AMP2016

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The 2016 Asset Management Plan for the

Municipality of Brockton

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Executive Summary

Infrastructure is inextricably linked to the economic, social and environmental advancement of a community. Municipalities own and manage nearly 60% of the public infrastructure stock in Canada. As analyzed in this asset management plan (AMP), the Municipality of Brockton's infrastructure portfolio comprises nine distinct infrastructure categories: roads, bridges & culverts, buildings, storm sewer services, water services, sanitary sewer services, land improvements, vehicles, and machinery & equipment. The nine asset classes analyzed in this asset management plan for the municipality had a total 2016 valuation of $190 million, of which the road network comprised 36%.

Strategic asset management is critical in extracting the highest total value from public assets at the lowest lifecycle cost. This AMP, the municipality's second following the completion of its first edition in 2013, details the state of infrastructure of the municipality's service areas and provides asset management and financial strategies designed to facilitate its pursuit of developing an advanced asset management program and mitigate long-term funding gaps.

Similar to other municipalities in Ontario, the Municipality of Brockton experienced a peak of asset investment in the early 1980s totaling nearly $65 million. The municipality also experienced slowly increasing investments throughout the rest of the 1980s and 1990s, which peaked again between 2000-and 2004 at nearly $25 million. Throughout this time, roads comprised the largest portion of investment. Since 2010, expenditures have totaled more than $7 million with investment distributed among many categories.

Based on 2016 replacement cost, and mostly age-based data, while nearly 30% of the municipality's total asset portfolio as analysed in this AMP is in very good or good condition, 42% of the assets, with a valuation of $80 million, is in poor to very poor condition. While age is not a precise indicator of the health of assets, it can serve as a useful approximation of asset deterioration. Approximately 65% of the municipality's assets, with a valuation of $122 million, have at least 10 years of useful life remaining. However, a significant portion, with a valuation of $41 million, remain in operation beyond their useful life. An additional 11% of assets valued at $20 million will reach the end of their useful life in the next five years.

In order for an AMP to be effectively put into action, it must be integrated with financial planning and long-term budgeting. The development of a comprehensive financial plan will allow the municipality to identify the financial resources required for sustainable asset management based on existing asset inventories, desired levels of service, and projected growth requirements. This AMP provides financial strategies to achieve fiscal sustainability for the municipality's tax and rate funded assets.

The average annual investment requirement for the municipality's tax categories is $6,057,000. Annual revenue currently allocated to these assets for capital purposes is $1,590,000 leaving an annual deficit of $4,467,000. To put it another way, these infrastructure categories are currently funded at 26% of their long-term requirements. In 2016, the municipality has annual tax revenues of $7,544,000. We recommend a 20 year option for phasing in full funding, including reallocations of decreasing debt repayments. This involves full funding being achieved over 20 years by:

- when realized, reallocating the debt cost reductions of $239,000 to the infrastructure deficit
- increasing tax revenues by 2.8% each year for the next 20 years solely for the purpose of phasing in full funding to the tax funded asset categories covered in this AMP.
- allocating the gas tax revenue and OCIF revenue to tax funded assets.
- increasing existing and future infrastructure budgets by the applicable inflation index on an annual basis in addition to the deficit phase-in.

The average annual investment requirement for the municipality's rate funded categories is $831,000. Annual revenue currently allocated to these assets for capital purposes is $421,000, leaving an annual deficit of

$410,000. To put it another way, these infrastructure categories are currently funded at 51% of their long-term requirements. In 2016, Brockton has annual sanitary revenues of $969,000 and annual water revenues of $941,000. We recommend a 10 year option for phasing in full funding, including the reallocations of debt repayment. This involves full funding being achieved over 10 years by:

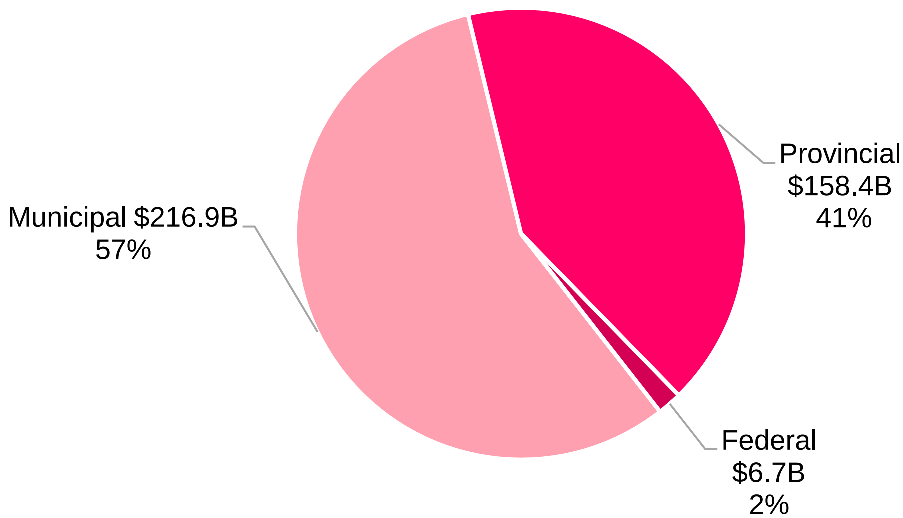
- when realized, reallocating the debt cost reductions of $4,000 for sanitary services and $60,000 for water services to the applicable infrastructure deficit.
- increasing rate revenues by 3.3% for sanitary services and 0.3% for water services each year for the next 10 years solely for the purpose of phasing in full funding to these rate funded asset categories.
- increasing existing and future infrastructure budgets by the applicable inflation index on an annual basis in addition to the deficit phase-in.

A critical aspect of this asset management plan is the level of confidence the municipality has in the data used to develop the state of the infrastructure and form the appropriate financial strategies. The municipality has indicated a very high degree of confidence in the accuracy, validity and completeness of the asset data for all categories analyzed in this asset management plan.

I. Introduction & Context

Across Canada, municipal share of public infrastructure increased from 22% in 1955 to nearly 60% in 2013. The federal government's share of critical infrastructure stock, including roads, water and wastewater, declined by nearly 80% in value since 1963.[1]

FIGURE 1 DISTRIBUTION OF NET STOCK OF CORE PUBLIC INFRASTRUCTURE



Ontario's municipalities own more of the province's infrastructure assets than both the provincial and federal government. The asset portfolios managed by Ontario's municipalities are also highly diverse. The total replacement cost of capital assets are analyzed in this document. The municipality relies on these assets to provide residents, businesses, employees and visitors with safe access to important services, such as transportation, recreation, culture, economic development and much more. As such, it is critical that the municipality manage these assets optimally in order to produce the highest total value for taxpayers. This asset management plan, (AMP) will assist the municipality in the pursuit of judicious asset management for its capital assets.

[1] Larry Miller, Updating Infrastructure In Canada: An Examination of Needs And Investments Report of the Standing Committee on Transport, Infrastructure and Communities, June 2015

II. Asset Management

Asset management can be best defined as an integrated business approach within an organization with the aim to minimize the lifecycle costs of owning, operating, and maintaining assets, at an acceptable level of risk, while continuously delivering established levels of service for present and future customers. It includes the planning, design, construction, operation and maintenance of infrastructure used to provide services. By implementing asset management processes, infrastructure needs can be prioritized over time, while ensuring timely investments to minimize repair and rehabilitation costs and maintain municipal assets.

TABLE 1 OBJECTIVES OF ASSET MANAGEMENT

Inventory	Capture all asset types, inventories and historical data.
Current Valuation	Calculate current condition ratings and replacement values.
Life Cycle Analysis	Identify Maintenance and Renewal Strategies & Life Cycle Costs.
Service Level Targets	Define measurable Levels of Service Targets
Risk & Prioritization	Integrates all asset categories through risk and prioritization strategies.
Sustainable Financing	Identify sustainable Financing Strategies for all asset categories.
Continuous Processes	Provide continuous processes to ensure asset information is kept current and accurate.
Decision Making & Transparency	Integrate asset management information into all corporate purchases, acquisitions and assumptions.
Monitoring & Reporting	At defined intervals, assess the assets and report on progress and performance.

1 Overarching Principles

The Institute of Asset Management (IAM) recommends the adoption of seven key principles for a sustainable asset management program. According to IAM, asset management must be:[2]

TABLE 2 PRINCIPLES OF ASSET MANAGEMENT – THE INSTITUTE OF ASSET MANAGEMENT (IAM)

Holistic	Asset management must be cross-disciplinary, total value focused
Systematic	Rigorously applied in a structured management system
Systemic	Looking at assets in their systems context, again for net, total value
Risk-based	Incorporating risk appropriately into all decision-making
Optimal	Seeking the best compromise between conflicting objectives, such as costs versus performance versus risks etc.
Sustainable	Plans must deliver optimal asset life cycles, ongoing systems performance, environmental and other long term consequences.
Integrated	At the heart of good asset management lies the need to be joined-up. The total jigsaw puzzle needs to work as a whole - and this is not just the sum of the parts.

[2] "Key Principles", The Institute of Asset Management, *www.iam.org*

III. AMP Objectives and Content

This AMP is one component of the Municipality of Brockton's overarching corporate strategy. It was developed to support the municipality's vision for its asset management practice and programs. It provides key asset attribute data, including current composition of the municipality's infrastructure portfolio, inventory, useful life etc., summarizes the physical health of the capital assets, assess the municipality's current capital spending framework, and outlines financial strategies to achieve fiscal sustainability in the long-term while reducing and eventually eliminating funding gaps.

As with the first edition of the municipality's asset management plan in 2013, this AMP is developed in accordance with provincial standards and guidelines, and new requirements under the federal Gas Tax Fund stipulating the inclusion of all eligible asset categories. Previously, only core infrastructure categories were analyzed. The following asset categories are analysed in this document: road network; bridges & culverts; water; waste water; storm; buildings; machinery and equipment; vehicles; and land improvements.

This AMP includes a detailed discussion of the state of local infrastructure and assets for each category; outlines industry standards levels of service and key performance indicators (KPIs); outlines asset management renewal strategy for major infrastructure; and provides financial strategy to mitigate funding shortfalls.

IV. Data and Methodology

The municipality's dataset for the asset categories analyzed in this AMP are maintained in PSD's CityWide® Tangible Assets module. This dataset includes key asset attributes and PSAB 3150 data, including historical costs, in-service dates, field inspection data (as available), asset health, replacement costs, etc.

1 Condition Data

Municipalities implement a straight-line amortization schedule approach to depreciate their capital assets. In general, this approach may not be reflective of an asset's actual condition and the true nature of its deterioration, which tends to accelerate toward the end of the asset's lifecycle. However, it is a useful approximation in the absence of standardized decay models and actual field condition data and can provide a benchmark for future requirements. We analyze each asset individually; therefore, while deficiencies may be presents at the individual level, imprecisions are minimized at the asset-class level as the data is aggregated.

As available, actual field condition data was used to make recommendations more precise. The value of condition data cannot be overstated as they provide a more accurate representation of the state of infrastructure.

2 Financial Data

In this AMP, the average annual requirement is the amount based on current replacement costs that municipalities should set aside annually for each infrastructure class so that assets can be replaced upon reaching the end of their lifecycle.

To determine current funding capacity, all existing sources of funding are identified, aggregated, and an average for the previous three years is calculated, as data is available. These figures are then assessed against the average annual requirements, and are used to calculate the annual funding shortfall (surplus) and for forming the financial strategies.

In addition to the annual shortfall, the majority of municipalities face significant infrastructure backlogs. The infrastructure backlog is the accrued financial investment needed in the short-term to bring the assets to a state of good repair. This amount is identified for each asset class.

Only predictable sources of funding are used, e.g., tax and rate revenues, user fees, and other streams of income the municipality can rely on with a high degree of certainty. Government grants and other ad-hoc injections of capital are not enumerated in this asset management plan given their unpredictability. As senior governments make greater, more predictable and permanent commitments to funding municipal infrastructure programs, e.g., the federal Gas Tax Fund, future iterations of this asset management plan will account for such funding sources.

3 Infrastructure Report Card

The asset management plan is a complex document, but one with direct implications on the public, a group with varying degrees of technical knowledge. To facilitate communications, we've developed an Infrastructure Report Card that summarizes our findings in accessible language that municipalities can use for internal and external distribution. The report card is developed using two key, equally weighted factors:

TABLE 3 INFRASTRUCTURE REPORT CARD DESCRIPTION

Financial Capacity		A municipality's financial capacity is determined by how well it's meeting the average annual investment requirements (0-100%) for each infrastructure class.	
Asset Health		Using either field inspection data as available or age-based data, the asset health provide a grades for each infrastructure class based on the portion of assets in poor to excellent condition (0-100%). We use replacement cost to determine the weight of each condition group within the asset class.	
Letter Grade	**Rating**	**Performance and Financial Capacity**	**Description**
A	Very Good	Assets are fit for the future and the municipality is funding at least 90% of its annual needs.	The asset is functioning and performing well, only normal preventative maintenance is required. The municipality is fully prepared for its long-term replacement needs based on existing infrastructure portfolio.
B	Good	Assets are adequate for now and the municipality is meeting 70-89% of its annual needs.	The municipality is well prepared to fund its long-term replacement needs but requires additional funding strategies in the short-term to begin to increase its reserves.
C	Fair	Assets require intervention and the municipality is meeting 60-69% of its annual needs.	The asset's performance or function has started to degrade and repair/rehabilitation is required to minimize lifecycle cost. The municipality is underpreparing to fund its long-term infrastructure needs. The replacement of assets in the short- and medium-term will likely be deferred to future years.
D	Poor	Assets are at risk and the municipality is meeting between 40-59% of its annual needs.	The asset's performance and function is below the desired level and immediate repair/rehabilitation is required. The municipality is not well prepared to fund its replacement needs in the short-, medium- or long-term. Asset replacements will be deferred and levels of service may be reduced.
F	Very Poor	Assets unfit for sustained service and the municipality is meeting less than 40% of its annual needs.	The municipality is significantly underfunding its short-term, medium-term, and long-term infrastructure requirements based on existing funds allocation. Asset replacements will be deferred indefinitely. The municipality may have to divest some of its assets (e.g., bridge closures, arena closures) and levels of service will be reduced significantly.

4 Limitations and Assumptions

Several limitations continue to persist as municipalities advance their asset management practices.

1. As available, we use field condition assessment data to determine both the state of infrastructure and develop the financial strategies. However, in the absence of observed data, we rely on the age of assets to estimate their physical condition.

2. A second limitation is the use of inflation measures, for example using CPI/NRBCPI to inflate historical costs in the absence of actual replacement costs. While a reasonable approximation, the use of such multipliers may not be reflective of market prices and may over- or understate the value of a municipality's infrastructure portfolio and the resulting capital requirements.

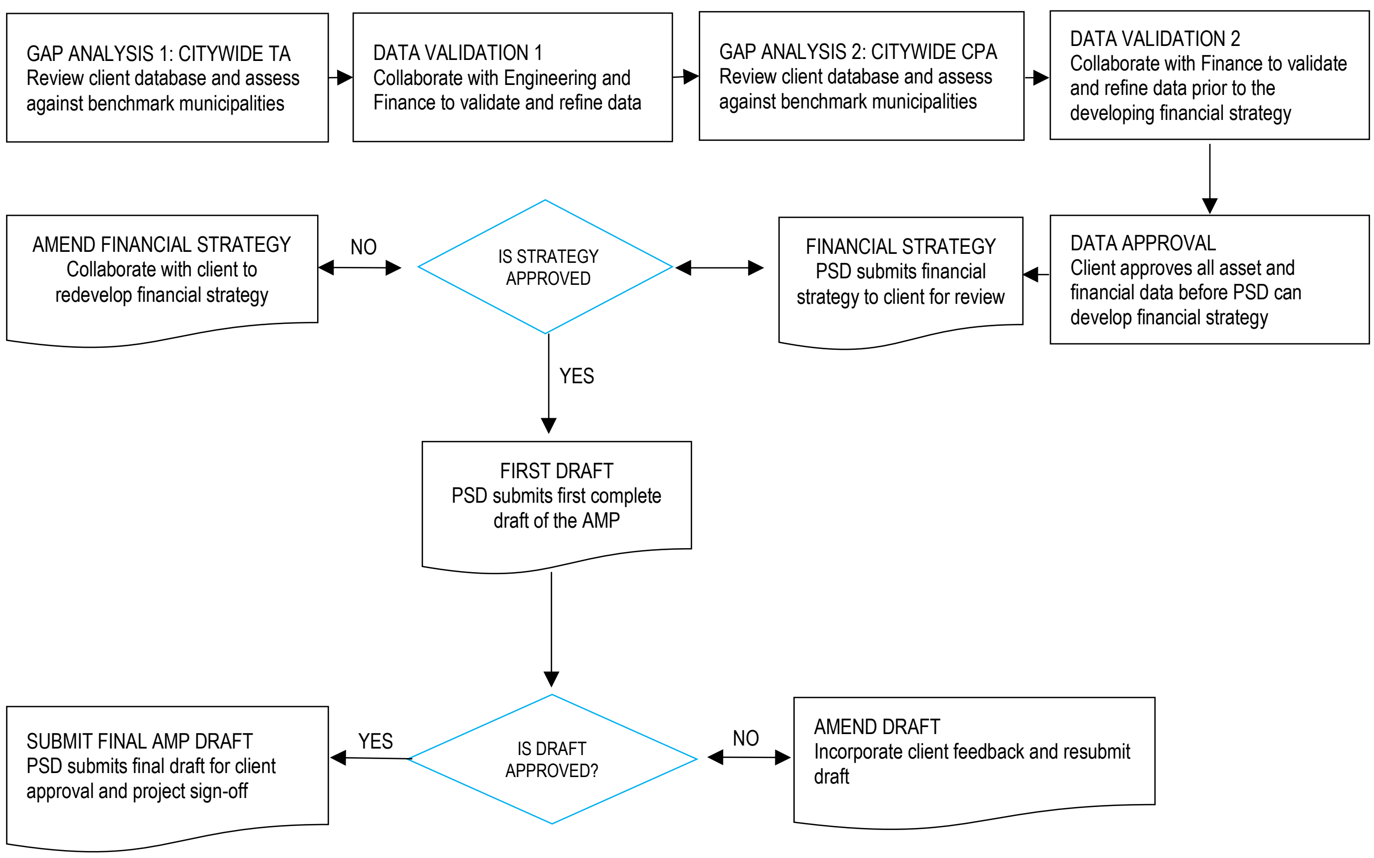
3. Our calculations and recommendations will reflect the best available data at the time this AMP was developed.

4. The focus of this plan is restricted to capital expenditures and does not capture O&M expenditures on infrastructure.

5 Process

High data quality is the foundation of intelligent decision-making. Generally, there are two primary causes of poor decisions: Inaccurate or incomplete data, and the misinterpretation of data used. The figure below illustrates an abbreviated version of our work order/work flow process between PSD and municipal staff. It is designed to ensure maximum confidence in the raw data used to develop the AMP, the interpretation of the AMP by all stakeholders, and ultimately, the application of the strategies outlined in this AMP.

FIGURE 2 DEVELOPING THE AMP - WORK FLOW AND PROCESS



6 Data Confidence Rating

Staff confidence in the data used to develop the AMP can determine the extent to which recommendations are applied. Low confidence suggests uncertainty about the data and can undermine the validity of the analysis. High data confidence endorses the findings and strategies, and the AMP can become an important, reliable reference guide for interdepartmental communication as well as a manual for long-term corporate decision-making. Having a numerical rating for confidence also allows the municipality to track its progress over time and eliminate data gaps.

Data confidence in this AMP is determined using five key factors and is based on the City of Brantford's approach. Municipal staff provide their level of confidence (score) in each factor for major asset classes along a spectrum, ranging from 0, suggesting low confidence in the data, to 100 indicative of high certainty regarding inputs. The five Factors used to calculate the municipality's data confidence ratings are:

F1	F2	F3	F4	F5
The data is up to date.	The data is complete and uniform.	The data comes from an authoritative source	The data is error free.	The data is verified by an authoritative source.

The municipality's self-assessed score in each factor is then used to calculate data confidence in each asset class using Equation 1 below.

$$Data\ Confidence\ Rating = \sum Score\ in\ each\ factor \times \frac{1}{5}$$

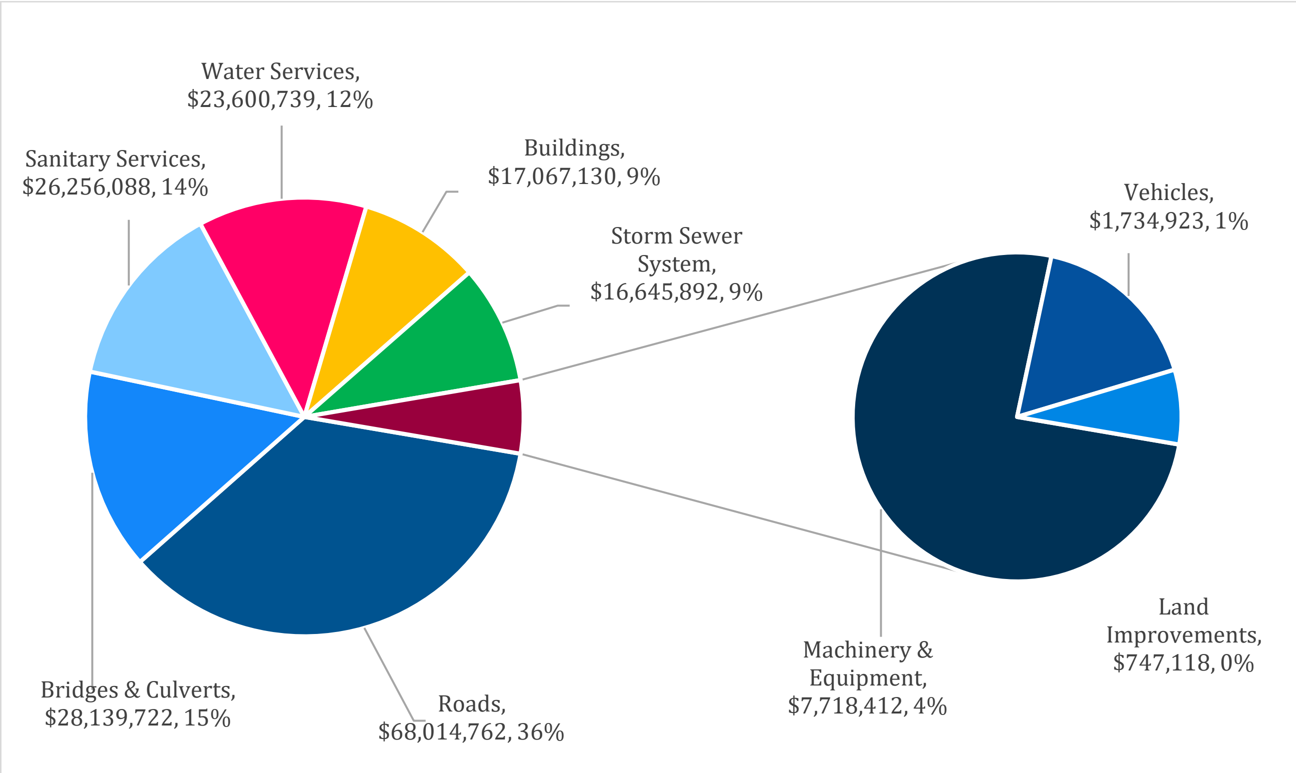
V. Key Stats

In this section, we provide aggregate indicators to summarize key elements of the municipalities asset classes in this AMP.

1 Asset Valuation

The nine asset classes analyzed in this asset management plan for the municipality had a total 2016 valuation of $190 million, of which the road network and bridges and culverts together make up 50%.

FIGURE 3 2016 ASSET VALUATION BY CLASS



2 Source of Condition Data by Asset Class

Observed data will provide the most precise indication of an asset's physical health. In the absence of such information, age of capital assets can be used as a meaningful approximation of the asset's condition. Table 5 indicates the source of condition data used for each of the nine asset classes in this AMP.

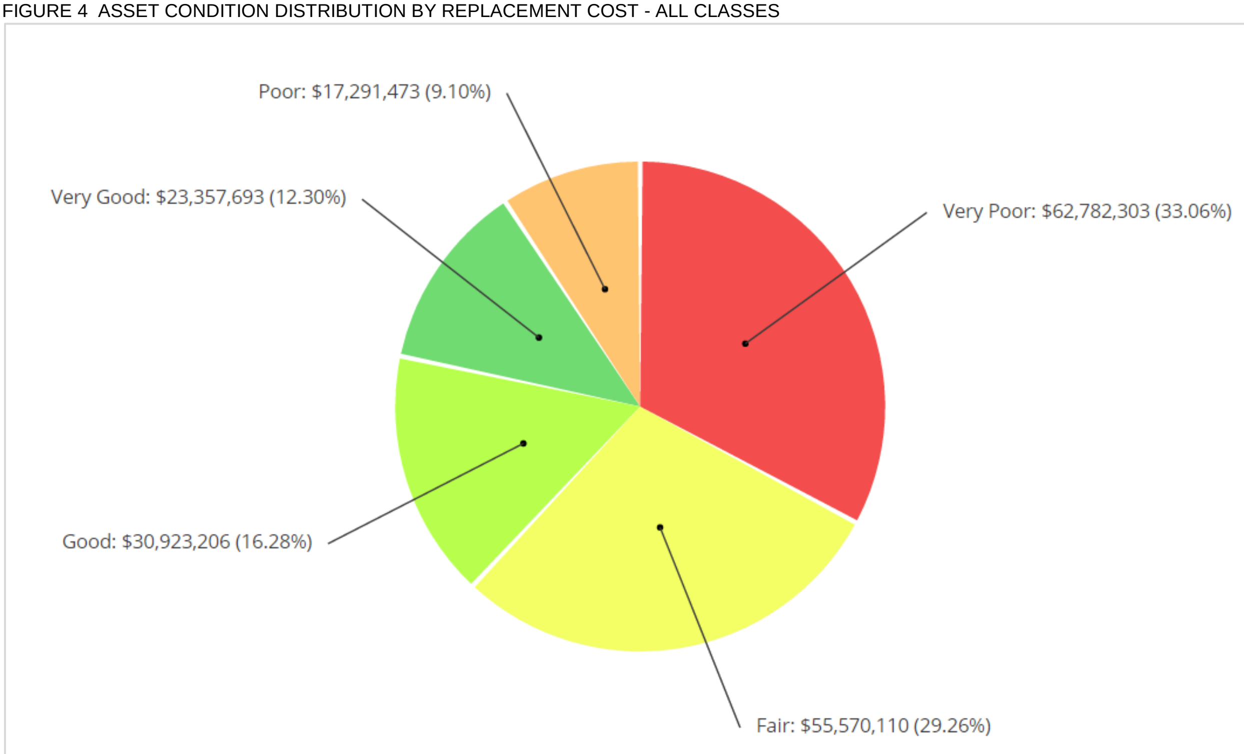
TABLE 4 SOURCE OF CONDITION DATA BY ASSET CLASS

Asset Class	Source of Condition Data
Road Network	Age-based
Bridges & Culverts	Assessed – 15 of 33 structures assessed in the 2014 Brant Bridge Study
Sanitary Services	Age-based
Water Mains	Age-based
Storm	Age-based
Vehicles	Age-based
Machinery & Equipment	Age-based
Buildings	Age-based
Land improvements	Age-based

3 Overall Condition – All Asset Classes

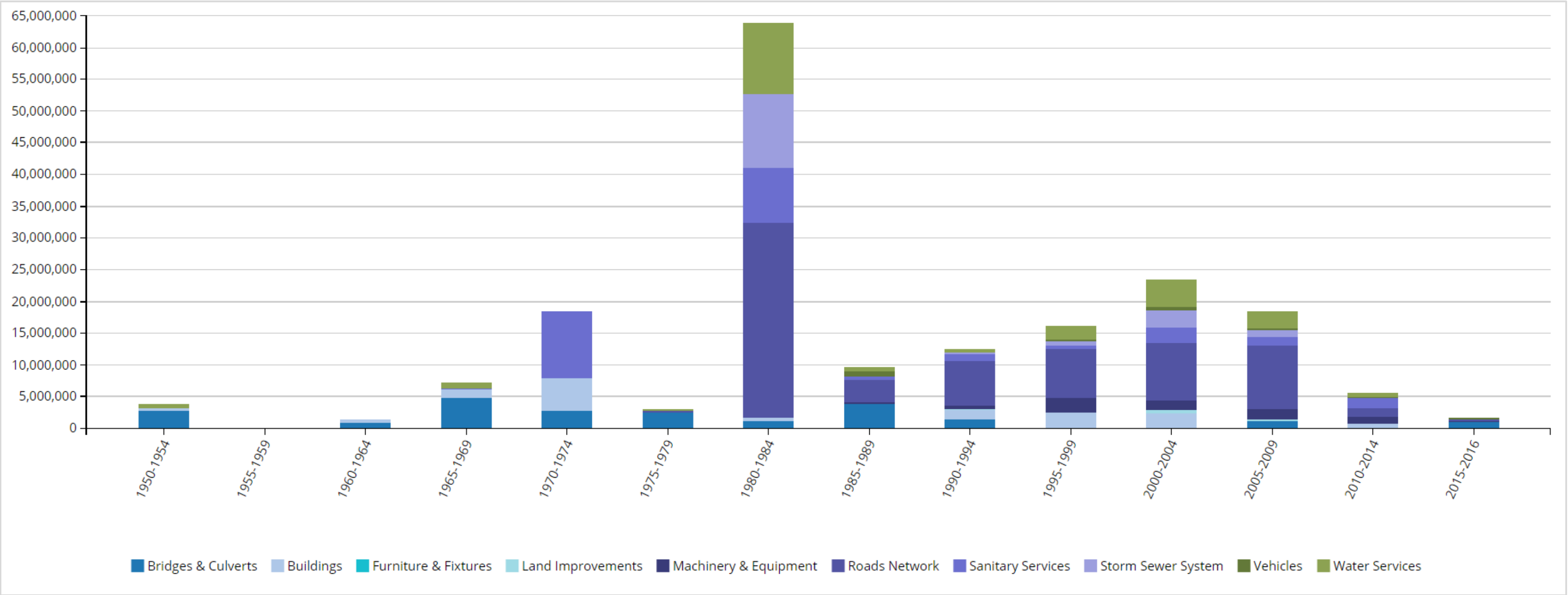
Based on 2016 replacement cost, and a blend of age-based and observed data, while 29% of the municipality's total asset portfolio as analysed in this AMP is in very good or good condition, over 42% of the assets, with a valuation of $80 million, is in poor to very poor condition.

FIGURE 4 ASSET CONDITION DISTRIBUTION BY REPLACEMENT COST - ALL CLASSES



In conjunction with condition data, two other measurements can augment staff understanding of the state of infrastructure and impending and long-term infrastucture needs: installation year profile, and useful life remaining. The installation year profile in the figure below illusrates the historical invesments in infrastructure across key asset classes. Often, investment in critical infrastructure parallels population growth or other significant shifts in demographics.

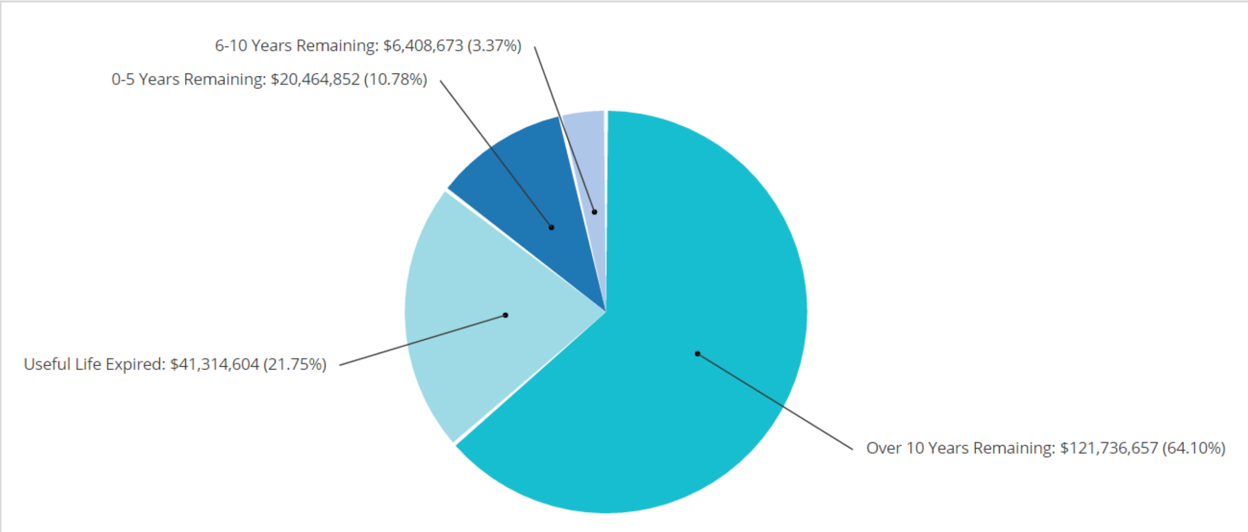
FIGURE 5 HISTORICAL INVESTMENT IN INFRASTRUCTURE - ALL ASSET CLASSES



Brockton experienced a significant period of investment in infrastructure from 1980-1984 totaling nearly $65 million. During this time, nearly 50% of the investment was focused on roads. Beyond that, investment slowed down, however peaked again in 2000-2004 with investments totaling $25 million. Again, roads were the major focus, comprising about a third of total investment. Since 2010, approximately $7 million has been invested.

While age is not a precise indicator of an asset's health, it can serve as a meaningful approxmiation in the absence of condition data and can serve as a signal. The following figure shows the distibution of assets based on the amount of useful life already consumed.

FIGURE 6 USEFUL LIFE REMAINING - ALL ASSET CLASSES



Approximately 64% of the municipality's assets, with a valuation of $122 million, have at least 10 years of useful life remaining. However, 22% of assets, with a valuation of $42 million, remain in operation beyond their useful life. An additional 11% of assets valued at $20 million will reach the end of their useful life in the next five years.

3 Data Confidence

Brockton has a very high degree of confidence in the data used to develop this AMP, receiving a weighted confidence rating of 98%. This is indicative of significant effort in collecting and refining its data set. All assets had an equal data confidence rating of 98%. The main area for improvement would be in the rating of "The data is error free" which is given a 90% score for all assets except for Vehicles which was rated at 100%.

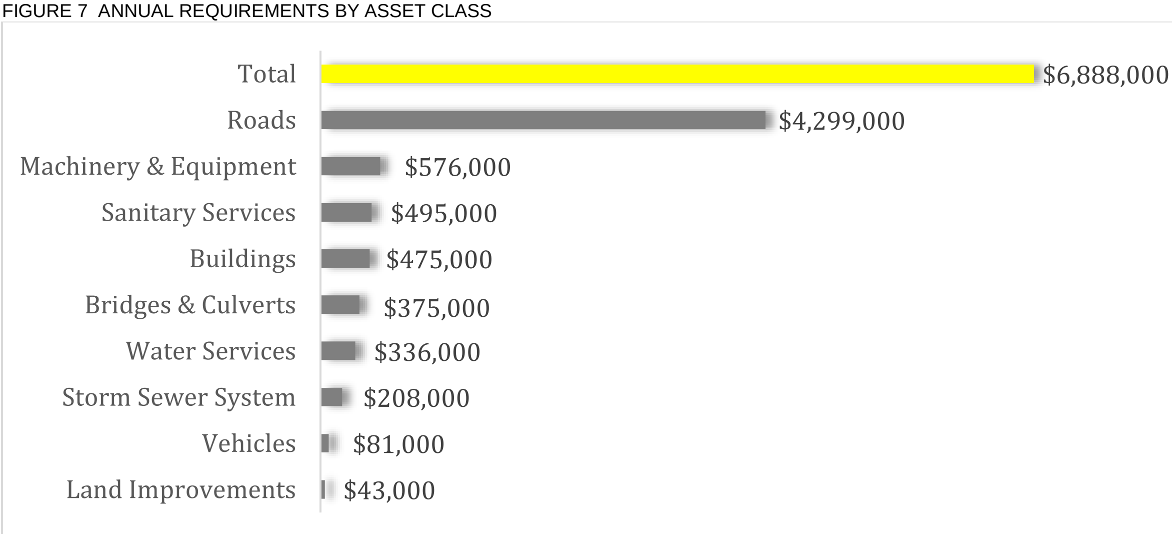
TABLE 5 DATA CONFIDENCE RATINGS

Asset Class	The data is up-to-date.	The data is complete and uniform.	The data comes from an authoritative source.	The data is error free.	The data is verified by an authoritative source.	Average Data Confidence Rating
Road Network	100%	100%	100%	90%	100%	98%
Bridges & Culverts	100%	100%	100%	90%	100%	98%
Water	100%	100%	100%	90%	100%	98%
Sanitary Services	100%	100%	100%	90%	100%	98%
Storm	100%	100%	100%	90%	100%	98%
Facilities	100%	100%	100%	90%	100%	98%
Land Improvements	100%	100%	100%	90%	100%	98%
Vehicles	100%	100%	90%	100%	100%	98%
Machinery & Equipment	100%	100%	100%	90%	100%	98%
					Weighted Data Confidence Rating	98%

4 Financial Profile

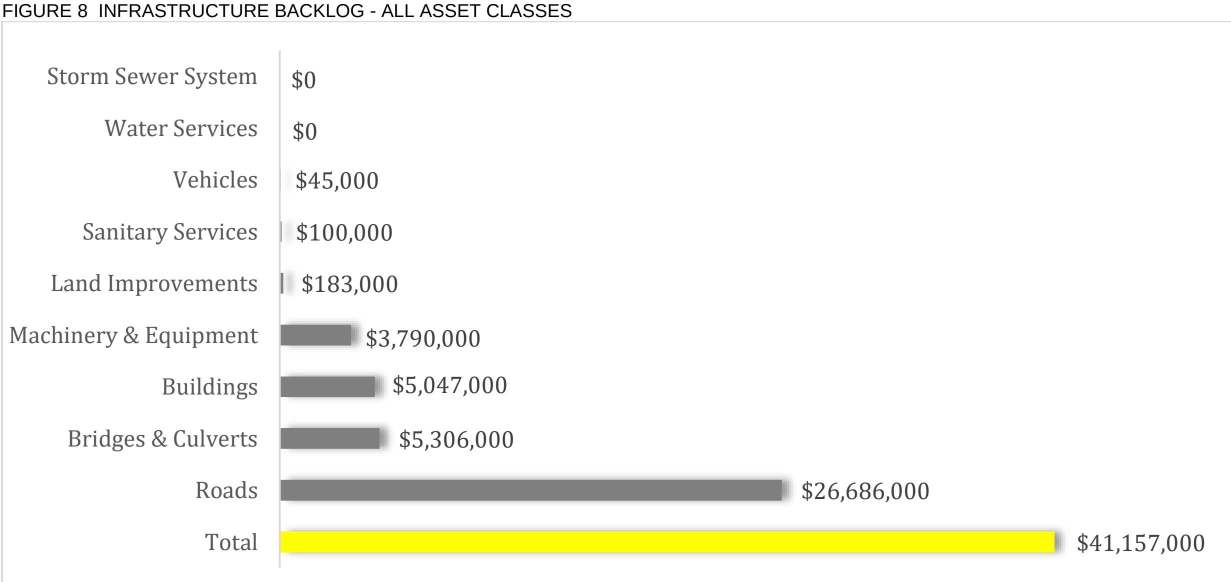
This section details key financial indicators related to the municipality's asset classes as analyzed in this asset management plan.

FIGURE 7 ANNUAL REQUIREMENTS BY ASSET CLASS



The annual requirements represent the amount the municipality should allocate annually to each of its asset classes to meet replacement needs as they arise and prevent infrastructure backlogs. In total, the municipality must allocate $6.9 million annually for the assets covered in this AMP.

FIGURE 8 INFRASTRUCTURE BACKLOG - ALL ASSET CLASSES



The municipality has a combined infrastructure backlog of $41.2 million, with roads comprising 65%. The backlog represents the investment needed today to meet previously deferred replacement needs. This data is based on assessed condition as available, and age-based data in the absence of such information.

VI. State of Local Infrastructure

In this section, we detail key indicators for each class discussed in this asset management plan. The state of local infrastructure includes the full inventory, condition ratings, useful life consumption data, and the backlog and upcoming infrastructure needs for each asset class.

1 Road Network

1.1 Asset Inventory

Table 1 illustrates key asset attributes for the municipality's road network, including quantities of various assets, their useful life, their replacement cost, and the valuation method by which the replacement cost were derived. In total, the municipality's roads assets are valued at $68 million based on 2016 replacement costs. The useful life indicated for the asset types below was assigned by the municipality and obtained from the municipality's accounting data as maintained in the CityWide® Tangible Asset module.

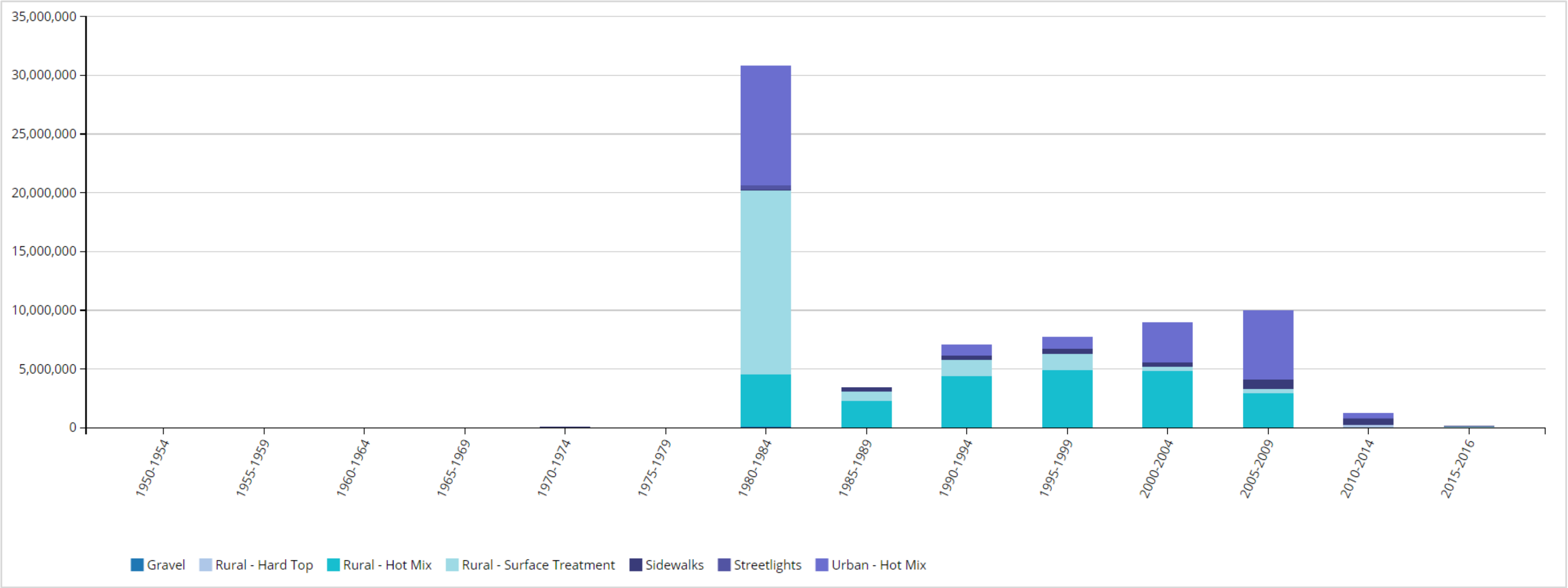
TABLE 6 KEY ASSET ATTRIBUTES – ROADS

Asset Type	Asset Component	Quantity	Useful Life in Years	Valuation Method	2016 Overall Replacement Cost
Roads	Gravel	22,974m³	-	Not planned for replacement	-
	Rural - Hard Top	268m³	7	NRBCPI	$293,588
	Rural - Hot Mix	60,331m³	35	NRBCPI	$23,682,098
	Rural - Surface Treatment	33, 860m³	7	NRBCPI	$20,191,569
	Urban - Hot Mix	23,418m³	35	NRBCPI	$20,748,508
	Sidewalks	6,676m³	30	NRBCPI	$2,785,775
	Streetlights	842	30	$372/unit	$313,224
				Total	$68,014,762

1.4 Historical Investment in Infrastructure

In these sections, we provide the installation profile and useful life consumption levels using in-service data obtained from CityWide® Tangible Assets. Together, these graphs can illustrate infrastructure investment trends and upcoming needs at Brockton. The chart below illustrates the historical levels of investment in roads at the Municipality of Brockton.

FIGURE 9 HISTORICAL INVESTMENT – ROAD NETWORK

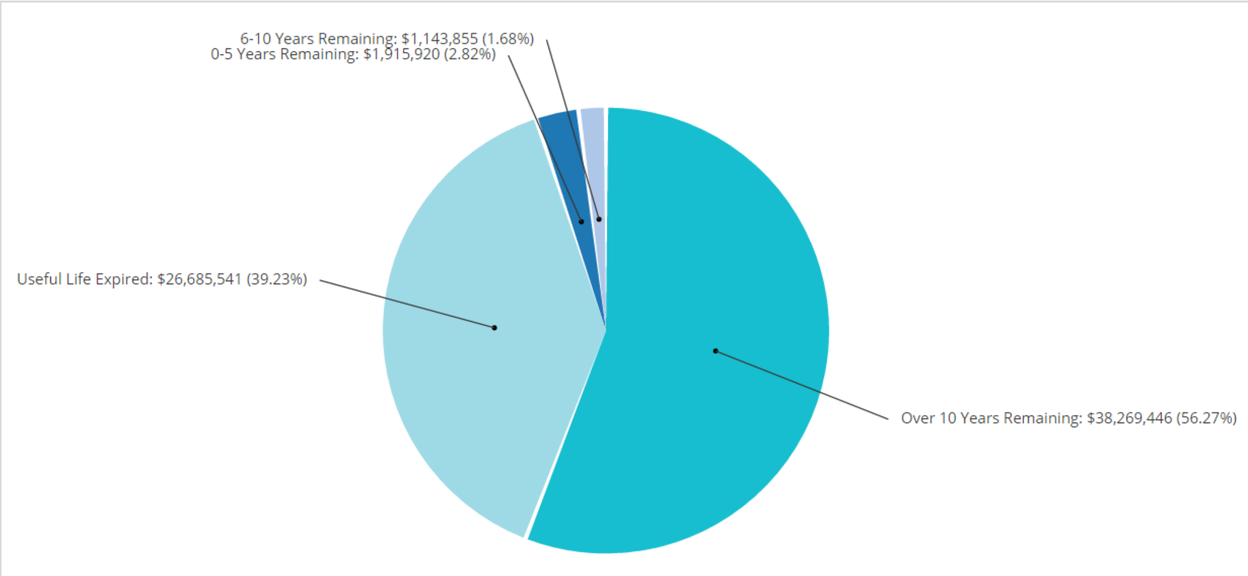


The municipalities investment in roads peaked in the early 1980s with an investment of over $30 million. Two thirds of that investment was on rural hot mix and surface treated roads. Beyond that time, investment significantly decreased, however peaked again in the late 2000s to reach $10 million. At that time, the focus was on urban roads with nearly $6 million put into urban hot mix roads.

1.5 Useful Life Consumption

In this section, we detail the extent to which assets have consumed their useful life based on the above, established useful life standards. In conjunction with asset condition data, understanding the consumption rate of assets based on industry established useful life measures provides a more complete profile of the state of a community's infrastructure. The figure below illustrates the useful life consumption levels for the municipality's road network.

FIGURE 10 USEFUL LIFE CONSUMPTION - ROAD NETWORK

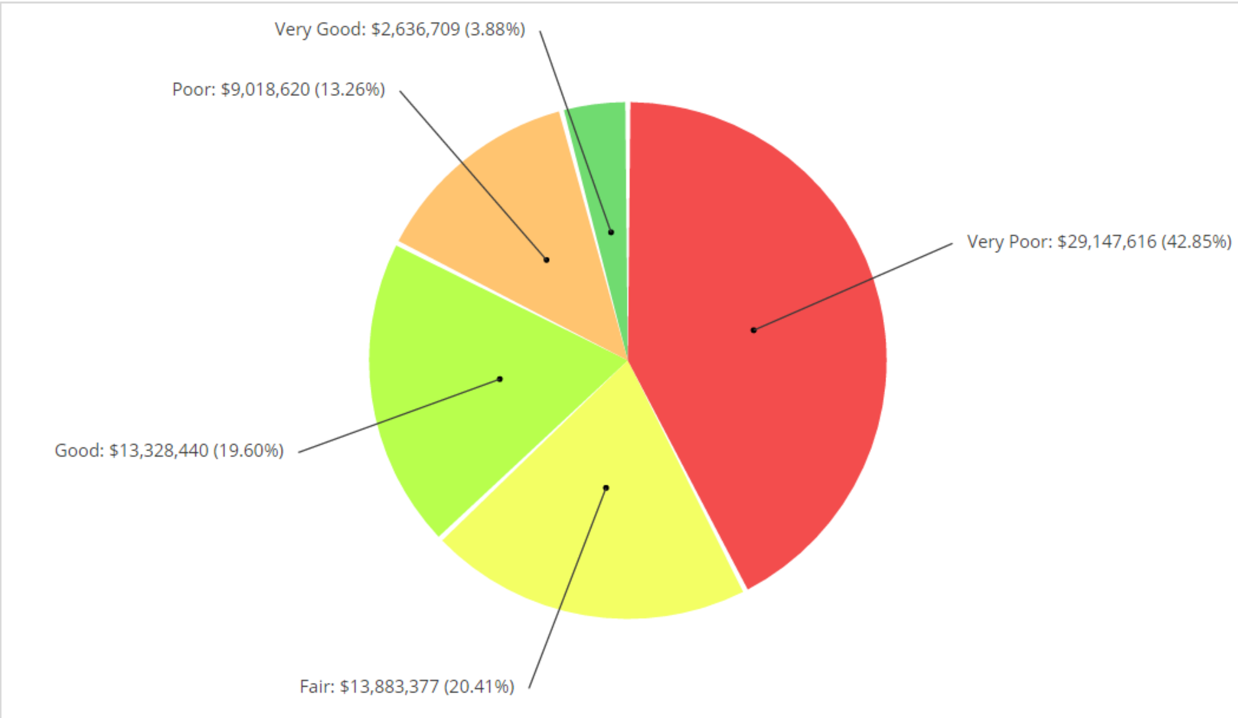


While over 56% of the municipality's road network assets have at least 10 years remaining, nearly 40%, with a valuation of $27 million, remain in operation beyond their useful life. An additional 3% of assets valued at $2 million will reach the end of their useful life in the next five years.

1.6 Current Asset Condition

Using replacement cost, in this section, we summarize the condition of the municipality's roads network. By default, we rely on observed field data as provided by the municipality. In the absence of such information, age-based data is used as a proxy.

FIGURE 11 ASSET CONDITION - ROAD NETWORK (AGE-BASED)

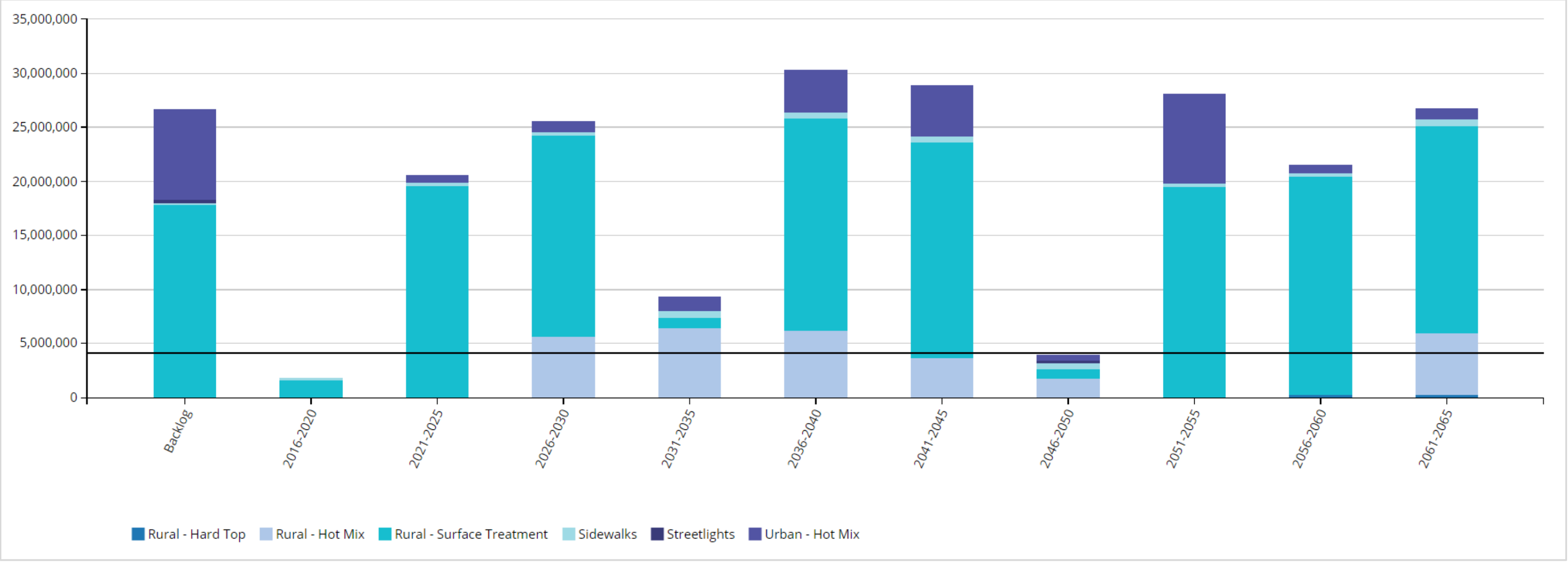


Based on age-based asset condition, more than 23% of the municipality's roads assets are in good to very good condition; however, 56%, with a valuation of $38 million, are in poor to very poor condition.

1.7 Forecasting Replacement Needs

In this section, we illustrate the short-, medium- and long-term infrastructure spending requirements (replacement only) for the municipality's road network assets. The backlog is the aggregate investment in infrastructure that was deferred over previous years or decades. In the absence of observed data, the backlog represents the value of assets that remain in operation beyond their useful life.

FIGURE 12 FORECASTING REPLACEMENT NEEDS - ROAD NETWORK



In addition to the backlog of $26 million, investment needs for the road network assets are forecasted to be $2 million over the next five years. An additional $21 million will be required between 2021 and 2025. For most periods over the next 50 years, an investment of $25 to $30 million will be required. The municipality's annual requirements for its road network total $4.3 million, as indicated by the trendline on the graph. At this level, funding is sustainable and replacement needs can be met as they arise without the need for deferring projects. However, the municipality is currently allocating $734,000, leaving an annual deficit of about $3.5 million.

1.8 Recommendations – Roads

- 56% of road assets are in poor or very poor condition, resulting in significant replacement needs starting in 2021. In addition, there is a backlog of over $25 million. This analysis is based on age-based data, therefore proper condition assessments are recommended for roads as assessment data will provide a more accurate estimate of the asset conditions and therefore a more accurate minimum sustainable funding level. See Section 2, 'Condition Assessment Programs' in the 'Asset Management Strategies' chapter for more information.

- The data collected from conditions assessments as described above should be integrated into a risk management framework which will guide the prioritization of short-, medium-, and long-term replacement needs and budget. See Section 2, 'Condition Assessment Programs' and Section 4, 'Risk' in the 'Asset Management Strategies' chapter.

- In addition to the above, a tailored life cycle activity framework should also be developed to promote standard life cycle management of the road network as outlined further within the "Asset Management Strategy" section of this AMP.

- The useful life projections used by the municipality should also be reviewed for consistency with industry standards. Increasing certain useful life projections appropriately will reduce the immediate requirements listed above.

- Road network key performance indicators should be established and tracked annually as part of an overall level of service model. See Section 7 "Levels of Service".

- Once the above initiatives are complete or underway, an updated "current state of the infrastructure" analysis should be generated.

2. Bridges & Culverts

2.1. Asset Portfolio: Quantity, Useful Life and Replacement Cost

Table 7 illustrates key asset attributes for the municipality's bridges & culverts, including quantities of various assets, their useful life, their replacement cost, and the valuation method by which the replacement costs were derived. In total, the municipality's bridges & culverts assets are valued at $28 million based on 2016 replacement costs. The useful life indicated for the asset types below was assigned by the municipality and obtained from the municipality's accounting data as maintained in the CityWide® Tangible Asset module.

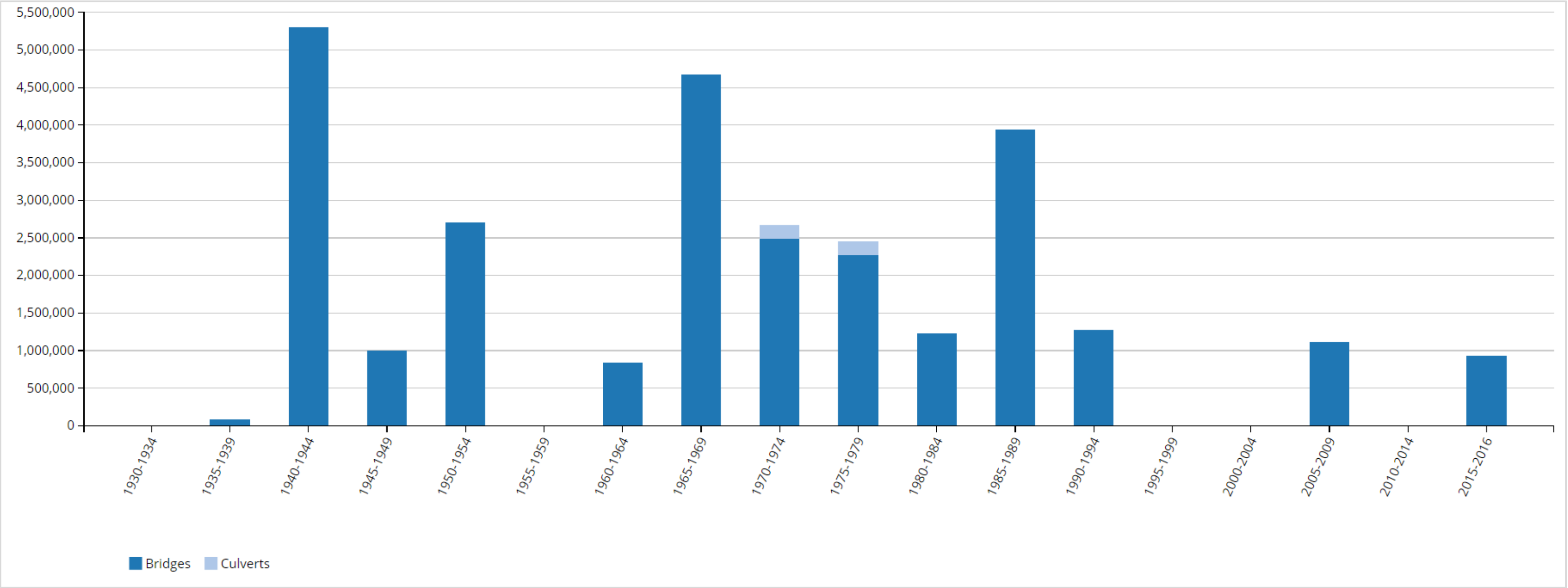
TABLE 7 KEY ASSET ATTRIBUTES – BRIDGES & CULVERTS

Asset Type	Asset Component	Quantity	Useful Life in Years	Valuation Method	2016 Overall Replacement Cost
Bridges & Culverts	Bridges	34	75	NRBCPI	$27,774,461
	Culverts	3	75	NRBCPI	$365,261
				Total	$28,139,722

2.4 Historical Investment in Infrastructure

In this section, we provide the installation profile and useful life consumption levels using in-service data obtained from CityWide® Tangible Assets. Together, these graphs can illustrate infrastructure investment trends and upcoming needs at the municipality. Figure 13 illustrates the historical levels of investment in the municipality's bridges & culverts.

FIGURE 13 HISTORICAL INVESTMENT - BRIDGES & CULVERTS

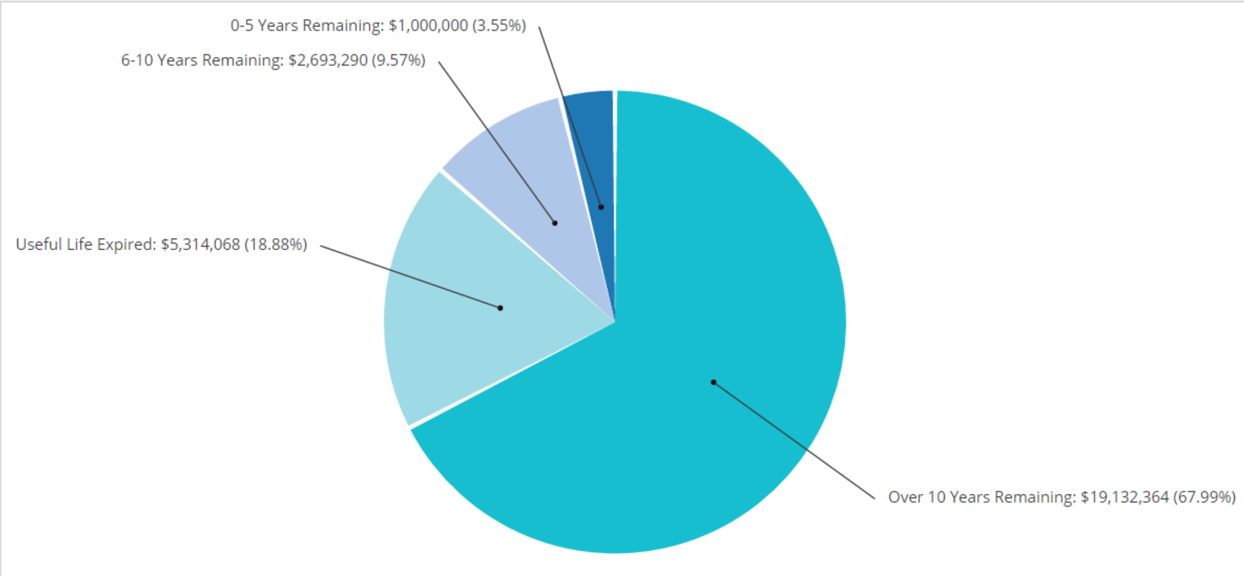


Investment in bridges have been widely distributed throughout the years with the largest investment in bridges of over $5 million occurring during the early 1940s. There was significant investment between 1960 and 1990 as well with total investment declining since then.

2.5 Useful Life Consumption

In this section, we detail the extent to which assets have consumed their useful life based on the above, established useful life standards. In conjunction with asset condition data, understanding the consumption rate of assets based on industry established useful life measures provides a more complete profile of the state of a community's infrastructure. The figure below illustrates the useful life consumption levels for the municipality's bridges & culverts.

FIGURE 14 USEFUL LIFE CONSUMPTION – BRIDGES & CULVERTS

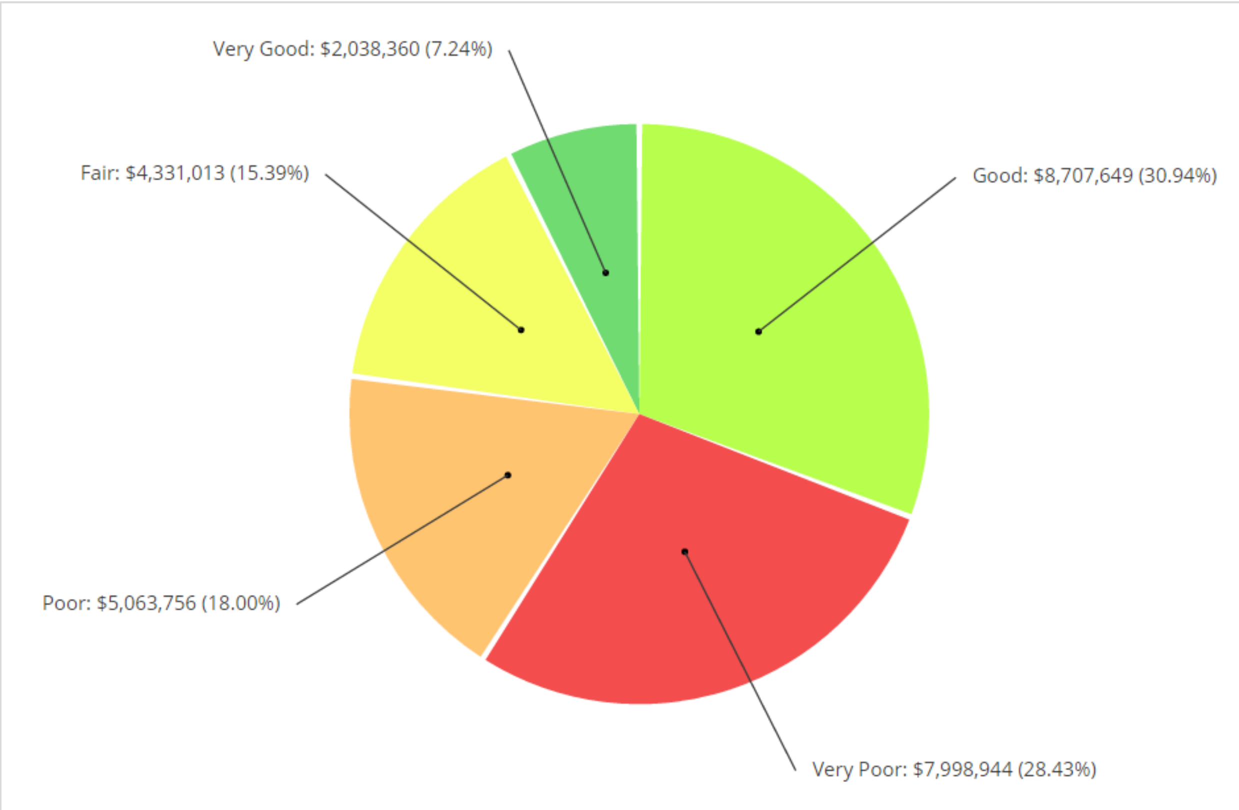


Nearly 70% of the municipality's bridges & culverts have at least 10 years of useful life remaining. However, 19% of assets, with a valuation of $5.3 million remain in operation beyond their estimated useful life. An additional 4% will reach the end of their useful life in the next five years.

2.6 Current Asset Condition

Using replacement cost, in this section, we summarize the condition of the municipality's bridges & culverts. By default, we rely on observed field data adapted from OSIM inspections as provided by the municipality. In the absence of such information, age-based data is used as a proxy. For Brockton, 15 out of 34 bridge structures were assessed as part of the 2014 Brant Bridge Study.

FIGURE 15 ASSET CONDITION – BRIDGES & CULVERTS (ASSESSED AND AGE-BASED)

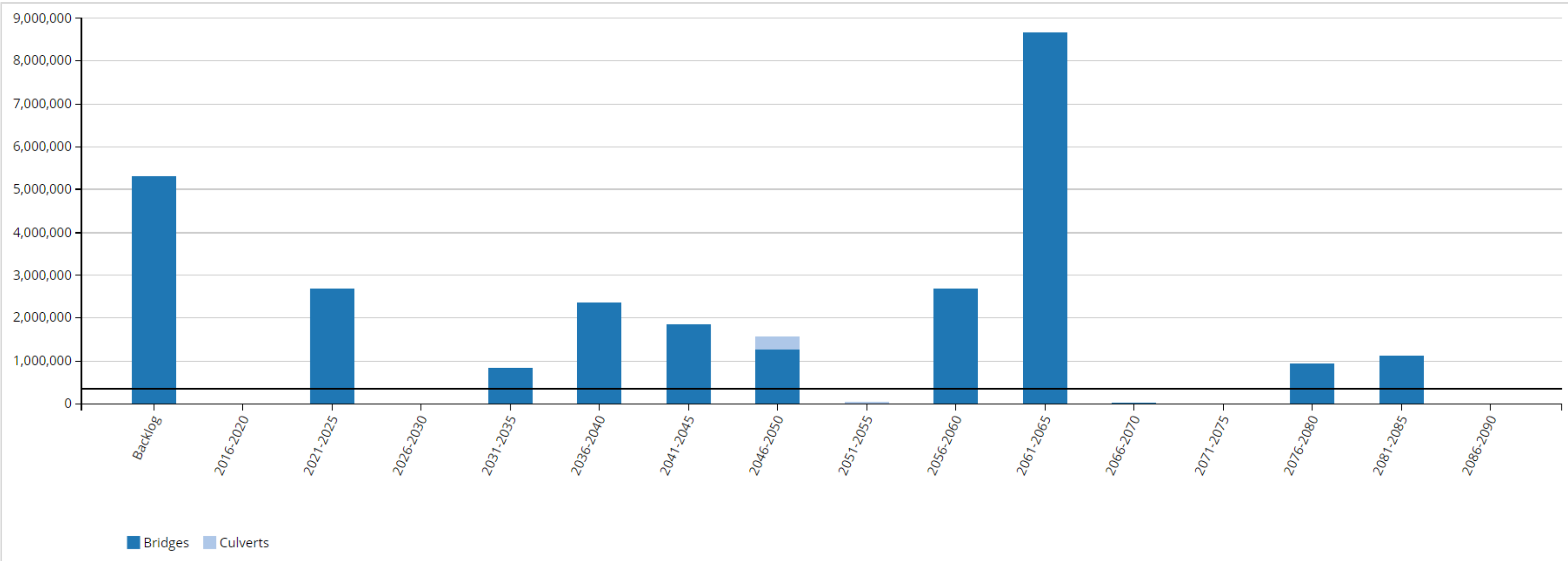


Based on a combination of age-based and assessed condition, 28% of the bridges and culverts assets are in very poor condition, which have a valuation of nearly $8 million. Another 18% of bridge and culvert assets, valued at $5 million, are in poor condition. Given the critical nature of bridges and culverts, these assets should be prioritized for further review.

2.7 Forecasting Replacement Needs

In this section, we illustrate the short-, medium- and long-term infrastructure spending requirements (replacement only) for the municipality's bridges & culverts. The backlog is the aggregate investment in infrastructure that was deferred over previous years or decades. In the absence of observed data, the backlog represents the value of assets that remain in operation beyond their useful life.

FIGURE 16 FORECASTING REPLACEMENT NEEDS - BRIDGES & CULVERTS



Investment for bridges and culverts over the next 50 years is stable at around $2.5 million for each 5-year period, however there is a sizable backlog of over $5 million that will need to be addressed. The municipality's annual requirements for its bridges & culverts total $375,000, as indicated by the trendline on the graph. At this level, funding is sustainable and all future replacement needs can be met as they arise without the need for deferring projects. Of course, this funding level does not address the backlog. The municipality is currently allocating $385,000 annually towards bridges and culverts, providing a surplus of $10,000. While meeting its annual requirements may eliminate the need to defer replacement projects in the pipeline, significant additional resources will be required to eliminate the existing backlog.

2.8 Recommendations – Bridges & Culverts

- Considering the critical nature of bridges and that only 15 out of 34 bridges were assessed through the 2014 Brant Bridge Study, it should be a priority for the municipality that the remainder of the bridges have OSIM condition assessments conducted. This will ensure an accurate picture of the current state of bridge assets as well as allow for a more accurate estimate on financial requirements.

- Once all condition assessments are complete the municipality should integrate a risk management framework, along with the OSIM condition data, to prioritize bridge & culvert capital projects as a continual process to eliminate the significant backlog that exists. See Section 2, 'Condition Assessment Programs' and Section 4, 'Risk' in the 'Asset Management Strategies' chapter.

- Also to maintain the overall good condition of structures moving forward, the municipality should continue to address both the capital and maintenance requirements of the bridge and culvert structures as outlined and listed within the OSIM engineering reports. The short and long term budgets should be based on these listings.

- Bridge and culvert key performance indicators should be established and tracked annually as part of an overall level of service model. See Section 7 "Levels of Service".

- Once the above initiatives are complete or underway, an updated "current state of the infrastructure" analysis should be generated.

3 Water Services

3.1 Asset Portfolio: Quantity, Useful Life and Replacement Cost

Table 8 illustrates key asset attributes for the municipality's water services assets, including quantities of various assets, their useful life, replacement costs, and the valuation method by which the replacement costs were derived. In total, the municipality's water services assets are valued at $23 million based on 2016 replacement costs. The useful life indicated for the asset types below was assigned by the municipality and obtained from the municipality's accounting data as maintained in the CityWide® Tangible Asset module.

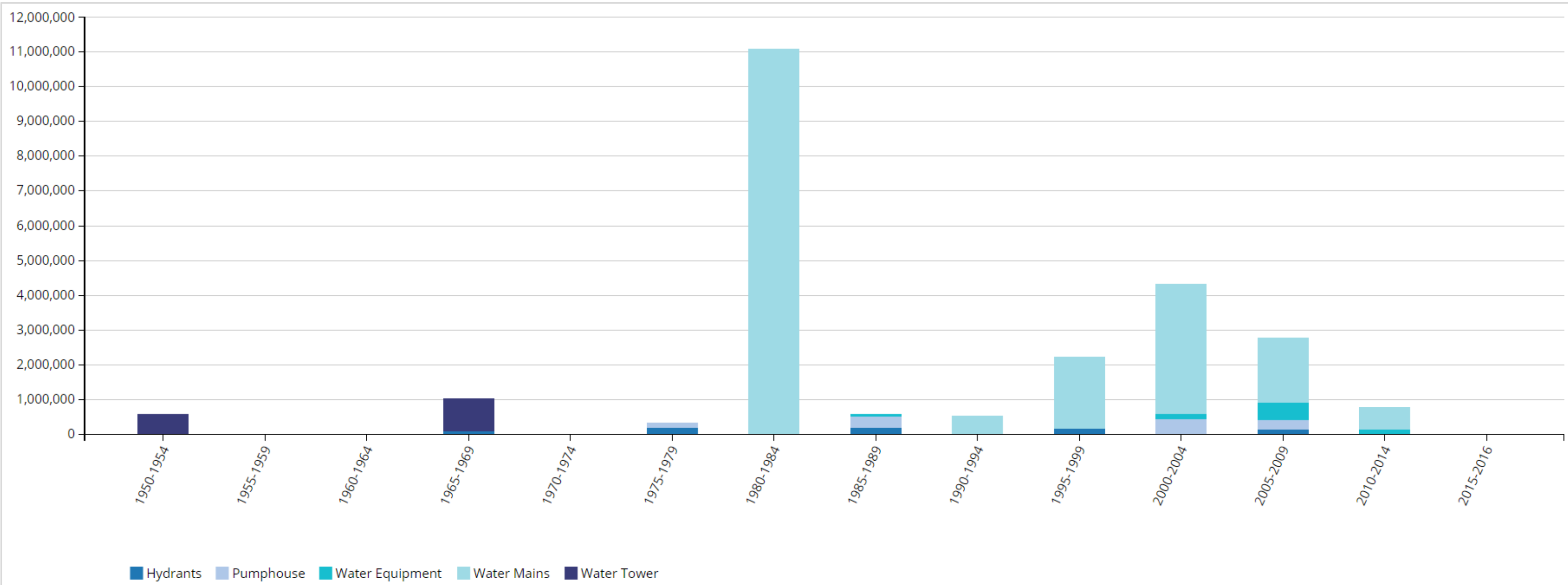
TABLE 8 KEY ASSET ATTRIBUTES – WATER SERVICES

Asset Type	Asset Component	Quantity	Useful Life in Years	Valuation Method	2016 Overall Replacement Cost
Water System	Hydrants	237	70	NRBCPI	$764,807
	Watermains - 151 - 300 mm	13,628m	80	NRBCPI	$7,457,887
	Watermains - 50 -150 mm	24,638m	80	NRBCPI	$9,911,888
	Watermains - under 50 mm	3,253m	80	NRBCPI	$1,935,084
	Pump house	4	40	NRBCPI	$1,160,412
	Water Tower	2	85	NRBCPI	$1,507,264
	Water Equipment	19	10, 15, 20, 22, 25, 30, 35, 40	NRBCPI	$863,397
				Total	$23,600,739

3.2 Historical Investment in Infrastructure

In this section, we provide the installation profile and useful life consumption levels using in-service data obtained from CityWide® Tangible Assets. Together, these graphs can illustrate infrastructure investment trends and upcoming needs at the municipality. Figure 17 illustrates the historical levels of investment in the municipality's water services assets.

FIGURE 17 HISTORICAL INVES TMENT – WATER SERVICES

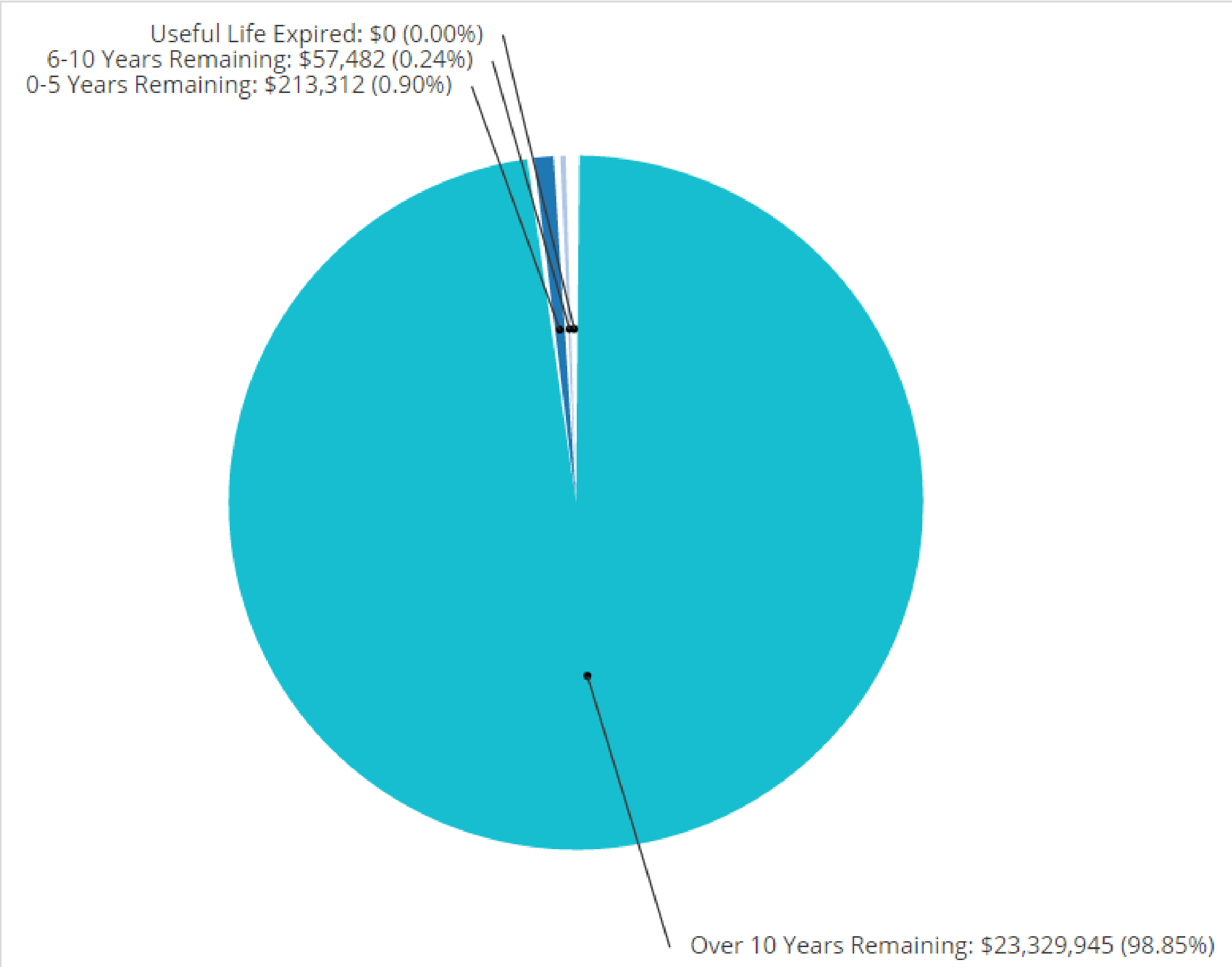


The early 1980s represented the period of largest investments in the municipality's water services, with expenditures totaling more than $11 million, with most of the investment going into water mains. Investments significantly declined immediately after that period, but grew steadily to peak at $4.5 million in the early 2000s.

3.3 Useful Life Consumption

In this section, we detail the extent to which assets have consumed their useful life based on the above, established useful life standards. In conjunction with asset condition data, understanding the consumption rate of assets based on industry established useful life measures provides a more complete profile of the state of a community's infrastructure. The figure below illustrates the useful life consumption levels for the municipality's water services.

FIGURE 18 USEFUL LIFE CONSUMPTION – WATER SERVICES

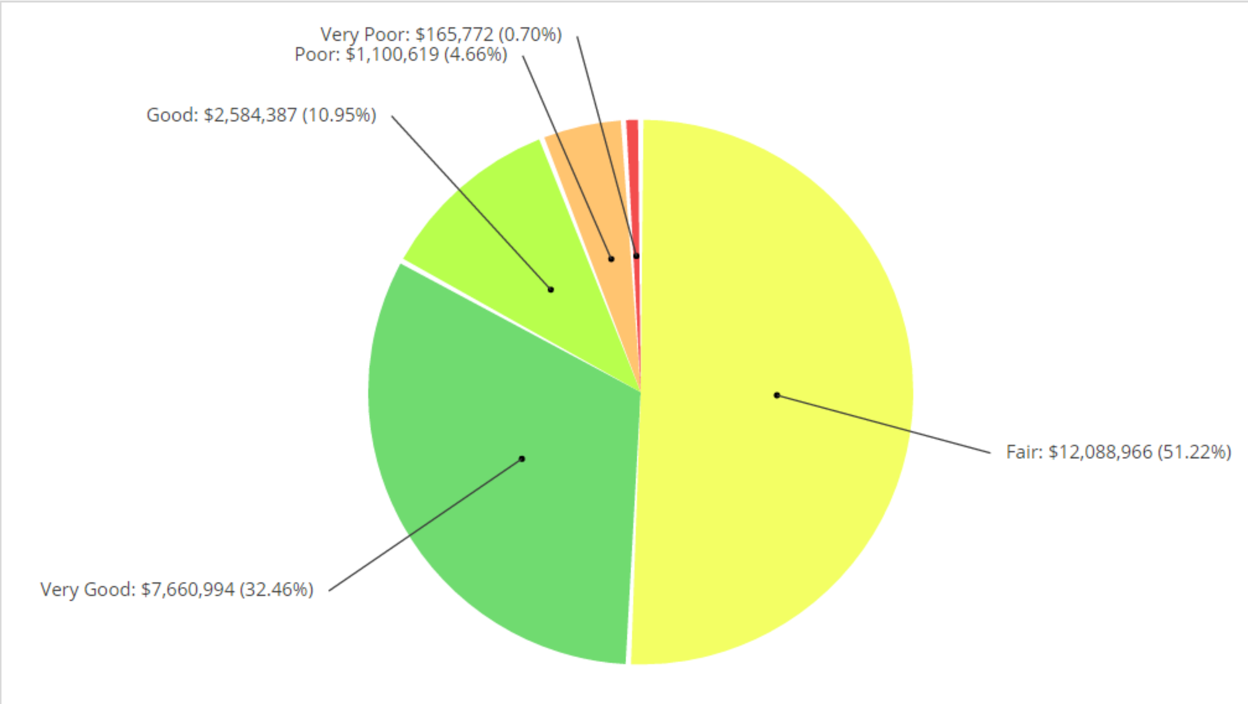


Nearly 99% of the municipality's water services assets have at least 10 years of useful life remaining. In addition, 0% of assets are beyond their useful life.

3.6 Current Asset Condition

Using replacement cost, in this section, we summarize the condition of the municipality's water services. By default, we rely on observed field data as provided by the municipality. In the absence of such information, age-based data is used as a proxy.

FIGURE 19 ASSET CONDITION – WATER SERVICES (AGE-BASED)

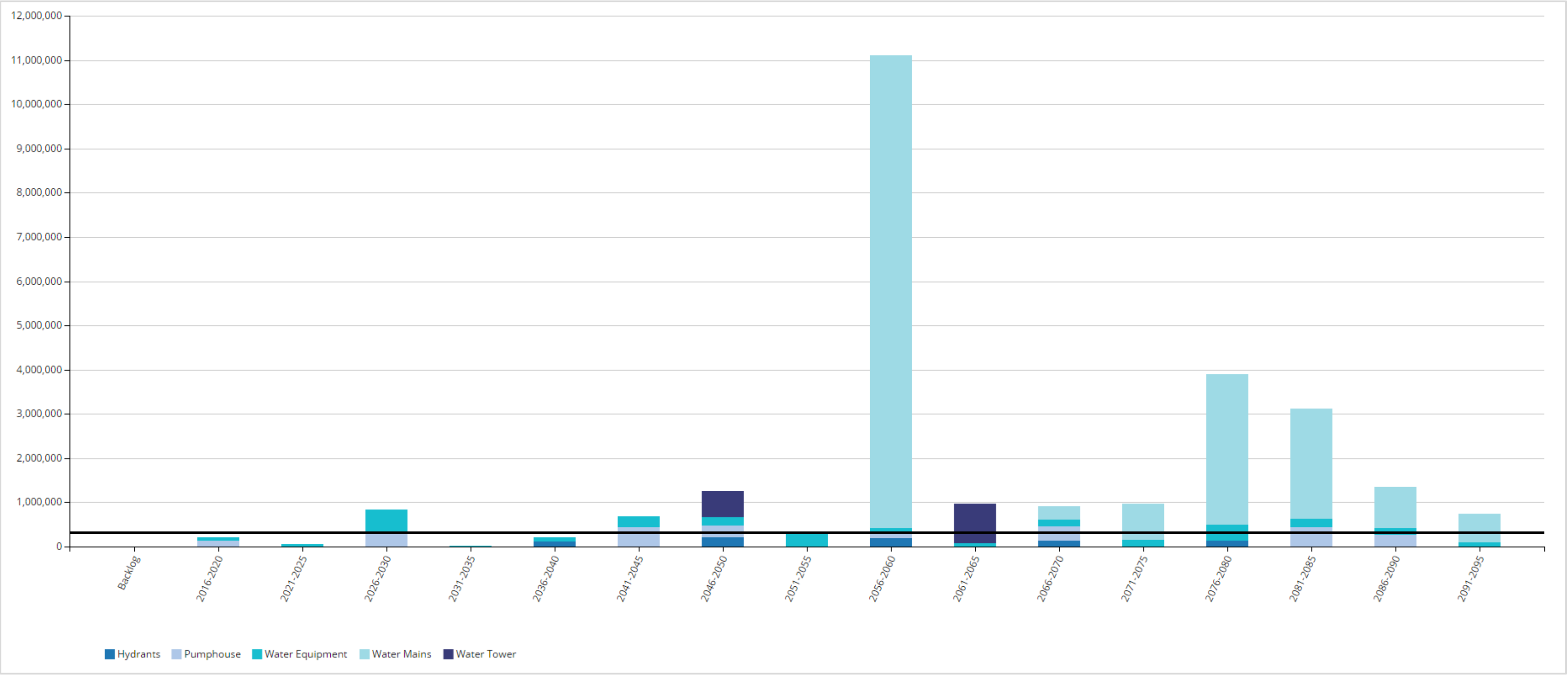


Based on age data, nearly 43% of water assets, valued at $10 million, are in good to very good condition. A majority of Brockton's water assets are in fair condition, however 5%, valued at $1.3 million are in poor to very poor condition.

3.7 Forecasting Replacement Needs

In this section, we illustrate the short-, medium- and long-term infrastructure spending requirements (replacement only) for the municipality's water services assets. The backlog is the aggregate investment in infrastructure that was deferred over previous years or decades. In the absence of observed data, the backlog represents the value of assets that remain in operation beyond their useful life.

FIGURE 20 FORECASTING REPLACEMENT NEEDS – WATER SERVICES



Due to the minimal percentage of water assets being in poor or very poor condition, the required investment into these assets is very minimal over the next 40 years. In addition to this minimal investment, there is also zero backlog that needs to be addressed in the short term. The municipality's annual requirements for its water network total $336,000, as indicated by the trendline on the graph. At this level, funding is sustainable and replacement needs can be met as they arise without the need for deferring projects. The municipality is currently allocating $248,000, leaving an annual deficit of $88,000.

3.8 Recommendations – Water Services

- Similar to bridges & culverts, water services are uniquely consequential to a community's wellbeing. While age-based data indicates that the majority of water assets are in good, very good or fair condition, field inspection may suggest otherwise. Therefore, a condition assessment program should be established to aid in prioritizing overall needs rehabilitation and replacement and to assist with optimizing the long and short term budgets. Further detail is outlined within the "asset management strategy" section of this AMP.

- Water distribution key performance indicators should be established and tracked annually as part of an overall level of service model. See Section 7 "Levels of Service".

- Once the above initiatives are complete or underway, an updated "current state of the infrastructure" analysis should be generated.

4 Sanitary Services

4.1 Asset Portfolio: Quantity, Useful Life and Replacement Cost

Table 9 and Table 10 illustrate key asset attributes for the municipality's wastewater assets, including quantities of various assets, their useful life, replacement costs, and the valuation method by which the replacement costs were derived. In total, the municipality's sanitary services assets are valued at $26 million based on 2016 replacement costs. The useful life indicated for the asset types below was assigned by the municipality and obtained from the municipality's accounting data as maintained in the CityWide® Tangible Asset module.

TABLE 9 KEY ASSET ATTRIBUTES – SANITARY SERVICES

Asset Type	Asset Component	Quantity	Valuation Method	2016 Overall Replacement Cost
Sanitary Services	Sewer mains - 451 mm and over	1,294m	NRBCPI	$484,848
	Sewer mains - 351 - 450 mm	3,769m	NRBCPI	$1,394,051
	Sewer mains - 251- 350 mm	6,967m	NRBCPI	$2,597,995
	Sewer mains - 151 - 250 mm	19,784m	NRBCPI	$7,339,756
	Sewer mains - 100 -150 mm	3,717m	NRBCPI	$1,721,741
	Treatment Plant	1	NRBCPI	$10,380,439
	Treatment Plant Equipment	18	NRBCPI	$2,337,258
			Total	$26,256,088

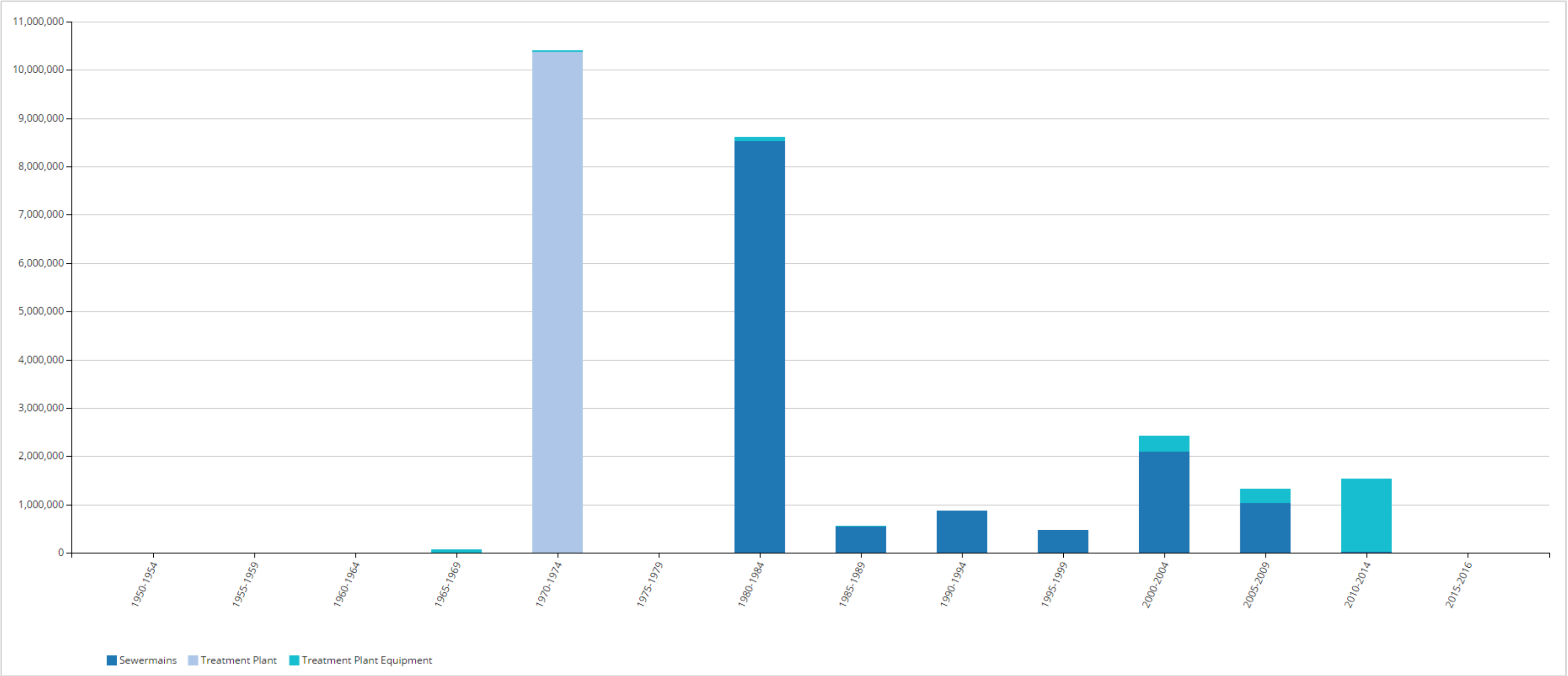
TABLE 10 USEFUL LIFE – SANITARY SERVICES

Asset Type	Asset Component	Useful Life in Years
Sanitary System	Sewer mains - Concrete	80
	Sewer mains - Brick	80
	Sewer mains - Metal	80
	Sewer mains - Polyethylene	100
	Treatment Plant	40
	Treatment Plant Equipment	25/28/30/35/40/45

4.2 Historical Investment in Infrastructure

In this section, we provide the installation profile and useful life consumption levels using in-service data obtained from CityWide® Tangible Assets. Together, these graphs can illustrate infrastructure investment trends and upcoming needs at the municipality. Figure 21 illustrates the historical levels of investment in the municipality's wastewater assets.

FIGURE 21 HISTORICAL INVESTMENT – SANITARY SERVICES

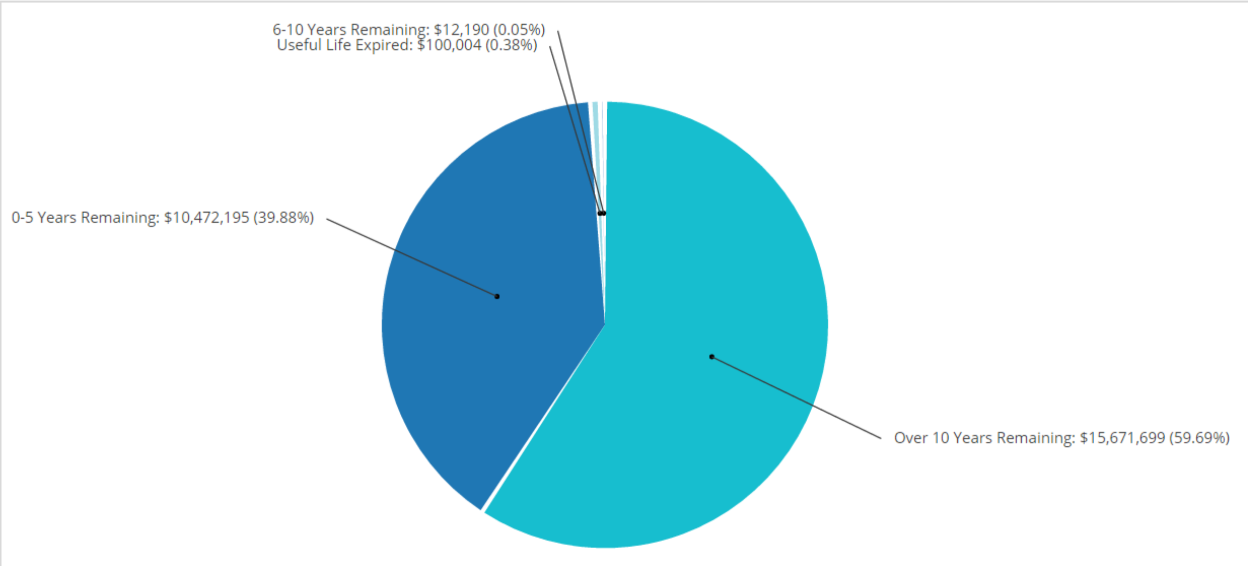


The municipality's investments in wastewater reached its peak in the early 1970s due to a $10 million investment into a treatment plant. 10 years later, in the early 1980s, $8.5 million was invested into sewer mains. Since then, average investment has been about $1 million for each period with the most recent investment being in the early 2010s with $1.5 million being put into treatment plant equipment.

4.5 Useful Life Consumption

In this section, we detail the extent to which assets have consumed their useful life based on the above, established useful life standards. In conjunction with asset condition data, understanding the consumption rate of assets based on industry established useful life measures provides a more complete profile of the state of a community's infrastructure. The figure below illustrates the useful life consumption levels for the municipality's wastewater services.

FIGURE 22 USEFUL LIFE CONSUMPTION – SANITARY SERVICES

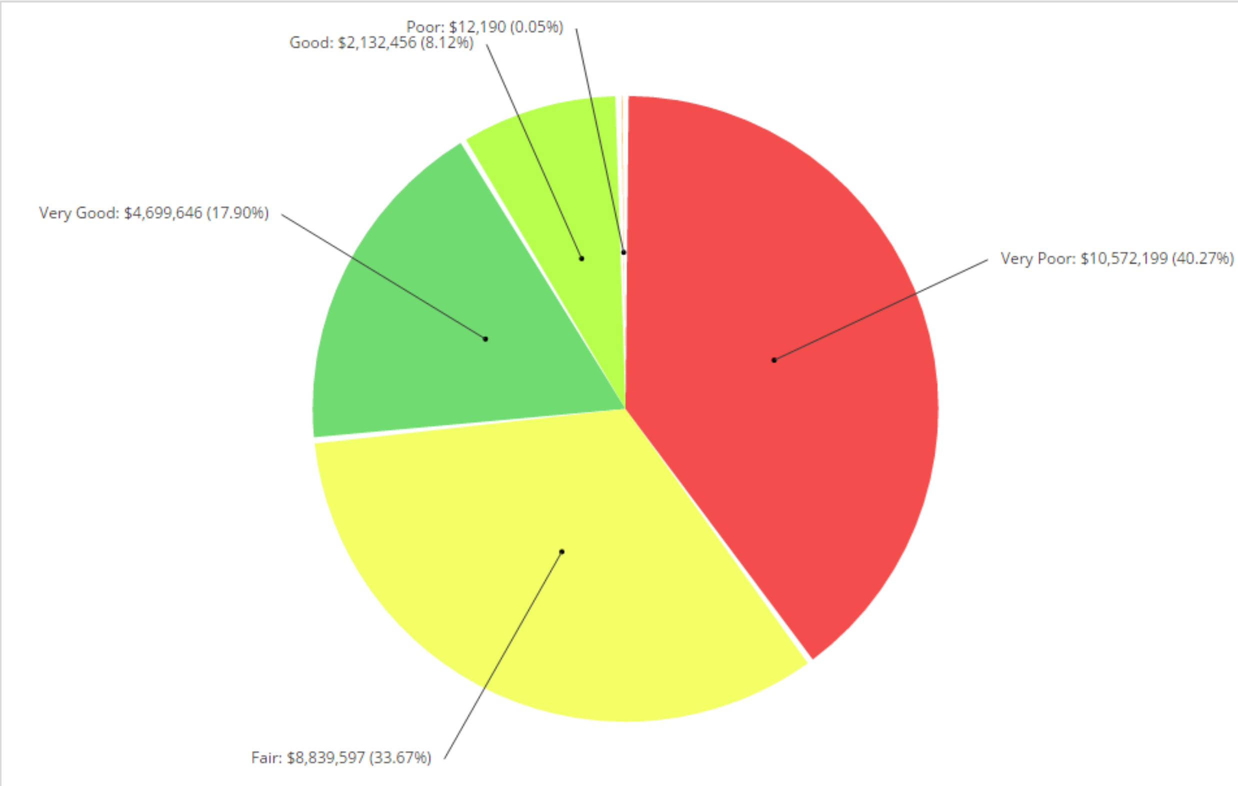


Nearly 60% of wastewater assets have at least 10 years of useful life remaining. Less than 1% remain in operation beyond their established useful life.

4.6 Current Asset Condition

Using replacement cost, in this section, we summarize the condition of the municipality's wastewater services. By default, we rely on observed field data as provided by the municipality. In the absence of such information, age-based data is used as a proxy.

FIGURE 23 ASSET CONDITION - SANITARY SERVICES (AGE-BASED)

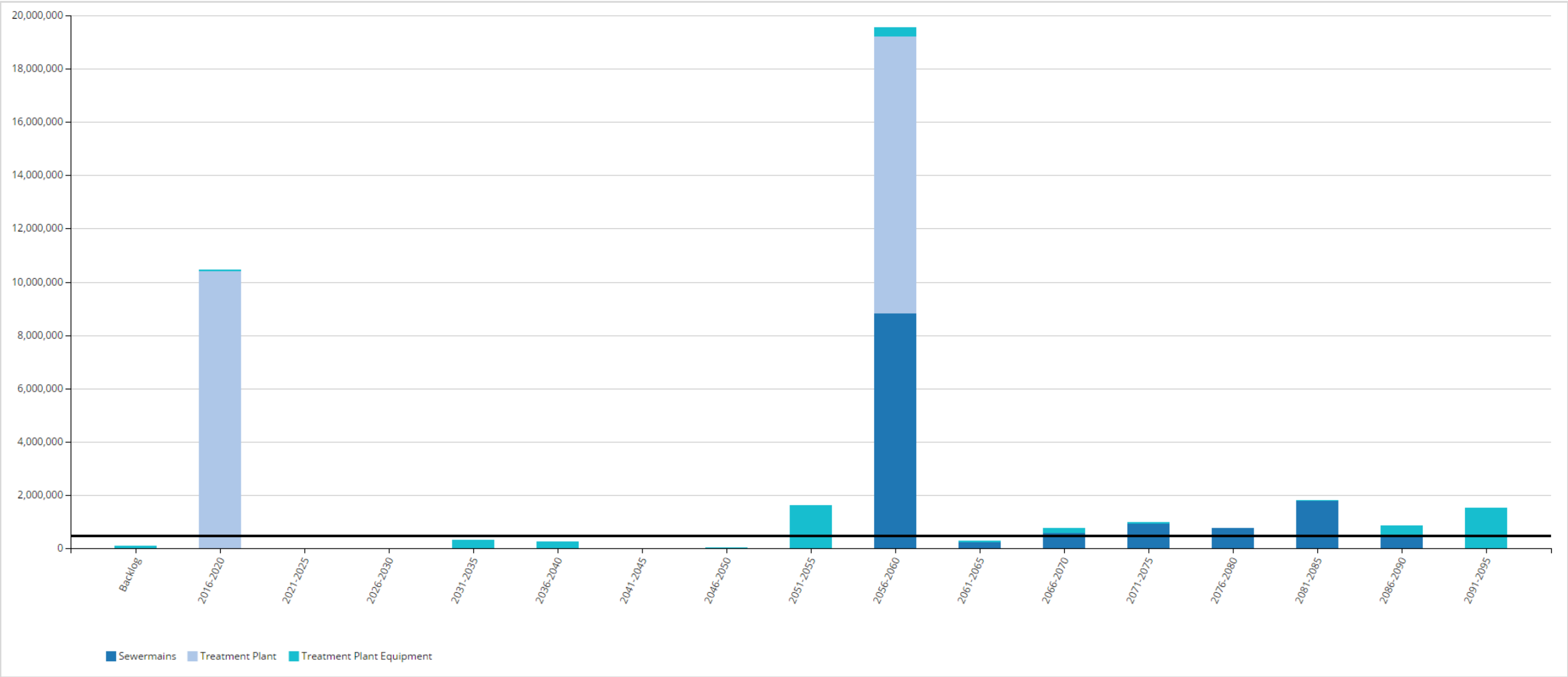


Based on age-based condition, while 26% of wastewater assets are in good to very good condition, 40%, with a valuation of $10.5 million are poor to very poor condition.

4.7 Forecasting Replacement Needs

In this section, we illustrate the short-, medium- and long-term infrastructure spending requirements (replacement only) for the municipality's wastewater services assets. The backlog is the aggregate investment in infrastructure that was deferred over previous years or decades. In the absence of observed data, the backlog represents the value of assets that remain in operation beyond their useful life.

FIGURE 24 FORECASTING REPLACEMENT NEEDS – SANITARY SERVICES



The current backlog for the municipality's wastewater services is $100,000. While replacements needs will be relatively small between 2021 and 2055, there is an immediate replacement need of over $10 million within the next 5 years. Then again, between 2056-2060, there will be another spike as the replacement need will jump to nearly $20 million. Brockton's annual requirement for sanitary services is $495,000, as indicated by the trendline on the graph. At this level, funding is sustainable and replacement needs can be met as they arise without the need for deferring projects. However, the municipality is currently allocating only $173,000, leaving an annual deficit of $322,000.

4.8 Recommendations –Sanitary Services

- While age-based data indicates that the majority of wastewater assets are in good, very good or fair condition, field inspection may suggest otherwise. Field inspections should be conducted to provide a more accurate estimate of the asset conditions and therefore a more accurate minimum sustainable funding level. See Section 2, 'Condition Assessment Programs' in the 'Asset Management Strategies' chapter for more information.

- Due to the large replacement need of $10 million required within the next 5 years, condition data generated from the above initiative should be integrated with a risk management framework. Together, this data should be used to systematically prioritize short-, medium-, and long-term replacement needs for the municipality's wastewater assets. See Section 4, 'Risk' in the 'Asset Management Strategies' chapter for more information.

- While wastewater facilities undergo visual inspections by structural engineers upon request, the municipality should establish a more strategic and systematic assessment schedule. See Section 2, 'Condition Assessment Programs' in the 'Asset Management Strategies' chapter.

- Waste water collection key performance indicators should be established and tracked annually as part of an overall level of service model. See Section 7 "Levels of Service".

- Once the above initiatives are complete or underway, an updated "current state of the infrastructure" analysis should be generated

5 Storm Sewer System

5.1 Asset Portfolio: Quantity, Useful Life and Replacement Cost

Table 11 illustrates key asset attributes for the municipality's storm water assets, including quantities of various assets, their useful life, replacement costs, and the valuation method by which the replacement costs were derived. In total, the municipality's storm water services assets are valued at $16.6 million based on 2016 replacement costs. The useful life indicated for the asset types below was assigned by the municipality and obtained from the municipality's accounting data as maintained in the CityWide® Tangible Asset module.

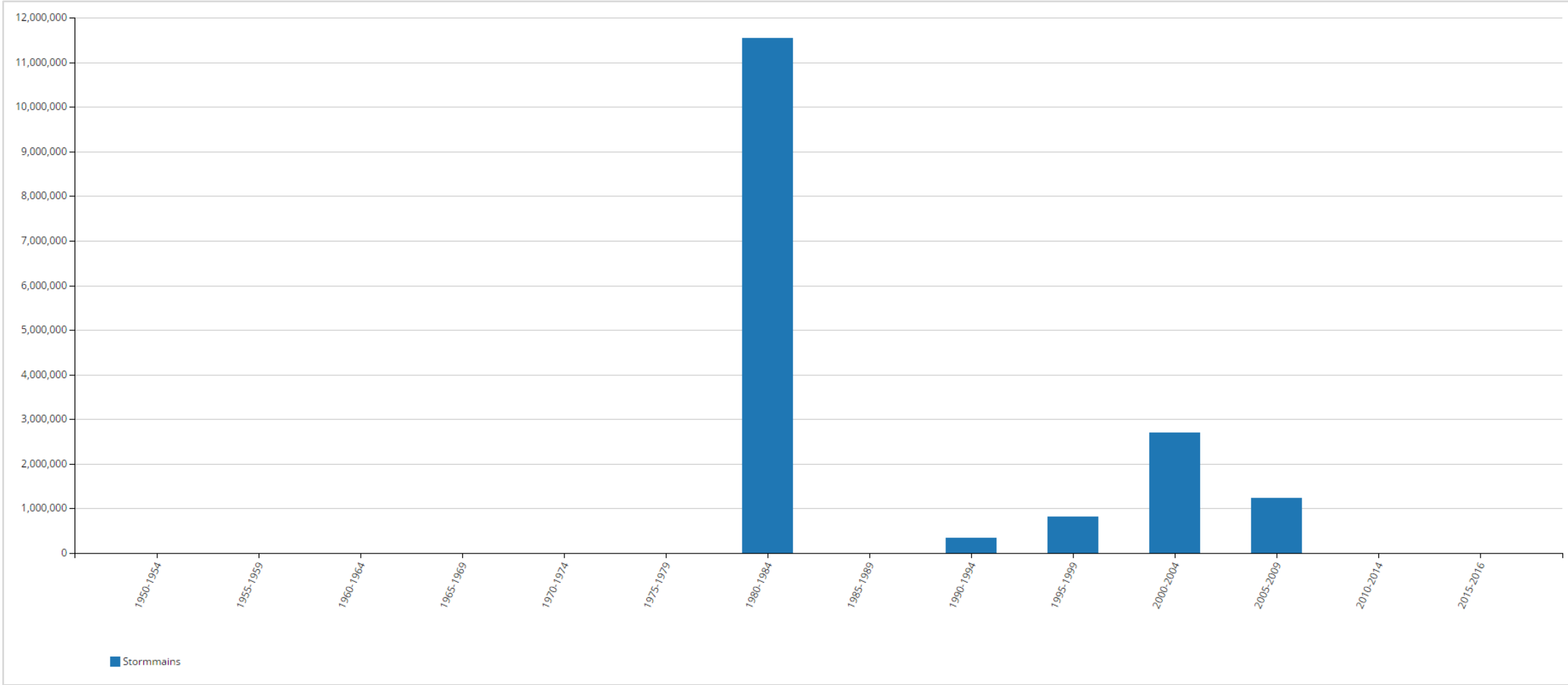
TABLE 11 KEY ASSET ATTRIBUTES – STORM SEWER SYSTEM

Asset Type	Asset Component	Quantity	Useful Life in Years	Valuation Method	2016 Overall Replacement Cost
Storm Sewer System	Storm mains - 901 mm and over	496m	80	NRBCPI	$5,440,698
	Storm mains - 601 - 900 mm	2,706m	80	NRBCPI	$627,433
	Storm mains - 301 - 600 mm	12,140m	80	NRBCPI	$3,258,919
	Storm mains - 100 - 300 mm	15,828m	80	NRBCPI	$7,292,793
	Storm mains - Undetermined	14,974m	80	NRBCPI	$26,049
				Total	$16,645,892

5.4 Historical Investment in Infrastructure

In this section, we provide the installation profile and useful life consumption levels using in-service data obtained from CityWide® Tangible Assets. Together, these graphs can illustrate infrastructure investment trends and upcoming needs at the municipality. Figure 21 illustrates the historical levels of investment in the municipality's storm water assets.

FIGURE 25 HISTORICAL INVESTMENT – STORM SEWER SYSTEM

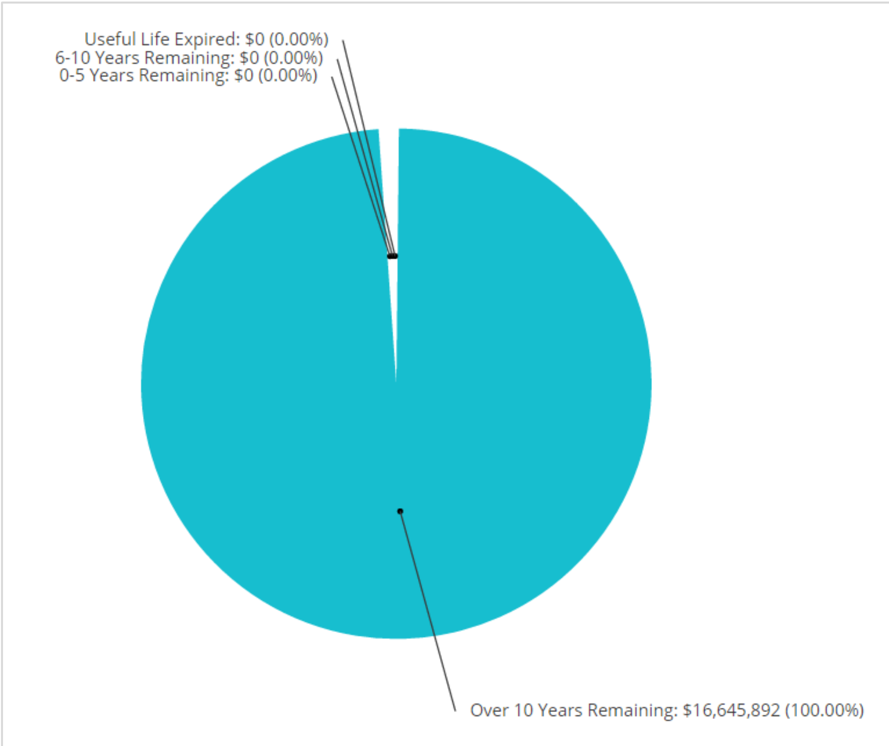


The largest expenditures in the municipality's storm sewer services, totaling over $11 million, occurred in the early 1980s. Since then, investment has been minimal, but peaked in the early 2000s with nearly $3 million invested.

5.5 Useful Life Consumption

In this section, we detail the extent to which assets have consumed their useful life based on the above, established useful life standards. In conjunction with asset condition data, understanding the consumption rate of assets based on industry established useful life measures provides a more complete profile of the state of a community's infrastructure. The figure below illustrates the useful life consumption levels for the municipality's storm sewer services .

FIGURE 26 USEFUL LIFE CONSUMPTION – STORM SEWER SYSTEM

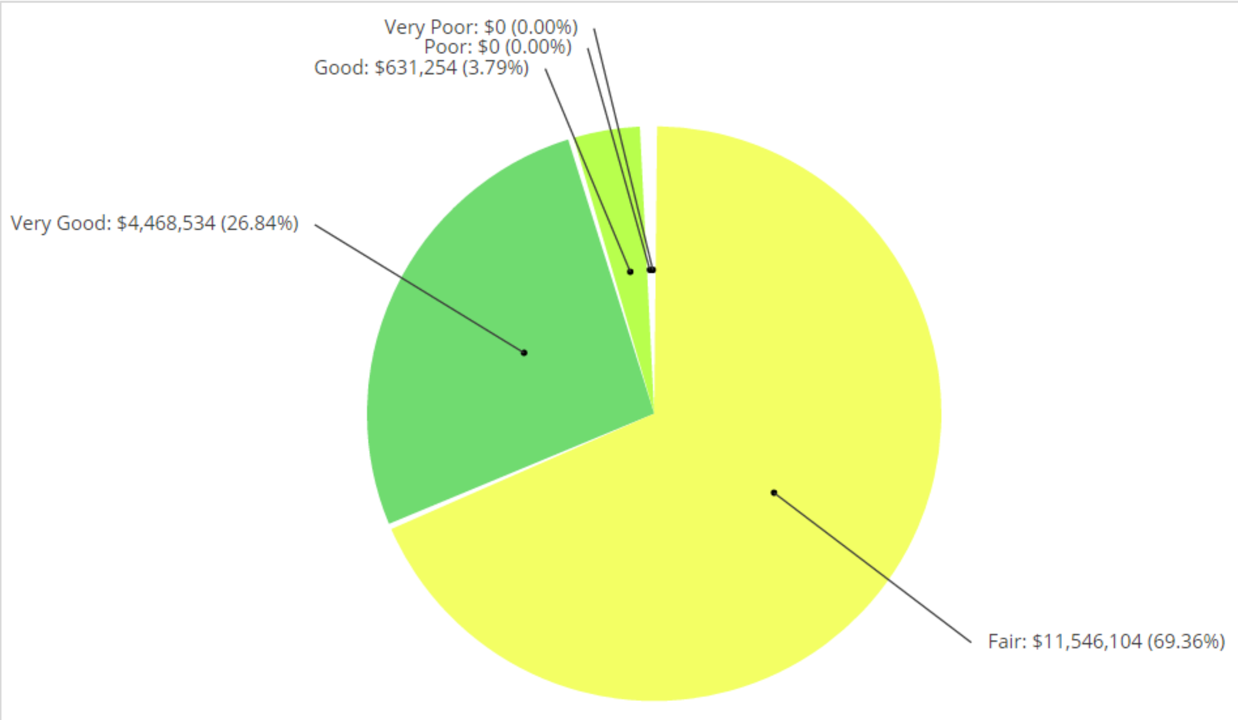


100% of Brockton's storm sewer assets have over 10 years of useful life remaining.

5.6 Current Asset Condition

Using replacement cost, in this section, we summarize the condition of the municipality's storm water services. As no observed condition data was provided, age-based data is used to approximate condition levels.

FIGURE 27 ASSET CONDITION – STORM SEWER SYSTEM (AGE-BASED)

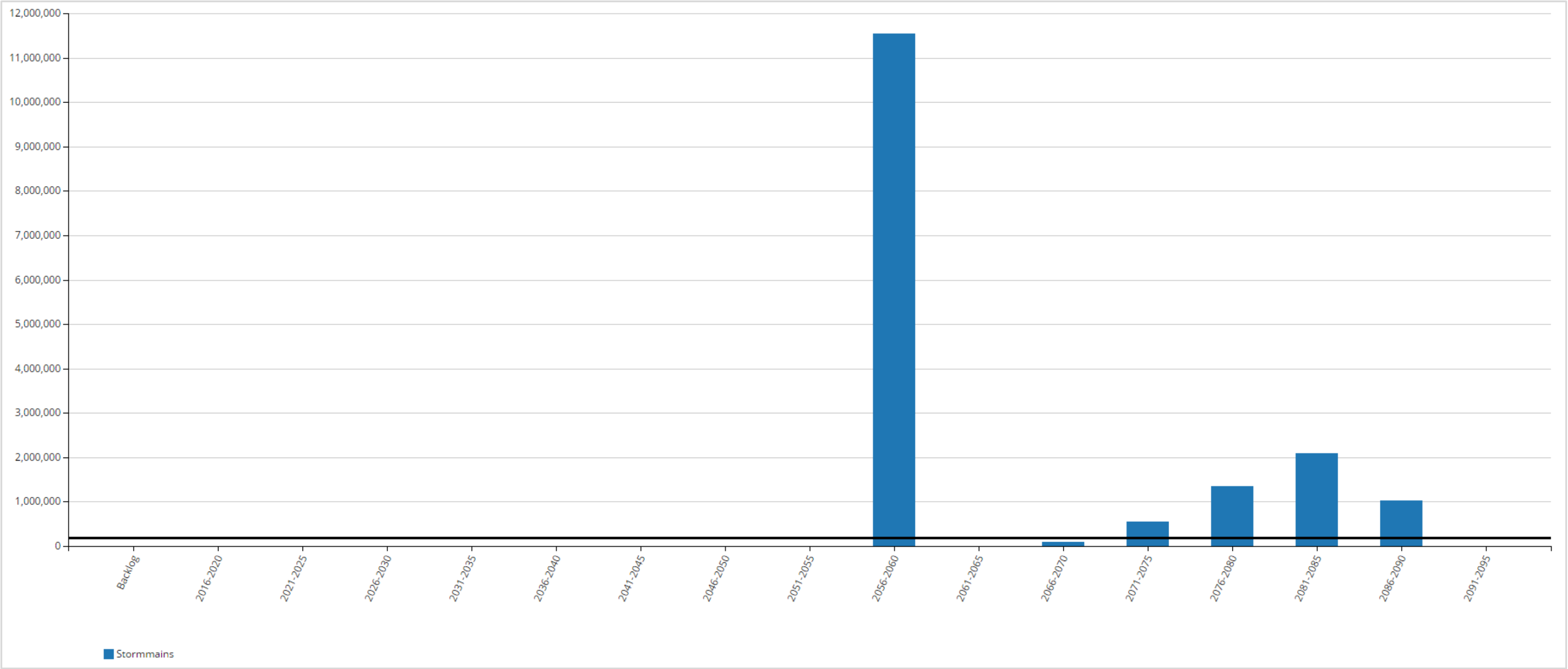


Based on age data, more than 30% of the municipality's storm water assets, valued at $5 million, are in good to very good condition. The remainder of the assets are in fair condition, with no assets reported as being in poor or very poor condition.

5.7 Forecasting Replacement Needs

In this section, we illustrate the short-, medium- and long-term infrastructure spending requirements (replacement only) for the municipality's storm water services assets. The backlog is the aggregate investment in infrastructure that was deferred over previous years or decades. In the absence of observed data, the backlog represents the value of assets that remain in operation beyond their useful life.

FIGURE 28 FORECASTING REPLACEMENT NEEDS – STORM SEWER SYSTEM



There is no backlog associated with Brockton's storm sewer assets and replacement needs will remain at zero until 2056. The municipality's annual requirements for its storm sewer services total $208,000, as indicated by the trendline on the graph. At this level, funding is sustainable and replacement needs can be met as they arise without the need for deferring projects. However, the municipality is currently allocating $0, leaving an annual deficit of $208,000.

5.8 Recommendations – Storm Sewer System

- While age-based data indicates that the majority of storm water assets are in good, very good or fair condition, field inspection may suggest otherwise. Field inspections should be conducted to provide an accurate estimate of the asset conditions and therefore a more accurate minimum sustainable funding level. See Section 2, 'Condition Assessment Programs' in the 'Asset Management Strategies' chapter for more information.

- Storm water collection key performance indicators should be established and tracked annually as part of an overall level of service model. See Section 7 "Levels of Service".

6 Buildings

6.1 Asset Portfolio: Quantity, Useful Life and Replacement Cost

Table 12 illustrates key asset attributes for the municipality's buildings assets, including quantities of various assets, their useful life, replacement costs, and the valuation method by which the replacement costs were derived. In total, the municipality's buildings assets are valued at $17 million based on 2016 replacement costs. The useful life indicated for the asset types below was assigned by the municipality and obtained from the municipality's accounting data as maintained in the CityWide® Tangible Asset module.

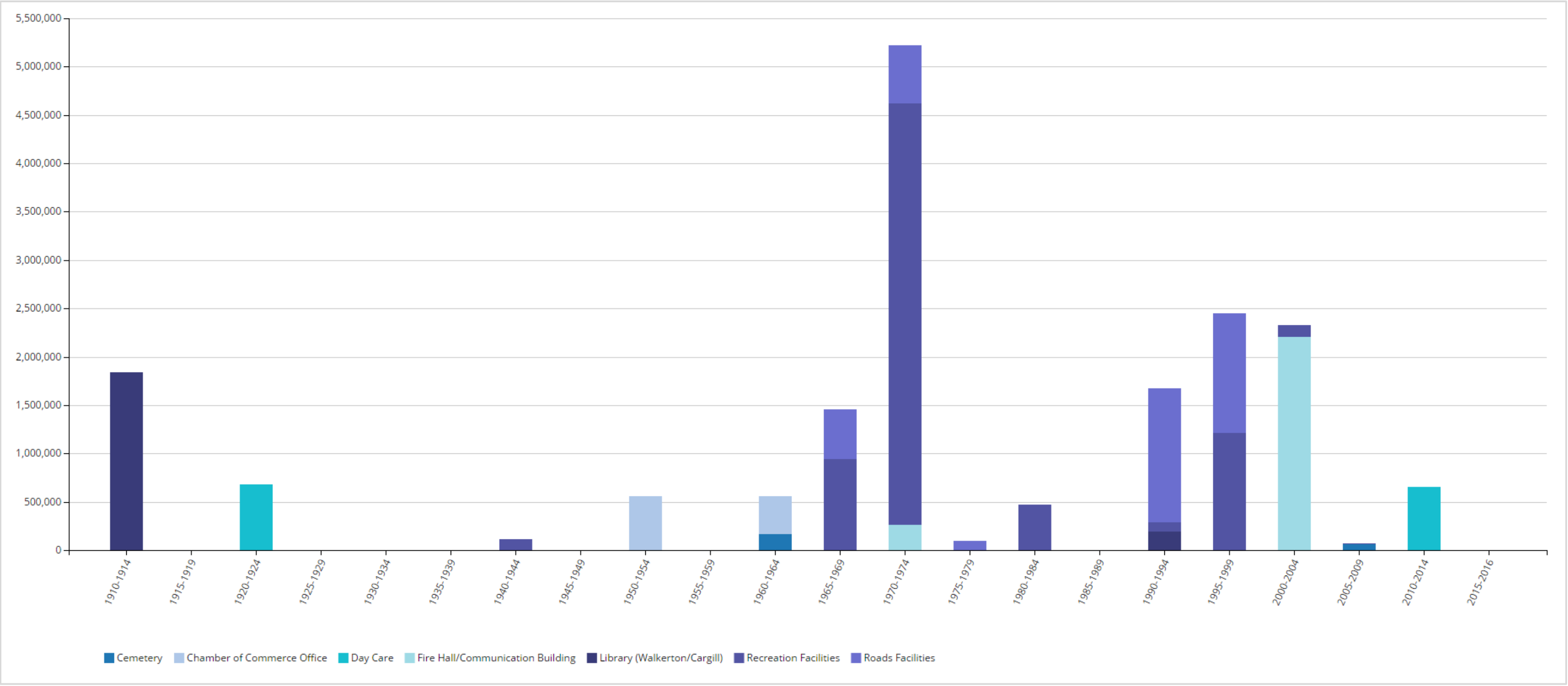
TABLE 12 KEY ASSET ATTRIBUTES – INVENTORY AND REPLACEMENT COSTS: BUILDINGS

Asset Type	Asset Component	Quantity	Useful Life in Years	Valuation Method	2016 Overall Replacement Cost
Buildings	Cemetery	2	40	NRBCPI	$227,100
	Day Care	2	40	NRBCPI	$1,329,451
	Fire Hall/Communication Building	2	40	NRBCPI	$2,209,159
	Chamber of Commerce Office	1	40	NRBCPI	$397,926
	Library (Walkerton/Cargill)	2	40	NRBCPI	$2,025,727
	Recreation Facilities	17	40	NRBCPI	$7,319,373
	Roads Facilities	9	40	NRBCPI	$3,558,394
				Total	$17,067,130

6.4 Historical Investment in Infrastructure

In this section, we provide the installation profile and useful life consumption levels using in-service data obtained from CityWide® Tangible Assets. Together, these graphs can illustrate infrastructure investment trends and upcoming needs at the municipality. The chart below illustrates the historical levels of investment in the municipality's buildings assets.

FIGURE 29 HISTORICAL INVESTMENT - BUILDINGS

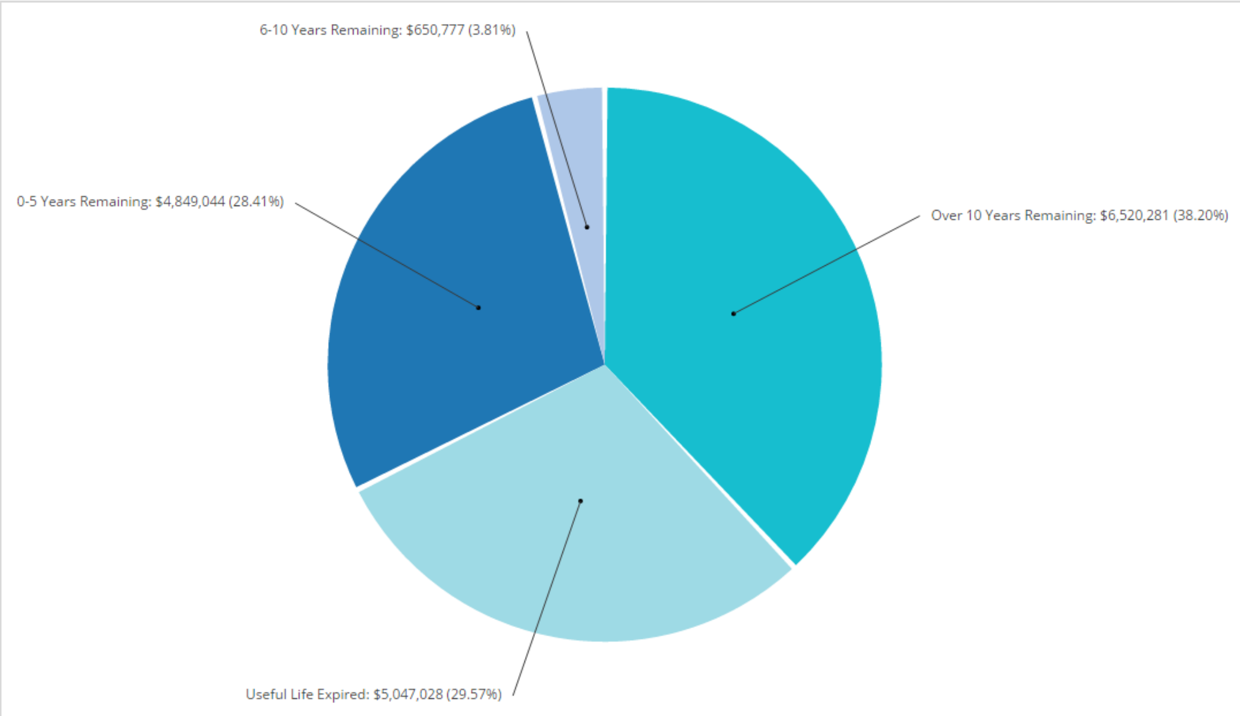


Investments have fluctuated over the last 100 years peaking in the early 1970s with over $5 million in investment focused on a recreation facility which cost $4.3 million. There was another period of sustained investment from 1990-2004 with total investment of about $6.5 million.

6.5 Useful Life Consumption

In this section, we detail the extent to which assets have consumed their useful life based on the above, established useful life standards. In conjunction with asset condition data, understanding the consumption rate of assets based on industry established useful life measures provides a more complete profile of the state of a community's infrastructure. The figure below illustrates the useful life consumption levels for the municipality's buildings assets.

FIGURE 30 USEFUL LIFE CONSUMPTION – BUILDINGS

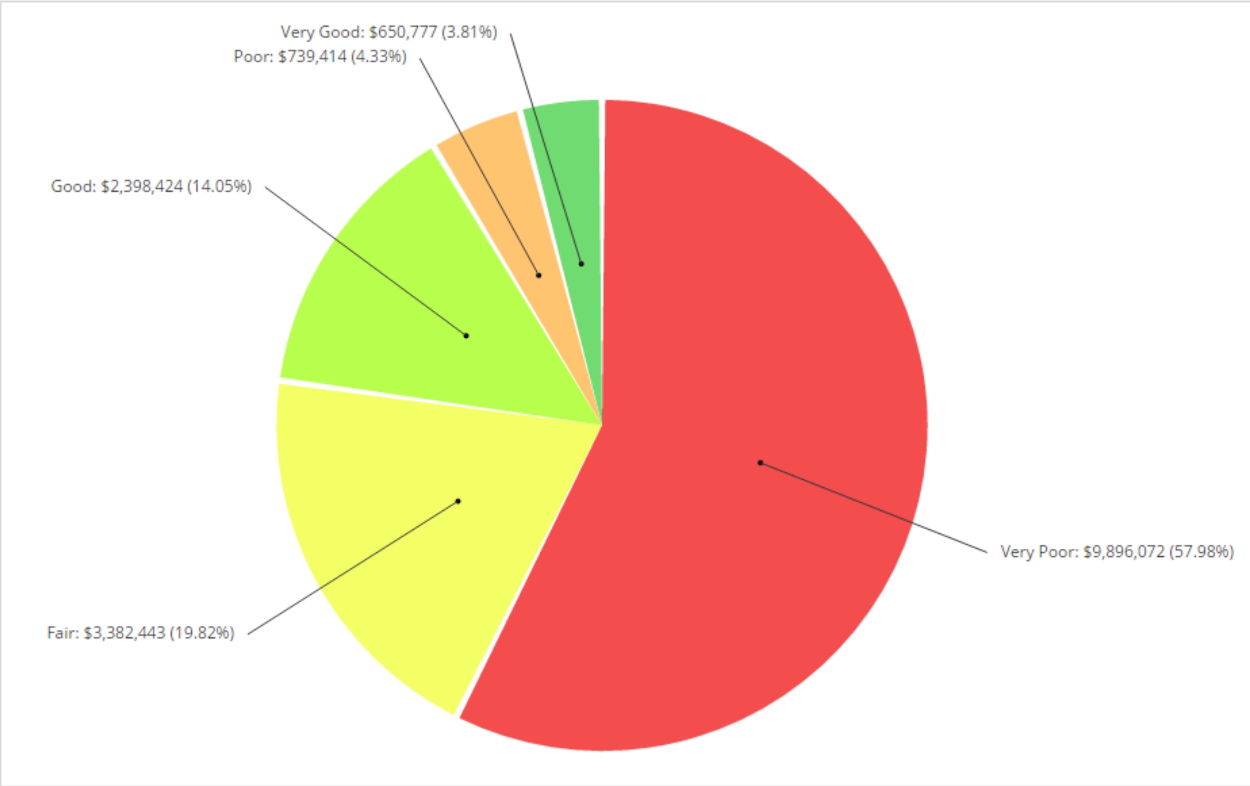


Nearly 40% of the buildings assets have at least 10 years of useful life remaining. However, 30%, valued at $5 million, remain in service beyond their established useful life.

6.6 Current Asset Condition

Using replacement cost, in this section, we summarize the condition of the municipality's buildings. By default, we rely on observed field data as provided by the municipality. In the absence of such information, age-based data is used as a proxy.

FIGURE 31 ASSET CONDITION – BUILDINGS (AGE-BASED)

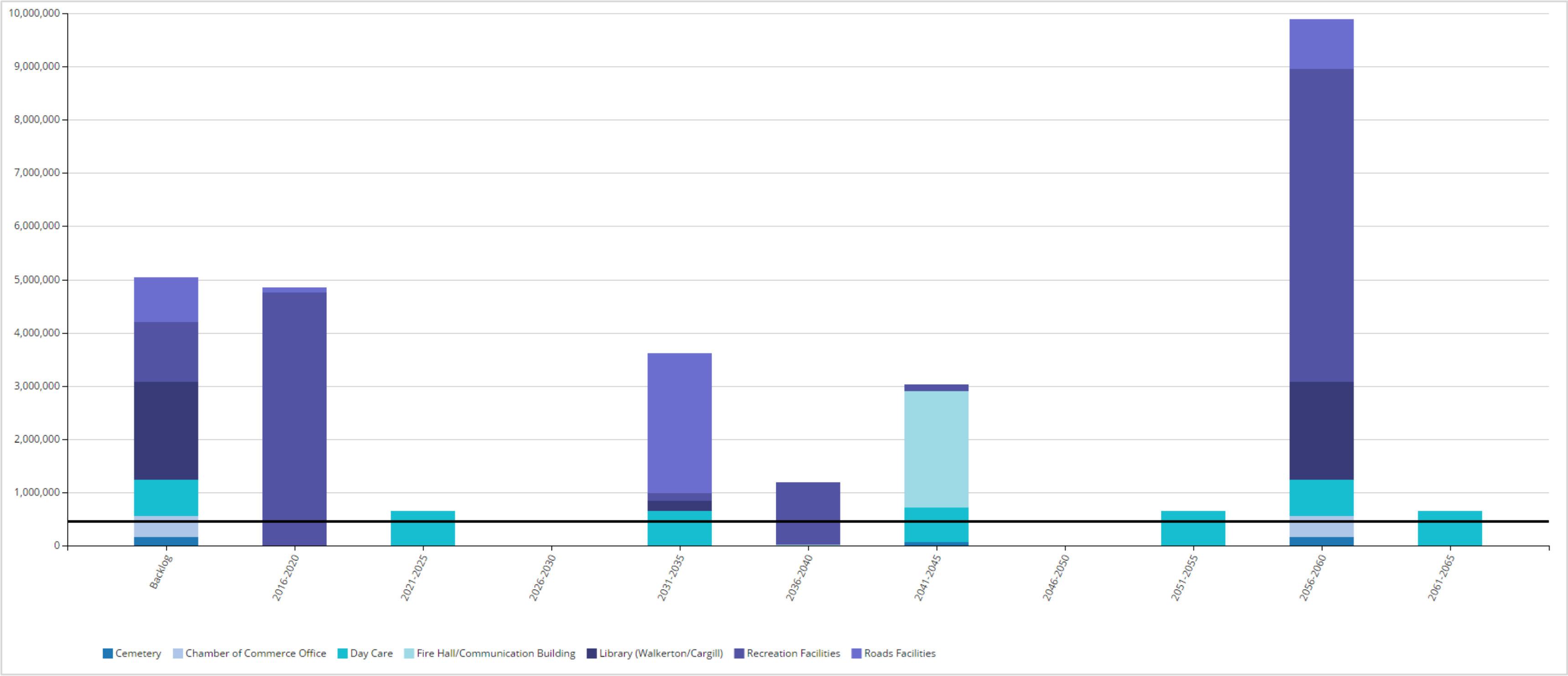


While nearly 18% of the municipality's buildings assets are in good to very good condition, a majority of assets, valued at $10.6 million are in poor to very poor condition.

6.7 Forecasting Replacement Needs

In this section, we illustrate the short-, medium- and long-term infrastructure spending requirements (replacement only) for the municipality's buildings assets. The backlog is the aggregate investment in infrastructure that was deferred over previous years or decades. In the absence of observed data, the backlog represents the value of assets that remain in operation beyond their useful life.

FIGURE 32 FORECASTING REPLACEMENT NEEDS – BUILDINGS



In addition to an infrastructure backlog totalling $5 million, the municipality will need to invest another $5 million within the next 5 years to meet replacement needs. The recreation facility will comprise the majority of these replacement related expenditures. The municipality's annual requirements for its buildings total $475,000, as indicated by the trendline on the graph. At this level, funding is sustainable and replacement needs can be met as they arise without the need for deferring projects. Of course, this funding level does not address the backlog. The municipality is currently allocating $0, leaving an annual deficit of $475,000.

6.8 Recommendations – Buildings

- Due to the current state and backlog of needs for the building assets, it is critical that the municipality implement a condition assessment program to aid in prioritizing overall needs for rehabilitation and replacement and to assist with optimizing the long and short term budgets. Further detail is outlined within the "asset management strategy" section of this AMP.

- There is a backlog as well as short term replacement need totaling $10 million. Conducting comprehensive condition assessments and integrating this data with a risk management framework will help the municipality obtain a more accurate indication of the backlog, and allow the municipality to prioritize its buildings related capital expenditures to eliminate the backlog.

- Facility key performance indicators should be established and tracked annually as part of an overall level of service model. See Section 7 "Levels of Service".

- Once the above initiatives are complete or underway, an updated "current state of the infrastructure" analysis should be generated.

7 Machinery & Equipment

7.1 Asset Portfolio: Quantity, Useful Life and Replacement Cost

Table 13 illustrates key asset attributes for the municipality's machinery & equipment assets, including quantities of various assets, their useful life, replacement costs, and the valuation method by which the replacement costs were derived. In total, the municipality's machinery & equipment assets are valued at $7.7 million based on 2016 replacement costs. The useful life indicated for the asset types below was assigned by the municipality and obtained from the municipality's accounting data as maintained in the CityWide® Tangible Asset module.

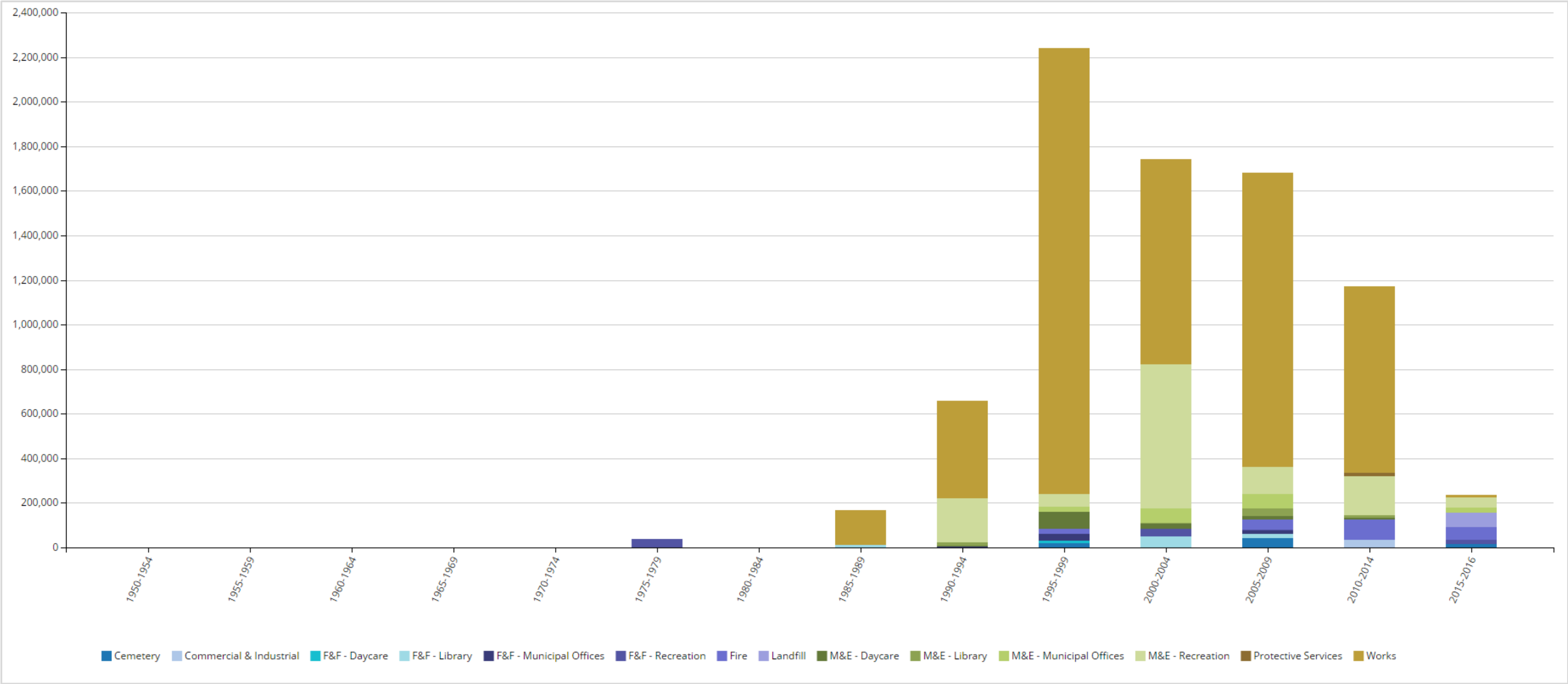
TABLE 13 KEY ASSET ATTRIBUTES – MACHINERY & EQUIPMENT

Asset Type	Asset Component	Quantity	Useful Life in Years	Valuation Method	2016 Overall Replacement Cost
Machinery & Equipment	Cemetery	4	10	CPI	$76,847
	Commercial & Industrial	1	10	CPI	$33,684
	Daycare	20	5, 10, 15, 25	CPI	$124,563
	Fire	27	5, 10, 20	CPI	$220,661
	Landfill	1	10	CPI	$64,660
	Library	5	10, 20, 40	CPI	$64,459
	Municipal Offices	10	10	CPI	$173,372
	Protective Services	1	10	CPI	$14,240
	Recreation	88	3, 5, 8, 10, 12, 15, 20, 25, 35	CPI	$1,229,452
	Works	64	10, 15	CPI	$5,404,762
Furniture & Fixtures	Daycare	127	5, 10	CPI	$11,998
	Library	49	10	CPI	$158,876
	Municipal Office	5	5, 10, 20, 50	CPI	$43,198
	Recreation	97	10, 15	CPI	$97,640
				Total	$7,718,412

7.4 Historical Investment in Infrastructure

In this section, we provide the installation profile and useful life consumption levels using in-service data obtained from CityWide® Tangible Assets. Together, these graphs can illustrate infrastructure investment trends and upcoming needs at the municipality. The chart below illustrates the historical levels of investment in the municipality's machinery & equipment.

FIGURE 33 HISTORICAL INVESTMENT – MACHINERY & EQUIPMENT

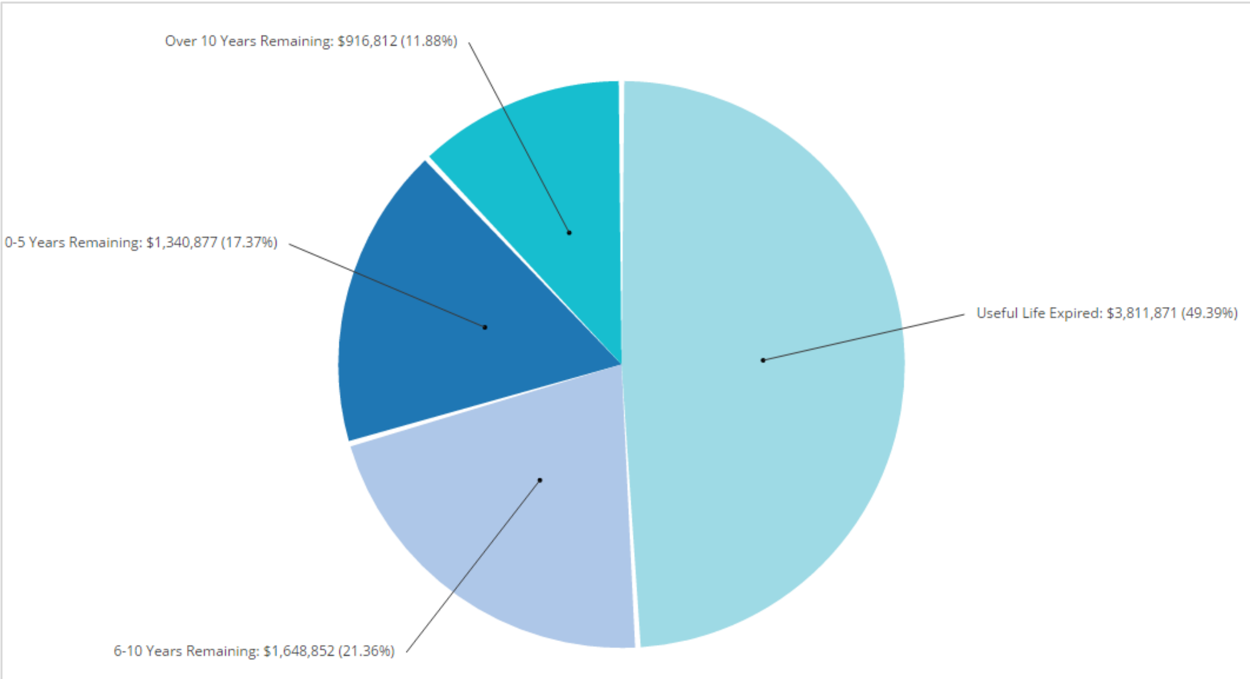


The vast majority of investments in machinery & equipment has taken place in the last 20 years, with expenditures totaling approximately $7 million. A majority of this investment has gone into works.

7.5 Useful Life Consumption

In this section, we detail the extent to which assets have consumed their useful life based on the above, established useful life standards. In conjunction with asset condition data, understanding the consumption rate of assets based on industry established useful life measures provides a more complete profile of the state of a community's infrastructure. The figure below illustrates the useful life consumption levels for the municipality's machinery & equipment assets.

FIGURE 34 USEFUL LIFE CONSUMPTION – MACHINERY & EQUIPMENT

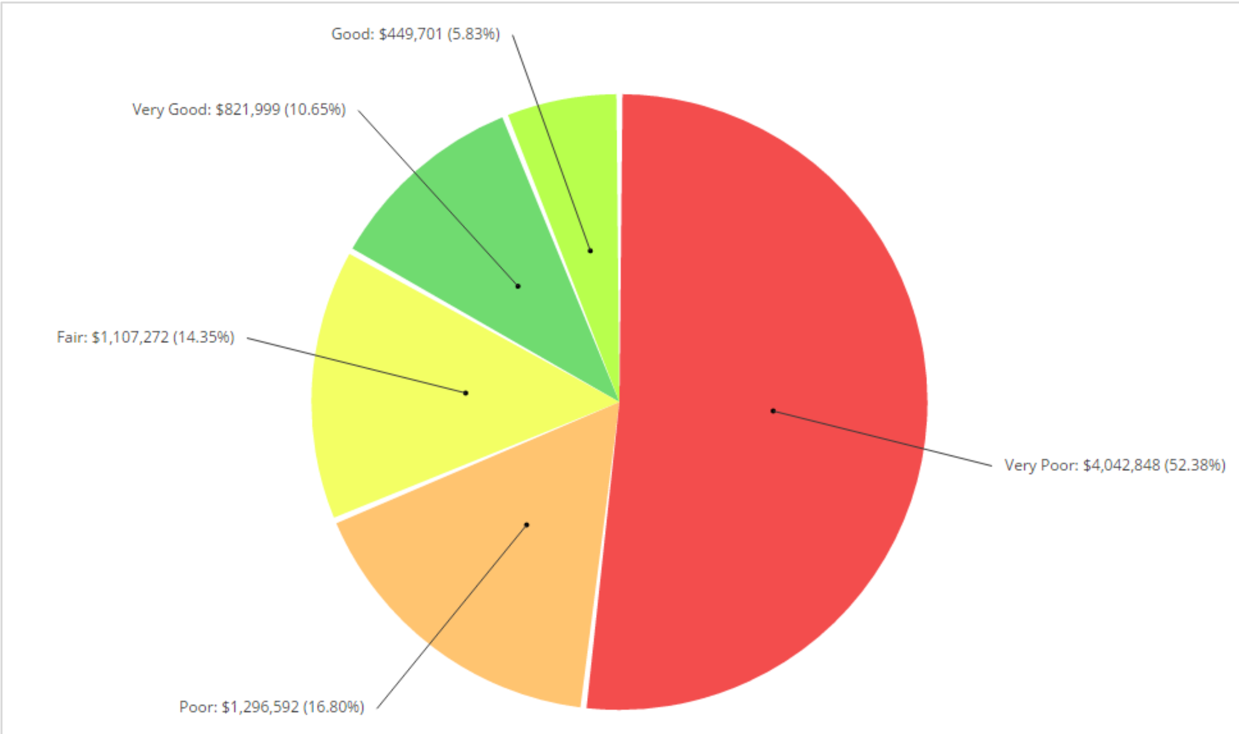


While 12% of the machinery & equipment assets have at least 10 years of useful life remaining, 50% of assets, valued at nearly $4 million, remain in operation beyond their useful life. In addition, another 17% of assets will reach the end of their useful life in the next five years.

7.6 Current Asset Condition

Using replacement cost, in this section, we summarize the condition of the municipality's machinery & equipment assets. By default, we rely on observed field data, e.g., mileage and hours, as provided by the municipality. In the absence of such information, age-based data is used as a proxy.

FIGURE 35 ASSET CONDITION – MACHINERY & EQUIPMENT (AGE-BASED)

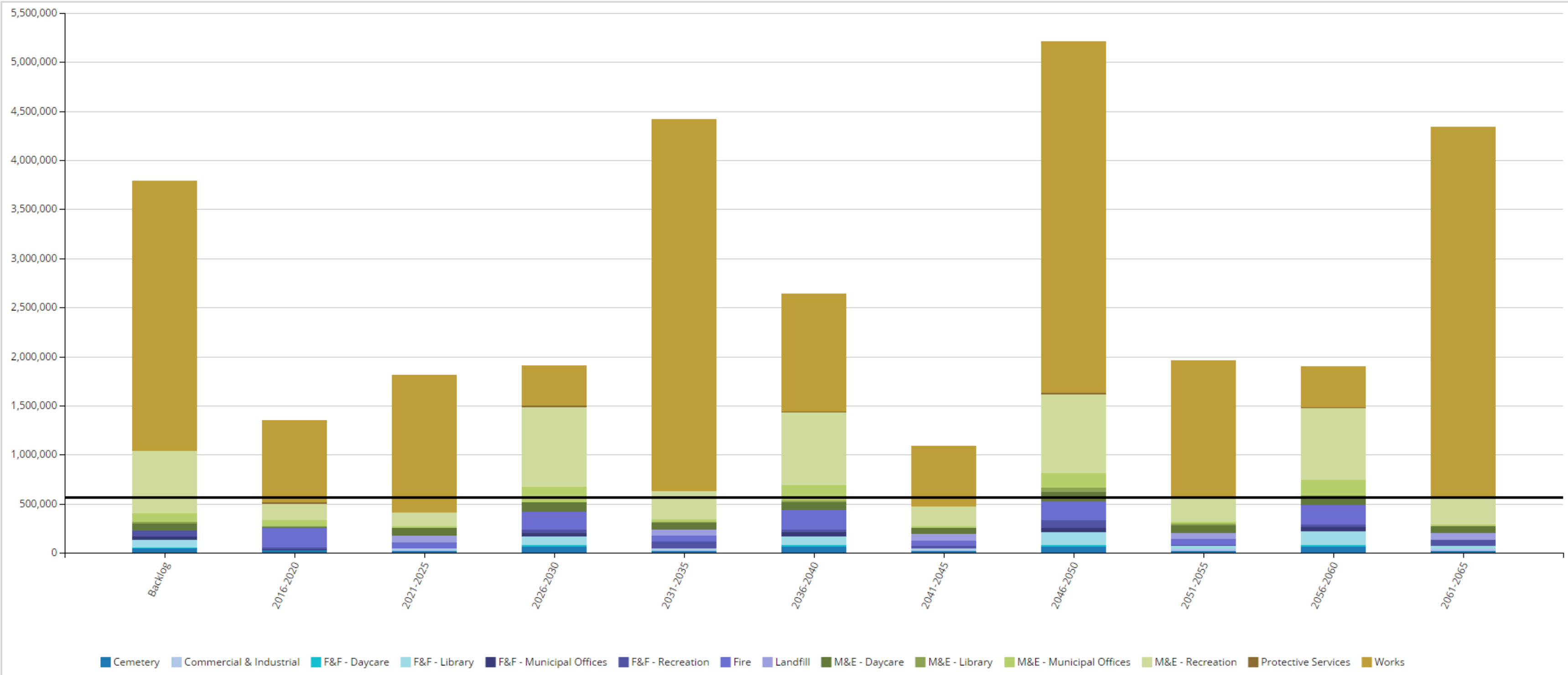


Based on age data, while 17% of machinery & equipment assets are in good to very good condition, nearly 70%, with a valuation of $5.3million, are in poor to very poor condition.

7.7 Forecasting Replacement Needs

In this section, we illustrate the short-, medium- and long-term infrastructure spending requirements (replacement only) for the municipality's machinery & equipment assets. The backlog is the aggregate investment in infrastructure that was deferred over previous years or decades. In the absence of observed data, the backlog represents the value of assets that remain in operation beyond their useful life.

FIGURE 36 FORECASTING REPLACEMENT NEEDS – MACHINERY & EQUIPMENT



Brockton has a backlog of replacement needs for machinery and equipment totaling $3.8 million which need to be addressed. In addition to this, needs in the next 5 years are $1.5 million and will continue to grow to a peak of nearly $4.5 million in 2031-2035. The municipality's annual requirements for its machinery and equipment total $576,000. At this level, funding is sustainable and replacement needs can be met as they arise without the need for deferring projects. The municipality is allocating $459,000, leaving an annual deficit of $117,000.

7.8 Recommendations – Machinery & Equipment

- Age-based data indicates a backlog of $3.8 million. Further, a significant majority of the machinery & equipment assets are in poor to very poor condition. Condition assessment data, once gathered, should be used to provide a better estimate of this pent-up demand, as well as provide a more accurate listing of replacements required for the short and long term budget. See Section 2, 'Condition Assessment Programs' in the 'Asset Management Strategies' chapter.

- Given the relatively minor valuation of the machinery & equipment portfolio, rudimentary levels of service (LOS) and KPIs may be established. The performance of the municipality's machinery & equipment assets should be assessed over time against target LOS and KPIs.

- The municipality should assess its short-, medium- and long-term operations and maintenance needs. An appropriate percentage of the replacement costs should then be allocated for the municipality's O&M requirements.

- Once the above initiatives are complete or underway, an updated "current state of the infrastructure" analysis should be generated.

8 Land improvements

8.1 Asset Portfolio: Quantity, Useful Life and Replacement Cost

Table 14 illustrates key asset attributes for the municipality's land improvement assets, including quantities of various assets, their useful life, replacement costs, and the valuation method by which the replacement costs were derived. In total, the municipality's land improvement assets are valued at nearly $750,000 based on 2016 replacement costs. The useful life indicated for the asset types below was assigned by the municipality and obtained from the municipality's accounting data as maintained in the CityWide® Tangible Asset module.

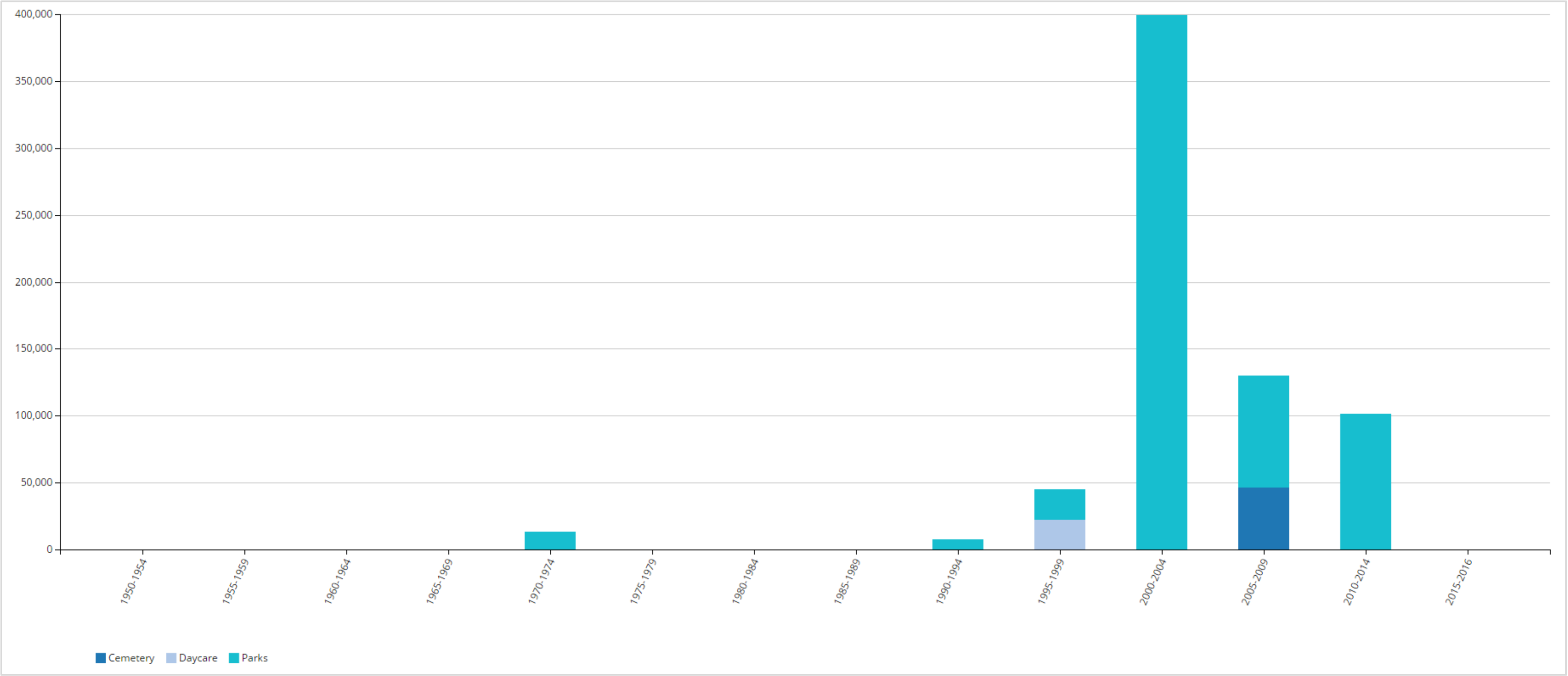
TABLE 14 KEY ASSET ATTRIBUTES – LAND IMPROVEMENTS

Asset Type	Asset Component	Quantity	Useful Life in Years	Valuation Method	2016 Overall Replacement Cost
Land Improvements	Cemetery	1	75	CPI	$46,034
	Day Care	1	10	CPI	$21,905
	Parks	43	10, 15, 40	CPI	$679,179
				Total	$747,118

8.4 Historical Investment in Infrastructure

In this section, we provide the installation profile and useful life consumption levels using in-service data obtained from CityWide® Tangible Assets. Together, these graphs can illustrate infrastructure investment trends and upcoming needs at the municipality. The chart below illustrates the historical levels of investment in the municipality's land improvements.

FIGURE 37 HISTORICAL INVESTMENT - LAND IMPROVEMENTS

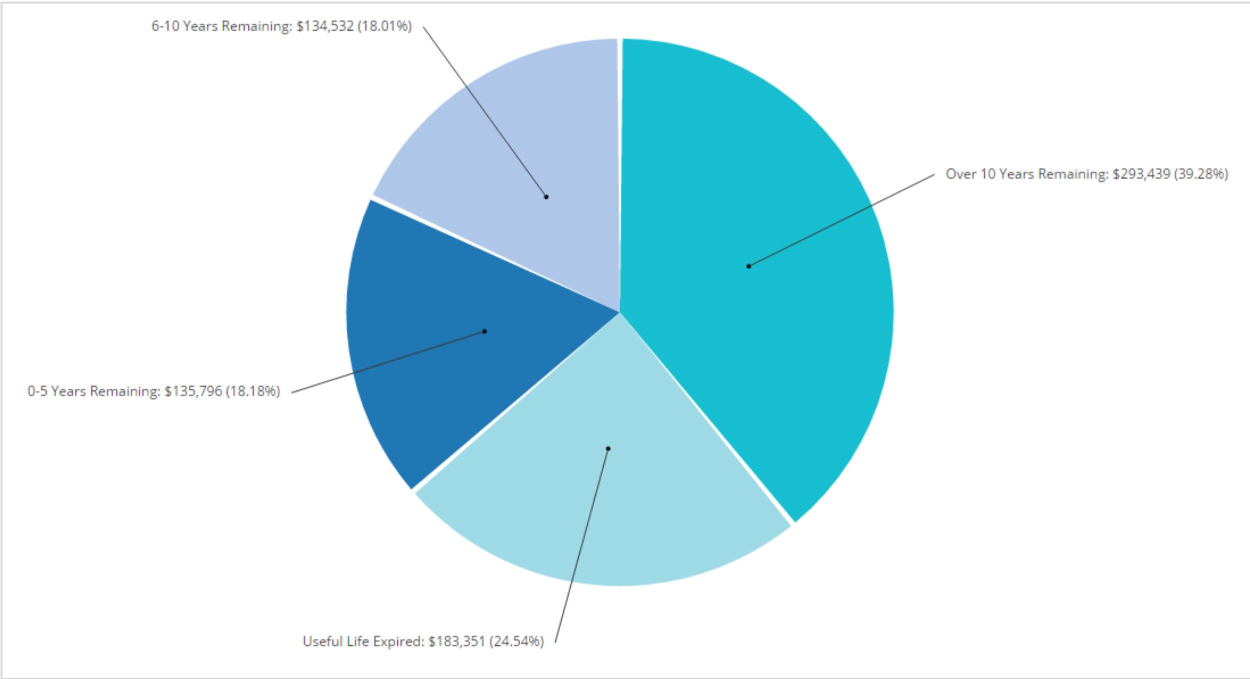


Most investments in land improvements took place between 1990-2014 with a peak of $400,000 in the early 2000s. A large majority of these investments have been put into parks.

8.5 Useful Life Consumption

In this section, we detail the extent to which assets have consumed their useful life based on the above, established useful life standards. In conjunction with asset condition data, understanding the consumption rate of assets based on industry established useful life measures provides a more complete profile of the state of a community's infrastructure. The figure below illustrates the useful life consumption levels for the municipality's land improvement assets.

FIGURE 38 USEFUL LIFE CONSUMPTION - LAND IMPROVEMENTS

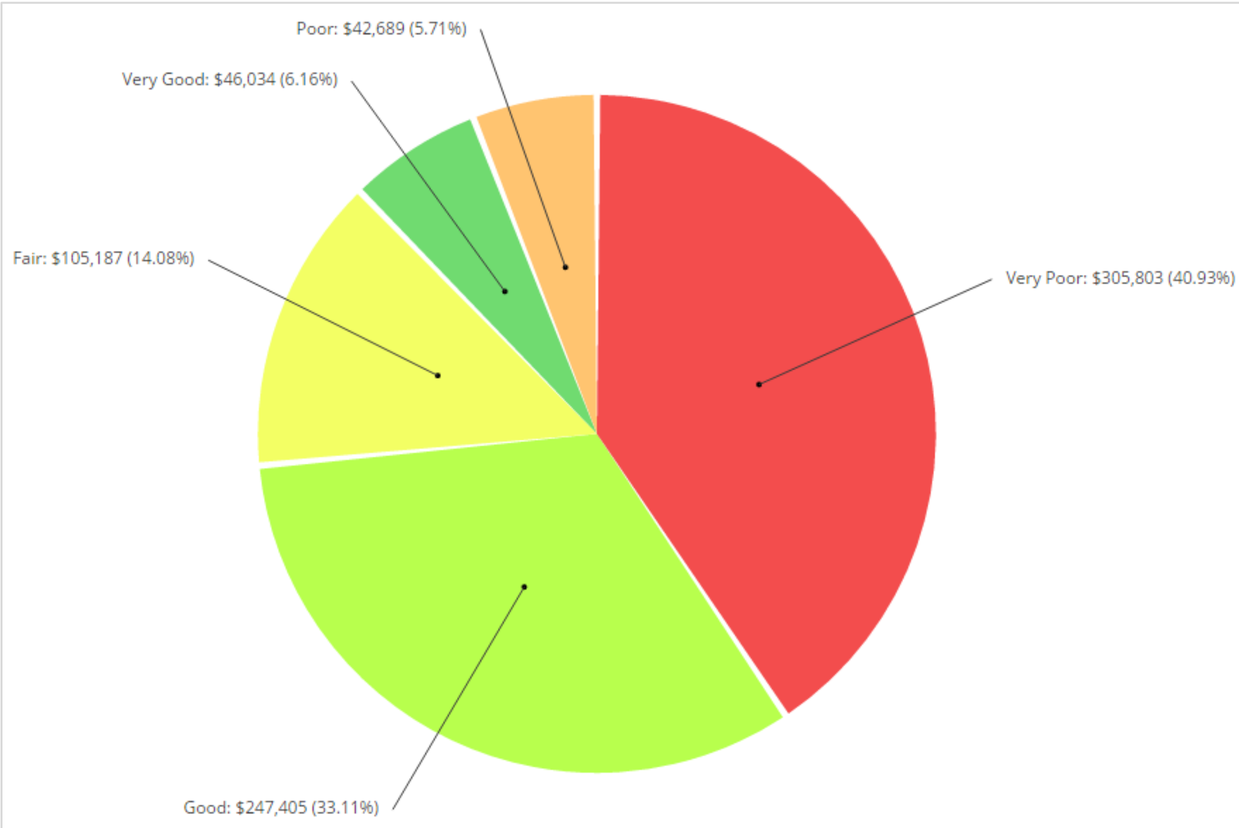


While approximately 40% of assets have at least 10 years of useful life remaining, a quarter of assets, valued at $183,351 remain in service beyond their useful life.

8.6 Current Asset Condition

Using replacement cost, in this section, we summarize the condition of the municipality's machinery & equipment assets. In the absence of such information, age-based data is used as a proxy.

FIGURE 39 ASSET CONDITION - LAND IMPROVEMENTS (AGE-BASED)

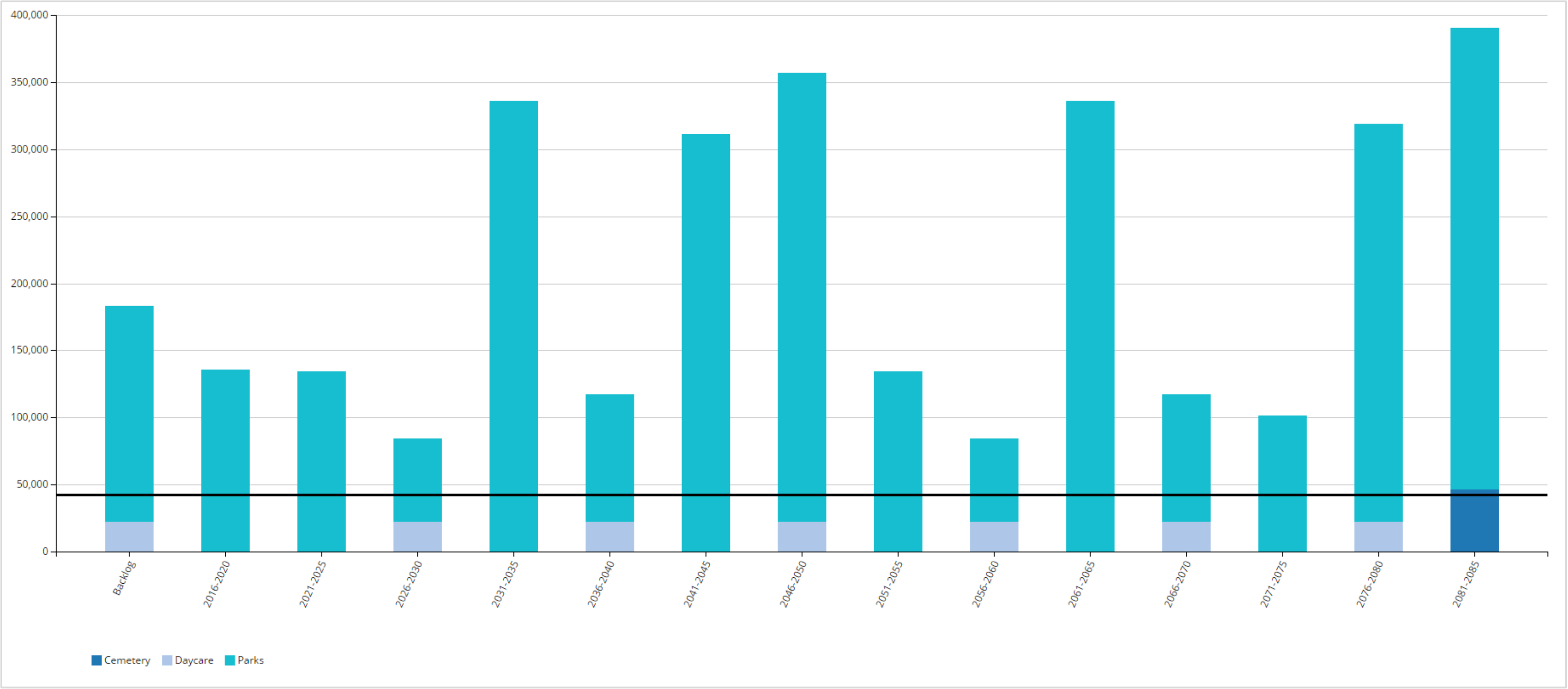


Based on age data, almost 40% of assets are in good to very good condition. However, nearly 47%, valued at almost $350,000, are in poor to very poor condition.

8.7 Forecasting Replacement Needs

In this section, we illustrate the short-, medium- and long-term infrastructure spending requirements (replacement only) for the municipality's land improvement assets. The backlog is the aggregate investment in infrastructure that was deferred over previous years or decades. In the absence of observed data, the backlog represents the value of assets that remain in operation beyond their useful life.

FIGURE 40 FORECASTING REPLACEMENT NEEDS - LAND IMPROVEMENTS



Based on age data, the backlog for land improvements totaled $183,000, while 10-year replacement needs total over $270,000. Beyond that, requirements will rise sharply to $350,000 between 2031-2035 and will fluctuate for the following 50 years. The municipality's annual requirements for its land improvement assets total $43,000, as indicated by the trendline on the graph. At this level, funding is sustainable and replacement needs can be met as they arise without the need for deferring projects. Of course this funding level does not address the backlog. The municipality is currently allocating $0, leaving an annual deficit of $43,000.

8.8 Recommendations – Land Improvements

- Age-based data shows that the nearly half of the municipality's land improvement assets are in poor to very poor condition. The municipality should establish a condition assessment program, particularly for the park assets, as observed data will provide a more accurate estimate of asset condition and will develop the prioritization of the short and long term budgets. See Section 2, 'Condition Assessment Programs' in the 'Asset Management Strategies' chapter.

- Given the relatively minor valuation of the land improvements portfolio, rudimentary levels of service (LOS) and KPIs may be established. The performance of the municipality's land improvement assets should be assessed over time against target LOS and KPIs.

- Once the above initiatives are complete or underway, an updated "current state of the infrastructure" analysis should be generated

9 Vehicles

9.1 Asset Portfolio: Quantity, Useful Life and Replacement Cost

Table 15 illustrates key asset attributes for the municipality's vehicles assets, including quantities of various assets, their useful life, replacement costs, and the valuation method by which the replacement costs were derived. In total, the municipality's vehicles assets are valued at $1.7 million based on 2016 replacement costs. The useful life indicated for the asset types below was assigned by the municipality and obtained from the municipality's accounting data as maintained in the CityWide® Tangible Asset module.

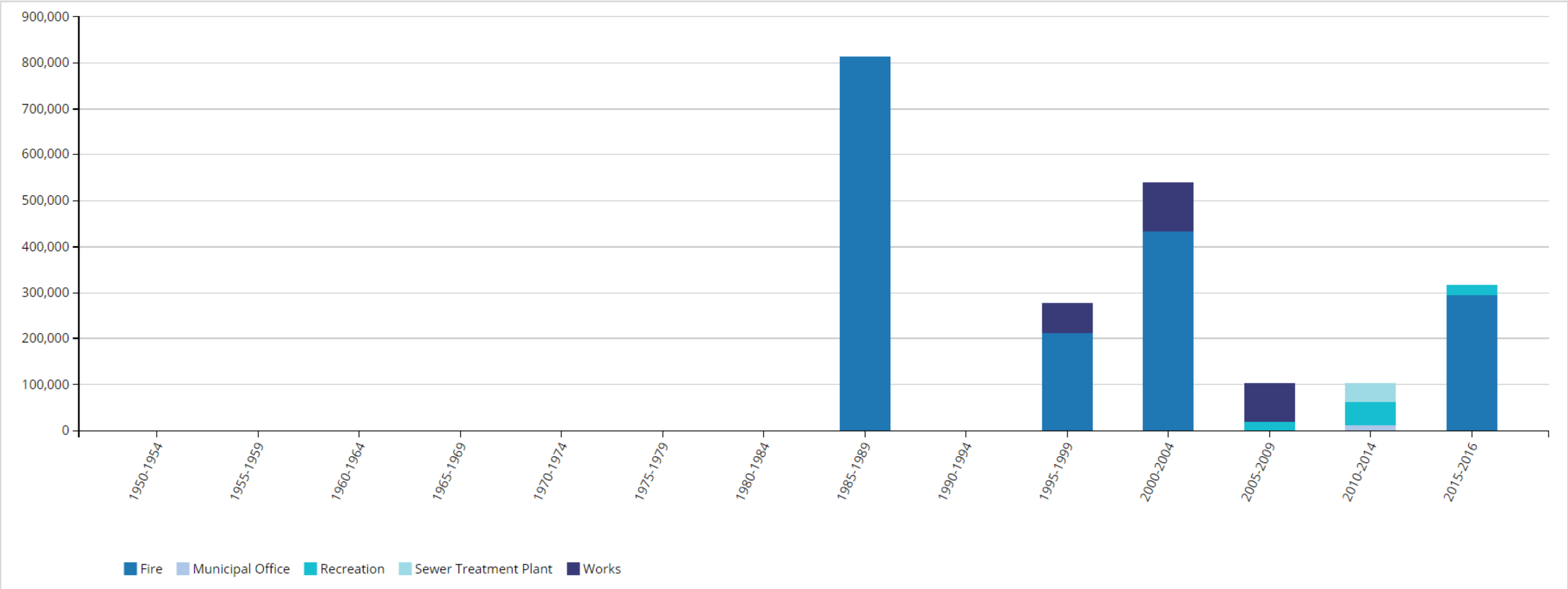
TABLE 15 KEY ASSET ATTRIBUTES - VEHICLES

Asset Type	Asset Component	Quantity	Useful Life in Years	Valuation Method	2016 Overall Replacement Cost
Vehicles	Fire	4	30	CPI	$1,368,100
	Municipal Office	1	10	CPI	$11,532
	Recreation	4	10, 15	CPI	$57,558
	Sewer Treatment Plant	1	10	CPI	$39,807
	Works	7	10	CPI	$257,926
				Total	$1,734,923

9.4 Historical Investment in Infrastructure

In this section, we provide the installation profile and useful life consumption levels using in-service data obtained from CityWide® Tangible Assets. Together, these graphs can illustrate infrastructure investment trends and upcoming needs at the municipality. The chart below illustrates the historical levels of investment in the municipality's vehicles.

FIGURE 41 HISTORICAL INVESTMENT – VEHICLES

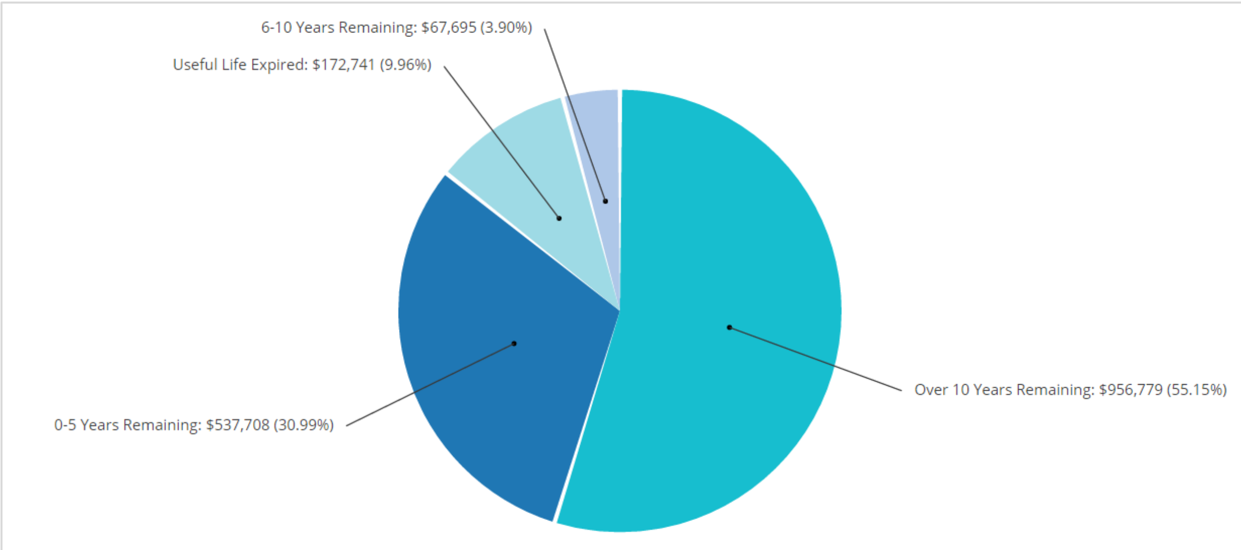


Brockton began investing into its vehicular assets in the late 1980s with an $800,000 investment into fire vehicles. Since then, investment has fluctuated, with fire vehicles still comprising the overwhelming majority of the total investment.

9.5 Useful Life Consumption

In this section, we detail the extent to which assets have consumed their useful life based on the above, established useful life standards. In conjunction with asset condition data, understanding the consumption rate of assets based on industry established useful life measures provides a more complete profile of the state of a community's infrastructure. The figure below illustrates the useful life consumption levels for the municipality's vehicles assets.

FIGURE 42 USEFUL LIFE CONSUMPTION – VEHICLES

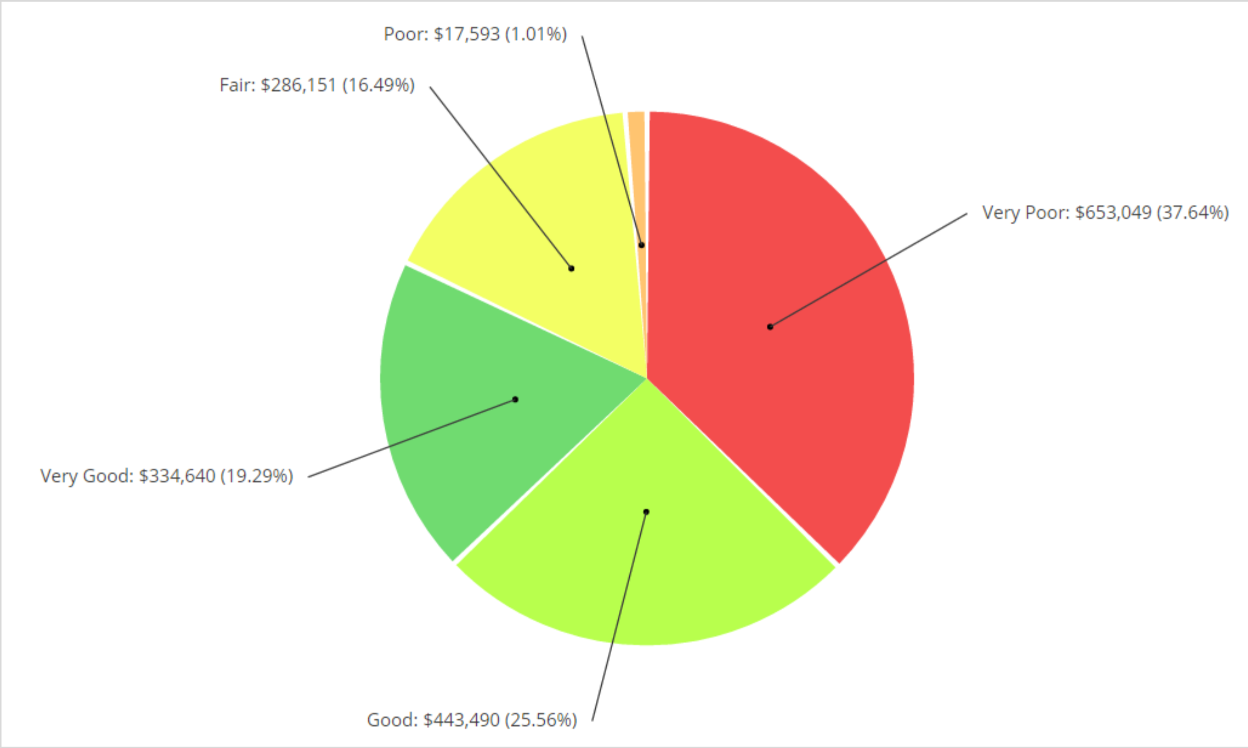


While 55% of the municipality's vehicles have at least 10 years of useful life remaining, nearly 10%, valued at nearly $175,000, remain in service beyond their useful life. Further, another 30% of assets will reach the end of their useful life within the next 5 years.

9.6 Current Asset Condition

Using replacement cost, in this section, we summarize the condition of the municipality's vehicles assets. In the absence of such information, age-based data is used as a proxy.

FIGURE 43 ASSET CONDITION – VEHICLES (AGE-BASED)

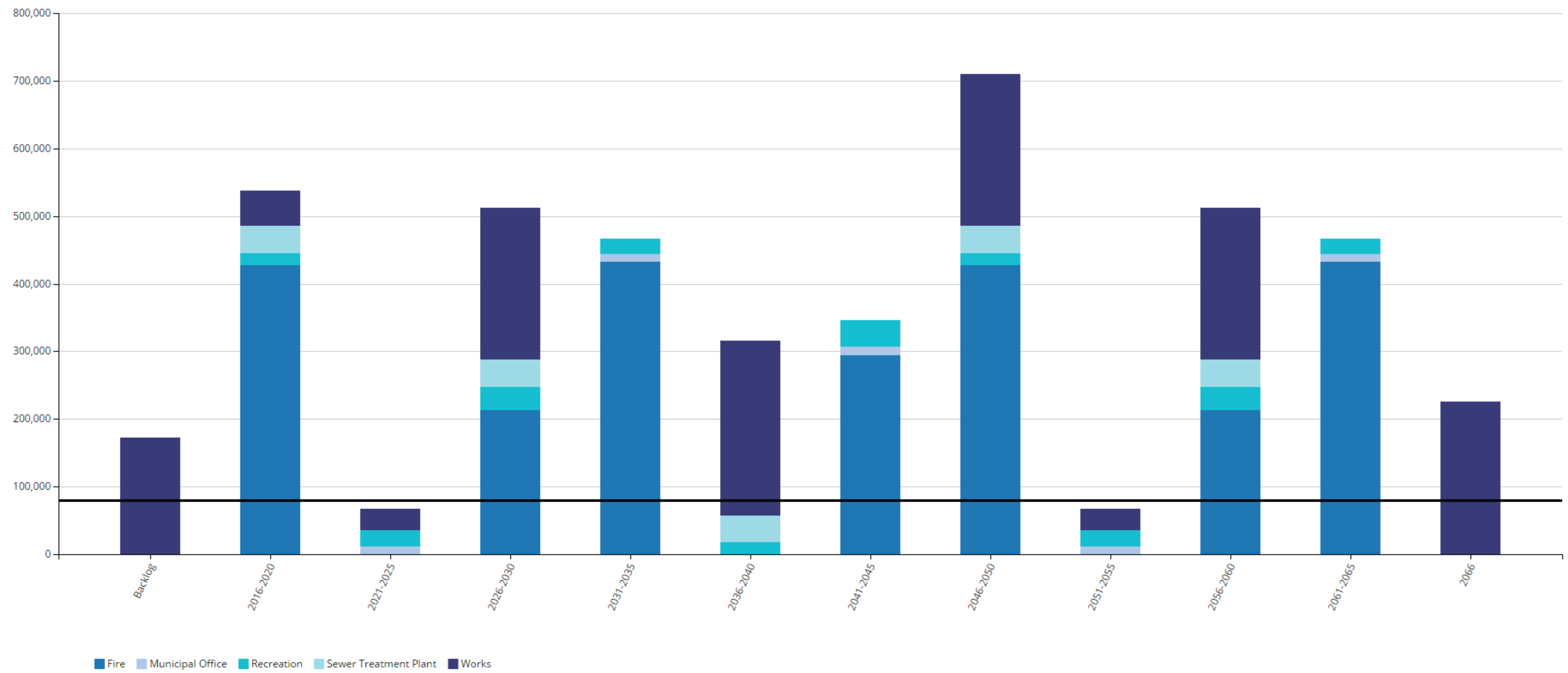


While 45% of the assets are in good to very good condition, nearly 39%, valued at more than $670,000, are in poor to very poor condition. This is based on age-based condition data.

9.7 Forecasting Replacement Needs

In this section, we illustrate the short-, medium- and long-term infrastructure spending requirements (replacement only) for the municipality's vehicles assets. The backlog is the aggregate investment in infrastructure that was deferred over previous years or decades. In the absence of observed data, the backlog represents the value of assets that remain in operation beyond their useful life.

FIGURE 44 FORECASTING REPLACEMENT NEEDS - VEHICLES



In addition to a backlog of $172,000, replacement needs within the next 5 years will reach nearly $550,000. The municipality's annual requirements for its vehicles total $81,000. At this level, funding is sustainable and replacement needs can be met as they arise without the need for deferring projects, however this will not address the backlog. The municipality is allocating $12,000, leaving an annual deficit of $69,000.

9.8 Recommendations – Vehicles

- All of the municipalities vehicles are assessed using condition data. Many such assets have direct impact on critical service delivery, e.g., fire trucks and dump trucks. A preventative maintenance and life cycle assessment program should be established for the fleet class to gain a better understanding of current condition and performance. See Section 2, 'Condition Assessment Programs' in the 'Asset Management Strategies' chapter.

- Age-based data indicates an infrastructure backlog of $172,000. Comprehensive condition assessment data, once gathered, should be used to provide better estimate of this pent-up demand, and to guide the prioritization of capital projects required to eliminate the backlog.

- The municipality should assess its short-, medium- and long-term operations and maintenance needs. An appropriate percentage of the replacement costs should then be allocated for the municipality's O&M requirements.

- Vehicle key performance indicators should be established and tracked annually as part of an overall level of service model. See Section 7 "Levels of Service".

- Once the above initiatives are complete or underway, an updated "current state of the infrastructure" analysis should be generated

VII. Levels of Service

The two primary risks to a municipality's financial sustainability are the total lifecycle costs of infrastructure, and establishing levels of service (LOS) that exceed its financial capacity. In this regard, municipalities face a choice: overpromise and underdeliver; under promise and overdeliver; or promise only that which can be delivered efficiently without placing inequitable burden on taxpayers. In general, there is often a trade-off between political expedience and judicious, long-term fiscal stewardship.

Developing realistic LOS using meaningful key performance indicators (KPIs) can be instrumental in managing citizen expectations, identifying areas requiring higher investments, driving organizational performance and securing the highest value for money from public assets. However, municipalities face diminishing returns with greater granularity in their LOS and KPI framework. That is, the objective should be to track only those KPIs that are relevant and insightful and reflect the priorities of the municipality.

1 Guiding Principles for Developing LOS

Beyond meeting regulatory requirements, levels of service established should support the intended purpose of the asset and its anticipated impact on the community and the municipality. LOS generally have an overarching corporate description, a customer oriented description, and a technical measurement. Many types of LOS, e.g., availability, reliability, safety, responsiveness and cost effectiveness, are applicable across all service areas in a municipality. The following levels of service categories are established as guiding principles for the LOS that each service area in The municipality should strive to provide internally to the municipality and to residents/customers. These are derived from the Town of Whitby's *Guide to Developing Service Area Asset Management Plans*.

- **Available**: Services of sufficient capacity are convenient and accessible to the entire community
- **Cost Effective**: Services are provided at the lowest possible cost for both current and future customers, for a required level of service, and are affordable
- **Reliable**: Services are predictable and continuous
- **Responsive**: Opportunities for community involvement in decision making are provided; and customers are treated fairly and consistently, within acceptable timeframes, demonstrating respect, empathy and integrity
- **Safe**: Services are delivered such that they minimize health, safety and security risks
- **Suitable**: Services are suitable for the intended function (fit for purpose)
- **Sustainable**: Services preserve and protect the natural and heritage environment.

While the above categories provide broad strategic direction to council and staff, specific and measurable KPIs related to each LOS category are needed to ensure the municipality remains steadfast in its pursuit of delivering the highest value for money to various internal and external stakeholders.

2 Key Performance Indicators and Targets

In this section, we identify industry standard KPIs for major infrastructure classes that the municipality can incorporate into its performance measurement and for tracking its progress over future iterations of its AMPs. The municipality should develop appropriate and achievable targets that reflect evolving demand on infrastructure, its fiscal capacity and the overall corporate objectives.

TABLE 16 KEY PERFORMANCE INDICATORS - ROAD NETWORK AND BRIDGES & CULVERTS

Level	KPI (Reported Annually)
Strategic	• Percentage of total reinvestment compared to asset replacement value • Completion of strategic plan objectives (related to right-of-way)
Financial Indicators	• Annual revenues compared to annual expenditures • Annual replacement value depreciation compared to annual expenditures • Cost per capita for roads, and bridges & culverts • Maintenance cost per square metre • Revenue required to maintain annual network growth • Total cost of borrowing vs. total cost of service
Tactical	• Overall Bridge Condition Index (BCI) as a percentage of desired BCI • Percentage of road network rehabilitated/reconstructed • Percentage of paved road lane km rated as poor to very poor • Percentage of bridges and large culverts rated as poor to very poor • Percentage of asset class value spent on O&M • Percentage of signage that pass reflectivity test. The remaining should be replaced
Operational Indicators	• Percentage of roads inspected within the last five years • Percentage of bridges and large culverts inspected within the last two years • Operating costs for paved lane per km • Operating costs for bridge and large culverts per square metre • Percentage of customer requests with a 24-hour response rate

TABLE 17 KEY PERFORMANCE INDICATORS - BUILDINGS & FACILITIES

Level	KPI (Reported Annually)
Strategic	• Percentage of total reinvestment compared to asset replacement value • Completion of strategic plan objectives (related buildings and facilities)
Financial Indicators	• Annual revenues compared to annual expenditures • Annual replacement value depreciation compared to annual expenditures • Revenue required to meet growth related demand • Repair and maintenance costs per square metre • Energy, utility and water cost per square metre
Tactical	• Percentage of component value replaced • Overall facility condition index as a percentage of desired condition index • Annual adjustment in condition indexes • Annual percentage of new facilities (square metre) • Percent of facilities rated poor or critical • Percentage of facilities replacement value spent on operations and maintenance Increase facility utilization rate by [x] percent by 2020. • $Utilization\ Rate = \frac{Occupied\ Space}{Facility\ Usable\ Area}$
Operational Indicators	• [x] sq.ft. of facilities per full-time employee (or equivalent), i.e., maintenance staff • Percentage of facilities inspected within the last five years • Number/type of service requests • Percentage of customer requests responded to within 24 hours

TABLE 18 KEY PERFORMANCE INDICATORS – FLEET AND VEHICLES

Level	KPI (Reported Annually)
Strategic	• Percentage of total reinvestment compared to asset replacement value • Completion of strategic plan objectives
Financial Indicators	• Annual revenues compared to annual expenditures • Annual replacement value depreciation compared to annual expenditures • Cost per capita for roads, and bridges & culverts • Maintenance cost per square metre • Revenue required to maintain annual network growth • Total cost of borrowing vs. total cost of service
Tactical	• Percentage of all vehicles replaced • Average age of fleet vehicles • Percent of vehicles rated poor or critical • Percentage of fleet replacement value spent on operations and maintenance
Operational Indicators	• Average downtime per fleet category • Average utilization per fleet category and/or each vehicle • Ratio of preventative maintenance repairs vs. reactive repairs • Percent of vehicles that received preventative maintenance • Number/type of service requests • Percentage of customer requests responded to within 24 hours

TABLE 19 KEY PERFORMANCE INDICATORS – WATER, WASTEWATER AND STORM NETWORKS

Level	KPI (Reported Annually)
Strategic	• Percentage of total reinvestment compared to asset replacement value • Completion of strategic plan objectives (related water / wastewater / storm)
Financial Indicators	• Annual revenues compared to annual expenditures • Annual replacement value depreciation compared to annual expenditures • Total cost of borrowing compared to total cost of service • Revenue required to maintain annual network growth • Lost revenue from system outages
Tactical	• Percentage of water / wastewater / storm network rehabilitated / reconstructed • Overall water / wastewater / storm network condition index as a percentage of desired condition index • Annual adjustment in condition indexes • Annual percentage of growth in water / wastewater / storm network • Percentage of mains where the condition is rated poor or critical for each network • Percentage of water / wastewater / storm network replacement value spent on operations and maintenance
Operational Indicators	• Percentage of water / wastewater / storm network inspected • Operating costs for the collection of wastewater per kilometre of main. • Number of wastewater main backups per 100 kilometres of main • Operating costs for storm water management (collection, treatment, and disposal) per kilometre of drainage system. • Operating costs for the distribution/ transmission of drinking water per kilometre of water distribution pipe. • Number of days when a boil water advisory issued by the medical officer of health, applicable to a municipal water supply, was in effect. • Number of water main breaks per 100 kilometres of water distribution pipe in a year. • Number of customer requests received annually per water / wastewater / storm networks • Percentage of customer requests responded to within 24 hours per water / wastewater / storm network

3 Future Performance

In addition to the financial capacity, and legislative requirements, e.g., *Safe Drinking Water Act*, the Minimum Maintenance Standards for municipal highways, building codes and the *Accessibility for Ontarians with Disability Act*, many factors, internal and external, can influence the establishment of LOS and their associated KPIs, both target and actual, including the municipality's overarching mission as an organization, the current state of its infrastructure, and the municipality's financial capacity.

Strategic Objectives and Corporate Goals
The municipality's long-term direction is outlined in its corporate and strategic plans. This direction will dictate the types of services it aims to deliver to its residents and the quality of those services. These high level goals are vital in identifying strategic (long-term) infrastructure priorities and as a result, the investments needed to produce desired levels of service.

State of the Infrastructure
The current state of capital assets will determine the quality of service the municipality can deliver to its residents. As such, levels of service should reflect the existing capacity of assets to deliver those services, and may vary (increase) with planned maintenance, rehabilitation or replacement activities and timelines.

Community Expectations
The general public will often have qualitative and quantitative opinions and insights regarding the levels of service a particular asset should deliver, e.g., what a road in 'good' condition should look like or the travel time between destinations. The public should be consulted in establishing LOS; however, the discussions should be centered on clearly outlining the lifecycle costs associated with delivering any improvements in LOS.

Economic Trends
Macroeconomic trends will have a direct impact on the LOS for most infrastructure services. Fuel costs, fluctuations in interest rates, and the purchasing power of the Canadian dollar can impede or facilitate any planned growth in infrastructure services.

Demographic Changes
The type of residents that dominate a municipality can also serve as infrastructure demand drivers, and as a result, can change how a municipality allocates its resources (e.g., an aging population may require diversion of resources from parks and sports facilities to additional wellbeing centers). Population growth is also a significant demand driver for existing assets (lowering LOS), and may require the municipality to construct new infrastructure to parallel community expectations.

Environmental Change
Forecasting for infrastructure needs based on climate change remains an imprecise science. However, broader environmental and weather patterns have a direct impact on the reliability of critical infrastructure services.

4 Monitoring, Updating and Actions

The municipality should collect data on its current performance against the KPIs listed and establish targets that reflect the current fiscal capacity of the municipality, its corporate and strategic goals, and as feasible, changes in demographics that may place additional demand on its various asset classes. For some asset classes, e.g., minor equipment, furniture, etc., cursory levels of service and their respective KPIs will suffice. For major infrastructure classes, detailed technical and customer-oriented KPIs can be critical. Once this data is collected and targets are established, the progress of the municipality should be tracked annually.

VIII. Asset Management Strategies

The asset management strategy will develop an implementation process that can be applied to the needs identification and prioritization of renewal, rehabilitation, and maintenance activities. This will assist in the production of a 10-year plan, including growth projections, to ensure the best overall health and performance of the municipality's infrastructure.

This section includes an overview of condition assessment; the life cycle interventions required; and prioritization techniques, including risk, to determine which priority projects should move forward into the budget first.

1 Non-Infrastructure Solutions and Requirements

The municipality should explore, as requested through the provincial requirements, which non-infrastructure solutions should be incorporated into the budgets for its infrastructure services. Non-Infrastructure solutions are such items as studies, policies, condition assessments, consultation exercises, etc., that could potentially extend the life of assets or lower total asset program costs in the future without a direct investment into the infrastructure.

Typical solutions for a municipality include linking the asset management plan to the strategic plan, growth and demand management studies, infrastructure master plans, better integrated infrastructure and land use planning, public consultation on levels of service, and condition assessment programs. As part of future asset management plans, a review of these requirements should take place, and a portion of the capital budget should be dedicated for these items in each programs budget.

It is recommended, under this category of solutions, that the municipality should develop and implement holistic condition assessment programs for all asset classes. This will advance the understanding of infrastructure needs, improve budget prioritization methodologies, and provide clearer path of what is required to achieve sustainable infrastructure programs.

2 Condition Assessment Programs

The foundation of good asset management practice is based on having comprehensive and reliable information on the current condition of the infrastructure. Municipalities need to have a clear understanding regarding performance and condition of their assets, as all management decisions regarding future expenditures and field activities should be based on this knowledge. An incomplete understanding about an asset may lead to its premature failure or premature replacement.

Some benefits of holistic condition assessment programs within the overall asset management process are listed below:

- Understanding of overall network condition leads to better management practices
- Allows for the establishment of rehabilitation programs
- Prevents future failures and provides liability protection
- Potential reduction in operation/maintenance costs
- Accurate current asset valuation
- Allows for the establishment of risk assessment programs
- Establishes proactive repair schedules and preventive maintenance programs
- Avoids unnecessary expenditures
- Extends asset service life therefore improving level of service

- Improves financial transparency and accountability
- Enables accurate asset reporting which, in turn, enables better decision making

Condition assessment can involve different forms of analysis such as subjective opinion, mathematical models, or variations thereof, and can be completed through a very detailed or very cursory approach.

When establishing the condition assessment of an entire asset class, the cursory approach (metrics such as good, fair, poor, very poor) is used. This will be a less expensive approach when applied to thousands of assets, yet will still provide up to date information, and will allow for detailed assessment or follow up inspections on those assets captured as poor or critical condition later.

2.1 Pavement Network

Typical industry pavement inspections are performed by consulting firms using specialized assessment vehicles equipped with various electronic sensors and data capture equipment. The vehicles will drive the entire road network and typically collect two different types of inspection data – surface distress data and roughness data.

Surface distress data involves the collection of multiple industry standard surface distresses, which are captured either electronically, using sensing detection equipment mounted on the van, or visually, by the van's inspection crew.

Roughness data capture involves the measurement of the roughness of the road, measured by lasers that are mounted on the inspection van's bumper, calibrated to an international roughness index.

Another option for a cursory level of condition assessment is for municipal road crews to perform simple windshield surveys as part of their regular patrol. Many municipalities have created data collection inspection forms to assist this process and to standardize what presence of defects would constitute a good, fair, poor, or critical score. Lacking any other data for the complete road network, this can still be seen as a good method and will assist greatly with the overall management of the road network. The CityWide Works software has a road patrol component built in that could capture this type of inspection data during road patrols in the field, enabling later analysis of rehabilitation and replacement needs for budget development.

It is recommended that the Municipality of Brockton implement a pavement condition assessment program and that a portion of capital funding is dedicated to this. This will provide a more accurate picture of the current state of the roads network.

2.2 Bridges & Culverts

Ontario municipalities are mandated by the Ministry of Transportation to inspect all structures that have a span of 3 meters or more, per the OSIM (Ontario Structure Inspection Manual).

Structure inspections must be performed by, or under the guidance of, a structural engineer, must be performed on a biennial basis (once every two years), and include such information as structure type, number of spans, span lengths, other key attribute data, detailed photo images, and structure element by element inspection, rating and recommendations for repair, rehabilitation, and replacement.

The best approach to develop a 10-year needs list for the municipality's structure portfolio would be to have the structural engineer who performs the inspections to develop a maintenance requirements report, and rehabilitation and replacement requirements report as part of the overall assignment. In addition to refining the overall needs requirements, the structural engineer should identify those structures that will require more detailed investigations and non-destructive testing techniques. Examples of these investigations are:

- Detailed deck condition survey
- Non-destructive delamination survey of asphalt covered decks
- Substructure condition survey

- Detailed coating condition survey
- Underwater investigation
- Fatigue investigation
- Structure evaluation

It is recommended that through the results of the OSIM inspections and additional detailed investigations, a 10-year needs list should be developed for the municipality's bridge and culvert structures. In addition, condition assessment protocols should be developed that include all bridge assets.

2.3 Facilities & Buildings

The most popular and practical type of buildings and facility assessment involves qualified groups of trained industry professionals (engineers or architects) performing an analysis of the condition of a group of facilities, and their components, that may vary in terms of age, design, construction methods, and materials. This analysis can be done by walk-through inspection, mathematical modeling, or a combination of both. But the most accurate way of determining the condition requires a walk-through to collect baseline data.

The following five asset classifications are typically inspected:

- Site Components – property around the facility and includes the outdoor components such as utilities, signs, stairways, walkways, parking lots, fencing, courtyards and landscaping.
- Structural Components – physical components such as the foundations, walls, doors, windows, roofs.
- Electrical Components – all components that use or conduct electricity such as wiring, lighting, electric heaters, and fire alarm systems
- Mechanical Components – components that convey and utilize all non-electrical utilities within a facility such as gas pipes, furnaces, boilers, plumbing, ventilation, and fire extinguishing systems
- Vertical movement – components used for moving people between floors of buildings such as elevators, escalators and stair lifts.

Once collected this type of information can be uploaded into the CityWide®, the municipality's asset management and asset registry software database for short- and long-term repair, rehabilitation and replacement reports to be generated to assist with programming the short- and long-term maintenance and capital budgets.

It is recommended that the municipality establish a facilities condition assessment program and that a portion of capital funding is dedicated to this.

2.4 Fleet

The typical approach to optimizing the maintenance expenditures of a corporate fleet of vehicles is through routine vehicle inspections, routine vehicle servicing, and an established routine preventative maintenance program. Most, if not all, makes and models of vehicles are supplied with maintenance manuals that define the appropriate schedules and routines for typical maintenance and servicing and also more detailed restoration or rehabilitation protocols.

The primary goal of good vehicle maintenance is to avoid or mitigate the consequence of failure of equipment or parts. An established preventative maintenance program serves to ensure this, as it will consist of scheduled inspections and follow up repairs of vehicles and equipment in order to decrease breakdowns and excessive downtimes.

A good preventative maintenance program will include partial or complete overhauls of equipment at specific periods, including oil changes, lubrications, fluid changes and so on. In addition, workers can record equipment or part deterioration so they can schedule to replace or repair worn parts before they fail. The ideal preventative maintenance program would move further and further away from reactive repairs and instead towards the prevention of all equipment failure before it occurs.

The Municipality of Brockton currently relies on age to gauge the condition of its fleet. It is recommended that an initial condition assessment as well as preventative maintenance routine is defined and established for all fleet vehicles and that a software application is utilized for the overall management of the program.

2.5 Water

Unlike sewer mains, it is very difficult to inspect water mains from the inside due to the high pressure flow of water constantly underway within the water network. Physical inspections require a disruption of service to residents, can be an expensive exercise, and are time consuming to set up. It is recommended practice that physical inspection of water mains typically only occurs for high risk, large transmission mains within the system, and only when there is a requirement. There are a number of high tech inspection techniques in the industry for large diameter pipes but these should be researched first for applicability as they are quite expensive. Examples are:

- Remote eddy field current (RFEC)
- Ultrasonic and acoustic techniques
- Impact echo (IE)
- Georadar

For the majority of pipes within the distribution network gathering key information in regards to the main and its environment can supply the best method to determine a general condition. Key data that could be used, along with weighting factors, to determine an overall condition score are listed below.

- Age
- Material Type
- Breaks
- Hydrant Flow Inspections
- Soil Condition

It is recommended that the municipality develop a rating system for the mains within the distribution network based on the availability of key data, and that funds are budgeted for this development.

2.6 Sewer network inspection (Wastewater and Storm)

The most popular and practical type of wastewater and storm sewer assessment is the use of Closed Circuit Television Video (CCTV). The process involves a small robotic crawler vehicle with a CCTV camera attached that is lowered down a maintenance hole into the sewer main to be inspected. The vehicle and camera then travels the length of the pipe providing a live video feed to a truck on the road above where a technician / inspector records defects and information regarding the pipe. A wide range of construction or deterioration problems can be captured including open/displaced joints, presence of roots, infiltration & inflow, cracking, fracturing, exfiltration, collapse, deformation of pipe and more. Therefore, sewer CCTV inspection is a very good tool for locating and evaluating structural defects and general condition of underground pipes.

Even though CCTV is an excellent option for inspection of sewers it is a fairly costly process and does take significant time to inspect a large volume of pipes.

Another option in the industry today is the use of Zoom Camera equipment. This is very similar to traditional CCTV, however, a crawler vehicle is not used but in it's a place a camera is lowered down a maintenance hole attached to a pole like piece of equipment. The camera is then rotated towards each connecting pipe and the operator above progressively zooms in to record all defects and information about each pipe. The downside to this technique is the further down the pipe the image is zoomed, the less clarity is available to accurately record defects and measurement. The upside is the process is far quicker and significantly less expensive and an assessment of the manhole can be provided as well. Also, it is important to note that 80% of pipe deficiencies generally occur within 20 metres of each manhole

It is recommended that the municipality establish a sewer condition assessment program, capturing the data and overall pipe condition scores within a database, for its sanitary and storm sewers, and that a portion of capital funding is dedicated to this.

2.7 Parks and open spaces

The park inspection will involve qualified groups of trained industry professionals (operational staff or landscape architects) performing an analysis of the condition of a group of Parks and their components. The most accurate way of determining the condition requires a walk-through to collect baseline data.

The following key asset classifications are typically inspected:

- **Physical Site Components –** physical components on the site of the park such as: fences, utilities, stairways, walkways, parking lots, irrigation systems, monuments, fountains.
- **Recreation Components –** physical components such as: playgrounds, bleachers, back stops, splash pads, and benches.
- **Land Site Components** – land components on the site of the park such as: landscaping, sports fields, trails, natural areas, and associated drainage systems.
- **Minor Park Facilities –** small facilities within the park site such as: sun shelters, washrooms, concession stands, change rooms, storage sheds.

It is recommended that the municipality establish a parks condition assessment program and that a portion of capital funding is dedicated to this.

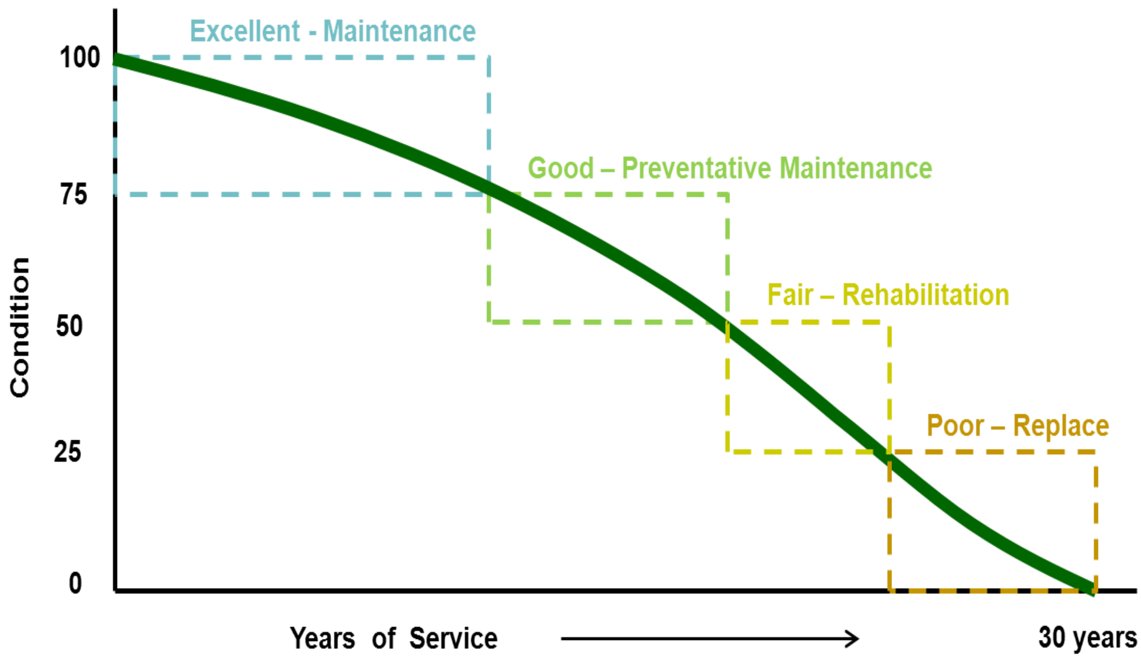
3 Life Cycle Analysis Framework

An industry review was conducted to determine which life cycle activities can be applied at the appropriate time in an asset's life, to provide the greatest additional life at the lowest cost. In the asset management industry, this is simply put as doing the right thing to the right asset at the right time. If these techniques are applied across entire asset networks or portfolios (e.g., the entire road network), the municipality could gain the best overall asset condition while expending the lowest total cost for those programs.

3.1 Paved Roads

The following analysis has been conducted at a fairly high level, using industry standard activities and costs for paved roads. With future updates of this Asset Management Strategy, the municipality may wish to run the same analysis with a detailed review of municipality activities used for roads and the associated local costs for those work activities. All of this information can be input into the CityWide software suite in order to perform updated financial analysis as more detailed information becomes available. The following diagram depicts a general deterioration profile of a road with a 30-year life.

FIGURE 45 PAVED ROAD GENERAL DETERIORATION PROFILE



As shown above, during the road's life cycle there are various windows available for work activity that will maintain or extend the life of the asset. These windows are: maintenance; preventative maintenance; rehabilitation; and replacement or reconstruction.

The windows or thresholds for when certain work activities should be applied to also coincide approximately with the condition state of the asset as shown below:

TABLE 20 ASSET CONDITION AND RELATED WORK ACTIVITY - PAVED ROADS

Condition	Condition Range	Work Activity
Excellent condition (Maintenance only phase)	100-76	■ maintenance only
Good Condition (Preventative maintenance phase)	75 - 51	■ crack sealing ■ emulsions
Fair Condition (Rehabilitation phase)	50 -26	■ resurface - mill & pave ■ resurface - asphalt overlay ■ single & double surface treatment (for rural roads)
Poor Condition (Reconstruction phase)	25 - 1	■ reconstruct - pulverize and pave ■ reconstruct - full surface and base reconstruction
Critical Condition (Reconstruction phase)	0	■ critical includes assets beyond their useful lives which make up the backlog. they require the same interventions as the “poor” category above.

With future updates of this asset management strategy, the municipality may wish to review the above condition ranges and thresholds for when certain types of work activity occur, and adjust to better suit the municipality’s work program. Also note: when adjusting these thresholds, it actually adjusts the level of service provided and ultimately changes the amount of money required. These threshold and condition ranges can be easily updated and a revised financial analysis can be calculated. These adjustments will be an important component of future Asset Management Plans, as the province requires each municipality to present various management options within the financing plan.

It is recommended that the municipality establish a life cycle activity framework for the various classes of paved road within their transportation network.

3.2 Bridges & Culverts

The best approach to develop a 10 year needs list for the municipality’s bridge structure portfolio would be to have the structural engineer who performs the inspections to develop a maintenance requirements report, a rehabilitation and replacement requirements report and identify additional detailed inspections as required.

3.3 Facilities & Buildings

The best approach to develop a 10-year needs list for the municipality’s facilities portfolio would be to have the engineers, operational staff or architects who perform the facility inspections to also develop a complete portfolio maintenance requirements report and rehabilitation and replacement requirements report, and also identify additional detailed inspections and follow up studies as required. This may be performed as a separate assignment once all individual facility audits/inspections are complete. Of course, if the inspection data is housed or uploaded into the CityWide software, then these reports can be produced automatically from the system.

The above reports could be considered the beginning of a 10-year maintenance and capital plan, however, within the facilities industry there are other key factors that should be considered to determine over all priorities and future expenditures. Some examples would be functional / legislative requirements, energy conservation programs and upgrades, customer complaints and health and safety concerns, and also customer expectations balanced with willingness to pay initiatives.

It is recommended that the municipality establish a prioritization framework for the facilities asset class that incorporates the key components outlined above.

3.4 Fleet and Vehicles

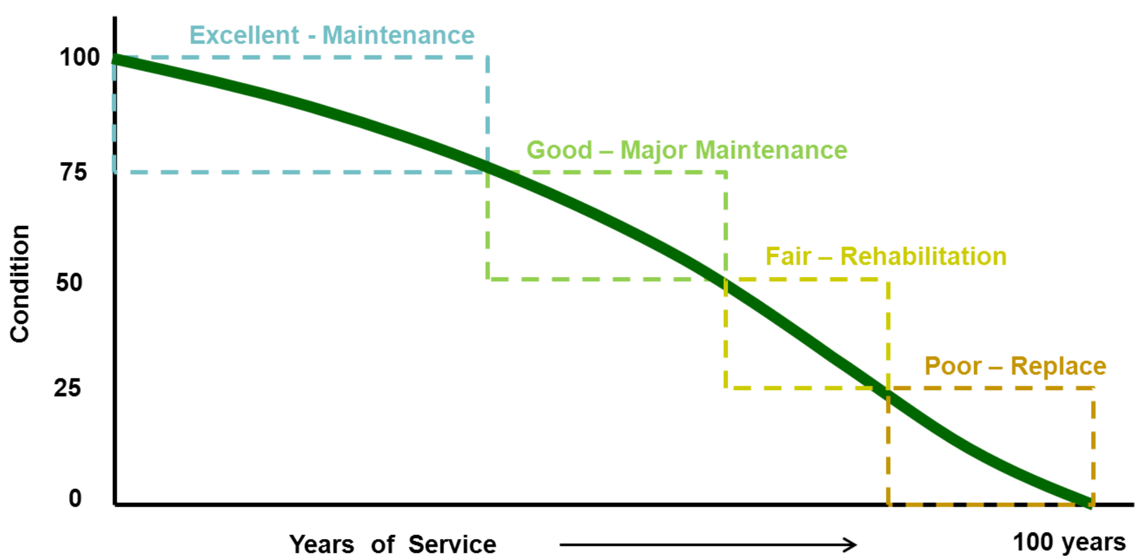
The best approach to develop a 10-year needs list for the municipality's fleet and vehicle portfolio would first be through a defined preventative maintenance program, and secondly, through an optimized life cycle vehicle replacement schedule. The preventative maintenance program would serve to determine budget requirements for operating and minor capital expenditures for part renewal and major refurbishments and rehabilitations. An optimized vehicle replacement program will ensure a vehicle is replaced at the correct point in time in order to minimize overall cost of ownership, minimize costly repairs and downtime, while maximizing potential re-sale value. There is significant benchmarking information available within the fleet industry in regards to vehicle life cycles which can be used to assist in this process. Once appropriate replacement schedules are established the short and long term budgets can be funded accordingly.

There are, of course, functional aspects of fleet management that should also be examined in further detail as part of the long-term management plan, such as fleet utilization and incorporating green fleet, etc. It is recommended that the municipality establish a prioritization framework for the fleet asset class that incorporates the key components outlined above.

3.5 Wastewater and storm sewers

The following analysis has been conducted at a fairly high level, using industry standard activities and costs for wastewater and storm sewer rehabilitation and replacement. With future updates of this asset management strategy, the municipality may wish to run the same analysis with a detailed review of municipality activities used for sewer mains and the associated local costs for those work activities. All of this information can be input into the CityWide software suite in order to perform updated financial analysis as more detailed information becomes available. The following diagram depicts a general deterioration profile of a sewer main with a 100 year life.

FIGURE 46 SEWER MAIN GENERAL DETERIORATION



As shown above, during the sewer main's life cycle there are various windows available for work activity that will maintain or extend the life of the asset. These windows are: maintenance; major maintenance; rehabilitation; and replacement or reconstruction.

The windows or thresholds for when certain work activities should be applied also coincide approximately with the condition state of the asset as shown below:

TABLE 21 ASSET CONDITION AND RELATED WORK ACTIVITY - SEWER MAINS

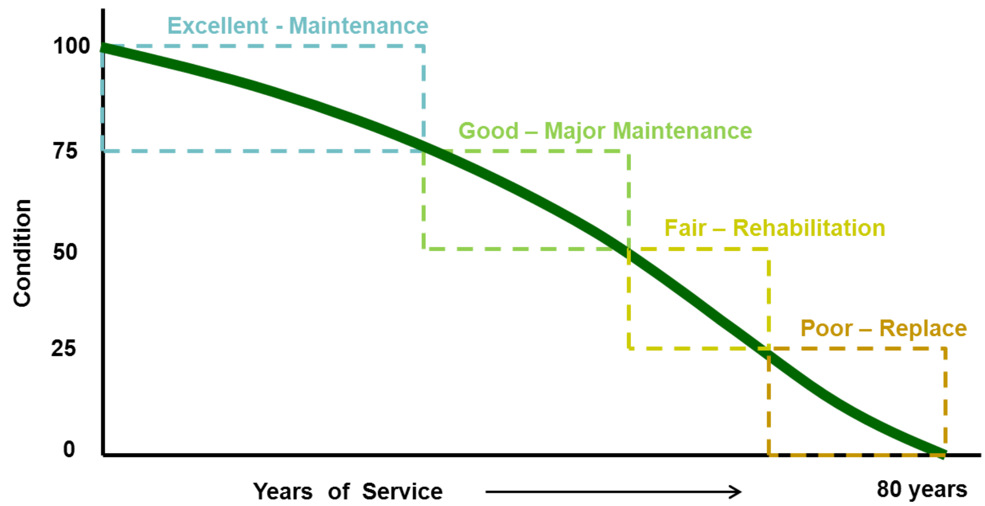
Condition	Condition Range	Work Activity
Excellent condition (Maintenance only phase)	100-76	■ maintenance only (cleaning & flushing etc.)
Good Condition (Preventative maintenance phase)	75 - 51	■ mahhole repairs ■ small pipe section repairs
Fair Condition (Rehabilitation phase)	50 -26	■ structural relining
Poor Condition (Reconstruction phase)	25 - 1	■ pipe replacement
Critical Condition (Reconstruction phase)	0	■ critical includes assets beyond their useful lives which make up the backlog. They require the same interventions as the "poor" category above.

With future updates of this Asset Management Strategy the municipality may wish to review the above condition ranges and thresholds for when certain types of work activity occur, and adjust to better suit the municipality's work program. Also note: when adjusting these thresholds, it actually adjusts the level of service provided and ultimately changes the amount of money required. These threshold and condition ranges can be easily updated with the CityWide software suite and an updated financial analysis can be calculated. These adjustments will be an important component of future Asset Management Plans, as the province requires each municipality to present various management options within the financing plan.

3.6 Water

As with roads and sewers above, the following analysis has been conducted at a fairly high level, using industry standard activities and costs for water main rehabilitation and replacement. The following diagram depicts a general deterioration profile of a water main with an 80 year life.

FIGURE 47 WATER MAIN GENERAL DETERIORATION



As shown above, during the water main's life cycle there are various windows available for work activity that will maintain or extend the life of the asset. These windows are: maintenance; major maintenance; rehabilitation; and replacement or reconstruction.

The windows or thresholds for when certain work activities should be applied also coincide approximately with the condition state of the asset as shown below:

TABLE 22 ASSET CONDITION AND RELATED WORK ACTIVITY - WATER MAINS

Condition	Condition Range	Work Activity
excellent condition (Maintenance only phase)	100-76	■ maintenance only (cleaning & flushing etc.)
good Condition (Preventative maintenance phase)	75 - 51	■ water main break repairs ■ small pipe section repairs
fair Condition (Rehabilitation phase)	50 -26	■ structural water main relining
poor Condition (Reconstruction phase)	25 - 1	■ pipe replacement
critical Condition (Reconstruction phase)	0	■ critical includes assets beyond their useful lives which make up the backlog. They require the same interventions as the "poor" category above.

4 Growth and Demand

Growth is a critical infrastructure demand driver for most infrastructure services. As such, the municipality must not only account for the lifecycle cost for its existing asset portfolio, but those of any anticipated and forecasted capital projects associated specifically with growth. According to the 2011 census, Brockton's population was 9,432, a decline of 2.2% from its 2006 population of 9,641.

Declining or stagnating populations present a catch-22, placing less demand on infrastructure services, but also reducing existing streams of revenues, which can compromise the capacity of the municipality to maintain existing LOS.

5 Project Prioritization and Risk Management

Generally, infrastructure needs exceed municipal capacity. As such, municipalities rely heavily on provincial and federal programs and grants to finance important capital projects. Fund scarcity means projects and investments must be carefully selected based on the state of infrastructure, economic development goals, and the needs of an evolving and growing community. These factors, along with social and environmental considerations will form the basis of a robust risk management framework.

5.1.1 Defining Risk Management

From an asset management perspective, risk is a function of the consequences of failure (e.g., the negative economic, financial, and social consequences of an asset in the event of a failure); and, the probability of failure (e.g., how likely is the asset to fail in the short- or long-term).

The consequences of failure are typically reflective of:

- An asset's **importance in an overall system**
  For example, the failure of an individual computer workstation for which there are readily available substitutes is much less consequential and detrimental than the failure of a network server or telephone exchange system.

- The **criticality of the function performed**
  For example, a mechanical failure on a piece road construction equipment may delay the progress of a project, but a mechanical failure on a fire pumper truck may lead to immediate life safety concerns for fire fighters, and the public, as well as significant property damage.

- The **exposure of the public and/or staff to injury or loss of life**
  For example, a single sidewalk asset may demand little consideration and carry minimum importance to the municipality's overall pedestrian network and performs a modest function. However, members of the public interact directly with the asset daily and are exposed to potential injury due to any trip hazards or other structural deficiencies that may exist.

The probability of failure is generally a function of an asset's physical condition, which is heavily influenced by the asset's age and the amount of investment that has been made in the maintenance and renewal of the asset throughout its life.

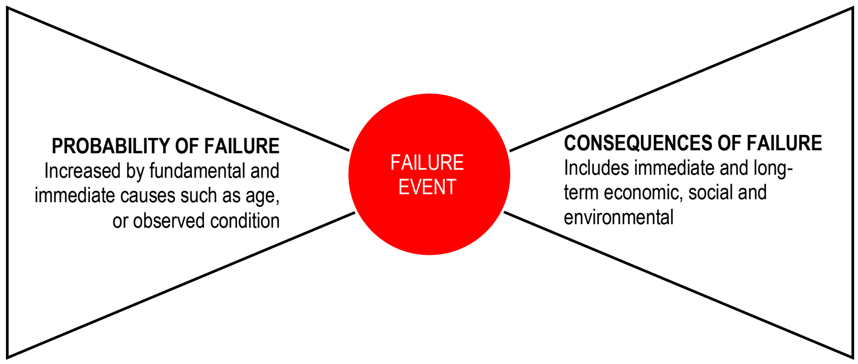
Risk mitigation is traditionally thought of in terms of safety and liability factors. In asset management, the definition of risk should heavily emphasize these factors but should be expanded to consider the risks to the municipality's ability to deliver targeted levels of service

- The impact that actions (or inaction) on one asset will have on other related assets
- The opportunities for economic efficiency (realized or lost) relative to the actions taken

5.1.2 Risk Matrices

Using the logic above, a risk matrix will illustrate each asset's overall risk, determined by multiplying the probability of failure (PoF) scores with the consequence of failure (CoF) score, as illustrated in the tables below. This can be completed as a holistic exercise against any data set by determining which factors (or attributes) are available and will contribute to the PoF or CoF of an asset. The following diagram (known as a bowtie model in the risk industry) illustrates this concept. The probability of failure is increased as more and more factors collude to cause asset failure.

FIGURE 48 BOW TIE RISK MODEL



The risk matrices that follow categorize the municipality's nine asset classes as analyzed in this document based on their consequence of failure and the likelihood of failure events.

Probability of Failure

In this AMP, the probability of a failure event is predicted by the condition of the asset.

TABLE 23 PROBABILITIY OF FAILURE – ALL ASSETS

Asset Classes	Condition Rating	Probability of Failure
ALL	0-20 Very Poor	5 – Very High
	21-40 Poor	4 – High
	41-60 Fair	3 – Moderate
	61-80 Good	2 – Low
	81-100 Excellent	1 – Very Low

Consequence of Failure

Bridges (based on valuation):
The consequence of failure score for this AMP is based upon the replacement value of the structure. The higher the value, probably the larger the structure and therefore probably the higher the consequential risk of failure:

TABLE 24 CONSEQUENCE OF FAILURE - BRIDGES

Replacement Value	Consequence of failure
$100k and less	Score of 1
$101 to $350k	Score of 2
$351 to $999k	Score of 3
$1 million to $1.49 million	Score of 4
$1.45 million and over	Score of 5

Roads (based on classification):
The consequence of failure score for this AMP is based upon the road classification as this will reflect traffic volumes and number of people affected. Currently Brockton does not capture road classification within their database, it is therefore recommended this is added in the future.

TABLE 25 CONSEQUENCE OF FAILURE - ROADS

Road Classification	Consequence of failure
Gravel	Score of 1
Surface Treatment (Rural)	Score of 3
Hard top / Hot Mix (Rural)	Score of 4
Hot Mix (Urban)	Score of 5

Sanitary Sewer (based on diameter):
We recommend the consequence of failure score for this AMP is based upon pipe diameter as this will reflect potential upstream service area affected.

TABLE 26 CONSEQUENCE OF FAILURE – SANITARY SEWERS

Pipe Diameter	Consequence of failure
150mm and less	Score of 1
151-250mm	Score of 2
251-350mm	Score of 3
351-450mm	Score of 4
451mm and over	Score of 5

Water (based on diameter):
The consequence of failure score for this AMP is based upon pipe diameter as this will reflect potential service area affected.

TABLE 27 CONSEQUENCE OF FAILURE – WATER MAINS

Pipe Diameter	***Consequence of Failure***
50mm and less	Score of 1
51–100mm	Score of 2
101–200mm	Score of 3
201–250mm	Score of 4
251mm and over	Score of 5

Storm Sewer (based on diameter):
The consequence of failure score for this AMP is based upon pipe diameter as this will reflect potential upstream service area affected.

TABLE 28 CONSEQUENCE OF FAILURE – STORM SEWERS

Replacement Value	Consequence of failure
200mm and less	Score of 1
201-400mm	Score of 2
401-600mm	Score of 3
601-900mm	Score of 4
900mm and over	Score of 5

Facilities: (based on valuation):
The consequence of failure score for this AMP is based upon the replacement value of the facility component. The higher the value, probably the larger and more important the component to the overall function of the facility and therefore probably the higher the consequential risk of failure:

TABLE 29 CONSEQUENCE OF FAILURE - FACILITIES

Replacement Value	**Consequence of failure**
Up to $50k	Score of 1
$51k to $100k	Score of 2
$101k to $300k	Score of 3
$301k to $1 million	Score of 4
Over $1 million	Score of 5

Land Improvements: (based on valuation):
The consequence of failure score for this AMP is based upon the replacement value of the asset or component. The higher the value, probably the larger and more important the component and therefore probably the higher the consequential risk of failure:

TABLE 30 CONSEQUENCE OF FAILURE – LAND IMPROVEMENTS

Replacement Value	Consequence of failure
$10k and less	Score of 1
$11k to $20k	Score of 2
$21k to $35k	Score of 3
$36k to $80k	Score of 4
Over $80k	Score of 5

Equipment: (based on valuation):
The consequence of failure score for this AMP is based upon the replacement value of the asset or component. The higher the value, probably the larger and more important the component and therefore probably the higher the consequential risk of failure:

TABLE 31 CONSEQUENCE OF FAILURE – MACHINERY & EQUIPMENT

Replacement Value	Consequence of failure
Up to $10k	Score of 1
$11k to $25k	Score of 2
$26k to $80k	Score of 3
$81k to $200k	Score of 4
Over $200k	Score of 5

Rolling Stock: (based on valuation):
The consequence of failure score for this AMP is based upon the replacement value of the asset or component. The higher the value, probably the larger and more important the component and therefore probably the higher the consequential risk of failure:

TABLE 32 CONSEQUENCE OF FAILURE – ROLLING STOCK

Replacement Value	Consequence of failure
Up to $25k	Score of 1
$26k to $60k	Score of 2
$61k to $100k	Score of 3
$101k to $300k	Score of 4
Over $300k	Score of 5

FIGURE 49 DISTRIBUTION OF ASSETS BASED ON RISK - ALL ASSETS

Consequence \ Probability	1	2	3	4	5
5	24 Assets 3,237.80 m, unit(s), m3 $4,417,067.00	47 Assets 6,397.60 unit(s), m3, m $9,505,520.00	76 Assets 9,867.30 unit(s), m3, m $11,514,973.40	13 Assets 1,444.00 unit(s), m3 $4,969,863.27	109 Assets 11,212.40 unit(s), m3 $32,572,018.50
4	28 Assets 2,125.50 unit(s), m, m3 $2,650,043.00	43 Assets 19,235.20 unit(s), m3, m $14,850,428.00	84 Assets 30,656.10 unit(s), m3, m $16,458,455.00	32 Assets 19,486.90 unit(s), m3 $9,209,324.00	19 Assets 45.00 unit(s) $5,032,646.00
3	125 Assets 16,806.40 unit(s), m, m3 $8,360,018.00	32 Assets 2,349.20 unit(s), m $1,451,996.00	191 Assets 21,134.10 unit(s), m3, m $9,324,082.00	7 Assets 7.00 unit(s) $1,992,560.00	82 Assets 31,567.60 unit(s), m3 $23,225,856.15
2	116 Assets 11,466.60 unit(s), m $4,694,281.00	67 Assets 4,412.10 unit(s), m $3,607,422.00	277 Assets 24,202.70 unit(s), m $9,307,345.00	10 Assets 10.00 unit(s) $565,341.00	31 Assets 699.00 unit(s) $989,858.00
1	114 Assets 5,779.25 unit(s), m, m3 $3,236,284.00	103 Assets 2,473.99 unit(s), m3, m $1,507,840.00	246 Assets 21,751.60 unit(s), m3, m $8,965,255.00	51 Assets 1,161.76 unit(s), m3 $554,385.00	208 Assets 1,852.60 unit(s), m3 $961,924.00

FIGURE 50 DISTRIBUTION OF ASSETS BASED ON RISK – ROAD NETWORK

Consequence \ Probability	1	2	3	4	5
5	11 Assets 988.80 unit(s), m3 $1,652,005.00	37 Assets 5,792.60 m3 $6,068,215.00	29 Assets 3,995.10 m3 $2,854,594.00	10 Assets 1,441.00 m3 $1,287,998.00	97 Assets 11,200.40 m3 $8,885,696.00
4	1 Assets 268.40 m3 $293,588.00	16 Assets 17,363.10 m3 $6,423,481.00	22 Assets 23,491.80 m3 $9,902,953.00	21 Assets 19,475.90 m3 $7,355,664.00	0 Assets - $0.00
3	2 Assets 1,656.00 m3, m $115,548.00	0 Assets - $0.00	1 Assets 671.00 m3 $628,378.00	0 Assets - $0.00	48 Assets 31,532.60 m3 $19,447,643.00
2	0 Assets - $0.00	0 Assets - $0.00	0 Assets - $0.00	0 Assets - $0.00	1 Assets 668.00 unit(s) $248,496.00
1	52 Assets 672.15 m3, unit(s) $575,568.00	86 Assets 1,930.99 m3, m $836,744.00	45 Assets 1,472.30 m3 $497,452.00	37 Assets 1,109.76 m3 $374,958.00	162 Assets 1,664.60 m3, unit(s) $565,781.00

FIGURE 51 DISTRIBUTION OF ASSETS BASED ON RISK – BRIDGES & CULVERTS

Consequence \ Probability	1	2	3	4	5
5	0 Assets - $0.00	0 Assets - $0.00	1 Assets 1.00 unit(s) $2,700,681.00	2 Assets 2.00 unit(s) $3,080,405.00	3 Assets 3.00 unit(s) $5,305,654.00
4	0 Assets - $0.00	6 Assets 6.00 unit(s) $6,966,776.00	1 Assets 1.00 unit(s) $1,128,861.00	0 Assets - $0.00	1 Assets 1.00 unit(s) $1,000,000.00
3	3 Assets 3.00 unit(s) $1,694,877.00	0 Assets - $0.00	0 Assets - $0.00	2 Assets 2.00 unit(s) $1,636,854.00	2 Assets 2.00 unit(s) $1,693,290.00
2	1 Assets 1.00 unit(s) $343,483.00	7 Assets 7.00 unit(s) $1,707,954.00	1 Assets 1.00 unit(s) $127,796.00	1 Assets 1.00 unit(s) $346,497.00	0 Assets - $0.00
1	0 Assets - $0.00	1 Assets 1.00 unit(s) $32,919.00	4 Assets 4.00 unit(s) $373,675.00	0 Assets - $0.00	0 Assets - $0.00

FIGURE 52 DISTRIBUTION OF ASSETS BASED ON RISK – STORM SEWER SYSTEM

Consequence \ Probability	1	2	3	4	5
5	3 Assets 375.00 m $131,657.00	0 Assets - $0.00	1 Assets 121.00 m $44,393.00	0 Assets - $0.00	0 Assets - $0.00
4	5 Assets 470.00 m $165,013.00	0 Assets - $0.00	15 Assets 2,236.00 m $820,349.00	0 Assets - $0.00	0 Assets - $0.00
3	15 Assets 1,838.00 m $635,694.00	2 Assets 281.00 m $98,655.00	28 Assets 3,427.00 m $1,257,300.00	0 Assets - $0.00	0 Assets - $0.00
2	46 Assets 6,760.00 m $2,373,361.00	8 Assets 1,082.00 m $379,876.00	87 Assets 12,319.00 m $4,519,604.00	0 Assets - $0.00	0 Assets - $0.00
1	22 Assets 3,312.00 m $1,162,809.00	4 Assets 435.00 m $152,723.00	92 Assets 13,368.00 m $4,904,458.00	0 Assets - $0.00	0 Assets - $0.00

FIGURE 53 DISTRIBUTION OF ASSETS BASED ON RISK – WATER SERVICES

Consequence \ Probability	1	2	3	4	5
5	9 Assets 1,873.00 m $1,141,128.00	5 Assets 589.00 m $379,177.00	27 Assets 4,464.00 unit(s), m $3,399,787.40	1 Assets 1.00 unit(s) $601,460.27	0 Assets - $0.00
4	5 Assets 451.00 m $392,169.00	7 Assets 822.00 unit(s), m $910,910.00	18 Assets 3,096.00 m $1,397,985.00	1 Assets 1.00 unit(s) $324,081.00	0 Assets - $0.00
3	85 Assets 12,048.00 m, unit(s) $5,218,793.00	18 Assets 1,469.00 unit(s), m $954,149.00	95 Assets 11,918.00 unit(s), m $5,176,846.00	1 Assets 1.00 unit(s) $66,849.00	2 Assets 2.00 unit(s) $165,772.15
2	1 Assets 45.00 unit(s) $132,559.00	1 Assets 1.00 unit(s) $17,970.00	5 Assets 36.00 unit(s), m $95,910.00	0 Assets - $0.00	0 Assets - $0.00
1	16 Assets 877.00 m $776,345.00	2 Assets 86.00 unit(s) $322,181.00	41 Assets 3,964.00 unit(s), m $2,018,438.00	1 Assets 37.00 unit(s) $108,229.00	0 Assets - $0.00

FIGURE 54 DISTRIBUTION OF ASSETS BASED ON RISK – SANITARY SERVICES

Consequence \ Probability	1	2	3	4	5
5	1 Assets 1.00 unit(s) $1,492,277.00	1 Assets 12.00 m $4,304.00	15 Assets 1,283.20 unit(s), m $739,803.00	0 Assets - $0.00	1 Assets 1.00 unit(s) $10,380,439.00
4	10 Assets 929.10 m $346,726.00	14 Assets 1,044.10 unit(s), m $549,261.00	20 Assets 1,796.30 m $673,220.00	0 Assets - $0.00	0 Assets - $0.00
3	15 Assets 1,256.40 m $487,522.00	9 Assets 596.20 unit(s), m $266,497.00	65 Assets 5,116.10 unit(s), m $1,962,316.00	0 Assets - $0.00	3 Assets 3.00 unit(s) $122,875.00
2	61 Assets 4,653.60 unit(s), m $1,737,228.00	45 Assets 3,316.10 m, unit(s) $1,312,394.00	174 Assets 11,819.70 m $4,378,410.00	1 Assets 1.00 unit(s) $12,190.00	4 Assets 4.00 unit(s) $68,885.00
1	15 Assets 820.10 m $635,893.00	0 Assets - $0.00	52 Assets 2,897.30 m $1,085,848.00	0 Assets - $0.00	0 Assets - $0.00

FIGURE 55 DISTRIBUTION OF ASSETS BASED ON RISK – BUILDINGS

Consequence \ Probability	1	2	3	4	5
5	0 Assets - $0.00	1 Assets 1.00 unit(s) $2,190,794.00	1 Assets 1.00 unit(s) $1,162,372.00	0 Assets - $0.00	2 Assets 2.00 unit(s) $6,122,369.50
4	1 Assets 1.00 unit(s) $650,777.00	0 Assets - $0.00	2 Assets 2.00 unit(s) $1,898,904.00	1 Assets 1.00 unit(s) $453,682.00	5 Assets 5.00 unit(s) $2,820,686.00
3	0 Assets - $0.00	0 Assets - $0.00	1 Assets 1.00 unit(s) $270,070.00	1 Assets 1.00 unit(s) $188,507.00	5 Assets 5.00 unit(s) $745,166.00
2	0 Assets - $0.00	2 Assets 2.00 unit(s) $130,605.00	0 Assets - $0.00	1 Assets 1.00 unit(s) $97,225.00	2 Assets 2.00 unit(s) $149,602.00
1	0 Assets - $0.00	3 Assets 3.00 unit(s) $77,025.00	4 Assets 4.00 unit(s) $51,097.00	0 Assets - $0.00	3 Assets 3.00 unit(s) $58,248.00

FIGURE 56 DISTRIBUTION OF ASSETS BASED ON RISK – LAND IMPROVEMENTS

Consequence \ Probability	1	2	3	4	5
5	0 Assets - $0.00	1 Assets 1.00 unit(s) $196,217.00	0 Assets - $0.00	0 Assets - $0.00	0 Assets - $0.00
4	1 Assets 1.00 unit(s) $46,034.00	0 Assets - $0.00	2 Assets 2.00 unit(s) $101,617.00	0 Assets - $0.00	3 Assets 3.00 unit(s) $146,730.00
3	0 Assets - $0.00	1 Assets 1.00 unit(s) $22,488.00	0 Assets - $0.00	1 Assets 1.00 unit(s) $26,002.00	4 Assets 4.00 unit(s) $104,937.00
2	0 Assets - $0.00	2 Assets 2.00 unit(s) $28,700.00	0 Assets - $0.00	1 Assets 1.00 unit(s) $13,344.00	3 Assets 3.00 unit(s) $46,751.00
1	0 Assets - $0.00	0 Assets - $0.00	2 Assets 17.00 unit(s) $3,570.00	1 Assets 3.00 unit(s) $3,343.00	1 Assets 6.00 unit(s) $7,385.00

FIGURE 57 DISTRIBUTION OF ASSETS BASED ON RISK – MACHINERY & EQUIPMENT

Consequence \ Probability	1	2	3	4	5
5	0 Assets - $0.00	1 Assets 1.00 unit(s) $234,855.00	2 Assets 2.00 unit(s) $613,343.00	0 Assets - $0.00	5 Assets 5.00 unit(s) $1,449,997.00
4	4 Assets 4.00 unit(s) $461,061.00	0 Assets - $0.00	3 Assets 30.00 unit(s) $320,962.00	9 Assets 9.00 unit(s) $1,075,897.00	10 Assets 36.00 unit(s) $1,065,230.00
3	5 Assets 5.00 unit(s) $207,584.00	2 Assets 2.00 unit(s) $110,207.00	1 Assets 1.00 unit(s) $29,172.00	2 Assets 2.00 unit(s) $74,348.00	18 Assets 19.00 unit(s) $946,173.00
2	7 Assets 7.00 unit(s) $107,650.00	2 Assets 2.00 unit(s) $29,923.00	8 Assets 25.00 unit(s) $113,078.00	6 Assets 6.00 unit(s) $96,085.00	15 Assets 16.00 unit(s) $250,938.00
1	6 Assets 95.00 unit(s) $45,704.00	6 Assets 17.00 unit(s) $74,716.00	6 Assets 25.00 unit(s) $30,717.00	11 Assets 11.00 unit(s) $50,262.00	42 Assets 179.00 unit(s) $330,510.00

FIGURE 58 DISTRIBUTION OF ASSETS BASED ON RISK – VEHICLES

Consequence \ Probability	1	2	3	4	5
5	0 Assets - $0.00	1 Assets 1.00 unit(s) $431,958.00	0 Assets - $0.00	0 Assets - $0.00	1 Assets 1.00 unit(s) $427,863.00
4	1 Assets 1.00 unit(s) $294,675.00	0 Assets - $0.00	1 Assets 1.00 unit(s) $213,604.00	0 Assets - $0.00	0 Assets - $0.00
3	0 Assets - $0.00	0 Assets - $0.00	0 Assets - $0.00	0 Assets - $0.00	0 Assets - $0.00
2	0 Assets - $0.00	0 Assets - $0.00	2 Assets 2.00 unit(s) $72,547.00	0 Assets - $0.00	6 Assets 6.00 unit(s) $225,186.00
1	3 Assets 3.00 unit(s) $39,965.00	1 Assets 1.00 unit(s) $11,532.00	0 Assets - $0.00	1 Assets 1.00 unit(s) $17,593.00	0 Assets - $0.00

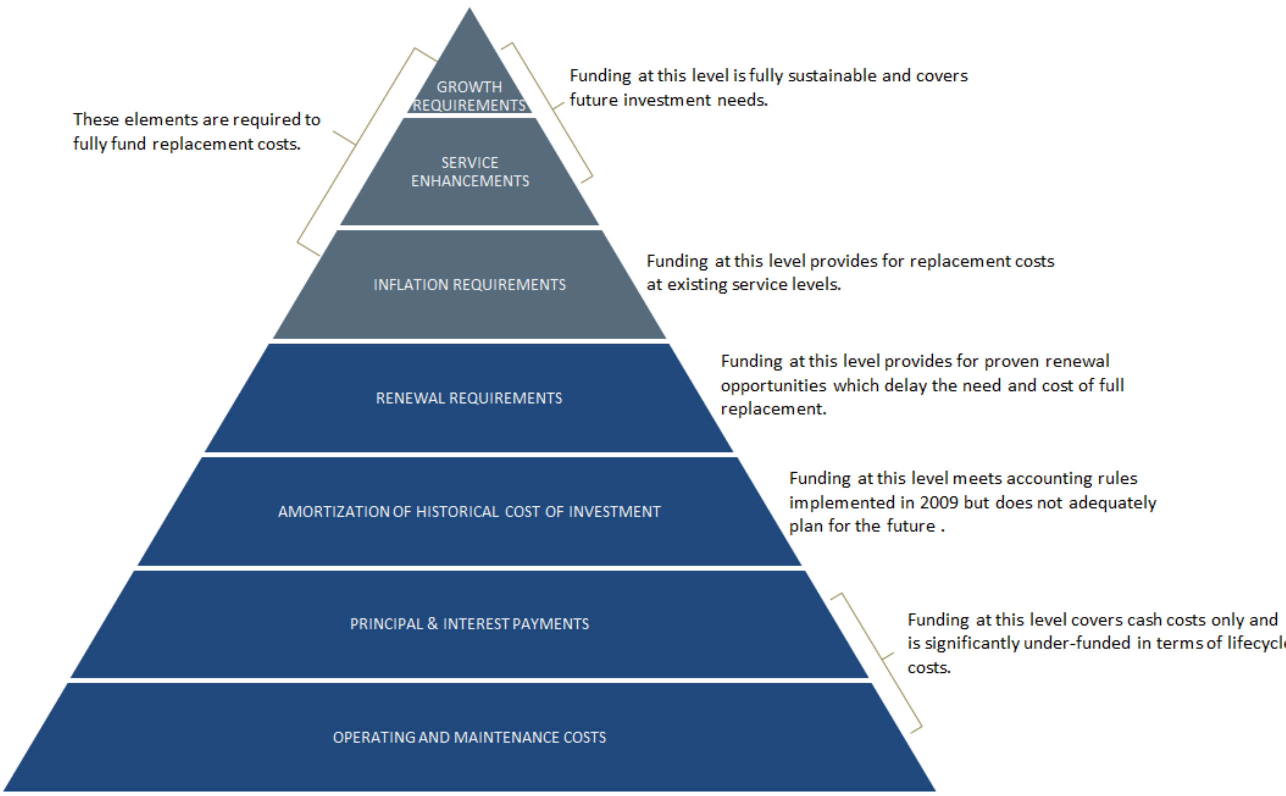
IX. Financial Strategy

1 General overview of financial plan requirements

In order for an AMP to be effectively put into action, it must be integrated with financial planning and long-term budgeting. The development of a comprehensive financial plan will allow Brockton to identify the financial resources required for sustainable asset management based on existing asset inventories, desired levels of service, and projected growth requirements.

The following pyramid depicts the various cost elements and resulting funding levels that should be incorporated into AMPs that are based on best practices.

FIGURE 59 COST ELEMENTS



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 (as documented in the SOTI section of this report) for:
   - existing assets
   - existing service levels
   - requirements of contemplated changes in service levels (none identified for this plan)
   - requirements of anticipated growth (none identified for this plan)

2. use of traditional sources of municipal funds:
    - tax levies
    - user fees
    - reserves
    - debt
    - development charges

3. use of non-traditional sources of municipal funds:
    - reallocated budgets
    - partnerships
    - procurement methods

4. use of senior government funds:
    - gas tax
    - grants (not included in this plan due to Provincial requirements for firm commitments)

If the financial plan component of an AMP 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 determining the legitimacy of a funding shortfall, the Province may evaluate a municipality'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:
    - if a zero debt policy is in place, is it warranted? If not, the use of debt should be considered.
    - do user fees reflect the cost of the applicable service? If not, increased user fees should be considered.

This AMP includes recommendations that avoid long-term funding deficits.

2 Financial Profile: Tax Funded Assets

2.1 Funding objective

We have developed scenarios that would enable Brockton to achieve full funding within five to 20 years for the following assets: road network; bridges & culverts; storm sewer network; buildings; machinery & equipment; vehicles; and land improvement. For each scenario developed we have included strategies, where applicable, regarding the use of tax revenues, user fees, reserves and debt.

Note: For the purposes of this AMP, we have excluded the category of gravel roads since gravel roads are a perpetual maintenance asset and end of life replacement calculations do not normally apply. If gravel roads are maintained properly, they could last forever.

2.2 Current funding position

Tables 33 and 34 outline, by asset category, the municipality's average annual asset investment requirements, current funding positions, and funding increases required to achieve full funding on assets funded by taxes.

TABLE 33 SUMMARY OF INFRASTRUCTURE REQUIREMENTS AND CURRENT FUNDING AVAILABLE

		2016 Funding Available					
Asset Category	Average Annual Investment Required	Taxes	Gas Tax	OCIF	Taxes to Reserves	Total Funding Available	Annual Deficit
Road Network	4,299,000	371,000	287,000	76,000	0	734,000	3,565,000
Bridges & Culverts	375,000	385,000	0	0	0	385,000	-10,000
Storm Sewer System	208,000	0	0	0	0	0	208,000
Machinery & Equipment	576,000	105,000	0	0	354,000	459,000	117,000
Buildings	475,000	0	0	0	0	0	475,000
Land Improvements	43,000	0	0	0	0	0	43,000
Vehicles	81,000	12,000	0	0	0	12,000	69,000
Total	**6,057,000**	**873,000**	**287,000**	**76,000**	**354,000**	**1,590,000**	**4,467,000**

Over time, the appropriate funding for asset categories with surpluses in Table 33 should be reallocated to categories with deficits. This will not change the recommendations as they are based on the bottom line deficit.

2.3 Recommendations for full funding

The average annual investment requirement for the above categories is $6,057,000. Annual revenue currently allocated to these assets for capital purposes is $1,590,000 leaving an annual deficit of $4,467,000. To put it another way, these infrastructure categories are currently funded at 26% of their long-term requirements.

In 2016, Brockton has annual tax revenues of $7,544,000. As illustrated in Table 34, without consideration of any other sources of revenue, full funding would require the following tax change over time:

TABLE 34 TAX CHANGE REQUIRED FOR FULL FUNDING

Asset Category	Tax Increase Required for Full Funding
Road Network	47.3%
Bridges & Culverts	-0.1%
Storm Sewer System	2.8%
Machinery & Equipment	1.6%
Buildings	6.3%
Land Improvements	0.6%
Vehicles	0.9%
Total	**59.4%**

As illustrated in Table 42, Brockton's debt payments for these asset categories will be decreasing by $73,000 over the next 5 years and by $208,000 over the next 10 years. Although not shown in the table, debt payment decreases will be $239,000 and $239,000 over the next 15 and 20 years respectively. Our recommendations include capturing those decreases in cost and allocating them to the infrastructure deficit outlined above.

The table below outlines this concept and presents several options:

TABLE 35 EFFECT OF REALLOCATING DECREASES IN DEBT COSTS

	Without Reallocation of Decreasing Debt Costs				With Reallocation of Decreasing Debt Costs			
	5 Years	10 Years	15 Years	20 Years	5 Years	10 Years	15 Years	20 Years
Infrastructure Deficit as Outlined in Table 39	4,467,000	4,467,000	4,467,000	4,467,000	4,467,000	4,467,000	4,467,000	4,467,000
Change in Debt Costs	N/A	N/A	N/A	N/A	-73,000	-208,000	-239,000	-239,000
Resulting Infrastructure Deficit	**4,467,000**	**4,467,000**	**4,467,000**	**4,467,000**	**4,394,000**	**4,259,000**	**4,228,000**	**4,228,000**
Resulting Tax Increase Required:								
Total Over Time	**59.2%**	**59.2%**	**59.2%**	**59.2%**	**58.2%**	**56.5%**	**56.0%**	**56.0%**
Annually	11.8%	5.9%	3.9%	3.0%	11.6%	5.7%	3.7%	2.8%

Considering all of the above information, we recommend the 20 year option in Table 35 that includes the reallocations. This involves full funding being achieved over 20 years by:

- when realized, reallocating the debt cost reductions of $239,000 to the infrastructure deficit as outlined above.
- increasing tax revenues by 2.8% 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.
- allocating the gas tax revenue and OCIF revenue as outlined in Table 33.
- 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 funding, if applicable, since this funding is a multi-year commitment.
2. We realize that raising tax revenues by the amounts recommended above for infrastructure purposes may be 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. Current data shows a pent-up investment demand of $26,686,000 for paved roads, $5,306,000 for bridges & culverts, $0 for storm sewers, $3,790,000 for machinery & equipment, $5,047,000 for facilities, $183,000 for land improvements and $172,000 for vehicles. 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.

3 Financial Profile: Rate Funded Assets

3.1 Funding objective

We have developed scenarios that would enable the municipality to achieve full funding within five to 20 years for the following assets: sanitary sewer network and water network. For each scenario developed we have included strategies, where applicable, regarding the use of tax revenues, user fees, reserves and debt.

3.2 Current funding position

Tables 36 and 37 outline, by asset category, the municipality's average annual asset investment requirements, current funding positions, and funding increases required to achieve full funding on assets funded by rates.

TABLE 36 SUMMARY OF INFRASTRUCTURE REQUIREMENTS AND CURRENT FUNDING AVAILABLE

Asset Category	Average Annual Investment Required	2014 Annual Funding Available				Annual Deficit
		Rates	To Operations	Other	Total	
Sanitary Sewer Network	495,000	969,000	-796,000	0	173,000	322,000
Water Network	336,000	941,000	-693,000	0	248,000	88,000
Total	**831,000**	**1,910,000**	**-1,489,000**	**0**	**421,000**	**410,000**

3.3 Recommendations for full funding

The average annual investment requirement for sanitary services and water services is $831,000. Annual revenue currently allocated to these assets for capital purposes is $421,000 leaving an annual deficit of $410,000. To put it another way, these infrastructure categories are currently funded at 51% of their long-term requirements.

In 2016, Brockton has annual sanitary revenues of $969,000 and annual water revenues of $941,000. As illustrated in Table 37, without consideration of any other sources of revenue, full funding would require the following increases over time:

TABLE 37 RATE CHANGE REQUIRED FOR FULL FUNDING

Asset Category	Rate Increase Required for Full Funding
Sanitary Sewer Network	33.2%
Water Network	9.4%

As illustrated in Table 42, Brockton's debt payments for sanitary services will be decreasing by $0 over the next 5 years and by $4,000 over the next 10 years. Although not shown in the table, debt payment decreases will be $4,000 over the next 15 years. For water services, the amounts are $60,000, $60,000 and $61,000 respectively. Our recommendations include capturing those decreases in cost and allocating them to the applicable infrastructure deficit.

Table 38 and Table 39 outline the above concept and present a number of options:

TABLE 38 EFFECT OF REALLOCATING DECREASES IN DEBT COSTS – WITHOUT CHANGE IN DEBT COSTS: RATE FUNDED ASSETS

	Sanitary Sewer Network			Water Network		
	5 Years	10 Years	15 Years	5 Years	10 Years	15 Years
Infrastructure Deficit as Outlined in Table 36	322,000	322,000	322,000	88,000	88,000	88,000
Change in Debt Costs	N/a	N/a	n/a	N/A	N/a	n/a
Resulting Infrastructure Deficit	**322,000**	**322,000**	**322,000**	**88,000**	**88,000**	**88,000**
Resulting Rate Increase Required:						
Total Over Time	**33.2%**	**33.2%**	**33.2%**	**9.4%**	**9.4%**	**9.4%**
Annually	6.6%	3.3%	2.2%	1.9%	0.9%	0.6%

TABLE 39 EFFECT OF REALLOCATING DECREASES IN DEBT COSTS – WITH CHANGE IN DEBT COSTS: RATE FUNDED ASSETS

	Sanitary Sewer Network			Water Network		
	5 Years	10 Years	15 Years	5 Years	10 Years	15 Years
Infrastructure Deficit as Outlined in Table 36	322,000	322,000	322,000	88,000	88,000	88,000
Change in Debt Costs	0	-4,000	-4,000	-60,000	-60,000	-61,000
Resulting Infrastructure Deficit	**322,000**	**318,000**	**318,000**	**28,000**	**28,000**	**27,000**
Resulting Rate Increase Required:						
Total Over Time	**33.2%**	**32.8%**	**32.8%**	**3.0%**	**3.0%**	**2.9%**
Annually	6.6%	3.3%	2.2%	0.6%	0.3%	0.2%

Considering all of the above information, we recommend the 10 year option which includes reallocations. This involves full funding being achieved over 10 years by:

- when realized, reallocating the debt cost reductions of $4,000 for sanitary services and $60,000 for water services to the applicable infrastructure deficit.
- increasing rate revenues by 3.3% for sanitary services and 0.3% for water services each year for the next 10 years solely for the purpose of phasing in full funding to the asset categories covered in this section of the AMP.
- increasing existing and future infrastructure budgets by the applicable inflation index on an annual basis in addition to the deficit phase-in.

Notes:

- 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 funding, if applicable, since this funding is a multi-year commitment.
- We realize that raising rate 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.
- Any increase in rates required for operations would be in addition to the above recommendations.

Although this option achieves full funding on an annual basis in 10 years and provides financial sustainability over the period modeled, the recommendations do require prioritizing capital projects to fit the resulting annual funding available. Current data shows a pent-up investment demand of $100,000 for sanitary services and $0 for water services. 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.

4 Use of debt

For reference purposes, Table 40 outlines the premium paid on a project if financed by debt. For example, a $1M project financed at 3.0%[3] over 15 years would result in a 26% premium or $260,000 of increased costs due to interest payments. For simplicity, the table does not consider the time value of money or the effect of inflation on delayed projects.

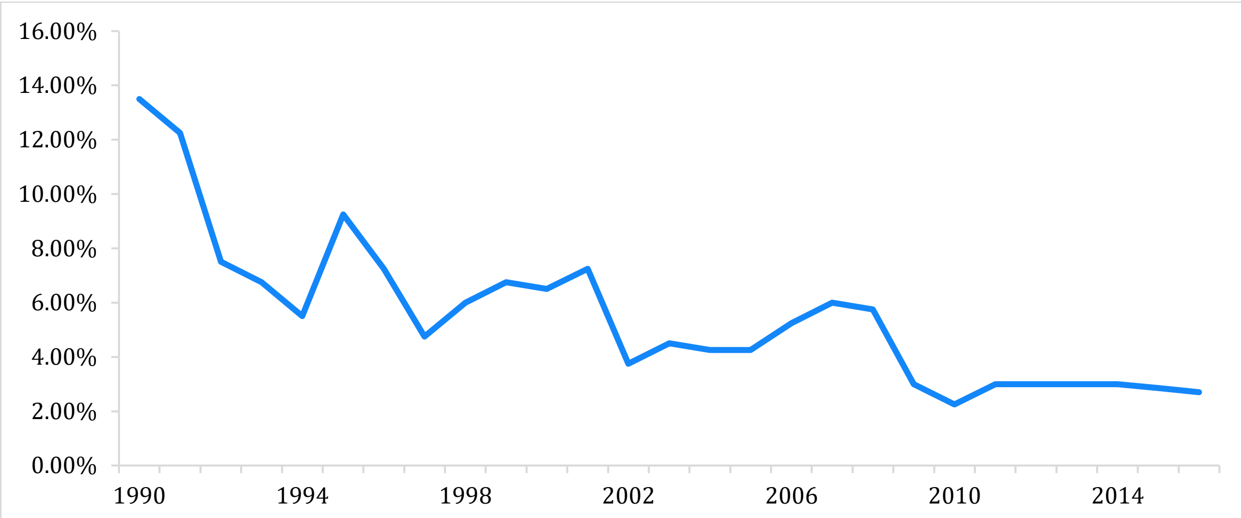
TABLE 40 TOTAL INTEREST PAID AS A % OF PROJECT COSTS

	Number of Years Financed					
Interest Rate	5	10	15	20	25	30
7.0%	22%	42%	65%	89%	115%	142%
6.5%	20%	39%	60%	82%	105%	130%
6.0%	19%	36%	54%	74%	96%	118%
5.5%	17%	33%	49%	67%	86%	106%
5.0%	15%	30%	45%	60%	77%	95%
4.5%	14%	26%	40%	54%	69%	84%
4.0%	12%	23%	35%	47%	60%	73%
3.5%	11%	20%	30%	41%	52%	63%
3.0%	9%	17%	26%	34%	44%	53%
2.5%	8%	14%	21%	28%	36%	43%
2.0%	6%	11%	17%	22%	28%	34%
1.5%	5%	8%	12%	16%	21%	25%
1.0%	3%	6%	8%	11%	14%	16%
0.5%	2%	3%	4%	5%	7%	8%
0.0%	0%	0%	0%	0%	0%	0%

[3] Current municipal Infrastructure Ontario rates for 15 year money is 3.2%.

It should be noted that current interest rates are near all-time lows. Sustainable funding models that include debt need to incorporate the risk of rising interest rates. The following graph shows where historical lending rates have been:

FIGURE 60 HISTORICAL PRIME BUSINESS INTEREST RATES



As illustrated in Table 40, a change in 15 year rates from 3% to 6% would change the premium from 26% to 54%. Such a change would have a significant impact on a financial plan.

Table 41 and Table 42 outline how Brockton has historically used debt for investing in the asset categories as listed. There is currently $2,488,000 of debt outstanding for the assets covered by this AMP with corresponding principal and interest payments of $304,000. In terms of overall debt capacity, in 2015 Brockton had $728,000 in total annual principal and interest payment commitments, well within its provincially prescribed maximum of $3,149,000.

TABLE 41 OVERVIEW OF USE OF DEBT

Asset Category	Debt Outstanding	Use of Debt in Last Five Years				
		2011	2012	2013	2014	2015
Road Network	1,113,000	0	0	464,000	0	0
Bridges & Culverts	0	0	0	0	0	0
Storm Sewer Network	0	0	0	0	0	0
Machinery & Equipment	0	0	0	0	0	0
Buildings	1,220,000	0	0	0	725,000	0
Land Improvements	0	0	0	0	0	0
Vehicles	0	0	0	0	0	0
Total tax funded	2,333,000	0	0	464,000	725,000	0
Sanitary Sewer Network	29,000	0	0	0	0	0
Water Network	126,000	0	0	0	0	0
Total rate Funded	155,000	0	0	0	0	0

TABLE 42 OVERVIEW OF DEBT COSTS

	Principal & Interest Payments in Next Ten Years					
Asset Category	2016	2017	2018	2019	2020	2021
Road Network	104,000	31,000	31,000	31,000	31,000	31,000
Bridges & Culverts	0	0	0	0	0	0
Storm Sewer Network	0	0	0	0	0	0
Machinery & Equipment	0	0	0	0	0	0
Buildings	135,000	135,000	135,000	135,000	135,000	135,000
Land Improvements	0	0	0	0	0	0
Vehicles	0	0	0	0	0	0
Total tax funded	239,000	166,000	166,000	166,000	166,000	166,000
Sanitary Sewer Network	4,000	4,000	4,000	4,000	4,000	4,000
Water Network	61,000	61,000	61,000	1,000	1,000	1,000
Total rate Funded	65,000	65,000	65,000	5,000	5,000	5,000

The revenue options outlined in this plan allow Brockton to fully fund its long-term infrastructure requirements without further use of debt. However, as explained in sections 2.3 and 3.3, the recommended condition rating analysis may require otherwise.

5 Use of reserves

5.1 Available reserves

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

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

By infrastructure category, Table 43 outlines the details of the reserves currently available to Brockton.

TABLE 43 SUMMARY OF RESERVES AVAILABLE

Asset Category	Balance at December 31, 2015
Road Network	251,000
Bridges & Culverts	251,000
Storm Sewer Network	50,000
Machinery & Equipment	1,504,000
Buildings	201,000
Land Improvements	78,000
Vehicles	251,000
Total tax funded	**2,586,000**
Water Network	228,000
Sanitary Sewer Network	88,000
Total rate funded	**316,000**

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

- breadth of services provided
- age and condition of infrastructure
- use and level of debt
- economic conditions and outlook
- internal reserve and debt policies.

The reserves in Table 43 are available for use by applicable asset categories during the phase-in period to full funding. This, coupled with Brockton'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.

5.2 Recommendation

As Brockton updates its AMP and expands it to include other asset categories, we recommend that future planning should include determining what its long-term reserve balance requirements are and a plan to achieve such balances.

X. 2016 Infrastructure Report Card

The following infrastructure report card illustrates the municipality's performance on the two key factors: Asset Health and Financial Capacity. Appendix 1 provides the full grading scale and conversion chart, as well as detailed descriptions, for each grading level.

TABLE 44 2016 INFRASTRUCTURE REPORT CARD

Asset Category	Asset Health Grade	Funding Percentage	Financial Capacity Grade	Average Asset Category Grade	Comments
Road Network	D	17%	F	F	Based on 2016 replacement cost, and a blend of age-based and observed data, while 29% of the municipality's total asset portfolio as analysed in this AMP is in very good or good condition, over 42% of the assets, with a valuation of $80 million, is in poor to very poor condition. With the exceptions bridges & culverts the municipality is underfunding its tax and rate funded assets. Average funding is 26% for tax funded assets and 51% for rate funded assets.
Bridges & Culverts	D	112%	A	C	
Water Services	C	74%	C	C	
Sanitary Services	D	35%	F	F	
Storm Sewer System	C	0%	F	F	
Buildings	D	0%	F	F	
Machinery & Equipment	D	80%	B	C	
Land Improvements	D	0%	F	F	
Vehicles	D	15%	F	F	
		Average Asset Health Grade	D		
		Average Financial Capacity Grade	F		
		Overall Grade for the Municipality	F		

XI. Appendices: Grading and Conversion Scales

Appendix 1: Grading and Conversion Scales

TABLE 45 ASSET HEALTH SCALE

Letter Grade	Rating	Description
A	Excellent	Asset is new or recently rehabilitated
B	Good	Asset is no longer new, but is fulfilling its function. Preventative maintenance is beneficial at this stage.
C	Fair	Deterioration is evident but asset continues to full its function. Preventative maintenance is beneficial at this stage.
D	Poor	Significant deterioration is evident and service is at risk.
F	Very Poor	Asset is beyond expected life and has deteriorated to the point that it may no longer be fit to fulfill its function.

TABLE 46 FINANCIAL CAPACITY SCALE

How well is the municipality funding its long-term infrastructure requirements?
Short Term: Less than 5 years
Medium Term: 5 to 20 years
Long Term: Greater than 20 years

Letter Grade	Rating	Funding percent	Timing Requirements	Description
A	Excellent	90-100 percent	☑ Short Term ☑Medium Term ☑Long Term	The municipality is fully prepared for its short-, medium- and long-term replacement needs based on existing infrastructure portfolio.
B	Good	70-89 percent	☑Short Term ☑Medium Term ☒Long Term	The municipality is well prepared to fund its short-term and medium-term replacement needs but requires additional funding strategies in the long-term to begin to increase its reserves.
C	Fair	60-69 percent	☑Short Term ☒Medium Term ☒Long Term	The municipality is underpreparing to fund its medium- to long-term infrastructure needs. The replacement of assets in the medium-term will likely be deferred to future years.
D	Poor	40-59 percent	☒/☑ Short Term ☒Medium Term ☒Long Term	The municipality is not well prepared to fund its replacement needs in the short-, medium- or long-term. Asset replacements will be deferred and levels of service may be reduced.
F	Very Poor	0-39 percent	☒Short Term ☒Medium Term ☒Long Term	The municipality is significantly underfunding its short-term, medium-term, and long-term infrastructure requirements based on existing funds allocation. Asset replacements will be deferred indefinitely. The municipality may have to divest some of its assets (e.g., bridge closures, arena closures) and levels of service will be reduced significantly.