

2017 AMP

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The 2017 Asset Management Plan for the
Municipality of Chatham-Kent

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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 Chatham-Kent's infrastructure portfolio comprises its road network, bridges & culverts, buildings, storm, land improvements, the municipal airport, vehicles, and machinery & equipment. Together, these assets had a total valuation of \$4.5 billion in 2017, with its storm network comprising 43% of the portfolio valuation, followed by road network at 23%.

Strategic asset management is critical in extracting the highest total value from public assets at the lowest lifecycle cost. This AMP, the municipality's third following the completion of its second edition in 2016, 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.

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.

The average annual investment requirement for tax funded categories is \$95,507,000. Annual revenue currently allocated to these assets for capital purposes is \$47,952,000, leaving an annual deficit of \$47,555,000. To put it another way, these infrastructure categories are currently funded at 50% of their long-term requirements. In 2017, the municipality has annual tax revenues of \$148,508,000.

We recommend a 20 year option for phasing in full funding. This involves full funding being by:

1. when realized, reallocating the debt cost reductions of \$3,182,000 to the infrastructure deficit as outlined above.
2. increasing tax revenues by 1.4% each year for the next 20 years solely for the purpose of phasing in full funding to the asset categories covered in this AMP.
3. continuing allocating the current gas tax and OCIF revenue as outlined in Table 34.
4. allocating the scheduled OCIF grant increases to the infrastructure deficit as they occur.
5. increasing existing and future infrastructure budgets by the applicable inflation index on an annual basis in addition to the deficit phase-in.

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

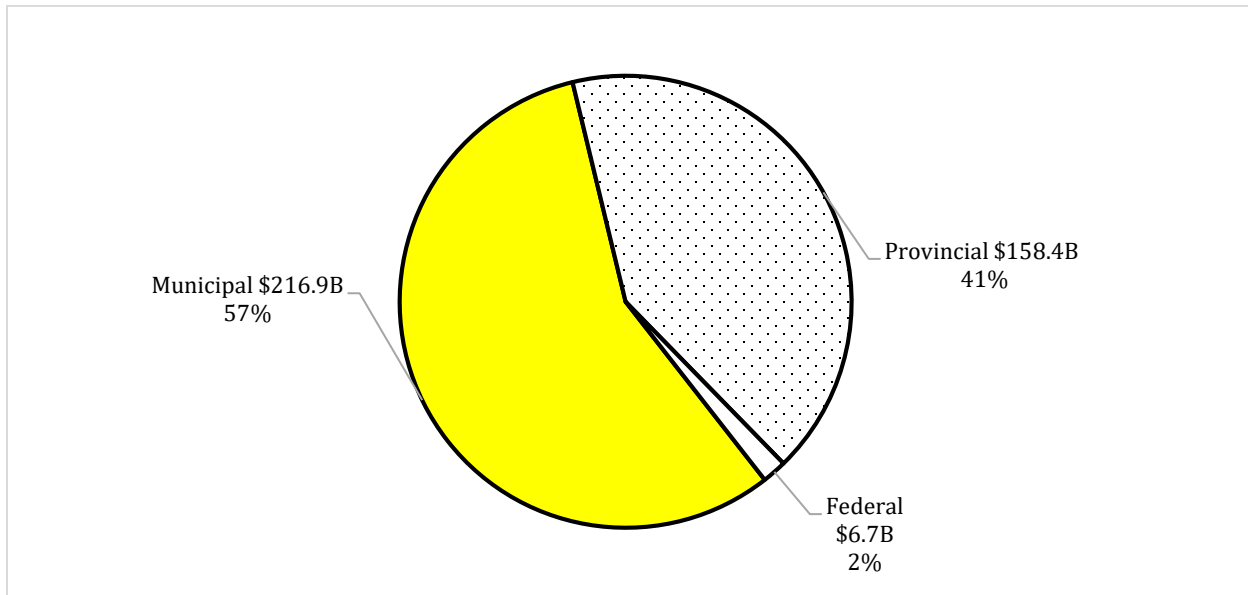


Figure 1 Distribution of Net Stock of Core Public Infrastructure

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 Municipality of Chatham-Kent's capital assets portfolio, as analyzed in this asset management plan (AMP) is valued at \$4.5 billion using 2017 replacement costs. 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.
Lifecycle Analysis	Identify Maintenance and Renewal Strategies & Lifecycle Costs.
Service Level Targets	Define measurable Levels of Service Targets.
Risk & Prioritization	Integrates all asset classes through risk and prioritization strategies.
Sustainable Financing	Identify sustainable Financing Strategies for all asset classes.
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

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 lifecycles, 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 Chatham-Kent' 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, replacement costs, useful life etc., summarizes the physical health of the capital assets, enumerates 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 2016, this AMP is developed in accordance with provincial standards and guidelines, and new requirements under the Federal Gas Tax Fund (GTF) stipulating the inclusion of all eligible asset classes. The following asset classes are analysed in this document: road network; bridges & culverts; combined storm; facilities; machinery & equipment; land improvements; rolling stock; municipal airport; transit .



IV. Data and Methodology

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

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 prior to aggregation and reporting; therefore, many imprecisions that may be highlighted at the individual asset level are attenuated at the class level.

As available, actual field condition data was used to make recommendations more meaningful and representative of the municipality's state of infrastructure. The value of condition data cannot be overstated as they provide a more accurate representation of the state of infrastructure. The type of condition data used for each class is indicated in Chapter V, Section 2.

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 and combined to enumerate the total available funding; funding for the previous three years is analyzed 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 included 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 make communications more meaningful and the AMP more accessible, we've developed an Infrastructure Report Card that summarizes our findings in common language that municipalities can use for internal and external distribution. The report card is developed using two key, equally weighted factors: Financial Capacity and Asset Health.

Table 3 Infrastructure Report Card Description

Financial Capacity	A municipality's financial capacity grade is determined by the level of funding available (0-100%) for each asset class for the purpose of meeting the average annual investment requirements.	
Asset Health	Using either field inspection data as available or age-based data, the asset health component of the report card uses condition (0-100%) to estimate how capable assets are in performing their required functions. We use replacement cost to determine the weight of each condition group within the asset class.	
Letter Grade	Rating	Description
A	Very Good	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 its existing infrastructure portfolio.
B	Good	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	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	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	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.

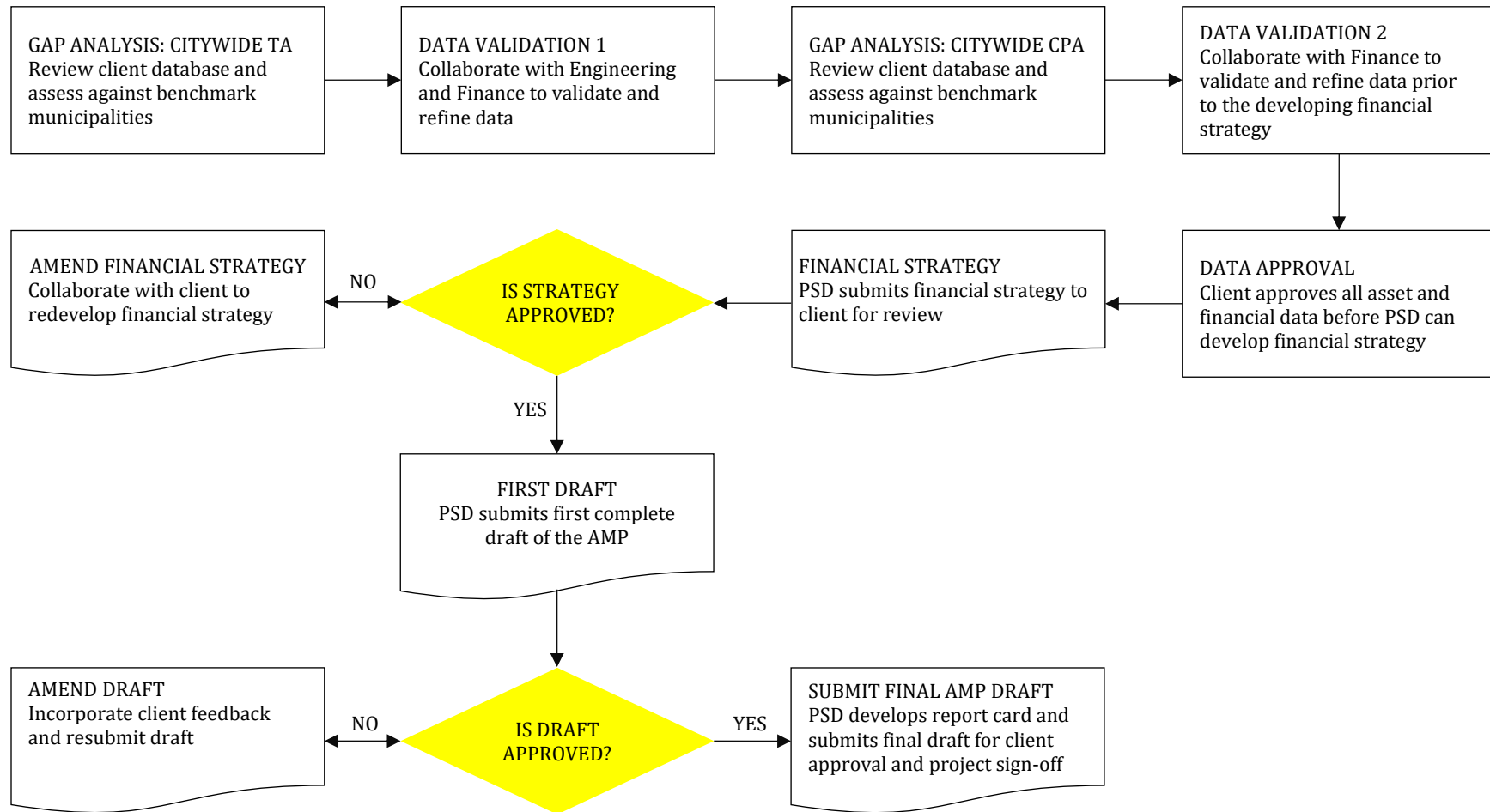
- As available, we use field condition assessment data to illustrate the state of infrastructure and develop the requisite financial strategies. However, in the absence of observed data, we rely on the age of assets to estimate their physical condition.
- A second limitation is the use of inflation measures, 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.
- Our calculations and recommendations will reflect the best available data at the time this AMP was developed.
- 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



V. Summary Statistics

In this section, we aggregate technical and financial data across all asset classes analyzed in this AMP, and summarize the state of the infrastructure using key indicators, including asset condition, useful life consumption, and important financial measurements.



1. Asset Valuation

The asset classes analyzed in this asset management plan for the municipality had a total 2017 valuation of \$4.5 billion, of which storm network comprised 43%, followed by road network and bridges & culverts at 23%. The ownership per household (Figure 4) totaled \$93,666 based on 47,889 households for all asset categories.

Figure 3 Asset Valuation by Class

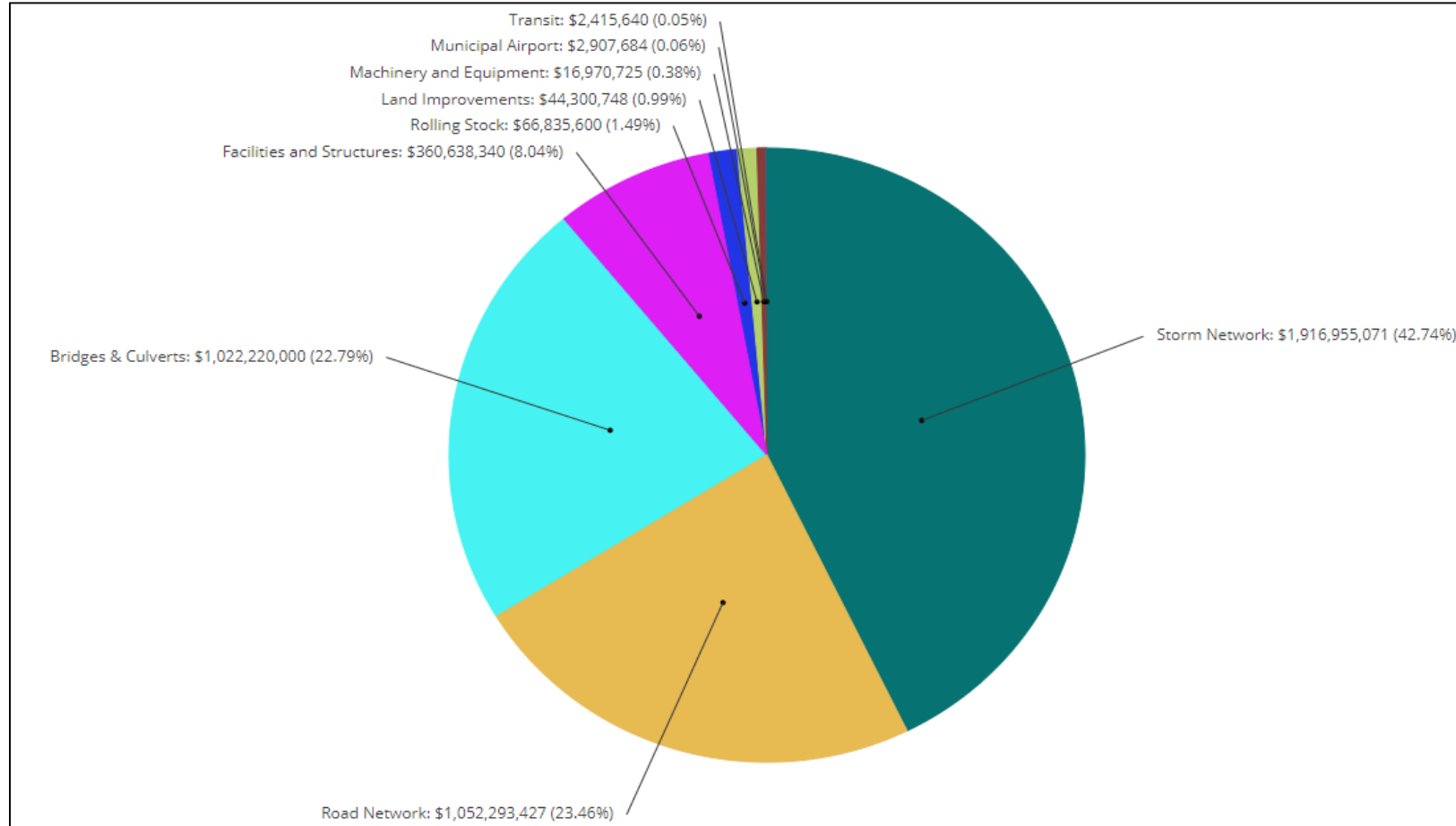
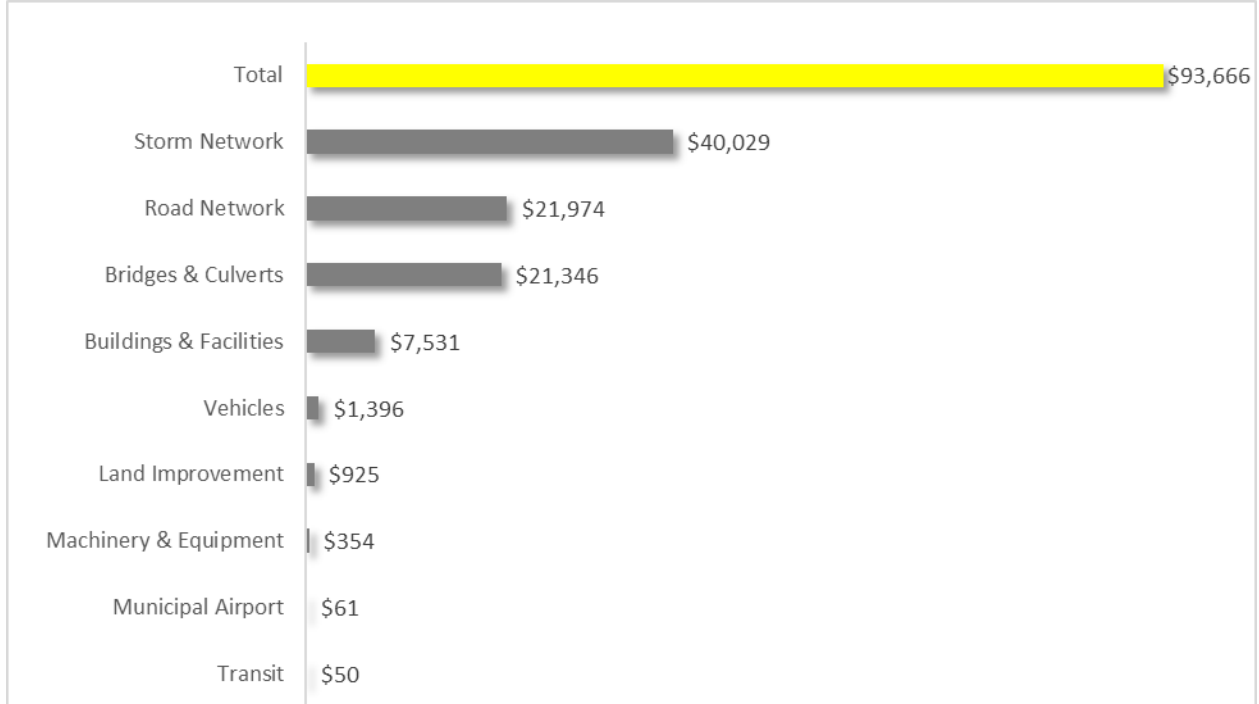


Figure 4 2016 Ownership Per Household



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, the age of capital assets can be used as a meaningful approximation of the asset's condition. Table 4 indicates the source of condition data used for the various asset classes in this AMP. The municipality has condition data for 83% of all assets based on 2017 replacement cost.

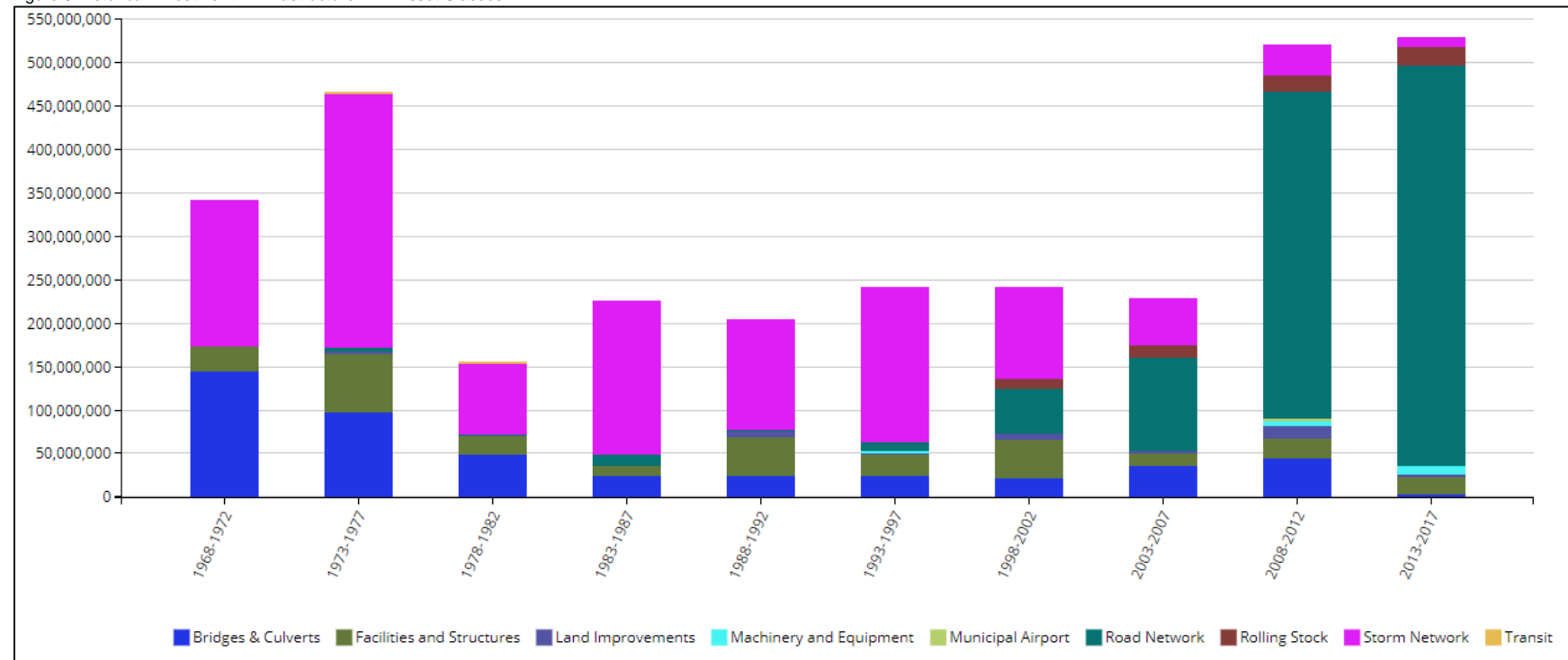
Table 4 Source of Condition Data by Asset Class

Asset class	Component	Source of Condition Data
Roads Network	Arena Parking Lots	100% Assessed – 2017
	Curbs	75% Assessed – 2017
	Guiderails	100% Assessed – 2017
	Sidewalks	100% Assessed – 2017
	Traffic Signals	100% Age-Based
	Roads	100% Assessed – 2017
Bridges & Culverts	Bridges & Culverts >3m	100% Assessed – 2017
Municipal Airport	All asset categories	100% Age-Based
Transit	All asset categories	100% Age-Based
Combined Storm Network	All asset categories	100% Age-based
Buildings & Facilities	Infrastructure & Engineering Services	75% Assessed – 2016
	Recreational Facilities	100% Age-based
	Parks & Open Spaces	100% Assessed – 2016
	Affordable Housing	100% Age-based
	Social Housing	100% Age-based
Machinery & Equipment	All asset categories	100% Age-based
Land Improvements	Cemeteries	100% Age-based
	Parks & Open Spaces	100% Assessed – 2017
	Sports Fields and Associated Amenities	100% Assessed – 2017
Rolling Stock	All asset categories	100% Age-based

3. Historical Investment in Infrastructure – All Asset Classes

In conjunction with condition data, two other measurements can augment staff understanding of the state of infrastructure and impending and long-term infrastructure needs: installation year profile, and useful life remaining. Using asset in-service date and 2017 replacement costs, Figure 5 illustrates the historical acquisitions made in the asset classes analyzed in this AMP since 1968. Often, investment in critical infrastructure parallels population growth or other significant shifts in demographics; they can also fluctuate with provincial and federal stimulus programs. Note that this graph only includes the active asset inventory as of December 31, 2017. Infrastructure investments that have not been capitalized are not included in this graph.

Figure 5 Historical Investment in Infrastructure – All Asset Classes

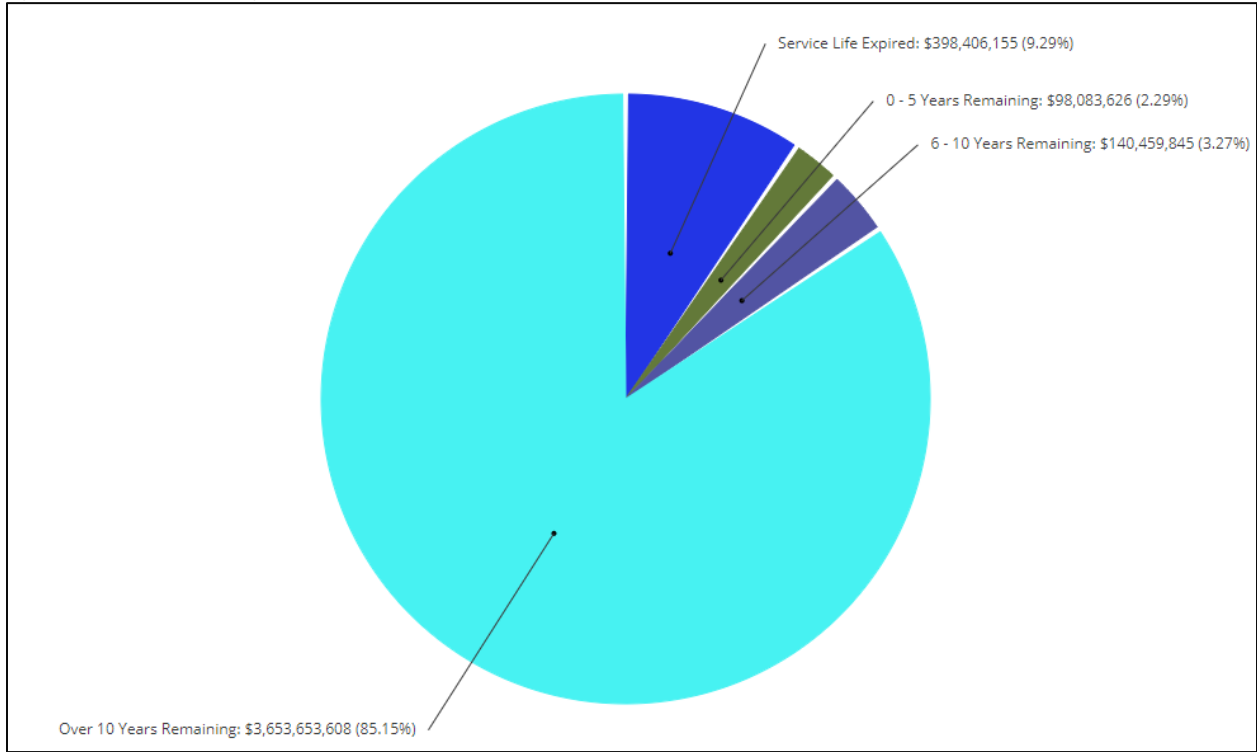


The municipality has continuously invested into its infrastructure over the decades. Investments fluctuated during the 1970s and 2000s and then peaked in the late 2000s. During this time, \$270 million was invested with \$183 million put into the road network. Since 2013, \$525 million has been invested with a focus on road network.

4. Useful Life Consumption – All Asset Classes

While age is not a precise indicator of an asset’s health, in the absence of observed condition assessment data, it can serve as a high-level, meaningful approximation and help guide replacement needs and facilitate strategic budgeting. Figure 6 shows the distribution of assets based on the percentage of useful life already consumed.

Figure 6 Useful Life Remaining as of 2017 – All Asset Classes

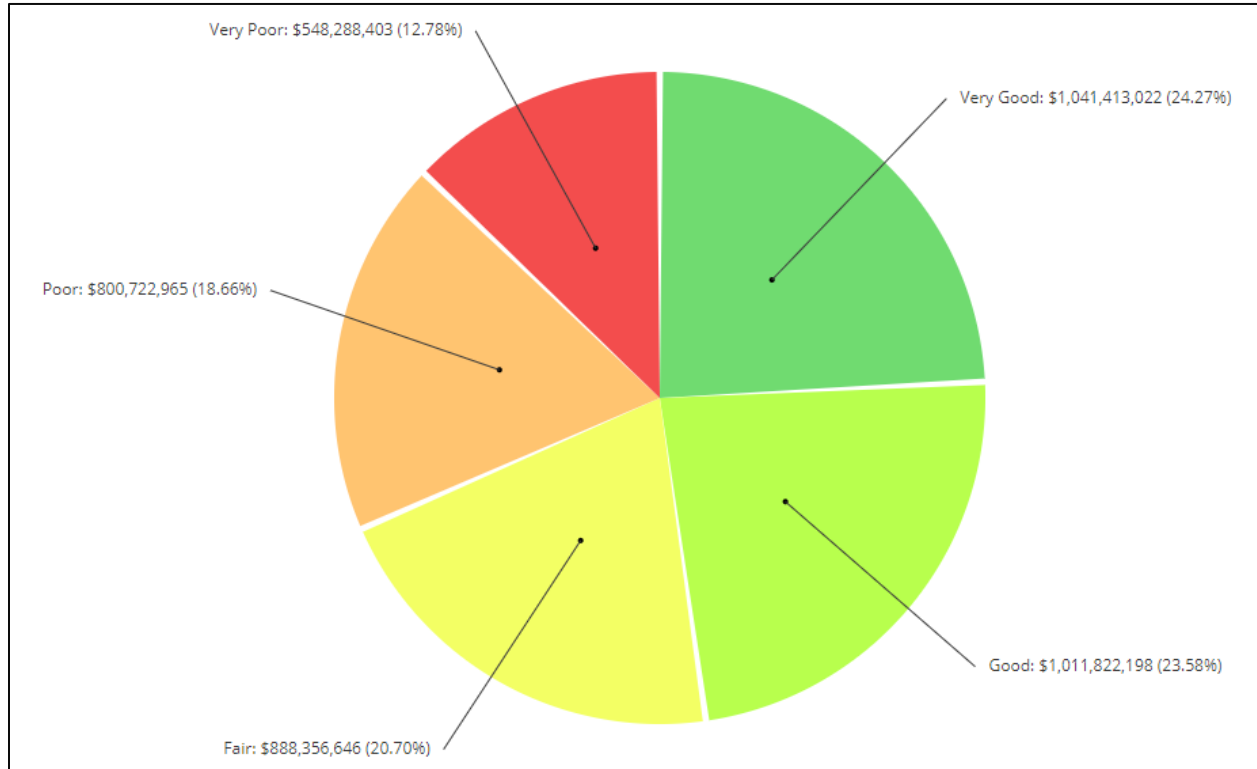


85% of the assets analyzed in this AMP have at least 10 years of useful life remaining. However, 9%, with a valuation of \$398 million, remain in operation beyond their established useful life. An additional 2% will reach the end of their useful life within the next five years.

5. Overall Condition – All Asset Classes

Based on 2017 replacement cost, and primarily condition data, over 48% of assets, with a valuation of \$2 billion, are in good to very good condition; 31% are in poor to very poor condition.

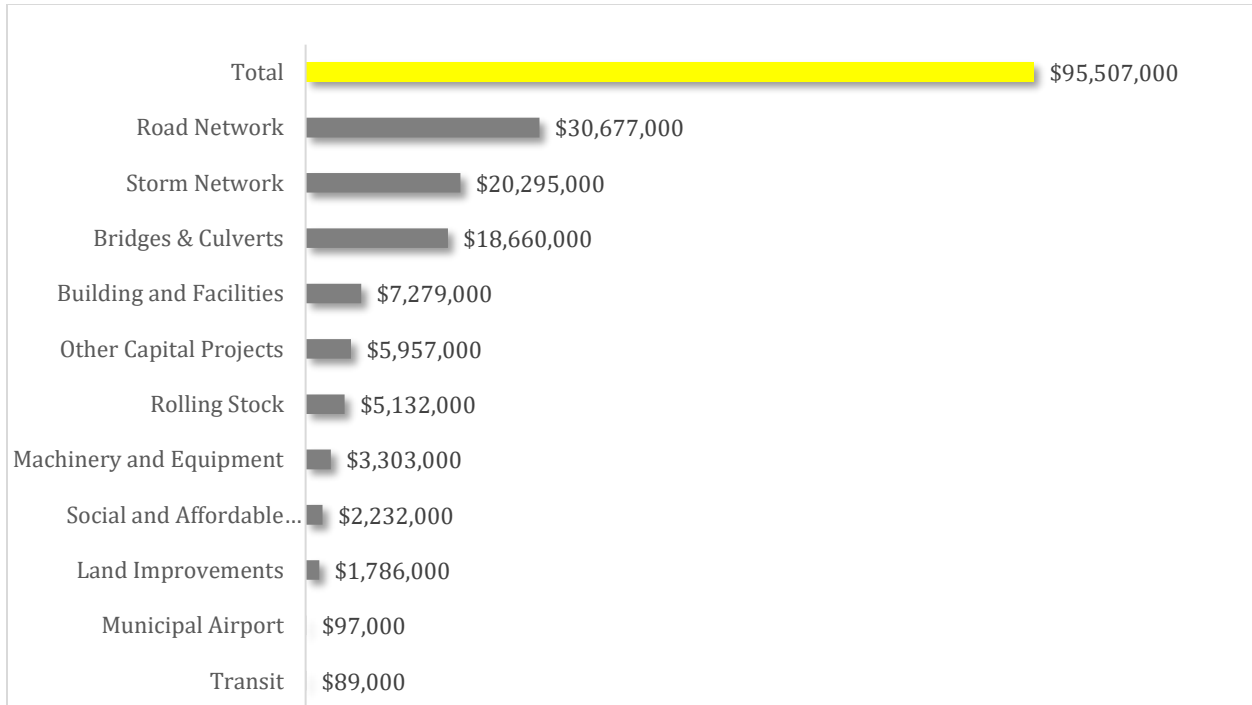
Figure 7 Asset Condition Distribution by Replacement Cost as of 2017 – All Asset Classes



6. Financial Profile

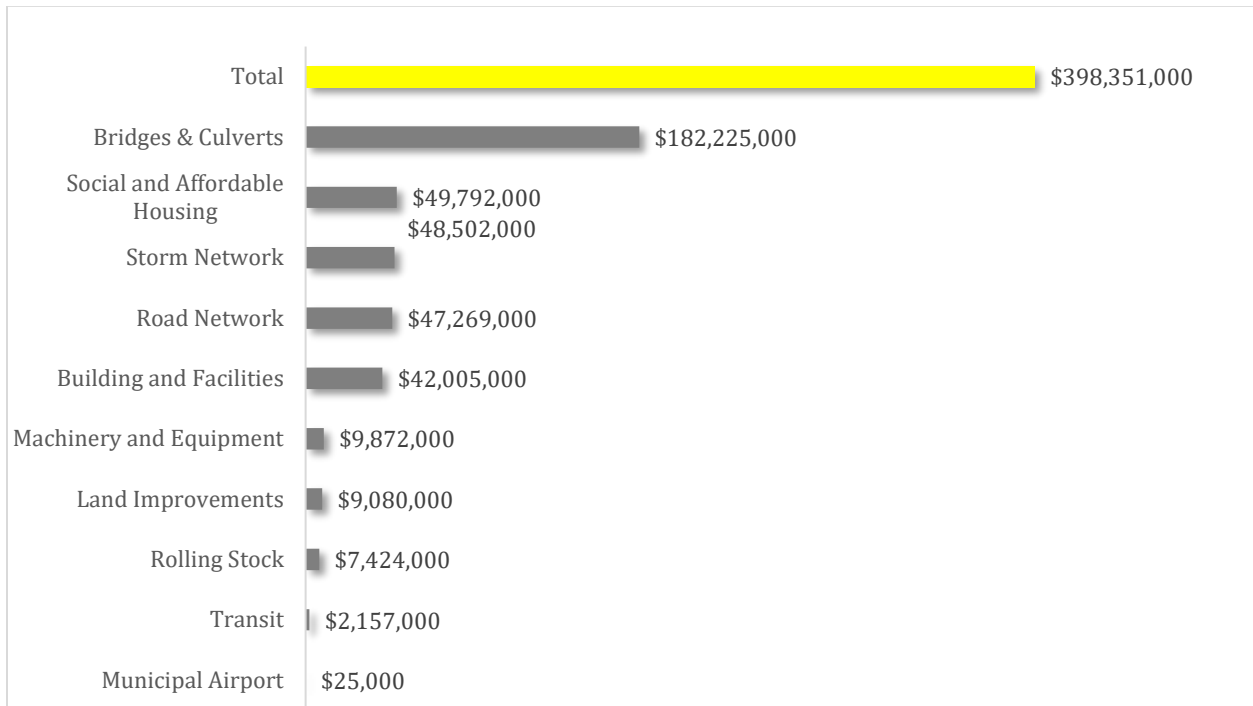
This section details key high-level financial indicators for the municipality’s asset classes.

Figure 8 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, prevent infrastructure backlogs and achieve long-term sustainability. In total, the municipality must allocate \$95,507,000 annually for the assets covered in this AMP.

Figure 9 Infrastructure Backlog – All Asset Classes

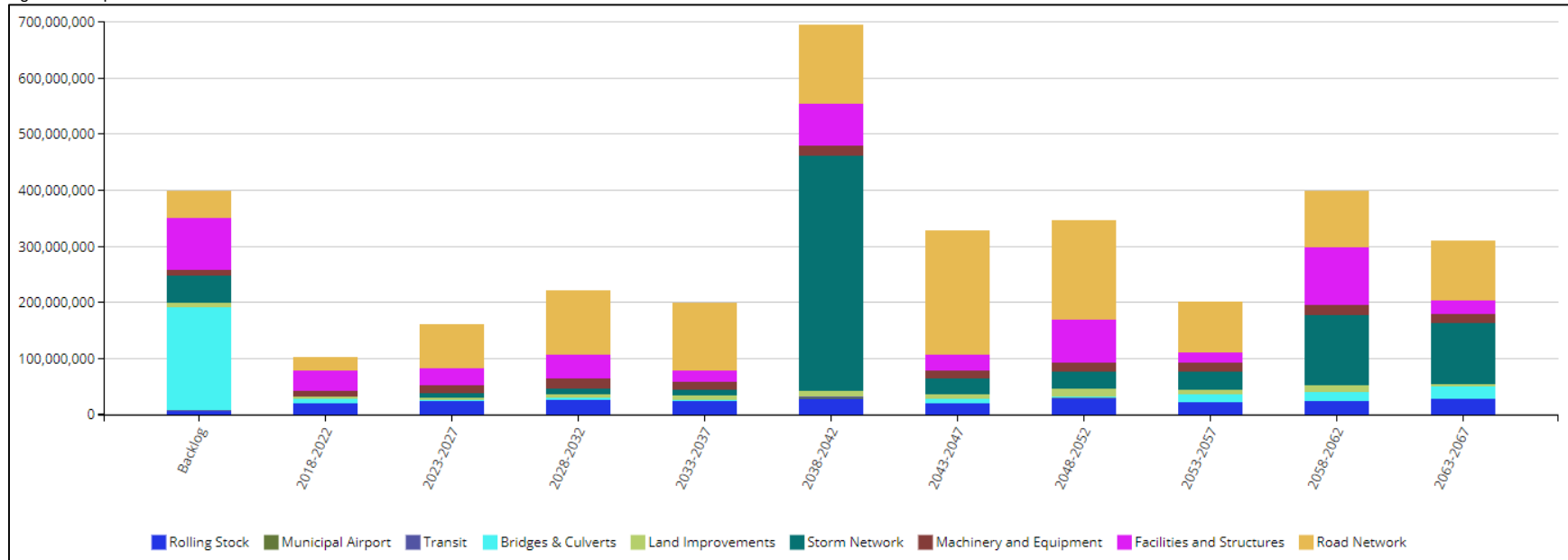


The municipality has a combined infrastructure backlog of \$400 million, with bridges & culverts comprising 46%. The backlog represents the investment needed today to meet previously deferred replacement needs. In the absence of assessed data, the backlog represents the value of assets still in operation beyond their established useful life.

7. Replacement Profile – All Asset Classes

In this section, we illustrate the aggregate short-, medium- and long-term infrastructure spending requirements (replacement only) for the municipality’s asset classes. The backlog is the total 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 10 Replacement Profile – All Asset Classes



Based primarily on condition data, the municipality has a combined backlog of \$398 million, of which bridges & culverts comprises \$182 million. Aggregate replacement needs will total \$101 million over the next five years. An additional \$160 million will be required between 2023 and 2027. The municipality’s aggregate annual requirements total \$95.5 million. At this funding level, the municipality would be allocating sufficient funds on an annual basis to meet the replacement needs for its various asset classes as they arise without the need for deferring projects and accruing annual infrastructure deficits. Currently, the municipality is funding 50% of the annual requirements for tax-funded assets. See the ‘Financial Strategy’ chapter for achieving a more optimal and sustainable funding level. Further, while fulfilling the annual requirements will position the municipality to meet its future replacement needs, injection of additional revenues will be needed to mitigate existing infrastructure backlogs.

VI. State of Local Infrastructure

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. As available, assessed condition data was used to inform the discussion and recommendations; in the absence of such information, age-based data was used as the next best alternative.



1. Road Network

1.1 Asset Portfolio: Quantity, Useful Life and Replacement Cost

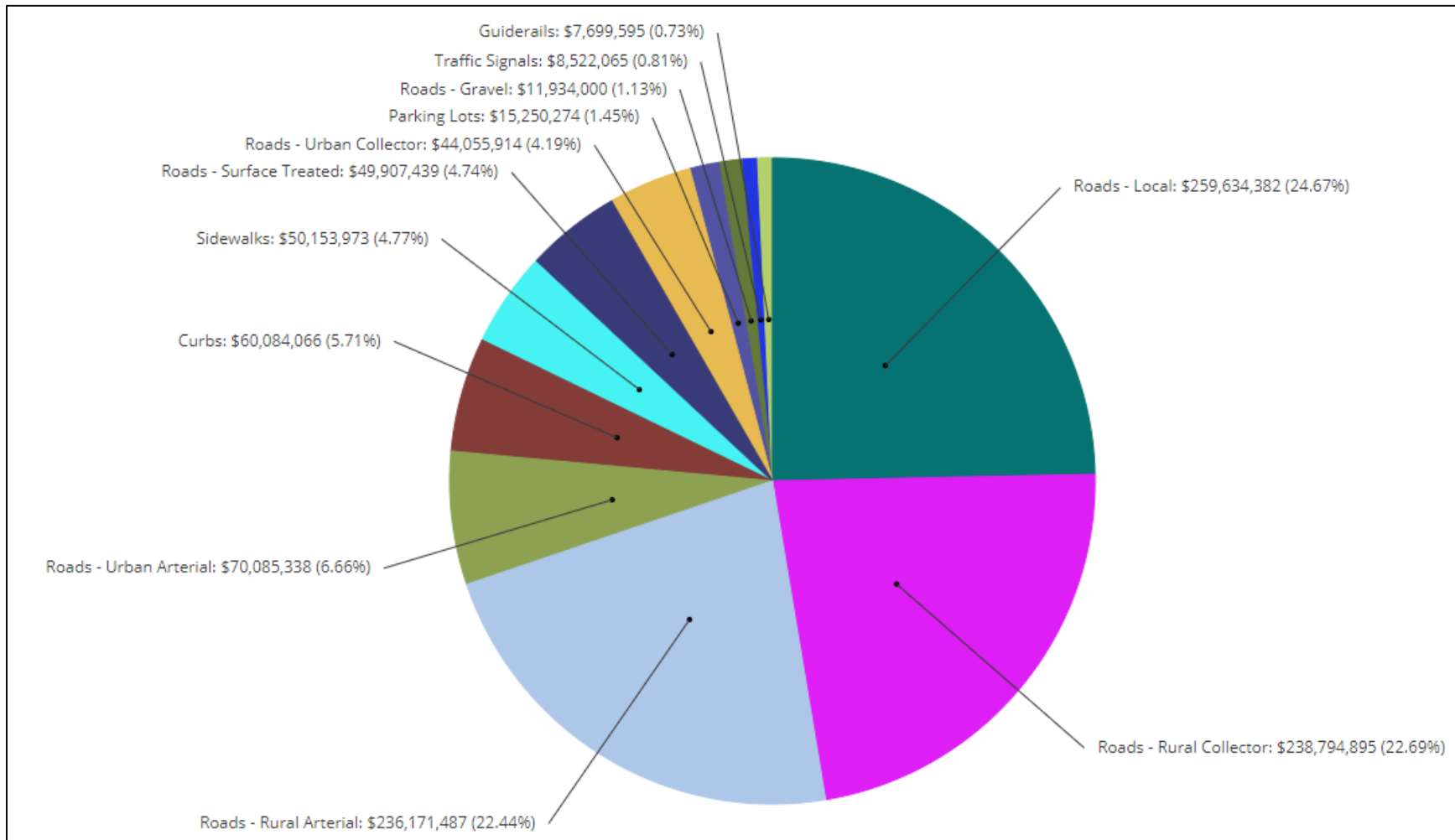
Table 5 illustrates key asset attributes for the municipality's road network, including quantities of various assets, their useful life, their replacement cost, and the valuation method by which the replacement costs were derived. In total, the municipality's roads assets are valued at \$1.05 billion based on 2017 replacement costs. The useful life indicated for each asset type below was assigned by the municipality.

Table 5 Key Asset Attributes – Road Network

Asset Type	Asset Component	Quantity	Useful Life (Years)	2017 Unit Replacement Cost	2017 Overall Replacement Cost
Road Network	Parking Lots	234,619.60m ²	20	\$65/m ²	\$15,250,274
	Curbs	572,229.20m	60	\$105/m	\$60,084,066
	Guiderails	42,415m	30	\$181.53m	\$7,699,595
	Sidewalks	557,266.37m ²	40	\$90/m ²	\$50,153,973
	Traffic Signals	127 units	17 - 28	\$2,570 - \$133,400/unit	\$8,522,065
	Roads - Gravel	11,395,800m ²	3	\$1.05/m ²	\$11,934,000
	Roads - Surface Treated	1,434,121.81m ²	18	\$34.80/m ²	\$49,907,439
	Roads - Local	3,735,746.43m ²	88	\$69.50/m ²	\$259,634,382
	Roads - Rural Arterial	3,373,878.38m ²	33	\$70/m ²	\$236,171,487
	Roads - Rural Collector	3,411,355.64m ²	38	\$70/m ²	\$238,794,895
	Roads - Urban Arterial	1,015,729.53m ²	28	\$69/m ²	\$70,085,338
	Roads - Urban Collector	638,491.50m ²	33	\$69/m ²	\$44,055,914
Total					\$1,052,293,428

Note: gravel roads are shown in the table above and Figure 11 to highlight the total valuation of owned assets. These assets are not included within the remaining figures in this section as they are perpetually maintained. A new layer of gravel is applied on all gravel road sections every 3 years with annual costs averaging \$3,978,000.

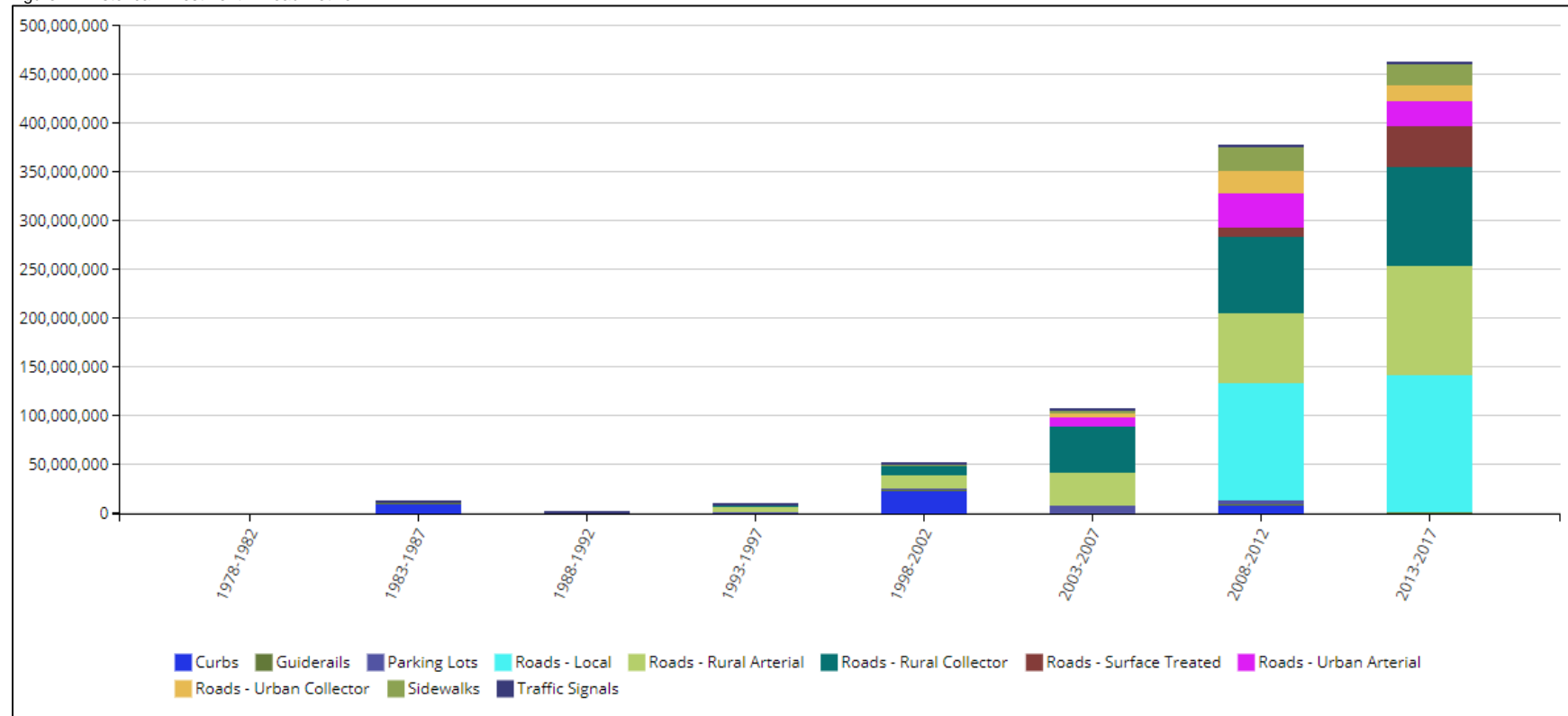
Figure 11 Asset Valuation – Road Network



1.2 Historical Investment in Infrastructure

Figure 12 shows the municipality’s historical investments in its road network since 1978. While observed condition data will provide superior accuracy in estimating replacement needs and should be incorporated into strategic plans, in the absence of such information, understanding past expenditure patterns and current useful life consumption levels (Section 1.3) can inform the forecasting and planning of infrastructure needs and in the development of a capital program. Using asset in-service date and 2017 replacement costs, Figure 12 illustrates the historical acquisitions made in this asset category. Note that this graph only includes the active asset inventory as of December 31, 2017. Infrastructure investments that have not been capitalized are not included in this graph.

Figure 12 Historical Investment – Road Network

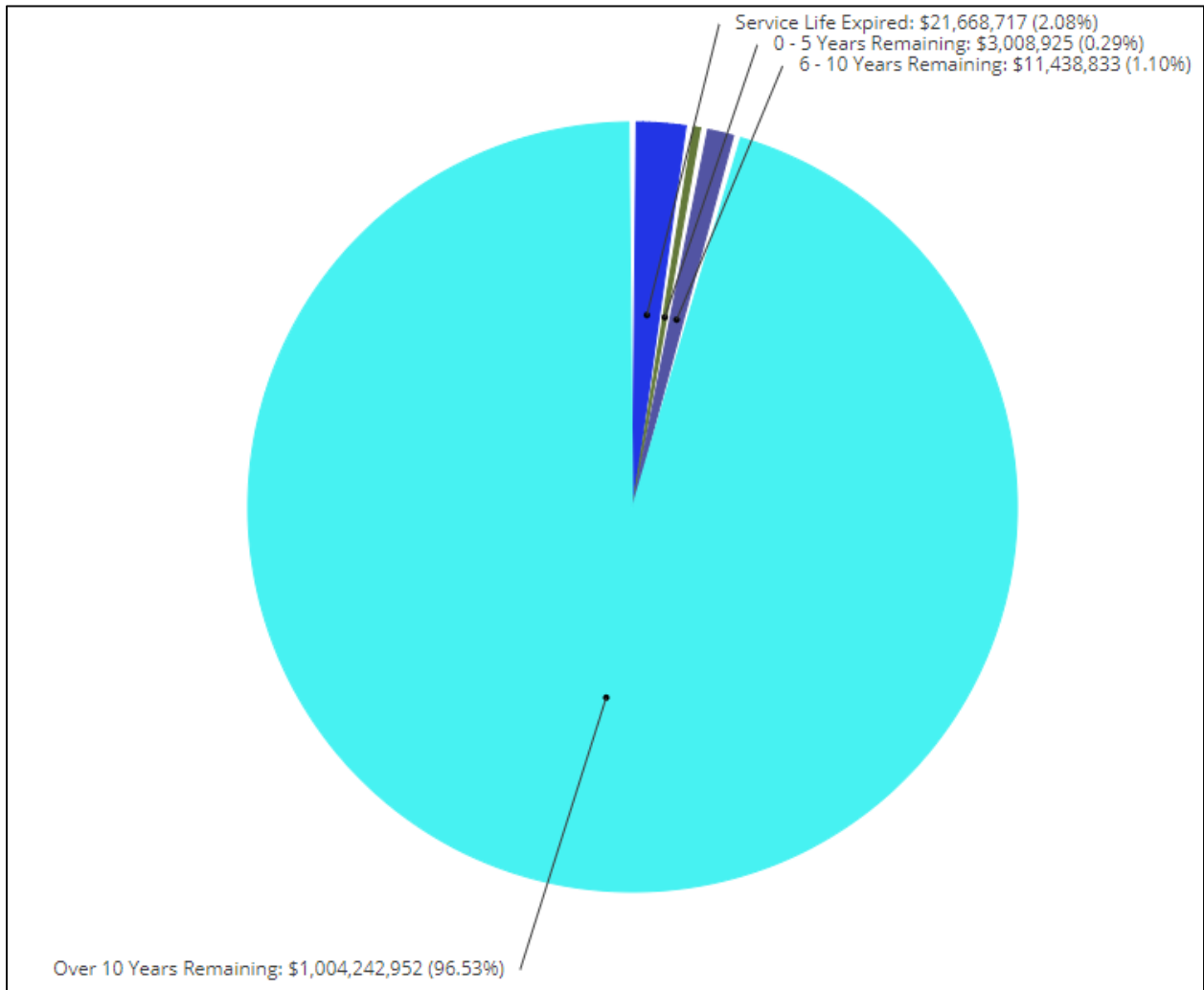


Investments in the municipality’s road network have grown since the 2000s with a large increase in the late 2000s. Between 2013 to 2017, the period of largest investment, \$460 million was invested with over \$214 million put into rural roads.

1.3 Useful Life Consumption

In conjunction with historical spending patterns and observed condition data, understanding the consumption rate of assets based on industry established useful life standards provides a more complete profile of the state of a community’s infrastructure. Figure 13 illustrates the useful life consumption levels as of 2017 for the municipality’s road network.

Figure 13 Useful Life Consumption - Road Network

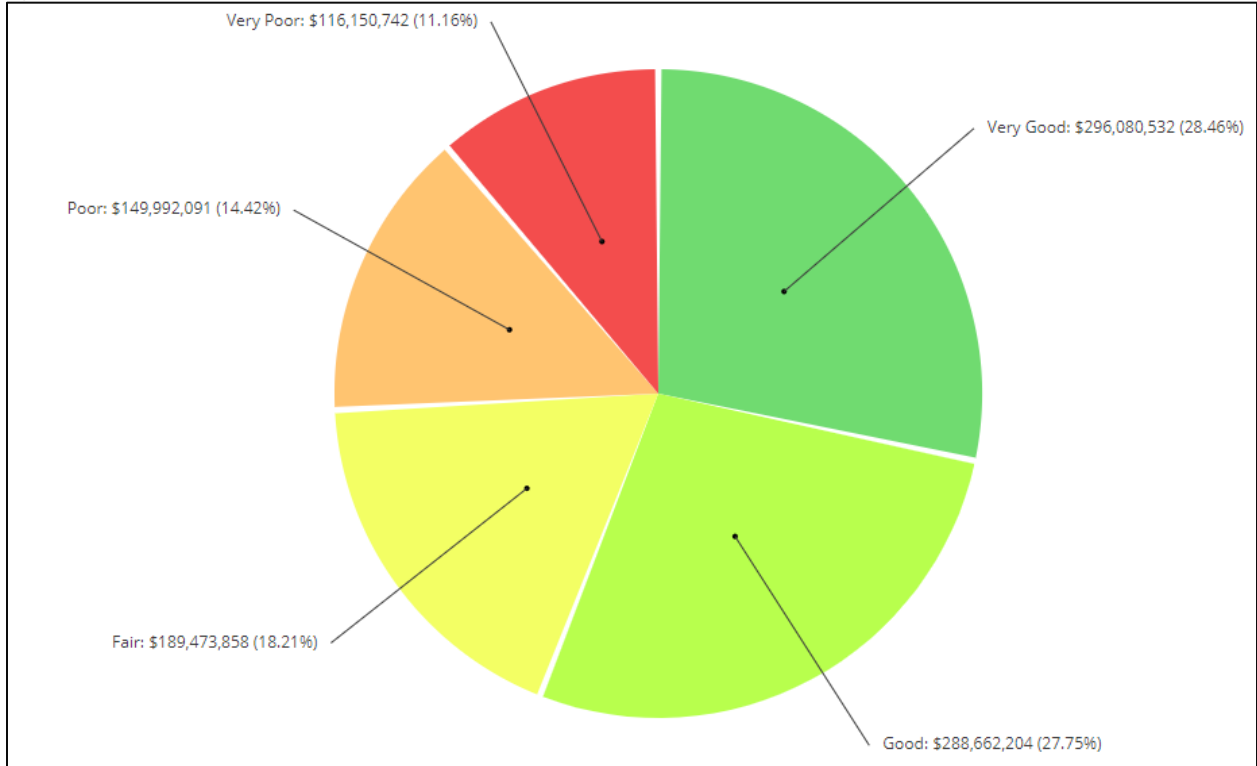


While almost all of the municipality’s road network has at least 10 years of useful life remaining, 2%, with a valuation of \$22 million, remain in operation beyond their useful life. An additional \$3 million will reach the end of their useful life within the next five years.

1.4 Current Asset Condition

Using replacement cost, in this section we summarize the condition of the municipality’s road network as of 2017. 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. The municipality has provided condition data for 100% of the road network except for curbs and traffic signals.

Figure 14 Asset Condition – Road Network (Primarily Assessed)

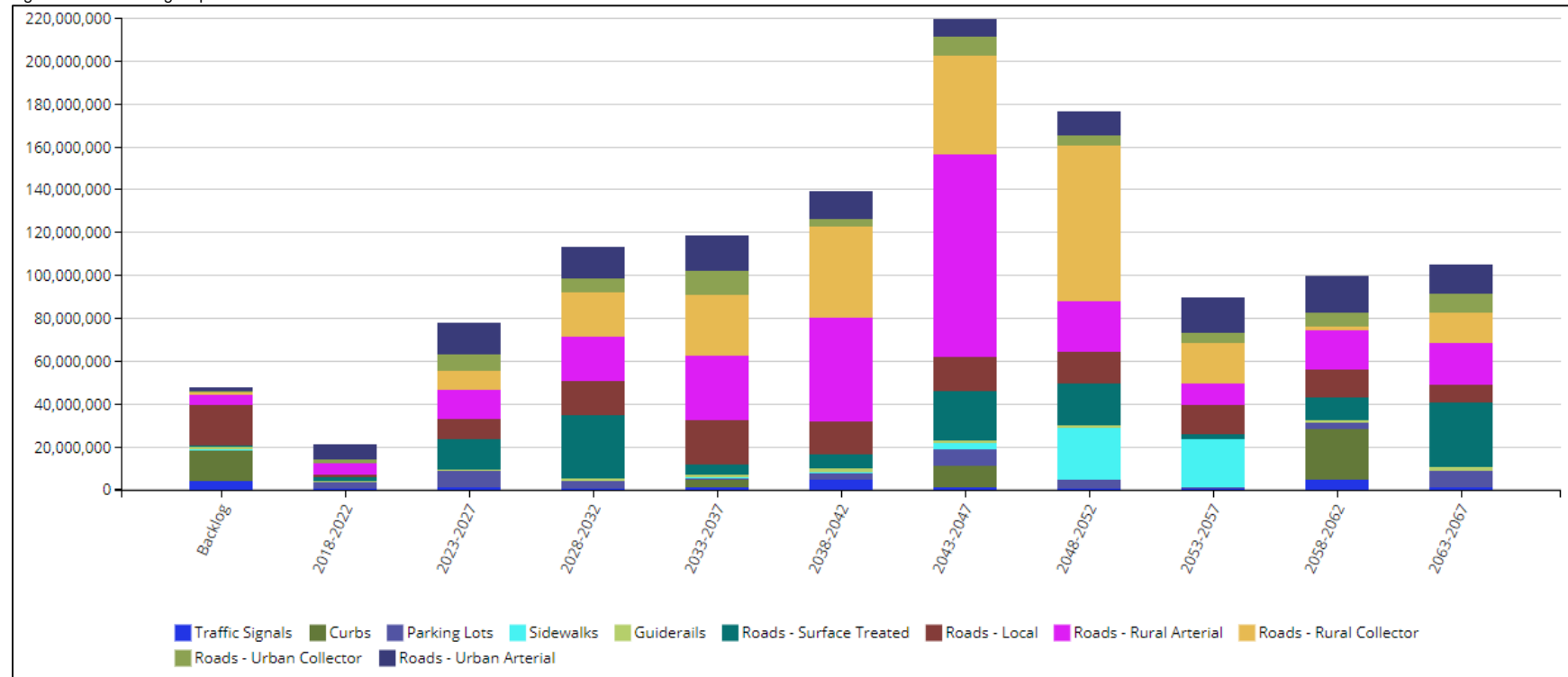


Based primarily on assessed condition data, 56% of assets, with a valuation of \$585 million are in good to very good condition; 26% are in poor to very poor condition.

1.5 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 15 Forecasting Replacement Needs – Road Network



In addition to a backlog of \$47 million, replacement needs are forecasted to be \$21 million in the next five years; an additional \$78 million is forecasted in replacement needs between 2023-2027. The municipality’s annual requirements for its road network (including gravel road maintenance) total \$30,677,000. At this funding level, the municipality would be allocating sufficient funds on an annual basis to meet replacement needs as they arise without the need for deferring projects and accruing annual infrastructure deficits. The municipality is currently allocating \$10,740,000, leaving an annual deficit of \$19,937,000. See the ‘Financial Strategy’ section for achieving a more optimal and sustainable funding level. Further, while fulfilling the annual requirements will position the municipality to meet its future replacement needs, injection of additional revenues will be needed to mitigate existing infrastructure backlogs.

1.6 Recommendations – Road Network

- Primarily assessed condition data indicates a backlog of \$47 million and significant 10-year replacement needs of \$99 million. The municipality should continue its condition assessments of its road network, and expand the program to incorporate all assets to more precisely estimate its actual financial requirements and field needs. See Section 2, ‘Condition Assessment Programs’ in the ‘Asset Management Strategies’ chapter.
- Preventative maintenance and rehabilitation events established and recommended by the condition assessment program should be integrated into lifecycle events in CityWide. If implemented, lifecycle events will ensure that the right activity is performed on the right asset at the right time to achieve the lowest total cost of ownership
- The data collected through condition assessment programs should be integrated into a risk management framework which will guide prioritization of the backlog as well as short, medium, and long term replacement needs. See Section 4, ‘Risk’ in the ‘Asset Management Strategies’ chapter for more information.
- In addition to the above, a tailored lifecycle activity framework should also be developed to promote standard lifecycle management of the road network as outlined further within the “Asset Management Strategy” section of this AMP.
- 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’.
- The municipality is funding 35% of its long-term requirements on an annual basis. See the ‘Financial Strategy’ section on how to achieve more sustainable funding levels.

2. Bridges & Culverts

2.1 Asset Portfolio: Quantity, Useful Life and Replacement Cost

Table 6 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 \$1 billion based on 2017 replacement costs. The useful life indicated for each asset type below was assigned by the municipality.

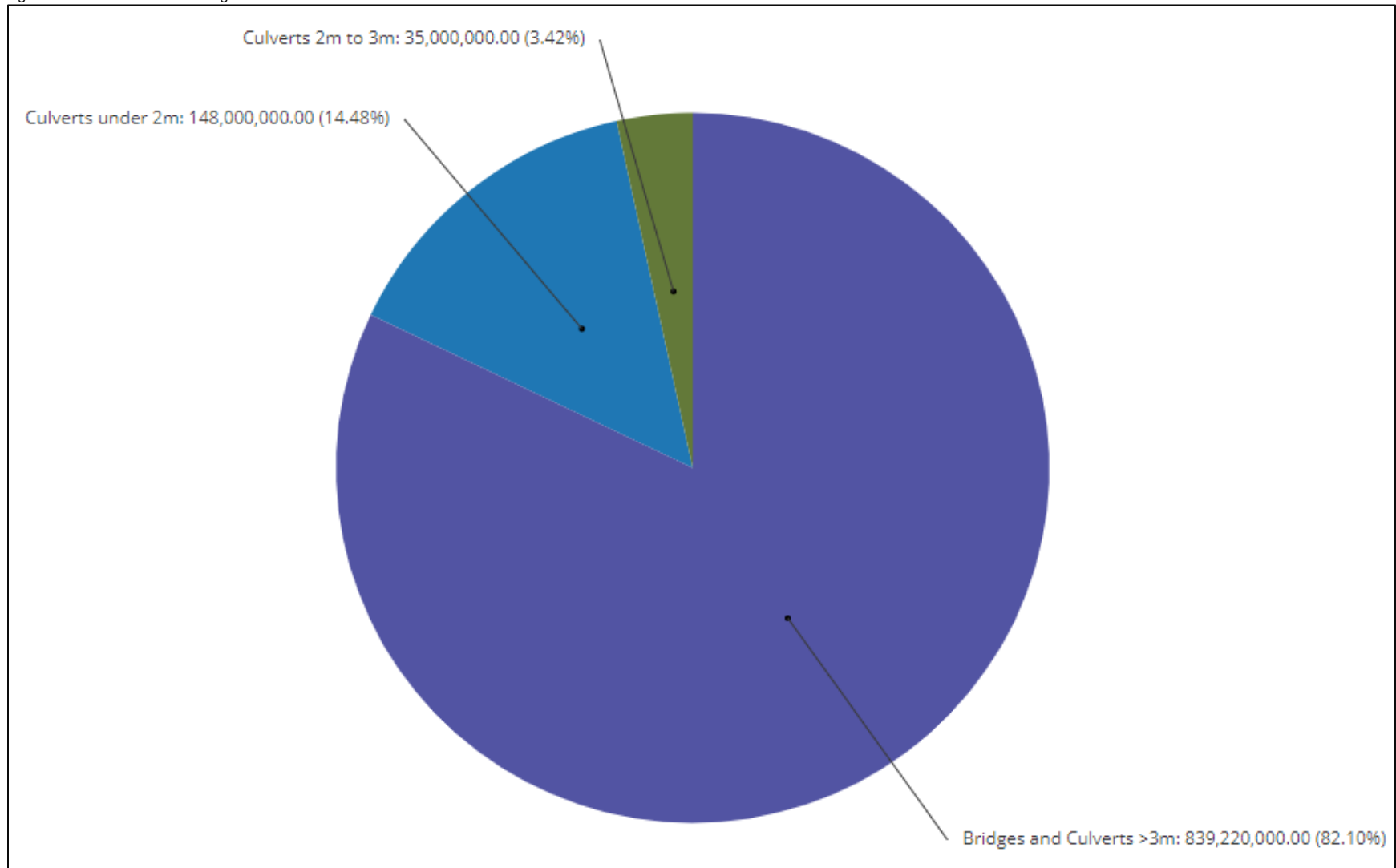
Table 6 Key Asset Attributes – Bridges & Culverts

Asset Type	Asset Component	Quantity	Useful Life (Years)	2017 Unit Replacement Cost	2017 Overall Replacement Cost
Bridges & Culverts	Culverts under 2m	18,500 units	50	\$8,000/unit	\$148,000,000
	Culverts 2m to 3m	500 units	35	\$70,000/unit	\$35,000,000
	Bridges & Culverts >3m	852 units	75	\$985,000/unit	\$839,220,000
Total					\$1,022,220,000

Note¹: culverts under 2m and culverts 2m to 3m are shown in the table above and Figure 16 to highlight the total valuation of owned assets. These assets are not included within the remaining figures in this section as they do not have sufficient data. However, these assets are accounted for within the annual requirements and financial strategy.

Note²: the 75-year useful life for bridges & culverts >3m includes at least one rehabilitation per bridge and regular annual maintenance.

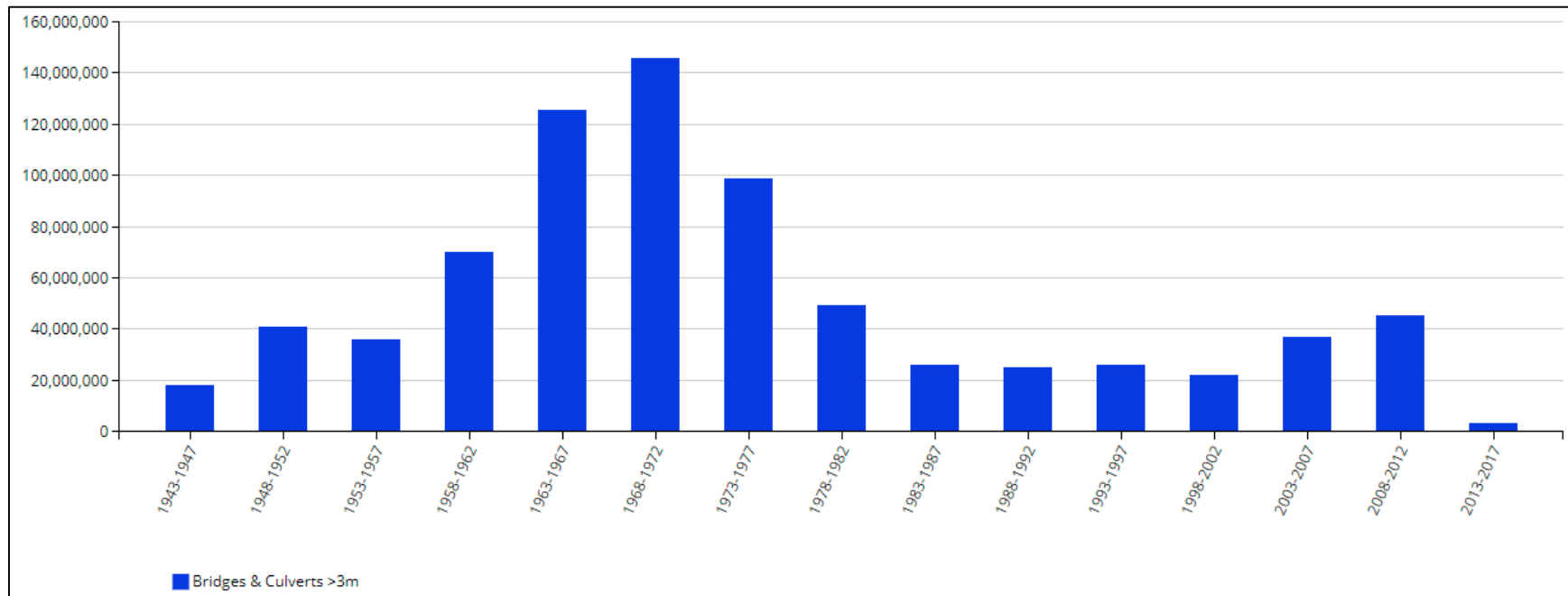
Figure 16 Asset Valuation – Bridges & Culverts



2.2 Historical Investment in Infrastructure

Figure 17 shows the municipality's historical investments in its bridges & culverts since 1940s. While observed condition data will provide superior accuracy in estimating replacement needs and should be incorporated into strategic plans, in the absence of such information, understanding past expenditure patterns and current useful life consumption levels (Section 2.3) can inform the forecasting and planning of infrastructure needs and in the development of a capital program. Using asset in-service date and 2017 replacement costs, Figure 17 illustrates the historical acquisitions made in bridges >3m since 1943. Note that this graph only includes the active asset inventory as of December 31, 2017. Bridge investments that have not been capitalized are not included in this graph.

Figure 17 Historical Investment – Bridges & Culverts

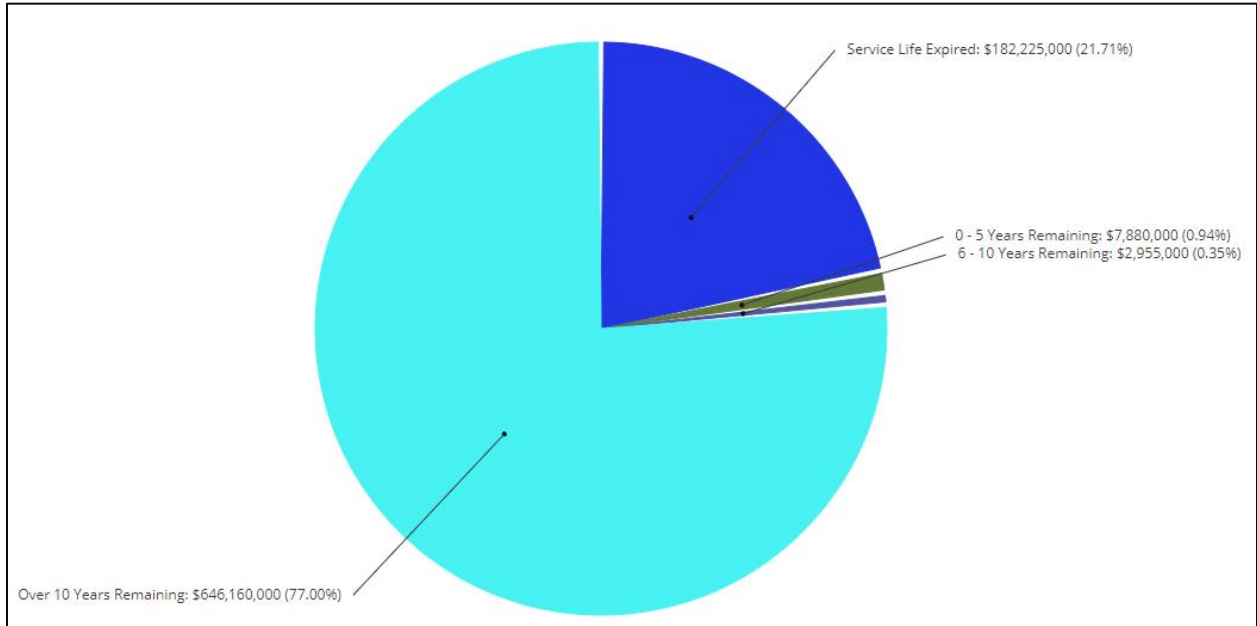


The municipality has invested sporadically in its bridges and culverts since 1940s. In the late 1960s and early 1970s, the period of largest investment, \$146 million put into bridges >3m.

2.3 Useful Life Consumption

In conjunction with historical spending patterns and observed condition data, understanding the consumption rate of assets based on industry established useful life standards provides a more complete profile of the state of a community’s infrastructure. Figure 18 illustrates the useful life consumption levels as of 2017 for the municipality’s bridges & culverts.

Figure 18 Useful Life Consumption – Bridges & Culverts

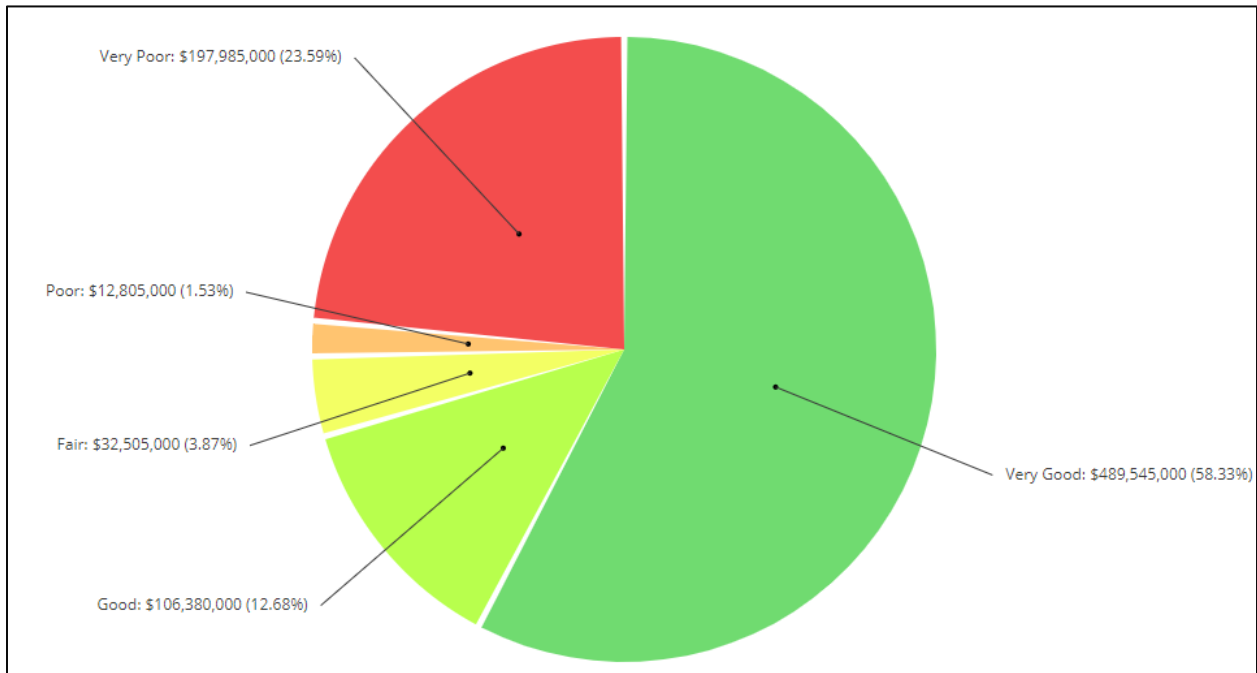


77% of the assets have at least 10 years of useful life remaining while 1%, with a valuation of \$7.9 million, will expire in the next 5 years.

2.4 Current Asset Condition

Using replacement cost, in this section we summarize the condition of the municipality’s bridges & culverts as of 2017. 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. All assets are based on assessed condition data.

Figure 19 Asset Condition – Bridges & Culverts (Assessed)

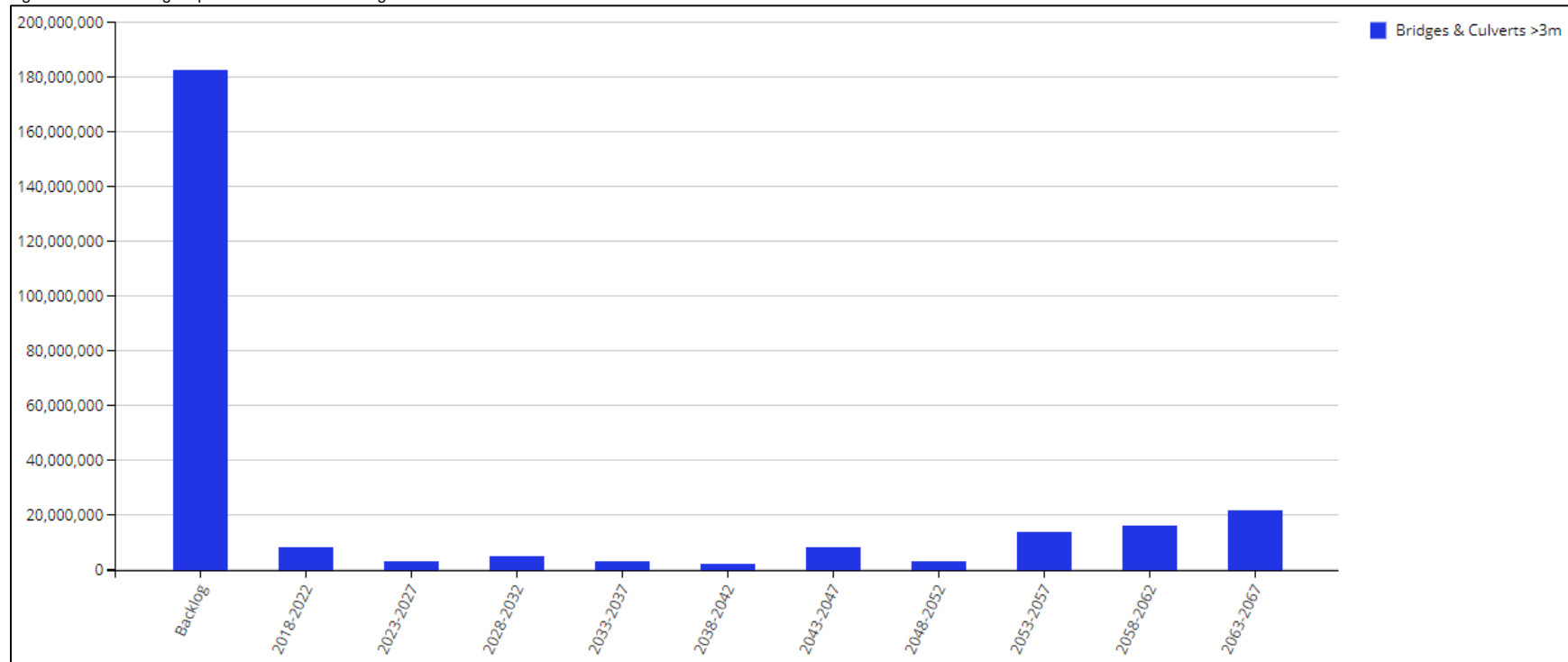


Assessed condition data indicates that while 71% of the municipality’s bridges & culverts are in good to very good condition, 25%, with a valuation of \$211 million, are in poor to very poor condition.

2.5 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 20 Forecasting Replacement Needs – Bridges & Culverts



In addition to a backlog of \$182 million, replacement needs will total \$2 million in the next five years; an additional \$3 million will be required between 2023 and 2027. The municipality’s annual requirements for its bridges & culverts total \$18,660,000. At this funding level, the municipality would be allocating sufficient funds on an annual basis to meet replacement needs as they arise without the need for deferring projects and accruing annual infrastructure deficits. The municipality is currently allocating \$15,859,000, leaving an annual deficit of \$2,801,000. See the ‘Financial Strategy’ section for achieving a more optimal and sustainable funding level. Further, while fulfilling the annual requirements will position the municipality to meet its future replacement needs, injection of additional revenues will be needed to mitigate existing infrastructure backlogs.

2.6 Recommendations – Bridges & Culverts

- Assessed condition data indicates a significant backlog of \$182 million and 10-year replacement needs of \$7.9 million. The results and recommendations from the OSIM inspections should be incorporated into the AMP analysis and used to generate the short-and long-term capital and maintenance budgets for the bridge and large culvert structures. See Section VIII, ‘Asset Management Strategies’.
- Preventative maintenance and rehabilitation events established and recommended by the OSIM condition study should be integrated into lifecycle events in CityWide. If implemented, lifecycle events will ensure that the right activity is performed on the right asset at the right time to achieve the lowest cost of ownership.
- Bridge & culvert structure key performance indicators should be established and tracked annually as part of an overall level of service model. See Section VII ‘Levels of Service’.
- The municipality is funding 85% of its long-term requirements on an annual basis. See the ‘Financial Strategy’ section on how to achieve more sustainable and optimal funding levels.

3. Municipal Airport

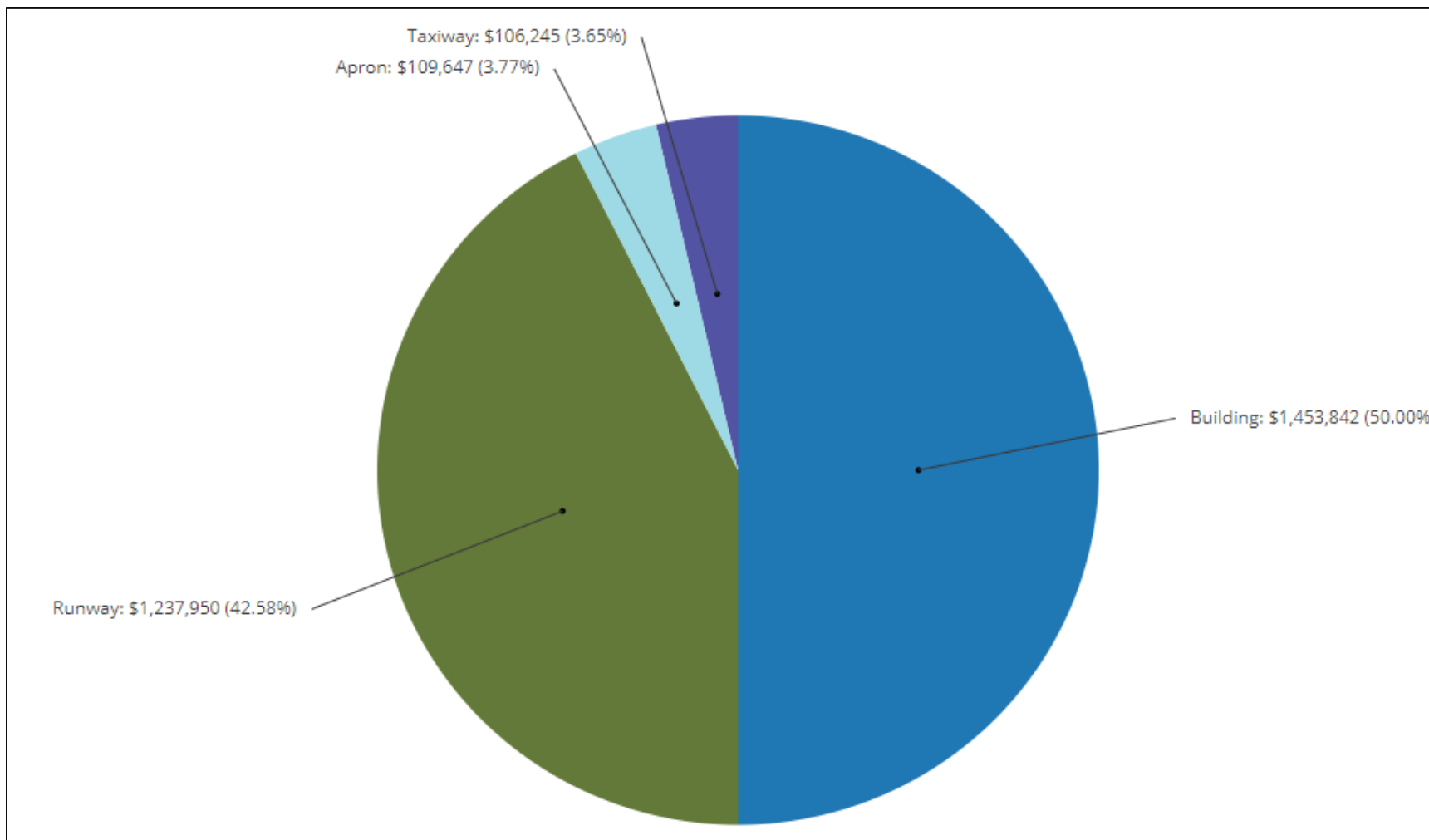
3.1 Asset Portfolio: Quantity, Useful Life and Replacement Cost

Table 8 illustrates key asset attributes for the municipality's airport, 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 airport assets are valued at \$3 million based on 2017 replacement costs. The useful life indicated for each asset type below was assigned by the municipality.

Table 7 Key Asset Attributes – Municipal Airport

Asset Type	Asset Component	Quantity	Useful Life (Years)	2017 Unit Replacement Cost	2017 Overall Replacement Cost
Municipal Airport	Building	1 unit	30	\$1,453,842 / unit	\$1,453,842
	Runway	412,650sq ft	30	\$3 / sq ft	\$1,237,950
	Taxiway	35,415sq ft	30	\$3 / sq ft	\$106,245
	Apron - Asphalt	25,369sq ft	30	\$3 / sq ft	\$76,107
	Apron - Concrete	11,180sq ft	30	\$3 / sq ft	\$33,540
					Total

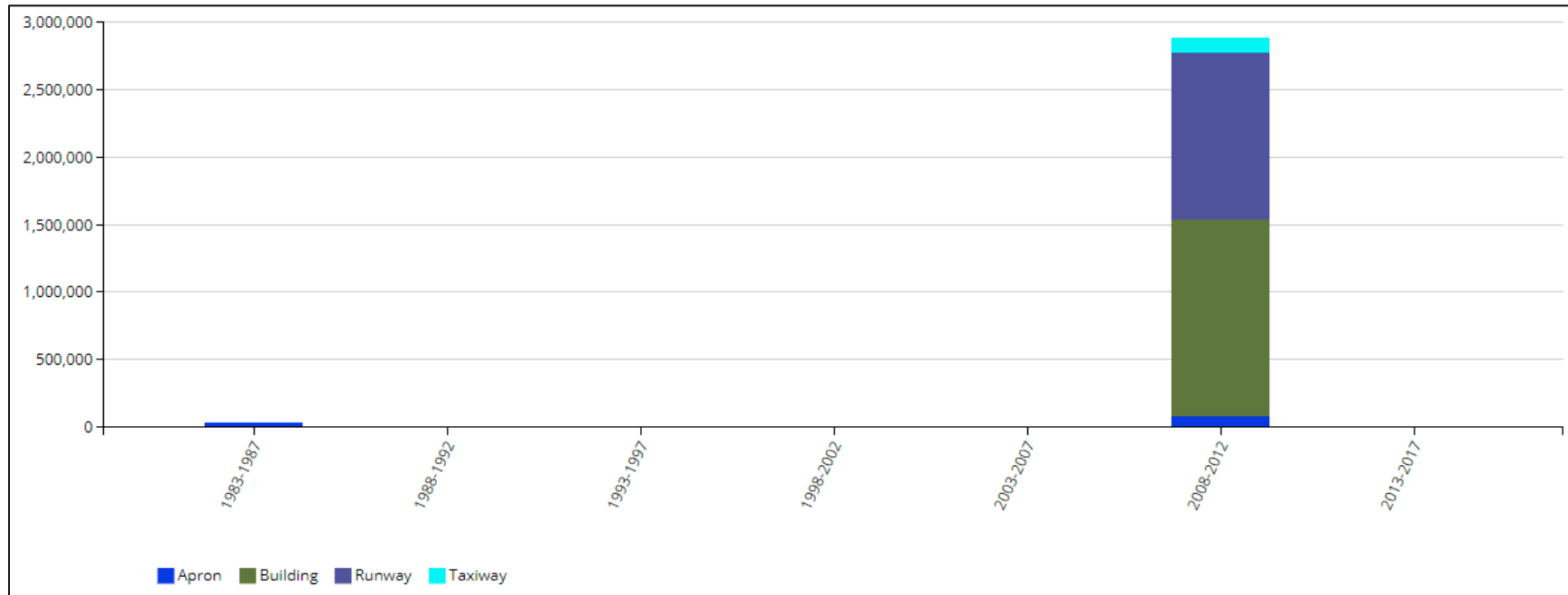
Figure 21 Asset Valuation – Municipal Airport



3.2 Historical Investment in Infrastructure

Figure 22 shows the municipality’s historical investments in its municipal airport since 1980s. While observed condition data will provide superior accuracy in estimating replacement needs and should be incorporated into strategic plans, in the absence of such information, understanding past expenditure patterns and current useful life consumption levels (Section 3.3) can inform the forecasting and planning of infrastructure needs and in the development of a capital program. Using asset in-service date and 2017 replacement costs, Figure 22 illustrates the historical acquisitions made on the Municipal Airport since 1983. Note that this graph only includes the active asset inventory as of December 31, 2017. Infrastructure investments that have not been capitalized are not included in this graph.

Figure 22 Historical Investment – Municipal Airport

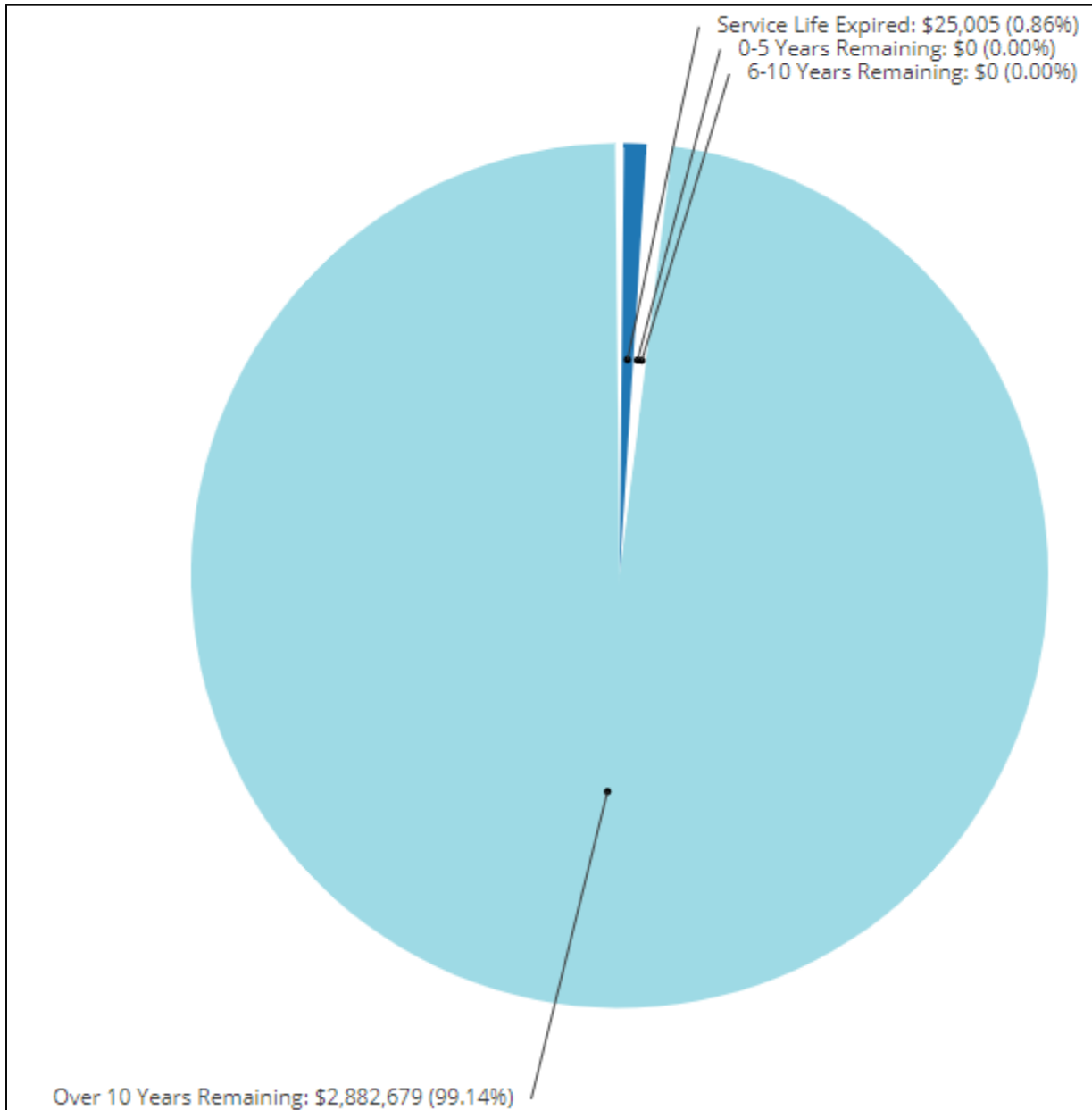


Investments in the municipal airport started in the early 1980s with no other investments being made until the late 2000s. In 2010, the period of largest investment, \$2.9 million was invested in the municipal airport.

3.3 Useful Life Consumption

In conjunction with historical spending patterns and observed condition data, understanding the consumption rate of assets based on industry established useful life standards provides a more complete profile of the state of a community's infrastructure. Figure 23 illustrates the useful life consumption levels as of 2017 for the municipality's airport.

Figure 23 Useful Life Consumption – Municipal Airport

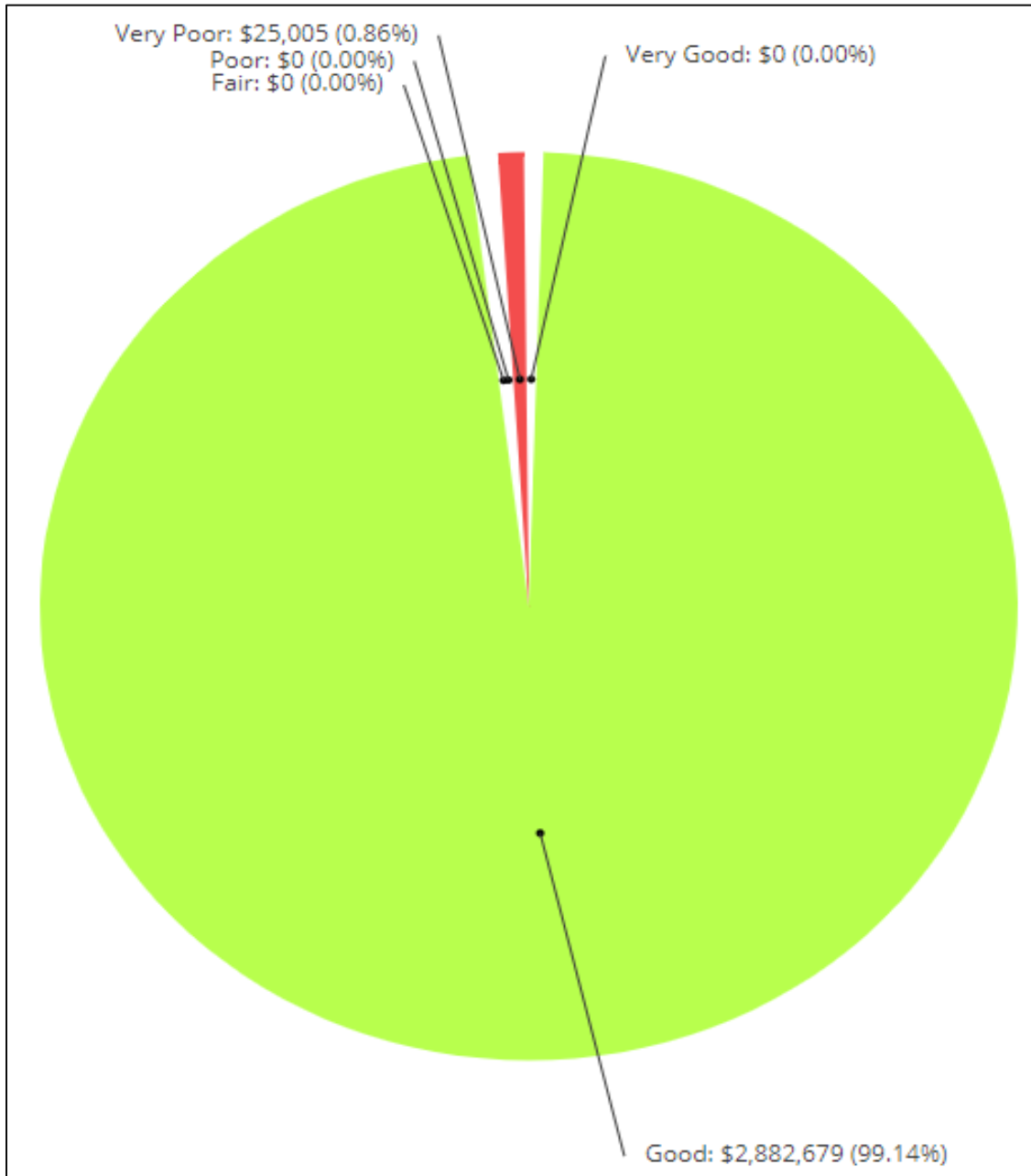


Virtually all municipal airport assets have at least 10 years of useful life remaining.

3.4 Current Asset Condition

Using replacement cost, in this section we summarize the condition of the municipality's airport. 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. The municipality has not provided condition data for its airport assets.

Figure 24 Asset Condition – Municipal Airport (Age-Based)

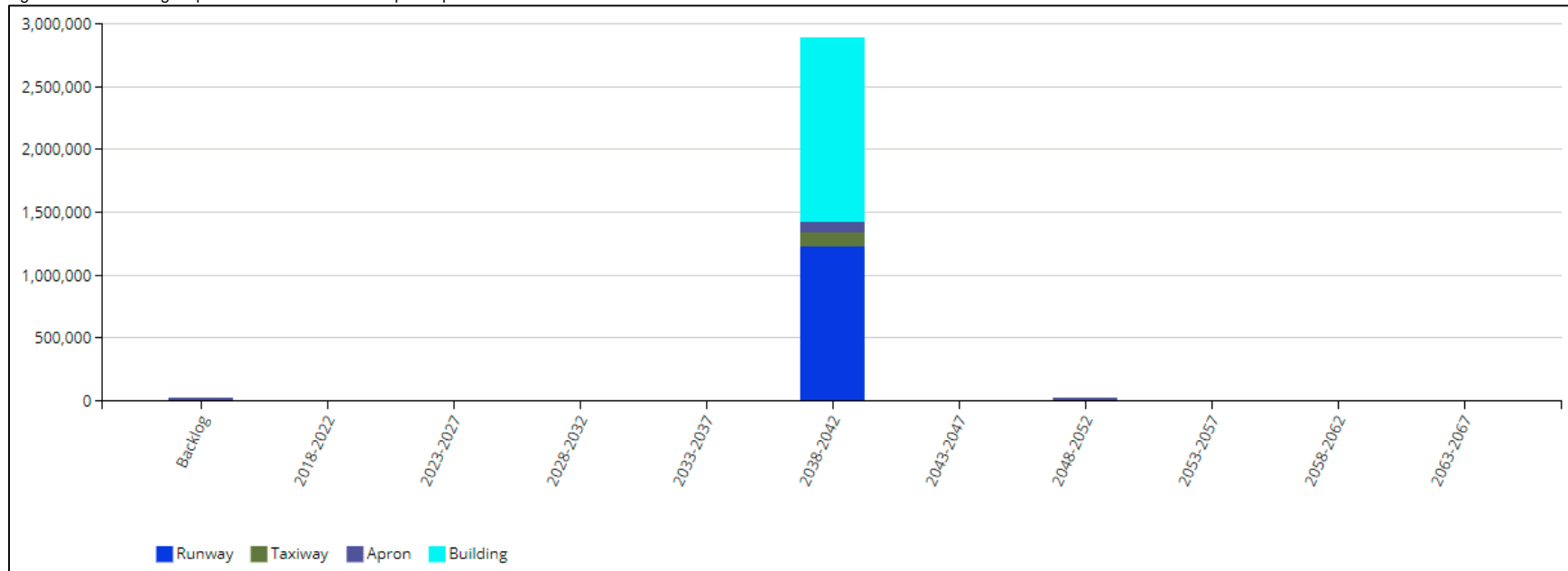


Based on age-based data, almost all assets are in good to very good condition with less than 1% in very poor condition.

3.5 Forecasting Replacement Needs

In this section, we illustrate the short-, medium- and long-term infrastructure spending requirements (replacement only) for the municipality’s airport 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 25 Forecasting Replacement Needs – Municipal Airport



Age-based condition data shows minimal backlog of \$25,000. The municipality’s annual requirements for its airport total \$97,000. At this funding level, the municipality would be allocating sufficient funds on an annual basis to meet replacement needs as they arise without the need for deferring projects and accruing annual infrastructure deficits. The municipality is currently allocating \$10,000 funding towards this asset category leaving an annual deficit of \$87,000. Municipal Airport assets are funded on a per-need basis. See the ‘Financial Strategy’ section for achieving a more optimal and sustainable funding level.

3.6 Recommendations – Municipal Airport

- Age based data shows a minimal backlog of \$25,000. The municipality should implement a condition assessment program of its airport to precisely estimate its financial requirements and field needs. See Section 2, ‘Condition Assessment Programs’ in the ‘Asset Management Strategies’ chapter.
- In addition to the above, a tailored lifecycle activity framework should be developed to promote standard lifecycle management of the municipal airport as outlined further within the “Asset Management Strategy” section of this AMP.
- Airport key performance indicators should be established and tracked annually as part of an overall level of service model. See Section VII ‘Levels of Service’.
- The municipality should assess its short-, medium- and long-term capital, and operations and maintenance needs.
- An appropriate percentage of the replacement costs should then be allocated for the municipality’s O&M requirements.
- The municipality is funding 10% of its long-term requirements on an annual basis. See the ‘Financial Strategy’ section on how to achieve more sustainable and optimal funding levels.

4. Transit

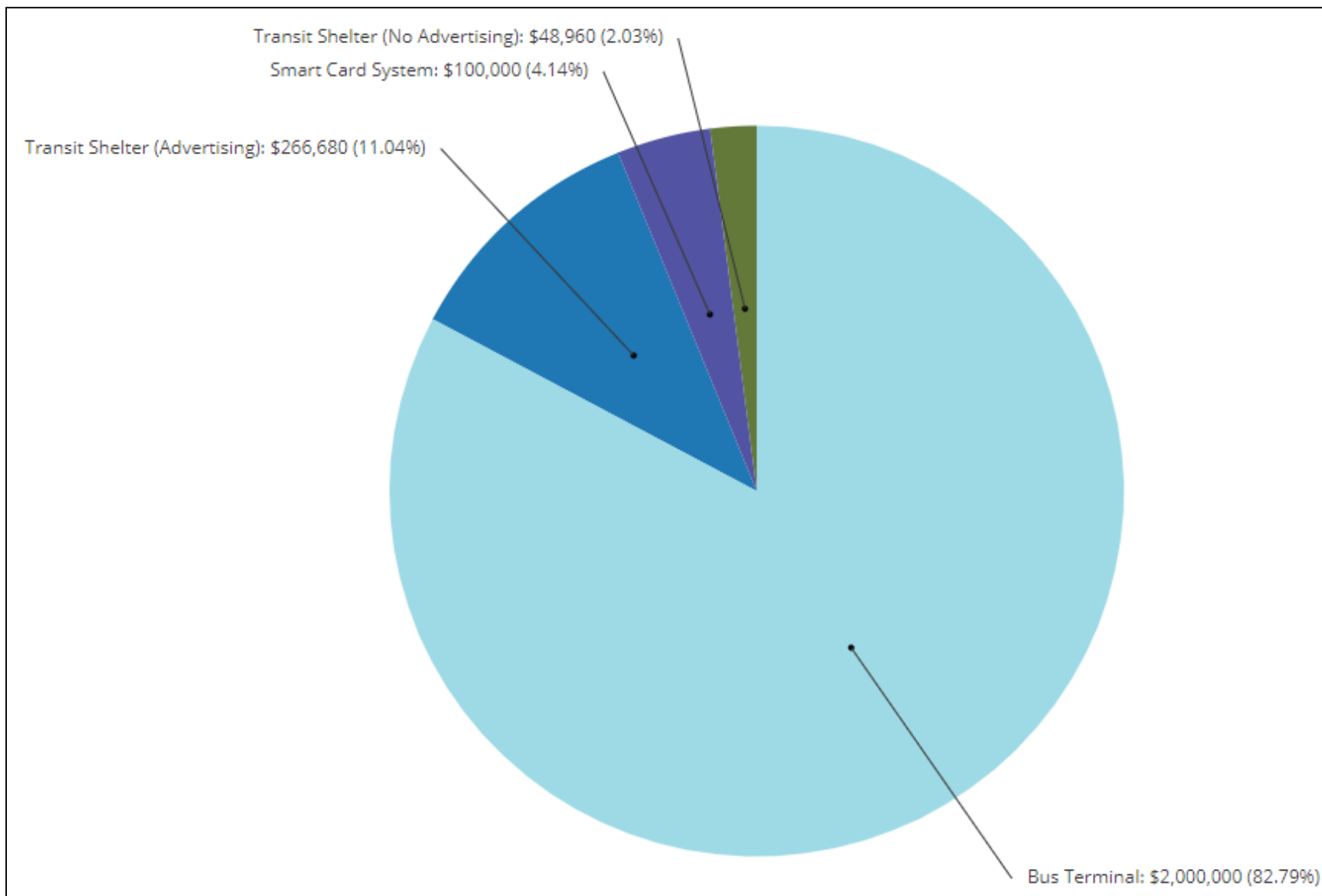
4.1 Asset Portfolio: Quantity, Useful Life and Replacement Cost

Table 8 illustrates key asset attributes for the municipality's transit portfolio, 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 transit assets are valued at \$2 million based on 2017 replacement costs. The useful life indicated for each asset type below was assigned by the municipality.

Table 8 Asset Inventory – Transit

Asset Type	Asset Component	Quantity	Useful Life (Years)	2017 Unit Replacement Cost	2017 Overall Replacement Cost
Transit	Transit Shelter (Advertising)	25 units	25	\$10,390 - \$12,700 / unit	\$266,680
	Transit Shelter (No Advertising)	6 units	25	\$8,160 / unit	\$48,960
	Smart Card System	1 unit	10	\$100,000 / unit	\$100,000
	Bus Terminal	1 unit	30	\$2,000,000 / unit	\$2,000,000
Total					\$2,415,640

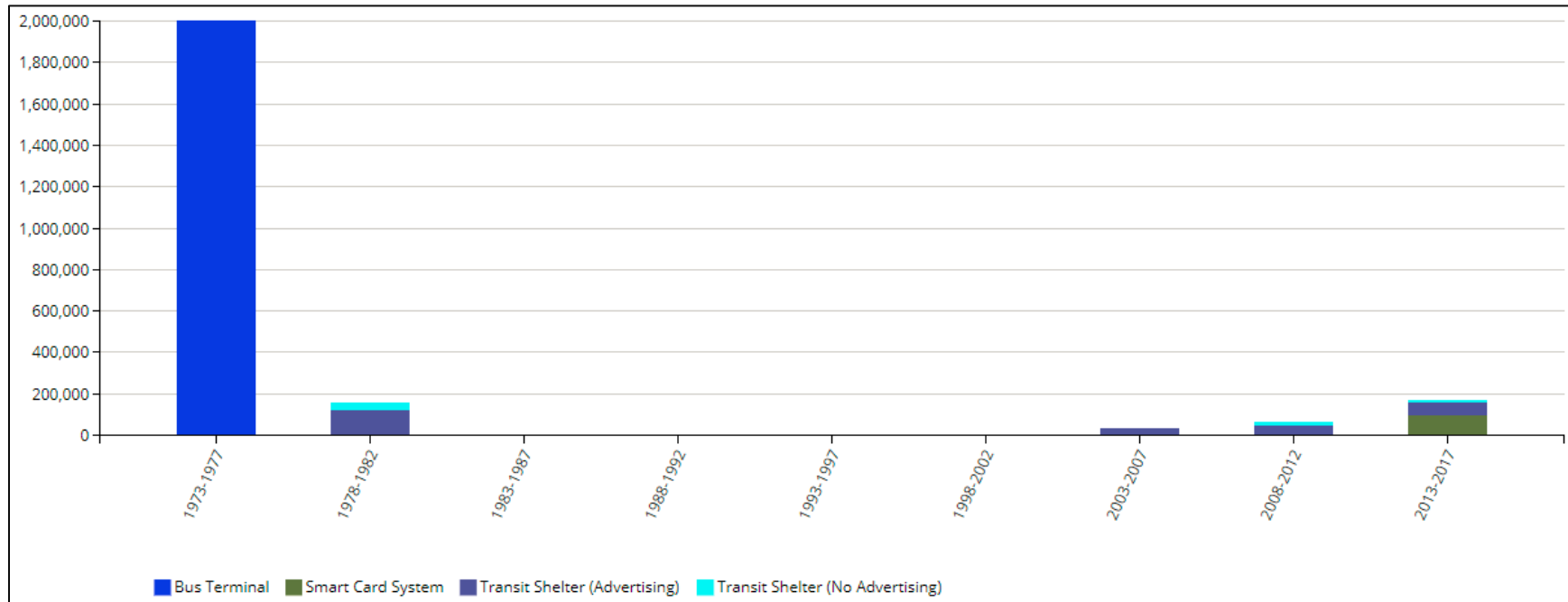
Figure 26 Asset Valuation – Transit



4.2 Historical Investment in Infrastructure

Figure 27 shows the municipality’s historical investments in its transit since 1970s. While observed condition data will provide superior accuracy in estimating replacement needs and should be incorporated into strategic plans, in the absence of such information, understanding past expenditure patterns and current useful life consumption levels (Section 4.3) can inform the forecasting and planning of infrastructure needs and in the development of a capital program. Note that this graph only includes the active asset inventory as of December 31, 2017.

Figure 27 Historical Investment – Transit

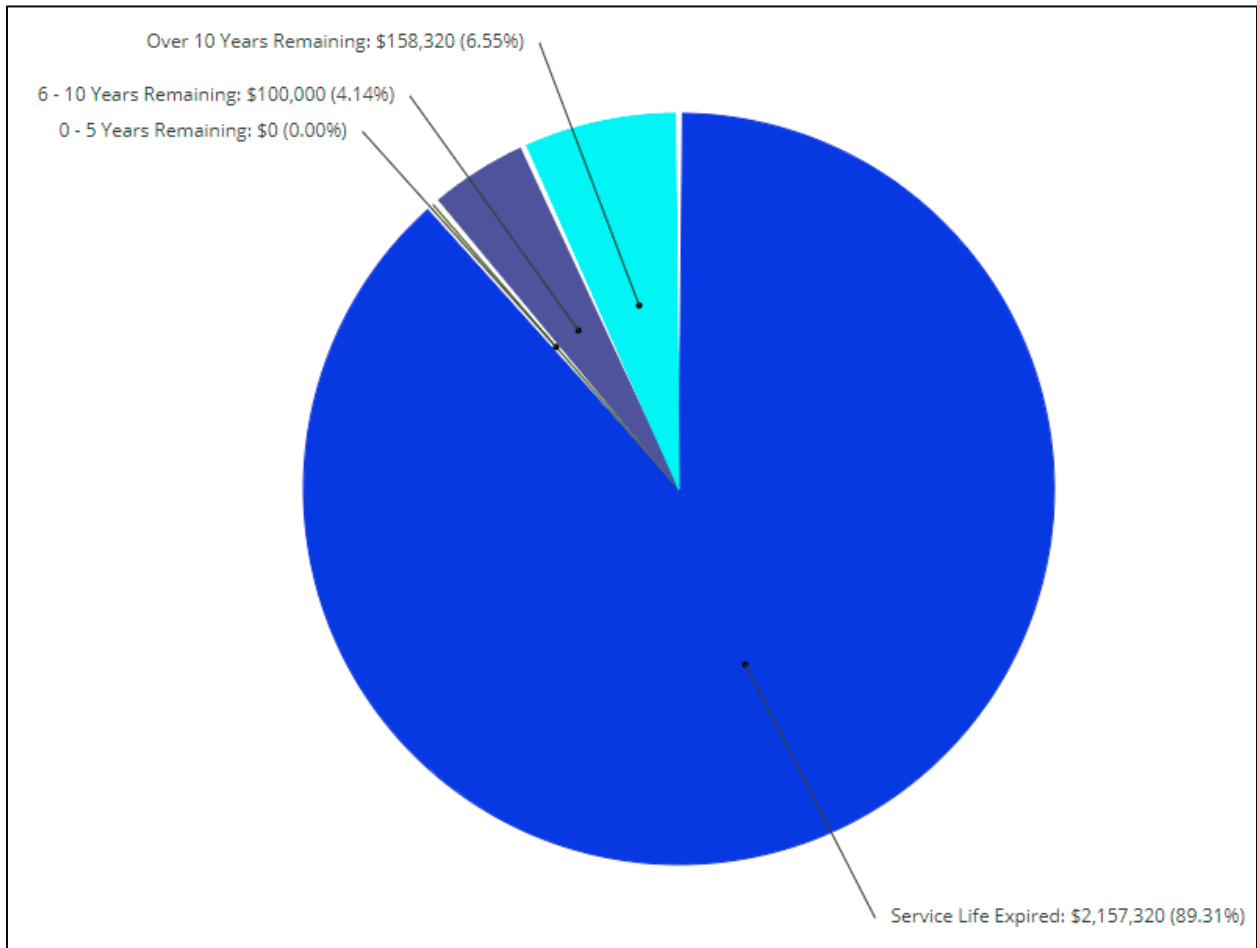


Major investments into the municipality’s transit services began in the early 1970s. Investments then fluctuated with no major investments being made until early 2010s.

4.3 Useful Life Consumption

In conjunction with historical spending patterns and observed condition data, understanding the consumption rate of assets based on industry established useful life standards provides a more complete profile of the state of a community’s infrastructure. Figure 28 illustrates the useful life consumption levels as of 2017 for the municipality’s transit system.

Figure 28 Useful Life Consumption – Transit

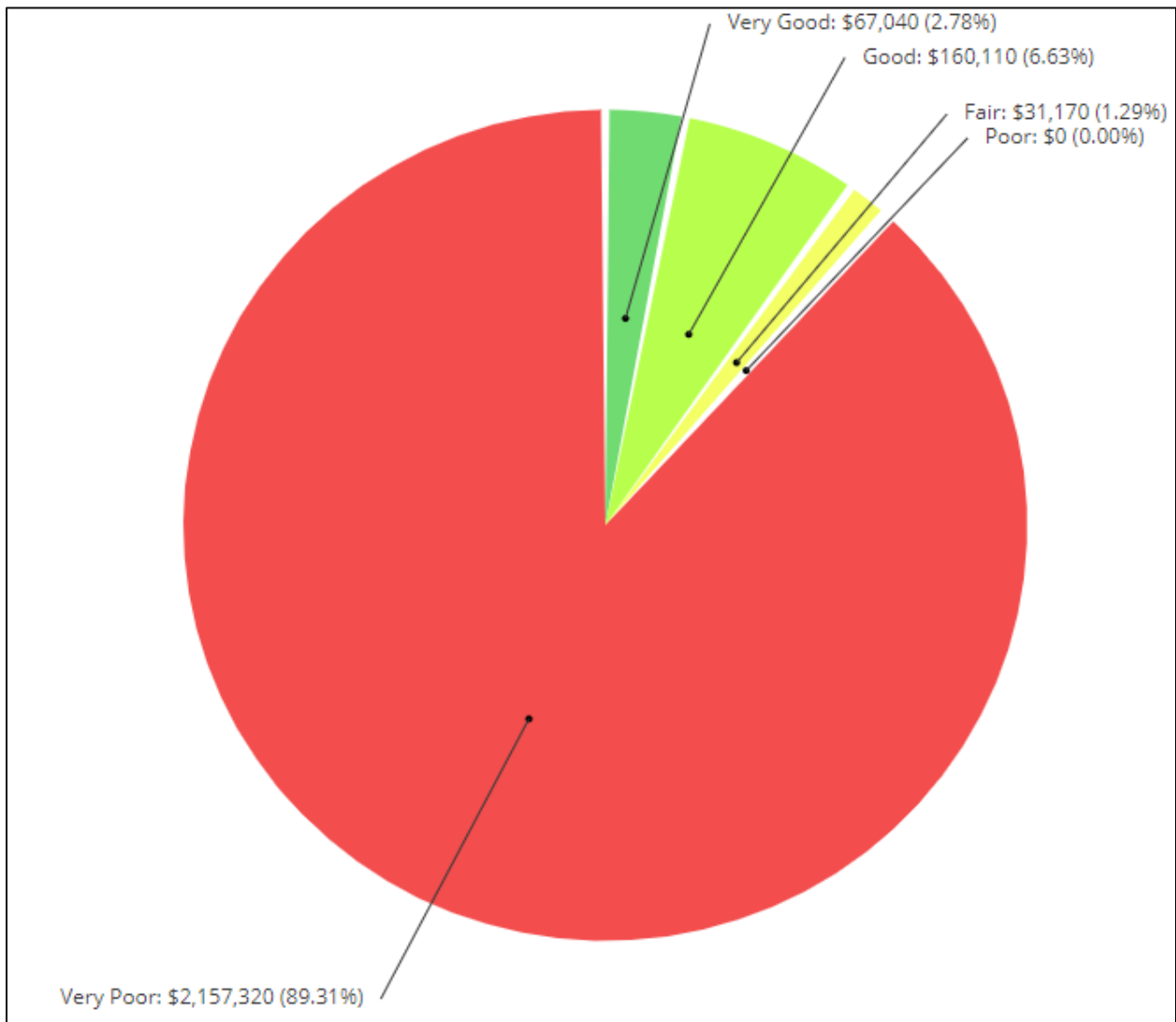


Approximately 89% of assets with a value of \$2.2 million are in service past useful life. The remaining 7% have over 10 years of useful life remaining.

4.4 Current Asset Condition

Using replacement cost, in this section we summarize the condition of the municipality’s transit services as of 2017. 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. The municipality has not provided condition data for all transit assets.

Figure 29 Asset Condition – Transit (Age-Based)

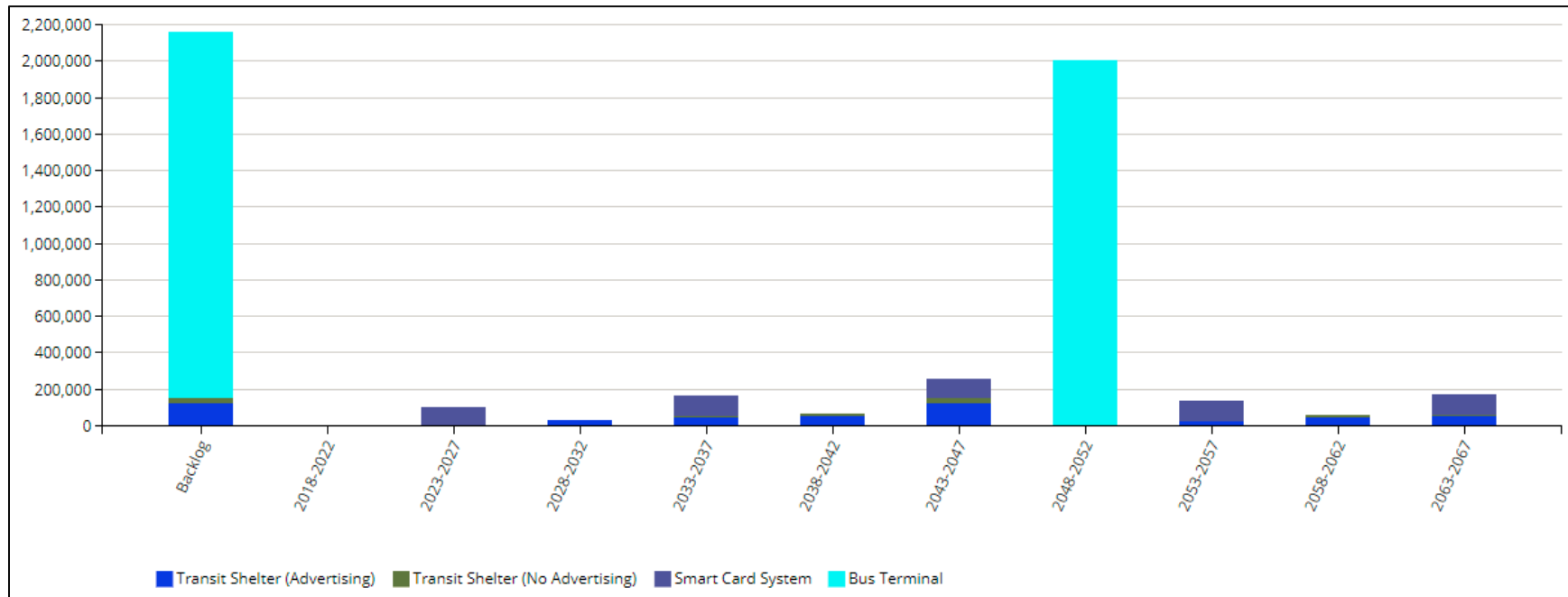


Age-based data indicates that 89% of the assets are in poor to very poor condition, while 9%, with a valuation of \$227,000, are in good to very good condition.

4.5 Forecasting Replacement Needs

In this section, we illustrate the short-, medium- and long-term infrastructure spending requirements (replacement only) for the municipality’s transit system 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 30 Forecasting Replacement Needs – Transit



Age-based data indicates a backlog of \$2.2 million in replacement needs. The municipality’s annual requirements for its transit assets total \$89,000. At this level, funding would be sustainable and replacement needs could be met as they arise without the need for deferring projects. The municipality is currently allocating \$5,000 of funding towards this asset category leaving an annual deficit of \$84,000. See the ‘Financial Strategy’ section for achieving a more optimal and sustainable funding level.

4.6 Recommendations – Transit

- Age-based data shows a backlog of \$2.2 million and. The municipality should implement a condition assessment program of its transit assets to precisely estimate its financial requirements and field needs. See Section 2, ‘Condition Assessment Programs’ in the ‘Asset Management Strategies’ chapter.
- In addition to the above, a tailored lifecycle activity framework should be developed to promote standard lifecycle management of the transit system as outlined further within the “Asset Management Strategy” section of this AMP.
- Transit system key performance indicators should be established and tracked annually as part of an overall level of service model. See Section VII ‘Levels of Service’.
- 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.
- The municipality is funding 6% of its long-term requirements on an annual basis. See the ‘Financial Strategy’ section on how to achieve more sustainable and optimal funding levels.

5. Storm Network

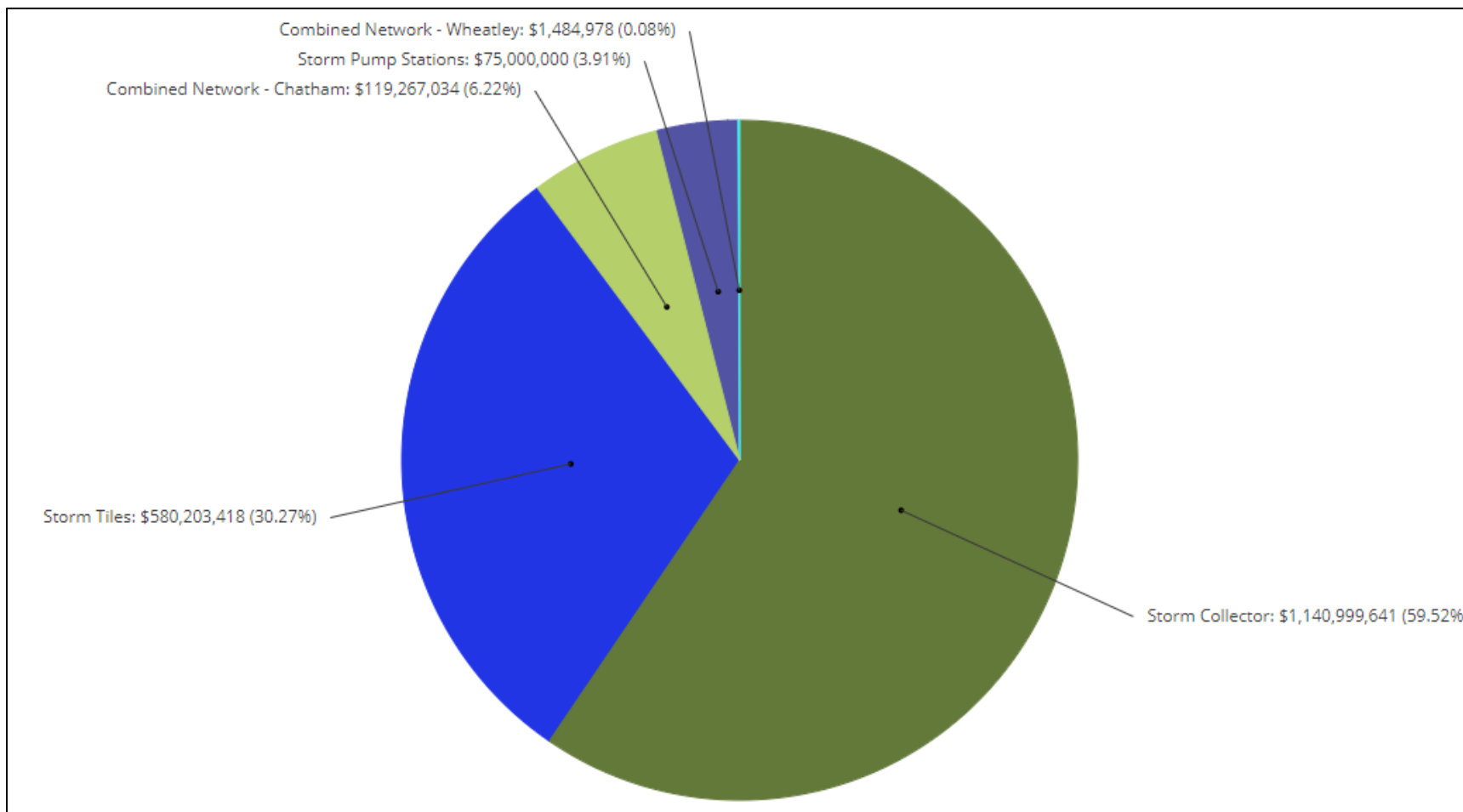
5.1 Asset Portfolio: Quantity, Useful Life and Replacement Cost

Table 9 illustrates key asset attributes for the municipality's storm network, 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 storm network assets are valued at \$1.9 billion based on 2017 replacement costs. The useful life indicated for each asset type below was assigned by the municipality.

Table 9 Asset Inventory – Storm Network

Asset Type	Asset Component	Quantity	Useful Life in Years	2017 Unit Replacement Cost	2017 Replacement Cost
Storm Network	Combined Network – Chatham (under 500mm)	48,041.06m	100	\$2,367.19/m	\$113,722,317
	Combined Network – Chatham (500mm-1000mm)	784.85m	100	\$2,367.19/m	\$1,857,889
	Combined Network – Chatham (over 1000mm)	106.90m	100	\$2,367.19/m	\$253,053
	Combined Network – Chatham (unknown diameter)	1,450.57m	100	\$2,367.19/m	\$3,433,775
	Combined Network – Wheatley (200mm)	18.52m	100	\$2,367.19/m	\$43,840
	Combined Network – Wheatley (750mm)	94.38m	100	\$2,367.19/m	\$223,415
	Combined Network – Wheatley (800mm)	514.41m	100	\$2,367.19/m	\$1,217,723
	Storm Collector (under 500mm)	253,613.66m	100	\$2,625/m	\$665,735,859
	Storm Collector (500mm-1000mm)	124,074.76m	100	\$2,625/m	\$325,696,245
	Storm Collector (over 1000mm)	38,392.47m	100	\$2,625/m	\$100,780,232
	Storm Collector (unknown diameter)	18,585.64m	100	\$2,625/m	\$48,787,305
	Storm Tiles	364,907.81m	100	\$1,590/m	\$580,203,418
	Storm Pump Stations	30 units	40	\$2,500,000/unit	\$75,000,000
Total					\$1,916,955,071

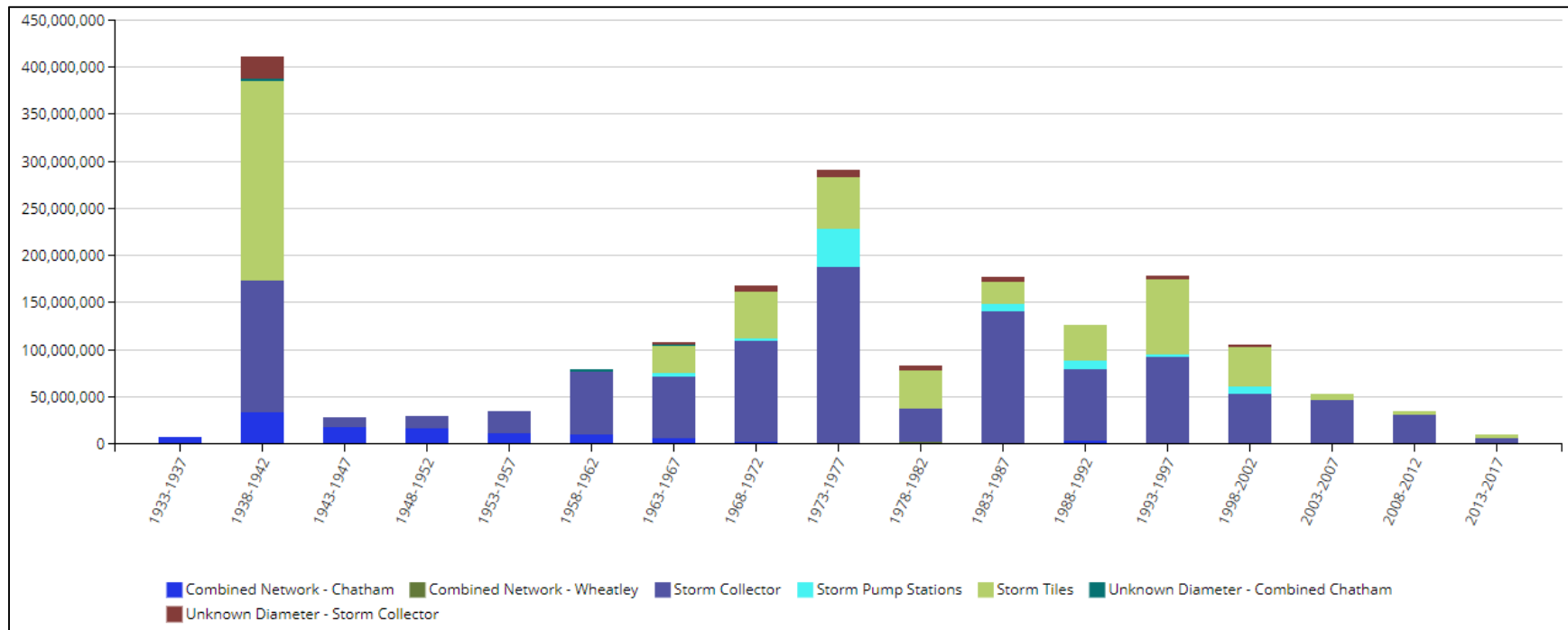
Figure 31 Asset Valuation – Storm Network



5.2 Historical Investment in Infrastructure

Figure 32 shows the municipality’s historical investments in its combine storm network since 1933. While observed condition data will provide superior accuracy in estimating replacement needs and should be incorporated into strategic plans, in the absence of such information, understanding past expenditure patterns and current useful life consumption levels (Section 5.3) can inform the forecasting and planning of infrastructure needs and in the development of a capital program. Note that this graph only includes the active asset inventory as of December 31, 2017.

Figure 32 Historical Investment – Storm Network

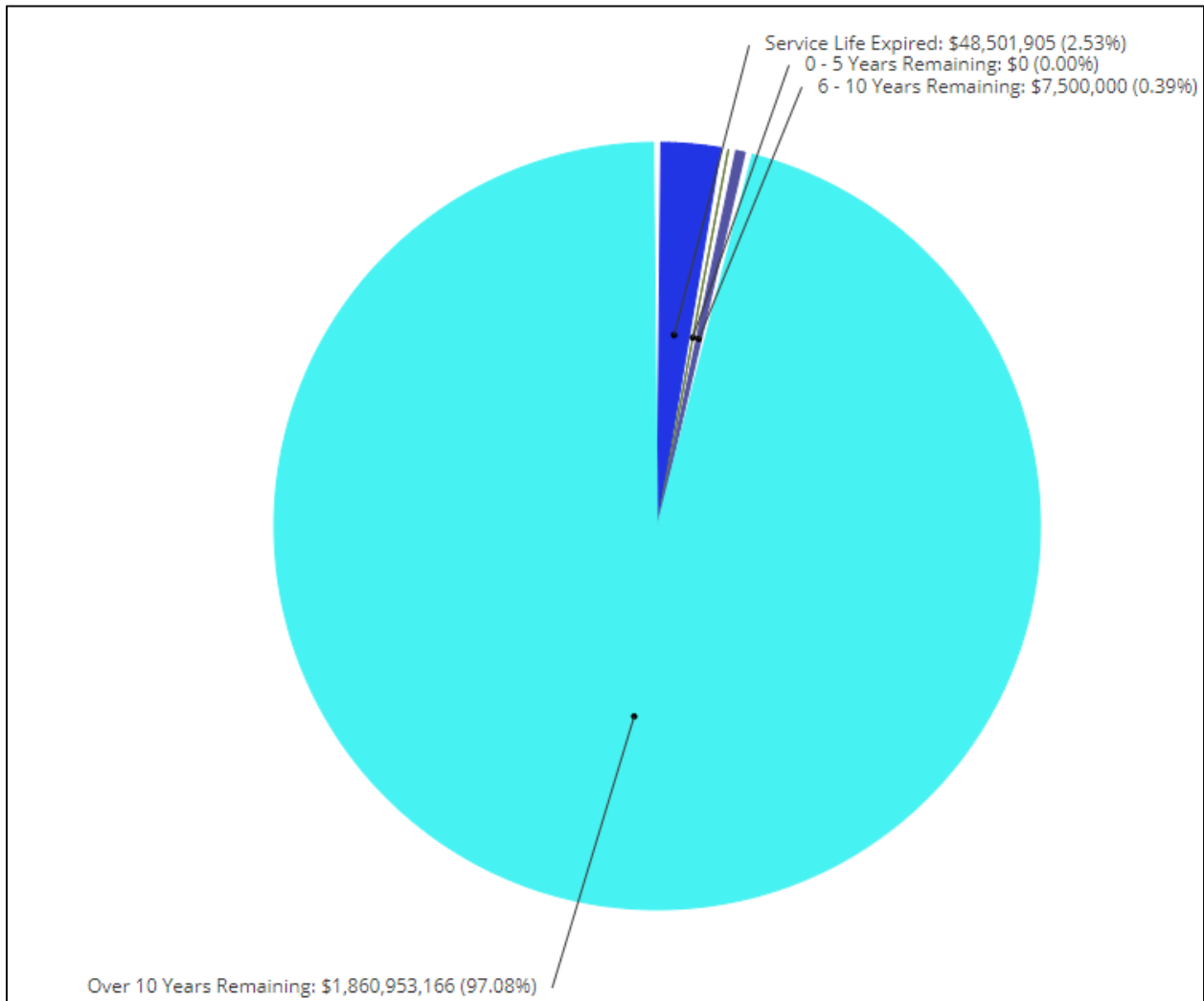


The combined storm network was installed before 1930 with the largest investment taking place in the 1970s with a valuation of \$42 million with a focus on storm pump stations.

5.3 Useful Life Consumption

In conjunction with historical spending patterns and observed condition data, understanding the consumption rate of assets based on industry established useful life standards provides a more complete profile of the state of a community’s infrastructure. Figure 33 illustrates the useful life consumption levels as of 2017 for the municipality’s storm assets.

Figure 33 Useful Life Consumption – Storm Network

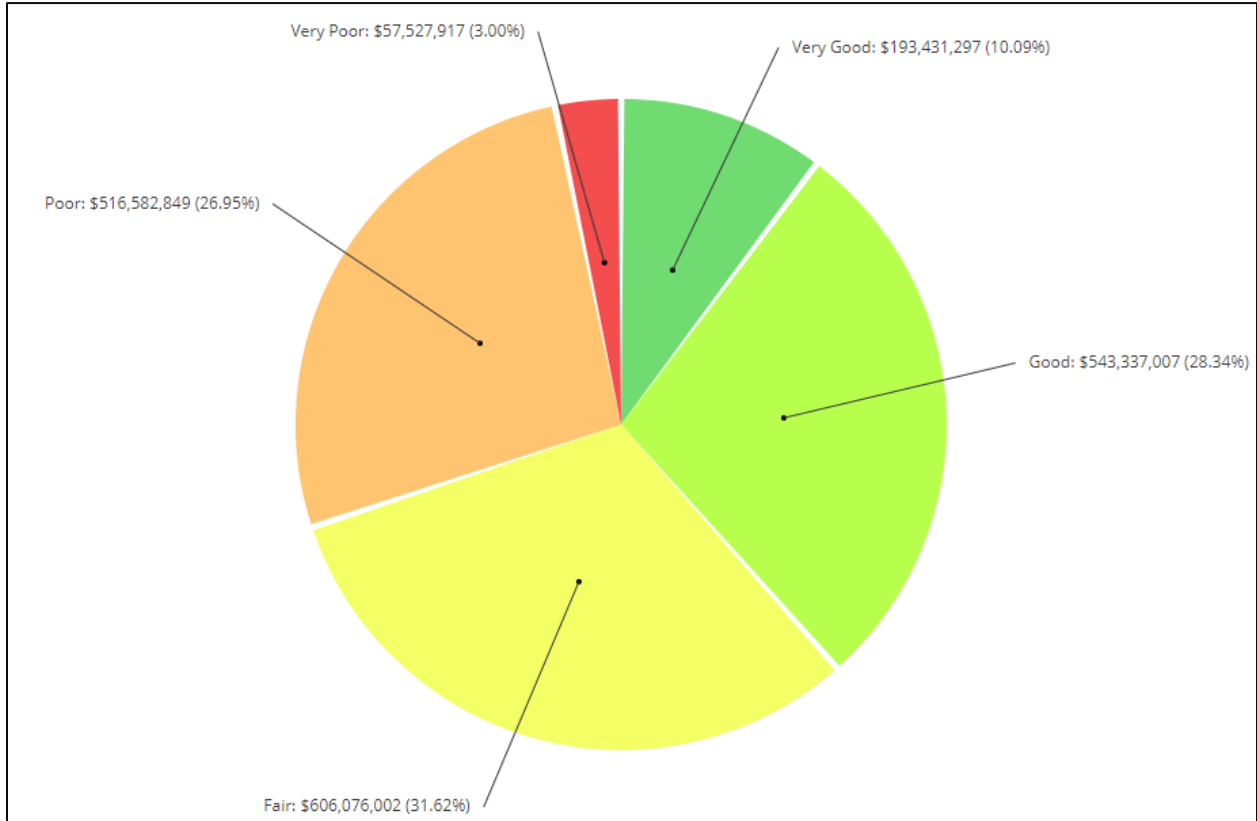


97% of the assets have at least 10 years of useful life remaining while 3%, with a valuation of \$49 million, remain in operation beyond their useful life.

5.4 Current Asset Condition

Using replacement cost, in this section we summarize the condition of the municipality’s storm 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. The municipality has not provided condition data for its storm network assets.

Figure 34 Asset Condition – Storm Network (Age-based)

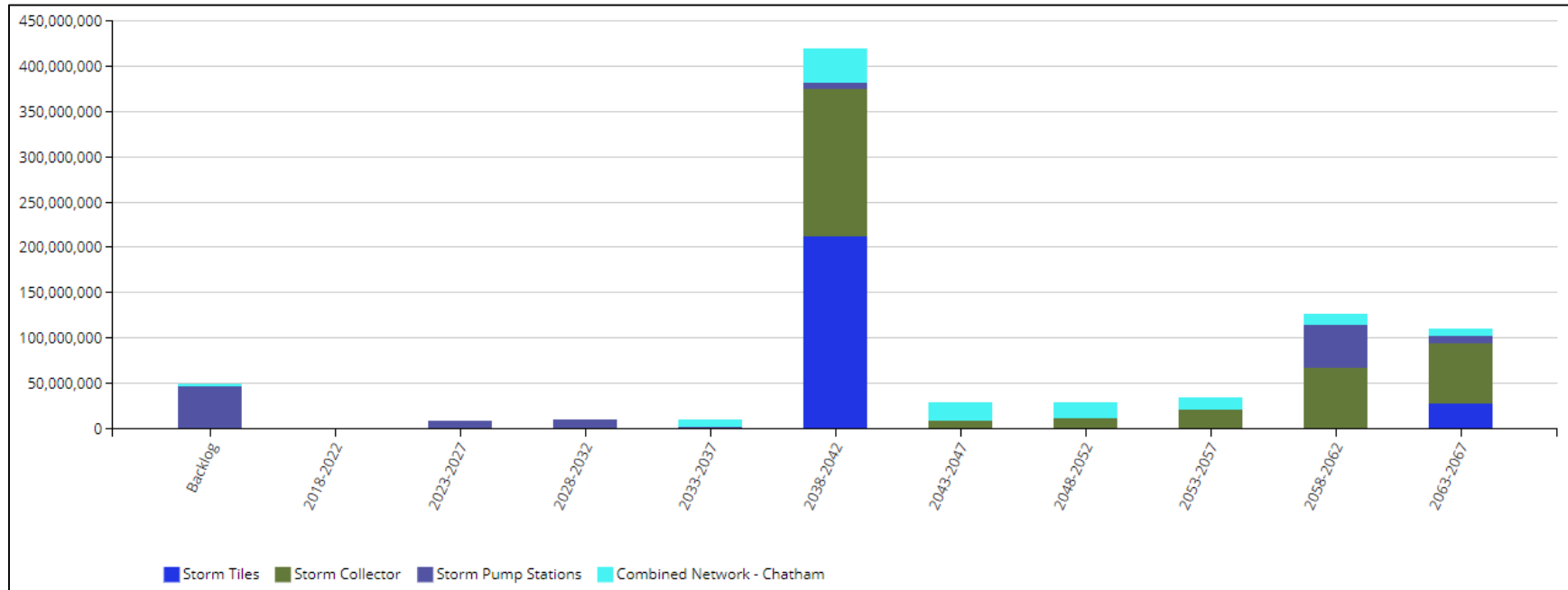


Based on age data, 30% of the storm network assets with a valuation of \$574 million are in poor to very poor condition.

5.5 Forecasting Replacement Needs

In this section, we illustrate the short-, medium- and long-term infrastructure spending requirements (replacement only) for the municipality’s storm 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 35 Forecasting Replacement Needs – Storm Network



Age-based data shows a backlog of \$49 million and no additional replacement needs in the next five years. An additional \$7.5 million will be required between 2023-2027. The municipality’s annual requirements for storm assets total \$20,295,000. At this funding level, the municipality would be allocating sufficient funds on an annual basis to meet replacement needs as they arise without the need for deferring projects and accruing annual infrastructure deficits. The municipality is currently allocating \$2,009,000 towards this asset category leaving a deficit of \$18,286,000. See the ‘Financial Strategy’ section for achieving a more optimal and sustainable funding level. Further, while fulfilling the annual requirements will position the municipality to meet its future replacement needs, injection of additional revenues will be needed to mitigate existing infrastructure backlogs.

5.6 Recommendations – Storm Network

- The municipality should implement a condition assessment program of its storm mains to further define field needs and to assist the prioritization of the short and long term capital budget. See Section 2, ‘Condition Assessment Programs’ in the ‘Asset Management Strategies’ chapter.
- Using the above information, the municipality should assess its short-, medium- and long-term capital, and operations and maintenance needs.
- An appropriate percentage of the replacement value of the assets should then be allocated for the municipality’s O&M requirements.
- Storm network key performance indicators should be established and tracked annually as part of an overall level of service model. See Section VII ‘Levels of Service’.
- The municipality is funding 10% of its long-term requirements on an annual basis. See the ‘Financial Strategy’ section on how to achieve more sustainable and optimal funding levels.

6. Buildings & Facilities

6.1 Asset Portfolio: Quantity, Useful Life and Replacement Cost

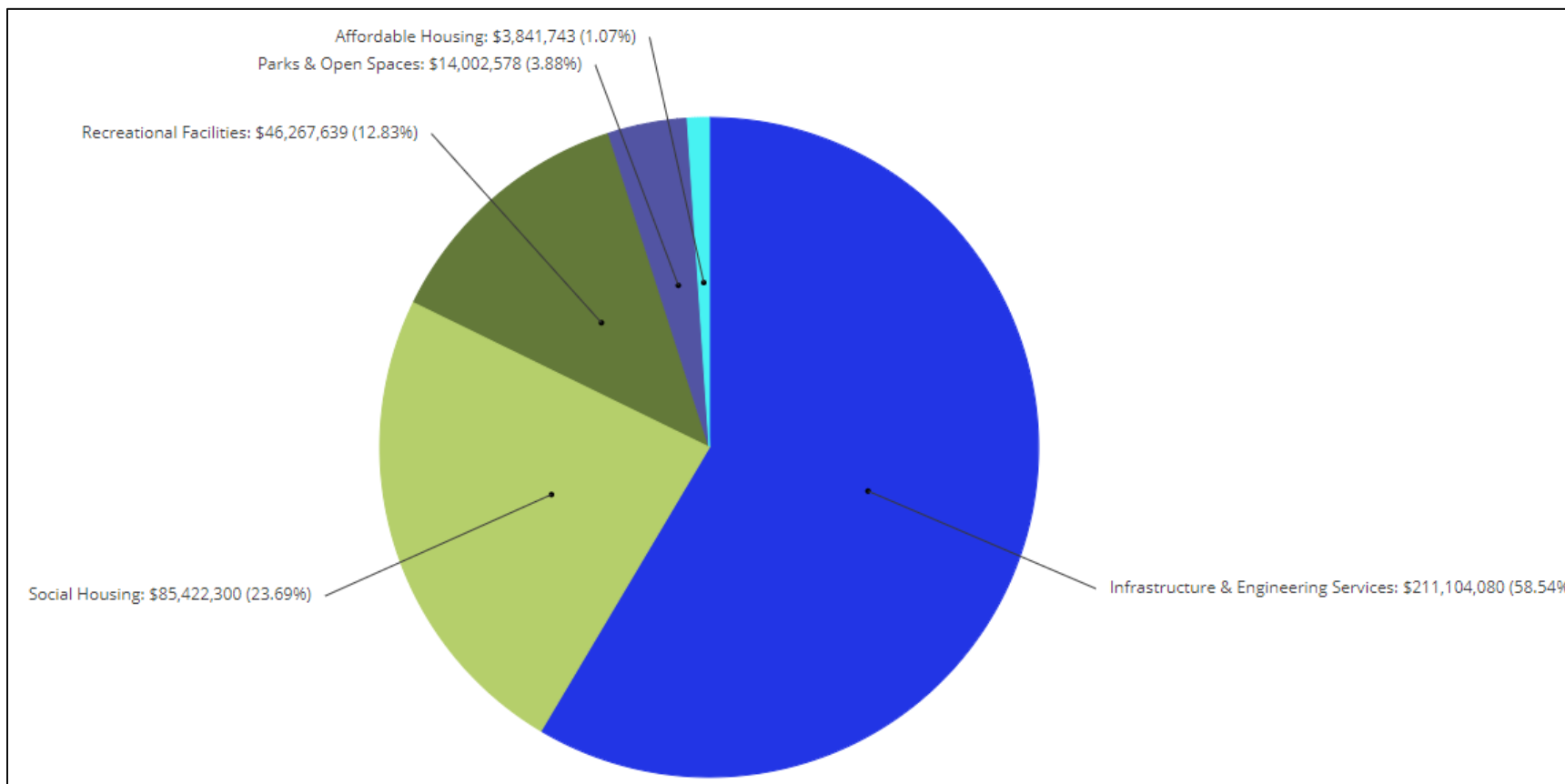
Table 10 illustrates key asset attributes for the municipality's buildings & facilities, including quantities of various assets, their useful life, their replacement cost, and the valuation method by which the replacement costs were derived. In total, the municipality's buildings assets are valued at \$361 million based on 2017 replacement costs. The useful life indicated for each asset type below was assigned by the municipality.

Table 10 Key Asset Attributes – Buildings & Facilities

Asset Type	Asset Component	Quantity	Useful Life in Years	2017 Unit Replacement Cost	2017 Replacement Cost
Buildings & Facilities	IES - Administration & Court Offices	4 buildings	15 - 75	Internal Assessment	\$20,223,736
	IES - Airport	1 building	15 - 75	Internal Assessment	\$2,607,307
	IES - Animal Services	2 buildings	25 - 75	Internal Assessment	\$255,978
	IES - Arts, Culture & Entertainment	7 buildings	15 - 75	Internal Assessment	\$35,017,160
	IES - Community Centre	2 buildings	15 - 75	Internal Assessment	\$5,594,888
	IES - EMS	3 buildings	15 - 75	Internal Assessment	\$4,245,292
	IES - Economic & Business Centres	3 buildings	15 - 75	Internal Assessment	\$8,727,076
	IES - Fire Stations	8 buildings	15 - 75	Internal Assessment	\$23,037,249
	IES - Garage	2 buildings	15 - 75	Internal Assessment	\$1,483,710
	IES - Libraries	8 buildings	15 - 75	Internal Assessment	\$8,419,181
	IES - MTO	6 buildings	15 - 75	Internal Assessment	\$1,620,217
	IES - Other	2 buildings	15 - 75	Internal Assessment	\$48,452,204
	IES - Police	4 buildings	15 - 75	Internal Assessment	\$11,794,483
	IES - Public Works	32 buildings	15 - 75	Internal Assessment	\$15,544,655
IES - Service Centres	4 buildings	15 - 75	Internal Assessment	\$22,728,944	
IES - Transfer Stations	5 buildings	50	Internal Assessment	\$1,352,000	

RECFAC - Arenas	10 buildings	10 - 50	Internal Assessment	\$26,318,900
RECFAC - Halls	7 buildings	15 - 50	Internal Assessment	\$1,120,650
RECFAC - Outdoor Fit Parks	5 units	25	Internal Assessment	\$125,000
RECFAC - Park Campground	10 units	1 - 50	Internal Assessment	\$30,000
RECFAC - Parking Lots	17 units	40	Internal Assessment	\$170,000
RECFAC - Parks	Pooled	1 - 50	Internal Assessment	\$7,163,089
RECFAC - Playgrounds	45 units	10	Internal Assessment	\$3,360,000
RECFAC - Pools	9 units	5 - 50	Internal Assessment	\$6,974,000
RECFAC - Splash Pads	6 units	20	Internal Assessment	\$1,006,000
Parks & Open Spaces	Pooled	15 - 40	Internal Assessment	\$14,002,578
Affordable Housing	1 building	40	Internal Assessment	\$3,841,743
Social Housing	52 buildings	40	Internal Assessment	\$85,422,300
			Total	\$360,638,340

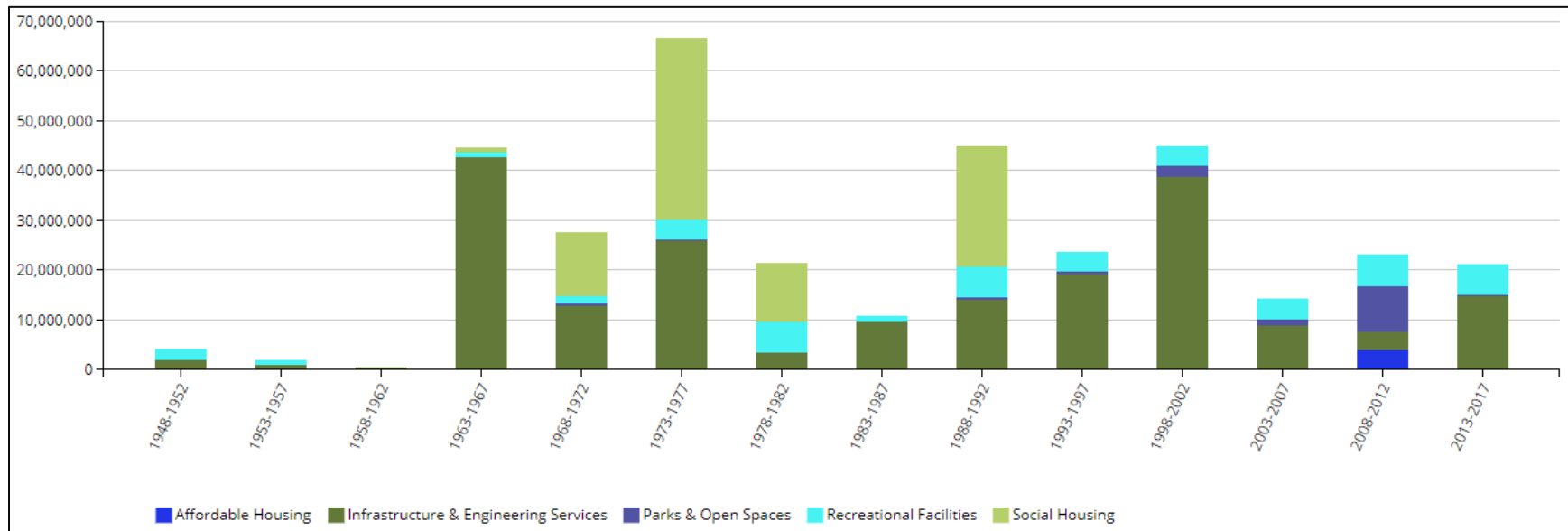
Figure 36 Asset Valuation – Buildings & Facilities



6.2 Historical Investment in Infrastructure

Figure 37 shows the municipality’s historical investments in its buildings & facilities since 1948. While observed condition data will provide superior accuracy in estimating replacement needs and should be incorporated into strategic plans, in the absence of such information, understanding past expenditure patterns and current useful life consumption levels (Section 6.3) can inform the forecasting and planning of infrastructure needs and in the development of a capital program. Note that this graph only includes the active asset inventory as of December 31, 2017.

Figure 37 Historical Investment – Buildings & Facilities

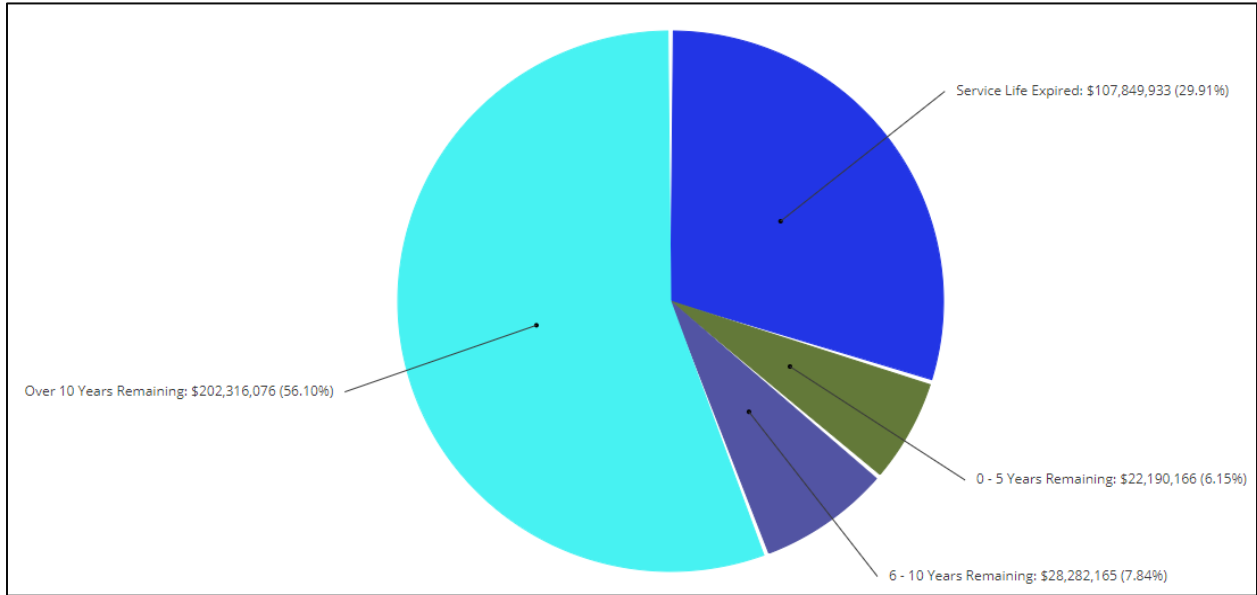


The municipality’s investments into its building assets grew consistently starting in 1963. Between 1998 and 2002, the period of largest investment, \$45 million was invested into the building assets with a focus on infrastructure, engineering services and social housing.

6.3 Useful Life Consumption

In conjunction with historical spending patterns and observed condition data, understanding the consumption rate of assets based on industry established useful life standards provides a more complete profile of the state of a community’s infrastructure. Figure 38 illustrates the useful life consumption levels as of 2017 for the municipality’s buildings assets.

Figure 38 Useful Life Consumption – Buildings & Facilities

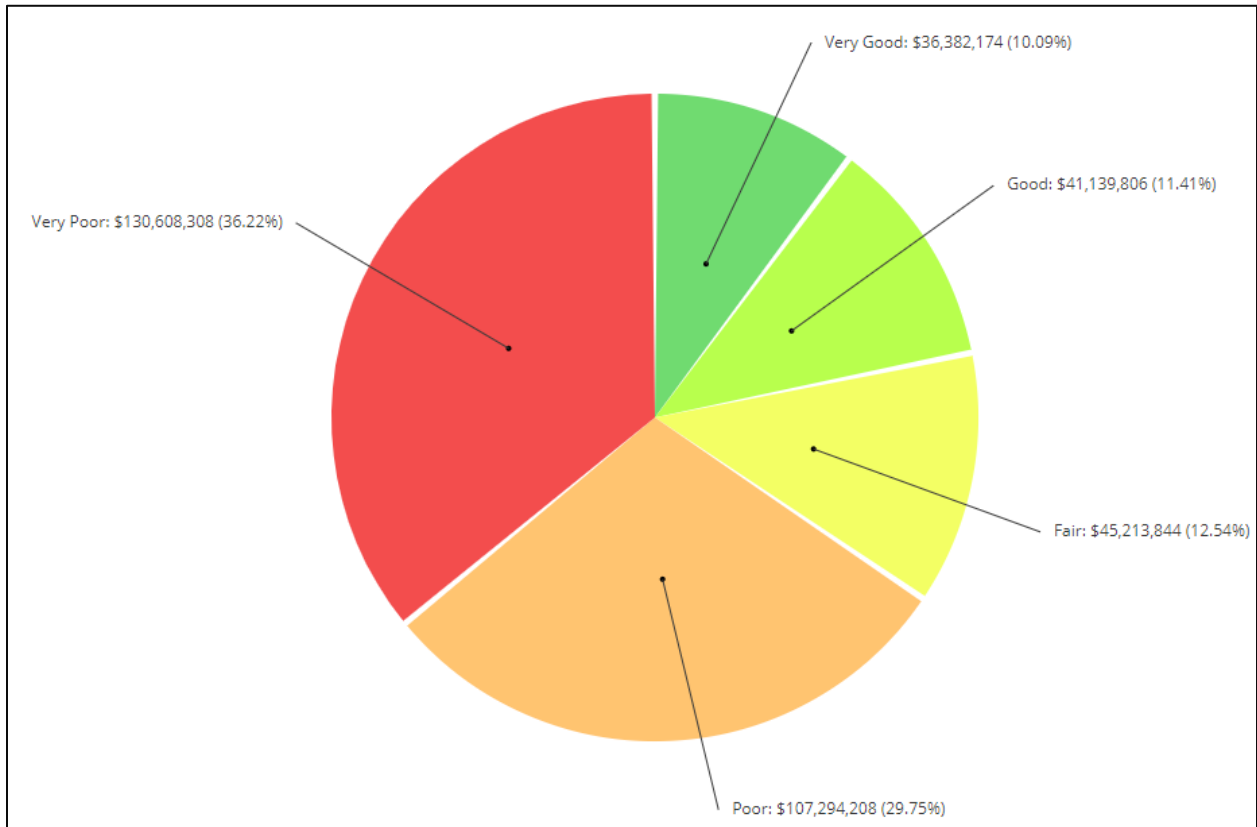


56% of buildings assets have at least 10 years of useful life remaining; 30%, with a valuation of \$108 million remain in operation beyond their established useful life

6.4 Current Asset Condition

Using replacement cost, in this section we summarize the condition of the municipality's buildings assets. 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. The municipality has provided condition data for 75% of its structures.

Figure 39 Asset Condition – Buildings & Facilities (Primarily Assessed)

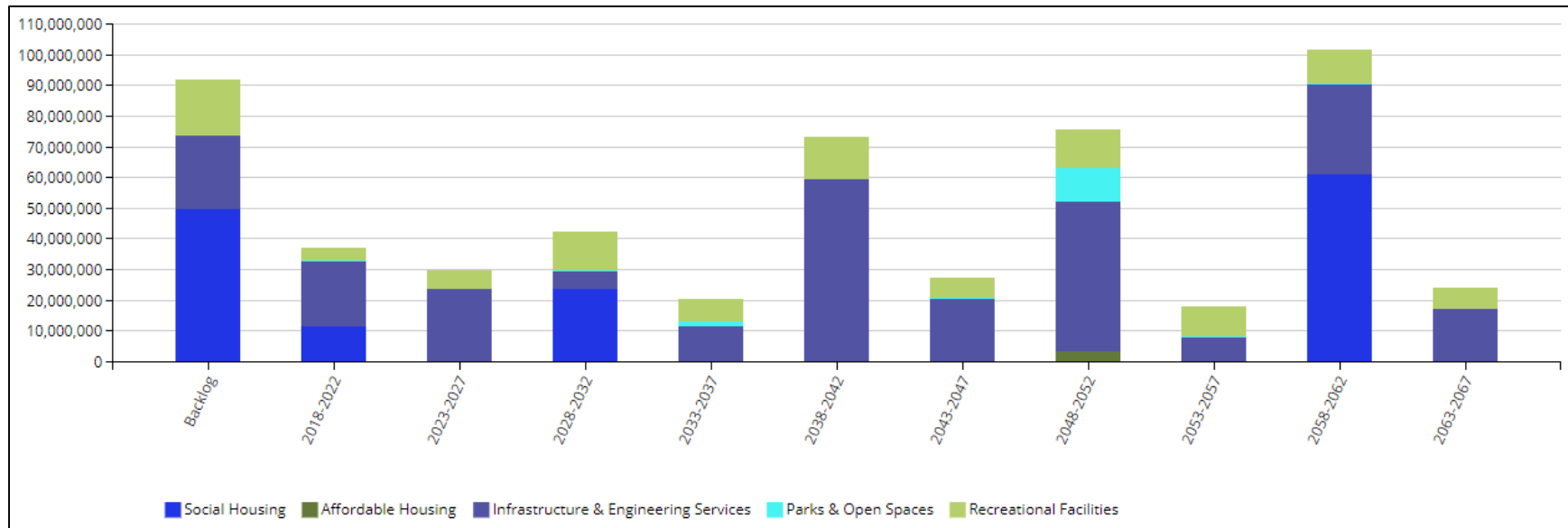


22% of buildings assets, with a valuation of \$77.5 million, are in good to very good condition; 66% are in poor to very poor condition.

6.5 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. Also

Figure 40 Forecasting Replacement Needs – Buildings & Facilities



Primarily condition data indicates a backlog of \$92 million and five-year replacement needs of \$37.1 million. The municipality’s annual requirements for its buildings total \$9,511,000. At this funding level, the municipality would be allocating sufficient funds on an annual basis to meet replacement needs as they arise without the need for deferring projects and accruing annual infrastructure deficits. The municipality is currently allocating approximately \$5,707,000, leaving an annual deficit of \$3,804,000. See the ‘Financial Strategy’ section for achieving a more optimal and sustainable funding level. Further, while fulfilling the annual requirements will position the municipality to meet its future replacement needs, injection of additional revenues will be needed to mitigate existing infrastructure backlogs.

6.6 Recommendations – Buildings & Facilities

- The municipality should continue its condition inspection program for its buildings & facilities to precisely estimate future financial needs. See Section 2, ‘Condition Assessment Programs’ in the ‘Asset Management Strategies’ chapter.
- The data collected through condition assessment programs should be integrated into a risk management framework which will guide prioritization of short, medium, and long term replacement needs. See Section 4, ‘Risk’ in the ‘Asset Management Strategies’ chapter for more information.
- In addition to the above, a tailored lifecycle activity framework should be developed to promote standard lifecycle management of buildings & facilities as outlined further within the “Asset Management Strategy” section of this AMP.
- Using the above information, the municipality should assess its short-, medium- and long-term capital, and operations and maintenance needs.
- An appropriate percentage of the replacement costs should then be allocated for the municipality’s O&M requirements.
- Facility key performance indicators should be established and tracked annually as part of an overall level of service model. See Chapter VII, ‘Levels of Service’.
- The municipality is funding 60% of its long-term requirements on an annual basis. See the ‘Financial Strategy’ section on how to achieve more sustainable and optimal funding levels.

7. Machinery & Equipment

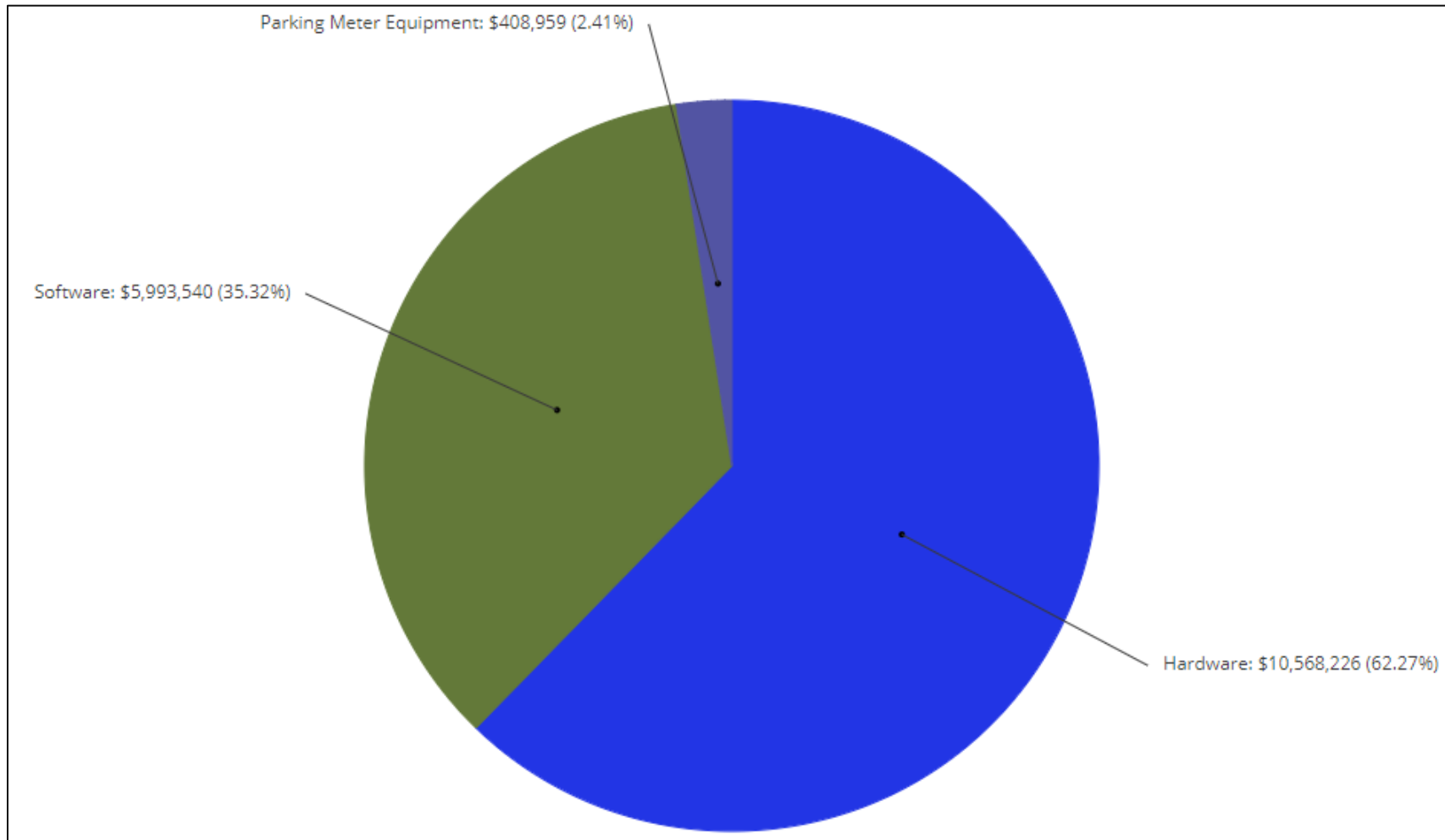
7.1 Asset Portfolio: Quantity, Useful Life and Replacement Cost

Table 11 illustrates key asset attributes for the municipality's machinery & equipment, 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 machinery & equipment assets are valued at \$30 million based on 2017 replacement costs. The useful life indicated for each asset type below was assigned by the municipality.

Table 11 Asset Inventory – Machinery & Equipment

Asset Type	Components	Quantity	Useful Life in Years	2017 Unit Replacement Cost	2017 Replacement Cost
Machinery & Equipment	Hardware - Audio Video	114 units	7	Pooled Cost	\$176,633
	Hardware - Computers	1,569 units	4	Pooled Cost	\$2,021,621
	Hardware - Mobile Phones	576 units	2.5	Pooled Cost	\$379,500
	Hardware - Networking	548 units	5	Pooled Cost	\$1,918,344
	Hardware - Printers	2,149 units	5	Pooled Cost	\$1,062,425
	Hardware - Storage	20 units	5	Pooled Cost	\$739,232
	Hardware - Systems	339 units	5	Pooled Cost	\$2,080,720
	Hardware - Telecoms	1,715 units	10	Pooled Cost	\$2,189,751
	Software - Adobe Software	145 units	3	Pooled Cost	\$17,190
	Software - Corporate Software	2,516 units	5	Pooled Cost	\$1,232,776
	Software - Inventoried Software	132,895 units	5	Pooled Cost	\$4,116,157
	Software - Microsoft Licensing	3,985 units	5	Pooled Cost	\$627,417
	Parking Meter Equipment - Single Space Meter	31 units	10	\$1,460/unit	\$45,260
	Parking Meter Equipment - Double Space Meter	95 units	10	\$2,543/unit	\$241,569
	Parking Meter Equipment - Pay and Display	4 units	10	\$20,336/unit	\$81,343
	Parking Meter Equipment - Pay and Display Solar	2 units	10	\$20,394/unit	\$40,787
				Total	\$16,970,725

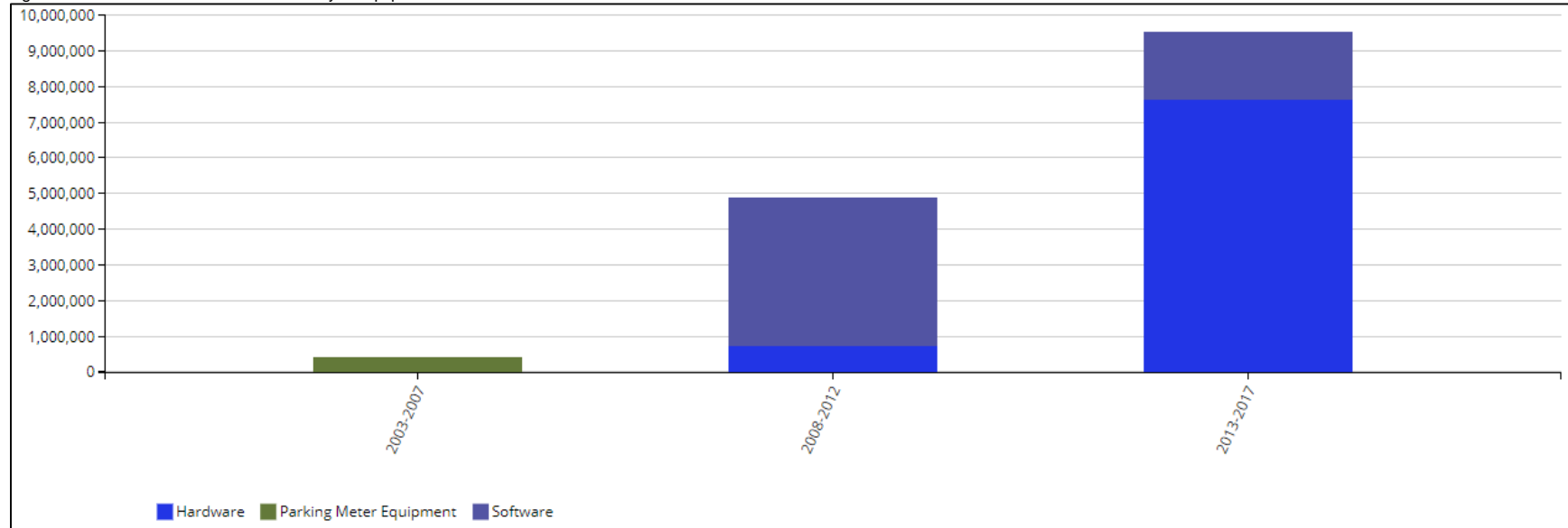
Figure 41 Asset Valuation – Machinery & Equipment



7.2 Historical Investment in Machinery & Equipment

Figure 42 shows the municipality's historical investments in its machinery & equipment since 2003. While observed condition data will provide superior accuracy in estimating replacement needs and should be incorporated into strategic plans, in the absence of such information, understanding past expenditure patterns and current useful life consumption levels (Section 7.3) can inform the forecasting and planning of infrastructure needs and in the development of a capital program. Note that this graph only includes the active asset inventory as of December 31, 2017.

Figure 42 Historical Investment – Machinery & Equipment

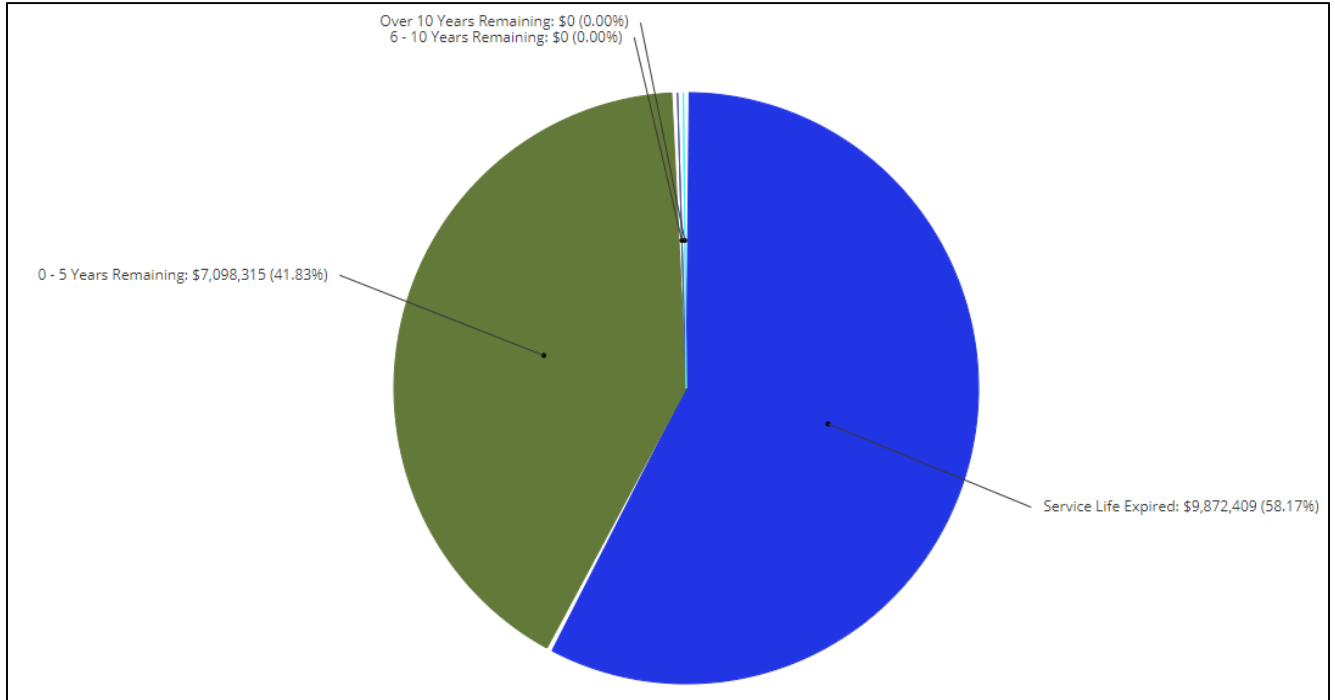


The municipality rapidly expanded its machinery & equipment portfolio beginning in the late 2000s. Between 2013 and 2017, the period of largest investment, \$9.5 million was invested in hardware and software.

7.3 Useful Life Consumption

In conjunction with historical spending patterns and observed condition data, understanding the consumption rate of assets based on industry established useful life standards provides a more complete profile of the state of a community’s infrastructure. Figure 43 illustrates the useful life consumption levels as of 2017 for the municipality’s machinery & equipment assets.

Figure 43 Useful Life Consumption – Machinery & Equipment

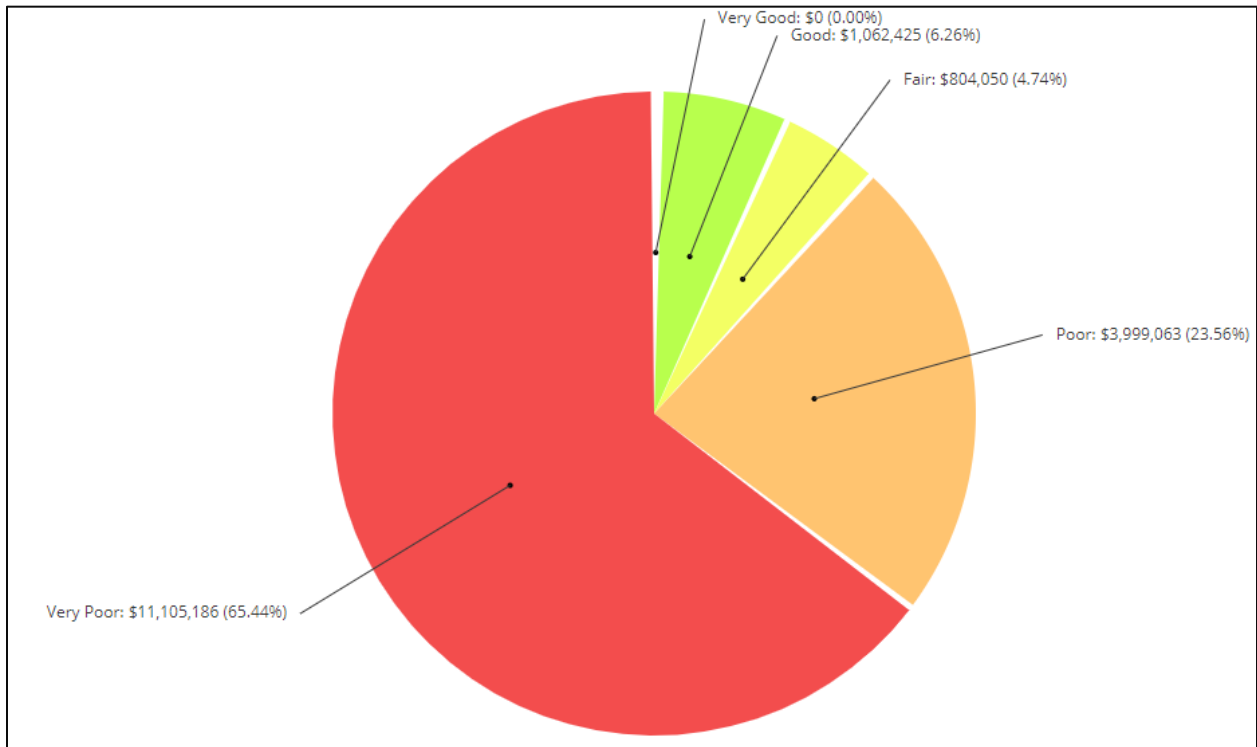


Most assets, with a valuation of \$10 million, remain in operation beyond their useful life. An additional 42% will reach the end of their useful life within the next five years.

7.4 Current Asset Condition

Using replacement cost, in this section we summarize the condition of the municipality's machinery & equipment assets as of 2016. 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. The municipality has not provided condition data for its machinery & equipment assets.

Figure 44 Asset Condition – Machinery & Equipment (Age-based)

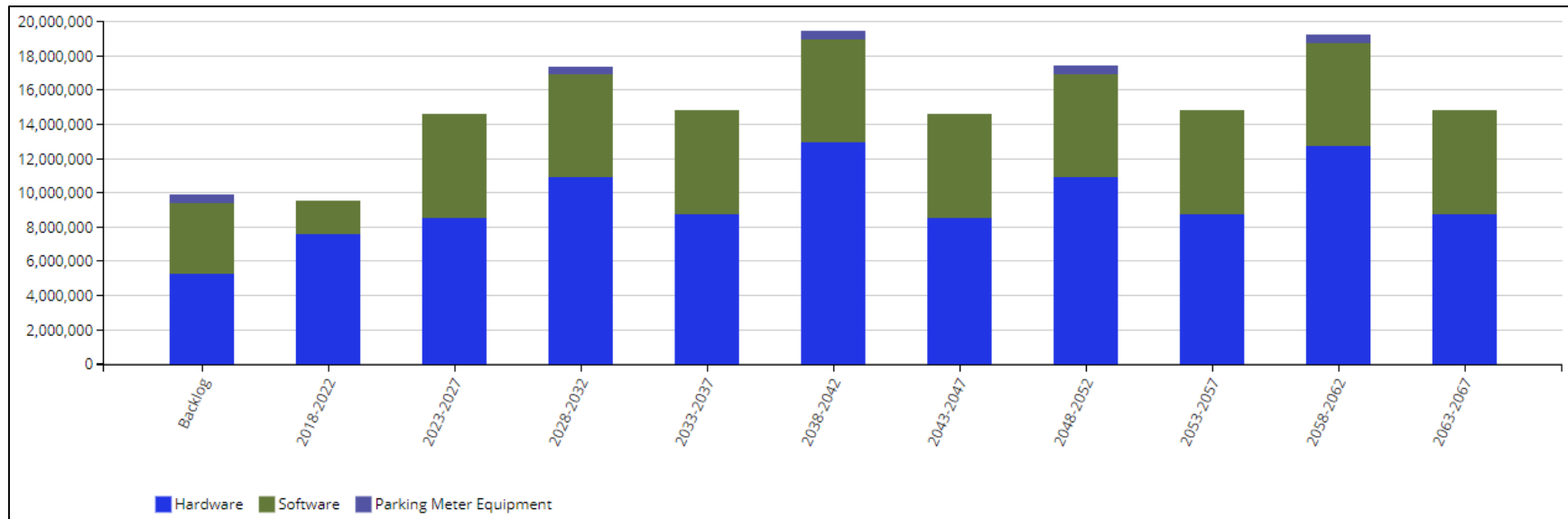


Based on age data, 89% of assets, with a valuation of \$15 million, are in poor to very poor condition; 6% are in good to very good condition.

7.5 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 45 Forecasting Replacement Needs – Machinery & Equipment



In addition to a backlog of \$10 million, the municipality’s replacement needs total \$9.5 million in the next five years. An additional \$15 million will be required between 2023-2027. The municipality’s annual for its machinery & equipment total \$3,303,000. At this funding level, the municipality would be allocating sufficient funds on an annual basis to meet replacement needs as they arise without the need for deferring projects and accruing annual infrastructure deficits. However, the municipality is currently allocating \$2,330,000, leaving an annual deficit of \$973,000. See the ‘Financial Strategy’ section for maintaining a sustainable funding level. Further, while fulfilling the annual requirements will position the municipality to meet its future replacement needs, injection of additional revenues will be needed to mitigate existing infrastructure backlogs.

7.6 Recommendations – Machinery & Equipment

- The municipality should implement a component based condition inspection program for all machinery & equipment assets to better define financial requirements for its machinery and equipment. See Section 2, ‘Condition Assessment Programs’ in the ‘Asset Management Strategies’ chapter.
- Using the above information, the municipality should assess its short-, medium- and long-term capital, and operations and maintenance needs.
- An appropriate percentage of the replacement costs should then be allocated for the municipality’s O&M requirements.
- The municipality is funding 71% of its long-term requirements on an annual basis. See the ‘Financial Strategy’ section on how to maintain sustainable and optimal funding levels.

8. Land Improvements

8.1 Asset Portfolio: Quantity, Useful Life and Replacement Cost

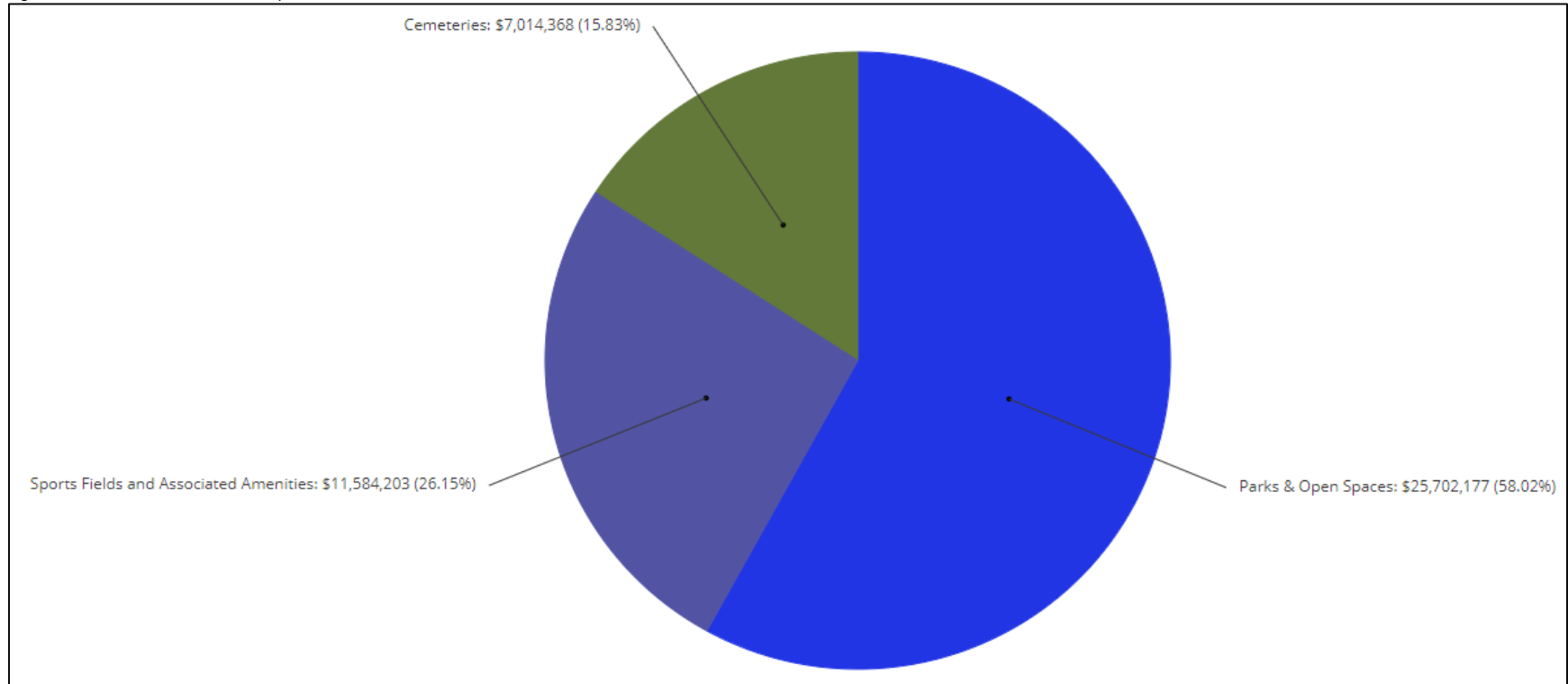
Table 12 illustrates key asset attributes for the municipality's land improvements, including quantities of various assets, their useful life, their replacement cost, and the valuation method by which the replacement costs were derived. In total, the municipality's land improvements assets are valued at \$44 million based on 2017 replacement costs. The useful life indicated for each asset type below was assigned by the municipality.

Table 12 Asset Inventory – Land Improvements

Asset Type	Components	Quantity	Useful Life in Years	2017 Unit Replacement Cost	2017 Replacement Cost
Land Improvements	Dresden Cemetery	Pooled	15 - 40	Internal Assessment	\$753,150
	Evergreen Cemetery	Pooled	15 - 40	Internal Assessment	\$802,000
	Greenwood Cemetery	Pooled	15 - 40	Internal Assessment	\$18,000
	Maple Leaf Cemetery	Pooled	15 - 40	Internal Assessment	\$3,509,718
	Riverview Cemetery	Pooled	15 - 40	Internal Assessment	\$1,725,000
	Sherman Cemetery	Pooled	15 - 40	Internal Assessment	\$15,000
	West Bothwell Cemetery	Pooled	15 - 40	Internal Assessment	\$191,500
	Parks and Open Spaces - Marine Related	7 units	3 - 75	Internal Assessment	\$7,683,735
	Parks and Open Spaces - Miscellaneous	16 units	3 - 75	Internal Assessment	\$4,810,933
	Parks and Open Spaces - Playground Equipment	44 units	3 - 75	Internal Assessment	\$3,532,134
	Parks and Open Spaces - Splash Pads	4 units	3 - 75	Internal Assessment	\$2,507,040
	Parks and Open Spaces - Trails and Pathways	64 units	3 - 75	Internal Assessment	\$7,168,335
	Sports Fields and Associated Amenities - Ball Diamond	12 units	12 - 50	Internal Assessment	\$7,576,694
	Sports Fields and Associated Amenities - Ball Diamond Fencing	12 units	12 - 50	Internal Assessment	\$630,400
	Sports Fields and Associated Amenities - Ball Diamond Irrigation	1 unit	12 - 50	Internal Assessment	\$17,325
	Sports Fields and Associated Amenities - Baseball Fields Irrigation	1 unit	12 - 50	Internal Assessment	\$98,820

Sports Fields and Associated Amenities - Soccer Fields	4 units	12 - 50	Internal Assessment	\$1,059,660
Sports Fields and Associated Amenities - Soccer Fields Fencing	3 units	12 - 50	Internal Assessment	\$160,375
Sports Fields and Associated Amenities - Sports Area Lighting	9 units	12 - 50	Internal Assessment	\$1,111,410
Sports Fields and Associated Amenities - Tennis Courts	3 units	12 - 50	Internal Assessment	\$929,519
			Total	\$44,300,748

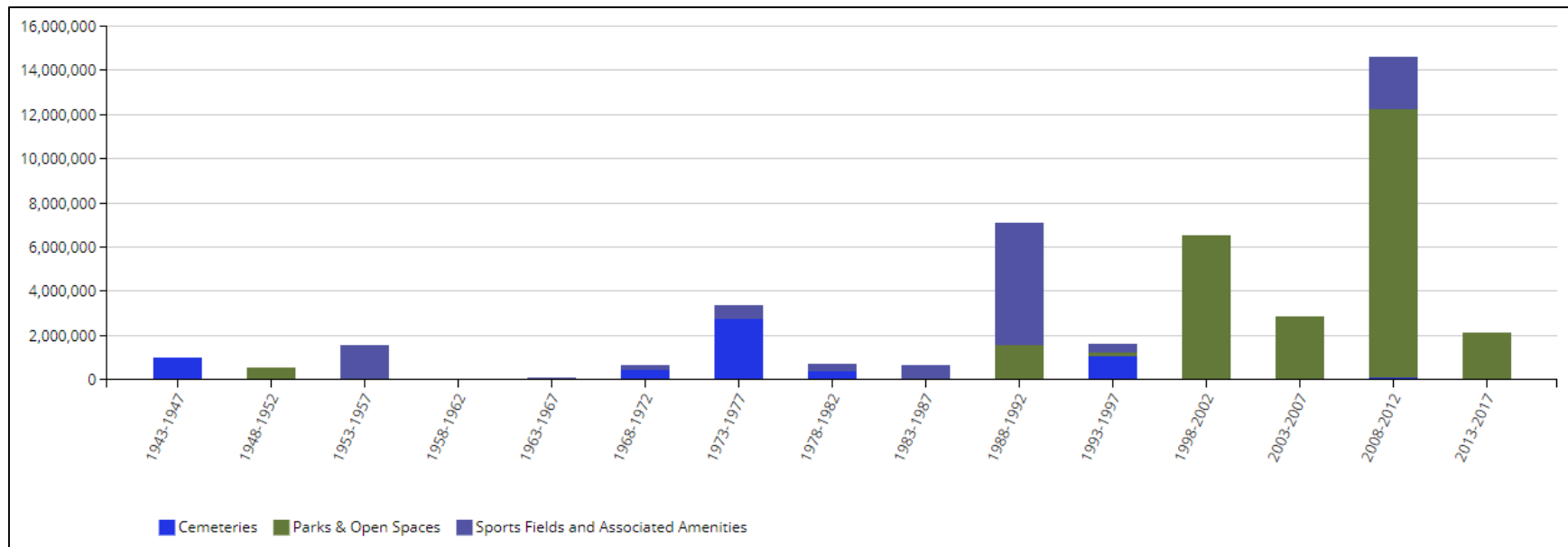
Figure 46 Asset Valuation – Land Improvements



8.2 Historical Investment in Infrastructure

Figure 47 shows the municipality’s historical investments in its land improvements since 1950. While observed condition data will provide superior accuracy in estimating replacement needs and should be incorporated into strategic plans, in the absence of such information, understanding past expenditure patterns and current useful life consumption levels (Section 8.3) can inform the forecasting and planning of infrastructure needs and in the development of a capital program. Note that this graph only includes the active asset inventory as of December 31, 2017.

Figure 47 Historical Investment – Land Improvements

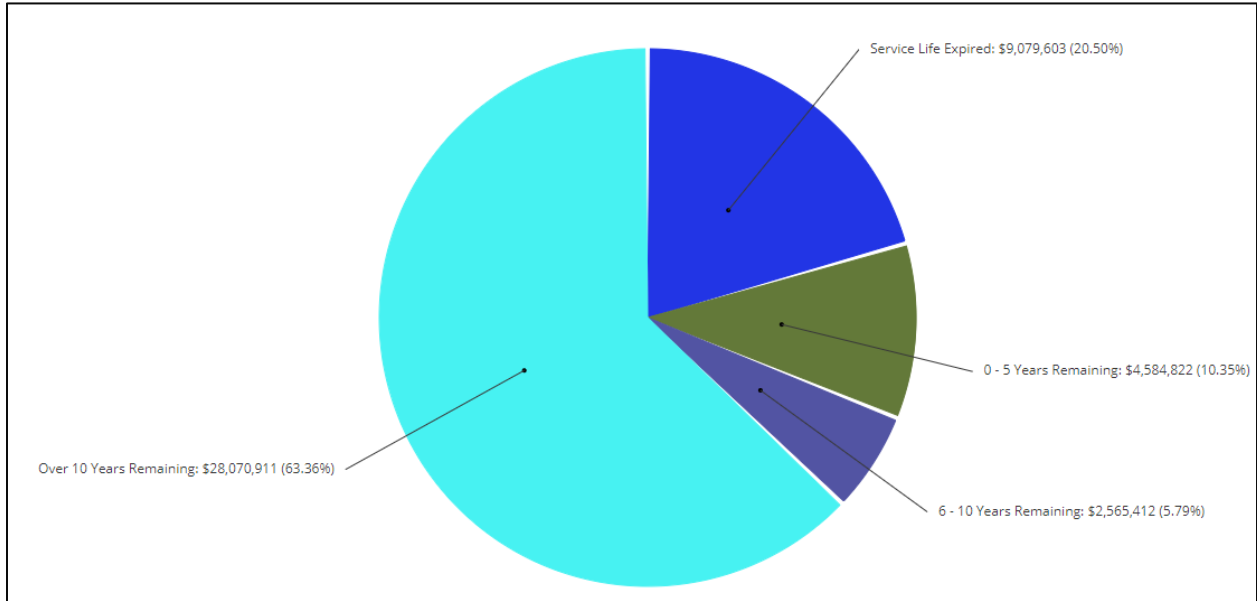


Expenditures in land improvements have fluctuated across the decades. Between 2008 and 2012, the period of largest investment, \$14.4 million was invested with a focus on parks and open spaces.

8.3 Useful Life Consumption

In conjunction with historical spending patterns and observed condition data, understanding the consumption rate of assets based on industry established useful life standards provides a more complete profile of the state of a community’s infrastructure. Figure 48 illustrates the useful life consumption levels as of 2017 for the municipality’s land improvement assets.

Figure 48 Useful Life Consumption – Land Improvements

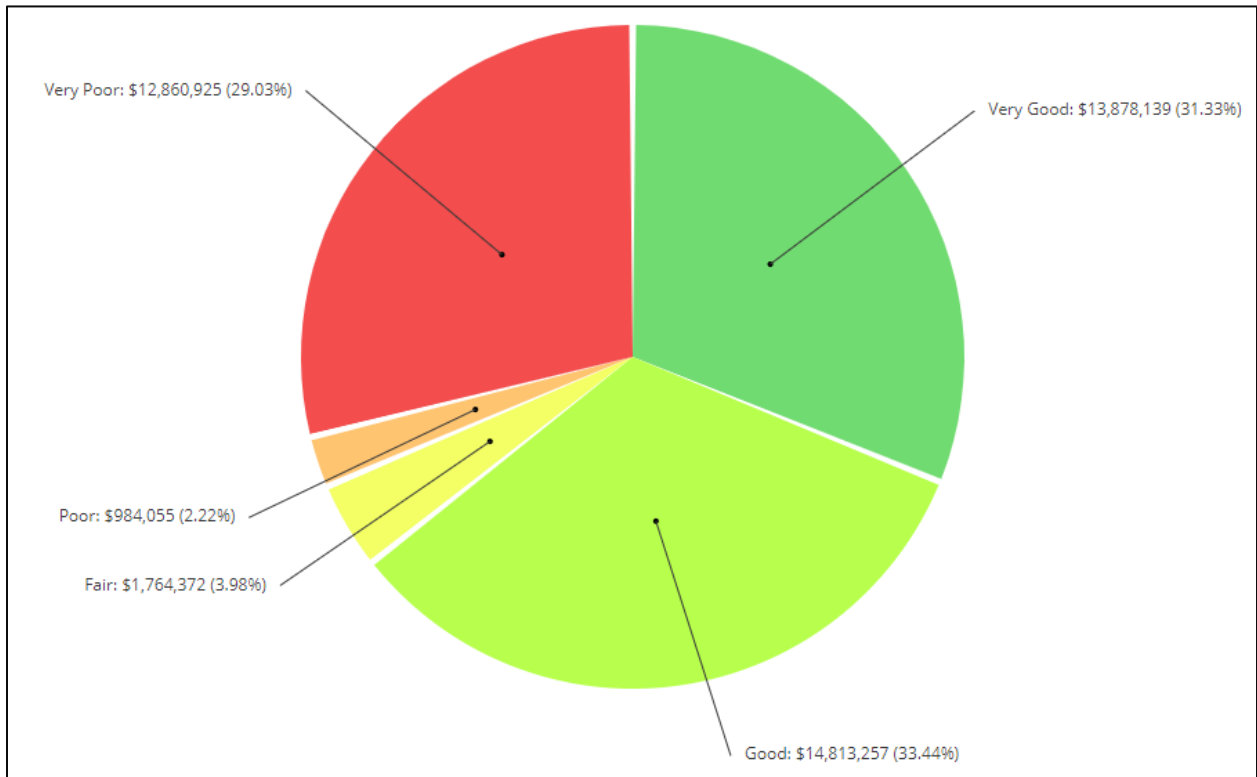


63% of the municipality’s land improvement assets, with a valuation of \$28 million, have at least 10 years of useful life remaining. An additional 10% will reach the end of their useful life within the next five years.

8.4 Current Asset Condition

Using replacement cost, in this section we summarize the condition of the municipality’s land improvement assets. 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. The municipality has provided condition data for approximately 67% of land improvement assets.

Figure 49 Asset Condition - Land Improvements (Primarily Assessed)

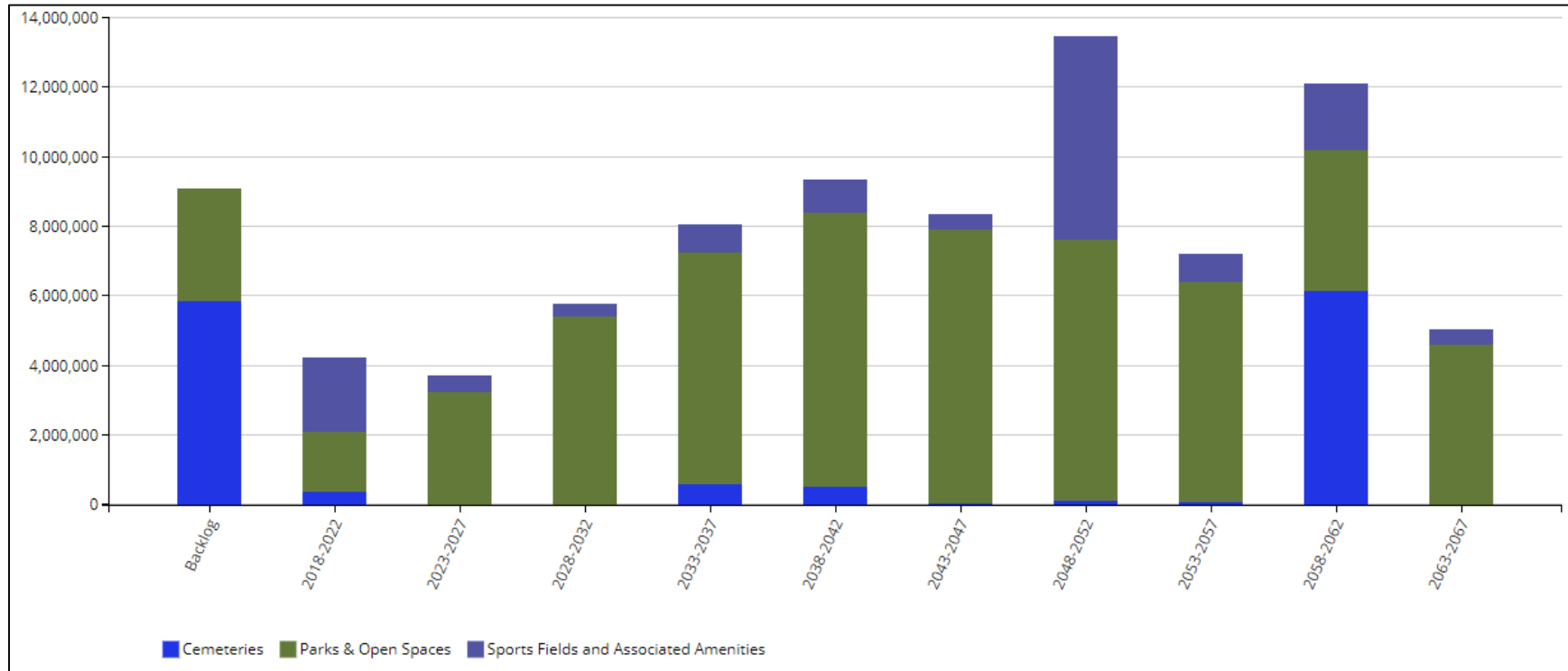


Based primarily assessed data, 65% of the municipality’s land improvement assets, with a valuation of \$29 million, are in good to very good condition; 31% are in poor to very poor condition.

8.5 Forecasting Replacement Needs

In this section, we illustrate the short-, medium- and long-term infrastructure spending requirements (replacement only) for the municipality’s land improvements 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 50 Forecasting Replacement Needs – Land Improvements



Primarily assessed based data shows a backlog of \$9 million. Additionally, five-year replacement needs are projected at \$4.2 million with half of the requirements attributed to sports fields and associated amenities. The municipality’s annual requirements for its land improvements total \$1,786,000. At this funding level, the municipality would be allocating sufficient funds on an annual basis to meet replacement needs as they arise without the need for deferring projects and accruing annual infrastructure deficits. However, the municipality is currently allocating \$1,136,000, leaving an annual deficit of \$650,000. See the ‘Financial Strategy’ section for achieving a more optimal and sustainable funding level.

8.6 Recommendations – Land Improvements

- The municipality should continue its condition assessment program for its land improvement assets to precisely estimate financial needs. See Section 2, ‘Condition Assessment Programs’ in the ‘Asset Management Strategies’ chapter.
- The data collected through condition assessment programs should be integrated into a risk management framework which will guide prioritization of short, medium, and long term replacement needs. See Section 4, ‘Risk’ in the ‘Asset Management Strategies’ chapter for more information.
- Using the above information, the municipality should assess its short-, medium- and long-term capital and operations and maintenance needs.
- An appropriate percentage of the replacement costs should then be allocated for the municipality’s O&M requirements.
- The municipality is funding 64% of its long-term replacement needs on an annual basis. See the ‘Financial Strategy’ section on how to achieve more sustainable and optimal funding levels

9. Vehicles

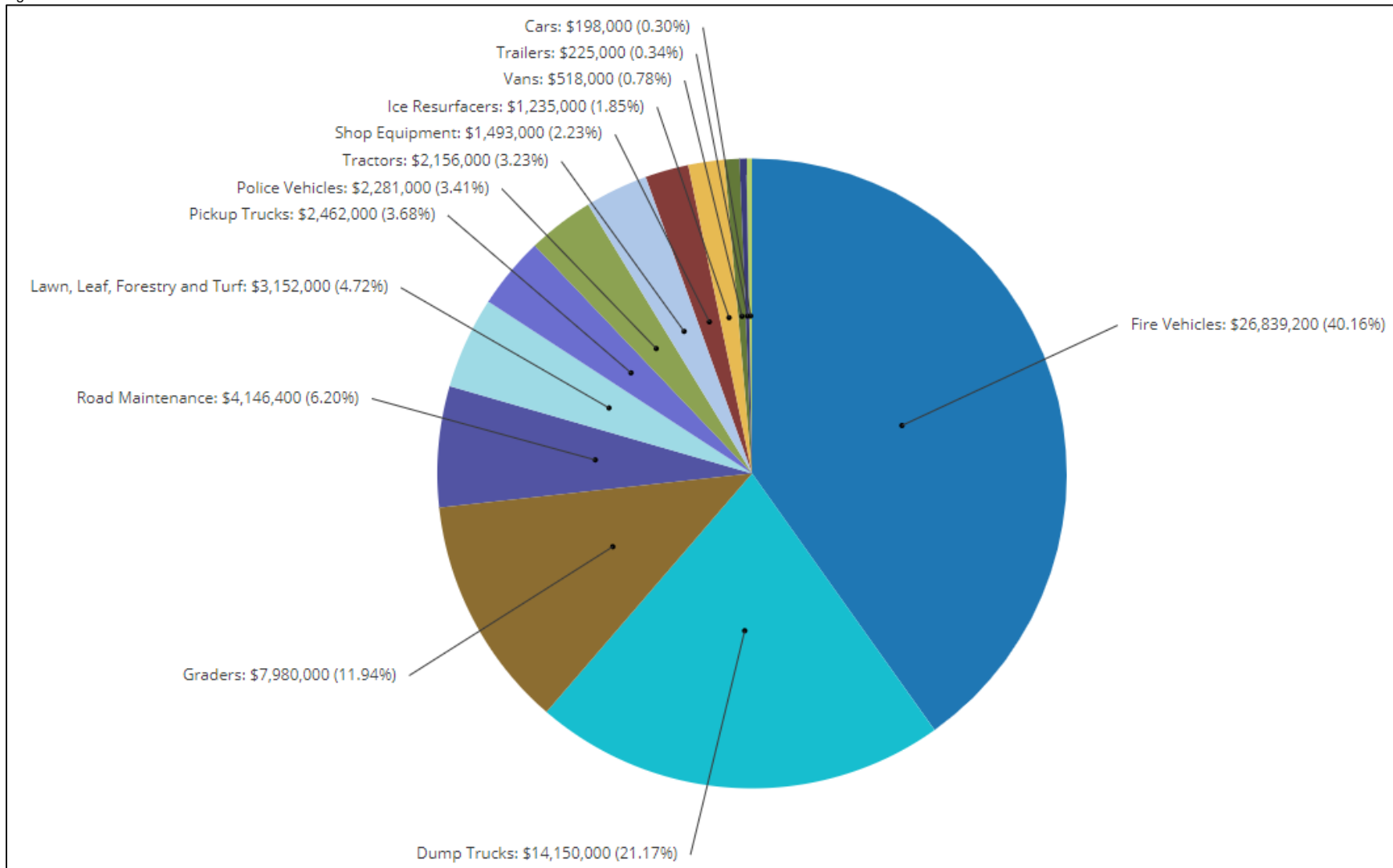
9.1 Asset Portfolio: Quantity, Useful Life and Replacement Cost

Table 13 illustrates key asset attributes for the municipality's vehicles portfolio, 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 vehicles assets are valued at \$66.8 million based on 2017 replacement costs. The useful life indicated for each asset type below was assigned by the municipality.

Table 13 Asset Inventory – Vehicles

Asset Type	Components	Quantity	Useful Life in Years	Valuation Method	2017 Replacement Cost
Vehicles	Cars	7 units	8	\$26,000 - \$32,000 / unit	\$198,000
	Dump Trucks	65 units	10-12	\$72,000 - \$295,000 / unit	\$14,150,000
	Fire Vehicles	73 units	8-20	\$7,000 - \$1,300,000 / unit	\$26,839,200
	Graders	21 units	17	\$380,000 / unit	\$7,980,000
	Ice Resurfacers	13 units	15	\$95,000 / unit	\$1,235,000
	Lawn, Leaf, Forestry and Turf	76 units	2-15	\$3,000 - \$120,000 / unit	\$3,152,000
	Pickup Trucks	82 units	8	\$28,000 - \$34,000 / unit	\$2,462,000
	Police Vehicles	64 units	3-20	\$12,000 - \$48,000 / unit	\$2,281,000
	Road Maintenance	19 units	15 - 20	\$32,700 - \$480,000 / unit	\$4,146,400
	Shop Equipment	53 units	5-20	\$5,000 - \$195,000 / unit	\$1,493,000
	Tractors	36 units	8-15	\$24,000 - \$112,000 / unit	\$2,156,000
	Trailers	33 units	20	\$5,000 - \$20,000 / unit	\$225,000
	Vans	17 units	8	\$30,000 - \$31,000 / unit	\$518,000
Total					\$66,835,600

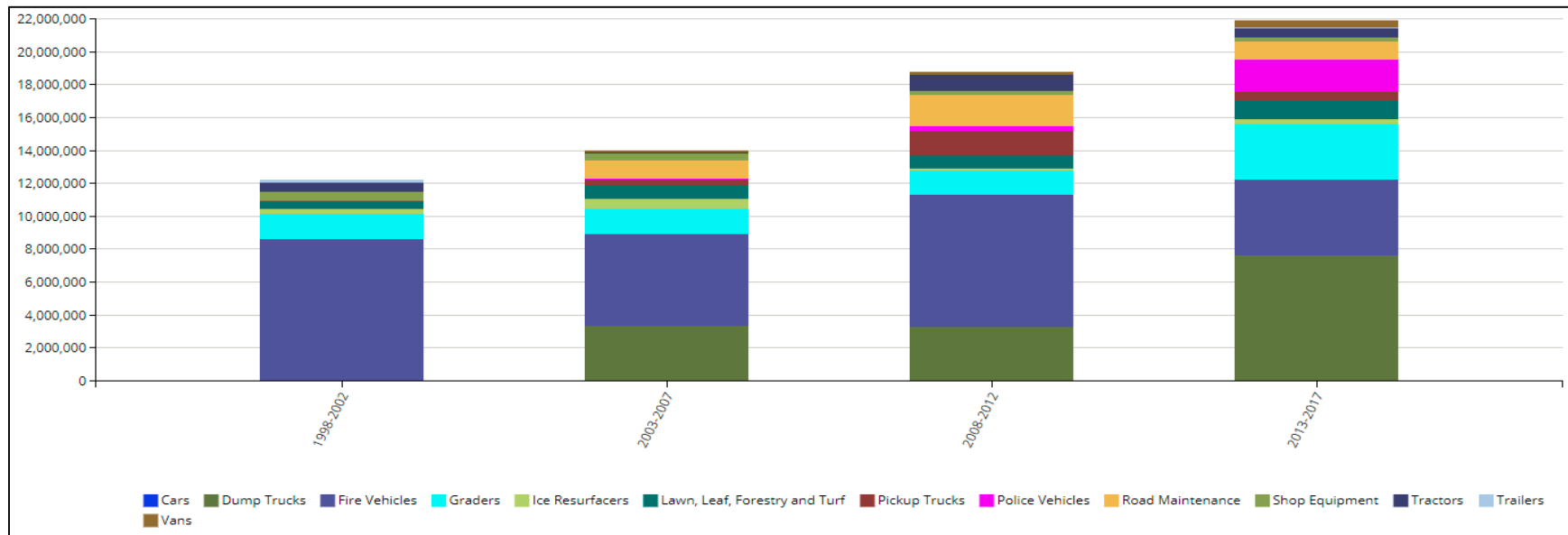
Figure 51 Asset Valuation – Vehicles



9.2 Historical Investment in Infrastructure

Figure 52 shows the municipality’s historical investments in its vehicles portfolio since 1970s. While observed condition data will provide superior accuracy in estimating replacement needs and should be incorporated into strategic plans, in the absence of such information, understanding past expenditure patterns and current useful life consumption levels (Section 9.3) can inform the forecasting and planning of infrastructure needs and in the development of a capital program. Note that this graph only includes the active asset inventory as of December 31, 2017.

Figure 52 Historical Investment – Vehicles

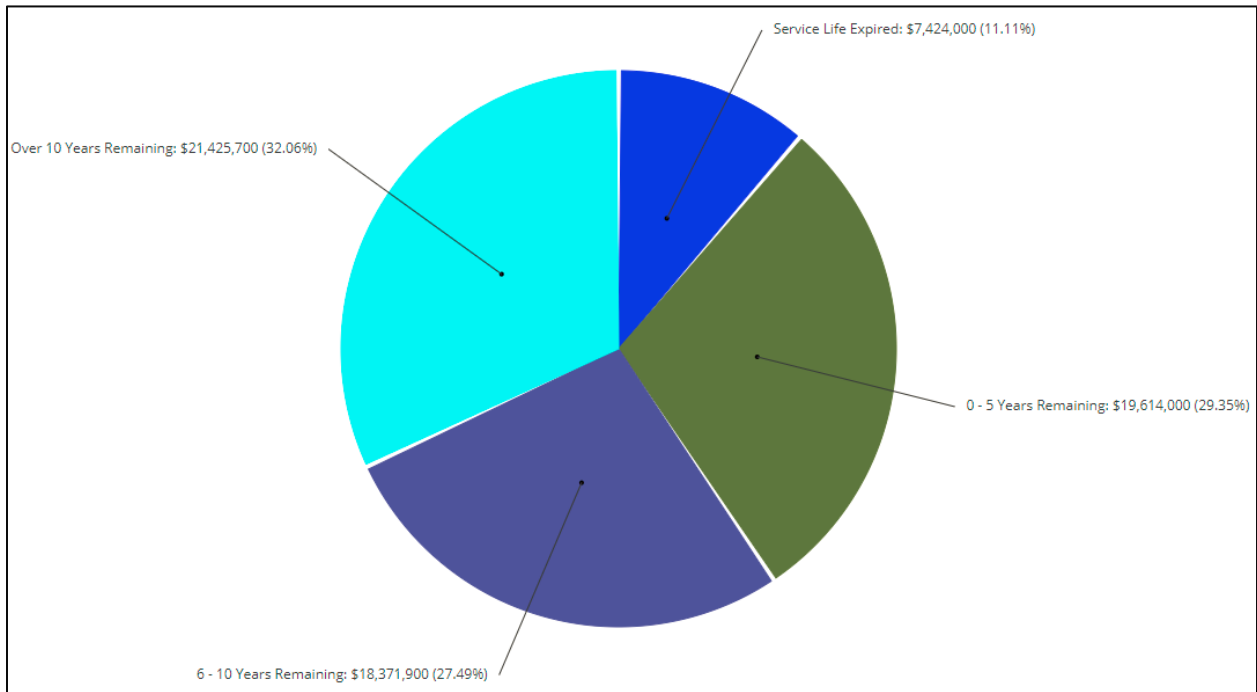


Investments in vehicles have been consistent. In 2013-2017, the period of largest investment, \$22 million was invested with \$12.4 million put into fire vehicles and dump trucks.

9.3 Useful Life Consumption

In conjunction with historical spending patterns and observed condition data, understanding the consumption rate of assets based on industry established useful life standards provides a more complete profile of the state of a community’s infrastructure. Figure 53 illustrates the useful life consumption levels as of 2017 for the municipality’s vehicles.

Figure 53 Useful Life Consumption – Vehicles

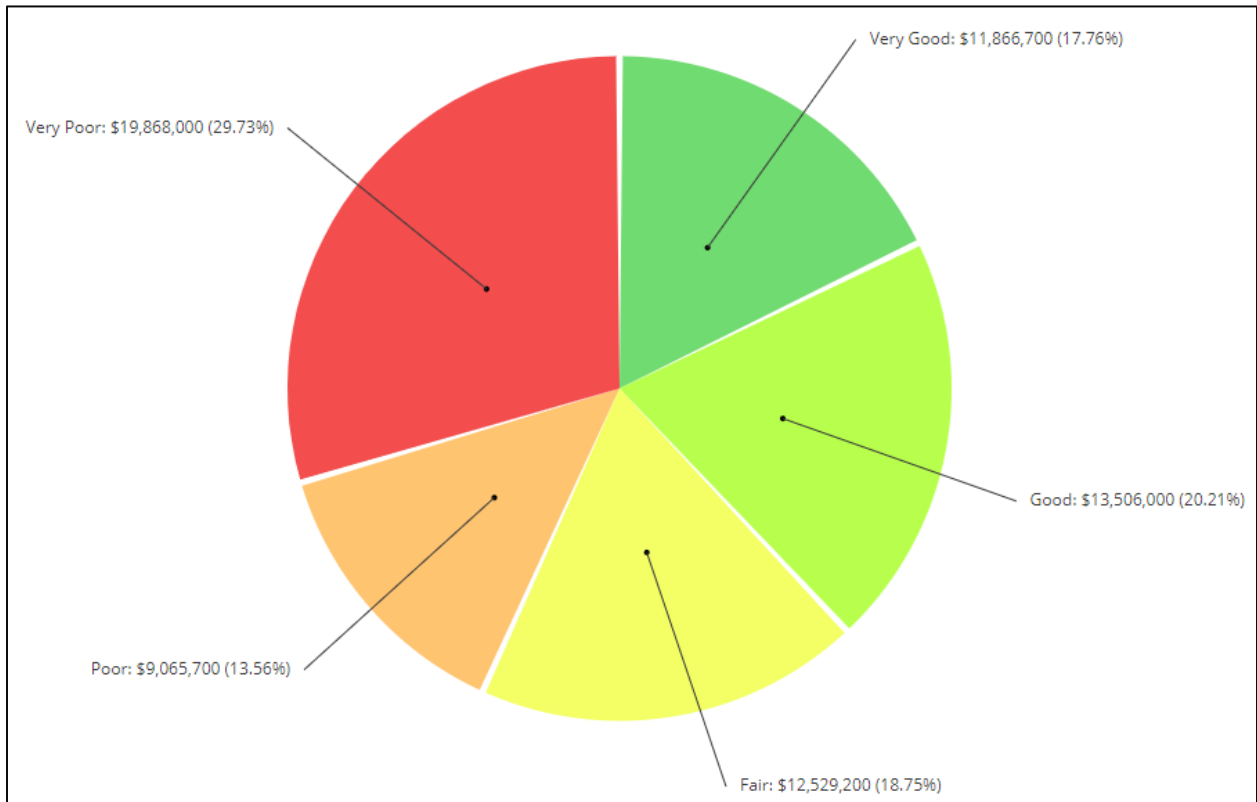


32% of assets have at least 10 years of useful life remaining; 11%, with a valuation of \$7.4 million remain in operation beyond their useful life. An additional 29% will reach the end of their useful life within the next five years.

9.4 Current Asset Condition

Using replacement cost, in this section, we summarize the condition of the municipality’s vehicles assets as of 2017. 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. The municipality has not provided condition data for this asset class.

Figure 54 Asset Condition – Vehicles (Age-based)

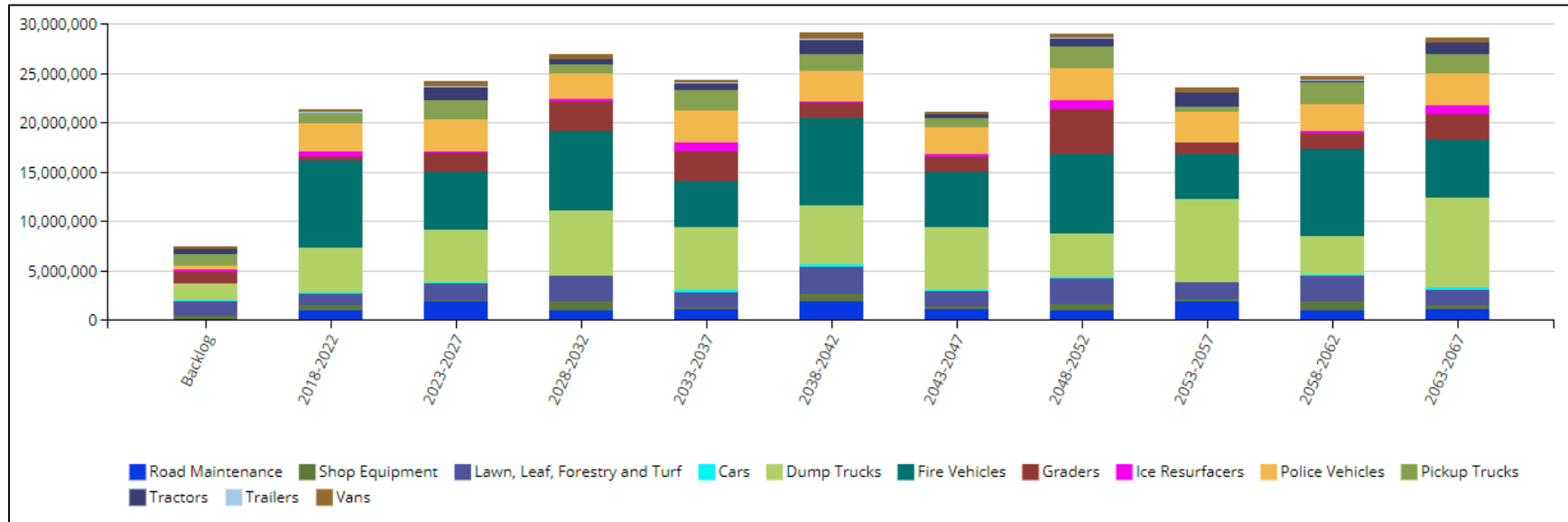


Age-based data shows that 43% of the municipality’s vehicle assets are in poor to very poor condition; 38%, with a valuation of \$25 million are in good to very good condition.

9.5 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 55 Forecasting Replacement Needs – Vehicles



In addition to a backlog of \$7.4 million, replacement needs will total over \$21.3 million over the next five years; an additional \$24 million will be required between 2023-2027. The municipality’s annual requirements for its vehicles total \$5,132,000. At this funding level, the municipality would be allocating sufficient funds on an annual basis to meet replacement needs as they arise without the need for deferring projects and accruing annual infrastructure deficits. However, the municipality is currently allocating \$4,316,000, leaving an annual deficit of \$816,000. See the ‘Financial Strategy’ section for achieving a more optimal and sustainable funding level. Further, while fulfilling the annual requirements will position the municipality to meet its future replacement needs, injection of additional revenues will be needed to mitigate existing infrastructure backlogs.

9.6 Recommendations – Vehicles

- The municipality should continue its preventative maintenance and lifecycle assessment program for all vehicle assets to precisely estimate its actual financial requirements and field needs. Current condition and performance data should be implemented in CityWide to gain a better understanding of the short- and medium-term replacement needs. See Section 2, ‘Condition Assessment Programs’ in the ‘Asset Management Strategies’ chapter.
- Using the above information, the municipality should assess its short-, medium- and long-term capital and operations and maintenance needs.
- An appropriate percentage of the replacement costs should then be allocated for the municipality’s O&M requirements.
- The municipality is funding 84% of its long-term replacement needs on an annual basis. See the ‘Financial Strategy’ section on how to achieve more sustainable and optimal funding levels.

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 LOS 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*.

Table 14 LOS Categories

LOS Category	Description
Reliable	Services are predictable and continuous; 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.
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.

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 15 Key Performance Indicators – Road Network and Bridges & Culverts

Level	KPI (Reported Annually)
Strategic	<ul style="list-style-type: none"> – Percentage of total reinvestment compared to asset replacement value – Completion of strategic plan objectives (related to roads, and bridges & culverts)
Financial Indicators	<ul style="list-style-type: none"> – 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	<ul style="list-style-type: none"> – Overall Bridge Condition Index (BCI) as a percentage of desired BCI – Percentage of road network rehabilitated/reconstructed – Percentage of paved road lane kilometres 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
Operational Indicators	<ul style="list-style-type: none"> – 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 kilometres – Operating costs for bridge and large culverts per square metre – Percentage of customer requests with a 24-hour response rate

Table 16 Key Performance Indicators – Buildings & Facilities

Level	KPI (Reported Annually)
Strategic	<ul style="list-style-type: none"> – Percentage of total reinvestment compared to asset replacement value – Completion of strategic plan objectives (related to buildings & facilities)
Financial Indicators	<ul style="list-style-type: none"> – 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	<ul style="list-style-type: none"> – Percentage of component value replaced – Percent of facilities rated poor or critical – Percentage of facilities replacement value spent on O&M – Facility utilization rate <ul style="list-style-type: none"> – $Utilization Rate = \frac{Occupied\ Space}{Facility\ Usable\ Area}$
Operational Indicators	<ul style="list-style-type: none"> – Percentage of facilities inspected within the last five years – Number/type of service requests – Percentage of customer requests addressed within 24 hours

Level	KPI (Reported Annually)
Strategic	<ul style="list-style-type: none"> – Percentage of total reinvestment compared to asset replacement value – Completion of strategic plan objectives (related to vehicles)
Financial Indicators	<ul style="list-style-type: none"> – Annual revenues compared to annual expenditures – Annual replacement value depreciation compared to annual expenditures – Cost per capita for vehicles – Revenue required to maintain annual fleet portfolio growth – Total cost of borrowing vs. total cost of service
Tactical	<ul style="list-style-type: none"> – Percentage of all vehicles replaced – Average age of vehicles – Percent of vehicles rated poor or critical – Percentage of vehicles replacement value spent on O&M
Operational Indicators	<ul style="list-style-type: none"> – Average downtime per vehicles category – Average utilization per vehicles 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 addressed within 24 hours

Table 17 Key Performance Indicators – Vehicles

Table 18 Key Performance Indicators – Water and Storm Networks

Level	KPI (Reported Annually)
Strategic	<ul style="list-style-type: none"> – Percentage of total reinvestment compared to asset replacement value – Completion of strategic plan objectives (related to water, sanitary and storm)
Financial Indicators	<ul style="list-style-type: none"> – 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
Tactical	<ul style="list-style-type: none"> – Percentage of water, sanitary and storm network rehabilitated/reconstructed – Annual percentage of growth in water, sanitary and storm network – Percentage of mains where the condition is rated poor or critical for each network – Percentage of water, sanitary and storm network replacement value spent on O&M
Operational Indicators	<ul style="list-style-type: none"> – Percentage of water, sanitary and 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, sanitary and storm – Percentage of customer requests addressed within 24 hours per water, sanitary and storm network

Table 19 Key Performance Indicators – Machinery & Equipment

Level	KPI (Reported Annually)
Strategic	<ul style="list-style-type: none"> – Percentage of total reinvestment compared to asset replacement value – Completion of strategic plan objectives (related to machinery & equipment)
Financial Indicators	<ul style="list-style-type: none"> – Annual revenues compared to annual expenditures – Annual replacement value depreciation compared to annual expenditures – Cost per capita for machinery & equipment – Revenue required to maintain annual portfolio growth – Total cost of borrowing vs. total cost of service
Tactical	<ul style="list-style-type: none"> – Percentage of all machinery & equipment replaced – Average age of machinery & equipment assets – Percent of machinery & equipment rated poor or critical – Percentage of vehicles replacement value spent on O&M
Operational Indicators	<ul style="list-style-type: none"> – Average downtime per machinery & equipment asset – Ratio of preventative maintenance repairs vs. reactive repairs – Percent of machinery & equipment that received preventative maintenance – Number/type of service requests

Table 20 Key Performance Indicators – Land Improvements

Level	KPI (Reported Annually)
Strategic	<ul style="list-style-type: none"> – Percentage of total reinvestment compared to asset replacement value – Completion of strategic plan objectives (related to land improvements)
Financial Indicators	<ul style="list-style-type: none"> – Annual revenues compared to annual expenditures – Annual replacement value depreciation compared to annual expenditures – Cost per capita for supplying parks, playgrounds, etc. – Repair and maintenance costs per square metre
Tactical	<ul style="list-style-type: none"> – Percent of land improvements rated poor or critical – Percentage of replacement value spent on O&M – Parkland per capita
Operational Indicators	<ul style="list-style-type: none"> – Percentage of land improvements inspected within the last five years – Number/type of service requests – Percentage of customer requests addressed within 24 hours

3. Future Performance

In addition to a municipality's financial capacity and legislative requirements, many factors, internal and external, can influence the establishment of LOS and their associated KPI. These can include the municipality's overarching mission as an organization, the current state of its infrastructure and the wider social, political and macroeconomic context. The following factors should inform the development of most levels of service targets and their associated KPIs:

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 services 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 insights regarding the levels of service a particular asset or a network of assets 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 accelerate any planned growth in infrastructure services.

Demographic Changes

The composition of residents in a municipality can also serve as an infrastructure demand driver, 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 section will outline an implementation process that can be used to identify and prioritize renewal, rehabilitation and maintenance activities. This will assist in the development of a 10-year capital plan, including growth projections, to ensure the best overall



1. Non-Infrastructure Solutions & 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 a clearer path of what is required to achieve sustainable infrastructure programs.

2. Condition Assessment Programs

The foundation of an intelligent 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 the 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 of an asset may lead to its untimely 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

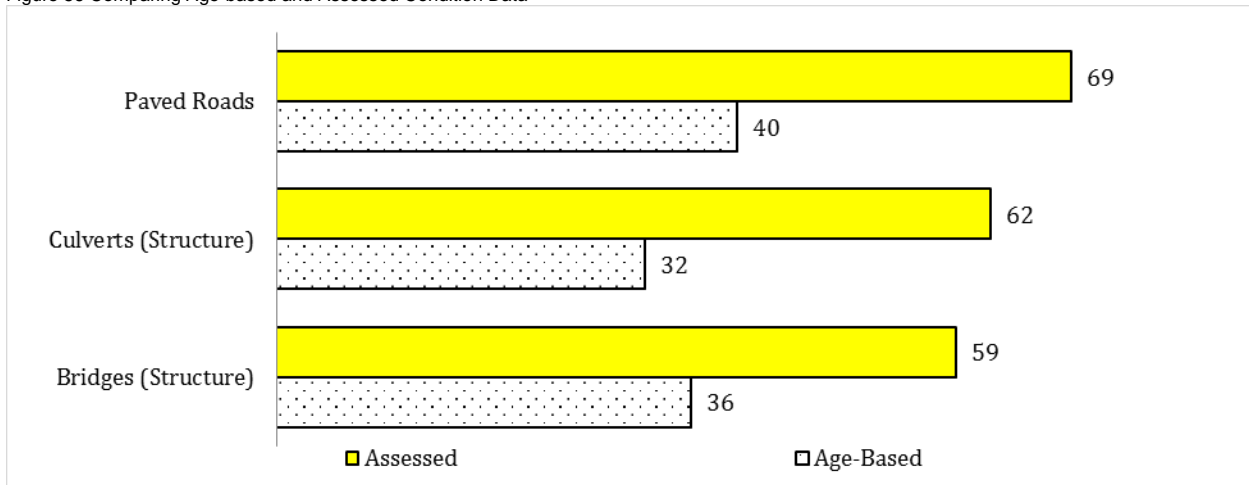
Condition assessment can involve different forms of analysis such as subjective opinion, mathematical models, or variations thereof, and can be completed through a very detailed or very cursory approach. When establishing the condition assessment for an entire asset class, a cursory approach (metrics such as good, fair, poor, very poor) is used. This is an economical strategy that 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.

The Impact of Condition Assessments

In 2015, PSD published a study in partnership with the Association of Municipalities of Ontario (AMO). The report, *The State of Ontario's Roads and Bridges: An Analysis of 93 Municipalities*, enumerated the infrastructure deficits, annual investment gaps, and the physical state of roads, bridges and culverts with a 2013 replacement value of \$28 billion.

A critical finding of the report was the dramatic difference in the condition profile of the assets when comparing age-based estimates and actual field inspection observations. For each asset group, field data based condition ratings were significantly higher than age-based condition ratings, with paved roads, culverts, and bridges showing an increase in score (0-100) of +29, +30, and +23 points respectively. In other words, age-based measurements maybe underestimating the condition of assets by as much as 30%.

Figure 56 Comparing Age-based and Assessed Condition Data



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.

It is recommended that the municipality continue its pavement condition assessment program and that a portion of capital funding is dedicated to this. We also recommend expansion of this program to incorporate additional components.

2.2 Bridges & Culverts

Ontario municipalities are mandated by the Ministry of Transportation to inspect all structures that have a span of 3 metres or more, according to 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 relies on the structural engineer who performs the inspections to also produce a maintenance requirements report, and rehabilitation & replacement requirements report as part of the overall assignment. In addition to defining 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

In 2017 Chatham-Kent completed a bridge condition assessment as per Ministry of Transportation requirements. Through the OSIM recommendations and additional detailed investigations, a 10-year needs list was developed for the municipality's bridges. The recommendations should be integrated in CityWide to ensure more accurate future reporting. It is recommended that this study should expand to structures that have a span of less than 3m (Bridges & Culverts <3m).

2.3 Buildings & Facilities

The most popular and practical type of buildings & facilities 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 (the most accurate approach), mathematical modeling or a combination of both. The following asset classifications are typically inspected:

- **Site Components** – property around the facility and 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 information can be uploaded into the CityWide®, the municipality's asset management and asset registry software database in order 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 continue its inspection of structures and expand its condition assessment program for other segments. It is also recommended that a portion of capital funding is dedicated to this.

2.4 Vehicles and Machinery & Equipment

The typical approach to optimizing the maintenance expenditures of vehicles and machinery & equipment, is through routine vehicle and component inspections, routine servicing, and a routine preventative maintenance program. Most makes and models of vehicles and machinery assets 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 sound 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 machinery & 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 progressively further away from reactive repairs and instead towards the prevention of all equipment failure before it occurs.

It is recommended that a preventative maintenance routine is defined and established for all vehicles and machinery & equipment assets, and that a software application is utilized for the overall management of the program.

2.5 Storm Network Inspection

The most popular and practical type of 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 travel 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 an effective 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. Rather, in its 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 implement a storm main assessment program. A portion of capital funding should be dedicated to this.

2.6 Parks and Land Improvements

CSA standards provide guidance on the process and protocols in regards to the inspection of parks and their associated assets, e.g., play spaces and equipment. The land improvements inspection will involve qualified groups of trained industry professionals (operational staff or landscape architects) performing an analysis of the condition of a group of land improvement assets 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 continue its parks condition assessment program and that a portion of capital funding is dedicated to this.

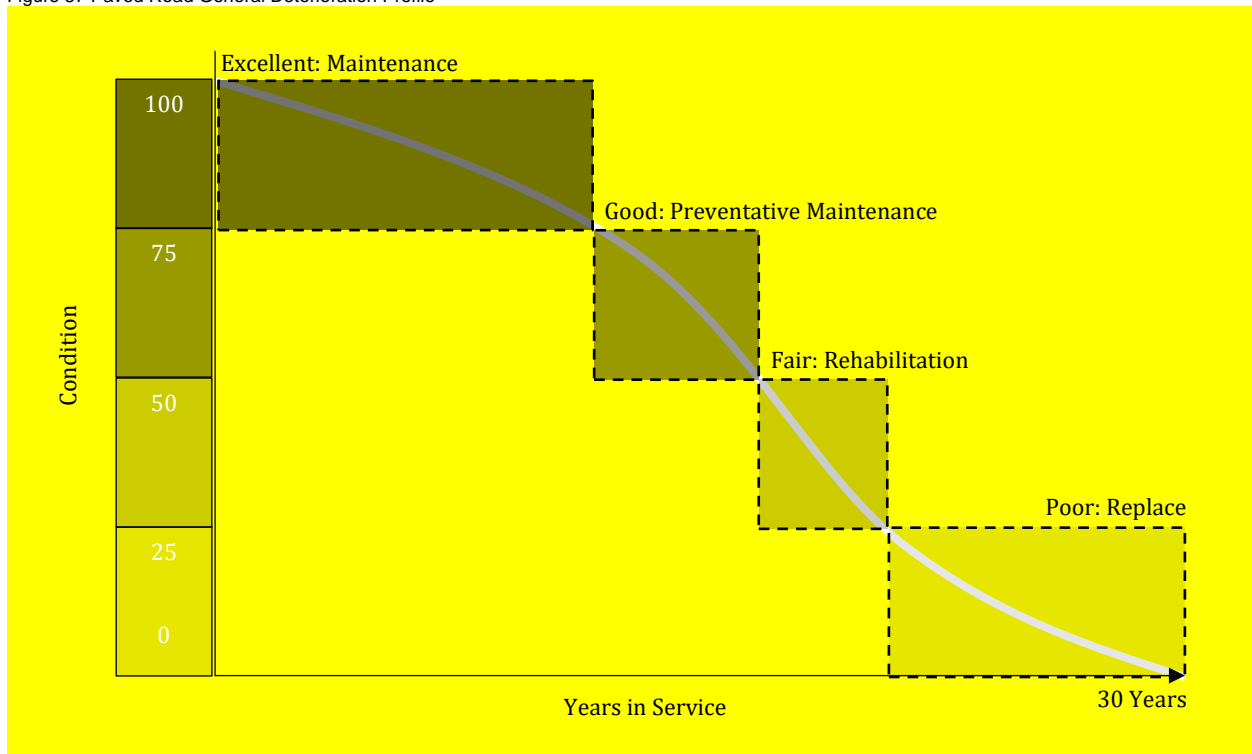
3. Lifecycle Analysis Framework

An industry review was conducted to determine which lifecycle 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 can 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 entered 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

Figure 57 Paved Road General Deterioration Profile



As shown above, during the road’s lifecycle, 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 21 Asset Condition and Related Work Activity for Paved Roads

Condition	Condition Range	Work Activity
Very Good (Maintenance only phase)	81-100	– Maintenance only
Good (Preventative maintenance phase)	61-80	– Crack sealing – Emulsions
Fair (Rehabilitation phase)	41-60	– Resurface - mill & pave – Resurface - asphalt overlay – Single & double surface treatment (for rural roads)
Poor (Reconstruction phase)	21-40	– Reconstruct - pulverize and pave – Reconstruct - full surface and base reconstruction
Very Poor (Reconstruction phase)	0-20	– 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 thresholds and condition ranges can be 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 lifecycle 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 relies on 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 Buildings & Facilities

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.

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 and legislative requirements, energy conservation programs and upgrades, customer complaints and health and safety concerns, and 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 Vehicles and Machinery & Equipment

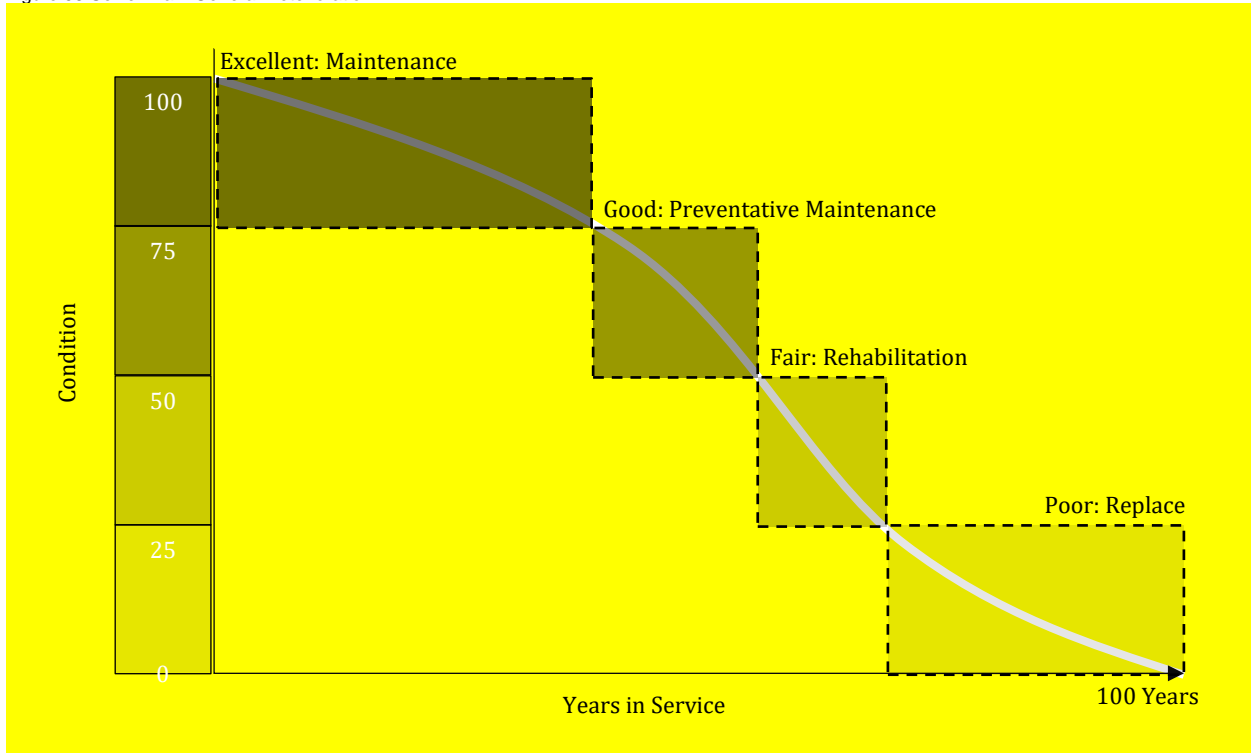
The best approach to develop a 10-year needs list for the municipality's vehicles and machinery & equipment portfolio would first be through a defined preventative maintenance program, and secondly, through an optimized lifecycle vehicle replacement schedule. The preventative maintenance program would serve to determine budget requirements for operating and minor capital expenditures for renewal of parts, and major refurbishments and rehabilitations. An optimized replacement program will ensure a vehicle or equipment asset 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 vehicles industry in regard to vehicle lifecycles 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 vehicles management that should also be examined in further detail as part of the long-term management plan, such as vehicles utilization and incorporating green vehicles, etc. It is recommended that the municipality establish a prioritization framework for the vehicles asset class that incorporates the key components outlined above.

3.5 Storm Sewers

The following analysis has been conducted at a fairly high level, using industry standard activities and costs for 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 activities used for sewer mains and the associated local costs for those work activities. 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 58 Sewer Main General Deterioration



As shown above, during the sewer main’s lifecycle 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 for Sewer Mains

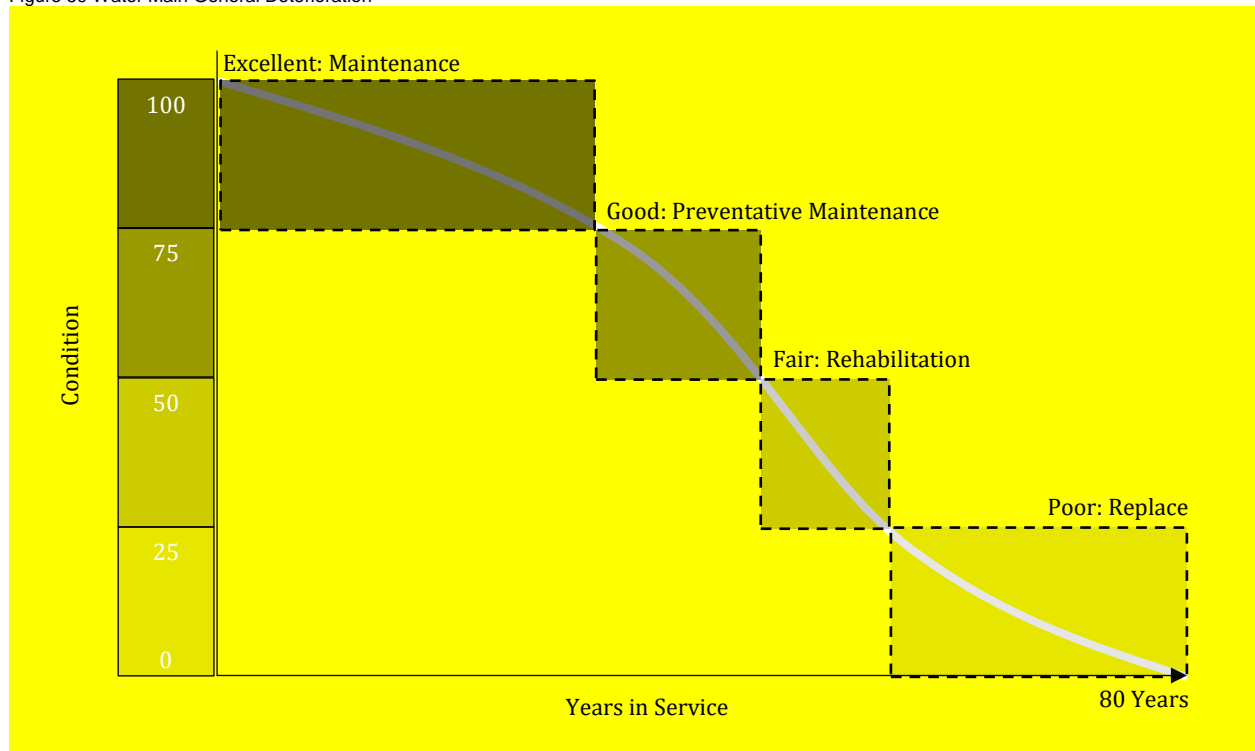
Condition	Condition Range	Work Activity
Very Good (Maintenance only phase)	81-100	– Maintenance only (cleaning & flushing etc.)
Good (Preventative maintenance phase)	61-80	– Mahhole repairs – Small pipe section repairs
Fair (Rehabilitation phase)	41-60	– Structural relining
Poor (Reconstruction phase)	21-40	– Pipe replacement
Very Poor (Reconstruction phase)	0-20	– 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 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 System

As with roads and sewers, the following analysis has been conducted at a 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 59 Water Main General Deterioration



As shown above, during the water main’s lifecycle, 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 in Table 23.

Table 23 Asset Condition and Related Work Activity for Water Mains

Condition	Condition Range	Work Activity
Very Good (Maintenance only phase)	81-100	– Maintenance only (cleaning & flushing etc.)
Good (Preventative maintenance phase)	61-80	– Water main break repairs – Small pipe section repairs
Fair (Rehabilitation phase)	41-60	– Structural water main relining
Poor (Reconstruction phase)	21-40	– Pipe replacement
Very Poor (Reconstruction phase)	0-20	– 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. Based on the 2016 census, the population for Chatham-Kent has decreased 2% since 2011 dropping to 104,075. Population changes will require the municipality to determine the impact to expected levels of service and if any changes to the existing asset inventory may be required.

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 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 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.

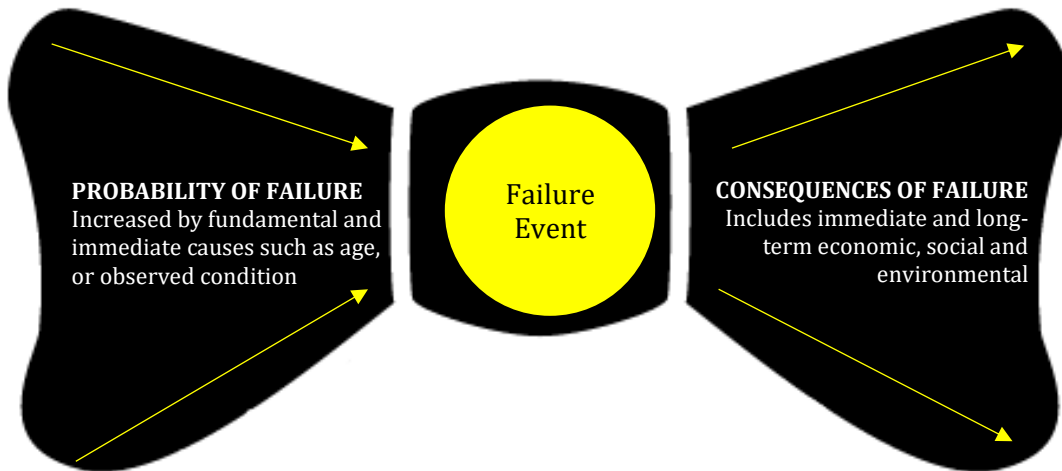
Risk mitigation is traditionally thought of in terms of safety and liability factors. In asset management, the definition of risk should heavily emphasize these factors but should be expanded to consider the risks to the municipality’s ability to deliver targeted levels of service

- 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

5.2 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 table that follow. 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. Figure 60 (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 60 Bow Tie Risk Model



Probability of Failure

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

Table 24 Probability 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

The consequence of failure for the asset classes analyzed in this AMP will be determined either by the replacement costs of assets, or other attributes as relevant. These attributes include material types, classifications, or size. Asset classes for which replacement cost is used include: bridges & culverts, buildings & facilities, land improvements, vehicles, and machinery & equipment, municipal airport and transit. This approach is premised on the assumption that the higher the replacement cost, the larger (and likely more important) the asset, requiring a higher risk scoring.

Assets for which other attributes are used include: combined storm network and road network. Attributes are selected based on their impact on service delivery. For linear infrastructure, pipe diameter is used to estimate a suitable consequence of failure score as it reflects the potential upstream service area affected. Scoring for roads, the risk is based on classification as it reflects the traffic volumes and number of people affected.

Table 25 Consequence of Failure – Roads

Road Classification	Consequence of failure
Gravel	Score of 1
BST	Score of 3
Asphalt	Score of 4
PCC	Score of 5

Table 26 Consequence of Failure – Bridges & Culverts

Replacement Value	Consequence of failure
Under \$1 million	Score of 4

Table 27 Consequence of Failure – Combined Storm Sewer Mains

Pipe Diameter	Consequence of Failure
Less than 300mm	Score of 1
300mm	Score of 2
300-499mm	Score of 3
400-499mm	Score of 4
500mm and over	Score of 5

Note: Consequence of failure values can only be calculated for mains that have diameter information. Approximately 3% of mains have been excluded from the analysis above due to diameter information missing. It is recommended that the municipality gather and complete any data gaps prior to the completion of future asset management plans.

Table 28 Consequence of Failure – Facilities and Structures

Replacement Value	Consequence of failure
Up to \$450k	Score of 1
\$450k to \$2 million	Score of 2
\$2 million to \$5 million	Score of 3
\$5 million to \$10 million	Score of 4
Over \$10 million	Score of 5

Table 29 Consequence of Failure – Land Improvements

Replacement Value	Consequence of Failure
Up to \$10k	Score of 1
\$10k to \$450k	Score of 2
\$450k to \$1 million	Score of 3
\$1 million to \$1.5 million	Score of 4
Over \$1.5 million	Score of 5

Table 30 Consequence of Failure – Machinery & Equipment

Replacement Value	Consequence of failure
Up to \$750k	Score of 1
\$750k to \$2 million	Score of 2
\$2 million to \$3 million	Score of 3
\$3 million to \$5 million	Score of 4
Over \$5 million	Score of 5

Table 31 Consequence of Failure – Rolling Stock

Replacement Value	Consequence of failure
Up to \$100k	Score of 1
\$100k to 250k	Score of 2
\$250k to \$350k	Score of 3
\$350k to \$500k	Score of 4
Over \$500k	Score of 5

Table 32 Consequence of Failure – Municipal Airport

Replacement Value	Consequence of failure
Up to \$10k	Score of 1
\$10k to \$50k	Score of 2
\$50k to \$100k	Score of 3
\$100k to \$500k	Score of 4
Over \$500k	Score of 5

Table 33 Consequence of Failure – Transit

Replacement Value	Consequence of failure
Up to \$10k	Score of 1
\$10k to \$12k	Score of 2
\$12k to \$25k	Score of 3
\$25k to \$100k	Score of 4
Over \$100k	Score of 5

The risk matrices that follow show the distribution of assets within each asset class according to the probability and likelihood of failure scores as discussed above.

Figure 61 Distribution of Assets Based on Risk – Road Network (Road Surfaces)

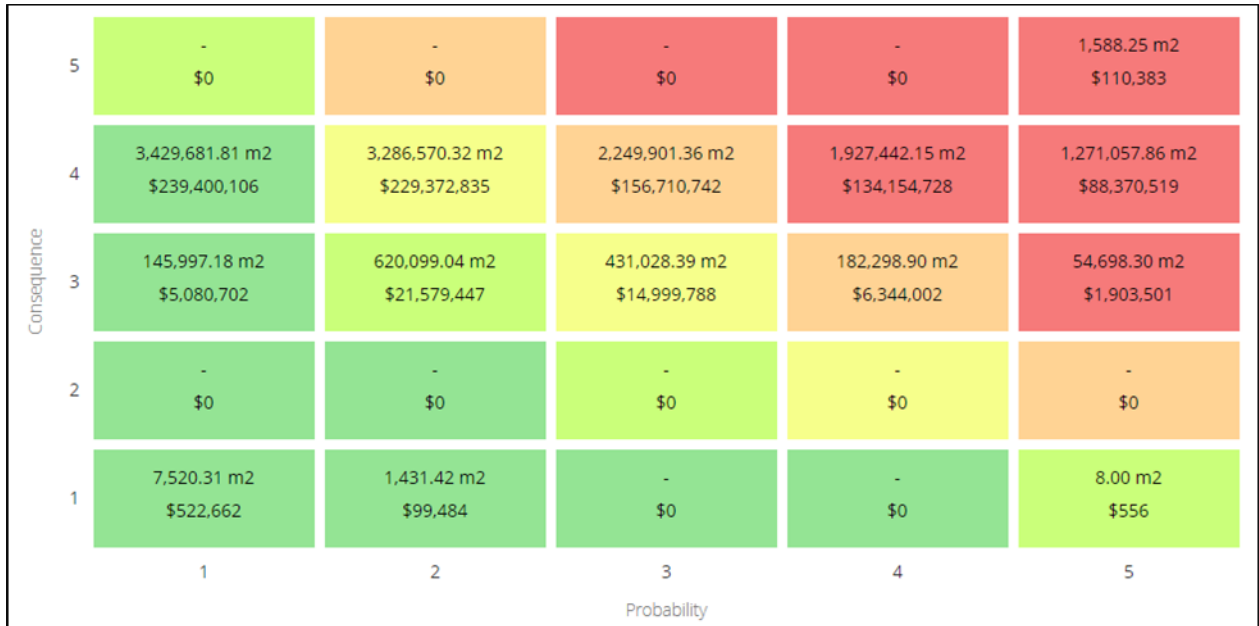


Figure 62 Distribution of Assets Based on Risk – Bridges & Culverts >3m



Figure 63 Distribution of Assets Based on Risk – Storm Network (combined network & storm collector mains)

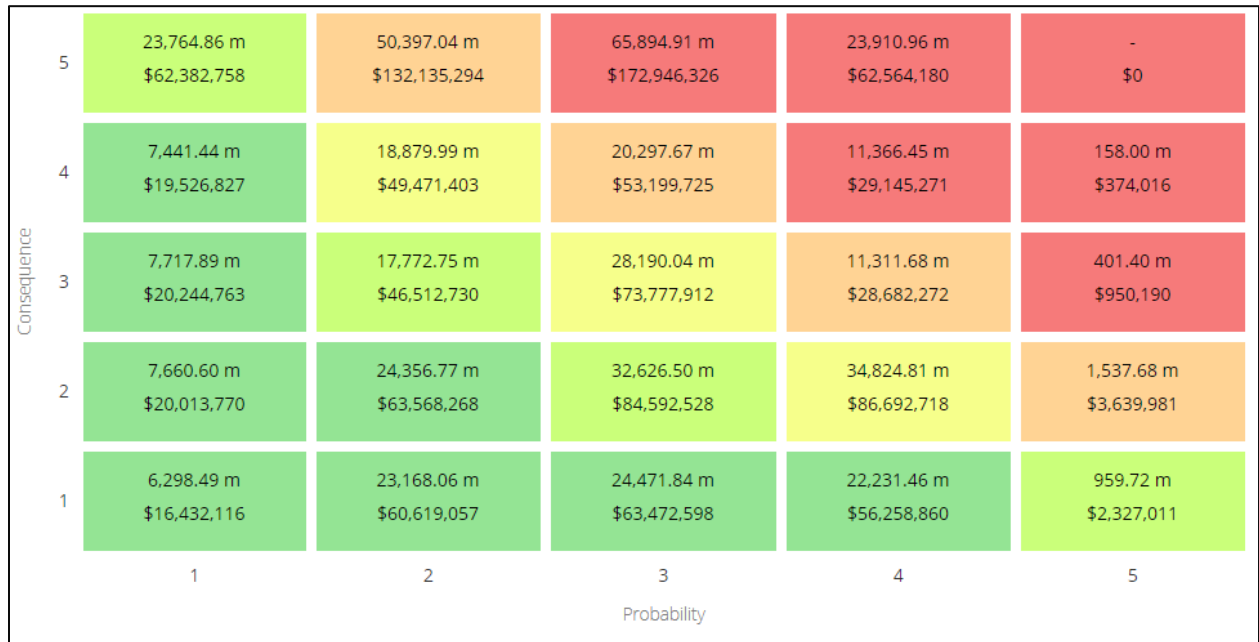


Figure 64 Distribution of Assets Based on Risk – Facilities & Structures

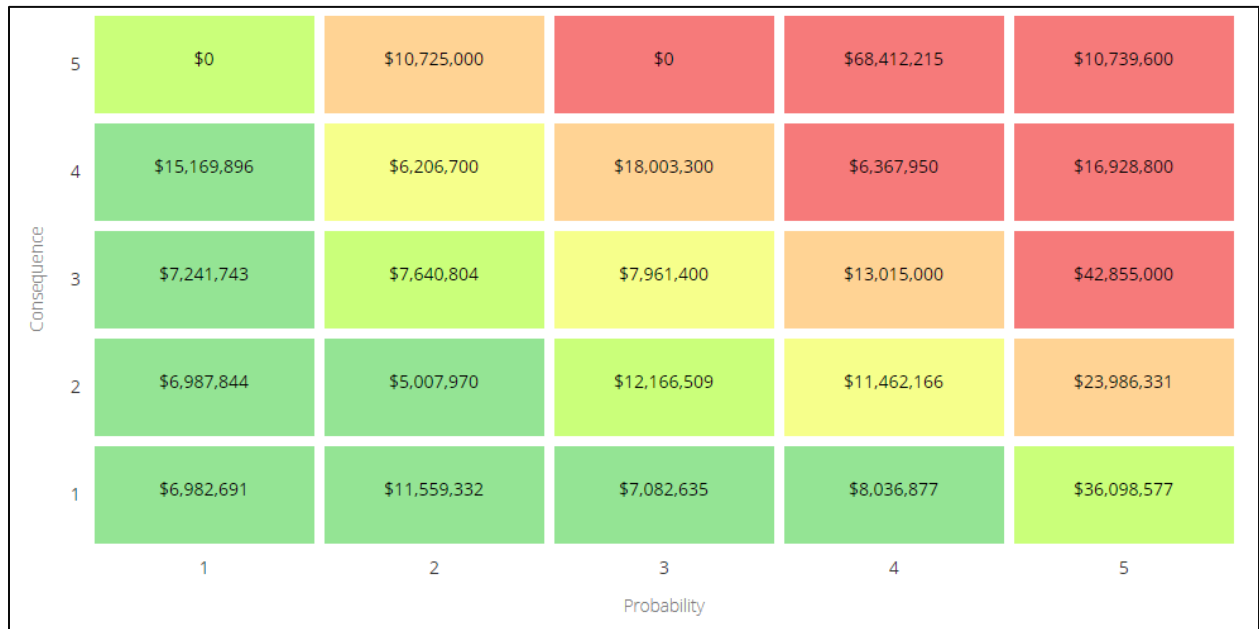


Figure 645 Distribution of Assets Based on Risk – Land Improvements

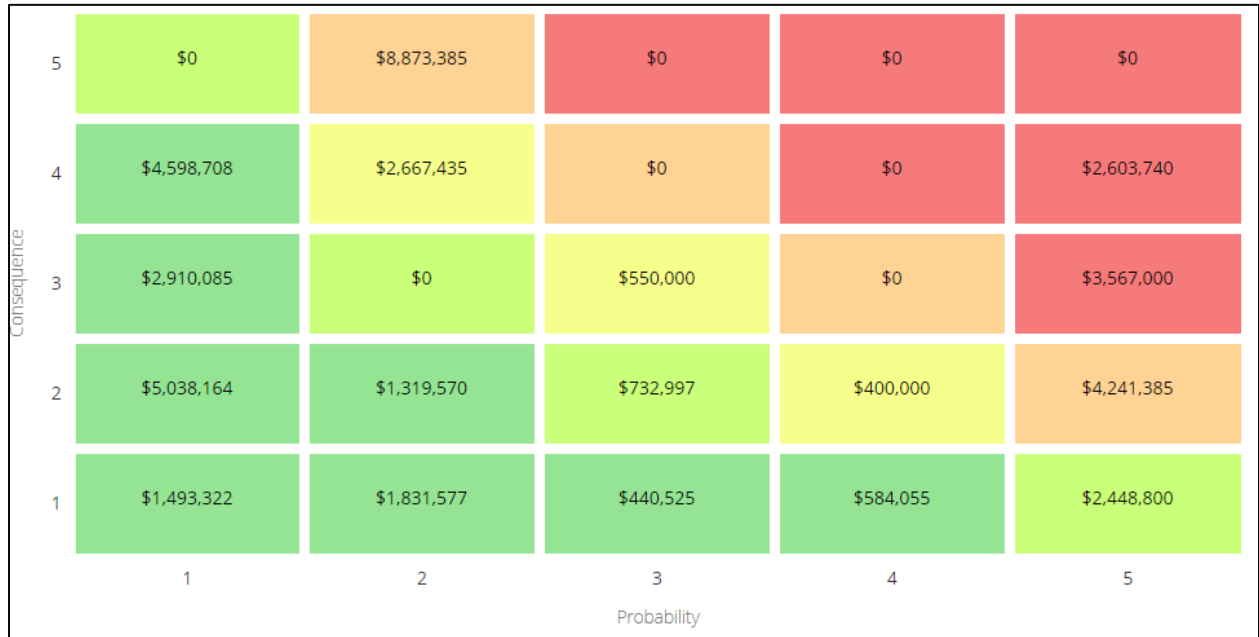


Figure 66 Distribution of Assets Based on Risk – Machinery & Equipment

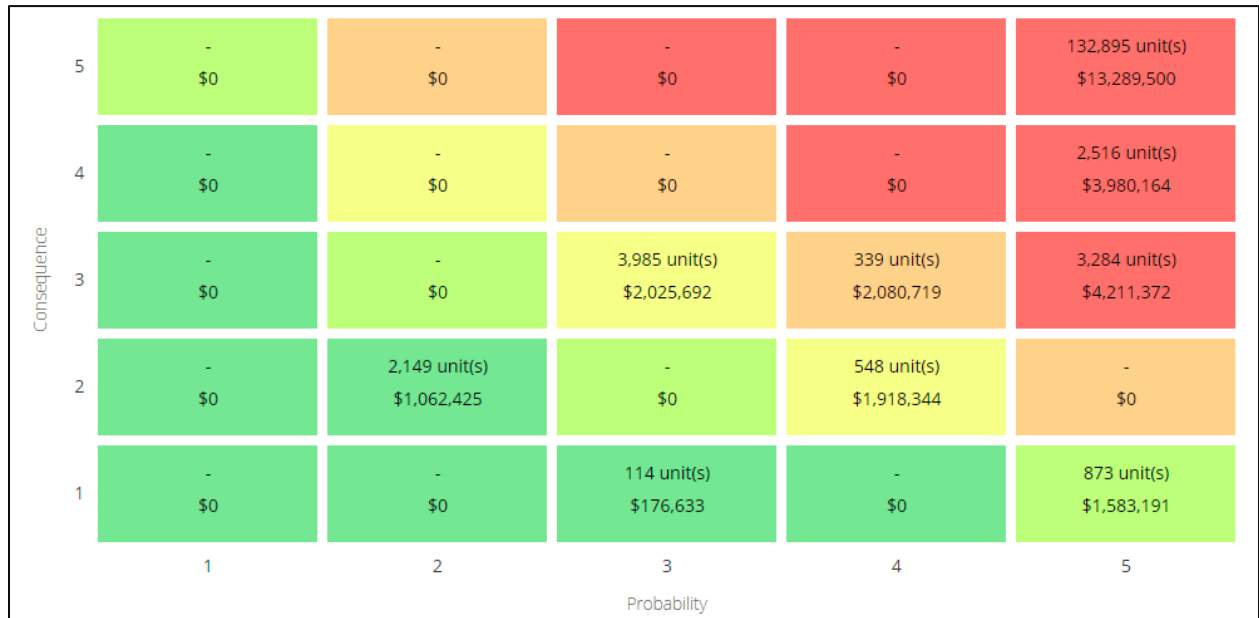


Figure 67 Distribution of Assets Based on Risk – Rolling Stock



Figure 68 Distribution of Assets Based on Risk – Municipal Airport



Figure 69 Distribution of Assets Based on Risk – Transit

Consequence	5	- \$0	- \$0	- \$0	- \$0	1 unit(s) \$2,000,000
	4	- \$0	1 unit(s) \$100,000	- \$0	- \$0	- \$0
	3	3 unit(s) \$38,100	- \$0	- \$0	- \$0	- \$0
	2	2 unit(s) \$20,780	5 unit(s) \$51,950	3 unit(s) \$31,170	- \$0	12 unit(s) \$124,680
	1	1 unit(s) \$8,160	1 unit(s) \$8,160	- \$0	- \$0	4 unit(s) \$32,640
		1	2	3	4	5
		Probability				

IX. Financial Strategy

1. General Overview

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



Figure 65 Cost Elements

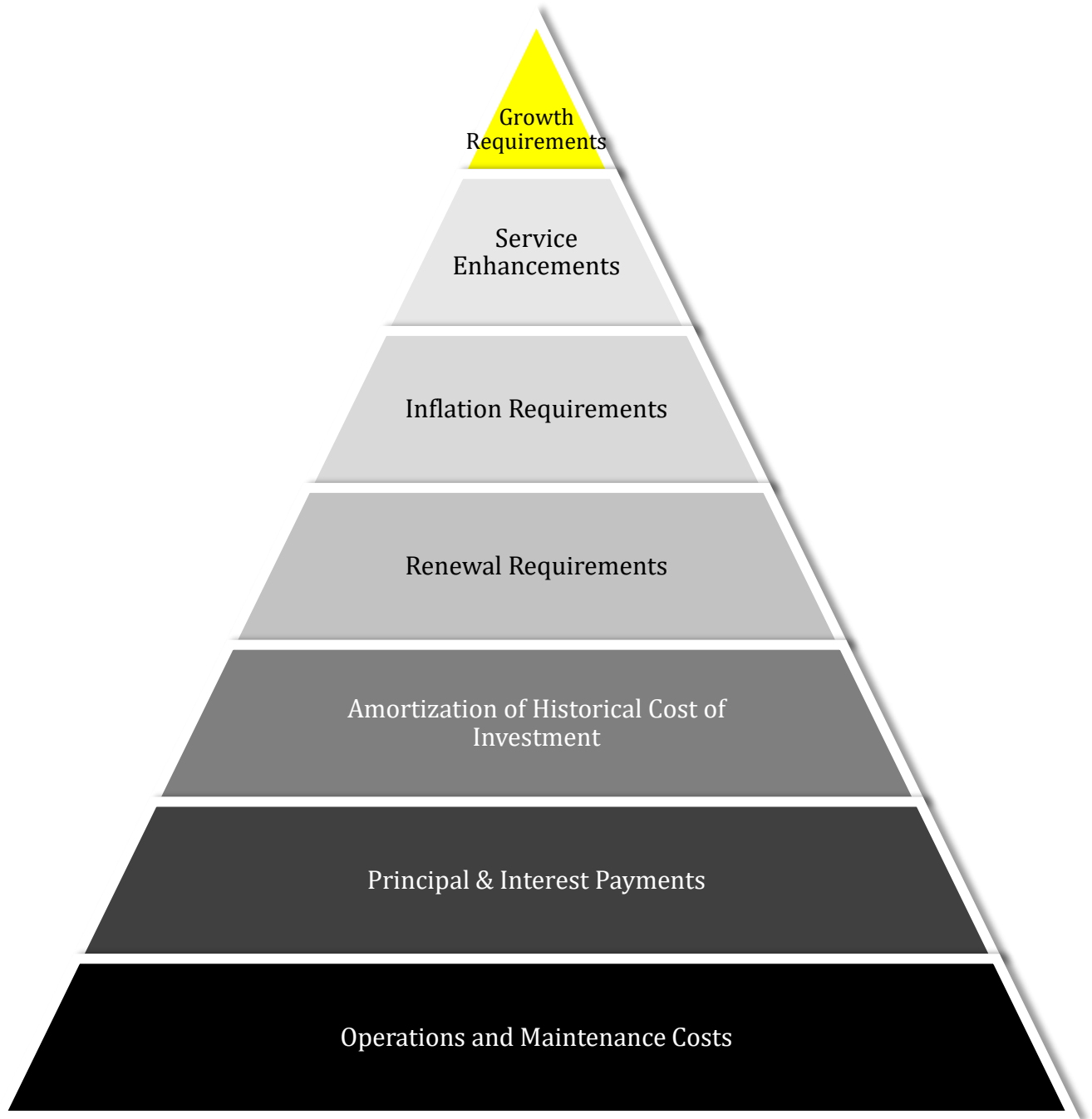


Figure 65 depicts the various cost elements and resulting funding levels that should be incorporated into AMPs that are based on best practices. Municipalities meeting their operational and maintenance needs, and debt obligations are funding only their cash cost. Funding at this level is severely deficient in terms of lifecycle costs.

Meeting the annual amortization expense based on the historical cost of investment will ensure municipalities adhere to accounting rules implemented in 2009; however, funding is still deficient for long-term needs. As municipalities graduate to the next level and meet renewal requirements, funding at this level ensures that need and cost of full replacement is deferred. If municipalities meet inflation requirements, they're positioning themselves to meet replacement needs at existing levels of service. In the final level, municipalities that are funding for service enhancement and growth requirements are fiscally sustainable and cover future investment needs.

This report develops a financial plan by presenting several scenarios for consideration and culminating with final recommendations. It includes recommendations that avoid long-term funding deficits. As outlined below, the scenarios presented model different combinations of the following components:

- 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), and requirements of anticipated growth (none identified for this plan)
- use of traditional sources of municipal funds including tax levies, user fees, reserves, debt, and development charges
- use of non-traditional sources of municipal funds, e.g., reallocated budgets
- use of senior government funds, such as the federal Gas Tax Fund, Ontario Community Infrastructure Fund (OCIF)

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:

- In order to reduce financial requirements, consideration has been given to revising service levels downward.
- 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.

2. Financial Profile: Tax Funded Assets

2.1 Funding Objective

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

2.2 Current Funding Position

Table 34 and Table 35 outline, by asset class, 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 34 Infrastructure Requirements and Current Funding Available: Tax Funded Assets

Asset class	Average Annual Investment Required	Total Funding Available in 2017					Annual Deficit/Surplus
		Taxes	Gas Tax	OCIF	User Fees	Total Funding Available	
Road Network	26,699,000	3,396,000	1,576,000	2,473,000	0	7,445,000	19,254,000
Gravel Roads	3,978,000	3,295,000	0	0	0	3,295,000	683,000
Bridges & Culverts	18,660,000	11,131,000	4,728,000	0	0	15,859,000	2,801,000
Storm Network	20,295,000	2,009,000	0	0	0	2,009,000	18,286,000
Facilities	7,279,000	3,547,000	0	0	350,000	3,897,000	3,382,000
Social Housing	2,232,000	1,810,000	0	0	0	1,810,000	422,000
Municipal Airport	97,000	10,000	0	0	0	10,000	87,000
Transit	89,000	5,000	0	0	0	5,000	84,000
Machinery & Equipment	3,303,000	2,330,000	0	0	0	2,330,000	973,000
Vehicles	5,132,000	4,316,000	0	0	0	4,316,000	816,000
Land Improvements	1,786,000	1,136,000	0	0	0	1,136,000	650,000
Other capital Projects	5,957,000	5,840,000	0	0	0	5,840,000	117,000
Total	\$95,507,000	\$38,825,000	\$6,304,000	\$2,473,000	\$350,000	\$47,952,000	\$47,555,000

Note: Chatham-Kent has included lifecycle maintenance events in the calculation of its annual requirements for bridges & culverts as presented in Table 34. This has increased their annual requirements from \$15,150,000 to \$18,660,000. Public Sector Digest has not reviewed the adequacy of the lifecycle events included in their calculation.

2.3 Recommendations for Full Funding

The average annual investment requirement for tax funded categories is \$95,507,000. Annual revenue currently allocated to these assets for capital purposes is \$47,952,000, leaving an annual deficit of \$47,555,000. To put it another way, these infrastructure categories are currently funded at 50% of their long-term requirements. In 2017, the municipality has annual tax revenues of \$148,508,000. As illustrated in Table 35, without consideration of any other sources of revenue, full funding would require the following tax change over time:

Table 35 Tax Change Required for Full Funding

Asset class	Tax Change Required for Full Funding
Road Network	13.5%
Bridges & Culverts	1.9%
Storm Network	12.3%
Buildings & Facilities	2.3%
Social & Affordable Housing	0.3%
Municipal Airport	0.1%
Transit	0.1%
Machinery & Equipment	0.7%
Vehicles	0.5%
Land Improvements	0.4%
Other capital projects	0.1%
Total	32.2%

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

- Chatham-Kent' formula based OCIF grant is scheduled to grow from \$2,473,000 in 2017 to \$5,333,000 in 2019.
- Chatham-Kent's debt payments for these asset categories will be decreasing by \$2,603,000 over the next 5 years and by \$2,603,000 over the next 10 years. Although not shown in the table, debt payment decreases will be \$2,603,000 and \$3,182,000 over the next 15 years and 20 years respectively.

Our recommendations include capturing the above changes and allocating them to the infrastructure deficit. Table 36 outlines this concept and presents a number of options.

Table 36 Effect of Changes in OCIF Funding and Reallocating Decreases in Debt Costs

	Without Capturing Changes					With Capturing Changes				
	5 Years	10 Years	15 Years	20 Years	25 Years	5 Years	10 Years	15 Years	20 Years	25 Years
Infrastructure Deficit	47,555,000	47,555,000	47,555,000	47,555,000	47,555,000	47,555,000	47,555,000	47,555,000	47,555,000	47,555,000
Change in OCIF Grant	N/A	N/A	N/A	N/A	N/A	-2,860,000	-2,860,000	-2,860,000	-2,860,000	-2,860,000
Changes in Debt Costs	N/A	N/A	N/A	N/A	N/A	-2,603,000	-2,603,000	-2,603,000	-3,182,000	-3,182,000
Resulting Infrastructure Deficit	47,555,000	47,555,000	47,555,000	47,555,000	47,555,000	42,092,000	42,092,000	42,092,000	41,513,000	41,513,000
Resulting Tax Increase Required:										
Total Over Time	32.1%	32.1%	32.1%	32.1%	32.1%	28.3%	28.3%	28.3%	28.0%	28.0%
Annually	6.4%	3.2%	2.1%	1.6%	1.3%	5.7%	2.8%	1.9%	1.4%	1.1%

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

- when realized, reallocating the debt cost reductions of \$3,182,000 to the infrastructure deficit as outlined above.
- increasing tax revenues by 1.4% each year for the next 15 years solely for the purpose of phasing in full funding to the tax funded asset classes covered in this AMP.
- allocating the current gas tax and OCIF revenue as outlined in Table 34.
- allocating the scheduled OCIF grant increases to the infrastructure deficit as they occur.
- 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 tax revenues by the amounts recommended above for infrastructure purposes will be very difficult to do. However, considering a longer phase-in window may have even greater consequences in terms of infrastructure failure.

Although this option achieves full funding on an annual basis in 20 years and provides financial sustainability over the period modeled, the recommendations do require prioritizing capital projects to fit the resulting annual funding available. Current data shows a pent-up investment demand of \$47 million for paved roads, \$184 million for bridges & culverts, \$49 million for storm network, \$10 million for machinery & equipment, \$92 million for facilities and structures, \$9 million for land improvements, \$25,000 for municipal airport, \$2 million for transit and \$7 million 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.

4. Use of Debt

For reference purposes, Table 37 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 take into account the time value of money or the effect of inflation on delayed projects.

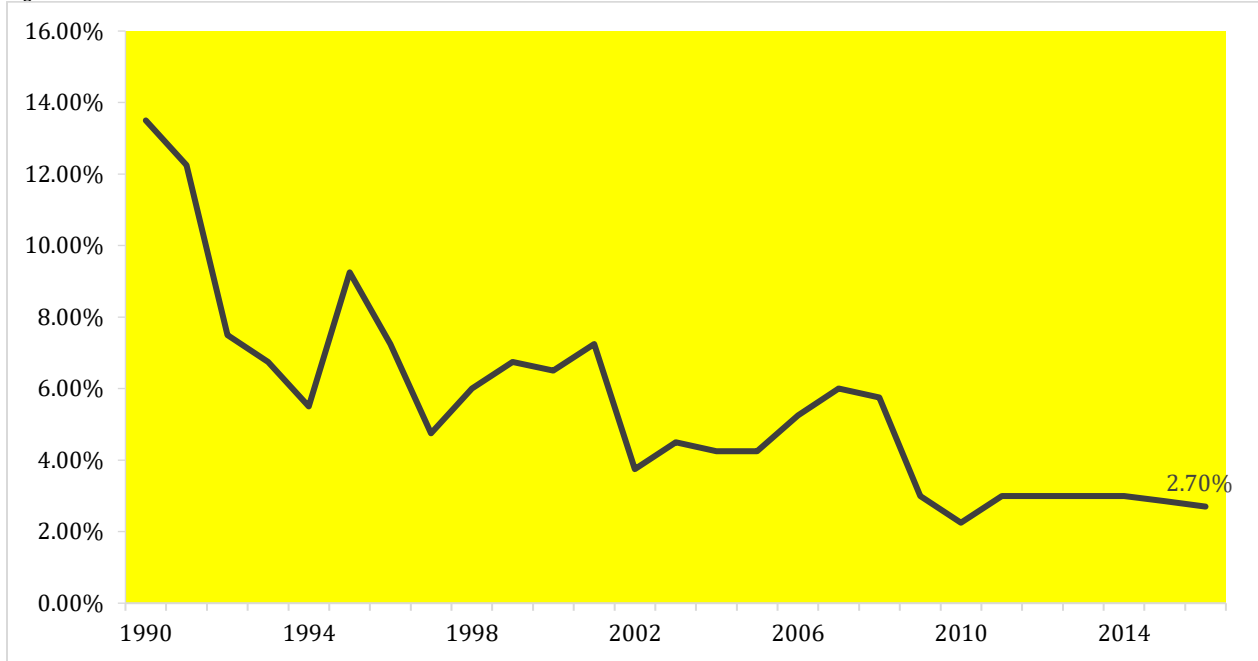
Table 37 Total Interest Paid as a Percentage of Project Costs

Interest Rate	Number of Years Financed					
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 66 Historical Prime Business Interest Rates



As illustrated in Table 37 , 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 38 and Table 39 outline how Chatham-Kent has historically used debt for investing in the asset categories as listed. There is currently \$37,600,000 of debt outstanding for the assets covered by this AMP with corresponding principal and interest payments of \$3,182,000 well within its provincially prescribed maximum of \$54,263,000.

Table 38 Overview of Use of Debt

Asset class	Debt at December 31 st , 2016	Use of Debt in Last Five Years				
		2012	2013	2014	2015	2016
Road Network	650,000	0	0	0	0	0
Bridges & Culverts	4,548,000	0	0	0	0	0
Storm Network	11,802,000	0	0	0	0	0
Buildings & Facilities	0	0	7,978,000	0	0	0
Social Housing	0	0	0	0	0	0
Municipal Airport	0	0	0	0	0	0
Transit	0	0	0	0	0	0
Machinery & Equipment	0	0	0	0	0	0
Vehicles	0	0	0	0	0	0
Land Improvements	0	0	0	0	0	0
Total	17,000,000	0	7,978,000	0	0	0

Table 39 Overview of Debt Costs

Asset class	Principal & Interest Payments in Next Ten Years						
	2017	2018	2019	2020	2021	2022	2027
Road Network	210,000	210,000	210,000	105,000	0	0	0
Bridges & Culverts	1,302,000	1,302,000	1,302,000	651,000	0	0	0
Storm Network	0	0	0	0	0	0	0
Buildings & Facilities	1,670,000	1,670,000	1,670,000	1,651,000	1,633,000	579,000	579,000
Social Housing	0	0	0	0	0	0	0
Municipal Airport	0	0	0	0	0	0	0
Transit	0	0	0	0	0	0	0
Machinery & Equipment	0	0	0	0	0	0	0
Vehicles	0	0	0	0	0	0	0
Land Improvements	0	0	0	0	0	0	0
Total Rate Funded	3,182,000	3,182,000	3,182,000	2,407,000	1,633,000	579,000	579,000

The revenue options outlined in this plan allow Chatham-Kent to fully fund its long-term infrastructure requirements without further use of debt. However, project prioritization based on replacing age-based data with observed data for several tax funded and rate funded classes 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; and, normalizing infrastructure funding requirements. By infrastructure class, Table 40 outlines the details of the reserves currently available to Chatham-Kent.

Table 40 Summary of Reserves Available

Asset class	Balance at December 31 st , 2016
Road Network	9,484,000
Bridges & Culverts	13,972,000
Storm Network	9,115,000
Buildings & Facilities	8,237,000
Social Housing	2,896,000
Municipal Airport	0
Transit	4,544,000
Machinery & Equipment	12,081,000
Vehicles	7,396,000
Land Improvements	2,849,000
Total	70,574,000

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 40 are available for use by applicable asset categories during the phase-in period to full funding. This, coupled with Chatham-Kent'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 Chatham-Kent updates its AMP, we recommend that future planning should include determining what its long-term reserve balance requirements are and a plan to achieve such balances.

X. 2017 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 41 2016 Infrastructure Report Card

Asset class	Asset Health Grade	Funding Percentage	Financial Capacity Grade	Average Asset Class Grade	Comments
Road Network	C	35%	F	D	<p>Based on 2017 replacement cost, and some condition data, 48% of assets, with a valuation of \$2 billion, are in good to very good condition; 31% are in poor to very poor condition.</p> <p>The municipality is underfunding its tax-funded assets at 50%.</p>
Bridges & Culverts	C	85%	B	C	
Storm Network	C	10%	F	F	
Buildings & Facilities, Social Housing	D	60%	D	D	
Municipal Airport	C	10%	F	F	
Transit	F	6%	F	F	
Machinery & Equipment	F	71%	C	D	
Vehicles	D	84%	B	C	
Land Improvements	C	64%	C	C	
Average Asset Health Grade			C		
Average Financial Capacity Grade			F		
Overall Grade for the Municipality			D		

XI. Appendix: Grading and Conversion Scales

Table 42 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 43 Financial Capacity Scale

Letter Grade	Rating	Funding percent	Timing Requirements	Description
A	Excellent	90-100 percent	<input checked="" type="checkbox"/> Short Term <input checked="" type="checkbox"/> Medium Term <input checked="" type="checkbox"/> 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	<input checked="" type="checkbox"/> Short Term <input checked="" type="checkbox"/> Medium Term <input checked="" type="checkbox"/> 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	<input checked="" type="checkbox"/> Short Term <input checked="" type="checkbox"/> Medium Term <input checked="" type="checkbox"/> Long Term	The municipality is underprepared 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	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> Short Term <input checked="" type="checkbox"/> Medium Term <input checked="" type="checkbox"/> 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	<input checked="" type="checkbox"/> Short Term <input checked="" type="checkbox"/> Medium Term <input checked="" type="checkbox"/> 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.