THE ASSET MANAGEMENT PLAN FOR THE MUNICIPALITY OF BROCKTON

2013

THE MUNICIPALITY OF BROCKTON
100 SCOTT ST. BOX 68
WALKERTON, ONTARIO, N0G 2V0

SUBMITTED DECEMBER 2013
BY PUBLIC SECTOR DIGEST
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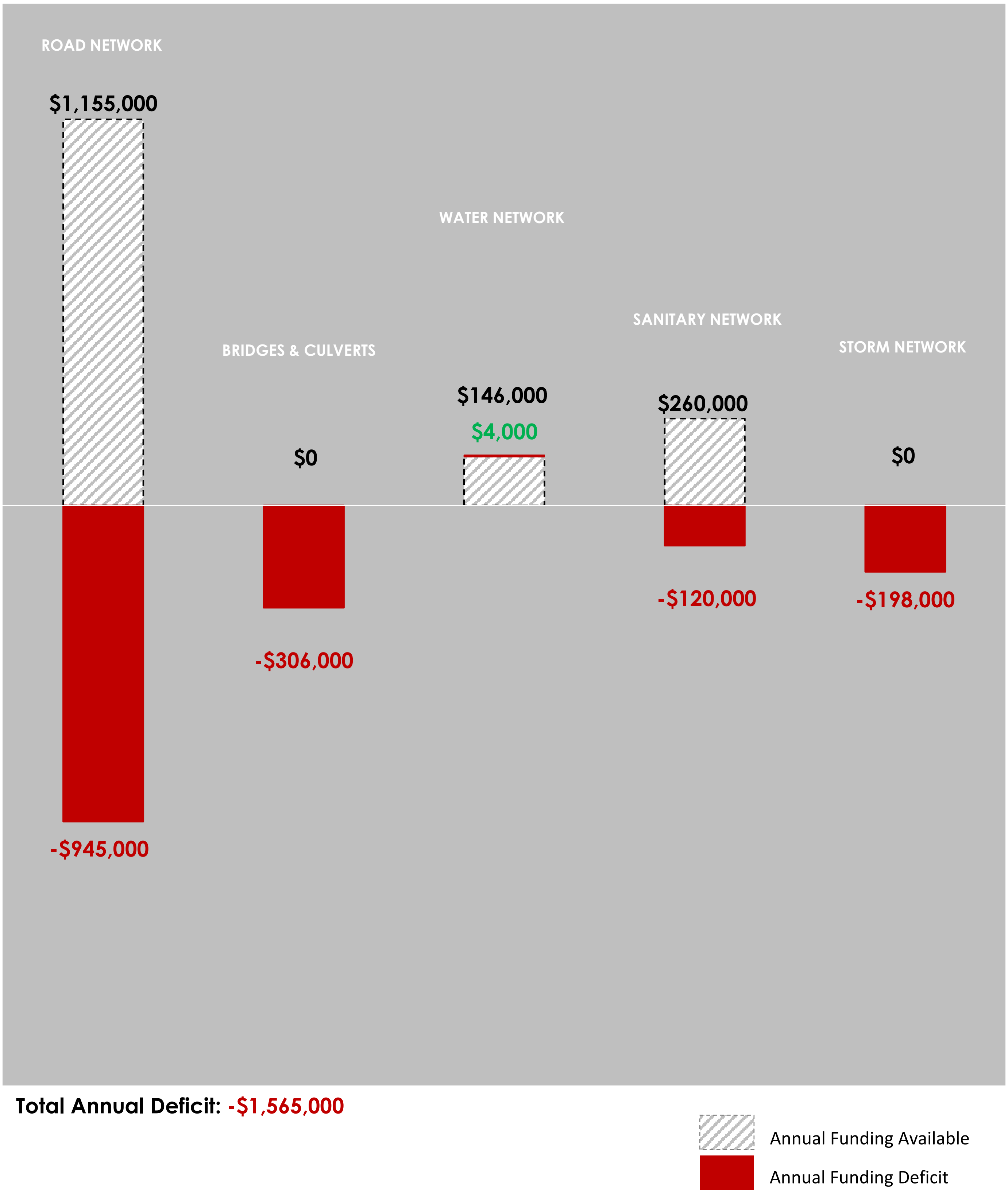
LONDON, ONTARIO, N6A 5P3

AVERAGE ANNUAL FUNDING REQUIRED **vs.** AVERAGE ANNUAL FUNDING AVAILABLE



Total Annual Deficit: -$1,565,000

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December 2013

The Municipality of Brockton
100 Scott St. Box 68
Walkerton, Ontario, N0G 2V0

We are pleased to submit the 2013 Asset Management Plan (AMP) for the Municipality of Brockton. This AMP complies with the requirements as outlined within the provincial *Building Together Guide for Municipal Asset Management Plans.* It will serve as a strategic, tactical, and financial document, ensuring the management of the municipal infrastructure follows sound asset management practices and principles, while optimizing available resources and establishing desired levels of service. Given the broad and profound impact of asset management on the community, and the financial & administrative complexity involved in this ongoing process, we recommend that senior decision-makers from across the organization are actively involved in its implementation.

The performance of a community's infrastructure provides the foundation for its economic development, competitiveness, prosperity, reputation, and the overall quality of life for its residents. As such, we are appreciative of your decision to entrust us with the strategic direction of its infrastructure and asset management planning, and are confident that this AMP will serve as a valuable tool.

Sincerely,
The Public Sector Digest Inc.

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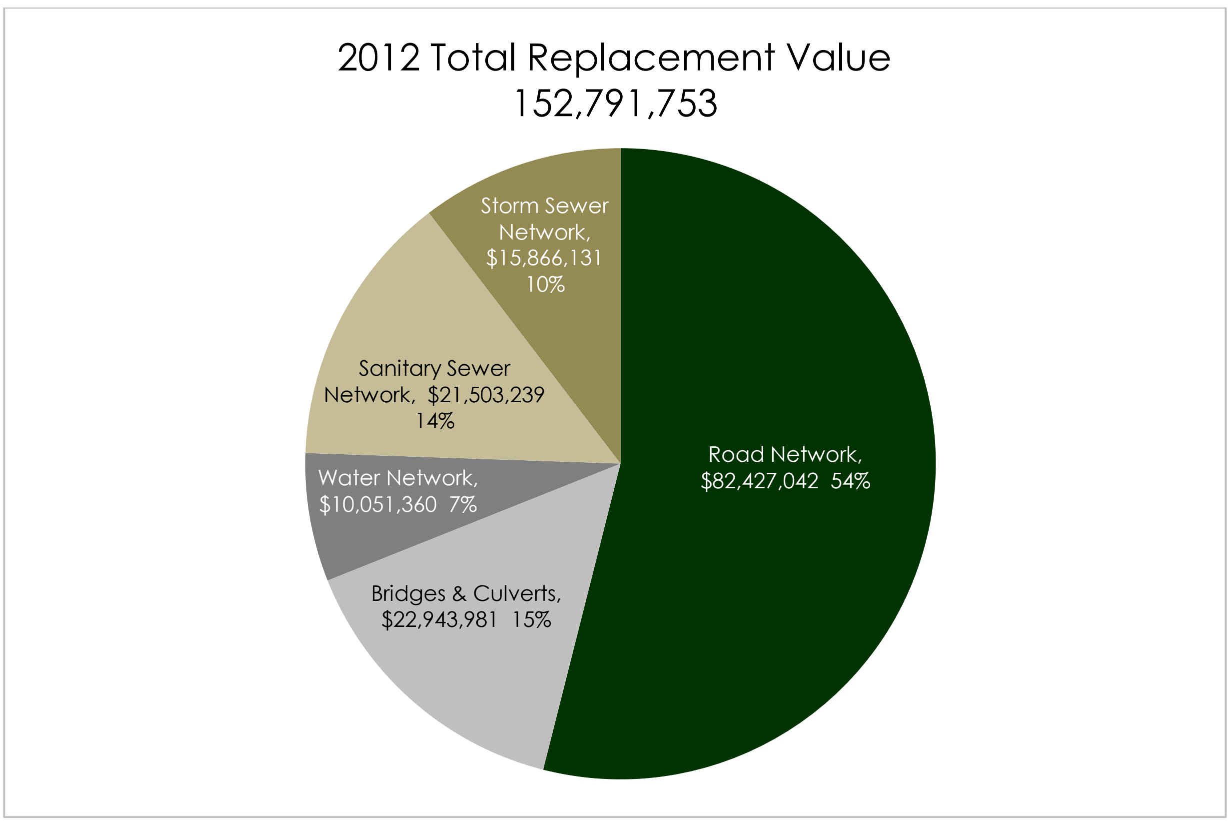
1.0 Executive Summary

The performance of a community's infrastructure provides the foundation for its economic development, competitiveness, prosperity, reputation, and the overall quality of life for its residents. Reliable and well-maintained infrastructure assets are essential for the delivery of critical core services for the citizens of a municipality.

A technically precise and financially rigorous asset management plan, diligently implemented, will mean that sufficient investments are made to ensure delivery of sustainable infrastructure services to current and future residents. The plan will also indicate the respective financial obligations required to maintain this delivery at established levels of service.

This Asset Management Plan (AMP) for the Municipality of Brockton meets all requirements as outlined within the provincial *Building Together Guide for Municipal Asset Management Plans.* It will serve as a strategic, tactical, and financial document, ensuring the management of the municipal infrastructure follows sound asset management practices and principles, while optimizing available resources and establishing desired levels of service. Given the expansive financial and social impact of asset management on both a municipality, and its citizens, it is critical that senior decision-makers, including department heads as well as the chief executives, are strategically involved.

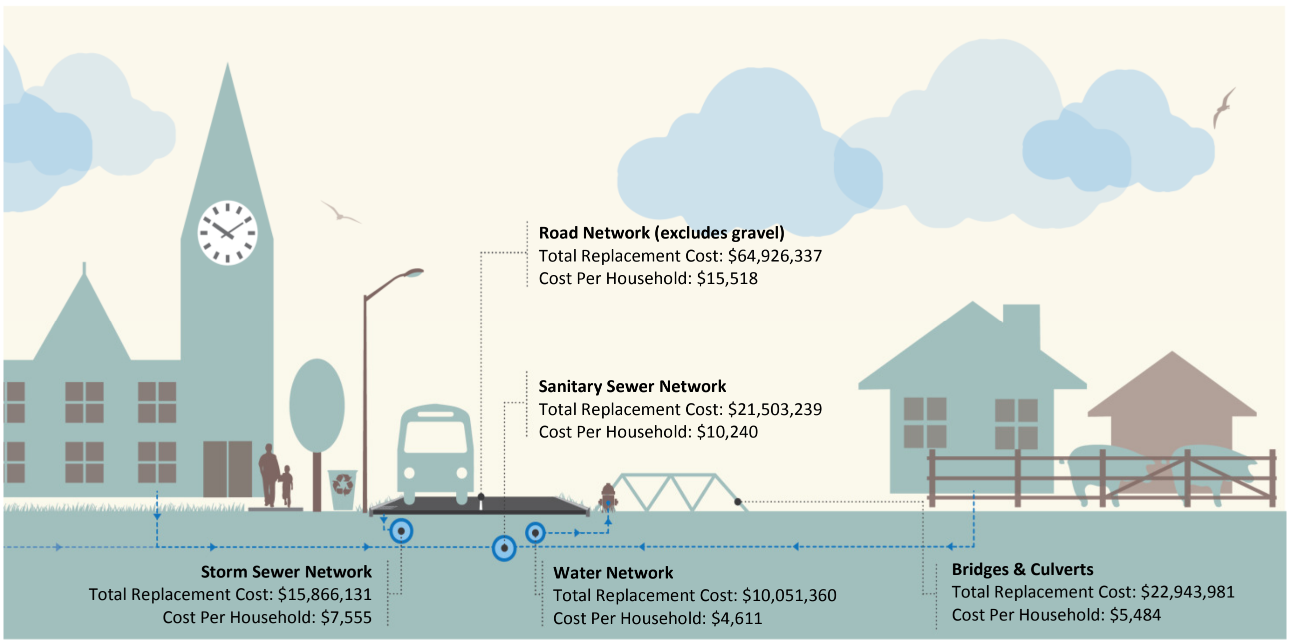
Measured in 2012 dollars, the replacement value of the asset classes analyzed totaled **$153 million** for Brockton.



While the municipality is responsible for the strategic direction, it is the taxpayer in Brockton who ultimately bears the financial burden. As such, a 'cost per household' (CPH) analysis was conducted for each of the asset classes to determine the financial obligation of each household in sharing the replacement cost of the municipality's assets. Such a measurement can serve as an excellent communication tool for both the administration and the council in communicating the importance of asset management to the citizen. The diagram below illustrates the total CPH, as well as the CPH for individual asset classes.

Infrastructure Replacement Cost Per Household

Total: $43,408 per household



In assessing the municipality's state of the infrastructure, we examined, and graded, both the current condition (Condition vs. Performance) of the asset classes as well as the municipality's financial capability to fund the asset's average annual requirement for sustainability (Funding vs. Need). We then generated the municipality's infrastructure report card. The municipality received a **cumulative GPA of** '**D+**', with an **annual infrastructure deficit of $1.57 million**.

Brockton performed relatively well on the Condition vs. Performance dimension for the water and storm asset classes addressed. The municipality received a 'B' in its water and storm network, and a 'D+' in its road and bridges & culverts assets. Its lowest rating of 'D' was assigned in the sanitary network class. The road network is primarily in good/fair condition. However, 34% of the network in critical condition (based on age data) and has generated significant financial needs over the next five years totaling $28 million. Brockton's storm sewer network, based on age data only, has approximately three quarters of all pipes in good condition, generating no requirement over the next five years. Future funds should also be directed towards a condition assessment program to gain a better understanding of current performance.

While the water network is generally in good and excellent condition, 14% of the facilities are in critical condition. For the sanitary network, 100% of the facilities are in critical condition.

Brockton's performance on the Funding vs. Need dimension varied significantly across the asset classes. While its bridges & culverts and storm assets are funded at 0% of their annual needs, its water networks is overfunded. Consequently, the municipality received an 'F' for its storm and bridges & culverts assets.

In order for an AMP to be effectively put into action, it must be integrated with financial planning and long-term budgeting. We have developed scenarios that would enable Brockton to achieve full funding within 5 years or 10 years for the following: tax funded assets, including road network (paved roads), bridges & culverts, storm sewer network, and; rate funded assets, including water network, and sanitary sewer network.

The average annual investment requirement for paved roads, bridges & culverts and storm sewers is $2,604,000. Annual revenue currently allocated to these assets is $1,155,000 leaving an annual ***deficit*** of $1,449,000. To put it another way, these infrastructure categories are currently funded at 44% of their long-term requirements.

Brockton has annual tax revenues of $6,407,000 in 2013. Full funding would require an increase in tax revenue of 22.6% over time. We recommend, with key qualifications (See the Financial Strategy section for a full discussion) the 10 year option which involves full funding being achieved over 10 years by:

a) When realized, reallocating the debt cost reductions of $145,000 to the infrastructure deficit
b) Increasing tax revenues by $2.0% each year for the next 10 years solely for the purpose of phasing in full funding to the asset categories covered in this section of the AMP
c) Allocating the $297,000 of gas tax revenue to the paved roads category
d) Increasing existing and future infrastructure budgets by the applicable inflation index on an annual basis in addition to the deficit phase-in

The average annual investment requirement for sanitary and water services is $522,000. Annual revenues currently allocated to sanitary and water services are $260,000 and $146,000 respectively. This leaves an annual ***deficit*** of $120,000 for sanitary services and a ***surplus*** for water services. To put it another way, these infrastructure categories are currently funded at 78% of their long-term requirements.

In 2013, Brockton has annual sanitary revenues of $965,000 and water revenues of $917,000. Full funding would require an increase in sanitary rates of 12.4% and reduction of water rates of 0.4% over time.

In November 2011, Brockton commissioned a study to determine a long-term financial plan for water and sanitary services. Based on the information available at that time, the study recommended an annual increase of 6% for the years 2013 to 2017 for both water and sanitary services in order to achieve full funding. The financial requirements of this asset management plan are significantly less than the 2011 study.

As a result, Brockton has two options to consider. Option 1 is to continue implementing the 2011 rate strategy and place any resulting surplus funds into applicable reserves. Option 2 is to revise the strategy to incorporate the updated information provided in this asset management plan. We recommend option 2 by implementing the 5 year which involves full funding being achieved over 5 years by:

a) A detailed condition analysis be performed on sanitary and water assets to determine whether the excess revenue is needed in the short to mid-term for capital purposes
b) Subsequent to a) above, operating requirements should be reviewed to determine if any of the excess revenue should be retained and used to offset any future rate increases required by operations
c) When realized, reallocating the debt cost reductions of $59,000 for sanitary services to the applicable infrastructure deficit
d) Increasing rate revenues by 1.3% for sanitary services and 0% for water services each year for the next 5 years solely for the purpose of phasing in full funding to the asset categories covered in this section of the plan
e) Increasing existing and future infrastructure budgets by the applicable inflation index on an annual basis in addition to the deficit phase-in

After considering the two options above, Brockton has made the decision to continue the implementation of option one.

The scenarios developed in this report do not draw on reserve funds during the phase-in period to full funding. The scenarios developed also exclude the use of debt. We recommend that as the Municipality of Brockton updates its asset management plan and expand it to include other asset categories, future planning should include determining what its long-term reserve balance requirements are and a plan to achieve such balances in the long-term.

2.0 Introduction

This Asset Management Plan meets all provincial requirements as outlined within the Ontario Building Together Guide for Municipal Asset Management Plans. As such, the following key sections and content are included:

1. Executive Summary and Introduction
2. State of the Current Infrastructure
3. Desired Levels of Service
4. Asset Management Strategy
5. Financial Strategy

The following asset classes are addressed:

1. **Road Network:** Urban and rural, paved and gravel
2. **Bridges & Culverts**: Bridges and large culverts with a span greater than 3m
3. **Water Network:** Water mains, hydrants, pump houses
4. **Sanitary Sewer Network:** Sanitary sewer mains and sewer treatment plant
5. **Storm Sewer Network:** Storm sewer mains

Municipalities are encouraged to cover all asset classes in future iterations of the AMP.

This asset management plan will serve as a strategic, tactical, and financial document ensuring the management of the municipal infrastructure follows sound asset management practices and principles, while optimizing available resources and establishing desired levels of service.

At a strategic level, within the State of the Current Infrastructure section, it will identify current and future challenges that should be addressed in order to maintain sustainable infrastructure services on a long-term, life cycle basis.

It will outline a Desired Level of Service (LOS) Framework for each asset category to assist the development and tracking of LOS through performance measures across strategic, financial, tactical, operational, and maintenance activities within the organization.

At a tactical level, within the Asset Management Strategy section, it will develop an implementation process to be applied to the needs-identification and prioritization of renewal, rehabilitation, and maintenance activities, resulting in a 10 year plan that will include growth projections.

At a financial level, within the Financial Strategy section, a strategy will be developed that fully integrates with other sections of this asset management plan, to ensure delivery and optimization of the 10 year infrastructure budget.

Through the development of this plan, all data, analysis, life cycle projections, and budget models will be provided through the Public Sector Digest's CityWide suite of software products. The software and plan will be synchronized, will evolve together, and therefore, will allow for ease of updates, and annual reporting of performance measures and overall results.

This will allow for continuous improvement of the plan and its projections. It is therefore recommended that the plan be revisited and updated on an annual basis, particularly as more detailed information becomes available.

2.1 Importance of Infrastructure

Municipalities throughout Ontario, large and small, own a diverse portfolio of infrastructure assets that in turn provide a varied number of services to their citizens. The infrastructure, in essence, is a conduit for the various public services the municipality provides, e.g., the roads supply a transportation network service; the water infrastructure supplies a clean drinking water service. A community's prosperity, economic development, competitiveness, image, and overall quality of life are inherently and explicitly tied to the performance of its infrastructure.

2.2 Asset Management Plan (AMP) - Relationship to Strategic Plan

The major benefit of strategic planning is the promotion of strategic thought and action. A strategic plan spells out where an organization wants to go, how it's going to get there, and helps decide how and where to allocate resources, ensuring alignment to the strategic priorities and objectives. It will help identify priorities and guide how municipal tax dollars and revenues are spent into the future.

The strategic plan usually includes a vision and mission statement, and key organizational priorities with alignment to objectives and action plans. Given the growing economic and political significance of infrastructure, the asset management plan will become a central component of most municipal strategic plans, influencing corporate priorities, objectives, and actions.

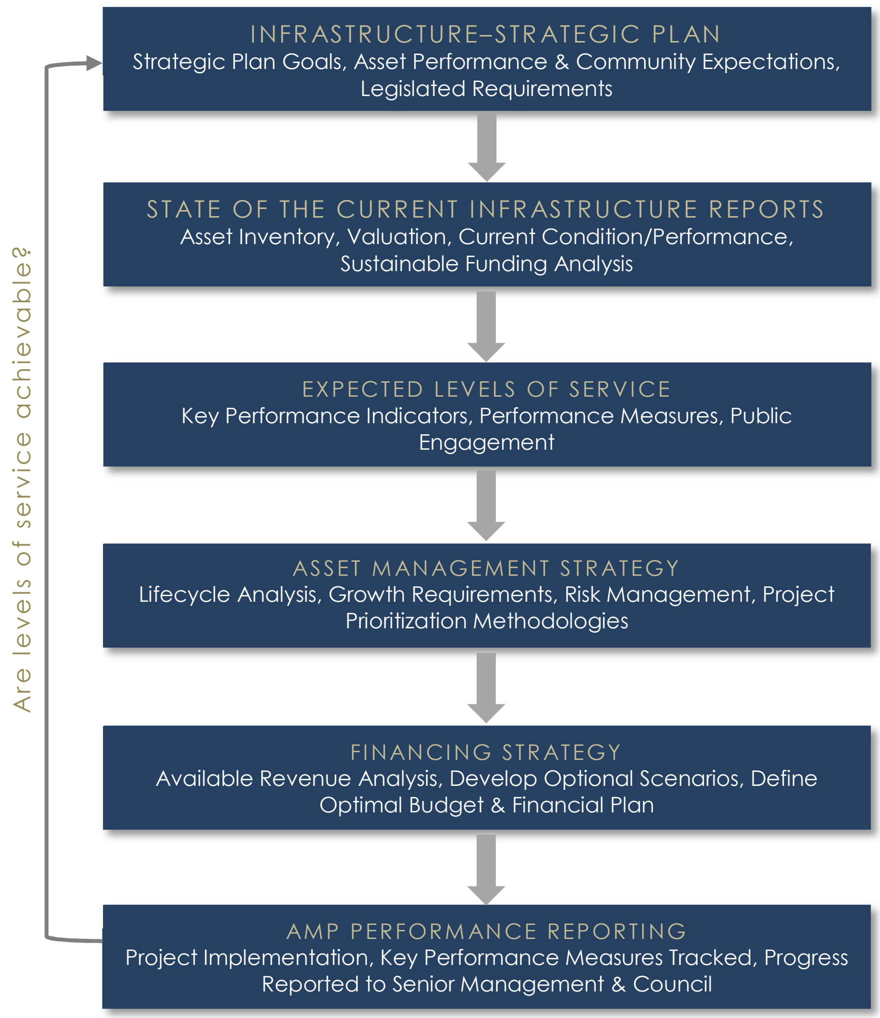
2.3 AMP - Relationship to other Plans

An asset management plan is a key component of the municipality's planning process linking with multiple other corporate plans and documents. For example:

- **The Official Plan** – The AMP should utilize and influence the land use policy directions for long-term growth and development as provided through the Official Plan.
- **Long Term Financial Plan** – The AMP should both utilize and conversely influence the financial forecasts within the long-term financial plan.
- **Capital Budget** – The decision framework and infrastructure needs identified in the AMP form the basis on which future capital budgets are prepared.
- **Infrastructure Master Plans** – The AMP will utilize goals and projections from infrastructure master plans and in turn will influence future master plan recommendations.
- **By-Laws, standards, and policies** – The AMP will influence and utilize policies and by-laws related to infrastructure management practices and standards.
- **Regulations** – The AMP must recognize and abide by industry and senior government regulations.
- **Business Plans** – The service levels, policies, processes, and budgets defined in the AMP are incorporated into business plans as activity budgets, management strategies, and performance measures.

2.4 Purpose and Methodology

The following diagram depicts the approach and methodology, including the key components and links between those components that embody this asset management plan:



It can be seen from the above that a municipality's infrastructure planning starts at the corporate level with ties to the strategic plan, alignment to the community's expectations, and compliance with industry and government regulations.

Then, through the State of the Infrastructure analysis, overall asset inventory, valuation, condition and performance are reported. In this initial AMP, due to a lack of current condition data for the majority of asset classes, present performance and condition are estimated by using the current age of the asset in comparison to its overall useful design life. In future updates to this AMP, accuracy of reporting will be significantly increased through the use of holistically captured condition data. Also, a life cycle analysis of needs for each infrastructure class is conducted. This analysis yields the sustainable funding level, compared against actual current funding levels, and determines whether there is a funding surplus or deficit for each infrastructure program. The overall measure of condition and available funding is finally scored for each asset class and presented as a star rating (similar to the hotel star rating) and a letter grade (A-F) within the Infrastructure Report card.

From the lifecycle analysis above, the municipality gains an understanding of the level of service provided today for each infrastructure class and the projected level of service for the future. The next section of the AMP provides a framework for a municipality to develop a Desired Level of Service (or target service level) and develop performance measures to track the year-to-year progress towards this established target level of service.

The Asset Management Strategy then provides a detailed analysis for each infrastructure class. Included in this analysis are best practices and methodologies from within the industry which can guide the overall management of the infrastructure in order to achieve the desired level of service. This section also provides an overview of condition assessment techniques for each asset class; life cycle interventions required, including those interventions that yield the best return on investment; and prioritization techniques, including risk quantification, to determine which priority projects should move forward into the budget first.

The Financing Strategy then fully integrates with the asset management strategy and asset management plan, and provides a financial analysis that optimizes the 10 year infrastructure budget. All revenue sources available are reviewed, such as the tax levy, debt allocations, rates, reserves, grants, gas tax, development charges, etc., and necessary budget allocations are analysed to inform and deliver the infrastructure programs.

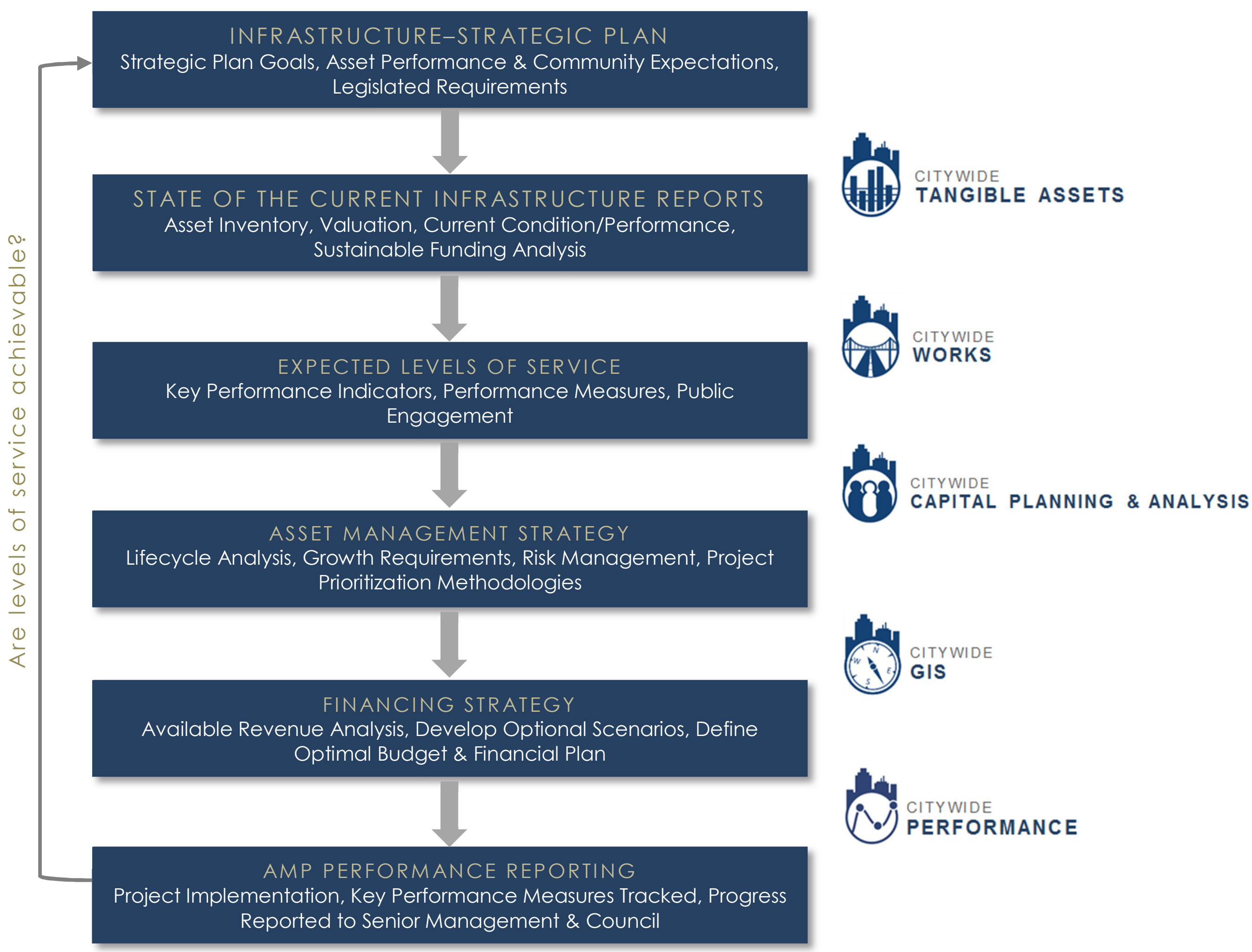
Finally, in subsequent updates to this AMP, actual project implementation will be reviewed and measured through the established performance metrics to quantify whether the desired level of service is achieved or achievable for each infrastructure class. If shortfalls in performance are observed, these will be discussed and alternate financial models or service level target adjustments will be presented.

2.5 CityWide Software alignment with AMP

The plan will be built and developed hand in hand with a database of municipal infrastructure information in the CityWide software suite of products. The software will ultimately contain the municipality's asset base, valuation information, life cycle activity predictions, costs for activities, sustainability analysis, project prioritization parameters, key performance indicators and targets, 10 year asset management strategy, and the financial plan to deliver the required infrastructure budget.

The software and plan will be synchronized, and will evolve together year-to-year as more detailed information becomes available. This synchronization will allow for ease of updates, modeling and scenario building, and annual reporting of performance measures and results. This will allow for continuous improvement of the plan and its projections. It is therefore recommended that it is revisited and updated on an annual basis.

The following diagram outlines the various CityWide software products and how they align to the various components of the AMP.



3.0 State of the Infrastructure (SOTI)

3.1 Objective and Scope

Objective: To identify the state of the municipality's infrastructure today and the projected state in the future if current funding levels and management practices remain status quo.

The analysis and subsequent communication tools will outline future asset requirements, will start the development of tactical implementation plans, and ultimately assist the organization to provide cost effective sustainable services to the current and future community.

The approach was based on the following key industry state of the infrastructure documents:

- Canadian Infrastructure Report Card
- City of Hamilton's State of the Infrastructure reports
- Other Ontario Municipal State of the Infrastructure reports

The above reports are themselves based on established principles found within key, industry best practices documents such as:

- The National Guide for Sustainable Municipal Infrastructure (Canada)
- The International Infrastructure Management Manual (Australia / New Zealand)
- American Society of Civil Engineering Manuals (U.S.A.)

Scope: Within this State of the Infrastructure report, a high level review will be undertaken for the following asset classes:

6. **Road Network:** Urban and rural, paved and gravel
7. **Bridges & Culverts**: Bridges and large culverts with a span greater than 3m
8. **Water Network:** Water mains, hydrants, pump houses
9. **Sanitary Sewer Network:** Sanitary sewer mains and sewer treatment plant
10. **Storm Sewer Network:** Storm sewer mains

3.2 Approach

The asset classes above were reviewed at a very high level due to the nature of data and information available. Subsequent detailed reviews of this analysis are recommended on an annual basis, as more detailed conditions assessment information becomes available for each infrastructure program.

3.2.1 Base Data

In order to understand the full inventory of infrastructure assets within Brockton, all tangible capital asset data, as collected to meet the PSAB 3150 accounting standard, was loaded into the CityWide Tangible Asset™ software module. This data base now provides a detailed and summarized inventory of assets as used throughout the analysis within this report and the entire Asset Management Plan.

3.2.2 Asset Deterioration Review

Without detailed condition assessment, information captured holistically across entire asset networks (e.g., the entire road network), the deterioration review will rely on the 'straight line' amortization schedule approach provided from the accounting data. Although this approach is not as accurate for entire life cycle analysis as the use of detailed condition data, it does provide a reliable benchmark of future requirements. Each asset is analyzed individually. Therefore, while there may be inaccuracies in the data associated with any given asset, these imprecisions are minimized at the aggregate over entire asset classes. It is a sound approach for a high level review.

3.2.3 Identify Sustainable Investment Requirements

A gap analysis was performed to identify sustainable investment requirements for each asset category. Information on current spending levels and budgets was acquired from the organization, future investment requirements were calculated, and the gap between the two was identified.

The above analysis is performed by using investment and financial planning models, and life cycle costing analysis, embedded within the CityWide software suite of applications.

3.2.4 Asset Rating Criteria

Each asset category will be rated on two key dimensions:

- **Condition vs. Performance**: Based on the condition of the asset today and how well performs its function.
- **Funding vs. Need**: Based on the actual investment requirements to ensure replacement of the asset at the right time, versus current spending levels for each asset group.

3.2.5 Infrastructure Report Card

The dimensions above will be based on a simple 1–5 star rating system, which will be converted into a letter grading system ranging from A-F. An average of the two ratings will be used to calculate the combined rating for each asset class. The outputs for all municipal assets will be consolidated within the CityWide software to produce one overall Infrastructure Report Card showing the current state of the assets.

Grading Scale: Condition vs. Performance

What is the condition of the asset today and how well does it perform its function?

Star Rating	Letter Grade	Color Indicator	Description
★★★★★	A		**Excellent**: No noticeable defects
★★★★	B		**Good**: Minor deterioration
★★★	C		**Fair**: Deterioration evident, function is affected
★★	D		**Poor**: Serious deterioration. Function is inadequate
★	F		**Critical**: No longer functional. General or complete failure

Grading Scale: Funding vs. Need

Based on the actual investment requirements to ensure replacement of the asset at the right time, versus current spending levels for each asset group.

Star Rating	Letter Grade	Description
★★★★★	A	**Excellent**: 91 to 100% of need
★★★★	B	**Good**: 76 to 90% of need
★★★	C	**Fair**: 61 to 75% of need
★★	D	**Poor**: 46 – 60% of need
★	F	**Critical**: under 45% of need

3.2.6 General Methodology and Reporting Approach

The report will be based on the seven key questions of asset management as outlined within the National Guide for Sustainable Municipal Infrastructure:

- What do you own and where is it? (inventory)
- What is it worth? (valuation / replacement cost)
- What is its condition / remaining service life? (function & performance)
- What needs to be done? (maintain, rehabilitate, replace)
- When do you need to do it? (useful life analysis)
- How much will it cost? (investment requirements)
- How do you ensure sustainability? (long-term financial plan)

The above questions will be answered for each individual asset category in the following report sections.

3.3 Road Network

D

INFRASTRUCTURE REPORT CARD GRADE

3.3 Road Network

Note: The financial analysis in this section includes paved roads. Gravel roads are excluded from the capital replacement analysis, as by nature, they require perpetual maintenance activities and funding. However, the gravel roads have been included in the Road Network inventory and replacement value tables. There is also further information regarding gravel roads in section 3.4 "Gravel Roads – Maintenance Requirements" of this AMP.

3.3.1 What do we own?

As shown in the summary table below, the entire network comprises approximately 348 lane km of road.

Road Network Inventory

Asset Type	Asset Component	Quantity/Units
Road Network	Gravel	22,173m3
	Rural - Hot Mix	53,995.8m3
	Rural - Surface Treatment	28,537.6m3
	Urban - Hot Mix	23,417.9m3
	Sidewalks	6,675.7m3
	Streetlights	252 units

The road network data was extracted from the Tangible Capital Asset module of the CityWide software suite.

3.3.2 What is it worth?

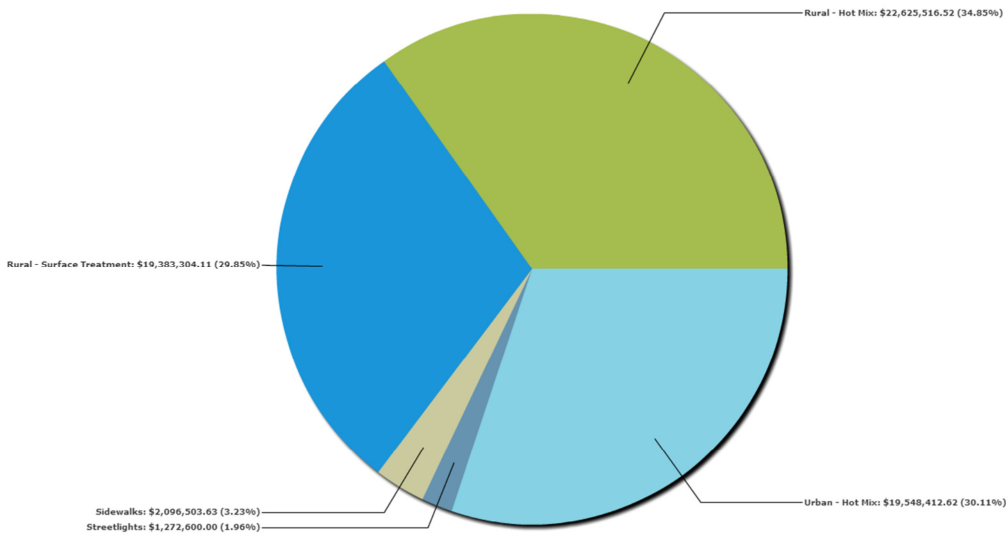
The estimated replacement value of the road network, in 2012 dollars, is approximately $82 million. For the purpose of further analysis, we use a replacement cost of $65 million (excludes gravel roads). The cost per household for the road network is $15,518 based on 4,184 households.

Road Network Replacement Value

Asset Type	Asset Component	Quantity/Units	2012 Unit Replacement Cost	2012 Overall Replacement Cost
Road Network	Gravel	22,173m3	$789/m3	$17,500,705
	Rural - Hot Mix	53,995.8m3	$419/m3	$22,625,517
	Rural - Surface Treatment	28,537.6m3	$679/m3	$19,383,304
	Urban - Hot Mix	23,417.9m3	$835/m3	$19,548,413
	Sidewalks	6,675.7m3	$314/m3	$2,096,504
	Streetlights	252 units	$5,050/unit	$1,272,600
				$82,427,042

The pie chart below provides a breakdown of each of the network components to the overall system value.

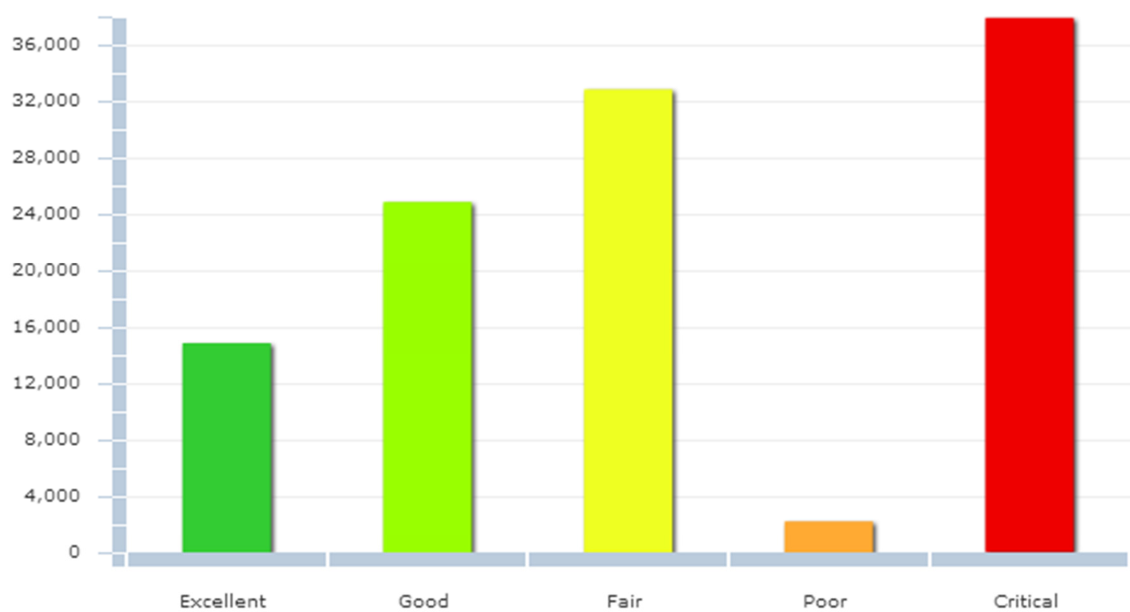
Road Network Components



3.3.3 What condition is it in?

The majority, 51%, of the municipality's road network is in fair to good condition, 13% in excellent condition and with the remaining 36% in poor to critical condition. As such, the municipality received a Condition vs. Performance rating of 'D+'.

Road Network Condition by Area (m3)



3.3.4 What do we need to do to it?

There are generally four distinct phases in an asset's life cycle that require specific types of attention and lifecycle activity. These are presented at a high level for the road network below. Further detail is provided in the "Asset Management Strategy" section of this AMP.

Addressing Asset Needs		
Phase	Lifecycle Activity	Asset Life Stage
Minor maintenance	Activities such as inspections, monitoring, sweeping, winter control, etc.	1st Qtr
Major maintenance	Activities such as repairing pot holes, grinding out roadway rutting, and patching sections of road.	2nd Qtr
Rehabilitation	Rehabilitation activities such as asphalt overlays, mill and paves, etc.	3rd Qtr
Replacement	Full road reconstruction	4th Qtr

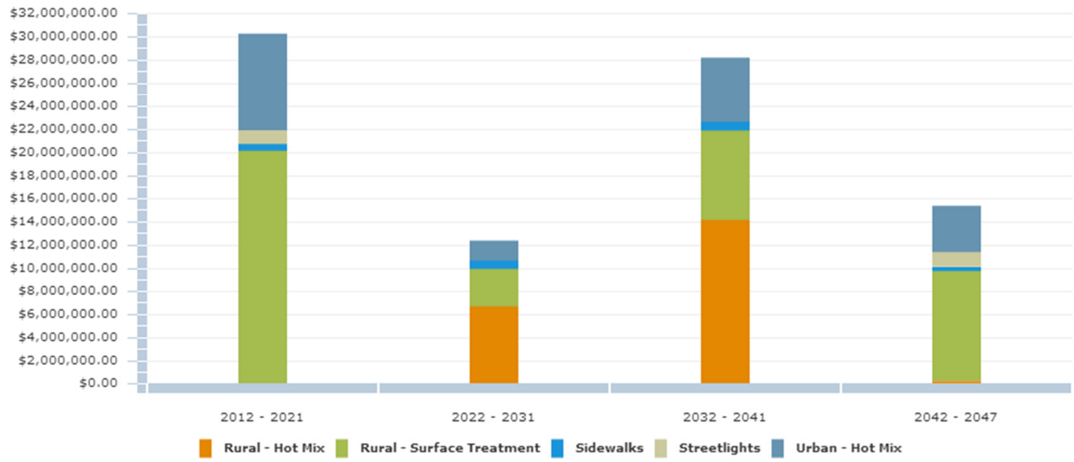
3.3.5 When do we need to do it?

For the purpose of this report, 'useful life' data for each asset class was obtained from the accounting data within the CityWide software database. This proposed useful life is used to determine replacement needs of individual assets. These needs are calculated and quantified in the system as part of the overall financial requirements.

Asset Useful Life in Years		
Asset Type	Asset Component	Useful Life
Road Network	Rural - Hot Mix	35
	Rural - Surface Treatment	7
	Urban - Hot Mix	35
	Sidewalks	30
	Streetlights	30

As additional field condition information becomes available, the data can be loaded into the CityWide system to increase the accuracy of current asset age and, therefore, that of future replacement requirements. The following graph shows the projection of road network replacement costs based on the age of the asset only.

Road Network Replacement Profile (excludes gravel roads)



3.3.6 How much money do we need?

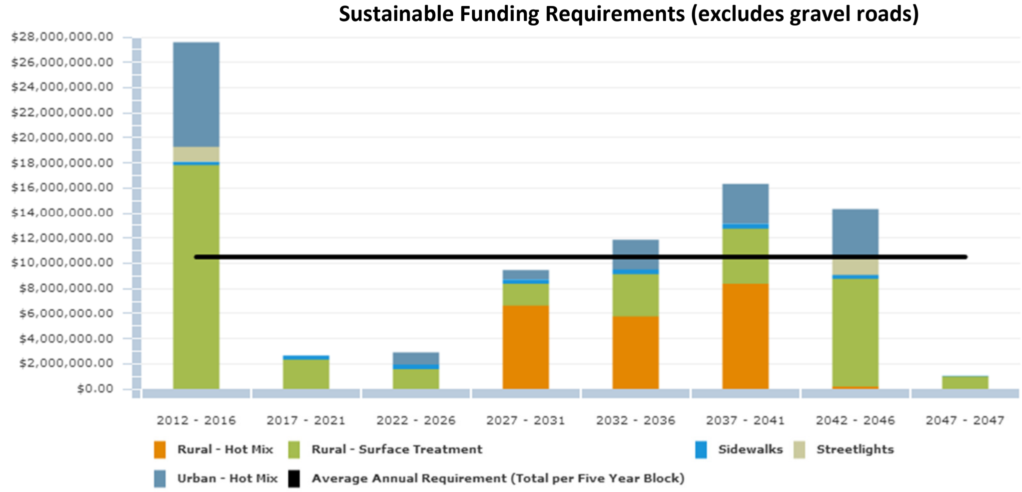
The analysis completed to determine capital revenue requirements was based on the following constraints and assumptions:

1. Replacement costs are based upon the unit costs identified within the "What is it worth" section.
2. The timing for individual road replacement was defined by the replacement year as described in the "When do you need to do it?" section.
3. All values are presented in (2012) dollars.
4. The analysis was run for a 35 year period to ensure all assets went through at least one iteration of replacement, therefore providing a sustainable projection.

3.3.7 How do we reach sustainability?

Based upon the above parameters, the average annual revenue required to sustain Brockton's paved road network is approximately **$2,100,000**. Based on Brockton's current annual funding of **$1,155,000**, there is an annual **deficit of $945,000**. As such, the municipality received a Funding vs. Need rating of 'D'. The following graph illustrates the expenditure requirements in five year increments against the sustainable funding threshold line.

Sustainable Funding Requirements (excludes gravel roads)



In conclusion, based on age data only, there is a significant portion of the road network in critical condition, generating a backlog of needs totaling approximately $28 million in the next 5 years. The implementation of a full condition assessment program for the road network, and the upload of that data into the CityWide software system should be an essential next step to defining actual field requirements. A condition assessment program will aid in prioritizing overall needs for rehabilitation and replacement and will assist with optimizing the long and short term budgets. Further detail is outlined within the "asset management strategy" section of this AMP.

3.3.8 Recommendations

The municipality received an overall rating of 'D' for its road network, calculated from the Condition vs. Performance and the Funding vs. Need ratings. Accordingly, we recommend the following:

1. A condition assessment program should be established for the entire paved road network to gain a better understanding of current condition and performance as outlined further within the "Asset Management Strategy" section of this AMP.

2. As some of the municipality's road network is gravel roads, a detailed study should be undertaken to assess the overall maintenance costs of gravel roads and whether there is benefit to converting some gravel roads to paved , or surface treated roads, thereby reducing future costs. This is further outlined within the "Asset Management Strategy" section of this AMP.

3. Once the above studies are complete or underway, the condition data should be loaded into the CityWide software and an updated "current state of the infrastructure" analysis should be generated.

4. An appropriate % of asset replacement value should be used for operations and maintenance activities on an annual basis. This should be determined through a detailed analysis of O & M activities and be added to future AMP reporting.

5. The Infrastructure Report Card should be updated on an annual basis.

3.4 Gravel Roads – Maintenance Requirements

3.4.1 Introduction

Paved roads are usually designed and constructed with careful consideration given to the correct shape of the cross section. Once paving is complete the roadway will keep its general shape for the duration of its useful life. Gravel roads are quite different. Many have poor base construction, will be prone to wheel track rutting in wet weather, and traffic will continually displace gravel from the surface to the shoulder area, even the ditch, during wet and dry weather. Maintaining the shape of the road surface and shoulder is essential to ensure proper performance and to provide a sufficient level of service for the public.

Therefore, the management of gravel roads is not through major rehabilitation and replacement, but rather through good perpetual maintenance and some minor rehabilitation which depend on a few basic principles: proper techniques and cycles for grading; the use and upkeep of good surface gravel; and, dust abatement and stabilization.

3.4.2 Maintaining a Good Cross Section

In order to maintain a gravel road properly, a good cross section is required consisting of a crowned driving surface, a shoulder with correct slope, and a ditch. The crown of the road is essential for good drainage. A road with no crown, or insufficient crown, will cause water to collect on the surface during a rainfall, will soften the crust, and ultimately lead to rutting which will become severe if the subgrade also softens. Even if the subgrade remains firm, traffic will cause depressions in the road where water collects and the road will develop potholes. It is a generally accepted industry standard that 1.25cm per 12cm (one foot), approximately 4%, on the cross slope is ideal for road crown.

The road shoulder serves some key functions. It supports the edge of the travelled portion of the roadway, provides a safe area for drivers to regain control of vehicles if they are forced to leave the road, and finally, carries water further away from the road surface. The shoulder should ideally meet the edge of the roadway at the same elevation and then slope away gradually towards the ditch.

The ditch is the most important and common drainage structure for gravel roads. Every effort should be made to maintain a minimal ditch. The ditch should be kept free of obstructions such as eroded soil, vegetation or debris.

3.4.3 Grading Operations

Routine grading is the activity that ensures gravel roadways maintain a good cross section or proper profile. The three key components to good grading are: operating speed, blade angle, and blade pitch.

Excessive operating speed can cause many problems such as inconsistent profile, and blade movement or bouncing that can cut depressions and leave ridges in the road surface. It is generally accepted that grader speed should not exceed 8km per hour. The angle of the blade is also critical for good maintenance and industry standards suggest the optimal angle is between 30 and 45 degrees. Finally, the correct pitch or tilt of the blade is very important. If the blade is pitched back too far, the material will tend to build up in front of the blade and will not fall forward, which mixes the materials, and will move along and discharge at the end of the blade.

3.4.4 Good Surface Gravel

Once the correct shape is established on a roadway and drainage matters are taken care of, attention must be given to the placement of good gravel. Good surface gravel requires a percentage of stone which gives strength to support loads, particularly in wet weather. It also requires a percentage of sand size particles to fill the voids between the stones which provide stability. And finally, a percentage of plastic fines are needed to bind the material together which allows a gravel road to form a crust and shed water. Typical municipal maintenance routines will include activities to ensure a good gravel surface through both spot repairs (often annually) and also re-graveling of roadways (approximately every five years).

3.4.5 Dust Abatement and stabilization

A typical maintenance activity for gravel roads also includes dust abatement and stabilization. All gravel roads will give off dust at some point, although the amount of dust can vary greatly from region to region. The most common treatment to reduce dust is the application of Calcium Chloride, in flake or liquid form, or Magnesium Chloride, generally just in liquid form. Of course, there are other products on the market as well. Calcium and Magnesium Chloride can be very effective if used properly. They are hygroscopic products which draw moisture from the air and keep the road surface constantly damp. In addition to alleviating dust issues, the continual dampness also serves to maintain the loss of fine materials within the gravel surface, which in turn helps maintain road binding and stabilization. A good dust abatement program can actually help waterproof and bind the road, in doing so can reduce gravel loss, and therefore, reduce the frequency of grading.

3.4.6 The Cost of Maintaining Gravel Roads

We conducted an industry review to determine the standard cost for maintaining gravel roads. However, it became apparent that no industry standard exists for either the cost of maintenance or for the frequency at which the maintenance activities should be completed. Presented below, as a guideline only, are two studies on the maintenance costs for gravel roads:

3.4.7 Minnesota Study (2005)

The first study is from the Minnesota Department of Transportation (MnDOT) Local Road Research Board (LRRB), where the researchers looked at historical and estimated cost data from multiple counties in Minnesota.

The study team found that the typical maintenance schedule consisted of routine grading and re-graveling with two inches of new gravel every five years. They found that a typical road needed to be graded 21 times a year or three times a month from April – October, and the upper bound for re-graveling was five years for any road over 100 ADT; lower volume roads could possibly go longer. The calculated costs including materials, labour, and hauling totaled $1,400 per year or $67 per visit for the grading activity and $13,800 for the re-gravel activity every five years. The re-gravel included an estimate gravel cost of $7.00 per cubic yard and a 2.5" thick lift of gravel (to be compacted down to 2"). Therefore, they developed an average estimated annual maintenance cost for gravel roads at $4,160 per mile. This converts to $2,600 per km of roadway and if adjusted for inflation into 2012 dollars, using the Non-Residential Building Construction Price Index (NRBCPI), it would be $3,500.

Reference: Jahren, Charles T. et. al. "Economics of Upgrading an Aggregate Road," Minnesota Department of Transportation, St. Paul, Mn, January 2005.

3.4.8 South Dakota study (2004)

This second study was conducted by South Dakota's Department of Transportation (SDDOT). The default maintenance program for gravel roads from SDDOT's report includes grading 50 times per year, re-graveling once every six years, and spot graveling once per year. The unit cost for grading was very similar to Minnesota at $65 per mile, re-gravel at $7,036 per mile and spot graveling or pothole repair at $2,420 per mile, totaling to an average annual maintenance cost of $6,843 per mile. Due to the frequency of the grading activity and the addition of the spot gravel maintenance, the SDDOT number is higher than Minnesota reported even though the re-gravel activity is reported at about half of the price in Minnesota.

This converts to $4,277 per km of roadway and if adjusted for inflation into 2012 dollars, using the NRBCPI, it would be $5,758.

Reference: Zimmerman, K.A. and A.S. Wolters. "Local Road Surfacing Criteria," South Dakota Department of Transportation, Pierre, SD, June 2004.

3.4.9 Ontario Municipal Benchmarking Initiative (OMBI)

One of the many metrics tracked through the Ontario Municipal Benchmarking Initiative is the "Operating costs for Unpaved (Loose top) Roads per lane Km." As referenced from the OMBI data dictionary, this includes maintenance activities such as dust suppression, loose top grading, loose top gravelling, spot base repair and wash out repair.

Of the six Ontario municipalities that included 2012 costs for this category, there is a wide variation in the reporting. The highest cost per lane km was $14,900 while the lowest cost was $397. The average cost was $6,300 per lane km. Assuming two lanes per gravel road to match the studies above, the Ontario OMBI average becomes $12,600 per km of roadway.

Summary of Costs	
Source	2012 Maintenance Cost per km (adjusted for inflation using NRBCPI)
Minnesota Study	$3,500
South Dakota Study	$5,758
OMBI Average (six municipalities)	12,600

3.4.10 Conclusion

As discussed above, there are currently no industry standards in regards to the cost of gravel road maintenance and the frequency at which the maintenance activities should be completed. Also, there is no established benchmark cost for the maintenance of a km of gravel road and the numbers presented above will vary significantly due to the level of service or maintenance that's provided (i.e., frequency of grading cycles and re-gravel cycles).

3.5 Bridges & Culverts

F

INFRASTRUCTURE REPORT CARD GRADE

3.5 Bridges & Culverts

3.5.1 What do we own?

As shown in the summary table below, the municipality owns 7 bridges and 5 large culverts.

Bridges & Culverts Inventory		
Asset Type	Asset Component	Units
Bridges & Culverts	Bridges	7 units
	Culverts	5 units

The bridges & culverts data was extracted from the Tangible Capital Asset module of the CityWide software suite.

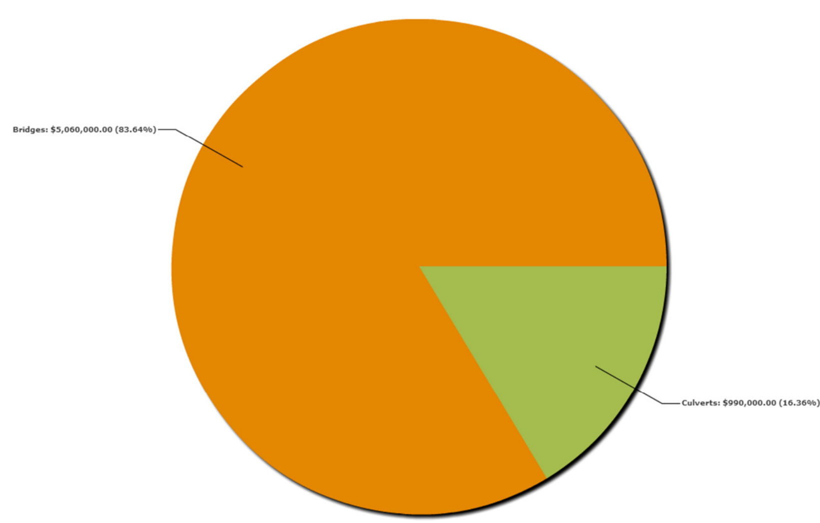
3.5.2 What is it worth?

The estimated replacement value of the municipality's bridges & culverts, in 2012 dollars, is approximately $6 million. The cost per household for bridges & culverts is $5,484 based on 4,184 households.

Bridges & Culverts Replacement Value				
Asset Type	Asset Component	Units	2012 Unit Replacement Cost	2012 Replacement Cost
Bridges & Culverts	Bridges	29 units	$757,034/unit	$21,953,981
	Culverts	5 units	$198,000/unit	$990,000
				$22,943,981

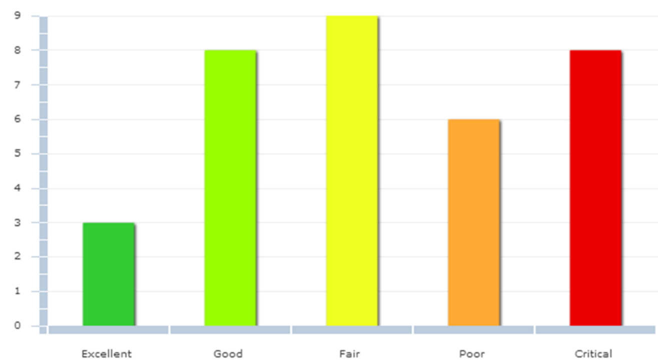
The pie chart below provides a breakdown of each of the bridges & culverts components to the overall structures value.

Bridges & Culverts Components



3.5.3 What condition is it in?
59% of the bridges & culverts are in fair to excellent condition with the remaining 41% in poor to critical condition. As such, the municipality received a Condition vs. Performance rating of 'D+'.

Bridge Structure and Culvert Condition by Quantity



3.5.4 What do we need to do to it?
There are generally four distinct phases in an asset's life cycle. These are presented at a high level for the bridge and culvert structures below. Further detail is provided in the "Asset Management Strategy" section of this AMP.

Addressing Asset Needs

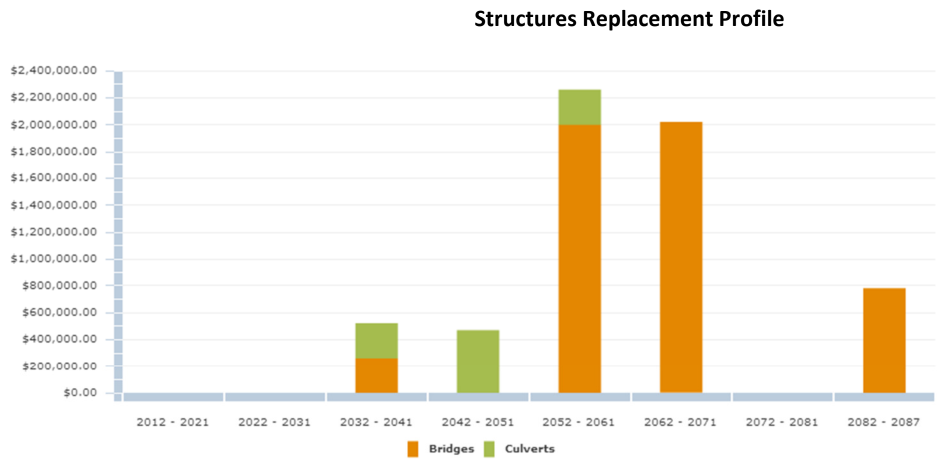
Phase	Lifecycle Activity	Asset Life Stage
Minor Maintenance	Activities such as inspections, monitoring, sweeping, winter control, etc.	1st Qtr
Major Maintenance	Activities such as repairs to cracked or spalled concrete, damaged expansion joints, bent or damaged railings, etc.	2nd Qtr
Rehabilitation	Rehabilitation events such as structural reinforcement of structural elements, deck replacements, etc.	3rd Qtr
Replacement	Full structure reconstruction	4th Qtr

3.5.5 When do we need to do it?
For the purpose of this report, 'useful life' data for each asset class was obtained from the accounting data within the CityWide software database. This proposed useful life is used to determine replacement needs of individual assets, which are calculated in the system as part of the overall financial requirements.

Asset Useful Life in Years		
Asset Type	Asset Component	Useful Life in Years
Bridges & Culverts	Bridges	75
	Culverts	75

As additional field condition information becomes available, the data can be loaded into the CityWide system to increase the accuracy of current asset age and, therefore, that of future replacement requirements. The following graph shows the projection of road network replacement costs based on the age of the asset only.

The following graph shows the current projection of structure replacements based on the age of the asset only.



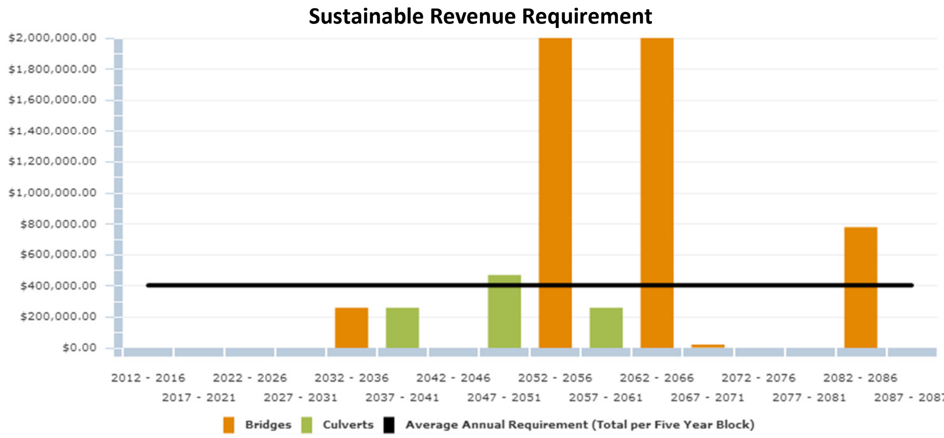
3.5.6 How much money do we need?

The analysis completed to determine capital revenue requirements was based on the following constraints and assumptions:

1. Replacement costs are based upon the "What is it worth" section above.
2. The timing for individual structure replacement was defined by the replacement year as described in the "When do you need to do it?" section above.
3. All values are presented in 2012 dollars.
4. The analysis was run for a 75 year period to ensure all assets cycled through at least one iteration of replacement, therefore providing a sustainable projection.

3.5.7 How do we reach sustainability?

Based upon the above assumptions, the average annual revenue required to sustain Brockton's bridges & culverts is $**306,000**. Based on Brockton's current annual funding of **$0**, there is an annual **deficit of $306,000**. As such, the municipality received a Funding vs. Need rating of 'F'. The following graph presents five year blocks of expenditure requirements against the sustainable funding threshold line.



In conclusion, based on the age data only, the bridges and large structures are in fair condition overall and due to the long life of these assets there are very little needs to be addressed within the immediate future. However, as structures are probably a municipality's highest liability asset, a condition assessment program should be established and/ or completed field assessments should be uploaded into the CityWide software system. The condition data will aid in prioritizing overall needs for rehabilitation and replacement and will assist with optimizing the long and short term budgets. Further detail is outlined within the "asset management strategy" section of this AMP.

3.5.8 Recommendations

The municipality received an overall rating of 'F' for its bridges & culverts, calculated from the Condition vs. Performance and the Funding vs. Need ratings. Accordingly, we recommend the following:

1. As a result of the condition assessment policy and the subsequent OSIM inspections, condition data should be loaded into the CityWide software and an updated 'current state of the infrastructure' analysis should be generated.

1. An appropriate % of asset replacement value should be used for operations and maintenance activities on an annual basis. This should be determined through a detailed analysis of O & M activities and added to future AMP reporting.

2. The Infrastructure Report Card should be updated on an annual basis.

3.6 Water Network

B+

INFRASTRUCTURE REPORT CARD GRADE

3.6 Water Network

3.6.1 What do we own?

Brockton is responsible for the following water network inventory which includes approximately 43km of water mains:

Water Network Inventory		
Asset Type	Asset Component	Quantity
Water Network	Hydrants	237 units
	Water Mains (less than 300mm)	42,533m
	Water Mains (unknown diameter)	812m
	Pumphouse	4 units

The water network data was extracted from the Tangible Capital Asset module of the CityWide software suite.

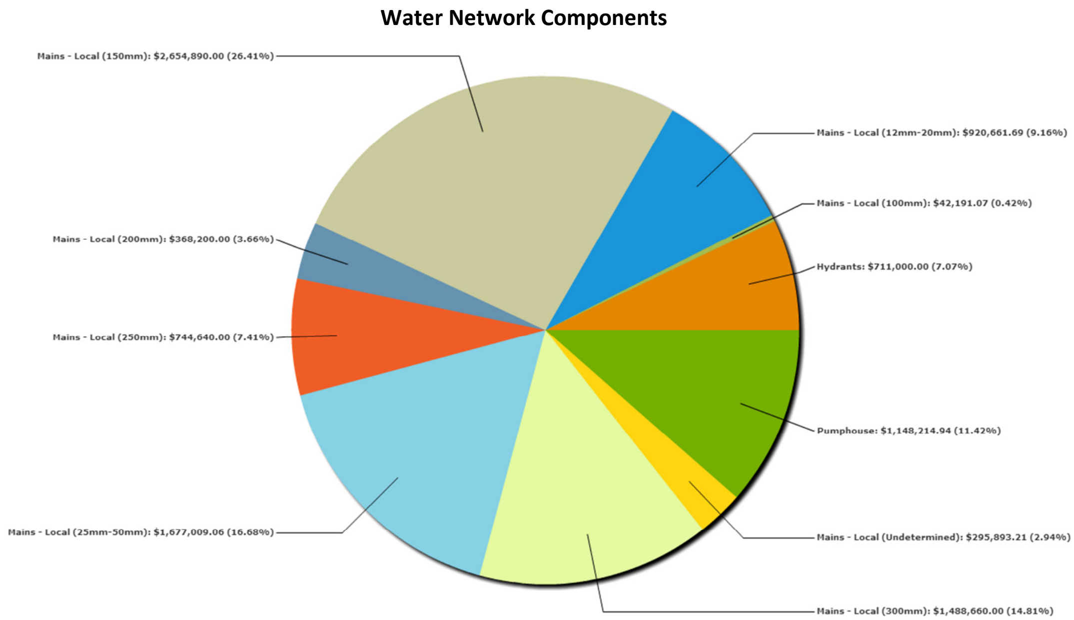
3.6.2 What is it worth?

The estimated replacement value of the water network, in 2012 dollars, is approximately $10 million. The cost per household for the water network is $4,611 based on 2,180 households.

Water Network Replacement Value				
Asset Type	Asset Component	Quantity	2012 Unit Replacement Cost	2012 Overall Replacement Cost
Water Network	Hydrants	237 units	$3,000/unit	$711,000
	Water Mains (12mm - 20mm)*	1,749m	$526/m	$920,662
	Water Mains (25mm - 50mm)*	3,458m	$485/m	$1,677,009
	Water Mains (100mm)*	32m	$1,318/m	$42,191
	Water Mains (150mm)	23,086m	$115/m	$2,654,890
	Water Mains (200mm)	2,630m	$140/m	$368,200
	Water Mains (250mm)	4,654m	$160/m	$744,640
	Water Mains (300mm)	6,924m	$215/m	$1,488,660
	Water Mains (unknown diameter)*	812m	$364/m	$295,893
	Pumphouse*	4 units	$287,054/unit	$1,148,215
				$10,051,360

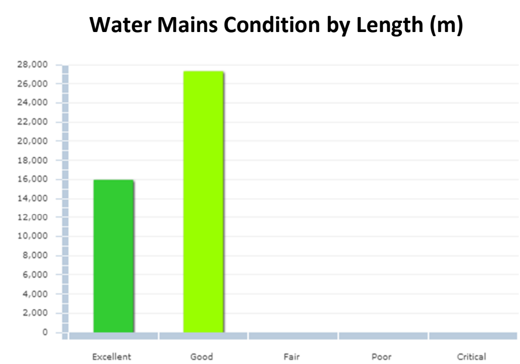
*Replacement cost is calculated using NRBCPI Quarterly (Toronto).

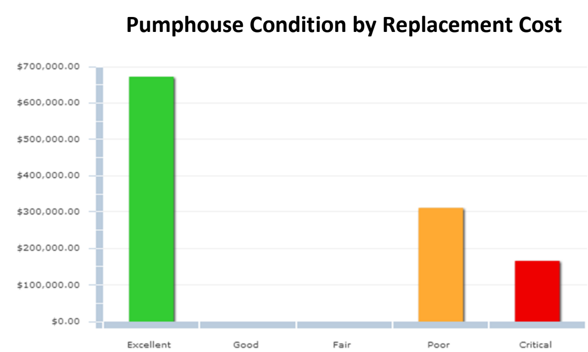
The pie chart below provides a breakdown of each of the network components to the overall system value.



3.6.3 What condition is it in?

All of the municipality's water mains are in good to excellent condition. 59% of the facilities are in excellent condition with the remaining 41% in poor to critical condition. As such, the municipality received a Condition vs. Performance rating of 'B'.





3.6.4 What do we need to do to it?

There are generally four distinct phases in an asset's life cycle. These are presented at a high level for the water network below. Further detail is provided in the "Asset Management Strategy" section of this AMP.

Addressing Asset Needs		
Phase	Lifecycle Activity	Asset Age
Minor Maintenance	Activities such as inspections, monitoring, cleaning and flushing, hydrant flushing, pressure tests, visual inspections, etc.	1st Qtr
Major Maintenance	Such events as repairing water main breaks, repairing valves, replacing individual small sections of pipe etc.	2nd Qtr
Rehabilitation	Rehabilitation events such as structural lining of pipes and a cathodic protection program to slow the rate of pipe deterioration.	3rd Qtr
Replacement	Pipe replacements	4th Qtr

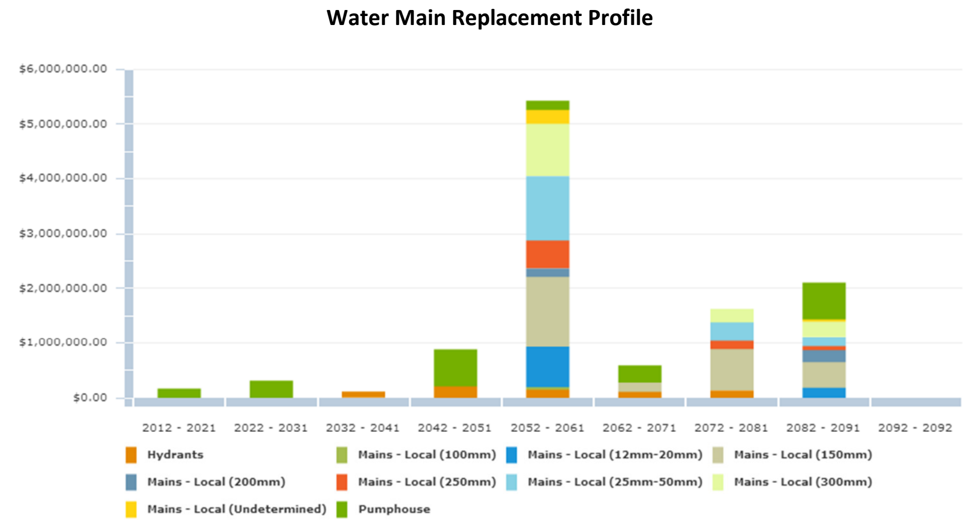
3.6.5 When do we need to do it?

For the purpose of this report "useful life" data for each asset class was obtained from the accounting data within the CityWide software database. This proposed useful life is used to determine replacement needs of individual assets, which are calculated in the system as part of the overall financial requirements.

Asset Useful Life in Years		
Asset Type	Asset Component	Useful Life in Years
Water Network	Hydrants	70
	Water Mains (12mm)	80
	Water Mains (19mm)	50
	Water Mains (19mm)	80
	Water Mains (20mm)	80
	Water Mains (25mm - 50mm)	80
	Water Mains (100mm)	80
	Water Mains (150mm)	80
	Water Mains (200mm)	80
	Water Mains (250mm)	80
	Water Mains (300mm)	80
	Water Mains (unknown diameter)	80
	Pumphouse	40

As field condition information becomes available in time, the data should be loaded into the CityWide system in order to increasingly have a more accurate picture of current asset age and condition, therefore, future replacement requirements.

The following graph shows the current projection of water main replacements based on the age of the assets only.



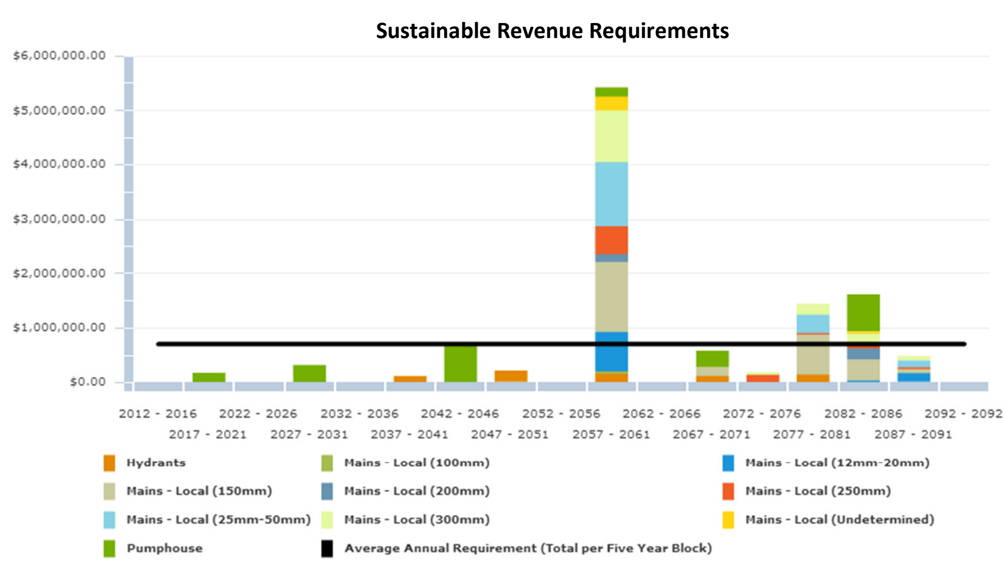
3.6.6 How much money do we need?

The analysis completed to determine capital revenue requirements was based on the following assumptions:

1. Replacement costs are based upon the unit costs identified within the "What is it worth" section above.
2. The timing for individual water main replacement was defined by the replacement year as described in the "When do you need to do it?" section above.
3. All values are presented in 2012 dollars.
4. The analysis was run for a 80 year period to ensure all assets went through at least one iteration of replacement, therefore providing a sustainable projection.

3.6.7 How do we reach sustainability?

Based upon the above assumptions, the average annual revenue required to sustain Brockton's water network is approximately **$142,000**. Based on Brockton's current annual funding of **$146,000**, there is a **surplus of $4,000**. As such, the municipality received a Funding vs. Need rating of 'A'. The following graph presents five year blocks of expenditure requirements against the sustainable funding threshold line.



In conclusion, Brockton's water distribution network is in very good condition based on age data only, while the pump houses have some assets in poor and critical condition. A condition assessment program should be established to aid in prioritizing overall needs for rehabilitation and replacement and to assist with optimizing the long and short term budgets. Further detail is outlined within the "asset management strategy" section of this AMP.

3.6.8 Recommendations

The municipality received an overall rating of 'B+' for its water network, calculated from the Condition vs. Performance and the Funding vs. Need ratings. Accordingly, we recommend the following:

1. A more detailed study to define the current condition of the water network should be undertaken as described further within the "Asset Management Strategy" section of this AMP.

2. Also, a detailed study to define the current condition of the pump houses and their components (structural, architectural, electrical, mechanical, process, etc) should be undertaken, as collectively they account for approximately 11% of the water infrastructure's value.

3. Once the above studies are complete, a new performance age should be applied to each water main and an updated "current state of the infrastructure" analysis should be generated.

4. An appropriate % of asset replacement value should be used for operations and maintenance activities on an annual basis. This should be determined through a detailed analysis of O & M activities and be added to future AMP reporting.

5. The Infrastructure Report Card should be updated on an annual basis.

3.7 Sanitary Sewer Network

D

INFRASTRUCTURE REPORT CARD GRADE

3.7 Sanitary Sewer Network

3.7.1 What do we own?

The inventory components of the sanitary sewer network are outlined in the table below. The entire Network consists of approximately 38km of sewer main.

Sanitary Sewer Inventory		
Asset Type	Asset Component	Quantity
Sanitary Sewer Network	Sanitary Mains	37,974.5m
	Sewer Treatment Plant	1 unit

The Sanitary Sewer Network data was extracted from the Tangible Capital Asset module of the CityWide software application.

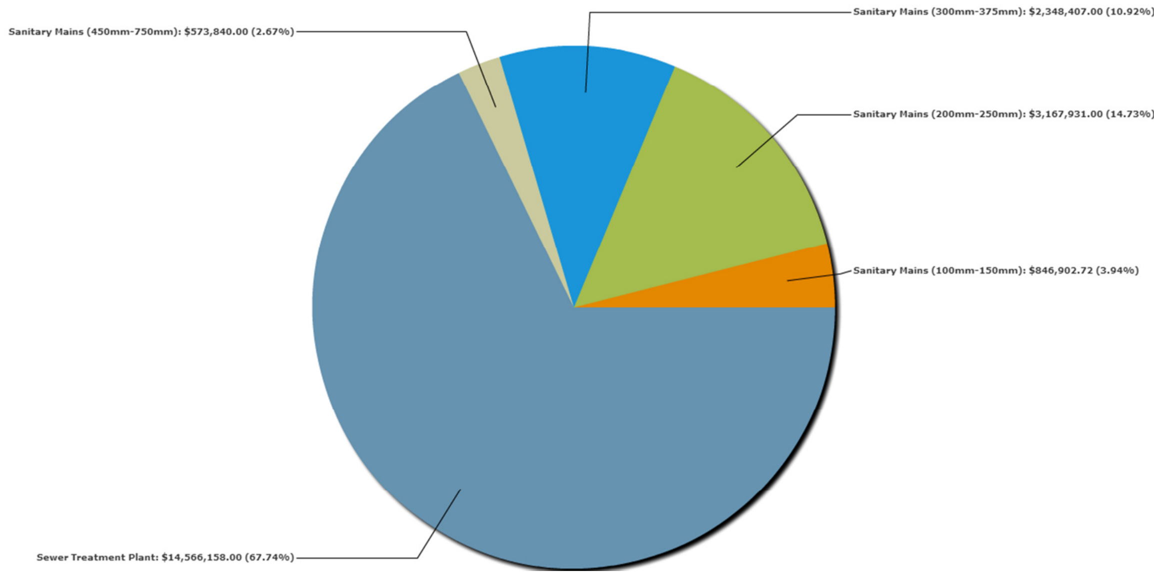
3.7.2 What is it worth?

The estimated replacement value of the sanitary sewer network, in 2012 dollars, is approximately $21 million. The cost per household for the sanitary network is $10,240 based on 2,100 households.

Sanitary Sewer Replacement Value				
Asset Type	Asset Component	Quantity	2012 Unit Replacement Cost	2012 Overall Replacement Cost
SANITARY	SANITARY MAINS (100MM - 150MM)	5,063.2m	$167/m	$846,903
	SANITARY MAINS (200MM - 250MM)	20,731.9m	$153/m	$3,167,931
	SANITARY MAINS (300MM - 375MM)	10,704.5m	$219/m	$2,348,407
	SANITARY MAINS (450MM - 750MM)	1,474.9m	$389/m	$573,840
	SEWER TREATMENT PLANT	1 unit	$14,566,158/unit	$14,566,158
				$21,503,239

The pie chart below provides a breakdown of each of the network components to the overall system value.

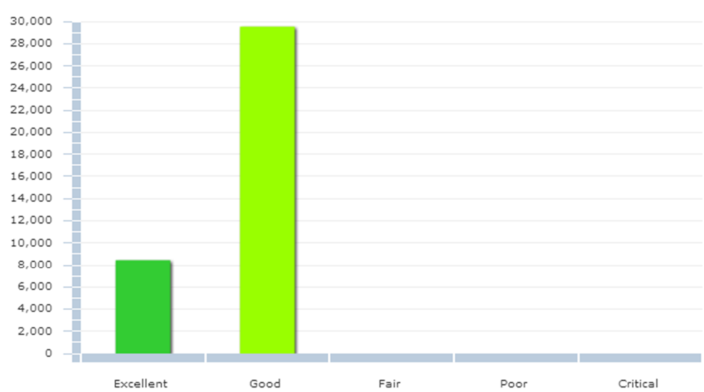
Sanitary Sewer Network Components



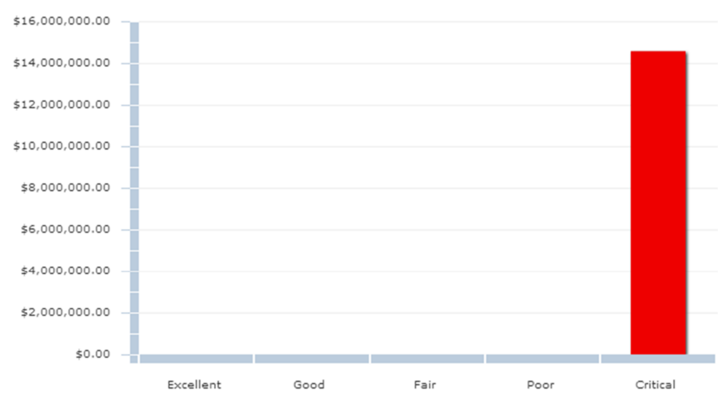
3.7.3 What condition is it in?

All 100% of the municipality's sanitary sewer mains are in good to excellent condition with the exclusion of the treatment plant which is in critical condition. As such, the municipality received a Condition vs. Performance rating of 'D'.

Sanitary Sewer Mains Condition by Length (m)



Sewer Treatment Plant by Replacement Cost



3.7.4 What do we need to do to it?

There are generally four distinct phases in an assets life cycle. These are presented at a high level for the sanitary sewer network below. Further detail is provided in the "Asset Management Strategy" section of this AMP.

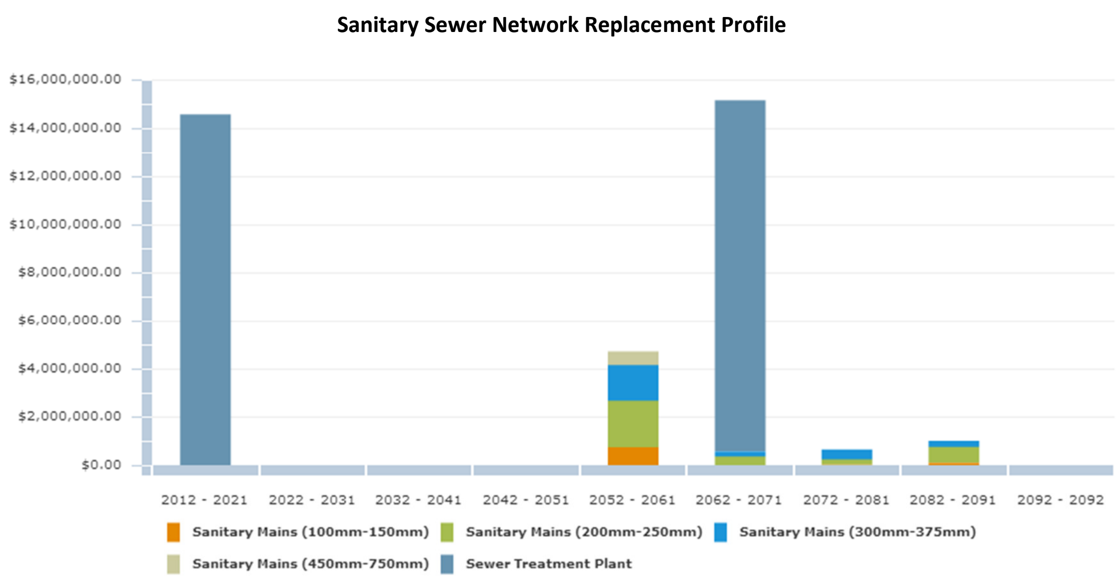
Addressing Asset Needs		
Phase	Lifecycle Activity	Asset Life Stage
Minor Maintenance	Activities such as inspections, monitoring, cleaning and flushing, zoom camera and CCTV inspections, etc.	1st Qtr
Major Maintenance	Activities such as repairing manholes and replacing individual small sections of pipe.	2nd Qtr
Rehabilitation	Rehabilitation events such as structural lining of pipes are extremely cost effective and provide an additional 75 plus years of life.	3rd Qtr
Replacement	Pipe replacements	4th Qtr

3.7.5 When do we need to do it?

For the purpose of this report "useful life" data for each asset class was obtained from the accounting data within the CityWide software database. This proposed useful life is used to determine replacement needs of individual assets, which are calculated in the system as part of the overall financial requirements.

Asset Useful Life in Years		
Asset Type	Asset Component	Useful Life in Years
Sanitary Sewer Network	Sanitary Mains (100mm - 150mm)	80
	Sanitary Mains (200mm - 250mm)	80
	Sanitary Mains (300mm - 375mm)	80
	Sanitary Mains (450mm - 750mm)	80
	Sewer Treatment Plant	40

As field condition information becomes available in time, the data should be loaded into the CityWide system in order to increasingly have a more accurate picture of current asset performance age and, therefore, future replacement requirements. The following graph shows the current projection of sanitary sewer network replacements based on the age of the asset only.



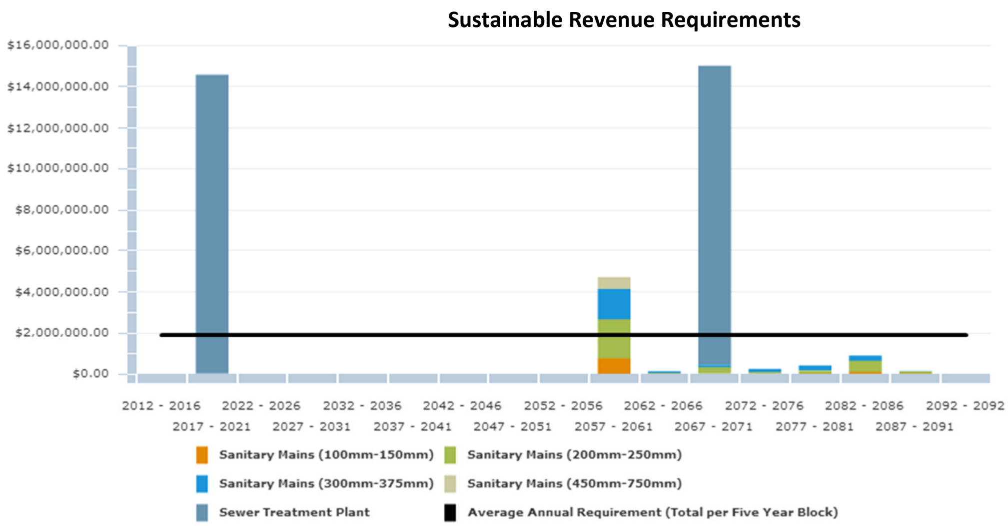
3.7.6 How much money do we need?

The analysis completed to determine capital revenue requirements was based on the following assumptions:

1. Replacement costs are based upon the unit costs identified within the "What is it worth" section above.
2. The timing for individual sewer main replacement was defined by the replacement year as described in the "When do you need to do it?" section above.
3. All values are presented in 2012 dollars.
4. The analysis was run for an 80 year period to ensure all assets went through at least one iteration of replacement, therefore providing a sustainable projection.

3.7.7 How do we reach sustainability?

Based upon the above assumptions, the average annual revenue required to sustain Brockton's sanitary sewer network is approximately **$380,000**. Based on Brockton's current annual funding of **$260,000**, there is an annual **deficit of $120,000**. As such, the municipality received a Funding vs. Need rating of 'C'. The following graph presents five year blocks of expenditure requirements against the sustainable funding threshold line.



In conclusion, the sanitary sewer network, from an age based analysis only, is generally in very good condition, while the treatment plant is in critical condition generating significant expenditure requirements over the next 10 years. It should be noted that the plant replacement requirements are based on all components having a 40 year life and therefore a detailed condition assessment program should be established to determine actual field requirements. The condition data will aid in prioritizing overall needs for rehabilitation and replacement and will assist with optimizing the long and short term budgets. Further detail is outlined within the "asset management strategy" section of this AMP.

3.7.8 Recommendations

The municipality received an overall rating of 'D' for its sanitary sewer network, calculated from the Condition vs. Performance and the Funding vs. Need ratings. Accordingly, we recommend the following:

1. A condition assessment program should be established for the sanitary sewer network to gain a better understanding of current condition and performance as outlined further within the "Asset Management Strategy" section of this AMP.

2. Also, a detailed study to define the current condition of the sanitary facilities and their components (structural, architectural, electrical, mechanical, process, etc) should be undertaken, as collectively they account for approximately 68% of the sanitary infrastructure's value.

3. Once the above studies are complete or underway, the condition data should be loaded into the CityWide software and an updated "current state of the infrastructure" analysis should be generated.

4. An appropriate % of asset replacement value should be used for operations and maintenance activities on an annual basis. This should be determined through a detailed analysis of O & M activities and be added to future AMP reporting.

5. The Infrastructure Report Card should be updated on an annual basis.

3.8 Storm Sewer Network

D

INFRASTRUCTURE REPORT CARD GRADE

3.8 Storm Sewer Network

3.8.1 What do we own?

The inventory components of the Storm Sewer Collection system are outlined in the table below. The entire network consists of approximately 46km of sewer mains.

Storm Sewer Network Inventory (Detailed)		
Asset Type	Asset Component	Quantity
Storm Sewer Network	Storm Mains (less than 500mm)	22,308m
	Storm Mains (greater than 500mm)	23,961m

The storm sewer network data was extracted from the Tangible Capital Asset module of the CityWide software suite.

3.8.2 What is it worth?

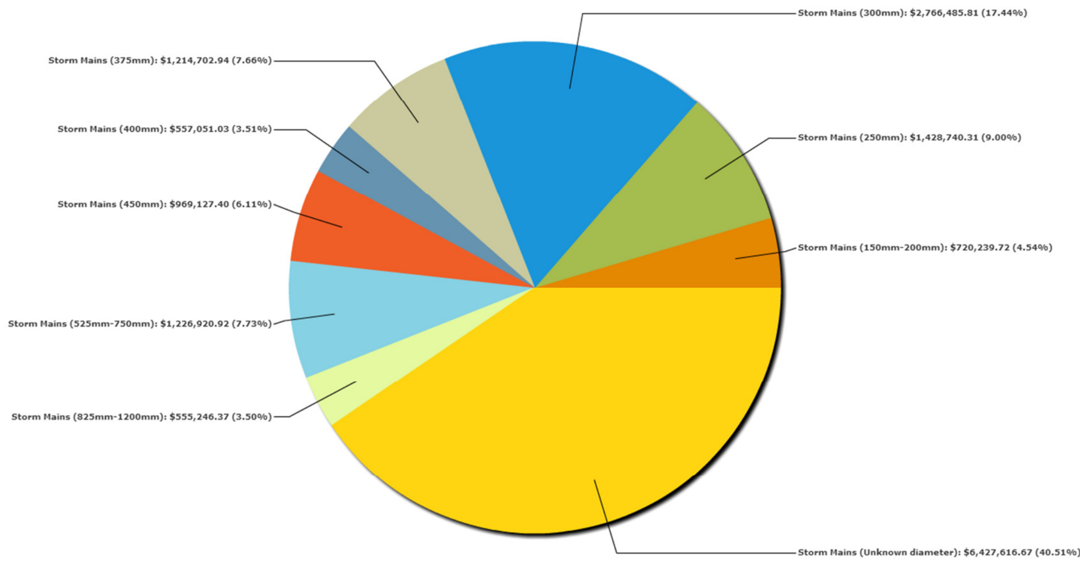
The estimated replacement value of the storm sewer network, in 2012 dollars, is approximately $16 million. The cost per household for the storm sewer network is $7,555 based on 2,100 households.

Storm Replacement Value				
Asset Type	Asset Component	Quantity	2012 Unit Replacement Cost	2012 Overall Replacement Cost
Storm Sewer Network	Storm Mains (150mm - 200mm)	2,084m	$346/m	$720,240
	Storm Mains (250mm)	4,154m	$344/m	$1,428,740
	Storm Mains (300mm)	8,055m	$343/m	$2,766,486
	Storm Mains (375mm)	3,542m	$343/m	$1,214,703
	Storm Mains (400mm)	1,633m	$341/m	$557,051
	Storm Mains (450mm)	2,840m	$341/m	$969,127
	Storm Mains (525mm - 750mm)	3,582m	$343/m	$1,226,921
	Storm Mains (825mm - 1200mm)	1,613m	$344/m	$555,246
	Storm Mains (Unknown diameter)	18,766m	$343/m	$6,427,617
				$15,866,131

*All replacement costs are calculated using NRBCPI Quarterly (Toronto).

The pie chart below provides a breakdown of each of the network components to the overall system value.

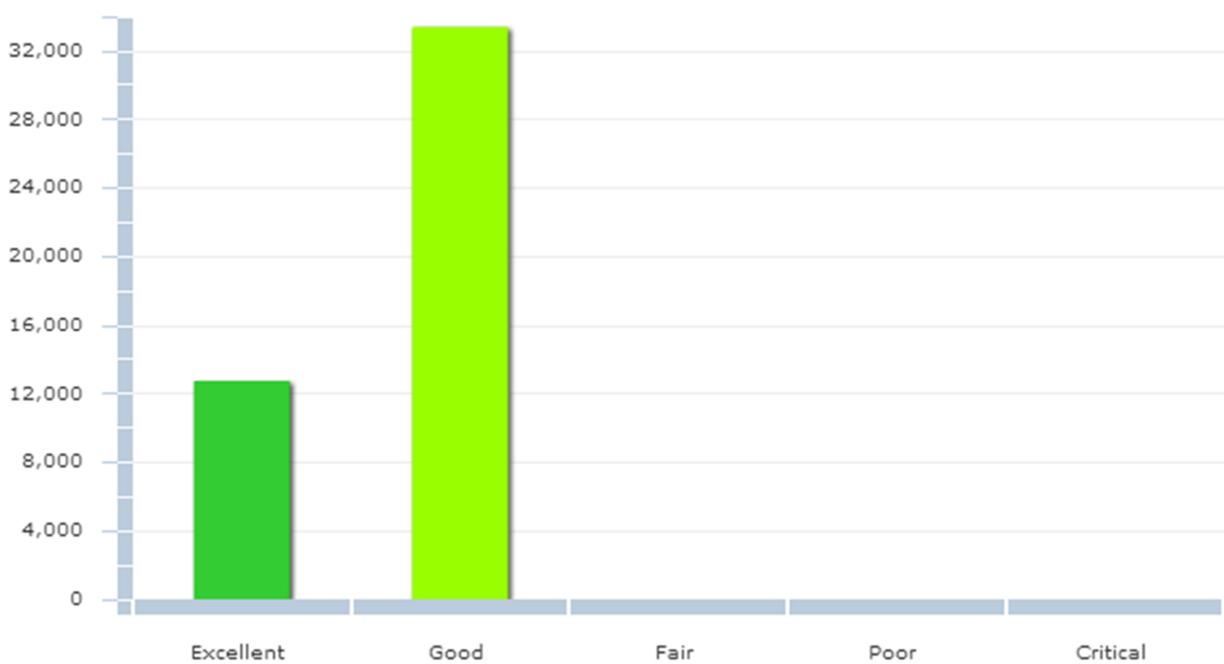
Storm Sewer Network Components



3.8.3 What condition is it in?

All of 100% of the municipality's storm sewer mains are in good to excellent condition. As such, the municipality received a Condition vs. Performance rating of 'B'.

Storm Mains Condition by Length (metres)



3.8.4 What do we need to do to it?

There are generally four distinct phases in an assets life cycle. These are presented at a high level for the storm sewer network below. Further detail is provided in the "Asset Management Strategy" section of this AMP.

Addressing Asset Needs

Phase	Lifecycle Activity	Asset Age
Minor Maintenance	Activities such as inspections, monitoring, cleaning and flushing, zoom camera and CCTV inspections, etc.	1st Qtr
Major Maintenance	Activities such as repairing manholes and replacing individual small sections of pipe.	2nd Qtr
Rehabilitation	Rehabilitation events such as structural lining of pipes are extremely cost effective and provide an additional 75 plus years of life.	3rd Qtr
Replacement	Pipe replacements	4th Qtr

3.8.5 When do we need to do it?

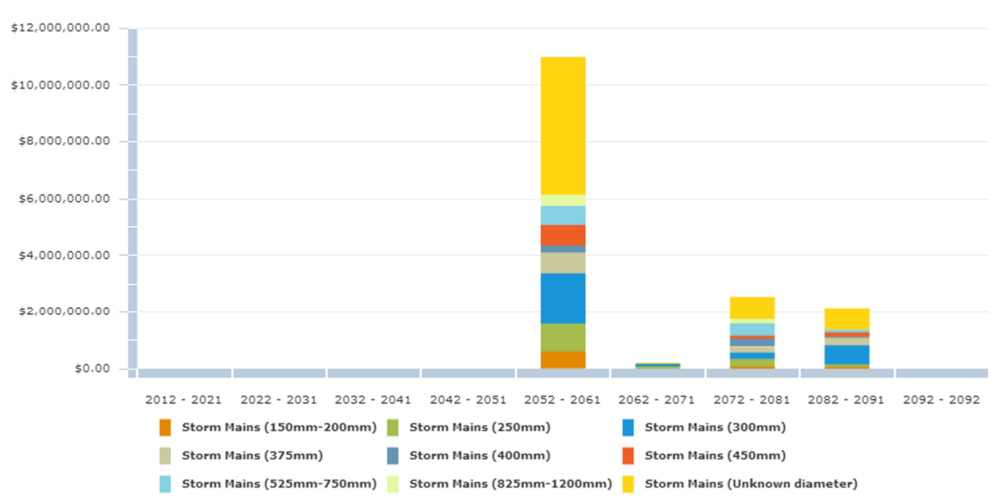
For the purpose of this report "useful life" data for each asset class was obtained from the accounting data within the CityWide software database. This proposed useful life is used to determine replacement needs of individual assets, which are calculated in the system as part of the overall financial requirements.

Asset Useful Life in Years

Asset Type	Asset Component	Useful Life in Years
Storm Sewer Network	Storm Mains (less than 500mm)	80
	Storm Mains (greater than 500mm)	80

As field condition information becomes available in time, the data should be loaded into the CityWide system in order to increasingly have a more accurate picture of current asset performance age and, therefore, future replacement requirements. The following graph shows the current projection of storm sewer network replacements based on the age of the asset only.

Storm Sewer Network Replacement Profile



3.8.6 How much money do we need?

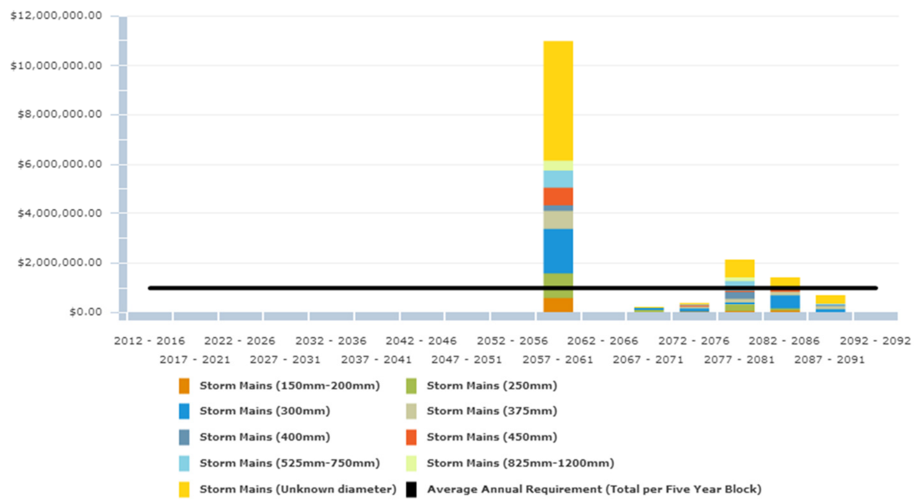
The analysis completed to determine capital revenue requirements was based on the following assumptions:

1. Replacement costs are based upon the unit costs identified within the "What is it worth" section above.
2. The timing for individual storm sewer main replacement was defined by the replacement year as described in the "When do you need to do it?" section above.
3. All values are presented in current (2012) dollars.
4. The analysis was run for an 80 year period to ensure all assets went through one iteration of replacement, therefore providing a sustainable projection.

3.8.7 How do we reach sustainability?

Based upon the above assumptions, the average annual revenue required to sustain Brockton's storm sewer network is approximately **$198,000**. Based on Brockton's current annual funding of **$0**, there is an annual **deficit of $198,000**. As such, the municipality received a Funding vs. Need rating of 'F'.

Storm Sewer Main Replacement Profile



In conclusion, Brockton's storm sewer collection network, based on age data only, is in very good condition with no immediate needs projected. Of course, a condition assessment program will aid in prioritizing actual needs for rehabilitation and replacement and will assist with optimizing the long term budget. Further detail is outlined within the "asset management strategy" section of this AMP.

3.8.8 Recommendations

The municipality received an overall rating of 'D' for its storm sewer network, calculated from the Condition vs. Performance and the Funding vs. Need ratings. Accordingly, we recommend the following:

1. A condition assessment program should be established for the storm sewer network to gain a better understanding of current condition and performance as outlined further within the "Asset Management Strategy" section of this AMP.

2. Once the above study is complete or underway, the condition data should be loaded into the CityWide software and an updated "current state of the infrastructure" analysis should be generated.

3. An appropriate % of asset replacement value should be used for operations and maintenance activities on an annual basis. This should be determined through a detailed analysis of O & M activities and be added to future AMP reporting.

4. The Infrastructure Report Card should be updated on an annual basis.

4.0 Infrastructure Report Card

CUMULATIVE GPA

D+

Infrastructure Report Card

The Municipality of Brockton

1. Each asset category was rated on two key, equally weighted (50/50)dimensions: **Condition vs. Performance**, and **Funding vs. Need**.
2. See the "***What condition is it in***?" section for each asset category for its star rating on the Condition vs. Performance dimension.
3. See the "***How do we reach sustainability***?" section for each asset category for its star rating on the Funding vs. Need dimension.
4. The 'Overall Rating' below is the average of the two star ratings converted to a letter grade.

Asset Category	Condition vs. Performance	Funding vs. Need	Overall Grade	Comments
Road Network	**D+**	**D**	**D**	The majority, 64%, of the municipality's road network is in fair to excellent condition, with the remaining 36% in poor to critical condition. The average annual revenue required to sustain Brockton's paved road network is approximately **$2,100,000**. Based on Brockton's current annual funding of **$1,155,000**, there is an annual **deficit of $945,000**.
Bridges & Culverts	**D+**	**F**	**F**	Approximately 60% of the municipality's bridges & culverts are in fair to excellent condition. The average annual revenue required to sustain Brockton's bridges & culverts is **$306,000**. Based on Brockton's current annual funding of **$0**, there is an annual **deficit of $306,000**.
Water Network	**B**	**A**	**B+**	All 100% of the municipality's water mains are in good to excellent condition with the majority of the water treatment plant in excellent condition. The average annual revenue required to sustain Brockton's water network is approximately **$142,000**. Based on Brockton's current annual funding of **$146,000**, there is a **surplus of $4,000**.
Sanitary Sewer Network	**D**	**C**	**D**	All 100% of the municipality's sanitary sewer assets are in good to excellent condition whereas 100% of the sanitary treatment plant is in critical condition. The average annual revenue required to sustain Brockton's sanitary sewer network is approximately **$380,000**. Based on Brockton's current annual funding of **$260,000**, there is an annual **deficit of $120,000**.
Storm Sewer Network	**B**	**F**	**D**	All 100% of the municipality's storm sewer network is in good to excellent condition. The average annual revenue required to sustain Brockton's storm sewer network is approximately **$198,000**. Based on Brockton's current annual funding of **$0**, there is an annual **deficit of $198,000**.

5.0 Desired Levels of Service

Desired levels of service are high level indicators, comprising many factors, as listed below, which establish defined quality thresholds at which municipal services should be supplied to the community. They support the organization's strategic goals and are based on customer expectations, statutory requirements, standards, and the financial capability of a municipality to deliver those levels of service.

Levels of Service are used:

- to inform customers of the proposed type and level of service to be offered;
- to identify the costs and benefits of the services offered;
- to assess suitability, affordability and equity of the services offered;
- as a measure of the effectiveness of the asset management plan
- as a focus for the AM strategies developed to deliver the required level of service

In order for a municipality to establish a desired level of service, it will be important to review the key factors involved in the delivery of that service, and the interactions between those factors. In addition, it will be important to establish some key performance metrics and track them over an annual cycle to gain a better understanding of the current level of service supplied.

Within this first Asset Management Plan, key factors affecting level of service will be outlined below and some key performance indicators for each asset type will be outlined for further review. This will provide a framework and starting point from which the municipality can determine future desired levels of service for each infrastructure class.

5.1 Key factors that influence a level of service:

- Strategic and Corporate Goals
- Legislative Requirements
- Expected Asset Performance
- Community Expectations
- Availability of Finances

5.1.1 Strategic and Corporate Goals

Infrastructure levels of service can be influenced by strategic and corporate goals. Strategic plans spell out where an organization wants to go, how it's going to get there, and helps decide how and where to allocate resources, ensuring alignment to the strategic priorities and objectives . It will help identify priorities and guide how municipal tax dollars and revenues are spent into the future. The level of importance that a community's vision is dependent upon infrastructure, will ultimately affect the levels of service provided or those levels that it ultimately aspires to deliver.

5.1.2 Legislative Requirements

Infrastructure levels of service are directly influenced by many legislative and regulatory requirements. For instance, the Safe Drinking Water Act, the Minimum Maintenance Standards for municipal highways, building codes, and the Accessibility for Ontarians with Disabilities Act are all legislative requirements that prevent levels of service from declining below a certain standard.

5.1.3 Expected Asset Performance

A level of service will be affected by current asset condition, and performance and limitations in regards to safety, capacity, and the ability to meet regulatory and environmental requirements. In addition, the design life of the asset, the maintenance items required, the rehabilitation or replacement schedule of the asset, and the total costs, are all critical factors that will affect the level of service that can be provided.

5.1.4 Community Expectations

Levels of services are directly related to the expectations that the general public has from the infrastructure. For example, the public will have a qualitative opinion on what an acceptable road looks like, and a quantitative one on how long it should take to travel between two locations. Infrastructure costs are projected to increase dramatically in the future, therefore it is essential that the public is not only consulted, but also be educated, and ultimately make choices with respect to the service levels that they wish to pay for.

5.1.5 Availability of Finances

Availability of finances will ultimately control all aspects of a desired level of service. Ideally, these funds must be sufficient to achieve corporate goals, meet legislative requirements, address an asset's life cycle needs, and meet community expectations. Levels of service will be dictated by availability of funds or elected officials' ability to increase funds, or the community's willingness to pay.

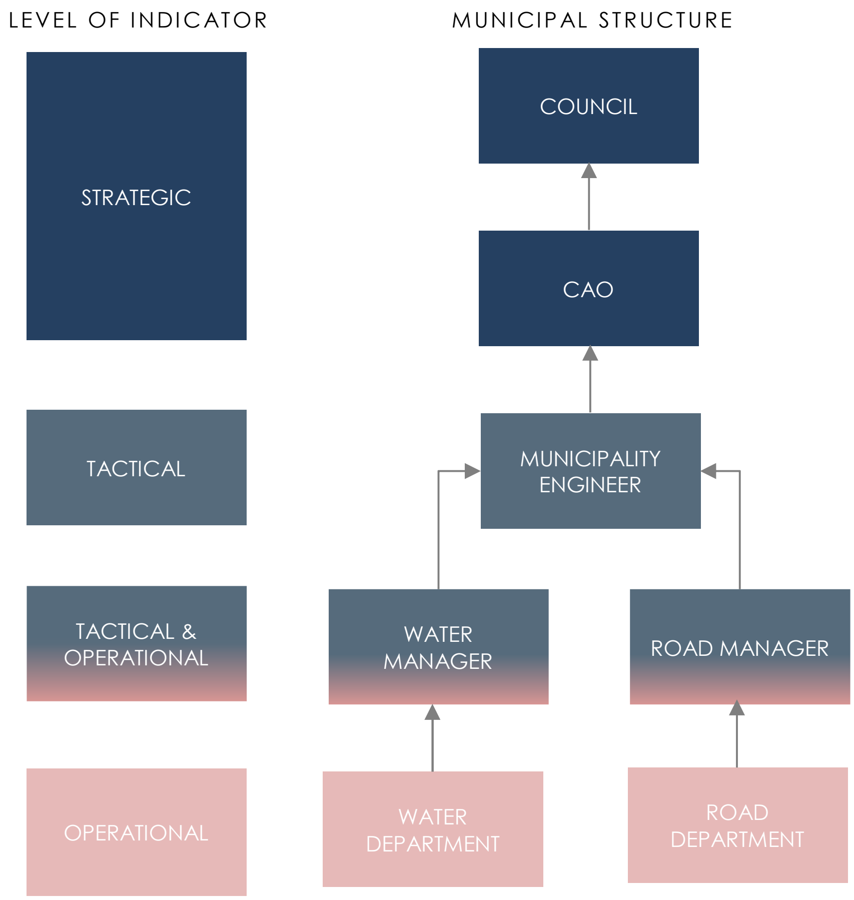
5.2 Key Performance Indicators

Performance measures or key performance indicators (KPIs) that track levels of service should be specific, measurable, achievable, relevant, and timebound (SMART). Many good performance measures can be established and tracked through the CityWide suite of software products. In this way, through automation, results can be reviewed on an annual basis and adjustments can be made to the overall asset management plan, including the desired level of service targets.

In establishing measures, a good rule of thumb to remember is that maintenance activities ensure the performance of an asset and prevent premature aging, whereas rehab activities extend the life of an asset. Replacement activities, by definition, renew the life of an asset. In addition, these activities are constrained by resource availability (in particular, finances) and strategic plan objectives. Therefore, performance measures should not just be established for operating and maintenance activities, but also for the strategic, financial, and tactical levels of the asset management program. This will assist all levels of program delivery to review their performance as part of the overall level of service provided.

This is a very similar approach to the "balanced score card" methodology, in which financial and non-financial measures are established and reviewed to determine whether current performance meets expectations. The "balanced score card", by design, links day to day operations activities to tactical and strategic priorities in order to achieve an overall goal, or in this case, a desired level of service.

The structure of accountability and level of indicator with this type of process is represented in the following table, modified from the InfraGuide's best practice document, "Developing Indicators and Benchmarks" published in April 2003.



As a note, a caution should be raised over developing too many performance indicators that may result in data overload and lack of clarity. It is better to develop a select few that focus in on the targets of the asset management plan.

Outlined below for each infrastructure class is a suggested service description, suggested service scope, and suggested performance indicators. These should be reviewed and updated in each iteration of the AMP.

5.3 Transportation Services

5.3.1 Service Description

The City's transportation network comprises gravel, rural and urban hot mix asphalt, rural surface treated roads. The transport network also includes 29 bridges, 5 large culverts, sidewalk, and street lights.

Together, the above infrastructure enables the municipality to deliver transportation and pedestrian facility services and give people a range of options for moving about in a safe and efficient manner.

5.3.2 Scope of Services

- **Movement** – providing for the movement of people and goods.
- **Access** – providing access to residential, commercial, and industrial properties and other community amenities.
- **Recreation** –providing for recreational use, such as walking, cycling, or special events such as parades.

5.3.3 Performance Indicators (reported annually)

Performance Indicators (reported annually)	
Strategic Indicators	■ percentage of total reinvestment compared to asset replacement value ■ completion of strategic plan objectives (related to transportation)
Financial Indicators	■ annual revenues compared to annual expenditures ■ annual replacement value depreciation compared to annual expenditures ■ total cost of borrowing compared to total cost of service ■ revenue required to maintain annual network growth
Tactical Indicators	■ percentage of road network rehabilitated / reconstructed ■ value of bridge / large culvert structures rehabilitated or reconstructed ■ overall road condition index as a percentage of desired condition index ■ overall bridge condition index as a percentage of desired condition index ■ annual adjustment in condition indexes ■ annual percentage of network growth ■ percent of paved road lane km where the condition is rated poor or critical ■ number of bridge / large culvert structures where the condition is rated poor or critical ■ percentage of road network replacement value spent on operations and maintenance ■ percentage of bridge / large culvert structures replacement value spent on operations and maintenance
Operational Indicators	■ percentage of road network inspected within last 5 years ■ percentage of bridge / large culvert structures inspected within last two years ■ operating costs for paved roads per lane km ■ operating costs for gravel roads per lane km ■ operating costs for bridge / large culvert structures per square metre ■ number of customer requests received annually ■ percentage of customer requests responded to within 24 hours

5.4 Water / Sanitary / Storm Networks

5.4.1 Service Description

The City's water distribution network comprises 43km of water main, 237 hydrants and 4 pump houses. The waste water network comprises 38 km of sanitary sewer main and a sewer treatment plant. The storm water network comprises 46km of storm main.

Together, the above infrastructure enables the municipality to deliver a potable water distribution service, and a waste water and storm water collection service to the residents of the municipality.

5.4.2 Scope of services

- The provision of clean safe drinking water through a distribution network of water mains and pumps.
- The removal of waste water through a collection network of sanitary sewer mains.
- The removal of storm water through a collection network of storm sewer mains, and catch basins

5.4.3 Performance Indicators (reported annually)

Performance Indicators (reported annually)	
Strategic Indicators	■ Percentage of total reinvestment compared to asset replacement value ■ Completion of strategic plan objectives (related water / sanitary / storm)
Financial Indicators	■ Annual revenues compared to annual expenditures ■ Annual replacement value depreciation compared to annual expenditures ■ Total cost of borrowing compared to total cost of service ■ Revenue required to maintain annual network growth ■ Lost revenue from system outages
Tactical Indicators	■ Percentage of water / sanitary / storm network rehabilitated / reconstructed ■ Overall water / sanitary / storm network condition index as a percentage of desired condition index ■ Annual adjustment in condition indexes ■ Annual percentage of growth in water / sanitary / storm network ■ Percentage of mains where the condition is rated poor or critical for each network ■ Percentage of water / sanitary / storm network replacement value spent on operations and maintenance
Operational Indicators	■ Percentage of water / sanitary / 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 / storm networks ■ Percentage of customer requests responded to within 24 hours per water / sanitary / storm network

6.0 Asset Management Strategy

6.1 Objective

To outline and establish a set of planned actions, based on best practice, that will enable the assets to provide a desired and sustainable level of service, while managing risk, at the lowest life cycle cost.

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

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

6.2 Non-Infrastructure Solutions and Requirements

The municipality should explore, as requested through the provincial requirements, which non-infrastructure solutions should be incorporated into the budgets for the road, water, sewer (sanitary and storm), and bridges & culverts programs. 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.

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 implement holistic condition assessment programs for their road, water, sanitary, and storm sewer networks. This will lead to higher understanding of infrastructure needs, enhanced budget prioritization methodologies, and a clearer path of what is required to achieve sustainable infrastructure programs.

6.3 Condition Assessment Programs

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

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

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

- Extends asset service life therefore improving level of service
- Improves financial transparency and accountability
- Enables accurate asset reporting which, in turn, enables better decision making

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

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

The following section outlines condition assessment programs available for road, bridge, sewer, and water networks that would be useful for the municipality.

6.3.1 Pavement Network Inspections

Typical industry pavement inspections are performed by consulting firms using specialised 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. Examples of surface distresses are:

- **For asphalt surfaces**
  alligator cracking; distortion; excessive crown; flushing; longitudinal cracking; map cracking; patching; edge cracking; potholes; ravelling; rippling; transverse cracking; wheel track rutting

- **For concrete surfaces**
  coarse aggregate loss; corner 'C' and 'D' cracking; distortion; joint faulting; joint sealant loss; joint spalling; linear cracking; patching; polishing; potholes; ravelling; scaling; transverse cracking

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.

Most firms will deliver this data to the client in a database format complete with engineering algorithms and weighting factors to produce an overall condition index for each segment of roadway. This type of scoring database is ideal for upload into the CityWide software database, in order to tag each road with a present condition and then further life cycle analysis to determine what activity should be completed on which road, in what timeframe, and to calculate the cost for the work will be completed within the CityWide system.

The above process is an excellent way to capture road condition as the inspection trucks will provide detailed surface and roughness data for each road segment, and often include video or street imagery. A very rough industry estimate of cost would be about $100 per centreline km of road.

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

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

6.3.2 Bridges & Culverts (greater than 3m) Inspections

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). At present, in the municipality, there are 34 structures that meet this criterion.

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

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

- Detailed deck condition survey
- Non-destructive delamination survey of asphalt covered decks
- Substructure condition survey
- Detailed coating condition survey
- Underwater investigation
- Fatigue investigation
- Structure evaluation

Through the OSIM recommendations and additional detailed investigations, a 10 year needs list will be developed for the municipality's bridges.

The 10 year needs list developed could then be further prioritized using risk management techniques to better allocate resources. Also, the results of the OSIM inspection for each structure, whether BCI (bridge condition index) or general condition (good, fair, poor, critical) should be entered into the CityWide software to update results and analysis for the development of the budget.

6.3.3 Sewer Network Inspections (Sanitary & Storm)

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

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

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

- A time and cost efficient way of examining sewer systems;
- Problem areas can be quickly targeted;
- Can be complemented by a conventional camera (CCTV), if required afterwards;
- In a normal environment, 20 to 30 manholes can be inspected in a single day, covering more than 1,500 meters of pipe;
- Contrary to the conventional camera approach, cleaning and upstream flow control is not required prior to inspection;
- Normally detects 80% of pipe deficiencies, as most deficiencies generally occur within 20 meters of manholes.

The following table is based on general industry costs for traditional CCTV inspection and Zoom Camera inspection; however, costs should be verified through local contractors. It is for illustrative purposes only but supplies a general idea of the cost to inspect Brockton's entire sanitary and storm networks.

Sanitary and Sewer Inspection Cost Estimates

Sewer Network	Assessment Activity	Cost	Metres of Main / # of Manholes	**Total**
Sanitary	Full CCTV	$10 (per m)	38,000m	**$380,000**
	Zoom	$300 (per mh)	475 manholes (estimated)*	**$142,500**
Storm	Full CCTV	$10 (per m)	46,000m	**$460,000**
	Zoom	$300 (Per mh)	575 manholes (estimated)*	**$172,500**

**manholes estimated by using one manhole per 80 metres of main*

It can be seen from the above table that there is a significant cost savings achieved through the use of Zoom Camera technology. A good industry trend and best practice is to inspect the entire network using Zoom Camera technology and follow up on the poor and critical rated pipes with more detail using a full CCTV inspection. In this way, inspection expenditures are kept to a minimum, however, an accurate assessment on whether to rehabilitate or replace pipes will be provided for those with the greatest need.

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

In addition to receiving a video and defect report of each pipe's CCTV or Zoom camera inspection, many companies can now provide a database of the inspection results, complete with scoring matrixes that provide an overall general condition score for each pipe segment that has been assessed. Typically pipes are scored from 1 – 5, with 1 being a relatively new pipe and 5 being a pipe at the end of its design life. This type of scoring database is ideal for upload into the CityWide software database, in order to tag each pipe with a present condition and then further life cycle analysis to determine what activity should be done to which pipe, in what timeframe, and to calculate the cost for the work will be completed by the CityWide system.

6.3.4 Water network inspections

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

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

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

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

Understanding the age of the pipe will determine useful life remaining, however, water mains fail for many other reasons than just age. The pipe material is important to know as different pipe types have different design lives and different deterioration profiles. Keeping a water main break history is one of the best analysis tools to predict future pipe failures and to assist with programming rehabilitation and replacement schedules. Also, most municipalities perform hydrant flow tests for fire flow prevention purposes. The readings from these tests can also help determine condition of the associated water main. If a hydrant has a relatively poor flow condition it could be indicative of a high degree of encrustation within the attached water main, which could then be flagged as a candidate for cleaning or possibly lining. Finally, soil condition is important to understand as certain soil types can be very aggressive at causing deterioration on certain pipe types.

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

Also, it is recommended that the municipality utilize the CityWide Works application to track water main break work orders and hydrant flow inspection readings as a starting point to develop a future scoring database for each water main.

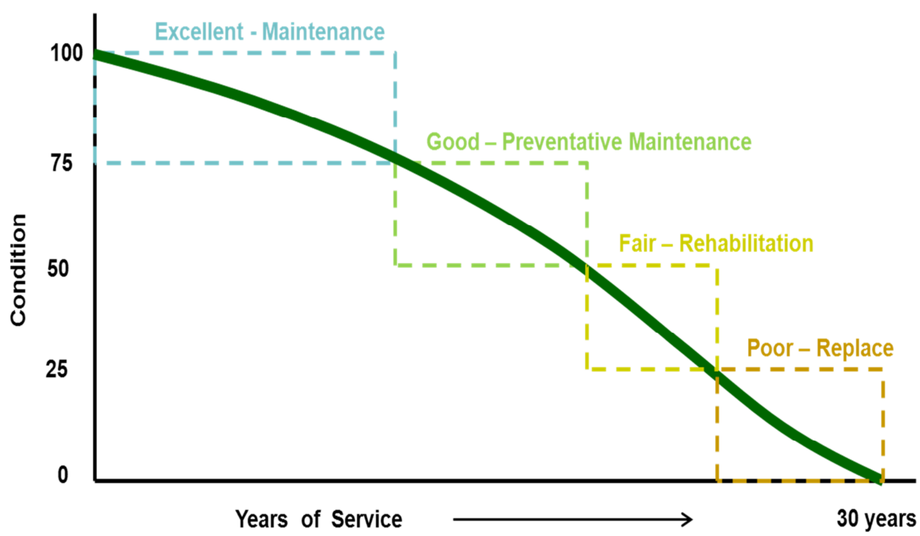
6.4 AM Strategy – Life Cycle Analysis Framework

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

6.4.1 Paved Roads

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

The following diagram depicts a general deterioration profile of a road with a 30 year life.



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

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

Asset Condition and Related Work Activity: **Paved Roads**		
Condition	Condition Range	Work Activity
excellent condition (Maintenance only phase)	100-76	■ maintenance only
good Condition (Preventative maintenance phase)	75 - 51	■ crack sealing ■ emulsions
fair Condition (Rehabilitation phase)	50 -26	■ resurface - mill & pave ■ resurface - asphalt overlay ■ single & double surface treatment (for rural roads)
poor Condition (Reconstruction phase)	25 - 1	■ reconstruct - pulverize and pave ■ reconstruct - full surface and base reconstruction
critical Condition (Reconstruction phase)	0	■ critical includes assets beyond their useful lives which make up the backlog. They require the same interventions as the "poor" category above.

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

The table below outlines the costs for various road activities, the added life obtained for each, the condition range at which they should be applied, and the cost of 1 year added life for each (cost of activity / added life) in order to present an apples to apples comparison.

Road Lifecycle Activity Options				
Treatment	Average Unit Cost (per sq. m)	Added Life (Years)	Condition Range	Cost Of Activity/Added Life
Urban Reconstruction	$205	30	25 - 0	$6.83
Urban Resurfacing	$84	15	50 - 26	$5.60
Rural Reconstruction	$135	30	25 - 0	$4.50
Rural Resurfacing	$40	15	50 - 26	$2.67
Double Surface Treatment	$25	10	50 - 26	$2.50
Routing & Crack Sealing (P.M)	$2	3	75 - 51	$0.67

As can be seen in the table above, preventative maintenance activities such as routing and crack sealing have the lowest associated cost (per sq. m) in order to obtain one year of added life. Of course, preventative maintenance activities can only be applied to a road at a relatively early point in the life cycle. It is recommended that the municipality engage in an active preventative maintenance program for all paved roads and that a portion of the maintenance budget is allocated to this.

Also, rehabilitation activities, such as urban and rural resurfacing or double surface treatments (tar and chip) for rural roads have a lower cost to obtain each year of added life than full reconstruction activities. It is recommended, if not in place already, that the municipality engages in an active rehabilitation program for urban and rural paved roads and that a portion of the capital budget is dedicated to this.

Of course, in order to implement the above programs it will be important to also establish a general condition score for each road segment, established through standard condition assessment protocols as previously described.

It is important to note that a "worst first" budget approach, whereby no life cycle activities other than reconstruction at the end of a roads life are applied, will result in the most costly method of managing a road network overall.

6.4.2 Gravel Roads

The life cycle activities required for these roads are quite different from paved roads. Gravel roads require a cycle of perpetual maintenance, including general re-grading, reshaping of the crown and cross section, gravel spot and section replacement, dust abatement and ditch clearing and cleaning.

Gravel roads can require frequent maintenance, especially after wet periods and when accommodating increased traffic. Wheel motion shoves material to the outside (as well as in-between travelled lanes), leading to rutting, reduced water-runoff, and eventual road destruction if unchecked. This deterioration process is prevented if interrupted early enough, simple re-grading is sufficient, with material being pushed back into the proper profile.

As a high proportion of gravel roads can have a significant impact on the maintenance budget, it is recommended that with further updates of this asset management plan the municipality study the traffic volumes and maintenance requirements in more detail for its gravel road network.

Similar studies elsewhere have found converting certain roadways to paved roads can be very cost beneficial especially if frequent maintenance is required due to higher traffic volumes. Roads within the gravel network should be ranked and rated using the following criteria:

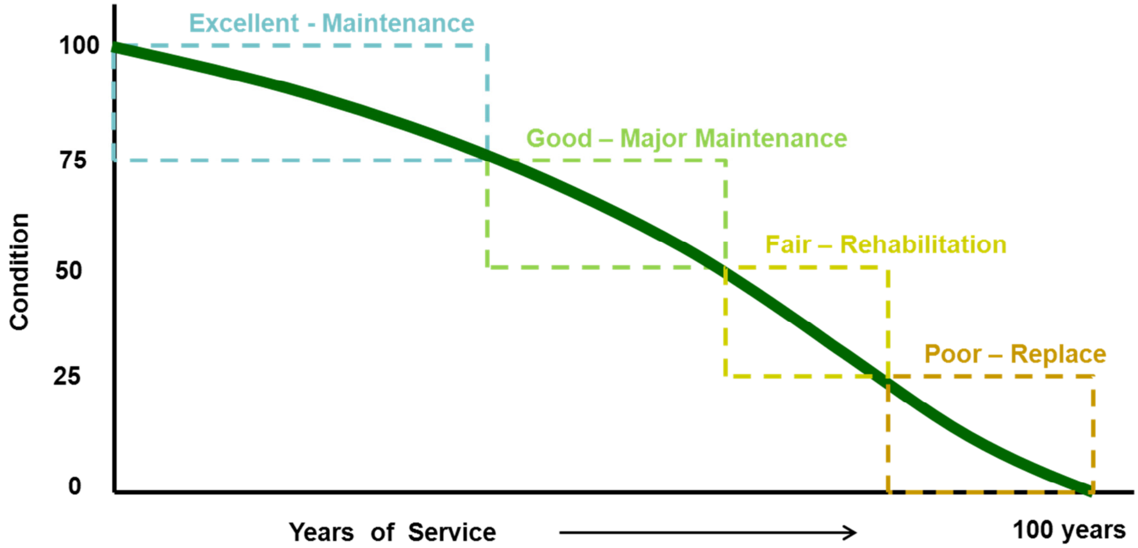
- Usage - traffic volumes and type of traffic
- Functional importance of the roadway
- Known safety issues
- Frequency of maintenance and overall expenditures required

Through the above type of analysis, a program could be introduced to convert certain gravel roadways into paved roads, reducing overall costs, and be brought forward into the long range budget.

6.4.3 Sanitary and Storm Sewers

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

The following diagram depicts a general deterioration profile of a sewer main with a 100 year life.



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

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

Asset Condition and Related Work Activity: Sewer Main

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

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

The table below outlines the costs, by pipe diameter, for various sewer main rehabilitation (lining) and replacement activities. The columns display the added life obtained for each activity, the condition range at which they should be applied, and the cost of 1 year added life for each (cost of activity / added life) in order to present an apples to apples comparison.

Sewer Main Lifecycle Activity Options

Category	Cost (per m)	Added Life	Condition Range	1 year Added Life Cost (Cost / Added Life)
Structural Rehab (m)				
0 - 325mm	$174.69	75	50 - 75	$2.33
325 - 625mm	$283.92	75	50 - 75	$3.79
625 - 925mm	$1,857.11	75	50 - 75	$24.76
> 925mm	$1,771.34	75	50 - 75	$23.62
Replacement (m)				
	$475.00	100	76 - 100	$4.75
325 - 625mm	$725.00	100	76 - 100	$7.25
625 - 925mm	$900.00	100	76 - 100	$9.00
> 925mm	$1,475.00	100	76 - 100	$14.75

As can be seen in the above table, structural rehabilitation or lining of sewer mains is an extremely cost effective industry activity and solution for pipes with a diameter less than 625mm. The unit cost of lining is approximately one third of replacement and the cost to obtain one year of added life is half the cost. For Brockton, this diameter range would account for over 95% of sanitary sewer mains and approximately 48% of storm mains. Structural lining has been proven through industry testing to have a design life (useful life) of 75 years, however, it is believed that liners will probably obtain 100 years of life (the same as a new pipe).

For sewer mains with diameters greater than 625mm specialized liners are required and therefore the costs are no longer effective. It should be noted, however, that the industry is continually expanding its technology in this area and therefore future costs should be further reviewed for change and possible price reductions.

It is recommended, if not in place already, that the municipality engage in an active structural lining program for sanitary and storm sewer mains and that a portion of the capital budget be dedicated to this.

In order to implement the above, it will be important to also establish a condition assessment program to establish a condition score for each sewer main within the sanitary and storm collection networks, and therefore identify which pipes are good candidates for structural lining.

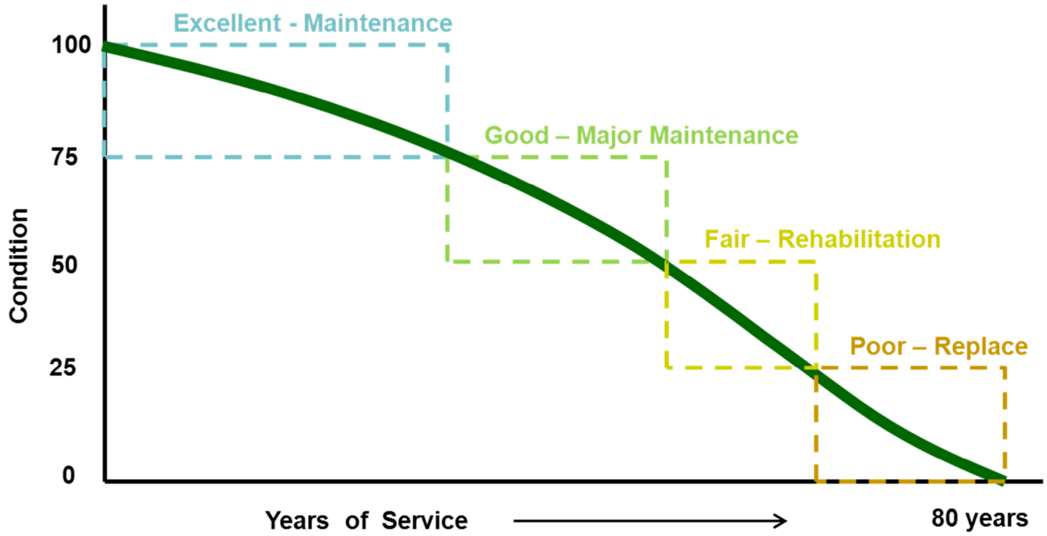
6.4.4 Bridges & Culverts (greater than 3m span)

The best approach to develop a 10 year needs list for the municipality's bridge structure portfolio would be to have the structural engineer who performs the inspections to develop a maintenance requirements report, a rehabilitation and replacement requirements report and identify additional detailed inspections as required. This approach is described in more detail within the "Bridges & Culverts (greater than 3m) Inspections" section above.

6.4.5 Water Network

As with roads and sewers above, the following analysis has been conducted at a fairly high level, using industry standard activities and costs for water main rehabilitation and replacement.

The following diagram depicts a general deterioration profile of a water main with an 80 year life.



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

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

Asset Condition and Related Work Activity: Water Main

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

Water main Lifecycle Activity Option				
Category	Cost	Added Life	Condition Range	Cost of Activity / Added Life
Structural Rehab (m)				
0.000 - 0.150m	$209.70	50	50 - 75	$4.19
0.150 - 0.300m	$315.00	50	50 - 75	$6.30
0.300 - 0.400m	$630.00	50	50 - 75	$12.60
0.400 - 0.700m	$1,500.00	50	50 - 75	$30.00
0.700 m - & +	$2,000.00	50	50 - 75	$40.00
Replacement (m)				
0.000 - 0.150m	$233.00	80	76 - 100	$2.91
0.150 - 0.300m	$350.00	80	76 - 100	$4.38
0.300 - 0.400m	$700.00	80	76 - 100	$8.75
0.400 - 0.700m	$1,500.00	80	76 - 100	$18.75
0.700 m - & +	$2,000.00	80	76 - 100	$25.00

Water rehab technologies still require some digging (known as low dig technologies, due to lack of access) and are actually more expensive on a life cycle basis. However, if the road above the water main is in good condition lining avoids the cost of road reconstruction still resulting in a cost effective solution.

It should be noted, that the industry is continually expanding its technology in this area and therefore future costs should be further reviewed for change and possible price reductions.

At this time, it is recommended that the municipality only utilize water main structural lining when the road above requires rehab or no work.

6.5 Growth and Demand

Typically a municipality will have specific plans associated with population growth. It is essential that the asset management strategy should address not only the existing infrastructure, as above, but must include the impact of projected growth on defined project schedules and funding requirements. Projects would include the funding of the construction of new infrastructure, and/or the expansion of existing infrastructure to meet new demands. The municipality should enter these projects into the CityWide software in order to be included within the short and long term budgets as required.

6.6 Project Prioritization

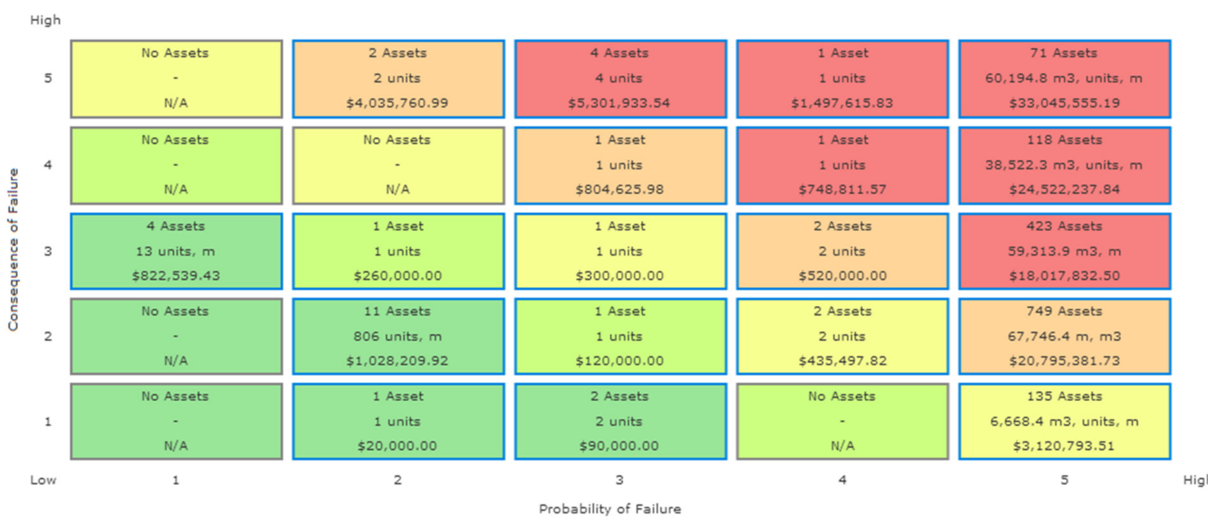
The above techniques and processes when established for the road, water, sewer networks and bridges will supply a significant listing of potential projects. Typically the infrastructure needs will exceed available resources and therefore project prioritization parameters must be developed to ensure the right projects come forward into the short and long range budgets. An important method of project prioritization is to rank each project, or each piece of infrastructure, on the basis of how much risk it represents to the organization.

6.6.1 Risk Matrix and Scoring Methodology

Risk within the infrastructure industry is often defined as the probability (likelihood) of failure multiplied by the consequence of that failure.

RISK = LIKELIHOOD OF FAILURE **x** CONSEQUENCE OF FAILURE

The likelihood of failure relates to the current condition state of each asset, whether they are in excellent, good, fair, poor or critical condition, as this is a good indicator regarding their future risk of failure. The consequence of failure relates to the magnitude, or overall effect, that an asset's failure will cause. For instance, a small diameter water main break in a sub division may cause a few customers to have no water service for a few hours, whereby a large trunk water main break outside a hospital could have disastrous effects and would be a front page news item. The following table represents the scoring matrix for risk:



All of the municipality's assets analyzed within this asset management plan have been given both a likelihood of failure score and a consequence of failure score within the CityWide software.

The following risk scores have been developed at a high level for each asset class within the CityWide software system. It is recommended that the municipality undertake a detailed study to develop a more tailored suite of risk scores, particularly in regards to the consequence of failure, and that this be updated within the CityWide software with future updates to this Asset Management Plan.

The current scores that will determine budget prioritization currently within the system are as follows:

All assets:
The Likelihood of Failure score is based on the condition of the assets:

Likelihood of Failure: **All Assets**	
Asset condition	Likelihood of failure
Excellent condition	score of 1
Good condition	score of 2
Fair condition	score of 3
Poor condition	score of 4
Critical condition	score of 5

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

Consequence of Failure: **Bridges**	
Replacement Value	Consequence of failure
Up to $100k	Score of 1
$101 to $250k	Score of 2
$251 to $500k	Score of 3
$501 to $850k	Score of 4
$851k and over	Score of 5

Roads (based on classification):
The consequence of failure score for this initial AMP is based upon the road classification as this will reflect traffic volumes and number of people affected.

Consequence of Failure: **Roads**	
Road Classification	Consequence of failure
Gravel	score of 1
Rural Surface Treated	score of 3
Rural Hot Mix	score of 4
Urban Hot Mix	score of 5

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

Consequence of Failure: **Sanitary Sewer**	
Pipe Diameter	Consequence of failure
Less than 150mm	Score of 1
151-250mm	Score of 2
251-350mm	Score of 3
351-600mm	Score of 4
601mm and over	Score of 5

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

Consequence of Failure: **Water**	
Pipe Diameter	Consequence of Failure
Less than 100mm	Score of 1
101 – 150mm	Score of 2
151 – 200mm	Score of 3
201 – 250mm	Score of 4
251 and over	Score of 5

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

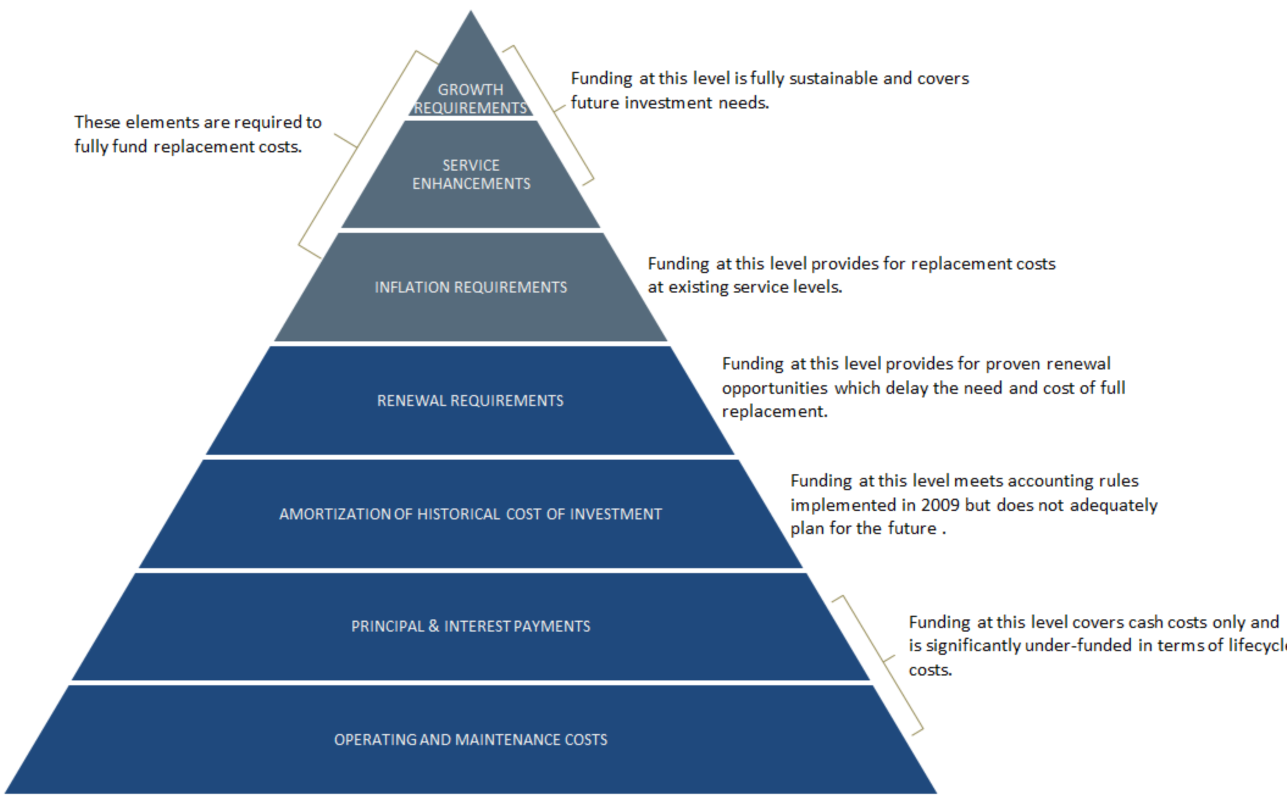
Consequence of Failure: **Storm Sewer**	
Replacement Value	Consequence of failure
Less than 200mm	Score of 1
201 – 350mm	Score of 2
351 – 500mm	score of 3
501 – 700mm	score of 4
701mm and over	score of 5

7.0 Financial Strategy

7.1 General overview of financial plan requirements

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

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



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

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

b) use of traditional sources of municipal funds:
- tax levies
- user fees
- reserves
- debt (no additional debt required for this AMP)
- development charges (not applicable)

c) use of non-traditional sources of municipal funds:
- reallocated budgets (not required for this AMP)
- partnerships (not applicable)
- procurement methods (no changes recommended)

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

If the financial plan component of an AMP results in a funding shortfall, the Province requires the inclusion of a specific plan as to how the impact of the shortfall will be managed. In determining the legitimacy of a funding shortfall, the Province may evaluate a municipality's approach to the following:

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

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

7.2 Financial information relating to Brockton's AMP

7.2.1 Funding objective

We have developed scenarios that would enable Brockton to achieve full funding within 5 years or 10 years for the following assets:

a) **Tax funded assets** – Road network (paved roads); Bridges & Culverts; Storm Sewer Network
b) **Rate funded assets** – Water Network; Sanitary Sewer Network

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

For each scenario developed we have included strategies, where applicable, regarding the use of tax revenues, user fees and reserves.

7.3 Tax funded assets

7.3.1 Current funding position

Tables 1 and 2 outline, by asset category, Brockton's average annual asset investment requirements, current funding positions and funding changes required to achieve full funding on assets funded by taxes.

Table 1. Summary of Infrastructure Requirements & Current Funding Available

Asset Category	Average Annual Investment Required	2013 Annual Funding Available				Annual Deficit/Surplus
		Taxes	Gas Tax	Taxes to Reserves	Total Funding Available	
Road Network	2,100,000	688,000	297,000	170,000	1,155,000	945,000
Bridges & Culverts	306,000	0	0	0	0	306,000
Storm Sewer Network	198,000	0	0	0	0	198,000
Total	**2,604,000**	**688,000**	**297,000**	**170,000**	**1,155,000**	**1,449,000**

7.3.2 Recommendations for full funding

The average annual investment requirement for paved roads, bridges & culverts, and storm sewers is $2,604,000. Annual revenue currently allocated to these assets for capital purposes is $1,155,000 leaving an annual deficit of $1,449,000. To put it another way, these infrastructure categories are currently funded at 44% of their long-term requirements.

In 2013, Brockton has annual tax revenues of $6,407,000. As illustrated in table 2, without consideration of any other sources of revenue, full funding would require the following tax increase over time:

Table 2. Tax Increases Required for Full Funding

Asset Category	Tax Increase Required for Full Funding
Road Network	14.7%
Bridges & Culverts	4.8%
Storm Sewer Network	3.1%
Total	**22.6%**

As illustrated in table 9, Brockton's debt payments for these asset categories will be decreasing by $66,000 from 2013 to 2017 (5 years). Although not illustrated, debt payments will decrease by $145,000 from 2013 to 2022 (10 years). Our recommendations include capturing those decreases in cost and allocating them to the infrastructure deficit outlined above.

Table 3 outlines these concepts and presents a number of options:

Table 3. Effect of Reallocating Decreases in Debt Costs

	Without Reallocation of Debt Costs		With Reallocation of Debt Costs	
	5 Years	10 Years	5 Years	10 Years
Infrastructure Deficit as Outlined in Table 1	1,449,000	1,449,000	1,449,000	1,449,000
Change in Debt Costs	0	0	-66,000	-145,000
Resulting Infrastructure Deficit	**1,449,000**	**1,449,000**	**1,383,000**	**1,304,000**
Resulting Tax Increase Required:				
Total Over Time	**22.6%**	**22.6%**	**21.6%**	**20.4%**
Annually	4.5%	2.3%	4.3%	2.0%

Considering the above information, we recommend the 10 year option in table 3 that includes the reallocation. This involves full funding being achieved over 10 years by:

a) when realized, reallocating the debt cost reductions of $145,000 to the infrastructure deficit as outlined above.
b) increasing tax revenues by 2.0% each year for the next 10 years solely for the purpose of phasing in full funding to the asset categories covered in this section of the AMP.
c) allocating the $297,000 of gas tax revenue to the paved roads category.
d) increasing existing and future infrastructure budgets by the applicable inflation index on an annual basis in addition to the deficit phase-in.

Notes:

1. As in the past, periodic senior government infrastructure funding will most likely be available during the phase-in period. By Provincial AMP rules, this funding cannot be incorporated into the AMP unless there are firm commitments in place.

2. We realize that raising tax revenues by the amounts recommended above for infrastructure purposes will be very difficult to do. However, considering a longer phase-in window may have even greater consequences in terms of infrastructure failure.

Although this option achieves full funding on an annual basis in 10 years and provides financial sustainability over the period modeled (to 2050), the recommendations do require prioritizing capital projects to fit the resulting annual funding available. As of 2013, age based data shows a pent up investment demand of $14,915,000 for paved roads, $88,000 for bridges & culverts, and $0 for storm sewers. Prioritizing future projects will require the age based 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.

7.4 Rate funded assets

7.4.1 Current funding position

Tables 4 and 5 outline, by asset category, Brockton's average annual asset investment requirements, current funding positions and funding increases required to achieve full funding on assets funded by rates.

Table 4. Summary of Infrastructure Requirements & Current Funding Available

Asset Category	Average Annual Investment Required	2013 Annual Funding Available				Annual Deficit/Surplus
		Rates	Less: Allocated to Operations	Other	Total Funding Available	
Sanitary Sewer Network	380,000	965,000	-705,000	0	260,000	120,000
Water Network	142,000	917,000	-771,000	0	146,000	-4,000
Total	**522,000**	**1,882,000**	**-1,476,000**	**0**	**406,000**	**116,000**

7.4.2 Recommendations for full funding

The average annual investment requirement for sanitary services and water services is $522,000. Annual revenue currently allocated to these assets for capital purposes is $406,000 leaving an annual deficit of $116,000. To put it another way, these infrastructure categories are currently funded at 78% of their long-term requirements.

In 2013, Brockton has annual sanitary revenues of $965,000 and annual water revenues of $917,000. As illustrated in table 5, without consideration of any other sources of revenue, full funding would require the following changes over time:

Table 5. Rate Changes Required for Full Funding

Asset Category	Rate Changes Required for Full Funding
Sanitary Sewer Network	12.4%
Water Network	-0.4%

As illustrated in table 9, Brockton's debt payments for sanitary services will be decreasing by $59,000 from 2013 to 2017 (5 years). Although not illustrated, debt payments for sanitary services will be decreasing by $59,000 from 2013 to 2022 (10 years). For water services, the amounts are $88,000 and $134,000 respectively. Our recommendations include capturing those decreases in cost and allocating them to the applicable infrastructure deficit.

Tables 6a and 6b outline these concepts and present a number of options:

Table 6a. Without Change in Debt Costs				
	Sanitary Sewer Network		Water Network	
	5 Years	10 Years	5 Years	10 Years
Infrastructure Deficit/(Surplus) as Outlined in Table 4	120,000	120,000	-4,000	-4,000
Change in Debt Costs	0	0	N/A due to surplus	N/A due to surplus
Resulting Infrastructure Deficit/(Surplus)	**120,000**	**120,000**	**-4,000**	**-4,000**
Resulting Rate Increase Required:				
Total Over Time	**12.4%**	**12.4%**	**-0.4%**	**-0.4%**
Annually	2.5%	1.2%	N/A	N/A

Table 6b. With Change in Debt Costs				
	Sanitary Sewer Network		Water Network	
	5 Years	10 Years	5 Years	10 Years
Infrastructure Deficit/(Surplus) as Outlined in Table 4	120,000	120,000	-4,000	-4,000
Change in Debt Costs	-59,000	-59,000	N/A Due to Surplus	n/A Due to Surplus
Resulting Infrastructure Deficit/(Surplus)	**61,000**	**61,000**	**-4,000**	**-4,000**
Resulting Rate Increase Required:				
Total Over Time	**6.3%**	**6.3%**	**-0.4%**	**-0.4%**
Annually	1.3%	0.6%	N/A	N/A

At least two factors need to be quantified before implementing the above reduction for water services:

a) Age based data shows no pent up investment demand for water services. Prioritizing future projects will require the age based data to be replaced by condition based data. The results of the condition based analysis may identify different pent up investment requirements.

   As a result, rates should not be decreased until a detailed work plan is developed for these projects based on their actual condition. A corresponding financial plan can then be developed taking into account that there are $1,102,000 of reserves available for water infrastructure (as noted in table 10).

b) 84% of water revenues are currently allocated to operations as opposed to capital. Overall rates should not be decreased until longer term operational requirements are determined and taken into account. This will avoid the complications of lowering rates for capital purposes and then possibly increasing them for operational requirements.

We recommend that the required work for a) and b) above be completed in order to determine what rate reductions can be achieved for water services and over what period those reductions can be implemented.

Other information:
In November 2011, Brockton commissioned a study to determine a long-term financial plan for water and sanitary services. Based on the information available at that time, that study recommended annual rate

increases of 6% for the years 2013 to 2017 for both water and sanitary services in order to achieve full funding.

As outlined above, the resulting financial requirements of this AMP are significantly less than the 2011 study. This is due to at least two issues: this AMP is based on detailed asset inventories now available; this AMP incorporates future debt reductions into available funding.

As a result, Brockton has a couple of options to consider. Option 1 is to continue implementing the 2011 rate strategy and place any resulting surplus funds into applicable reserves. Option 2 is to revise the strategy to incorporate the updated information provided in this AMP.

Considering all of the above information, we recommend option 2 by implementing the 5 year option in table 6 that includes the reallocations. This involves full funding being achieved over 5 years by:

a) the required work for a) and b) above be completed for water services in order to determine what rate reductions can be achieved and over what period those reductions can be implemented.
b) when realized, reallocating the debt cost reductions of $59,000 for sanitary services to the applicable infrastructure deficit.
c) increasing rate revenues by 1.3% for sanitary services and 0% for water services each year for the next 5 years solely for the purpose of phasing in full funding to the asset categories covered in this section of the AMP.
d) increasing existing and future infrastructure budgets by the applicable inflation index on an annual basis in addition to the deficit phase-in.

Notes:

1. As in the past, periodic senior government infrastructure funding will most likely be available during the phase-in period. By Provincial AMP rules, this funding cannot be incorporated into an AMP unless there are firm commitments in place.
2. We realize that raising rate revenues by the amounts recommended above for infrastructure purposes will be very difficult to do. However, considering a longer phase-in window may have even greater consequences in terms of infrastructure failure.
3. Any increase in rates required for operations would be in addition to the above recommendations.

Although this option achieves full funding on an annual basis in 5 years and provides financial sustainability over the period modeled (to 2050), the recommendations do require prioritizing capital projects to fit the resulting annual funding available. As of 2013, age based data shows a pent up investment demand of $0 for sanitary services and $0 for water services. Prioritizing future projects will require the age based 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.

7.5 Use of debt

For reference purposes, table 7 outlines the premium paid on a project if financed by debt. For example, a $1M project financed at 3.0%[1] 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.

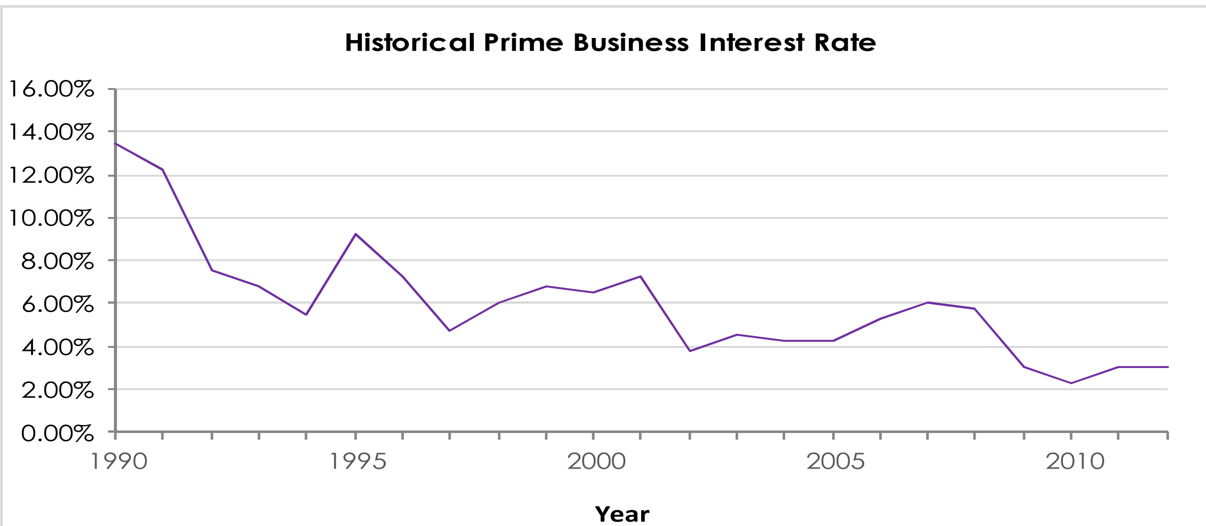
Table 7. Total Interest Paid as a % of Project Costs

Interest Rate	Number of Years Financed					
	5	10	15	20	25	30
7.0%	22%	42%	65%	89%	115%	142%
6.5%	20%	39%	60%	82%	105%	130%
6.0%	19%	36%	54%	74%	96%	118%

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

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%

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:



As illustrated in table 7, 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.

Tables 8 and 9 outline how Brockton has historically used debt for investing in the asset categories as listed. There is currently $1,725,000 of debt outstanding for the assets covered by this AMP. In terms of overall debt capacity, Brockton currently has $1,725,000 of total outstanding debt and $391,000 of total annual principal and interest payment commitments. These principal and interest payments are well within its provincially prescribed annual maximum of $2,618,000.

Table 8. Overview of Use of Debt

Asset Category	Current Debt Outstanding	Use Of Debt in the Last Five Years				
		2009	2010	2011	2012	2013
Road Network	1,200,000	0	0	1,526,000	0	0
Bridges & Culverts	0	0	0	0	0	0

Storm Sewers	0	0	0	0	0	0
Total Tax Funded	1,200,000	0	0	1,526,000	0	0
Sanitary Sewer Network	121,000	0	0	246,000	0	0
Water Network	404,000	0	0	649,000	0	0
Total rate Funded	525,000	0	0	895,000	0	0
Total AMP Debt	1,725,000	0	0	2,421,000	0	0
Non AMP Debt	0	0	0	0	0	0
Overall Total	**1,725,000**	**0**	**0**	**2,421,000**	**0**	**0**

Table 9. Overview of Debt Costs

Asset Category	Principal & Interest Payments in the Next Five Years				
	2013	2014	2015	2016	2017
Road Network	194,000	190,000	185,000	131,000	128,000
Bridges & Culverts	0	0	0	0	0
Storm Sewer Network	0	0	0	0	0
Total Tax Funded	194,000	190,000	185,000	131,000	128,000
Sanitary Sewer Network	63,000	30,000	5,000	4,000	4,000
Water Network	134,000	125,000	65,000	63,000	46,000
Total Rate Funded	197,000	155,000	70,000	67,000	50,000
Total Amp Debt	391,000	345,000	255,000	198,000	178,000
Non Amp Debt	0	0	0	0	0
Overall Total	**391,000**	**345,000**	**255,000**	**198,000**	**178,000**

The revenue options outlined in this plan allow Brockton to fully fund its long-term infrastructure requirements without further use of debt. However, as explained in sections 7.3.2 and 7.4.2, the recommended condition rating analysis may require otherwise.

7.6 Use of reserves

7.6.1 Available reserves

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

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

By infrastructure category, table 10 outlines the details of the reserves currently available to Brockton.

Table 10. Summary of Reserves Available

Asset Category	Balance at December 31, 2012
Road Network	203,000
Bridges	0
Storm Sewers	0
Total Tax Funded	**203,000**
Water Network	1,102,000
Sanitary Sewer Network	549,000
Total Rate Funded	**1,651,000**

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

7.6.2 Recommendation

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

8.0 Appendix A: Report Card Calculations

Key Calculations

1. "Weighted, unadjusted star rating":

(% of assets in given condition) x (potential star rating)

2. "Adjusted star rating"

(weighted, unadjsted star rating) x (% of total replacement value)

3. "Overall Rating"

$$\frac{\textbf{(Condition vs. Performance star rating) + (Funding vs. Need star rating)}}{\textbf{2}}$$

Grade Cutoffs	
1. Conditions vs Performance	
Letter Grade	Star Rating
F	0
D	2
D+	2.5
C	2.9
C+	3.5
B	3.9
B+	4.5
A	4.9
A	5

2. Funding vs Need		
Funding %	Star rating	Grade
0.0%	0	F
25.0%	1	F
46.0%	1.9	D
61.0%	2.9	C
76.0%	3.9	B
91.0%	4.9	A
100.0%	5	A

Roads Brockton

1. Condition vs. Performance

Total category replacement value	$63,653,737	Segment replacement value	$63,653,737	Segment value as a % of total category replacement value	100.0%

Segment	Condition	Letter grade	Star rating	Quantity (km) in given condition	% of Assets in given condition	Weighted, unadjusted star rating	Segment adjusted star rating
Roads (excludes gravel)	Excellent	A	5	14,882	13%	0.66	2.8
	Good	B	4	24,844	22%	0.88	
	Fair	C	3	32,809	29%	0.87	
	Poor	D	2	2,203	2%	0.04	
	Critical	F	1	37,889	34%	0.34	
			Totals	**112,627**	**100%**	**2.79**	

Category star rating	Category letter grade
2.8	**D+**

2. Funding vs. Need

Average annual investment required	2013 funding available	Funding percentage	Deficit
$2,100,000	$1,155,000	55.0%	$945,000

Category star rating	Category letter grade
1.9	**D**

3. Overall Rating

Condition vs Performance star rating	Funding vs. Need star rating	Average star rating	Overall letter grade
2.8	1.9	**2.3**	**D**

Bridges & Culverts Brockton

1. Condition vs. Performance

Total category replacement value	$22,943,981	Segment replacement value	$22,943,981	Segment value as a % of total category replacement value	100.0%

Segment	Condition	Letter grade	Star rating	Units in given condition	% of Assets in given condition	Weighted, unadjusted star rating	Segment adjusted star rating
Bridges & Culverts	Excellent	A	5	3	9%	0.44	2.8
	Good	B	4	8	24%	0.94	
	Fair	C	3	9	26%	0.79	
	Poor	D	2	6	18%	0.35	
	Critical	F	1	8	24%	0.24	
			Totals	**34**	**100%**	**2.76**	

Category star rating	Category letter grade
2.8	D+

2. Funding vs. Need

Average annual investment required	2013 funding available	Funding percentage	Deficit
$306,000	$0	0.0%	$306,000

Category star rating	Category letter grade
0.0	F

3. Overall Rating

Condition vs Performance star rating	Funding vs. Need star rating	Average star rating	Overall letter grade
2.8	0.0	1.4	F

Storm Brockton

1. Condition vs. Performance

Total category replacement value	**$15,866,131**	Segment replacement value	**$15,866,131**	Segment value as a % of total category replacement value	**100.0%**

Segment	Condition	Letter grade	Star rating	Quantity (m) in given condition	% of Assets in given condition	Weighted, unadjusted star rating	Segment adjusted star rating
Mains	Excellent	A	5	12,875	28%	1.39	**4.3**
	Good	B	4	33,394	72%	2.89	
	Fair	C	3	0	0%	0.00	
	Poor	D	2	0	0%	0.00	
	Critical	F	1	0	0%	0.00	
			Totals	**46,269**	**100%**	**4.28**	

Category star rating	Category letter grade
4.3	**B**

2. Funding vs. Need

Average annual investment required	2013 funding available	Funding percentage	Deficit
$198,000	$0	0.0%	$198,000

Category star rating	Category letter grade
0.0	**F**

3. Overall Rating

Condition vs Performance star rating	Funding vs. Need star rating	Average star rating	Overall letter grade
4.3	0.0	**2.1**	**D**

Water Brockton

1. Condition vs. Performance

Total category replacement value	$9,340,360	Segment replacement value	$8,192,145	Segment value as a % of total category replacement value	87.7%		
Segment	**Condition**	**Letter grade**	**Star rating**	**Quantity (m) in given condition**	**% of Assets in given condition**	**Weighted, unadjusted star rating**	**Segment adjusted star rating**
Mains	Excellent	A	5	15,949	37%	1.84	3.8
	Good	B	4	27,311	63%	2.53	
	Fair	C	3	0	0%	0.00	
	Poor	D	2	0	0%	0.00	
	Critical	F	1	0	0%	0.00	
			Totals	**43,260**	**100%**	**4.37**	

Total category replacement value	$9,340,360	Segment replacement value	$1,148,215	Segment value as a % of total category replacement value	12.3%		
Segment	**Condition**	**Letter grade**	**Star rating**	**Quantity ($) in given condition**	**% of Assets in given condition**	**Weighted, unadjusted star rating**	**Segment adjusted star rating**
Facilities	Excellent	A	5	$672,109	59%	2.93	0.4
	Good	B	4	$0	0%	0.00	
	Fair	C	3	$0	0%	0.00	
	Poor	D	2	$310,204	27%	0.54	
	Critical	F	1	$165,902	14%	0.14	
			Totals	**$1,148,215**	**100%**	**3.61**	

Category star rating	Category letter grade
4.3	**B**

2. Funding vs. Need

Average annual investment required	2013 funding available	Funding percentage	Deficit	Category star rating	Category letter grade
$142,000	$146,000	102.8%	-$4,000	5.0	**A**

3. Overall Rating

Condition vs Performance star rating	Funding vs. Need star rating	Average star rating	Overall letter grade
4.3	5.0	4.6	**B+**

Sanitary Brockton

1. Condition vs. Performance

Total category replacement value	$21,503,239	Segment replacement value	$6,937,081	Segment value as a % of total category replacement value	32.3%

Segment	Condition	Letter grade	Star rating	Quantity (m) in given condition	% of Assets in given condition	Weighted, unadjusted star rating	Segment adjusted star rating
Mains	Excellent	A	5	8,445	22%	1.11	1.4
	Good	B	4	29,530	78%	3.11	
	Fair	C	3	0	0%	0.00	
	Poor	D	2	0	0%	0.00	
	Critical	F	1	0	0%	0.00	
			Totals	**37,975**	**100%**	**4.22**	

Total category replacement value	$21,503,239	Segment replacement value	$14,566,158	Segment value as a % of total category replacement value	67.7%

Segment	Condition	Letter grade	Star rating	Quantities ($) given condition	% of Assets in given condition	Weighted, unadjusted star rating	Segment adjusted star rating
Facilities	Excellent	A	5	$0	0%	0.00	0.7
	Good	B	4	$0	0%	0.00	
	Fair	C	3	$0	0%	0.00	
	Poor	D	2	$0	0%	0.00	
	Critical	F	1	$14,566,158	100%	1.00	
			Totals	**$14,566,158**	**100%**	**1.00**	

Category star rating	Category letter grade
2.0	D

2. Funding vs. Need

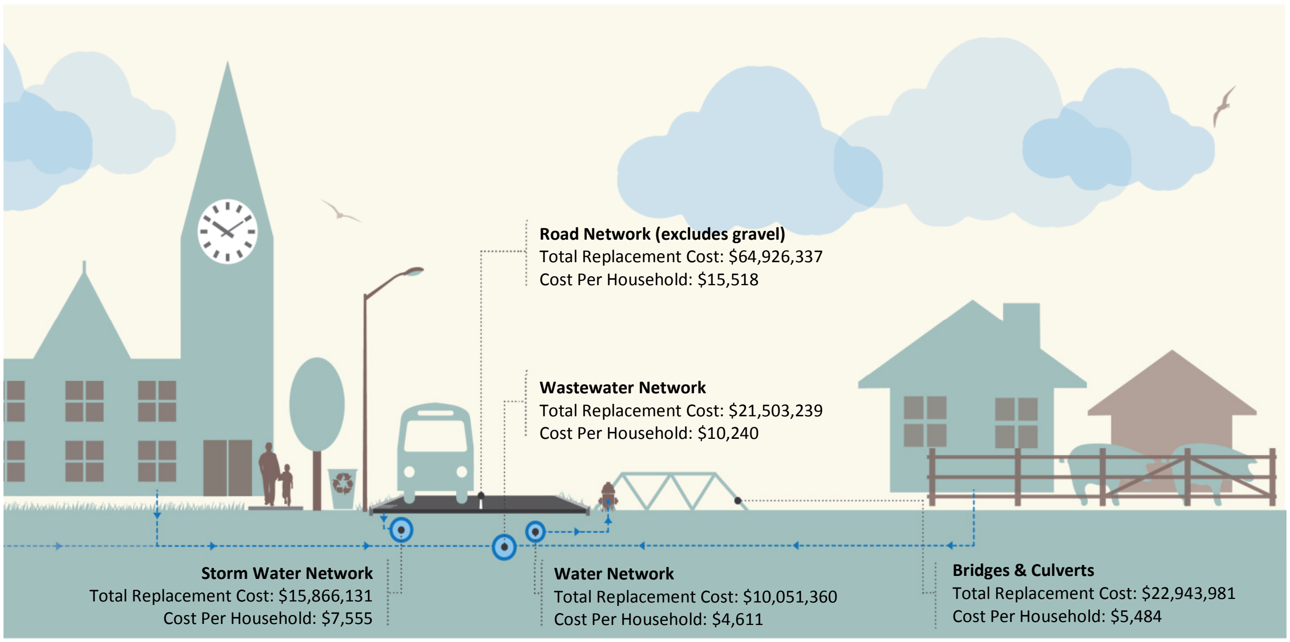
Average annual investment required	2013 funding available	Funding percentage	Deficit			Category star rating	Category letter grade
$380,000	$260,000	68.4%	$120,000			2.9	C

3. Overall Rating

Condition vs Performance star rating	Funding vs. Need star rating	Average star rating	Overall letter grade
2.0	2.9	2.4	D

Infrastructure Replacement Cost Per Household

Total: $43,408 per household (excludes gravel)



Daily Investment Required Per Household for Infrastructure Sustainability