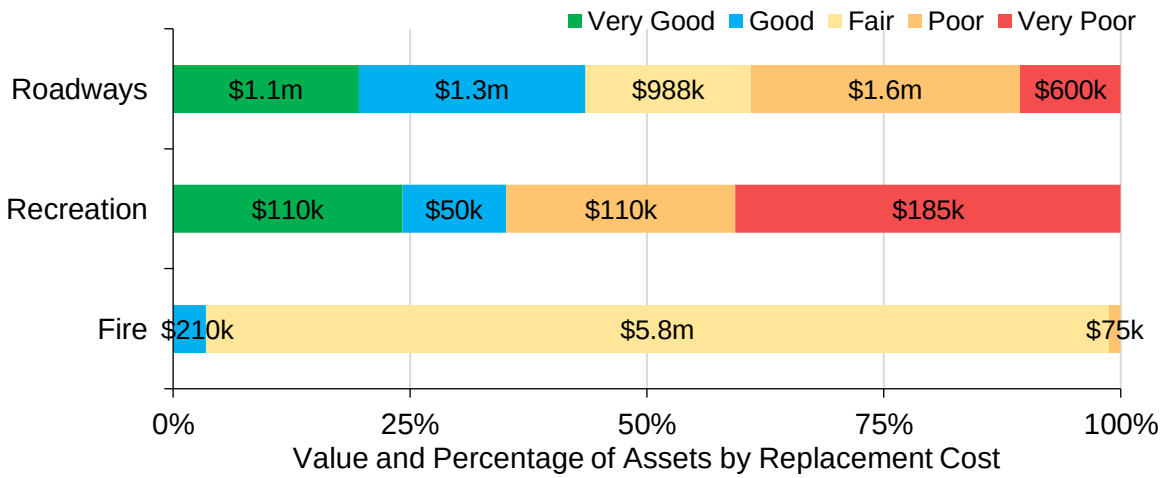
4.5.2 Asset Data: Useful Life, Age & Condition

The table below identifies the current average condition, the average age, and the estimated useful life for each asset segment. The Average Condition (%) is a weighted value based on replacement cost.

Asset Segment	Estimated Useful Life (Years)	Average Age (Years)	Average Condition (%)
Recreation	14.4	11.58	39
Roadways	16.6	9.5	53
Fire	18.25	9.5	53
Average	**16.75**	**9.75**	**53**

As part of the project engagement, PSD Citywide worked with Hamilton Township staff to review and as needed, update the assessed condition of their assets.

The following graph details the assessed condition for fleet and fleet equipment assets, reported by category, and weighted against asset replacement cost. The condition of fleet and fleet equipment assets is somewhat mixed, with recreation assets having the lowest average condition of fleet segments.



To ensure that fleet and fleet equipment assets continue to provide an acceptable level of service, the Township should monitor the average condition of all assets. If the average condition declines, staff should re-evaluate their lifecycle management strategy to determine what combination of maintenance, rehabilitation, and replacement activities is required to increase the overall condition of fleet and fleet equipment assets.

Each asset's Estimated Useful Life should also be reviewed periodically to determine whether adjustments need to be made to better align with the observed length of service life for each asset type.

Current Approach to Condition Assessment

Accurate and reliable condition data allows staff to determine the remaining service life of assets and identify the most cost-effective approach to managing assets more confidently. The following describes the Township's current approach:

- Assets are reviewed for condition on a regular basis and for the purposes of asset management reporting, rated on a 0 to 100 scale. Condition assessments are typically completed by the Township's mechanic. Currently condition assessments are not formally documented.
- Fire fleet and fire equipment assets are reviewed and rated for condition based on a 0-100 scale. Currently condition assessments are typically completed by the Township's Fire Chief or Director of Emergency Services.

In this AMP, the following rating criteria is used to determine the current condition of fleet and fleet equipment assets and forecast future capital requirements:

Condition	Rating
Very Good	80-100
Good	60-80
Fair	40-60
Poor	20-40
Very Poor	0-20

4.5.3 Lifecycle Management Strategy

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.

The following table outlines the Township's current lifecycle management strategy.

Event Class	Description
Maintenance & Inspection	• A staff mechanic completes regular maintenance and inspection for the Township's fleet and fleet equipment assets. Maintenance schedules are as per manufacturer's recommendations with additional maintenance completed as needed based on mileage or hours of use. • The Township's mechanic completes annual safeties as required by the Ministry of Transportation of Ontario (MTO). • All work is completed by the Township's staff mechanic unless the work is covered under a warranty term. • Assets are reviewed for condition on a regular basis and for the purposes of asset management reporting, rated on a 0 to 100 scale. Condition assessments are typically completed by the Township's mechanic. Currently condition assessments are not formally documented. • The 2021 operating budget for fleet assets is sub-divided by asset function.
Fire Fleet Maintenance & Inspection	• Maintenance requirements for fire fleet assets are most often based on the National Fire Protection Association (NFPA) 1901 and 1911 requirements[13]. • A staff mechanic completes regular maintenance and inspection for the Township's fire fleet and equipment assets that are not considered an emergency vehicle[14].

[13] NFPA 1911 is applicable to any public or private organization that uses fire apparatus and works to ensure that fire apparatuses are serviced and maintained to keep them in safe operating condition.

[14] Emergency Vehicles are required to be worked on by a registered emergency vehicle technician.

Event Class	Description
	• The annual maintenance budget for all fire fleet and fleet equipment assets is $20,000. • Assets are reviewed and rated for condition based on a 0-100 scale. Currently condition assessments are typically completed by the Township's Fire Chief or Director of Emergency Services.
Rehabilitation	• Rehabilitations are considered on a case by base basis; generally fleet assets are infrequently rehabilitated.
Replacement	• Replacement decisions consider the asset's age, condition, and maintenance cost and history (i.e., if there is a trend of increasing maintenance). • Replacement also considers the utility of the existing asset against the utility of potential replacements. For example, if a new fleet asset has multiple functions and can thereby replace multiple existing assets, replacement may be favourable even if the existing assets are functional.
Fire Fleet Replacement	• The replacement of fire fleet and fleet equipment assets is a two-step consideration process. First, it is determined if the asset is governed by NFPA (1) and if so when replacement is required. Next, for assets not governed by NFPA or for assets not yet at the NFPA required replacement date staff review the decision matrix which assesses the following: ➢ Asset condition: Asset is deemed good (no immediate investment required), repair (immediate investment needed), or replace (asset reliability may be low; replacement is needed) ➢ Asset Type: criticality to provision of protective services ➢ Redundancy: Availability of back-up assets in the event of failure of the primary asset. ➢ Trade in Value: Value expected upon trade-in of the existing asset. ➢ Delivery time: expected time for the delivery of a replacement of the subject asset. • In some cases, based on the above decision matrix an asset governed by NFPA may be replaced in advance of the NFPA required replacement date. • The decision-making matrix was implemented in late 2019

Event Class	Description
	following the Township's directive to review capital budget programs and schedules for efficiency and effectiveness.

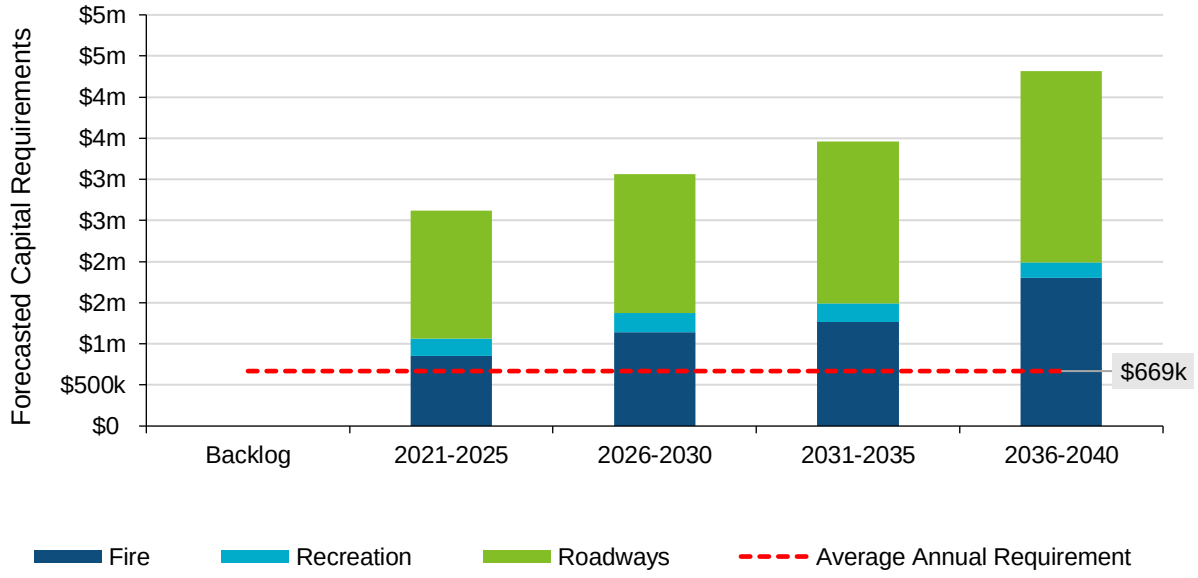
4.5.4 Forecasted Capital Requirements

The Township has identified a schedule and estimated cost for the replacement of fleet and fleet equipment assets for the period of 2021- 2040. Using this information, replacement events have been appended to assets in the asset management software system. For assets not specifically identified for replacement, estimated dates of replacement are determined based on the assets in-service date and its expected service life.

Using this approach, the period over which every asset in the category would be replaced was determined to be until 2040. On an annual basis, the average capital requirement is $669,000. This is detailed by asset segment as follows:

Asset Segment	Average Annual Capital Requirement
Recreation	$45,000
Fire	$283,000
Roadways	$341,000
Total	**$669,000**

Reporting in 5-year cumulative bins, the chart below summarizes the forecasted capital requirements by period and by asset segment. As indicated in the chart below, forecasted capital requirements are relatively similar over the period. By asset category, capital requirements are most significant for roadway assets who also carry most of the replacement cost total for fleet and fleet equipment assets.



The projected cost of lifecycle activities that will need to be undertaken over the next 10 years to maintain the current level of service can be found in Appendix B.

4.5.5 Risk & Criticality

Risk for Parks, Roadways and Recreation fleet and fleet equipment assets are quantified based on the following probability and consequence of failure attributes and the corresponding model weight, as indicated in brackets.

Probability of Failure (PoF)	Consequence of Failure (CoF)
Assessed Condition (70%)	Replacement Cost (75%)
Service Life Remaining (30%)	Segment (25%)

Fire fleet and fleet equipment assets utilize the following risk model:

Probability of Failure (PoF)	Consequence of Failure (CoF)
Assessed Condition (100%)	Replacement Cost (100%)

Using the risk model discussed above, the overall risk scores for all fleet and fleet equipment assets is summarized by asset segment in the table below:

Asset Segment	PoF	CoF	Weighted[15] Average Risk Rating
Fire	2.98 / 5	4.71 / 5	14.07 / 25
Parks	2 / 5	1.25 / 5	2.5 / 25
Recreation	2.12 / 5	1.84 / 5	3.9 / 25
Roadways	2.66 / 5	3.9 / 5	10.09 / 25
Total	**2.8 / 5**	**4.22 / 5**	**11.83 / 25**

Based on the weighted replacement costs, the average probability of failure for fleet & fleet equipment is 2.8, or unlikely and the average consequence of failure is 4.2, or major. The average risk rating is 11.8 (out of 25), which is considered high.

[15] Weighting is based on asset replacement value.

When viewing all fleet and fleet equipment assets, most assets carry a low risk of failure with nine (9) assets holding high risk. This is illustrated in the Matrix below:

This is a high-level model developed for the purposes of this AMP. As with any model, regular review and adjustment of the model is recommended. Such review should consider if there are any changes to the parameters that best indicate the probability and/or consequence of failure, or the asset data available to use for the risk model, alongside any regulatory or strategic changes that may affect the consequences of asset failure.

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Qualitative Risks

The following section summarizes key trends, challenges, and risks to service delivery that the Township is currently facing:

Fiscal Capacity & Price Escalations

The present level of financial reinvestment does not adequately address maintenance and capital rehabilitation requirements to ensure municipal assets remain in an adequate state of repair and achieve their intended service life. Inadequate funding is partly the result of significant price escalations over the last several years which are well outside of the Townships control. Bridging the capital deficit is a constant challenge due to the small tax base of the Township and public pressures to not increase taxes. This challenging position may negatively impact service delivery and quality.

Demographic Change & Community Expectations

Demographic changes can result in changes to the Township's level of service for existing assets, so more investment in infrastructure and services may be required to meeting community expectations. For example, increased expectations of asset performance would require increased staff to service infrastructure and increased number of fleet assets for staff to access the community. The existing funding challenges make it very difficult to satisfy the competing demands of performance against cost.

Organizational Change and Capacity (Fire Fleet)

Staff identified organizational change as a relevant risk, as this is a constant in any organization. It was noted that retirements over the next ten years are anticipated. Turnover will continue to be a risk given the size of the municipality, the lack of internal opportunities for advancement and salary and benefit competitiveness given the proximity to neighboring larger municipalities. The Township mitigates this risk through regular compensation reviews to remain competitive.

As with any organization, staff departures are a reality. Hamilton Township's existing use of asset management software to track asset attributes (i.e., road material, width, roadbed depth) and performance information reduces this risk. The Township also reduces this risk by ensuring each position has a trained backup.

4.5.6 Levels of Service

The following tables identify the Township's current level of service for Fleet and fleet equipment assets. These metrics have been selected by the Township.

Community Levels of Service

The following table outlines the qualitative descriptions that determine the community levels of service provided by fleet and fleet equipment assets.

Service Attribute	Qualitative Description	Current LOS (2021)
Quality	Appropriate actions and interventions are taken to ensure the regular safe use of fleet assets so that they can provide important services.	Using recent assessed condition information vehicle assets range from Poor (17%) to Very good (91%) and are on average in Fair (53%) condition. Fleet assets include diverse assets that service the Township's fire, public works, and parks and recreation departments.
Sustainable	There are long-term plans in place for the renewal and replacement of fleet assets	Fleet investments are generally planned 10 years out and consider the asset's age, condition, utility, and cost-benefit analysis of replacement.

Technical Levels of Service

The following table outlines the quantitative metrics that determine the technical level of service provided by fleet and fleet equipment assets.

Service Attribute	Technical Metric	Current LOS (2021)
Quality	Weighted Average Condition of Assets	Fair: 53 %
Sustainable	Current vs Target Capital Reinvestment Rate	3.49% Vs. 5.50%

4.5.7 Recommendations

Asset Inventory

- To ensure capital projections are as accurate as possible, regularly review and update replacement costs, especially for assets of high value. Wherever possible, obtain estimates based on comparable recent purchases or quotes.

Condition Assessment Strategies

- Ensure that the process for assessing asset condition is uniform across fleet assets so that meaningful comparisons and inferences can be drawn from condition data. A manual detailing the factors reviewed, with supportive information like photographs and scales would be helpful, especially in the event of staff changes.
- Work towards the digitization of assessed condition and thereafter the regular updating of asset condition in the asset management software. Consider digitizing service records so that review and costing analysis can be streamlined, and more easily documented.

Risk Management Strategies

- Risk results should be reviewed and considered when making investment prioritization decisions. Where there is high confidence in the asset information the risk models will generally be a more reliable tool for investment prioritization. Where there is low confidence in the accuracy of asset information, the results may be used with more discretion.
- Identify asset information most valuable to risk models and determine if it is currently available. If so, work to collect it and or review and update it. If the information is not available establish a plan to collect with consideration for priority (i.e., select assets of identified high risk for condition assessment first) assets. Collect asset information using the existing asset management software structure with reference to the Asset IDs.

Lifecycle Management Strategies

- Continue the use of the Fire fleet and fleet equipment decision matrix when determining which assets to replace and when. Consider testing the matrix in other departments with fleet and fleet equipment assets.
- Review projected capital requirements against current capital funding amounts to determine if funding adjustments may be needed and if so, to enable adjustments to be made more sustainably over time.

Levels of Service

- Clearly define roles and responsibility for data update, review, and LOS reporting. Consider developing a standard for reporting frequency and as neccesary for reviewing, and responding to LOS.
- To support LOS reporting, consider drafting budgets based on the asset management categorization to support asset management analysis and determination of investment allocations by asset category.

4.6 Machinery & Equipment

Machinery and equipment assets are diverse and serve various functions to the Municipality.

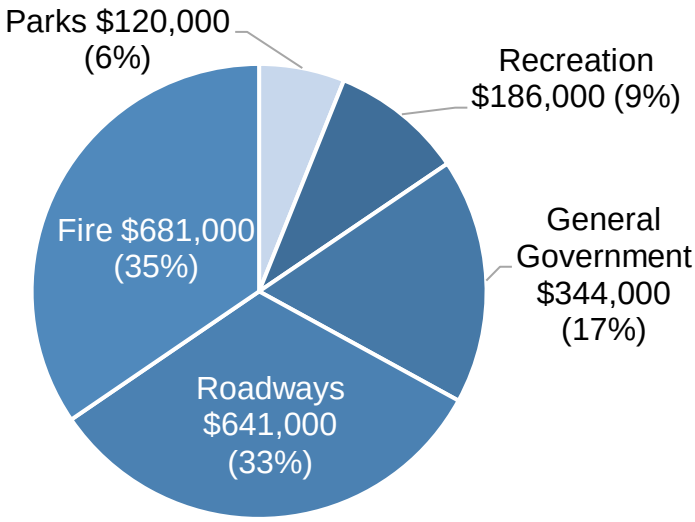
4.6.1 Asset Inventory & Replacement Cost

The following segments are within the machinery and equipment category, and can be defined as follows:

- General Government: software and hardware (i.e., tablets, communications) used to support the Township's operations.
- Library: an assortment of library furnishings (i.e., seating, tables, shelving) use to facilitate the use and organization of the library.
- Parks: various equipment to maintain parks (i.e., lawn mowers)
- Recreation: a diverse array of assets including security systems, and re-fueling systems used to support the operational of recreation programs and infrastructure.
- Roadways: primarily larger machinery and equipment assets including fuel management system and water tanks that serve important functions to daily road operations.
- Fire: Various equipment used to protect employees from fire dangers and to assist in emergency response.

Machinery and equipment assets are recorded in an asset management software system. The following table provides summary information based on a December 2021 effective date:

Asset Segment	Quantity	Average Age (Years)	Replacement Cost
General Government	12	4.25	$344,000
Parks	3	6	$120,000
Recreation	251	6.41	$186,000
Roadways	26	7.6	$641,000
Fire	50	4.58	$681,000
Total	**342**	**5.66**	**$1,973,000**



Total Current Replacement Cost: $1,973,000

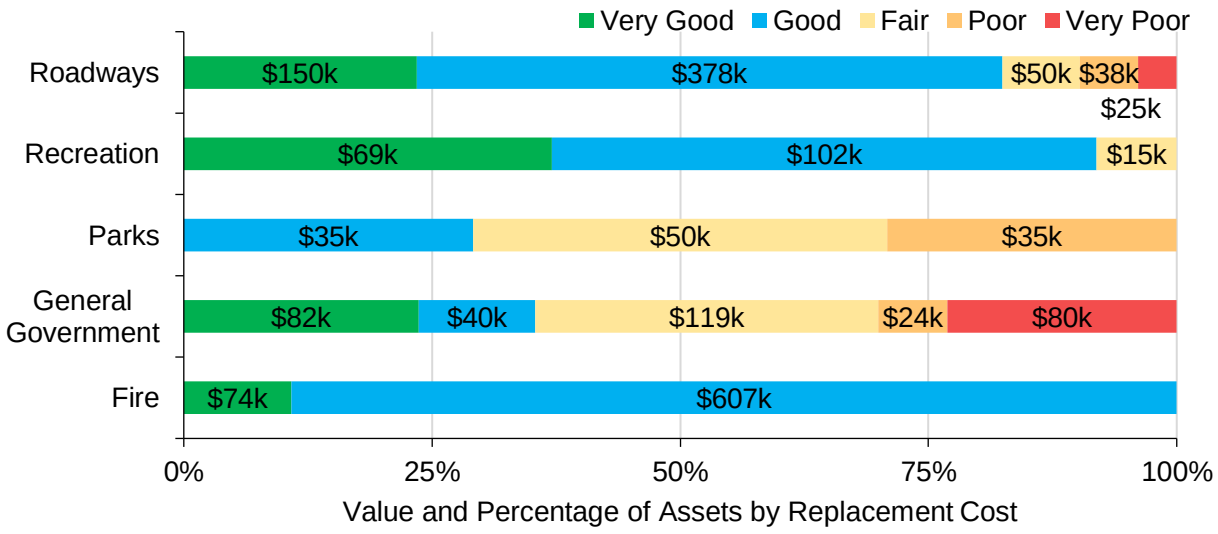
Each asset's replacement cost should be reviewed periodically to determine whether adjustments are needed to more accurate represent realistic capital requirements.

4.6.2 Asset Data: Useful Life, Age & Condition

The table below identifies the current average condition and age, and the estimated useful life for each asset segment. The Average Condition (%) is a weighted value based on replacement cost.

Asset Segment	Estimated Useful Life (Years)	Average Age (Years)	Average Condition (%)
General Government	6.25	4.33	49
Parks	10	6	59
Recreation	7	6.4	77
Roadways	14.25	7.8	69
Fire	10.25	4.6	72
Average	**9.9**	**5.66**	**67**

The following graph details the assessed condition for machinery and equipment assets, reported by category, and weighted against asset replacement cost. The condition of machinery and equipment assets is somewhat mixed, with fire and recreation assets having the highest and second highest average condition of machinery and equipment segments.



To ensure that the Township's machinery and equipment assets continue to provide an acceptable level of service, asset condition should be regularly monitored. If the average condition declines, staff should re-evaluate their lifecycle management strategy to determine what combination of maintenance, rehabilitation, and replacement

activities is required to increase the overall condition of machinery and equipment assets.

Each asset's Estimated Useful Life should also be reviewed periodically to determine whether adjustments need to be made to better align with the observed length of service life for each asset type.

Current Approach to Condition Assessment

Accurate and reliable condition data allows staff to determine the remaining service life of assets and identify the most cost-effective approach to managing assets more confidently. The following describes the Township's current approach:

- Machinery and equipment assets are most often reviewed for condition by the Staff mechanic. Assets are rated on a 0-100 scale based on considerations of assets function, failure history, and age.
- IT assets are not formally assessed; however, they are serviced as needed by IT staff.

In this AMP, the following rating criteria is used to determine the current condition of machinery and equipment assets and forecast future capital requirements:

Condition	Rating
Very Good	80-100
Good	60-80
Fair	40-60
Poor	20-40
Very Poor	0-20

4.6.3 Lifecycle Management Strategy

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.

The following table outlines the Township's current lifecycle management strategy.

Event Class	Description
Maintenance & Inspection	• The Township's staff complete basic maintenance and inspection on small machinery and equipment assets. • An external contractor is used to service ice resurfacers, tractors, and lawn mowers. • The operating budget for machinery and equipment assets is departmentally based. • There are no formal maintenance or rehab programs currently in place for IT equipment. However, lower-requirement, older assets are re-assigned where appropriate when upgrades occur.
Fire Machinery & Equipment Maintenance & Inspection	• Maintenance requirements for fire machinery and equipment assets are most often based on the National Fire Protection Association (NFPA) 1851 requirements[16]. • Self contained breathing apparatus (SCBA) equipment, thermal imaging equipment, water storage, and jaws of life assets are tested for performance by a third party. • Assets are reviewed and rated for condition based on a 0-100 scale.
Condition Assessments	• Machinery and equipment assets are most often reviewed for condition by the Staff mechanic. Assets are rated on a 0-100 scale based on considerations of assets function, failure history, and age.

[16] NFPA 1851 establishes requirements for the selection, care, and maintenance of firefighting protective gear.

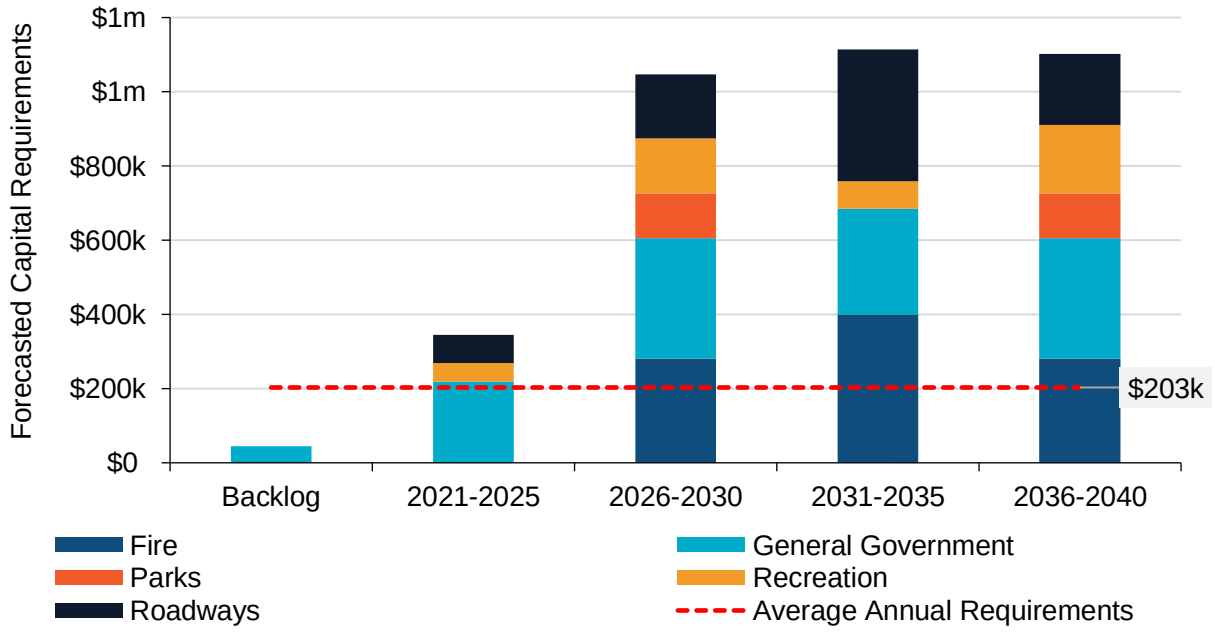
Event Class	Description
	• IT assets are not formally assessed; however, they are serviced as needed by IT staff.
Fire Replacement	• Replacement decisions consider anticipated expected life of each asset, performance trends from annual testing, and the cost effectiveness of repairing an asset or replacing it. • Generally, all assets are retained if they meet NFPA regulations and/or pass annual testing.
Replacement	• The annual capital budget for machinery and equipment assets varies by year based on departmentally identified capital needs. • Asset replacement decisions primarily consider asset condition and criticality. • Considerations for replacing IT equipment include age, compatibility with the current environment, possible future need, cost/benefit ratio, and current standards. • For IT assets, the Township is planning to move to a 3-year replacement schedule where devices are replaced as the typical 3-year warranty expires.

4.6.4 Forecasted Capital Requirements

The time over which every machinery and equipment asset will require replacement is until 2040. Excluding fire assets, this was determined based on the identified replacement schedules or the assets in-service date and EUL. Fire asset replacement schedules are as identified by staff. Using this information, replacement events have been appended to assets in the asset management software system. For assets not identified, estimated dates of replacement are determined based on the assets in-service date and its expected service life.

Asset Segment	Average Annual Capital Requirement
General Government	$61,000
Parks	$12,000
Recreation	$26,000
Fire	$56,000
Roadways	$48,000
Total	**$203,000**

Using this approach, the period over which every asset in the category would be replaced was determined to be 2021-2040. On an annual basis the average capital requirement is $203,000. As indicated in the chart below, forecasted capital requirements for fire machinery and equipment assets fluctuate by year. While relatively modest capital requirements are indicated for 2021-2035, they spike in 2026-2030 and continue until 2040.



The projected cost of lifecycle activities that will need to be undertaken over the next 10 years to maintain the current level of service can be found in Appendix B.

4.6.5 Risk & Criticality

Risk for machinery and equipment assets is quantified based on the following probability and consequence of failure attributes and the corresponding model weight, as indicated in brackets.

Probability of Failure (PoF)	Consequence of Failure (CoF)
Assessed Condition (70%)	Replacement Cost (75%)
Service Life Remaining (30%)	Segment (25%)

The following table summarizes the average probability and consequence of failure scores and the risk rating for machinery and equipment asset segments.

Asset Segment	PoF	CoF	Weighted[17] Average Risk Rating
Fire	2.16 / 5	3.57 / 5	7.92 / 25
General Government	3.15 / 5	2.32 / 5	7.39 / 25
Parks	2.96 / 5	2.25 / 5	6.67 / 25
Recreation	2.16 / 5	1.61 / 5	3.62 / 25
Roadways	2.15 / 5	3.51 / 5	7.27 / 25
Total	**2.38 / 5**	**3.07 / 5**	**7.14 / 25**

Based on the weighted replacement costs, the average probability of failure for machinery & equipment is 2.38, or unlikely and the average consequence of failure is 3.07, or moderate. The average risk rating is 7.14 (out of 25) which is considered low.

[17] Weighting is based on asset replacement value.

When viewing all machinery & equipment, most assets carry a low risk of failure (in green) with four assets in moderate to high risk (yellow and orange). This is illustrated in the matrix below:

This is a high-level model developed for the purposes of this AMP. As with any model, regular review and adjustment of the model is recommended. Such review should consider if there are any changes to the parameters that best indicate the probability and/or consequence of failure, or the asset data available to use for the risk model, alongside any regulatory or strategic changes that may affect the consequences of asset failure.

Qualitative Risks

The following section summarizes key trends, challenges, and risks to service delivery that the Township is currently facing:

Fiscal Capacity

The present level of financial reinvestment does not adequately address maintenance and capital rehabilitation requirements to ensure municipal assets remain in an adequate state of repair and achieve their intended service life. For fire machinery and equipment assets, there is currently only a $15,000 minor capital budget item and sometimes capital replacements may be funded from operational budgets. Bridging the capital deficit is a constant challenge due to the small tax base of the Township and public pressures to not increase taxes. This challenging position may negatively impact service delivery and quality.

Organizational Change and Capacity

Staff identified organizational change as a relevant risk, as this is a constant in any organization. It was noted that retirements over the next ten years are anticipated. Turnover will continue to be a risk given the size of the municipality, the lack of internal opportunities for advancement and salary and benefit competitiveness given the proximity to neighboring larger municipalities. The Township mitigates this risk through regular compensation reviews to remain competitive.

As with any organization, staff departures are a reality. Hamilton Township's existing use of asset management software to track asset attributes (i.e., road material, width, roadbed depth) and performance information reduces this risk. The Township also reduces this risk by ensuring each position has a trained backup.

4.6.6 Levels of Service

The following tables identify the Township's current level of service for machinery and equipment assets. These metrics include the technical and community level of service metrics that the Township has selected for this AMP.

Community Levels of Service

The following table outlines the qualitative descriptions that determine the community levels of service provided by machinery and equipment assets.

Service Attribute	Qualitative Description	Current LOS (2021)
Quality	Appropriate actions and interventions are taken to ensure the regular safe use of machinery & equipment assets	Using assessed condition data as available and age-based condition otherwise machinery & equipment assets range in condition from Very Poor (0) to Very Good (96) and are in average in good condition (67). Machinery and equipment assets are diverse and service the needs of fire, parks and recreation, and public works.
Sustainable	There are long-term plans in place for the renewal and replacement of machinery & equipment assets	Machinery & equipment asset replacement decisions predominantly consider asset condition, criticality, and legislative compliance. Machinery & equipment investments are currently identified and forecasted five (5) to ten (10) years in advance and presented for council approval one-year in advance with budgets determined based on departmentally identified need.

Technical Levels of Service

The following table outlines the quantitative metrics that determine the technical level of service provided by machinery and equipment assets.

Service Attribute	Technical Metric	Current LOS (2021)
Quality	Weighted Average Condition of Assets	Fair: 67 %
Sustainable	Current vs Target Capital Reinvestment Rate	5.22% Vs. 10.29%

4.6.7 Recommendations

Asset Inventory

- Review existing asset information, particularly IT and Fire assets and their replacement costs and quantities asset quantities and contents, to ensure it remains accurate and useful.

Condition Assessment Strategies

- Ensure that when assets are reviewed for condition, staff apply a consistent set of criteria. Consider the development of supportive guides and documentation.

Risk Management Strategies

- Implement risk-based decision-making as part of asset management planning and budgeting processes. This should include the regular review of high-risk assets to determine appropriate risk mitigation strategies.
- Review risk models on a regular basis and adjust according to an evolving understanding of the probability and consequences of asset failure.

Lifecycle Management Strategies

- Review projected replacement dates and estimated cost for machinery and equipment assets. If they do not appear reasonable, update the date, and adjust capital requirement projections accordingly.
- As part of the lifecycle strategy and replacement decision considerations, review and consider assets risk when making investment decisions.

Levels of Service

- Clearly define roles and responsibility for data update, review, and LOS reporting. Consider developing a standard for reporting frequency and as neccesary for reviewing, and responding to LOS.
- To support LOS reporting, consider drafting budgets based on the asset management categorization to support asset management analysis and determination of investment allocations by asset category.

4.7 Land Improvements

The Township is responsible for the operations and capital upkeep of a diverse array of land improvement assets.

4.7.1 Asset Inventory & Replacement Cost

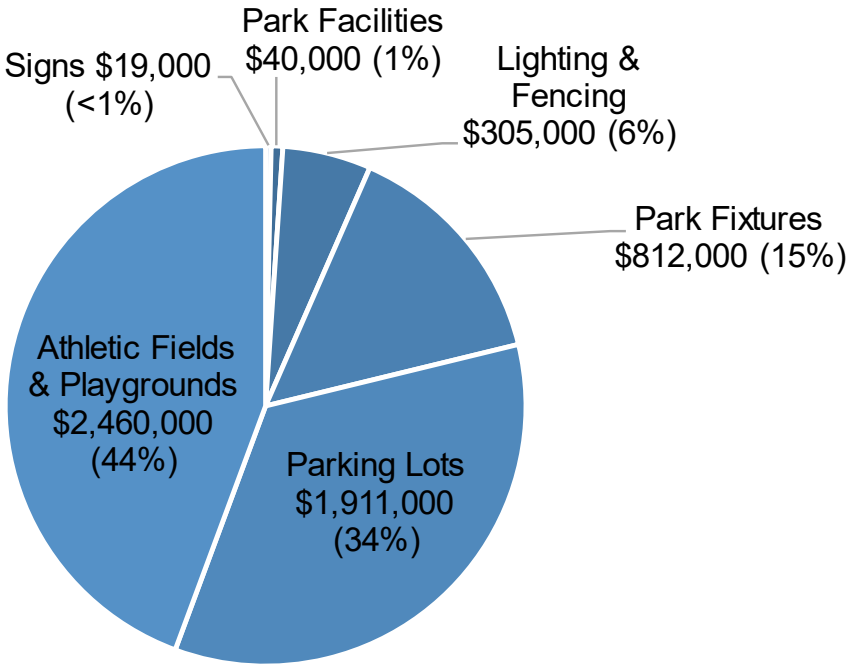
For reporting purposes these assets have been segmented based on similar function. These segments, and examples of common assets included in them, is detailed below:

- Athletic Fields & Playgrounds: outdoor playgrounds and play equipment, outdoor playing courts and fields.
- Lighting & Fencing: outdoor lighting
- Park Facilities: non-enclosed structures like gazebos
- Park Fixtures: benches, picnic tables, waste receptables, boardwalk and retaining walls.
- Parking Lots: parking lots associated with buildings and parks.
- Signs: various outdoor signs[18]

The Township's land improvement assets are recorded in an asset management software system. The following table provides summary information based on a December 2021 effective date:

Asset Segment	Quantity (# Assets)	Average Age (Years)	Replacement Cost
Athletic Fields & Playgrounds	11	24	$2,460,000
Lighting & Fencing	6	9	$305,000
Park Facilities	1	22	$40,000
Park Fixtures	13	7	$812,000
Parking Lots	11	20	$1,911,000
Signs	9	13	$19,000
Total	**51**	**16**	**$5,546,000**

[18] Please note that while the Township may own other land improvements like walking trails, they may not all be represented in this table. This will, in most cases be due to not meeting the Township's TCA threshold.



Total Current Replacement Cost: $5,546,000

Each asset's replacement cost should be reviewed periodically to determine whether adjustments are needed to more accurate represent realistic capital requirements.

4.7.2 Asset Data: Useful Life, Age & Condition

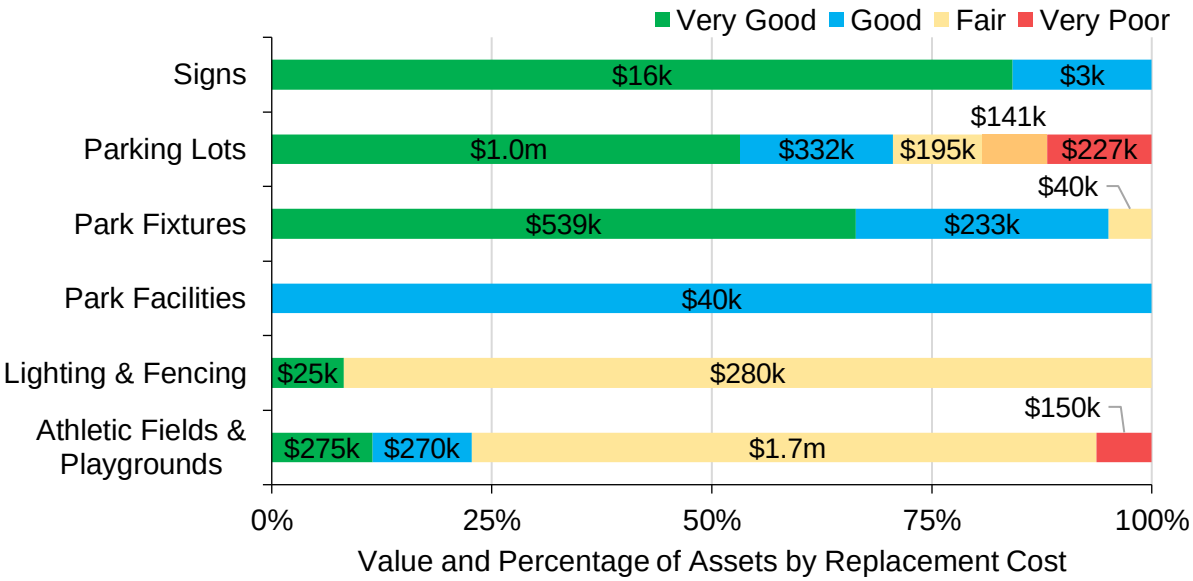
The table below identifies the current average condition, the average age, and the estimated useful life for each asset segment. The Average Condition (%) is a weighted value based on replacement cost.

Asset Segment	Estimated Useful Life (Years)	Average Age (Years)	Average Condition (%)
Athletic Fields & Playgrounds	10-75[19]	24	61
Lighting & Fencing	25	9	59
Park Facilities	25	22	75
Park Fixtures	25	7	84
Parking Lots	25	20	64
Signs	25	13	86
Average	**24.6**	**16**	**66**

As part of the project engagement, PSD Citywide worked with Hamilton Township staff to review and as needed update the assessed condition of their assets.

[19] Only one asset has a 10-year EUL; the remaining assets all have a 75-year EUL

The following graph details the assessed condition for land improvement assets, reported by category, and weighted against asset replacement cost. The condition of assets is somewhat mixed, with signs, parking lots, park fixtures, and park facilities assets having a higher average condition than lighting and fencing and athletic fields and playground segments.



To ensure that the Township's land improvement assets continue to provide an acceptable level of service, the Township should monitor the average condition of all assets. If the average condition declines, staff should re-evaluate their lifecycle management strategy to determine more effective asset interventions and associated schedule.

Each asset's Estimated Useful Life should also be reviewed periodically to determine whether adjustments need to be made to better align with the observed length of service life for each asset type.

Current Approach to Condition Assessment

Accurate and reliable condition data allows staff to determine the remaining service life of assets and identify the most cost-effective approach to managing assets more confidently. The following describes the Township's current approach:

- The Townships playgrounds are inspected monthly by a Canadian Standards Act (CSA) certified staff member. Inspections focus on safety and were last completed in August 2022. Identified safety issues are repaired by Parks and Recreation staff.
- While land improvement assets are monitored except for playgrounds there are no formal condition assessment programs in place. Staff mostly rely on age to determine a proxy of condition.

In this AMP, the following rating criteria is used to determine the current condition of land improvement assets and forecast future capital requirements:

Condition	Rating
Very Good	80-100
Good	60-80
Fair	40-60
Poor	20-40
Very Poor	0-20

4.7.3 Lifecycle Management Strategy

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.

The following table outlines the Township's current lifecycle management strategy.

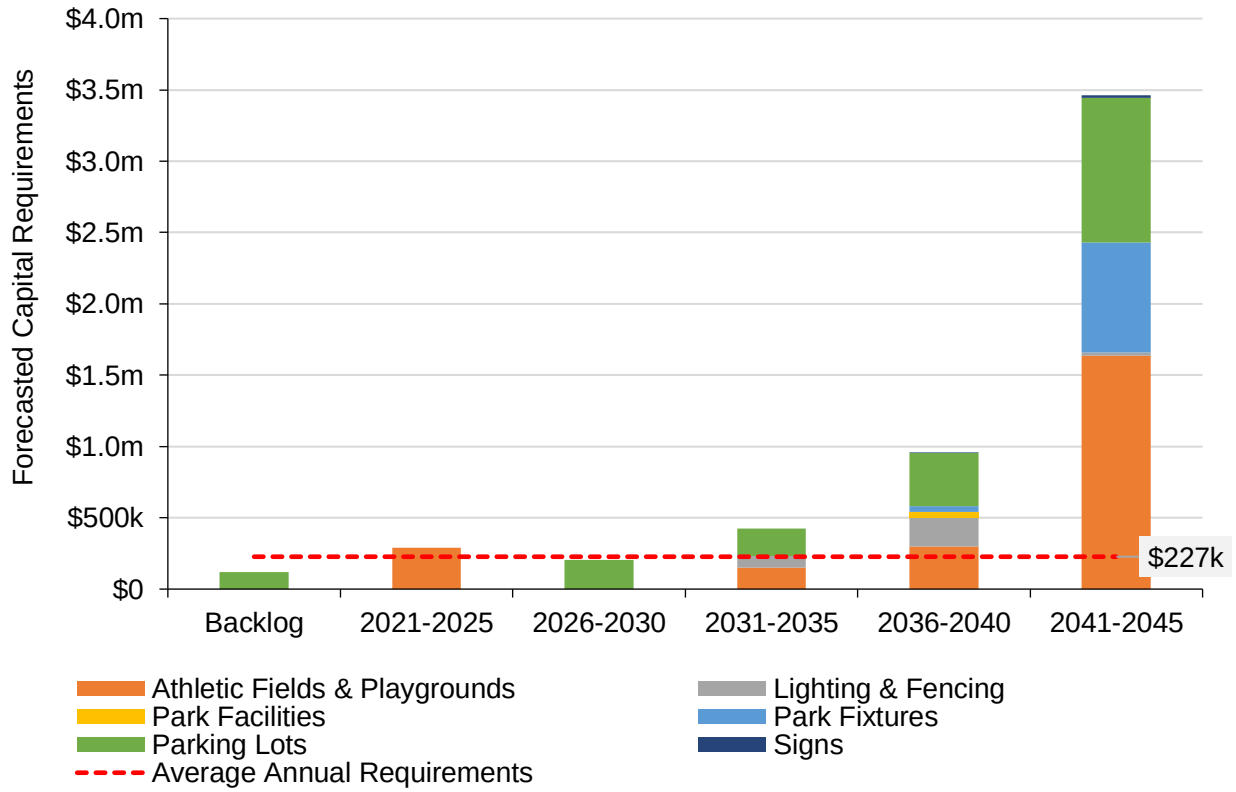
Event Class	Description
Maintenance & Inspection	• The Townships playgrounds are inspected monthly by a Canadian Standards Act (CSA) certified staff member. Inspections focus on safety and were last completed in August 2022. Identified safety issues are repaired by Parks and Recreation staff. • Staff complete regular visual inspection on ball diamonds and tennis courts. Identified deficiencies are noted and put on a list to repair.
Rehabilitation	• Tennis courts are resurfaced as needed based on their age and/or condition.
Replacement	• Asset replacement decisions consider the assets condition and expected future utility alongside its rate of use and the volume of public complaints regarding the assets condition, safety, and/or suitability. These factors are considered alongside the replacement cost. • The Township's understanding of asset use is based on the 2022 Recreation Master Plan which included telephone survey of residents and community organizations to gather information about what assets they utilize. • Asset capital replacements and rehabilitation activities are informally planned about 8 years in advance. • The 2020 capital budget for land improvement assets was $75,000 and funded the Recreation Master Plan only.

4.7.4 Forecasted Capital Requirements

The time over which every land improvement asset would be scheduled for replacement was determined to be 2045 based on planned replacements and/or the assets in-service date and EUL. Using this period, the total average annual capital requirement was determined to be $227,000. This is detailed by asset category in the table below and represents the average capital requirement per year, cumulatively and by asset category.

Asset Segment	Average Annual Capital Requirement
Athletic Fields & Playgrounds	$104,000
Lighting & Fencing	$12,000
Park Facilities	$2,000
Park Fixtures	$32,000
Parking Lots	$76,000
Signs	$1,000
Total	**$227,000**

Reporting in 5-year cumulative bins, the chart below summarizes the forecasted capital requirements by period and by asset segment. As indicated in the chart below, forecasted capital requirements for land improvement assets spike most significantly in 2036-2040 and remain relatively high into 2041-2045. Most capital costs are associated with athletic fields and playgrounds, as indicated by the orange bars.



The projected cost of lifecycle activities that will need to be undertaken over the next 10 years to maintain the current level of service can be found in Appendix B.

4.7.5 Risk & Criticality

Risk for land improvement assets is quantified based on the following probability and consequence of failure attributes and the corresponding model weight, as indicated in brackets.

Probability of Failure (PoF)	Consequence of Failure (CoF)
Assessed Condition (70%)	Replacement Cost (70%)
Service Life Remaining (30%)	Segment (30%)

The following table summarizes weighted average probability and consequence of failure, and risk rating for each land improvement segment.

Asset Segment	PoF	CoF	Weighted[20] Average Risk Rating
Athletic Fields & Playgrounds	3.24	4.01	13.36 / 25
Lighting & Fencing	2.56	2.38	6.28 / 25
Park Facilities	2.9	1.6	4.64 / 25
Park Fixtures	1.39	3.14	4.14 / 25
Parking Lots	2.37	3.7	7.98 / 25
Signs	1.16	1	1.16 / 25
Total	**2.62**	**3.66**	**9.66 / 25**

[20] Weighting is based on asset replacement value.

When viewing all land improvements, most assets carry a low probability and consequence of failure and therefore a low risk. Some assets (yellow and blue) however carry moderate risk due to a higher probability and/or consequence of failure, and a few assets (orange) are considered high risk.

This is a high-level model developed for the purposes of this AMP. As with any model, regular review and adjustment of the model is recommended. Such review should consider if there are any changes to the parameters that best indicate the probability and/or consequence of failure, or the asset data available to use for the risk model, alongside any regulatory or strategic changes that may affect the consequences of asset failure.

The identification of critical assets allows Hamilton Township to determine appropriate risk mitigation strategies and treatment options. Risk mitigation may include asset-specific lifecycle strategies, condition assessment strategies, or simply the need to collect better asset data.

Qualitative Risks

The following section summarizes key trends, challenges, and risks to service delivery that the Township is currently facing:

Fiscal Capacity

The present level of financial reinvestment is not sufficient to ensure municipal assets remain in an adequate state of repair and achieve their intended service life. Bridging the capital deficit is a constant challenge due to the small tax base of the Township and public pressures to not increase taxes. This challenging position may negatively impact service delivery and quality.

Required land improvement funding is far below the existing annual investment. There are persistent pressures from the public for investments to land improvement assets, like a splash pad, but with an existing capital funding deficit and public discontent with taxation increases, the Township is in a very challenging position. Historically, significant land improvement investments have depended on the availability of grant funding, the security of which is not guaranteed.

Demographic Change & Community Expectations

The Hamilton Parks and Recreation Master Plan notes the public's increased recognition of the importance of outdoor activity during the pandemic as well as dramatic increases in the use of parks, paths, and trails. This has stimulated support for renewal, expansion, and accessibility enhancements of land improvement assets. These sentiments are supported by a report by the Canadian Parks and Recreation Association which notes that in 2020, 70% of Canadians expressed an increased appreciation for parks and green spaces; 66% reported increased levels of walking/jogging outdoors, and there was a 25% increase in cycling. The increased valuation of land improvement assets combined with the challenging fiscal capacity severely hinders the Township's ability to fund their assets as required. This is a significant risk to the long-term asset performance and risk.

4.7.6 Levels of Service

The following tables identifies level of service metrics selected for land improvement assets. These metrics include the technical and community level of service metrics.

Community Levels of Service

The following table outlines the qualitative descriptions that determine the community levels of service provided by land improvement assets.

Service Attribute	Qualitative Description	Current LOS (2021)
Quality	Appropriate actions and interventions are taken to ensure the regular safe use of Land Improvements assets.	Using age-based condition land improvement assets range in condition from Very poor (0) to Very good (90) and are in average in condition Fair (66) condition. Land improvement assets include active and passive parkland, waterfront parks, and trails. Wherever possible, assets are designed to serve a wide range of users.
Sustainable	There are long-term plans in place for the renewal and replacement of land improvement assets	Land improvement asset investment decisions are predominantly based on asset condition and expected future utility alongside existing rate of use and relevant Master Plan findings. Land improvement capital investment projects are formally and publicly identified one-year in advance and internally identified ten (10) years in advance.

Technical Levels of Service

The following table outlines the quantitative metrics that determine the technical level of service provided by land improvement network assets.

Service Attribute	Technical Metric	Current LOS (2021)
Quality	Weighted Average Condition of Assets	Fair: 66 %
	% of Playgrounds that are Accessible	75 %
Sustainable	Current vs Target Capital Reinvestment Rate	0% Vs. 4.09%

4.7.7 Recommendations

Asset Inventory

- As with all assets, regular review of asset inventory information to ensure it remains accurate, comprehensive, and useful to decision making is recommended.

Condition Assessment Strategies

- Review internal processes for assessing asset condition and ensure that the considerations are appropriate for each asset and have a structured process with appropriate reference documentation for evaluation criteria. Such documentation will assist in more objective analysis and, in the event of staff changes, will be valuable to the new incumbent and the sustainability of the asset management program.

Risk Management Strategies

- Implement risk-based decision-making as part of asset management planning and budgeting processes. This should include the regular review of high-risk assets to determine appropriate risk mitigation strategies.
- Review risk models on a regular basis and adjust according to an evolving understanding of the probability and consequences of asset failure.

Lifecycle Management Strategies

- Assess the suitability of rehabilitation for certain assets, especially those that may be more costly to replace and can be cost-effectively rehabilitated (i.e., Tennis courts). If the Township has limited rehabilitation projects to analyze, consider engaging other Municipalities in the region to gather information and insights.
- Incorporate the results of the Parks and Recreation Master Plan into asset investment decisions. For example, consider the popularity of parks and baseball diamonds when determining asset investment prioritization.
- When developing capital budgets and presenting them to Council for deliberations, incorporate the results of projected capital requirements. Ensure the implications of not investing in assets is understood and, where investment may be obtained, ensure associated project management requirements are also sufficiently resourced.
- Recognizing that capital requirements are forecasted to spike significantly in future years explore opportunities to establish (as needed) and contribute to capital reserves now so that future capital requirements can be more sustainably funded.

Levels of Service

- Begin measuring current LOS now and review the selected LOS in advance of the 2024 O. Reg. 588/17 deadline. If the selected LOS are deemed not feasible to report on (e.g., data reliability issues), or not meaningful, consider selecting for the 2024 deadline alternative LOS that are more appropriate.

5 Analysis of Rate-funded Assets

Key Insights

- Rate-funded assets consist of the water network which has a total replacement cost of $23.5 million.
- 80% of rate-funded assets are in fair or better condition.
- The average annual capital requirement to sustain the current level of service for rate-funded assets is approximately $477,000.
- Critical assets should be evaluated to determine appropriate risk mitigation activities and treatment options

5.1 Water Network

The Township is responsible for maintaining a water network that is comprised of watermains, water treatment plants, and other supportive water infrastructure like valves, service lines, the water vehicle and equipment, and hydrants. The Waterworks department is responsible for the management and operation of the Camborne and Creighton Heights (Baltimore) Water Treatment Plant and distribution system along with supporting infrastructure. Lakefront Utility Services Inc (LUSI), an external operating authority, is responsible for the Buttersfield Distribution System.

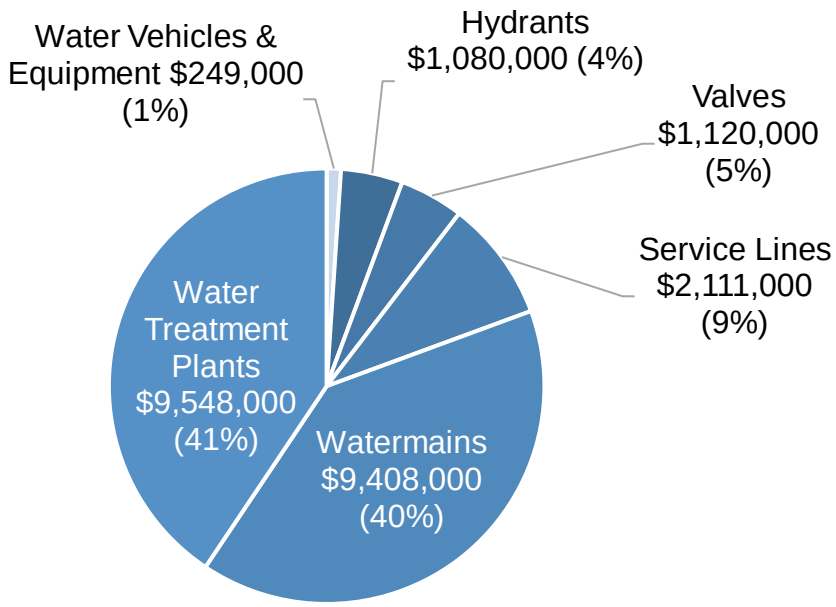
As the operating authority for the Township of Hamilton's drinking water systems, the Waterworks department is committed to providing safe drinking water to consumers, in compliance with the Drinking Water Act.

5.1.1 Asset Inventory & Replacement Cost

Water network assets are recorded in an asset manager software system. The following table provides summary information based on a December 2021 effective date:

Asset Segment	Quantity (Assets)	Average Age (Years)	Replacement Cost
Hydrants	90	22.5	$1,080,000
Service Lines	451	26.5	$2,111,000
Valves	114	23.75	$1,120,000
Water Treatment Plants	2 (3,320)[21]	17.5	$9,548,000
Water Vehicles & Equipment	74	8.08	$249,000
Watermains	21,664 linear Meters	25	$9,408,000
Total		**21.08**	**$23,516,000**

[21] There are two water treatments plants (Creighton Heights & Camborne) which each contain various building components. The figure in brackets represents the total number of various building components (i.e., roofing, doors, pumps, control values, filtration system etc.) contained within or connected to (i.e., associated parking lot) the treatment plants.



Total Current Replacement Cost: $23,516,000

Each asset's replacement cost should be reviewed periodically to determine whether adjustments are needed to more accurate represent realistic capital requirements.

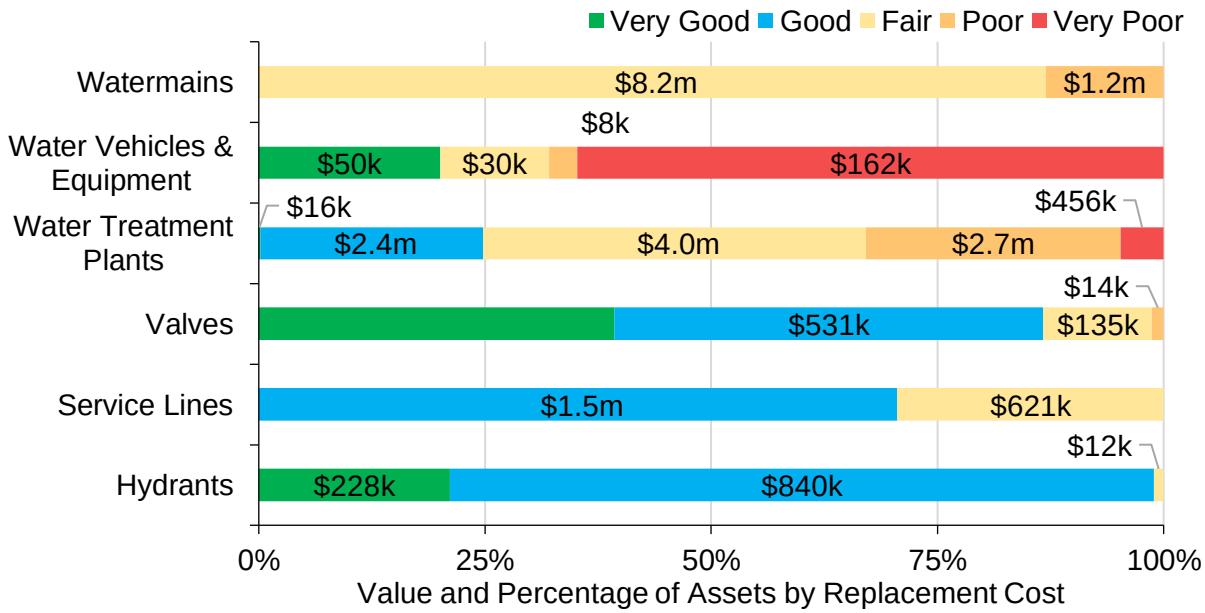
5.1.2 Asset Data: Useful Life, Age & Condition

The table below identifies the current average condition, the average age, and the estimated useful life for each asset segment. The Average Condition (%) is a weighted value based on replacement cost.

Asset Segment	Estimated Useful Life (Years)	Average Age (Years)	Average Condition (%)
Hydrants	75	22.5	71
Service Lines	75	26.5	62
Valves	75	23.75	74
Water Treatment Plants	35.25	17.5	52
Water Vehicles & Equipment	14	8.08	33
Watermains	75	25	56
Average	**54.16**	**21.08**	**56**

As part of the project engagement, PSD Citywide worked with Hamilton Township staff to review and as needed, update asset information.

Weighted by asset replacement value, 70% of water network assets are assessed for condition. Assessments are completed either by GM Blue Plan or the Water Operations Manager. Where assessed condition is not available, age-based condition based is used. The condition of water network assets by segment is summarized below.



To ensure that the Township's water network continue to provide an acceptable level of service, the Township should monitor the average condition of all assets. If the average condition declines, staff should re-evaluate their lifecycle management strategy to determine what combination of maintenance, rehabilitation, and replacement activities is required to increase the overall condition of the water network.

Each asset's Estimated Useful Life should also be reviewed periodically to determine whether adjustments need to be made to better align with the observed length of service life for each asset type.

Current Approach to Condition Assessment

Accurate and reliable condition data allows staff to determine the remaining service life of assets and identify the most cost-effective approach to managing assets more confidently. The following describes the Township's current approach:

- Staff perform visual inspections on water assets on a regular basis. When assessing condition, staff primarily rely on the number of water main breaks, service leaks, pipe material, and age.
- Health and Safety inspections are conducted monthly, by third-party contractors, for water buildings and structures.
- Pumping stations are inspected by in-house mechanics annually; their inspection includes the generator, electrical components, and overall structural integrity of the pump house.
- The water vehicle is inspected and serviced in accordance with Commercial Vehicle Operators Registration (CVOR) requirements.

In this AMP, the following rating criteria is used to determine the current condition of water network and forecast future capital requirements:

Condition	Rating
Very Good	80-100
Good	60-80
Fair	40-60
Poor	20-40
Very Poor	0-20

5.1.3 Lifecycle Management Strategy

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.

The following table outlines the Township's current lifecycle management strategy.

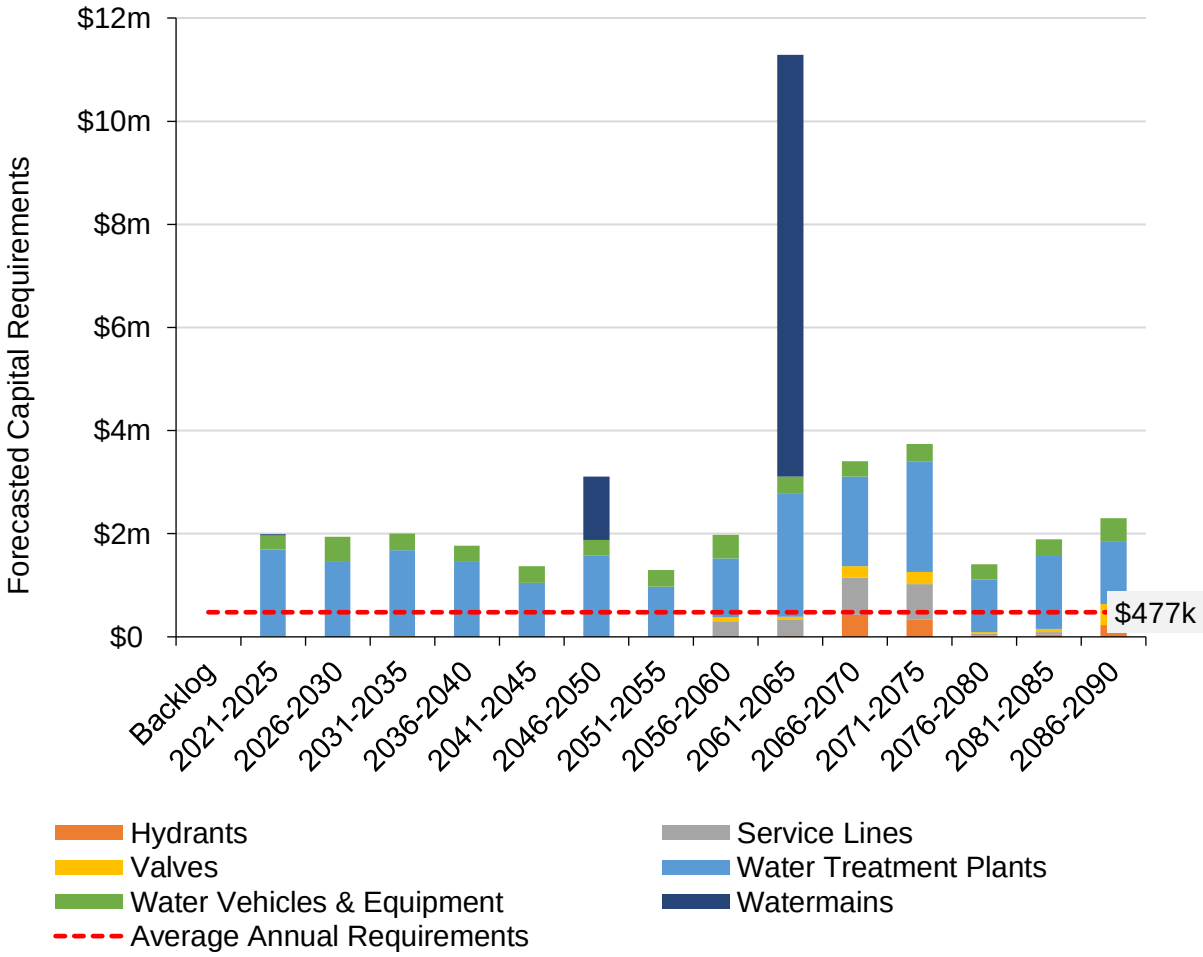
Event Class	Description
Maintenance & Testing	• Main flushing occurs throughout the year to prevent static water in dead-end areas. In Camborne and Creighton Heights, flushing is typically done once per month.
	• Valve turning is completed annually; in larger areas, such as Creighton, approximately 35% of the valves are exercised annually.
	• Periodic pressure testing is performed to identify deficiencies and potential leaks.
	• The water treatment plant and pumping stations are maintained on a regular basis, with a proactive maintenance program that complies with the Safe Drinking Water Act, 2002.
Rehabilitation & Replacement	• Staff developed a water systems capital needs assessment report which identified all rehabilitation and replacement needs of linear and vertical assets. These have been incorporated into this asset management report for more accurate capital projections.
	• Replacement of watermains is typically coordinated with road reconstruction and renewal whenever reasonably possible. Trenchless relining is not typically a viable option as much of the Township's mains are plastic or polyvinyl chloride (PVC).
	• Staff also prioritize looping watermains to reduce dead ends and prevent stagnation of water.

5.1.4 Forecasted Capital Requirements

The time over which every existing water network asset would be scheduled for replacement was determined based on each assets in-service date and its estimated useful life. Additionally, rehabilitation events were identified by asset based on the GM Blue Plan report and recommendations for existing assets over the period of 2021-2030. Over this period, the total average annual capital requirement was determined to be $477,000. This is detailed by asset category in the table below and represents the average capital requirement per year, cumulatively and by asset category.

Asset Segment	Average Annual Capital Requirement
Hydrants	$14,000
Service Lines	$28,000
Valves	$15,000
Water Treatment Plants	$280,000
Water Vehicle & Equipment	$14,000
Watermains	$125,000
Total	**$477,000**

Reporting in 5-year cumulative bins, the chart below summarizes the forecasted capital requirements by period and by asset segment. As indicated below, capital requirements fluctuate by period; in most 5-year periods capital requirements are about $2 million, but in 2061-2065 costs spike significantly most of which is attributed to watermain assets. On an average annual basis, capital requirements for the water network are $477,000; this is described by asset segment above.



The projected cost of lifecycle activities that will need to be undertaken over the next 10 years to maintain the current level of service can be found in Appendix B.

5.1.5 Risk & Criticality

Risk for water networks assets is quantified based on the probability and consequence of failure. The following table outlines the attributes and the corresponding model weight as indicated in brackets, used for water main assets:

Probability of Failure (PoF)	Consequence of Failure (CoF)
Assessed Condition (80%)	Replacement Cost (70%)
Asset Material (20%)	Pipe Diameter (30%)

For all other water network assets, the following table outlines the attributes and the corresponding model weight as indicated in brackets:

Probability of Failure (PoF)	Consequence of Failure (CoF)
Assessed Condition (100%)	Replacement Cost (100%)

Using the risk models developed, risk reports can be generated. Such outputs are often key resources and components of a municipality's Asset Management Program and provide valuable guidance on long-term financial planning, levels of service, and lifecycle management decisions.

Asset Segment	PoF	CoF	Risk Rating[22]
Hydrants	1.8	1.33	2.32 / 25
Service Lines	2.29	1.49	3.34 / 25
Valves	1.75	1.14	1.9 / 25
Water Treatment Plants	3.13	1.95	5.59 / 25
Water Vehicles & Equipment	3.93	1.69	7.21 / 25
Water Mains	2.92	2.96	8.62 / 25
Total	**2.85**	**2.24**	**6.29 / 25**

To gain a more detailed overview of risk distribution we can also review a risk matrix which plots each asset's probability and consequence of failure and overall risk. This can better illustrate risk distribution and associated replacement costs.

[22] When reporting at the segment level scores are weighted by asset replacement value.

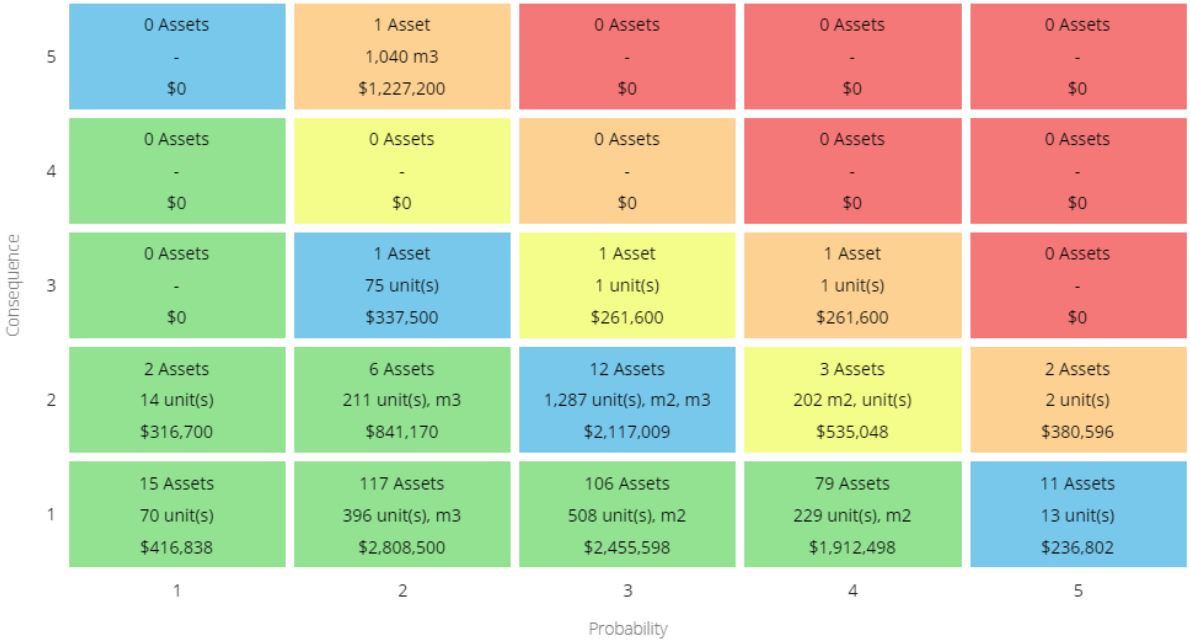
Using the risk model discussed above the overall risk scores for water main asset and all other water network assets are summarized in the matrixes below.

Water Mains: Risk Matrix

As indicated in the table above, most water main assets carry a low-to-moderate probability and consequence of failure; these assets are in green and blue boxes. Some assets carry a slightly higher consequence of failure and/or probability of failure and are considered to carry higher risks than average. These assets are identified in yellow and orange. As of 2021, there are no high-risk water main assets.

All Other Water Assets: Risk Matrix

The matrix below summarizes assets risks for water network assets (excluding water mains discussed previously). As identified in orange there are some assets that are moderately high risk. In these instances, the assets carry a low probability of failure but a very high consequence of failure or a low or moderate consequence of failure but a very high probability. Most assets carry low risk and are identified in green and blue boxes. Four assets carry moderate risk as identified in yellow.



This is a high-level model developed for the purposes of this AMP. As with any model, regular review and adjustment of the model is recommended. Such review should consider if there are any changes to the parameters that best indicate the probability and/or consequence of failure, or the asset data available to use for the risk model, alongside any regulatory or strategic changes that may affect the consequences of asset failure.

The identification of critical assets allows Hamilton Township to determine appropriate risk mitigation strategies and treatment options. Risk mitigation may include asset-specific lifecycle strategies, condition assessment strategies, or simply the need to collect better asset data.

Qualitative Risks

The following section summarizes key trends, challenges, and risks to service delivery that the Township is currently facing:

Fiscal Capacity

Currently the Township owns and operates three water systems which together service approximately 12% of properties within the Township. Throughout the Township, development is low density, so the amount of water infrastructure is high relative to the number service connections. This makes it very challenging to obtain the affordability benefits of economies of scale that are otherwise common of a municipal water system. Based on a review of historical actual and budgeted capital investments to the water network, less than 10% of the average annual capital requirement is funded. If the cost of municipal water rises, property owners may choose to switch to private service which would further the Township's challenge of providing an affordable water service. The historic level of underfunding in conjunction with the rural nature of the Township and the low percentage of properties connected is a severe risk to having the fiscal capacity (currently and in the future) to properly maintain water assets.

Asset Capacity & Design

The current water systems contain some problematic dead-ends and some capacity issues (primarily within Creighton) that can impact Staff's ability to meet desired levels of service when it comes to water quality (color/odor), affordability, and sustainability. Staff have considered conducting a hydraulic modelling analysis to gain a better understanding of what growth requirements are necessary to maintain their systems adequately.

Organizational Change & Capacity

Staff identified organizational change as an immediately relevant risk to the water network. As of 2022, several key operators for the Town's water systems were eligible to retire within three (3) years. Succession planning has begun for the first eligible retiree and throughout the last several years historical knowledge of the system has been collected by the Water Operations Manager. Given the critical service operators provide in the provision of water and the approaching retirements,

organization change is a risk. Through mitigative actions such as succession planning, this risk can be substantially reduced.

5.1.6 Levels of Service

The following tables identify the Township's current level of service for the water network. These metrics include the technical and community level of service metrics that are required as part of O. Reg. 588/17 as well as any additional performance measures that the Township has selected for this AMP.

Community Levels of Service

The following table outlines the qualitative descriptions that determine the community levels of service provided by the water network.

Service Attribute	Qualitative Description	Current LOS (2020)
Scope	Description, which may include maps, of the user groups or areas of the Township that are connected to the municipal water system	See Appendix D
	Description, which may include maps, of the user groups or areas of the Township that have fire flow	See Appendix D
Reliability	Description of boil water advisories and service interruptions	Current 2021 LOS: The Township has not experienced any service interruptions in 2021.

Technical Levels of Service

The following table outlines the quantitative metrics that determine the technical level of service provided by the water network.

Service Attribute	Technical Metric	Current LOS (2020)
Scope	% of properties connected to the municipal water system	59% for Camborne 50% for Creighton Heights
	% of properties where fire flow is available	0% for Camborne 50% for Creighton Heights
Reliability	# 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 days: 562[23]
	# of connection-days per year where water is not available due to water main breaks compared to the total number of properties connected to the municipal water system	0 days: 562

[23] Total number of properties connected to the water system is estimated to be 562.

5.1.7 Recommendations

Asset Inventory

- Continue to dedicate time and resources to review and plan for the management of water network asset information. Recommended data management considerations include:
    - Confirming data collection and management roles and responsibilities
    - Establishing data management standards (i.e., minimum data fields, frequency of data update, verification processes), reporting standards and frequency
    - Identification of how water network data collection and management will support the Township's broader asset management goals and values (as outlined in the Asset Management Policy).
- Some hydrants are pooled (i.e., assets 1426,1456) and would benefit from disaggregation so that attribute information including in-service date, location, and condition more accurately reflects each hydrant asset.

Condition Assessment Strategies

- Consider procurement of condition assessments so that asset condition, deficiencies, and attribute information can be verified and collected and incorporated into asset management planning. This will provide the Township with a more accurate understanding of the state of the infrastructure, asset risks, and asset investment prioritization. If needed, complete condition assessments in phases beginning with the oldest assets or those expected to be in the poorest condition.
- Utilize staff expertise to update condition information on a cyclical basis (i.e., every 3-5 years), between third-party water system assessments.

Lifecycle Management Strategies

- Ensure any decisions on the service delivery model reflect the principles of lifecycle management, that is managing assets at the lowest total cost of ownership by completing maintenance and rehabilitation activities and extending asset life to the greatest extent possible.

Risk Management Strategies

- Implement risk-based decision-making as part of asset management planning and budgeting processes.
- Identify suitable risk treatments for water network assets. Such treatments may include significant investment to substantially reduce risk, acceptance of risk, transfer of risk or some combination of all.
- Review risk models on a regular basis and adjust according to an evolving understanding of the probability and consequences of asset failure.

Levels of Service

- By 2025, all municipalities AMP's must include proposed LOS each year over the next 10 years from when it is developed. Begin preparing for this requirement. Consider what needs to be measured and reported, what information and tools are required to do so, and what staff resources are needed to manage the project.

6 Impacts of Growth

Key Insights

- Understanding the anticipated growth and the key drivers of it will assist the Township in anticipating infrastructure needs and planning for it more effectively. This may include maintaining existing assets, upgrading and/or expanding them or in some cases disposing of existing infrastructure.

- The Township's population has grown modestly; future population projections are also modest.

- The costs of growth should be considered in long-term funding strategies that are designed to maintain the current level of service.

6.1 Description of Growth Assumptions

The demand for infrastructure and services will change over time based on a combination of internal and external factors. Understanding the key drivers of growth and demand will allow the Township to better understand how population changes may impact infrastructure requirements. Increases or decreases in demand can affect what assets are needed and what level of service meets the needs of the community.

6.1.1 Township of Hamilton Official Plan (November 2010)

The Township of Hamilton's Official Plan was adopted by the Ontario Municipal Board on November 16th, 2010. It was then approved by the Ministry of Municipal Affairs and Housing, on August 28th, 2012.

The Official Plan provides context and a framework on how the Township will achieve its vision of being a "self-reliant, fiscally sound Township striving for positive growth, a sustainable infrastructure with socially responsible and accessible services that promote a safe, healthy and family friendly lifestyle".

The Township of Hamilton's population levels from 2011 until 2021 and their growth projections for 2031 alongside the Province of Ontario's population levels over these same years is summarized below:

Census Population				
Year	**2011**	**2016**	**2021**	**2031**
Township of Hamilton	10,700	10,942	11,059	*12,080
% Change		2.2	1.1	
Province of Ontario	12,851,821	13,448,494	14,223,942	
% Change		4.6	5.8	

*indicates projected population

As indicated above, the Township's population has grown modestly since 2011 and at a slower rate than the Province of Ontario. The Township's Official Plan directs population growth to designated settlement areas which include existing residential developments of the Baltimore and Camborne areas. Where residential development occurs outside of settlement areas, the Official Plan directs that the landscapes quality and rural nature shall be maintained. Throughout the Township the requirement for municipal services to support new residential development is to be carefully monitored, with private services considered.

6.1.2 Northumberland County Official Plan (November 2016)

The Township of Hamilton is located within Northumberland County. The Northumberland County Official Plan was approved by the Ontario Municipal Board on November 23rd, 2016, for the period until 2034. The Northumberland County Official Plan is intended to primarily deal with land use issues, namely growth and economic development, that *cross* municipal boundaries.

For the Township of Hamilton, the County Official Plan projects moderate growth amongst population, employment, and housing indicators. This can be seen below:

Township of Hamilton			
Year	**2034**	**2036**	**2041**
Population (Projection)	(12,359)	(13,788)	(15,574)
Population Increase	1,287	1,429	1,786
Employment Increase	328	356	499
Household Forecast	502		

Major Employment Area Special Policy Area

Regarding land use designation, the County Official Plan indicates the Township of Hamilton has 90 hectares of land located north and west of the Highway 401/Burnham Street interchange, which is considered suitable in "principle for the development of Major Employment uses".

6.2 Impact of Growth on Lifecycle Activities

By July 1, 2025, the Township'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 Township's AMP. While the addition of residential units will add to the existing assessment base and offset some of the costs associated with growth, the Township 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.

Staff have already identified multiple growth-related activities and assets with regards to their water network. These include:

- Developing a Water Supply Master Plan, for Creighton Heights, to assess capacity and upsizing opportunities.
- Conducting a Water Development Charge (DC) Study
- Conducting a Raw Water Quality Study for Creighton Heights
- Designing and constructing an Ammonia and Methane Removal System to improve water quality in well supply for Creighton Heights
- Expanding their distribution system and looping watermains in Creighton Heights to remove dead ends.

7 Financial Strategy

Key Insights

- The Township is committing approximately $2.61 million towards capital projects per year from sustainable revenue sources. Given the annual capital requirement of approximately $5.8 million the Township currently funds approximately 45% of its long-term requirements.[24]
- For tax-funded assets, we recommend increasing tax revenues by 1.4% each year for the next 20 years to achieve a sustainable level of funding.
- For the Water Network, we recommend increasing rate revenues by 2.8% annually for the next 20 years to achieve a sustainable level of funding

[24] Most municipalities in Canada face an ever-growing annual capital deficit as shown in the latest Canadian Infrastructure Report Cards (CIRCs). Hamilton Township shares this struggle with many similar-sized municipalities within its region.

7.1 Financial Strategy Overview

For an asset management plan to be effective and meaningful, it must be integrated with financial planning and long-term budgeting. The development of a comprehensive financial plan will allow the Township of Hamilton to identify the financial resources required for sustainable asset management based on existing asset inventories, desired levels of service, and projected growth requirements.

This report develops such a financial plan by presenting several scenarios for consideration and culminating with final recommendations. As outlined below, the scenarios presented model different combinations of the following components:

1. The financial requirements for:
    a. Existing assets
    b. Existing service levels
    c. Requirements of contemplated changes in service levels (none identified for this plan)
    d. Requirements of anticipated growth (none identified for this plan)
2. Use of traditional sources of municipal funds:
    a. Tax levies
    b. User fees
    c. Reserves
    d. Debt
    e. Development charges
3. Use of non-traditional sources of municipal funds:
    a. Reallocated budgets
    b. Partnerships
    c. Procurement methods
4. Use of Senior Government Funds:
    a. Canada Community Building Fund (CCBF)[25]
    b. Ontario Community Infrastructure Fund (OCIF)
    c. Annual grants

Note: Periodic grants are normally not included due to Provincial requirements for firm commitments. However, if moving a specific project forward is wholly dependent on receiving a one-time grant, the replacement cost included in the financial strategy is the net of such grant being received.

If the financial plan component results in a funding shortfall, the Province requires the inclusion of a specific plan as to how the impact of the shortfall will be managed. In

[25] This fund was previously called Gas Tax.

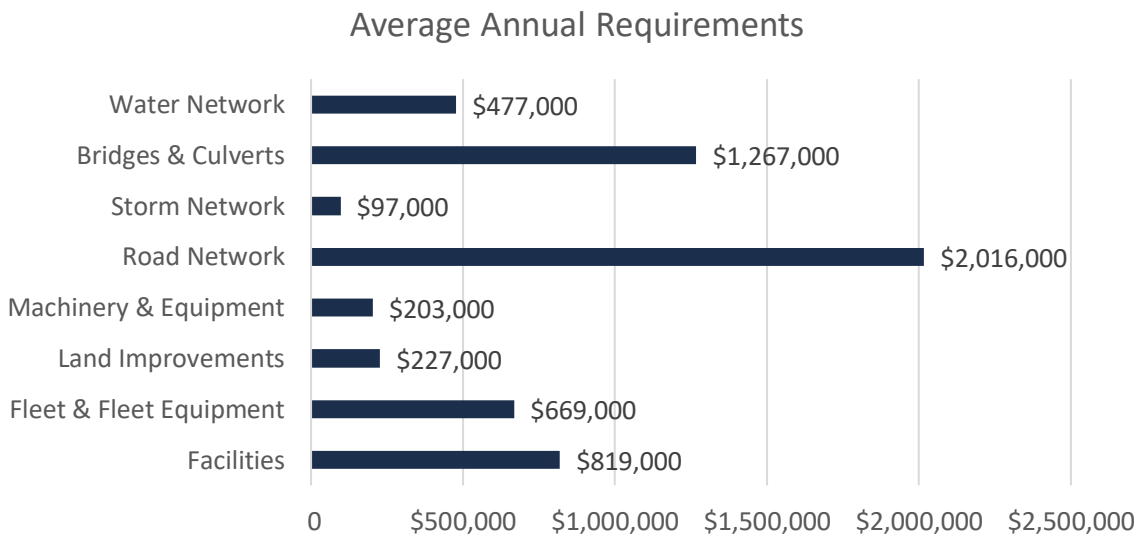
determining the legitimacy of a funding shortfall, the Province may evaluate a Township's approach to the following:

1. In order to reduce financial requirements, consideration has been given to revising service levels downward.
2. All asset management and financial strategies have been considered. For example:
    a. If a zero-debt policy is in place, is it warranted? If not, the use of debt should be considered.
    b. Do user fees reflect the cost of the applicable service? If not, increased user fees should be considered.

7.1.1 Annual Requirements & Capital Funding

Annual Requirements

The annual requirements represent the amount the Township should allocate annually to each asset category to meet replacement needs as they arise, prevent infrastructure backlogs, and achieve long-term sustainability. In total, the Township must allocate approximately $5.8 million annually to address capital requirements for the assets included in this AMP.



For some asset categories the annual requirement has been calculated based on a "replacement only" scenario, in which capital costs are only incurred at the construction and replacement of each asset.

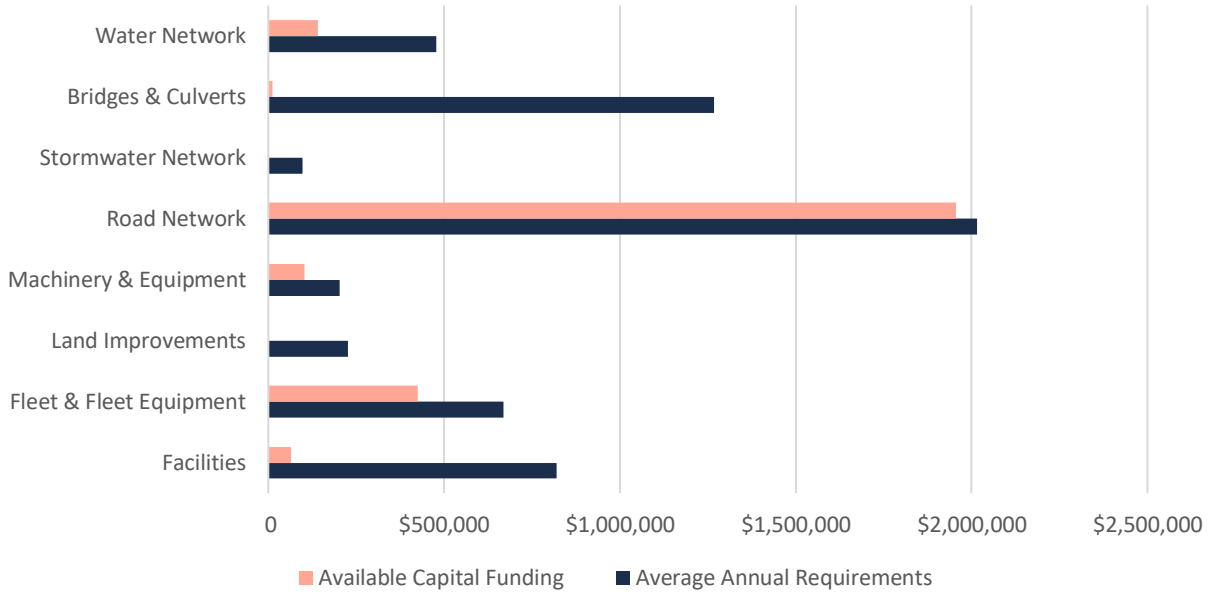
However, for the road network, bridges & culverts, and water network, lifecycle management strategies have been developed to identify capital costs that are realized

through strategic rehabilitation and renewal of the Township's assets. The development of these strategies follows expert recommendations based on asset inspection findings and often allows for a comparison of potential cost avoidance if the strategies were to be implemented.

The implementation of a proactive lifecycle strategy can lead to direct and indirect cost savings. Potential cost savings are influenced by current rehabilitation and reconstruction costs, the coordination of projects, and the criticality of the assets. Beyond cost avoidance, having proactive lifecycle strategies can also improve other valuable levels of service to the Township such as lowering health and safety hazards, decreasing the number of complaints received, and meeting public expectations.

Annual Funding Available

Based on a historical analysis of sustainable capital funding sources, the Township is committing approximately $2.61 million towards capital projects per year. Given the annual capital requirement of $5.8 million, there is currently a funding gap of $3.1 million annually[26].



[26] The Township's deficit or current reinvestment rate is in line with other Canadian municipalities as seen through the latest Canadian Infrastructure Report Card (CIRC).

7.2 Funding Objective

We have developed a scenario that would enable Hamilton to achieve full funding within 5,10,15 and 20 years for the following assets:

1. **Tax Funded Assets:** bridges & culverts, facilities, fleet & fleet equipment, land improvements, machinery & equipment, road network, stormwater network
2. **Rate-Funded Assets:** water network

Note: For the purposes of this AMP, we have excluded unpaved roads since they are perpetual maintenance assets and end of life replacement calculations do not normally apply. If gravel roads are maintained properly, they can theoretically have a limitless service life.

For each scenario developed we have included strategies, where applicable, regarding the use of cost containment and funding opportunities.

7.3 Financial Profile: Tax Funded Assets

7.3.1 Current Funding Position

The following tables show, by asset category, the Township's average annual asset capital investment requirements, current annual capital funding available, and resultant annual deficit.

Asset Category	Avg. Annual Requirement	Annual Funding Available				Annual Deficit
		Taxes	CCBF & OCIF	Capital Reserves Allocation	Total Available	
Bridges & Culverts	1,267,000	0	0	12,000	12,000	1,255,000
Facilities	819,000	0	0	64,000	64,000	755,000
Fleet & Fleet Equipment	669,000	0	0	424,000	424,000	245,000
Land Improvements	227,000	0	0	0	0	227,000
Machinery & Equipment	203,000	0	0	103,000	103,000	100,000
Road Network	2,016,000	860,000	1,088,000	7,000	1,955,000	61,000
Stormwater Network	97,000	0	0	0	0	97,000
Total	**5,298,000**	**860,000**	**1,088,000**	**610,000**	**2,558,000**	**2,740,000**

The average annual investment requirement for the above categories is $5,298,000. Annual revenue currently allocated to these assets for capital purposes is $2,558,000 leaving an annual deficit of $2,740,000. Put differently, these infrastructure categories are currently funded at 48% of their long-term requirements.

7.3.2 Full Funding Requirements

In 2022, Township of Hamilton has annual tax revenues of $8,937,968. As illustrated in the following table, without consideration of any other sources of revenue or cost containment strategies, full funding would require the following tax change over time:

Asset Category	Tax Change Required for Full Funding
Bridges & Culverts	14%
Facilities	8.4%

Fleet & Fleet Equipment	2.7%
Land Improvements	2.5%
Machinery & Equipment	1.1%
Road Network	0.7%
Stormwater Network	1.1%
Total	**30.5%**

The following table outlines the infrastructure deficit and tax rate impacts based on removing the deficit over 5-20 years.

	Infrastructure Deficit Analysis			
	5 Years	**10 Years**	**15 Years**	**20 Years**
Infrastructure Deficit	2,740,000	2,740,000	2,740,000	2,740,000
Resulting Infrastructure Deficit:	**5**	**10**	**15**	**20**
Tax Increase Required	30.5%	30.5%	30.5%	30.5%
Annually:	**5.5%**	**2.8%**	**1.8%**	**1.4%**

The following changes in costs and/or revenues over the next number of years should also be considered in the financial strategy:

a) Hamilton's formula based OCIF grant is scheduled to decrease from $505,000 in 2022 to $429,000 in 2023.

7.3.3 Financial Strategy Recommendations

Considering all the above information, we recommend the 20-year option. This involves full funding being achieved over 20 years by:

a) increasing tax revenues by 1.4% each year for the next 20 years solely for the purpose of phasing in full funding to the asset categories covered in this section of the AMP.
b) allocating the current CCBF and OCIF revenue as outlined previously.
c) reallocating appropriate revenue from categories in a surplus position to those in a deficit position.
d) increasing existing and future infrastructure budgets by the applicable inflation index on an annual basis in addition to the deficit phase-in.

Notes:

1. As in the past, periodic senior government infrastructure funding will most likely be available during the phase-in period. By Provincial AMP rules, this periodic funding cannot be incorporated into an AMP unless there are firm commitments in place. We have included OCIF formula based and CCBF funding, since this funding is a multi-year commitment[27].
2. We realize that raising tax revenues by the amounts recommended above for infrastructure purposes will be very difficult to do. However, considering a longer phase-in window may have even greater consequences in terms of infrastructure failure.

Although this option achieves full funding on an annual basis in 20 years and provides financial sustainability over the period modeled, the recommendations do require prioritizing capital projects to fit the resulting annual funding available.

Prioritizing future projects will require the current data to be replaced by condition-based data. Although our recommendations include no further use of debt, the results of the condition-based analysis may require otherwise.

[27] The Township should take advantage of all available grant funding programs and transfers from other levels of government. While OCIF has historically been considered a sustainable source of funding, the program is currently undergoing review by the provincial government. Depending on the outcome of this review, there may be changes that impact its availability.

Financial Profile: Rate Funded Assets

7.3.4 Current Funding Position

The following tables show, by asset category, the Township's average annual capital expenditures requirements, current funding positions, and funding increase required to achieve full funding on rate-funded assets.

Asset Category	Avg. Annual Requirement	Annual Funding Available				Annual Deficit
		Reserves for Capital	Gas Tax	OCIF	Total Available	
Water Network	477,000	141,000	0	0	141,000	336,000
Total	**477,000**	**141,000**	**0**	**0**	**141,000**	**336,000**

The average annual investment requirement for the above categories is $477,000. Annual revenue currently allocated to these assets for capital purposes is $141,000 leaving an annual deficit of $336,000. Put differently, these infrastructure categories are currently funded at 30% of their long-term requirements.

7.3.5 Full Funding Requirements

In 2022, Hamilton had annual water revenues of $470,578. As illustrated in the table below, without consideration of any other sources of revenue, full funding would require the following changes over time:

Asset Category	Rate Change Required for Full Funding
Water Network	71.4%

In the following tables, we have expanded the above scenario to present multiple options. Due to the significant increases required, we have provided phase-in options of up to 20 years:

	Water Network			
	5 Years	10 Years	15 Years	20 Years
Infrastructure Deficit	336,000	336,000	336,000	336,000
Tax Increase Required	71.4%	71.4%	71.4%	71.4%
Annually:	**11.4%**	**5.6%**	**3.7%**	**2.8%**

7.3.6 Financial Strategy Recommendations

Considering the above information, we recommend the 20-year option that includes debt cost reallocations. This involves full funding being achieved over 20 years by:

a) increasing rate revenues by 2.8% for water services each year for the next 20 years solely for the purpose of phasing in full funding to the asset categories covered in this section of the AMP.
b) increasing existing and future infrastructure budgets by the applicable inflation index on an annual basis in addition to the deficit phase-in.

Notes:

1. As in the past, periodic senior government infrastructure funding will most likely be available during the phase-in period. This periodic funding should not be incorporated into an AMP unless there are firm commitments in place.
2. Assumption is that no new debt will be taken on to pay for existing infrastructure.
3. We realize that raising rate revenues for capital expenditures purposes will be very difficult to do. However, considering a longer phase-in window may have even greater consequences in terms of infrastructure failure.
4. Any increase in rates required for operations would be in addition to the above recommendations.

Although this strategy achieves full capital expenditures funding for rate-funded assets over 20 years, the recommendations do require prioritizing capital projects to fit the resulting annual funding available.

7.4 Use of Reserves

7.4.1 Available Reserves

Reserves play a critical role in long-term financial planning. The benefits of having reserves available for infrastructure planning include:

a) the ability to stabilize tax rates when dealing with variable and sometimes uncontrollable factors
b) financing one-time or short-term investments
c) accumulating the funding for significant future infrastructure investments
d) managing the use of debt
e) normalizing infrastructure funding requirement

By asset category, the table below outlines the details of the reserves currently available to Hamilton.

Asset Category	Balance at December 31, 2022
Bridges & Culverts	50,000
Facilities	876,000
Fleet & Fleet Equipment	753,000
Land Improvements	0
Machinery & Equipment	735,000
Road Network	1,687,000
Storm Network	0
Total Tax Funded:	**4,101,000**
Water Network	(415,000)
Total Rate Funded:	**(415,000)**

There is considerable debate in the municipal sector as to the appropriate level of reserves that a Township should have on hand. There is no clear guideline that has gained wide acceptance. Factors that municipalities should consider when determining their capital reserve requirements include:

a) breadth of services provided
b) age and condition of infrastructure
c) use and level of debt
d) economic conditions and outlook
e) internal reserve and debt policies.

These reserves are available for use by applicable asset categories during the phase-in period to full funding. This coupled with the Township of Hamilton's judicious use of debt in the past, allows the scenarios to assume that, if required, available reserves and debt capacity can be used for high priority and emergency infrastructure investments in the short- to medium-term.

7.4.2 Recommendation

In 2025, Ontario Regulation 588/17 will require the Township of Hamilton to integrate proposed levels of service for all asset categories in its asset management plan update. We recommend that future planning should reflect adjustments to service levels and their impacts on reserve balances.

8 Appendices

Key Insights

- Appendix A defined risk specific terms.
- Appendix B identifies projected 10-year capital requirements for each asset category.
- Appendix C details the risk parameters for each risk model.
- Appendix D includes several maps that have been used to visualize the current level of service.
- Appendix E provides additional guidance on the development of a condition assessment program.

Appendix A: Risk Specific Terms

Asset management recognizes that organizations will respond to and tolerate risks differently based on their context, regulatory requirements, and degree of risk held. While discussing risk the following terms are of relevance:

Risk Appetite: Amount and type of risk than an organization is willing to retain or accept.

Risk Treatment: responses to risk, often with the objective of reducing the amount of risk held. Common types of risk treatment are outlined in the report's Conclusions and Recommendations.

Residual Risk: Risk remaining after risk treatment.

Risk Tolerance: organizations readiness to bear the residual risk after completion of risk treatment.

Appendix B: 10-Year Capital Requirements

The following tables identify the forecasted capital cost requirements over 10 years for each asset category and as a total:

Category	Backlog	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Facilities	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$388k
Fleet & Fleet Equipment	$0	$440k	$930k	$400k	$573k	$277k	$190k	$502k	$330k	$1.0m	$1.0m
Land Improvements	$121k	$0	$150k	$60k	$0	$80k	$106k	$0	$101k	$0	$0
Machinery & Equipment	$44k	$0	$36k	$24k	$164k	$122k	$104k	$101k	$156k	$364k	$359k
Road Network	$2.9m	$7k	$2.6m	$2.3m	$0	$0	$0	$0	$37k	$0	$20k
Bridges & culverts	$0	$333k	$2.6m	$1.1m	$1.5m	$206k	$50k	$0	$0	$250k	$0
Storm Network	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Water Network	$0	$327k	$355k	$621k	$486k	$206k	$236k	$60k	$628k	$557k	$454k
Total	**$3.1m**	**$1.1m**	**$6.6m**	**$4.5m**	**$2.7m**	**$891k**	**$686k**	**$663k**	**$1.3m**	**$2.2m**	**$2.2m**

Appendix C: Risk Rating Criteria

Probability of Failure

Asset Category/ Asset Segment	Risk Criteria	Criteria Weighting	Value/Range	Probability of Failure Score
Road Network / All	Condition	100 %	8 and above	1 - Rare
			6 and above	2 - Unlikely
			4 and above	3 – Possible
			2 and above	4 - Likely
			0 and above	5 – Almost Certain
Bridges & Culverts/All	Condition	100 %	75 and above	1 - Rare
			70 and above	2 - Unlikely
			60 and above	3 – Possible
			50 and above	4 - Likely
			0 and above	5 – Almost Certain
Stormwater Network/Storm Mains	Condition	80 %	80 and above	1 - Rare
			60 and above	2 - Unlikely
			40 and above	3 – Possible
			20 and above	4 - Likely
			0 and above	5 – Almost Certain
	Asset Material	20%	Plastics: HDPE, PVC, PE, CPP, CP	2—Unlikely
			CSP, Steel	4—Likely
Stormwater Network/All (Excluding Storm Mains)	Condition	100 %	80 and above	1 - Rare
			60 and above	2 - Unlikely
			40 and above	3 – Possible
			20 and above	4 - Likely
			0 and above	5 – Almost Certain
Water Network/Water Mains	Condition	80 %	1 and above	1 - Rare
			2 and above	2 - Unlikely
			3 and above	3 – Possible
			4 and above	4 - Likely

Asset Category/ Asset Segment	Risk Criteria	Criteria Weighting	Value/Range	Probability of Failure Score
			5 and above	5 – Almost Certain
	Asset Material	20%	Plastics: HDPE, PVC, PE, CPP, CP	2—Unlikely
			CSP, Steel	4—Likely
Facilities	Condition	75 %	80 and above	1—Rare
			60 and above	2—Unlikely
			40 and above	3—Possible
			20 and above	4—Likely
			0 and above	5—Almost Certain
	Service Life Remaining	25%	80 and above	1—Rare
			50 and above	2—Unlikely
			30 and above	3—Possible
			15 and above	4—Likely
			0 and above	5—Almost Certain
Land Improvments & Machinery & Equipment	Condition	70 %	80 and above	1—Rare
			60 and above	2—Unlikely
			40 and above	3—Possible
			20 and above	4—Likely
			0 and above	5—Almost Certain
	Service Life Remaining	30%	80 and above	1—Rare
			50 and above	2—Unlikely
			30 and above	3—Possible
			15 and above	4—Likely
			0 and above	5—Almost Certain
Public Works and Recreatoinal Fleet Assets	Condition	70 %	80 and above	1—Rare
			60 and above	2—Unlikely
			40 and above	3—Possible
			20 and above	4—Likely
			0 and above	5—Almost Certain
	Service Life Remaining	30%	80 and above	1—Rare
			60 and above	2—Unlikely
			40 and above	3—Possible

Asset Category/ Asset Segment	Risk Criteria	Criteria Weighting	Value/Range	Probability of Failure Score
			20 and above	4—Likely
			0 and above	5—Almost Certain
Fire Fleet Assets	Condition	100 %	80 and above	1—Rare
			60 and above	2—Unlikely
			40 and above	3—Possible
			20 and above	4—Likely
			0 and above	5—Almost Certain

Consequence of Failure

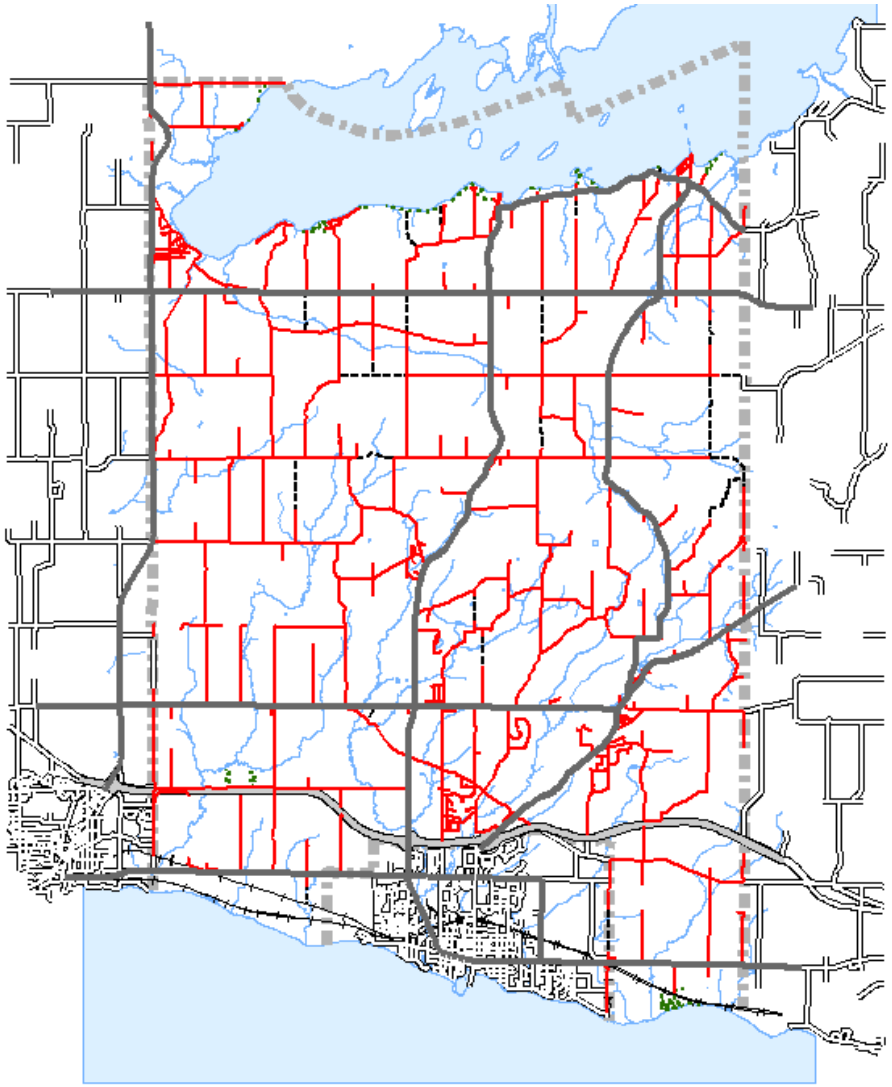
Asset Category	Risk Classification &Weighting	Risk Criteria	Value/Range	Consequence of Failure Score
Road Network/ Paved Roads	Economic (50%)	Replacement Cost (100%)	$30,000 or less	1 (Insignficiant)
			$60,000 or less	2 (Minor)
			$120,000 or less	3 (Moderate)
			$240,000 or less	4 (Major)
			$1,650,000 or less	5 (severe)
	Social (50%)	Number of Lanes (50%)	2	2 (Minor)
			1	4 (Major)
		Road Class (50%)	100	1 (Insignficiant)
			200	2 (Minor)
			300	3 (Moderate)
			400	4 (Major)
			500,600	5 (severe)
Road Network/ All (Excluding Paved Roads)	Economic (100%)	Replacement Cost	$100,000 or less	1 (Insignficiant)
			$250,000 or less	2 (Minor)
			$500,000 or less	3 (Moderate)
			$1,000,000 or less	4 (Major)
			$1,000,000 or less	5 (severe)
Bridges & Culverts	Economic (100%)	Replacement Cost (100%)	$225,000 and below	1 (Insignficiant)
			$300,000 and below	2 (Minor)
			$400,000 and below	3 (Moderate)
			$800,000 and below	4 (Major)
			$1,400,000 and below	5 (severe)
Stormwater Network/Storm Mains	Economic (70%)	Replacement Cost	$10,000 or less	1 (Insignficiant)
			$20,000 or less	2 (Minor)
			$50,000 or less	3 (Moderate)
			$100,000 or less	4 (Major)
			$375,000 or less	5 (severe)
	Social (30%)	Pipe Diameter	200 and below	1—Insignificant
			400 and below	2—Minor

Asset Category	Risk Classification &Weighting	Risk Criteria	Value/Range	Consequence of Failure Score
			800 and below	3—Moderate
			1200 and below	4—Major
			2400 and below	5—Severe
Stormwater Network/All (Excluding Storm Mains)	Economic (100%)	Replacement Cost	$100,000 and below	1—Insignificant
			$250,000 and below	2—Minor
			$500,000 and below	3—Moderate
			$1 M and below	4—Major
			$1 M and greater	5—Severe
Facilities	Economic (75%)	Replacement Cost	$400,000 and below	1—Insignificant
			$900,000 and below	2—Minor
			$1,300,000 and below	3—Moderate
			$5,000,000 and below	4—Major
			$5,200,000 and below	5—Severe
	Operational (25%)	Function	No Function	1—Insignificant
			General Government	2—Minor
			Recreation & Cultural Services	
			Environmental Services	3—Moderate
			Transportation services	
			Health Services	5—Severe
			Protection Services	
Land Improvments & Machinery & Equipment	Economic (70%)	Replacement Cost	$45,000 and below	1—Insignificant
			$80,000 and below	2—Minor
			$200,000 and below	3—Moderate
			$500,000 and below	4—Major
			$600,000 and below	5—Severe
	Operational (30%)	Function	Fencing, landscaping, waste receptacles	2—Minor
			Furnishings, Gazebo, Parking Lots, Retaining Walls	3—Moderate

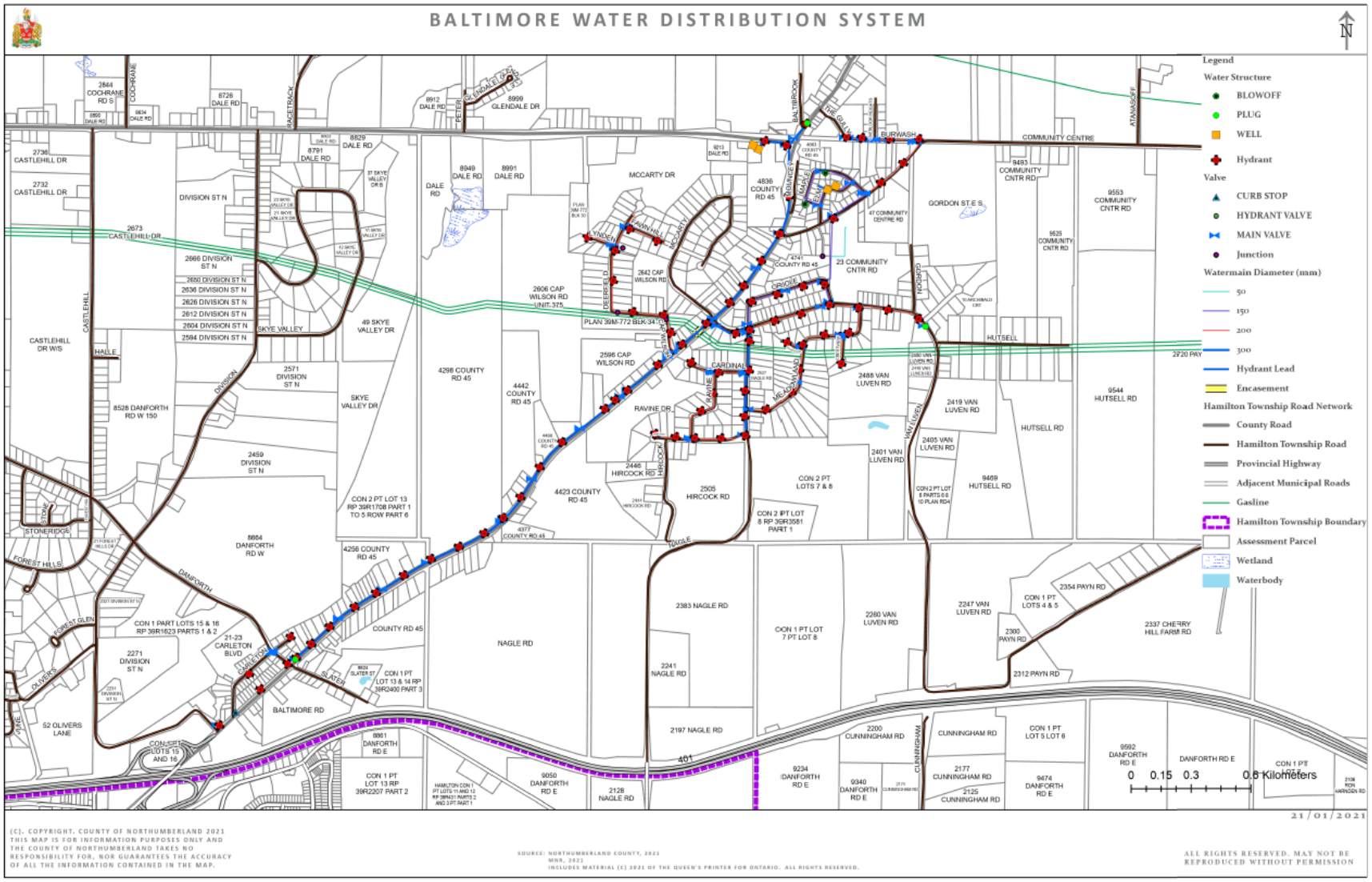
Asset Category	Risk Classification &Weighting	Risk Criteria	Value/Range	Consequence of Failure Score
			Athletic Fields & Playgrounds, Boardwalks, Picnic Tables, Playgrounds, Tennis Courts	4—Major
			Docks	5—Severe
Public Works and Recreational Fleet Assets	Economic (75%)	Replacement Cost	$80,000 and below	1—Insignificant
			$200,000 and below	2—Minor
			$225,000 and below	3—Moderate
			$250,000 and below	4—Major
			$300,000 and below	5—Severe
	Social (25%)	Segment	General Government, Recreation & cultural services	2—Minor
			Environmental Services, Transportation Services	3—Moderate
			Health Services, Protection Services	5—Severe
Fire Fleet Assets	Economic (100%)	Replacement Cost	$80,000 and below	1—Insignificant
			$200,000 and below	2—Minor
			$225,000 and below	3—Moderate
			$250,000 and below	4—Major
			$300,000 and below	5—Severe

Appendix D: Level of Service Maps

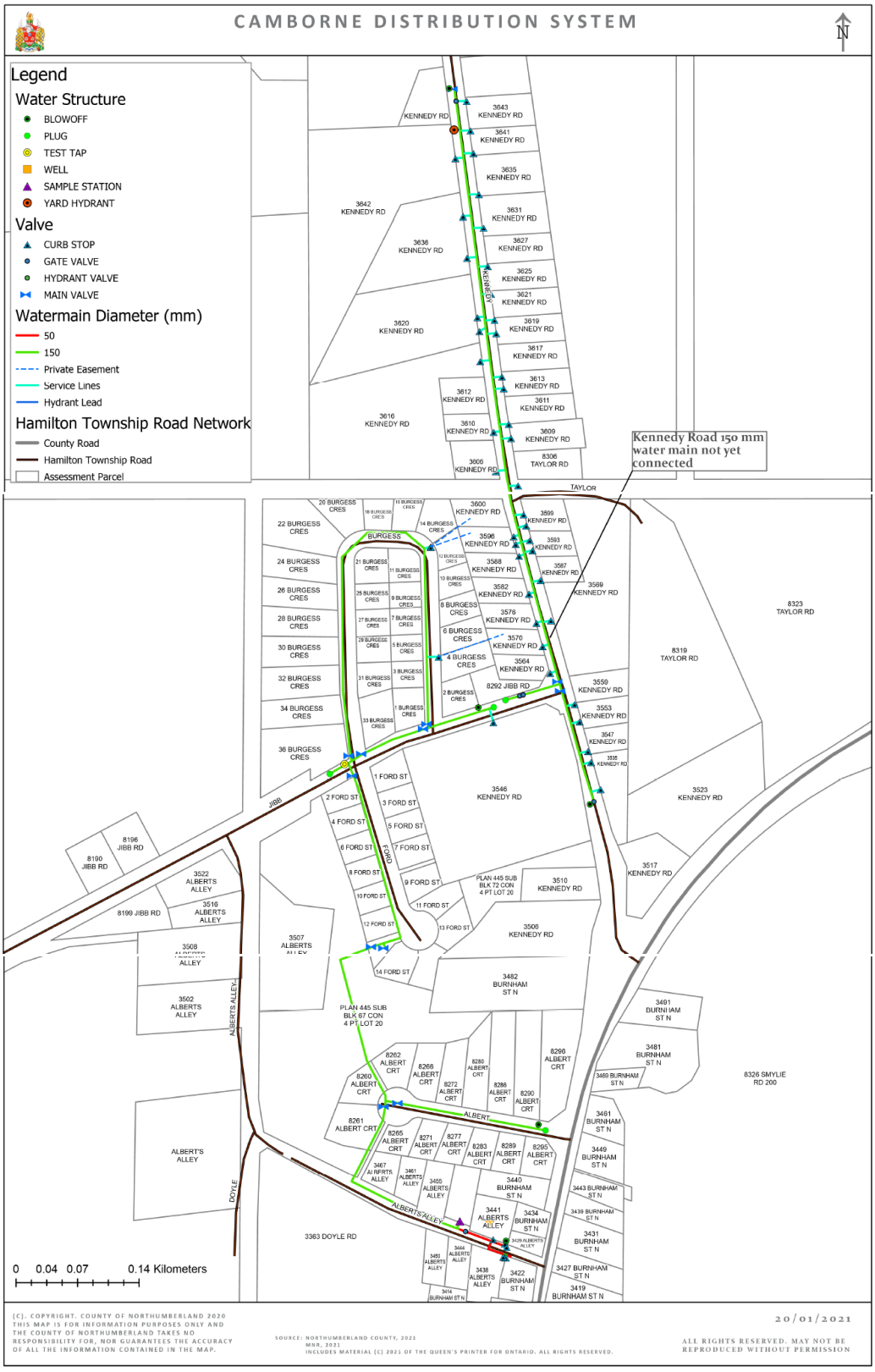
Road Network Map



Water Network Map – Part 1 (Baltimore/Creighton Heights Water Distribution System)



Water Network Map – Part 2 (Camborne Distribution System)



Appendix E: 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 Township'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 Township'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 Township 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 Township 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 Township 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 Township 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