THE ASSET MANAGEMENT PLAN FOR THE CITY OF NIAGARA FALLS

2013
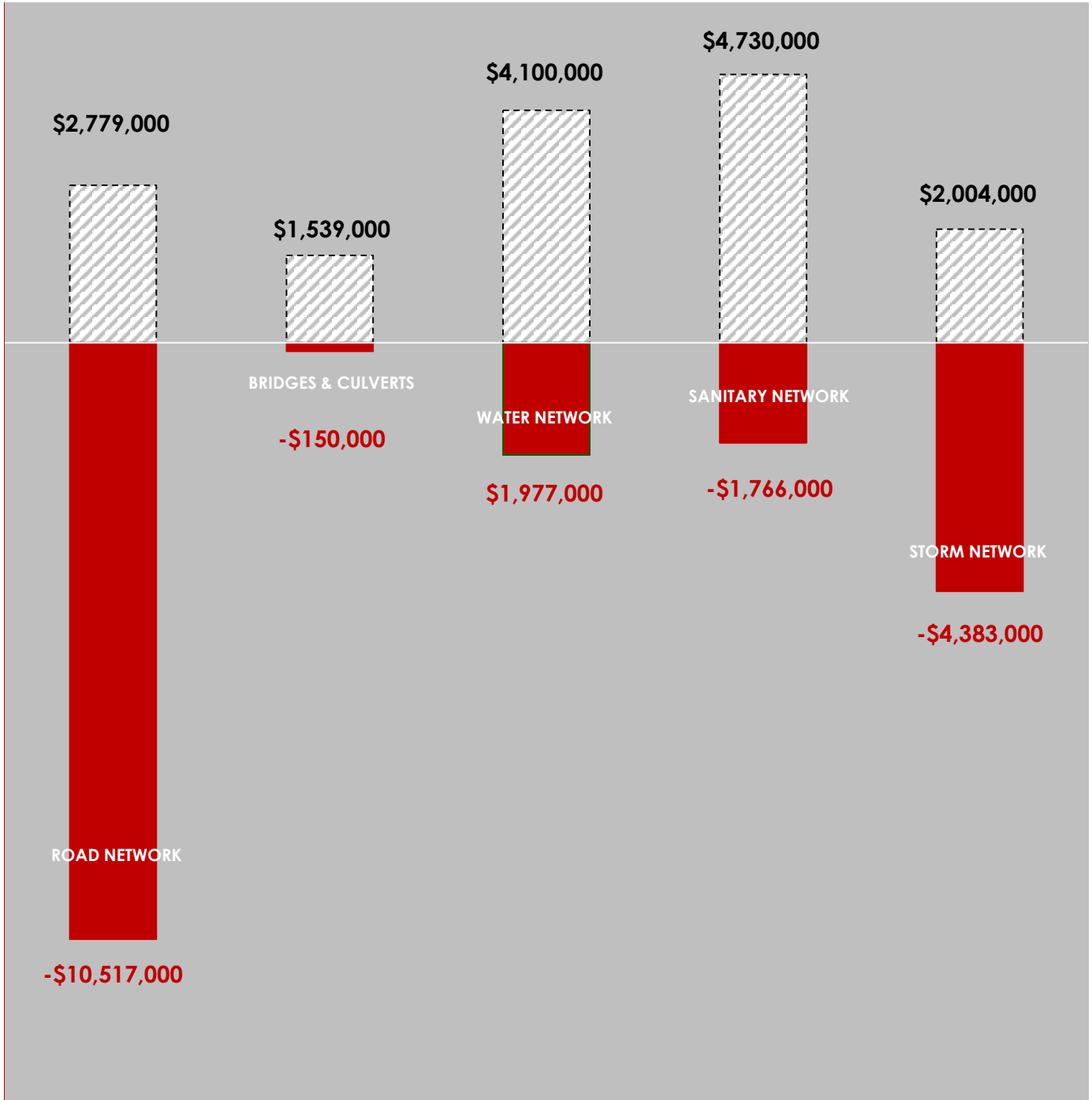
State of the Infrastructure
City of Niagara Falls

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

$2,779,000

$1,539,000

$4,100,000

$4,730,000

$2,004,000

BRIDGES & CULVERTS

-$150,000

WATER NETWORK

SANITARY NETWORK

-$1,766,000

$1,977,000

STORM NETWORK

-$4,383,000

ROAD NETWORK

-$10,517,000

Total Annual Deficit: -$18,793,000

Annual Funding Available

Annual Funding Deficit

PUBLIC SECTOR DIGEST
INTELLIGENCE FOR THE PUBLIC SECTOR.

December 2013

The City of Niagara Falls
4310 Queen Street
Niagara Falls, Ontario, L2E 6X5

We are pleased to submit the 2013 Asset Management Plan (AMP) for the City of Niagara Falls. 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.

Matthew Dawe
Vice President
mdawe@publicsectordigest.com

Israr Ahmad
Managing Editor
iahmad@publicsectordigest.com

PUBLIC SECTOR DIGEST
INTELLIGENCE FOR THE PUBLIC SECTOR.

Contacts

Matthew Dawe
Vice President
mdawe@publicsectordigest.com

Israr Ahmad
Managing Editor
iahmad@publicsectordigest.com

Christine Beneteau
Account Manager
cbeneteau@publicsectordigest.com

Lindsay Kay
Data Analyst
lkay@publicsectordigest.com

Amadea Setiabudhi
Data Analyst
asetiabudhi@publicsectordigest.com

Jona Mema
Data Analyst
jmema@publicsectordigest.com

Tyler Sutton
Senior Research Analyst
tsutton@publicsectordigest.com

James Davidson
Research Analyst
jdavidson@publicsectordigest.com

Matthew Van Dommelen
Regional Director
mvandommelen@publicsectordigest.com

Gabe Metron
Regional Director
gmetron@publicsectordigest.com

Holly Jennings
Account Manager
hjennings@publicsectordigest.com

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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 city.

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 City of Niagara Falls 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 city, 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 **$1.8 billion** for Niagara Falls.

2012 Replacement Value by Asset Class
Total: $1,821,460,205

Road Network, $431,357,964, 24%

Bridges & Culverts, $94,631,462 , 5%

Water Network, $296,807,895, 16%

Sanitary Sewer Network, $491,178,957, 27%

Storm Sewer Network, $507,483,928, 34%
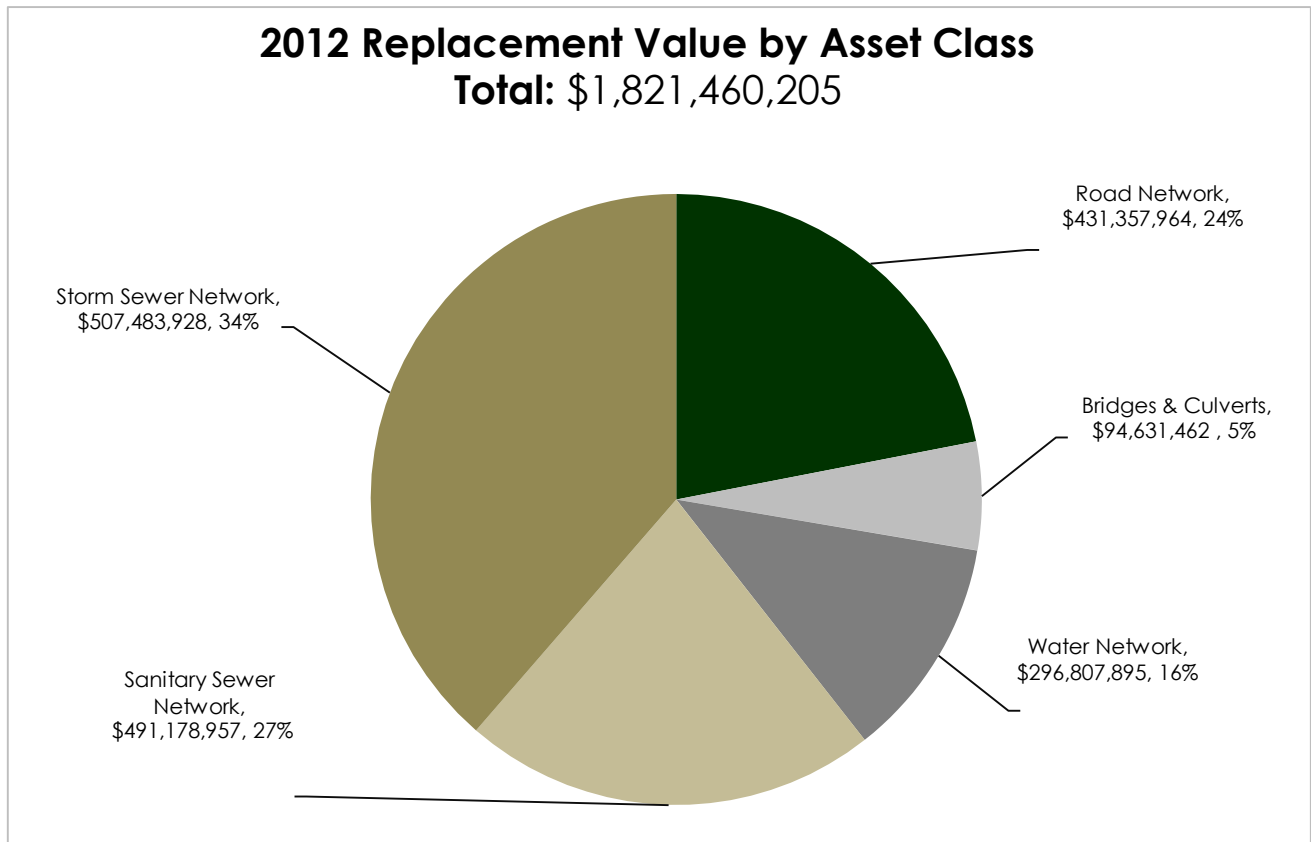
While the City is responsible for the strategic direction, it is the taxpayer in Niagara Falls who ultimately bears the financial burden. As such, a 'cost per household' (CPH) analysis was conducted for each of the asset classes to determine the financial obligation of each household in sharing the replacement cost of the City'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: $51,747 per household (excludes gravel)

Road Network (excludes sidewalk)
Total Replacement Cost: $364,194,367
Cost Per Household: $10,347

Sidewalks
Total Replacement Cost: $67,163,597
Cost Per Household: $1,908

Sanitary Sewer Network
Total Replacement Cost: $491,178,957
Cost Per Household: $13,954

Storm Sewer Network
Total Replacement Cost: $507,483,928
Cost Per Household: $14,418

Water Network
Total Replacement Cost: $296,807,895
Cost Per Household: $8,432

Bridges and Culverts
Total Replacement Cost: $94,631,462
Cost Per Household: $2,688

In assessing the City's state of the infrastructure, we examined, and graded, both the current condition (Condition vs. Performance) of the asset classes as well as the City's financial capacity to fund the asset's average annual requirement for sustainability (Funding vs. Need). We then generated the City's infrastructure report card. The City received a **cumulative GPA of 'D+'**, with an **annual infrastructure deficit of $18,793,000**.

Niagara Falls performed relatively well on the Condition vs. Performance dimension for each of the asset classes addressed. The City received a 'D+' in its roads, a 'C' in its storm classes, a C+ for its bridges & culverts, a 'D+' in its sanitary network, while receiving a 'B' in the water network class.

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 Niagara Falls to achieve full funding within 5 years or 10 years for the following: tax funded assets, including road network (paved roads and sidewalks), 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 $21,372,000. Annual revenue currently allocated to these assets for capital purposes is $ 6,322,000 leaving an annual deficit of $15,050,000. To put it another way, these infrastructure categories are currently funded at 30% of their long-term requirements.

Niagara Falls has annual tax revenues of $54,615,000 in 2013. Full funding would require an increase in tax revenue of 27.6% 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 $1,664,000 to the infrastructure deficit as outlined above.
b) increasing tax revenues by 2.5% 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 $2,521,000 of gas tax revenue as illustrated in table 1.
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 services and water services is $12,573,000. Annual revenue currently allocated to these assets for capital purposes is $8,830,000 leaving an annual **deficit** of $3,743,000. To put it another way, these infrastructure categories are currently funded at 70% of their long-term requirements.

In 2013, Niagara Falls has annual sanitary revenues of $12,403,000 and water revenues of $11,723,000. Without consideration of any other sources of revenue, full funding would require a 14.7% increase to sanitary and a 16.9% increase to water over time.

We recommend the 5 year option in table 6b that includes the reallocations for sanitary services and the 10 year option for water services. This involves full funding being achieved over 5 years and 10 years by:

a) when realized, reallocating the debt cost reductions of $231,000 for sanitary services to the applicable infrastructure deficit.
b) increasing rate revenues by 2.5% for sanitary 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.
c) Increasing rate revenues by 1.69% for water services each year for the next 10 years solely for the purpose of phasing in full funding to the asset categories covered in this section of the AMP.
d) ensuring that any surpluses experienced are allocated to the appropriate reserves.
e) increasing existing and future infrastructure budgets by the applicable inflation index on an annual basis in addition to the changes recommended above.

Although this option achieves full funding on an annual basis in 5 years for sanitary services and 10 years for water service 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 $66,724,000 for sanitary services and $23,959,000 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. The City's reserves, totaling approximately $11.6 million, are available for use by applicable asset categories during the phase-in period to full funding. This, coupled with Niagara Falls' 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.

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:** Paved roads and sidewalks
2. **Bridges & Culverts**: Bridges and large culverts with a span greater than 0.6 m
3. **Water Network:** Water mains, hydrants and valves
4. **Sanitary Sewer Network:** Sanitary sewer mains, manholes, facilities
5. **Storm Sewer Network:** Storm sewer mains, manholes and catch basins

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 city 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 city'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 city'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 some of the 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 Niagara Falls' case is its roads, bridges & culverts and watermains, for which assessed condition data is used for further analysis. 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 City 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 city 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 analyzed 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.

3.0 State of the Infrastructure (SOTI)

3.1 Objective and Scope

Objective: To identify the state of the city'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:

1. **Road Network:** Paved roads and sidewalks
2. **Bridges & Culverts**: Bridges and large culverts with a span greater than 0.6 m
3. **Water Network:** Water mains, hydrants and valves
4. **Sanitary Sewer Network:** Sanitary sewer mains, manholes, facilities
5. **Storm Sewer Network:** Storm sewer mains, manholes and catch basins

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 Niagara Falls, 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
The City has supplied condition data for the entire paved road network, all of the large bridge and culverts and the water mains. The condition data recalculates a new performance age for each individual asset and, as such, a far more accurate prediction of future replacement can be established and applied to the future investment requirements within this AMP report.

For those assets without condition data, the sidewalk, sanitary and storm assets, the deterioration review will rely on the 'straight line' amortization schedule approach provided from the accounting data. Although this approach is based on age data and useful life projections, and is not as accurate as the use of detailed condition data, it does provide a relatively reliable benchmark of future requirements.

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 it performs its function.
- **Funding vs. Need**: Based on the actual investment requirements to ensure replacement of the asset at the end of its useful life, 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

F

INFRASTRUCTURE REPORT CARD GRADE
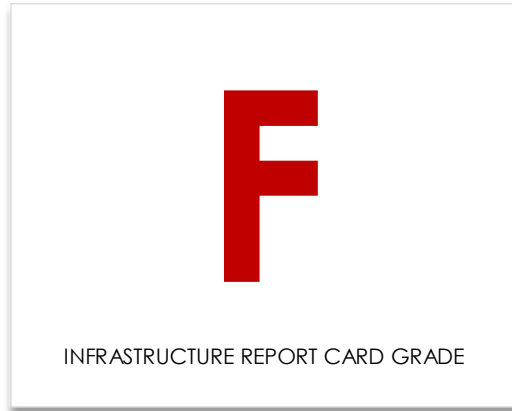
3.3 Road Network

3.3.1 What do we own?

The City of Niagara Falls Roadway Network consists of approximately 3,931,823 m2 of roads and 746,262 m2 of sidewalks.

Road Network Inventory		
Asset Type	Asset Component	Quantity/Units
Road Network	Curbs	462,157.32m
	Road Barriers	1,210.20m
	Road Base	4,047,286.95 m2
	Road Granular Sub-base	4,182,894.84 m2
	Road Top	3,931,822.66 m2
	Street Lights	9,191.00
	Traffic Signals	49.00
	Traffic Signs	15,521.00
Sidewalk	Sidewalks	746,262.19 m2

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

3.3.2 What is it worth?

The estimated replacement value of the road network (excludes gravel), in 2012 dollars, is approximately $364.1 million. The cost per household for the road network is $10,347 based on 35,199 households.

Road Network Replacement Value				
Asset Type	Asset Component	Quantity/Units	2012 Unit Replacement Cost	2012 Overall Replacement Cost
Road Network	Curbs	462,157.32 m	$105/m	$48,526,519
	Road Barriers	1,210.20 m	$180/m	$217,836.00
	Road Base	4,047,286.95 m2	$17/m2	$68,803,878.12
	Road Granular Sub-base	4,182,894.84 m2	$32.50/m2	$135,944,082.32
	Road Top	3,931,822.66 m2	$20/m2	$78,636,473.20
	Street Lights	9,191.00	$1750 ea.	$16,084,250.00
	Traffic Signals	49.00	NRBCPI	$8,522,128.12
	Traffic Signs	15,521.00	NRBCPI	$7,459,200
				$364,194,367

The estimated replacement value of the sidewalk network, in 2012 dollars, is approximately $67.2 million. This equates to a cost per household of $1,908.

Sidewalk Replacement Value			
Asset Component	Quantity/Units	2012 Unit Replacement Cost	2012 Overall Replacement Cost
Sidewalks	746,262.19 m2	$90/m2	$67,163,597
			$67,163,597

The pie charts below provide a breakdown of each of the network components to the overall system value.

Road Network Replacement Cost by Components (Excludes Sidewalk)

Road Base: $68,803,878.12 (18.89%)
Road Barriers: $217,836.00 (0.06%)
Curbs: $48,526,518.60 (13.32%)
Traffic Signs: $7,459,199.84 (2.05%)
Traffic Signals: $8,522,128.12 (2.34%)
Street Lights: $16,084,250.00 (4.42%)
Road Top: $78,636,473.20 (21.59%)
Road Granular Sub-base: $135,944,082.32 (37.33%)

Sidewalk Replacement Cost

Sidewalks: $67,163,597.10 (100.00%)
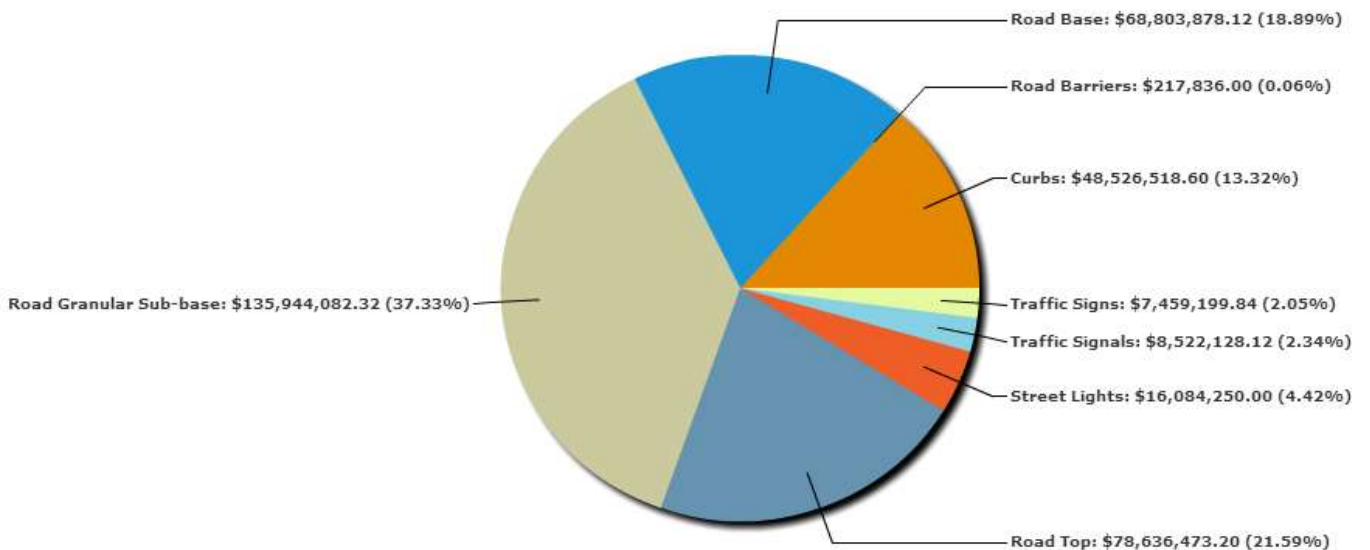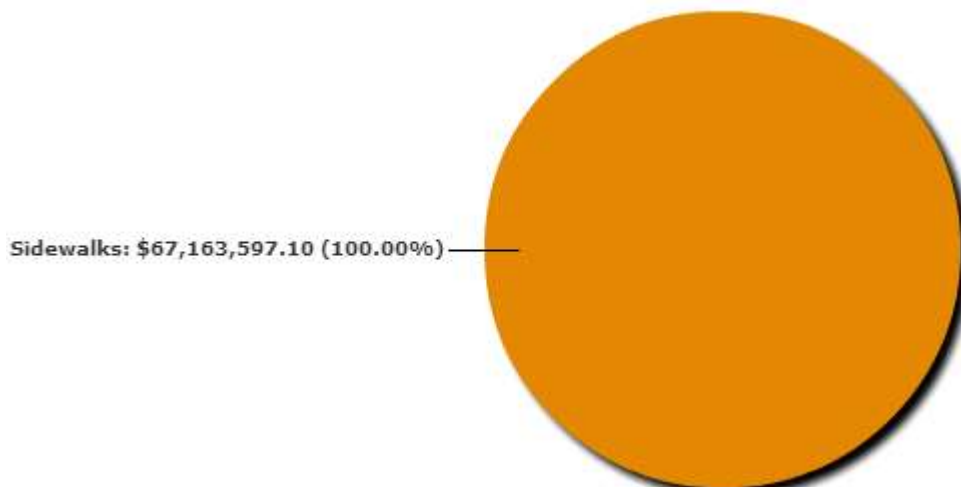
3.3.3 What condition is it in?

According to field condition assessments, 82%, of the City's road network is in fair to excellent condition, with the remaining 18% in poor to critical condition, mainly due to the critical condition of sidewalks. The high percentage of critical condition sidewalk is due to a large portion of the network having surpassed its estimated useful lifespan. As such, the City received a Condition vs. Performance rating of 'D+'.

Base and Paved Roads Condition by Area (m2)
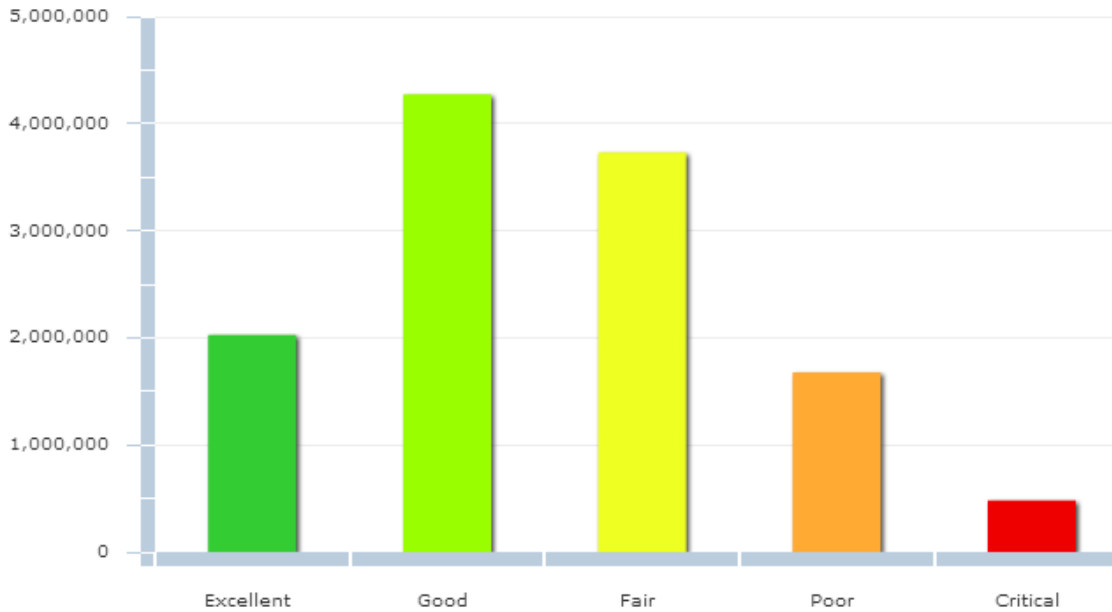
Sidewalk Conditions by Area (m2)
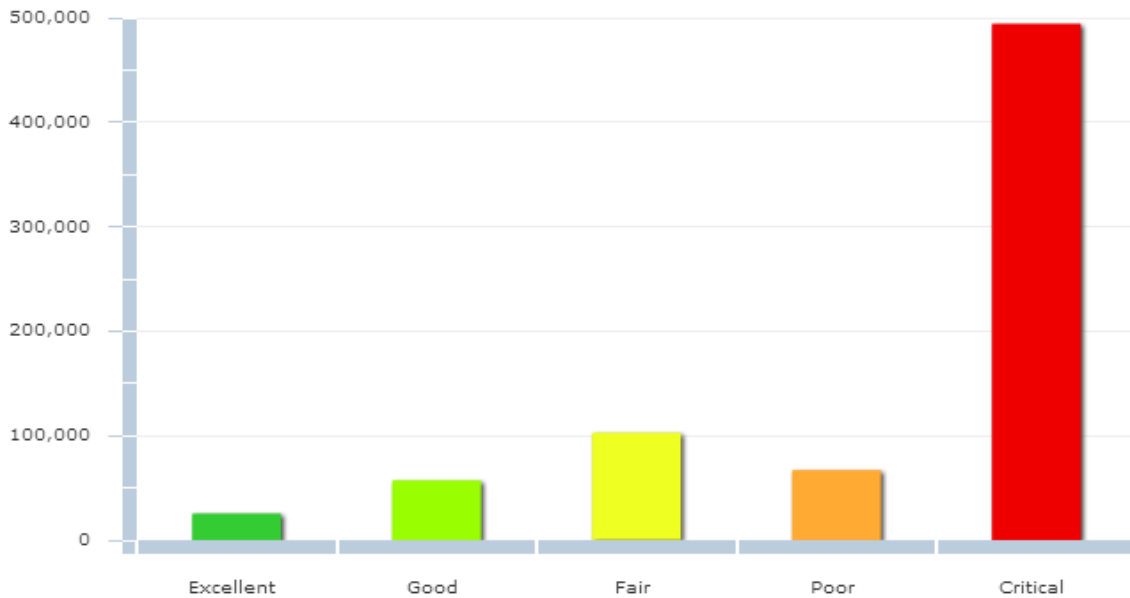
3.3.4 What do we need to do to it?

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, crack routing & sealing, 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	Curbs	40
	Road Barriers	15
	Road Base	50
	Road Granular Sub-base	75
	Road Top	25
	Street Lights	30
	Traffic Signals	25
	Traffic Signs	10
Sidewalk	Sidewalks	40

Paved Road Network Replacement Profile

Legend: Curbs, Road Barriers, Road Base, Road Granular Sub-base, Road Top, Street Lights, Traffic Signals, Traffic Signs
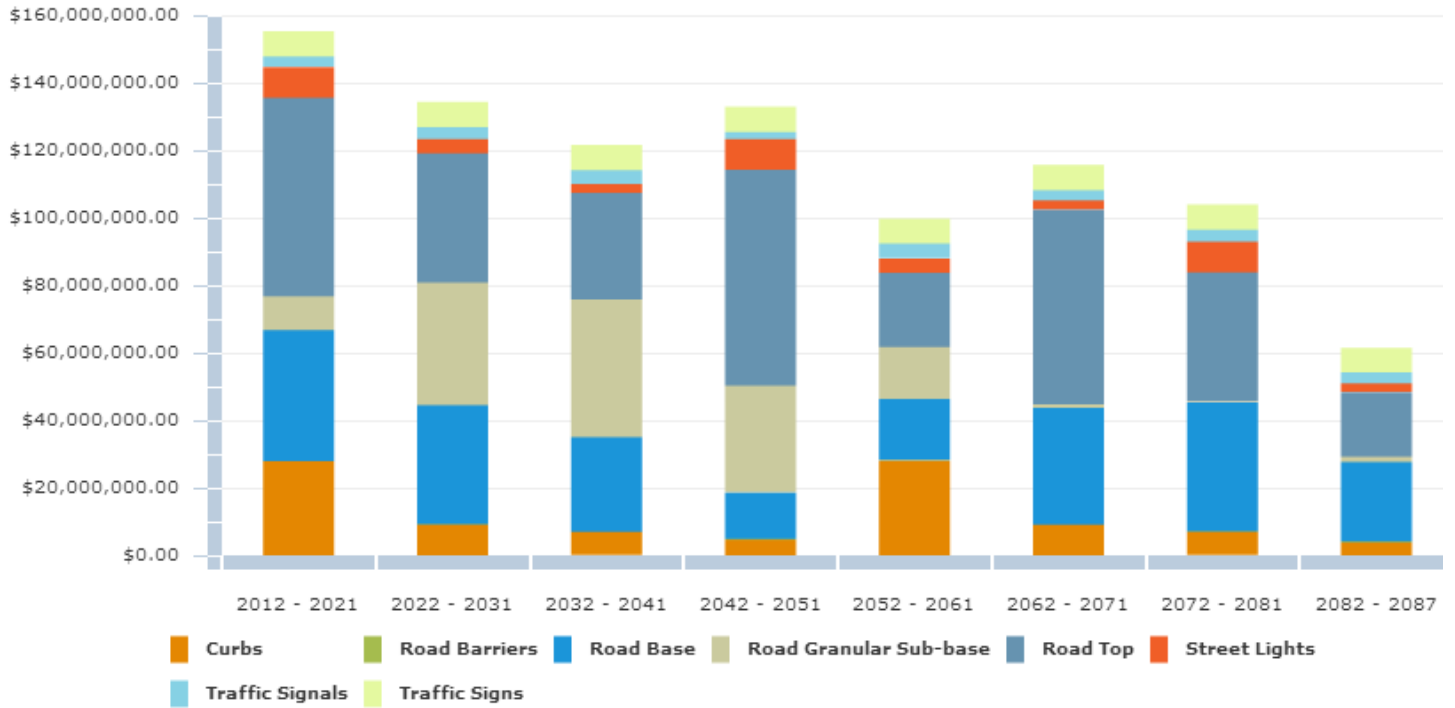
Sidewalk Replacement Profile

Legend: Sidewalks
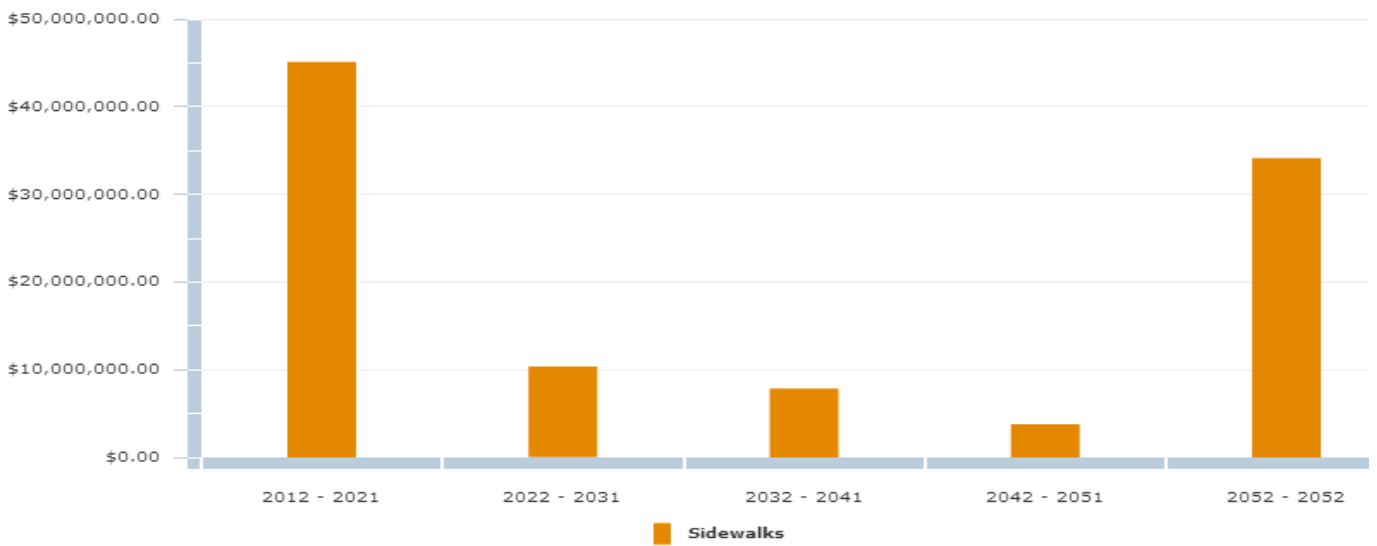
3.3.6 How much money do we need?

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 50 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 Niagara Falls' paved road network is approximately **$ 11,614,000** and **$1,682,000** for sidewalks. Based on Niagara Falls' current annual funding of **$2,479,000** for roads and **$300,000** for sidewalks, there is an annual **deficit of $9,135,000** for roads and an annual **deficit of $1,382,000** for Sidewalk. As such, the City received a Funding vs. Need rating of 'F'. The following graph illustrates the expenditure requirements in five year increments against the sustainable funding threshold line.

Paved Road Network Sustainable Funding Requirements
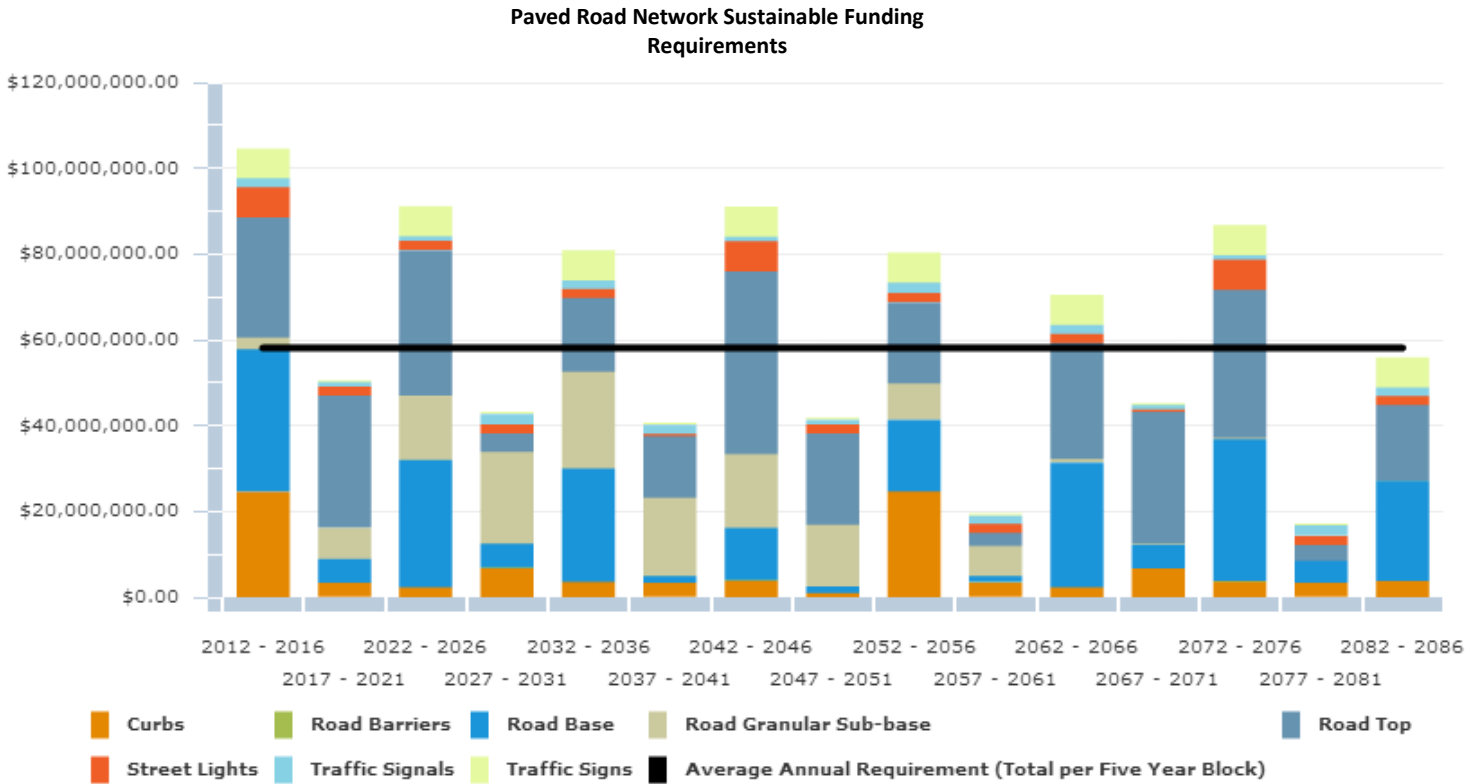
Sidewalk Sustainable Funding Requirements
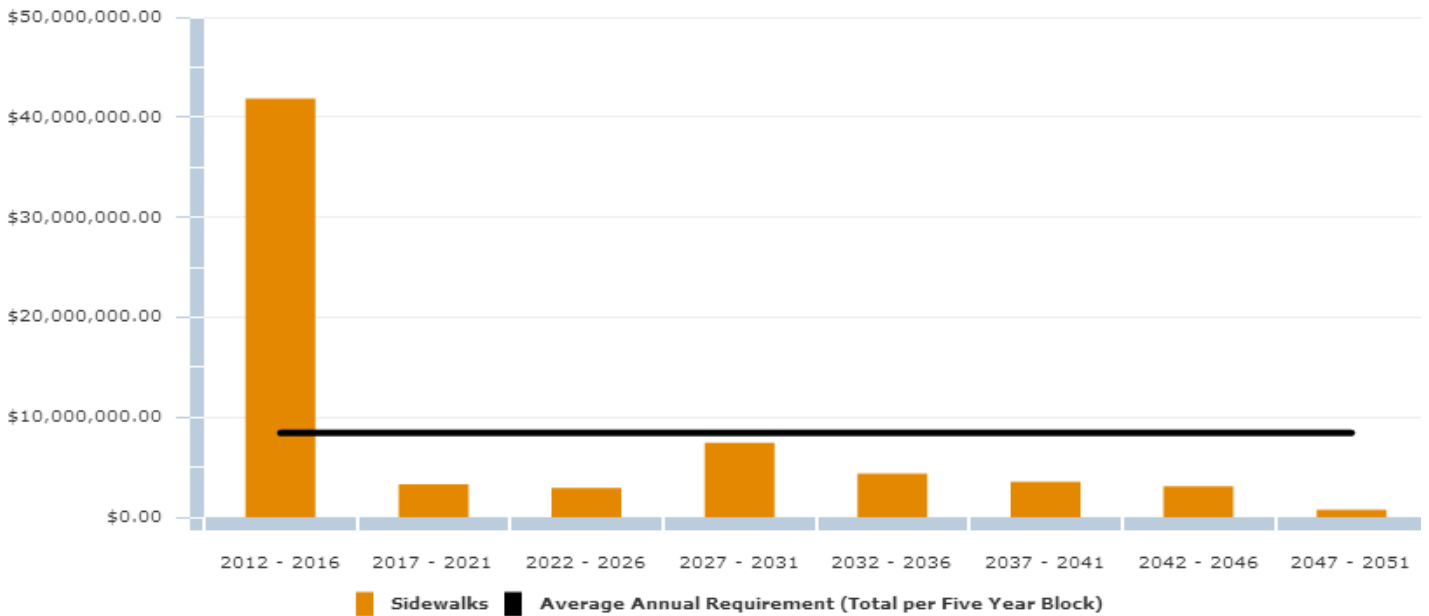
In conclusion, based on field condition data, the paved road network is generally in fair condition. This has generated a backlog of needs that must be addressed within the next 5 years totaling approximately $105 million. The condition assessment data, along with risk management strategies, should be reviewed together to aid in prioritizing overall needs for rehabilitation and replacement and 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 City received an overall rating of 'F' for its road network (including sidewalk), calculated from the Condition vs. Performance and the Funding vs. Need ratings. Accordingly, we recommend the following:

1. The condition assessment data, along with risk management strategies, should be reviewed together to aid in prioritizing overall needs for rehabilitation and replacement.

2. A tailored life cycle activity framework should be also be developed by the City as outlined further within the "Asset Management Strategy" section of this AMP.

3. As approximately 3% of the City'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.

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

5. 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.

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

3.4 Bridges & Culverts

B

INFRASTRUCTURE REPORT CARD GRADE
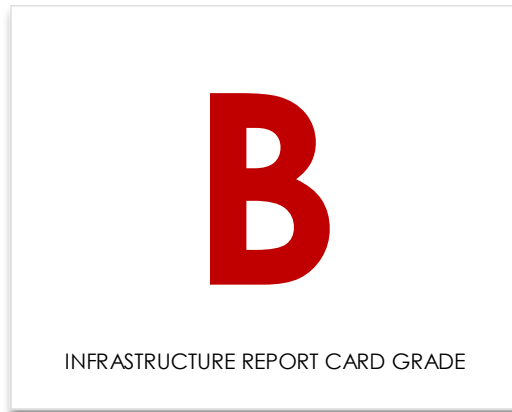
3.4 Bridges & Culverts

3.4.1 What do we own?
As shown in the summary table below, the City owns 75 bridges and 75 large culverts.

Bridges & Culverts Inventory		
Asset Type	Asset Component	Quantity/Units
Bridges & Culverts	Bridges Structure incl abutments	75
	Bridges Deck incl deck joints	71
	Culverts (50 years)	38
	Culverts (80 years)	37

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

3.4.2 What is it worth?
The estimated replacement value of the City's bridges & culverts, in 2012 dollars, is approximately $94.6 million. The cost per household for bridges & culverts is $2,688 based on 35,199 households.

Bridges & Culverts Replacement Value				
Asset Type	Asset Component	Quantity/Units	2012 Unit Replacement Cost	2012 Replacement Cost
Bridges & Culverts	Bridges Structure incl abutments	75	NRBCPI	$42,158,629
	Bridges Deck incl deck joints	71	NRBCPI	$14,600,403
	Culverts (50 years)	38	NRBCPI	$4,108,643
	Culverts (80 years)	37	NRBCPI	$33,763,787
				$94,631,463

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

Bridges & Culverts Components

Bridges: $56,759,032.70 (59.98%)

Culverts: $37,872,430.19 (40.02%)
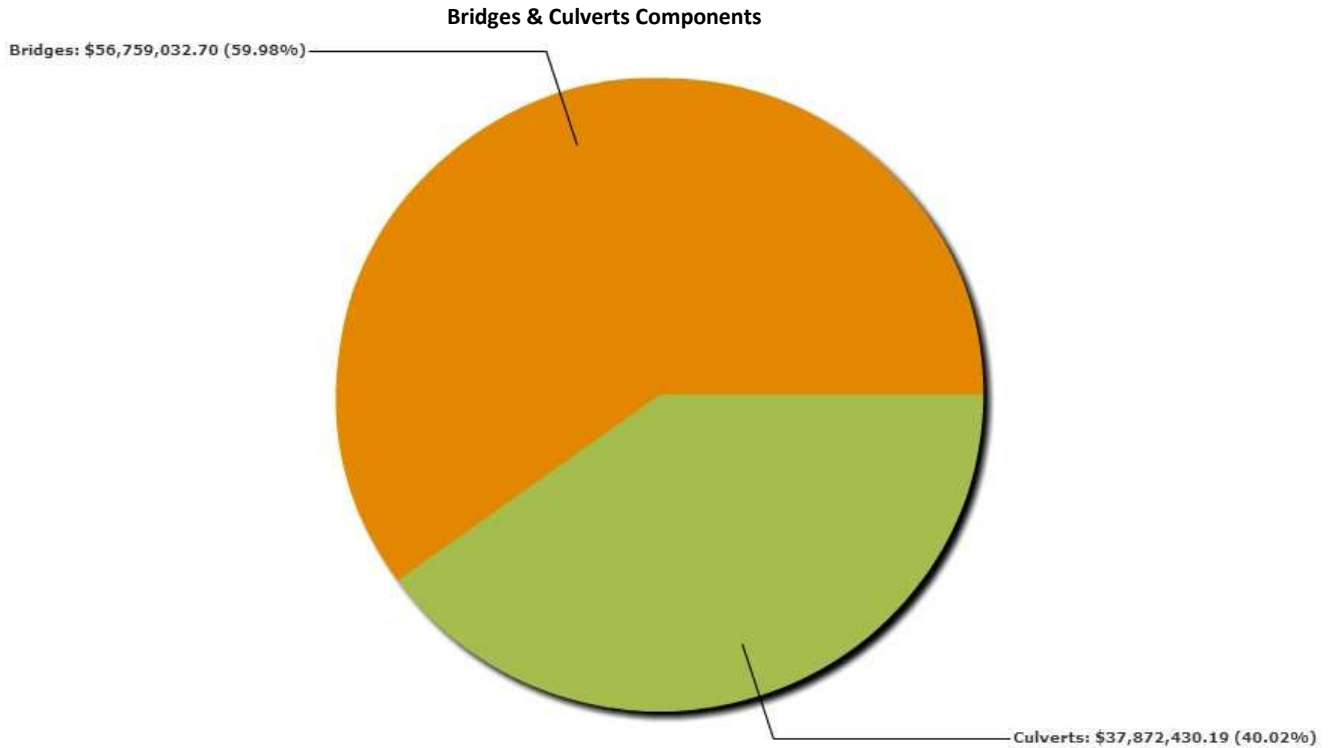
3.4.3 What condition is it in?

According to an age based analysis, 86% of the City's bridges & culverts are in fair to excellent condition. As such, the City received a Condition vs. Performance rating of 'C+'.

Bridges & Culverts Condition by Quantity
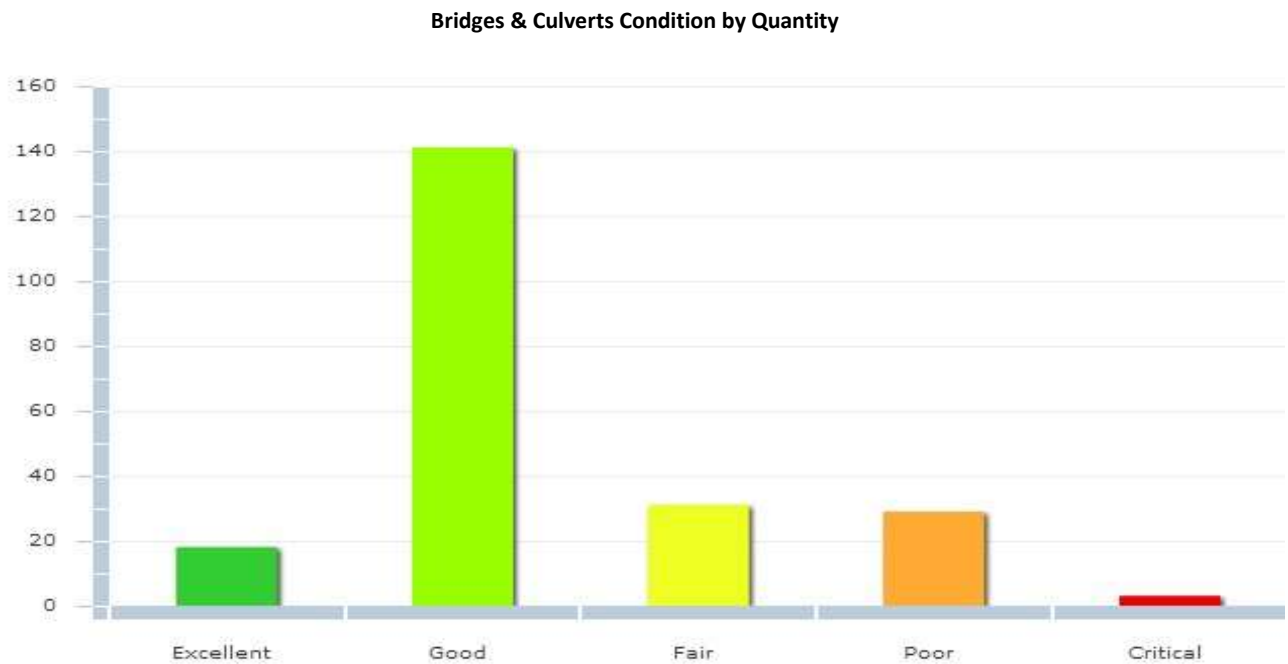
3.4.4 What do we need to do to it?

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

3.4.5 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 Structure incl abutments	80
	Bridges Deck incl deck joints	25
	Culverts (50 years)	50
	Culverts (80 years)	80

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

Structures Replacement Profile
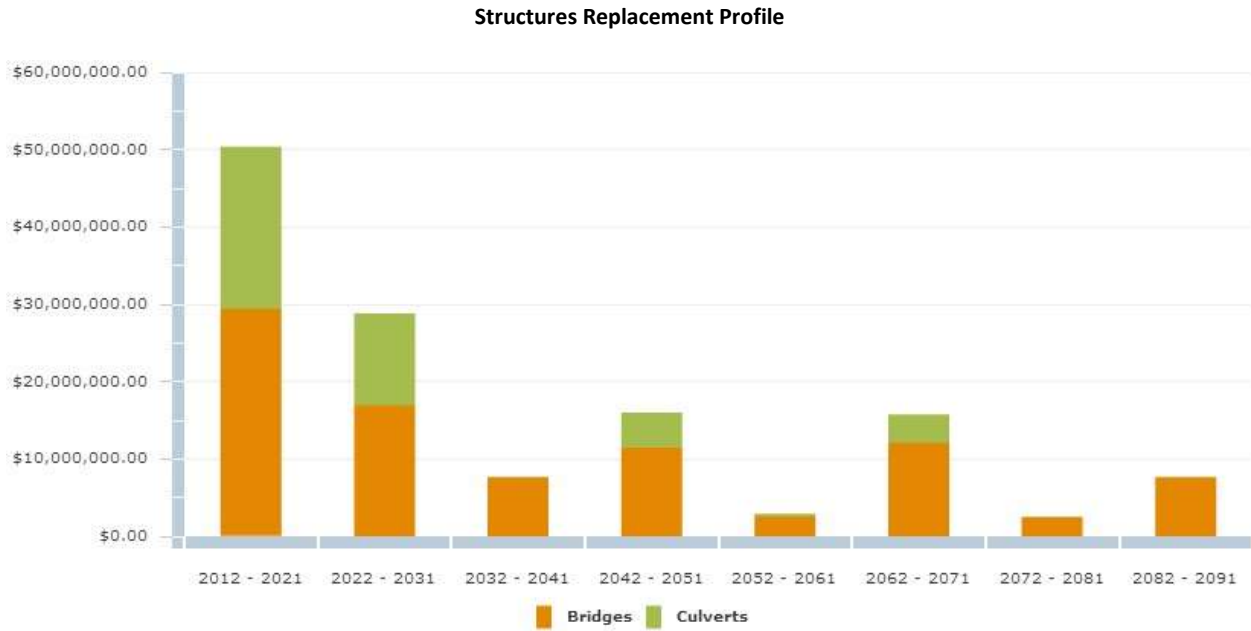
3.4.6 How much money do we need?
The analysis completed to determine capital revenue requirements was based on the following constraints and assumptions:

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 an 80 year period to ensure all assets cycled through at least one iteration of replacement, therefore providing a sustainable projection.

3.4.7 How do we reach sustainability?

Based upon the above assumptions, the average annual revenue required to sustain Niagara Falls' bridges & culverts is **$1,689,000**. Based on Niagara Falls' current annual funding of **$1,539,000**, there is an annual **deficit of $150,000**. As such, the City received a Funding vs. Need rating of 'A'. The following graph presents five year blocks of expenditure requirements against the sustainable funding threshold line.

Sustainable Revenue Requirement
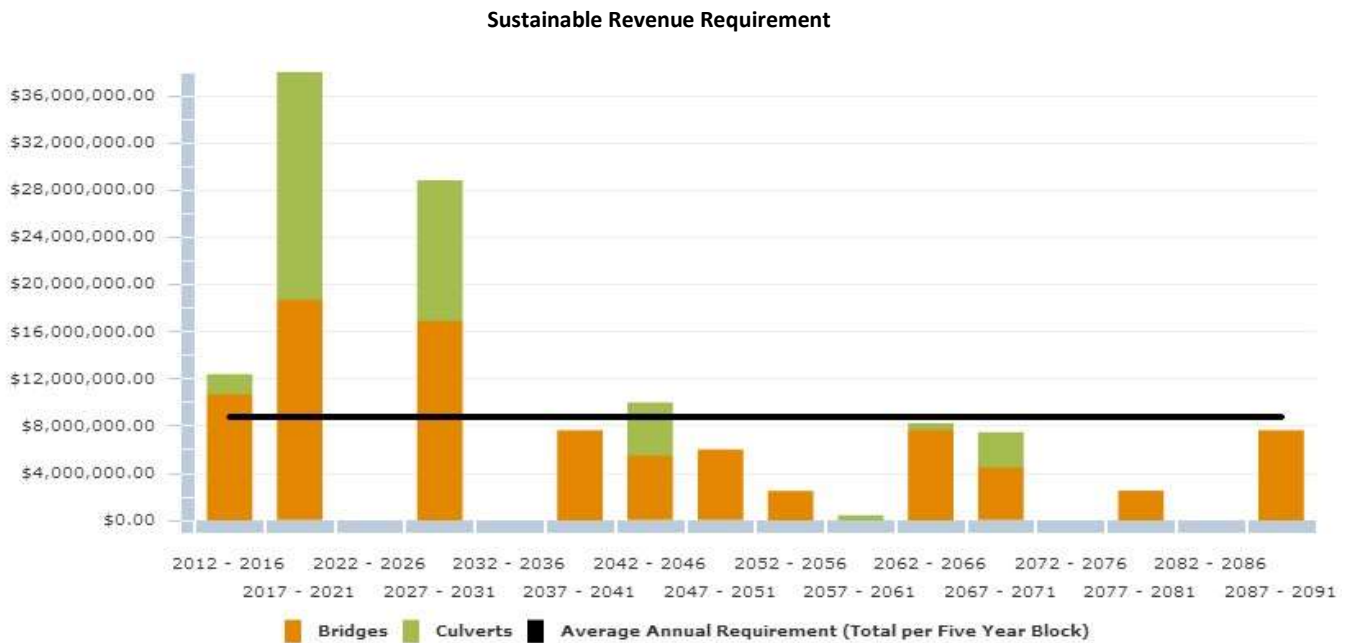
In conclusion, based on field condition data, the majority of bridges and large structures are in good condition. There are, however, needs to be addressed within the next 5 years totaling approximately $12 million. The condition assessment data, along with risk management strategies, should be reviewed together to aid in prioritizing overall needs for rehabilitation and replacement and assist with optimizing the long and short term budgets. Further detail is outlined within the "asset management strategy" section of this AMP.

3.4.8 Recommendations

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

1. The condition assessment data, along with risk management strategies, should be reviewed together to aid in prioritizing overall needs for rehabilitation and replacement.

2. 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.

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

3.5 Water Network

INFRASTRUCTURE REPORT CARD GRADE
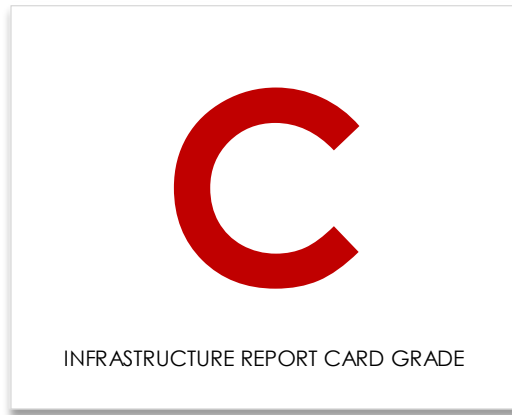
3.5 Water Network.

3.5.1 What do we own?

Niagara Falls is responsible for the following water network inventory which includes approximately 441 km of water mains:

Water Network Inventory		
Asset Type	Asset Component	Quantity
Water Network	Hydrants	2,729.00
	Site Services	24.00
	Water Service	277,964.08 m
	Water Service Meter	27,248
	Water Service Meter Chamber	107
	Water Valve and Box	3,951.00
	Water Valve and Chamber	233.00
	Watermains – Local (25mm)	135.07m
	Watermains – Local (38mm)	6.52m
	Watermains – Local (50mm)	5,311.43m
	Watermains – Local (100mm)	3,246.13m
	Watermians – Local (150mm)	233,439.29m
	Watermains – Local (200mm)	87,268.77m
	Watermains – Local (250mm)	7,791.90m
	Watermains – Local (300mm)	102,537m
	Watermains - Local (350mm)	7.36m
	Watermains - Local (400mm)	1,374.64m
	Watermains - Local (450mm)	230.44m
	Watermains - Local (500mm)	9.72m
	Watermains - Local (unknown diameter)	1.00m

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

3.5.2 What is it worth?

The estimated replacement value of the water network, in 2012 dollars, is approximately $296 million. The cost per household for the water network is $8,432 based on 35,199 households.

	Water Network Replacement Value			
Asset Type	Asset Component	Quantity	2012 Unit Replacement Cost	2012 Overall Replacement Cost
Water Network	Hydrants	2,729.00	$5,250 ea.	$14,327,250
	Site Services	24.00	NRBCPI	$672,759
	Water Service	277,964.08 m	$150/m	$41,694,612
	Water Service Meter	27,248	$1,150 ea.	$31,335,200
	Water Service Meter Chamber	107	$2,350 ea.	$251,450
	Water Valve and Box	3,951.00	$2,250 ea.	$8,889,750
	Water Valve and Chamber	233.00	$4,400 ea.	$1,025,200
	Watermains - Local (25mm)	135.07m	$450/m	$60,781.50
	Watermains - Local (38mm)	6.52m	$450/m	$2,934.00
	Watermains - Local (50mm)	5,311.43m	$450/m	$2,390,143.50
	Watermains - Local (100mm)	3,246.13m	$450/m	$1,460,758.50
	Watermains - Local (150mm)	233,439.29m	$450/m	$105,047,680.50
	Watermains - Local (200mm)	87,268.77m	$450/m	$39,270,946.50
	Watermains - Local (250mm)	7,791.90m	$450/m	$3,506,355.00
	Watermains - Local (300mm)	102,537m	$450/m	$46,141,650
	Watermains - Local (350mm)	7.36m	$450/m	$3,314.00
	Watermains - Local (400mm)	1,374.64m	$450/m	$618,588.00
	Watermains - Local (450mm)	230.44m	$450/m	$103,698.00
	Watermains - Local (500mm)	9.72m	$450/m	$4,374.00
	Watermains - Local (unknown diameter)	1.00m	$450/m	$450.00
				$296,807,895

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

Water Network Components

Water Service Meter Chamber: $251,450.00 (0.08%)
Water Valve and Box: $8,889,750.00 (3.00%)
Water Valve and Chamber: $1,025,200.00 (0.35%)

Water Service Meter: $31,335,200.00 (10.56%)

Water Service: $41,694,612.00 (14.05%)

Site Services: $672,759.16 (0.23%)

Hydrants: $14,327,250.00 (4.83%)

Watermains: $198,611,677.70 (66.92%)
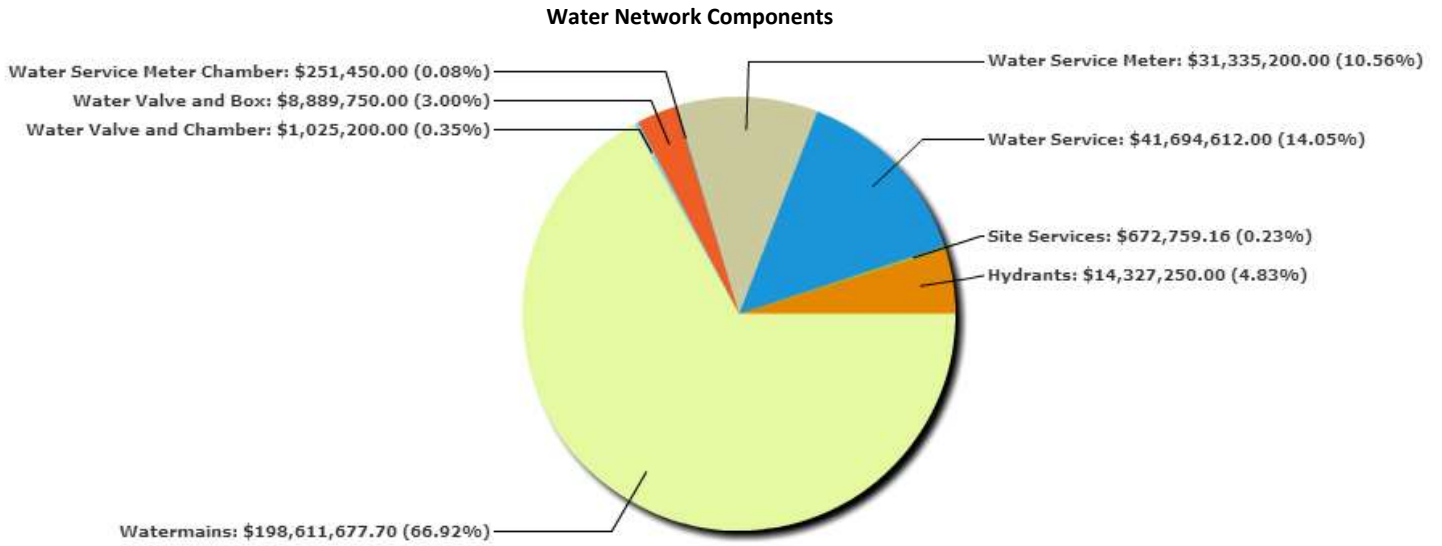
3.5.3 What condition is it in?

According to a field condition assessment, 84% of the City's water mains are in fair to excellent condition. As such, the City received a Condition vs. Performance rating of 'B'.

Water Mains Condition by Length (metres)
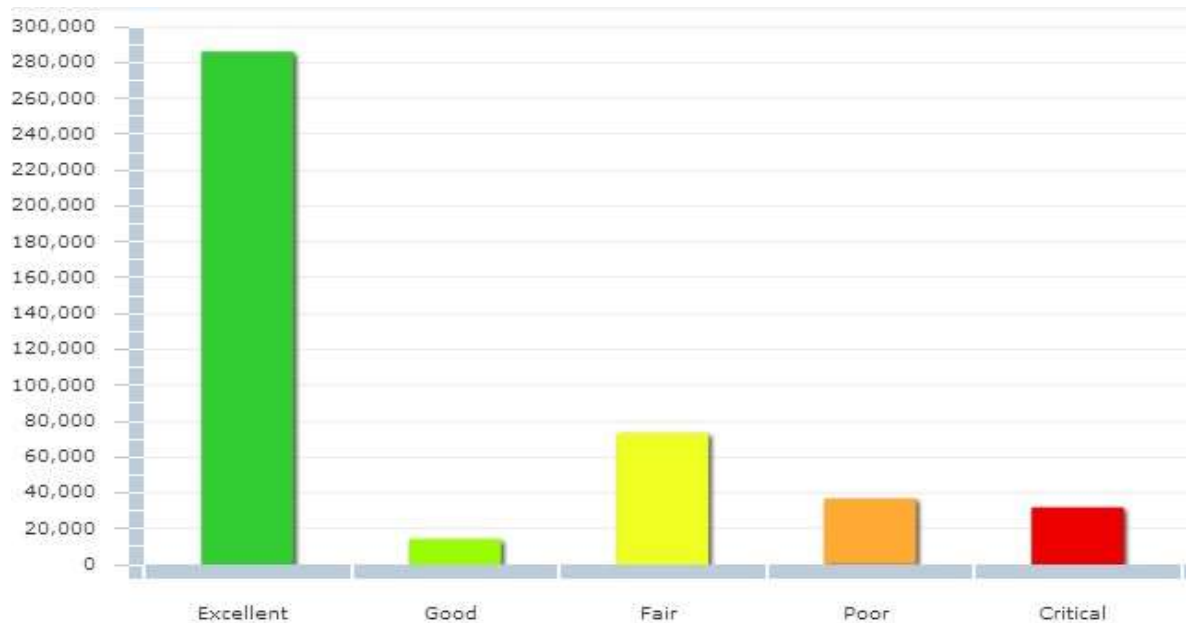
3.6.4 What do we need to do to it?

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

3.5.5 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
Water Network	Hydrants	75
	Site Services	50
	Water Service	70
	Water Service Meter	15
	Water Service Meter Chamber	50
	Water Valve and Box	60
	Water Valve and Chamber	60
	Watermains - Local (38mm)	70
	Watermains - Local (50mm)	75
	Watermains - Local (100mm)	100
	Watermains - Local (150mm)	75
	Watermains - Local (200mm)	75
	Watermains - Local (250mm)	75
	Watermains - Local (300mm)	75
	Watermains - Local (400mm)	100
	Watermains - Local (450mm)	100
	Watermains - Local (500mm)	60
	Watermains Local (Unknown)	60

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.

Water Main Replacement Profile
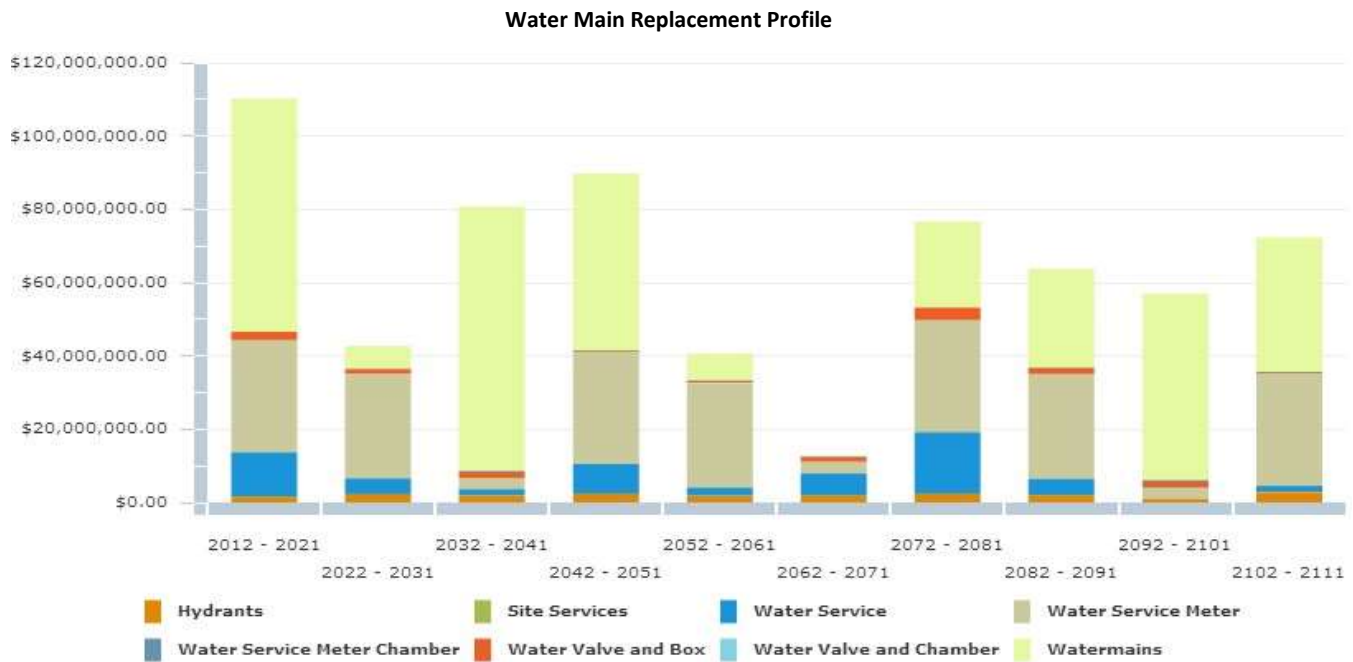
3.5.6 How much money do we need?

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 100 year period to ensure all assets went 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 Niagara Falls' water network is approximately **$6,077,000**. Based on Niagara Falls' current annual funding of **$4,100,000**, there is an annual **deficit of $1,977,000**. As such, the City received a Funding vs. Need rating of 'C'. The following graph presents five year blocks of expenditure requirements against the sustainable funding threshold line.

Sustainable Revenue Requirements
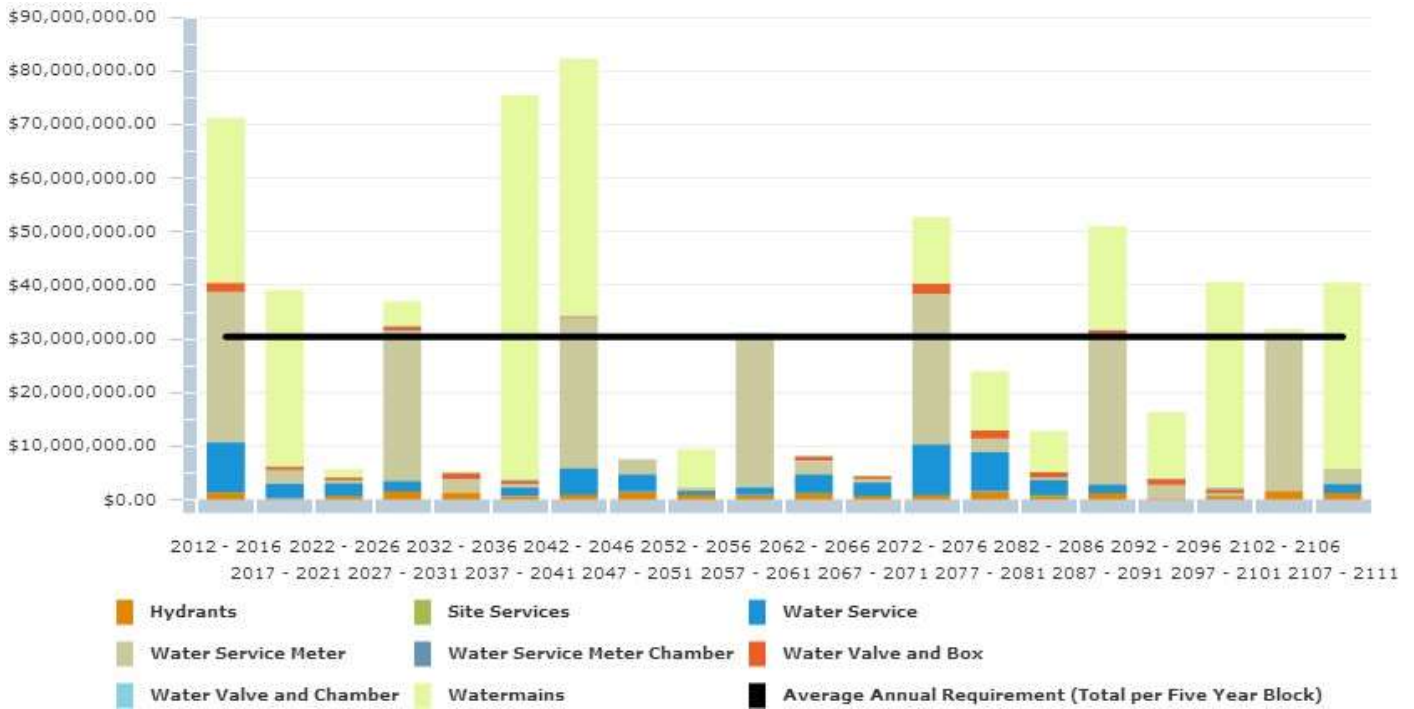
In conclusion, Niagara Fall's water distribution network is in very good condition based on field condition data. There is, however, a backlog of needs as well as significant replacement needs within the next 5 years totaling approximately $71 million. The condition assessment data, along with risk management strategies, should be reviewed together to aid in prioritizing overall needs for rehabilitation and replacement and 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 City received an overall rating of 'C' for its water network, calculated from the Condition vs. Performance and the Funding vs. Need ratings. Accordingly, we recommend the following:

1. The condition assessment data, along with risk management strategies, should be reviewed together to aid in prioritizing overall needs for rehabilitation and replacement.

2. Once the above study is complete, a new performance age should be applied to each water main 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.

3.6 Sanitary Sewer Network

C+

INFRASTRUCTURE REPORT CARD GRADE
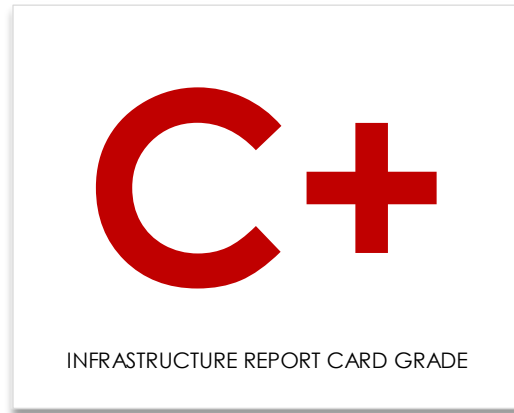
3.6 Sanitary Sewer Network

3.6.1 What do we own?
The inventory components of the sanitary sewer network are outlined in the table below. The entire Network consists of approximately 411 km of sewer main.

Sanitary Sewer Inventory		
Asset Type	Asset Component	Quantity
Sanitary Sewer Network	Maintenance Hole (Sewer)	5,473 units
	Sanitary Lateral	152,848.07 m
	Sanitary Sewer - Local (less than 300mm)	268,046.5m
	Sanitary Sewer - Local (larger than 300mm)	143,254.4m
	Sanitary Sewer - Local (unknown diameter)	13 units
	Combined Sewer (less than 300mm)	24,499.20m
	Combined Sewer (greater than or equal to 300mm)	48,574.60m
	Site Services	8
	Wastewater Facility & Equipment	8

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

3.6.2 What is it worth?
The estimated replacement value of the sanitary sewer network, in 2012 dollars, is approximately $491million. The cost per household for the sanitary network is $13,954 based on 35,199 households.

Sanitary Sewer Replacement Value				
Asset Type	Asset Component	Quantity	2012 Unit Replacement Cost	2012 Overall Replacement
Sanitary Sewer Network	Maintenance Hole (Sewer)	5,473 units	$6,400 ea.	$34,976,000
	Sanitary Lateral	152,848.07 m	$220/m	$33,511,408
	Sanitary Sewer - Local (less than 300mm)	268,046.5 m	$595/m	$97,578,037
	Sanitary Sewer – Local (larger than or equal to 300mm)	143,254.4 m	$815/m	$128,659,814
	Sanitary Sewer – Local (unknown diameter)	13 units	NRBCPI	$225,972
	Combined Sewer (less than 300mm)	24,499.20 m	$1,545/m	$37,851,264
	Combined Sewer (greater or equal to 300mm)	48,574.6 0m	$2,565/m	$124,593,849
	Site Services	8 units	NRBCPI	$1,940,564
	Wastewater Facility & Equipment	8 units	NRBCPI	$31,842,049
				$491,178,957

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

Sanitary Sewer Network Components

Maintenance Hole (Sewer): $34,976,000.00 (7.12%)

Sanitary Lateral: $33,511,407.60 (6.82%)

Combined Sewer: $162,445,113.00 (33.07%)

Wastewater Facility: $31,842,049.17 (6.48%)

Site Services: $1,940,563.56 (0.40%)

Sanitary Sewer: $226,463,822.06 (46.11%)
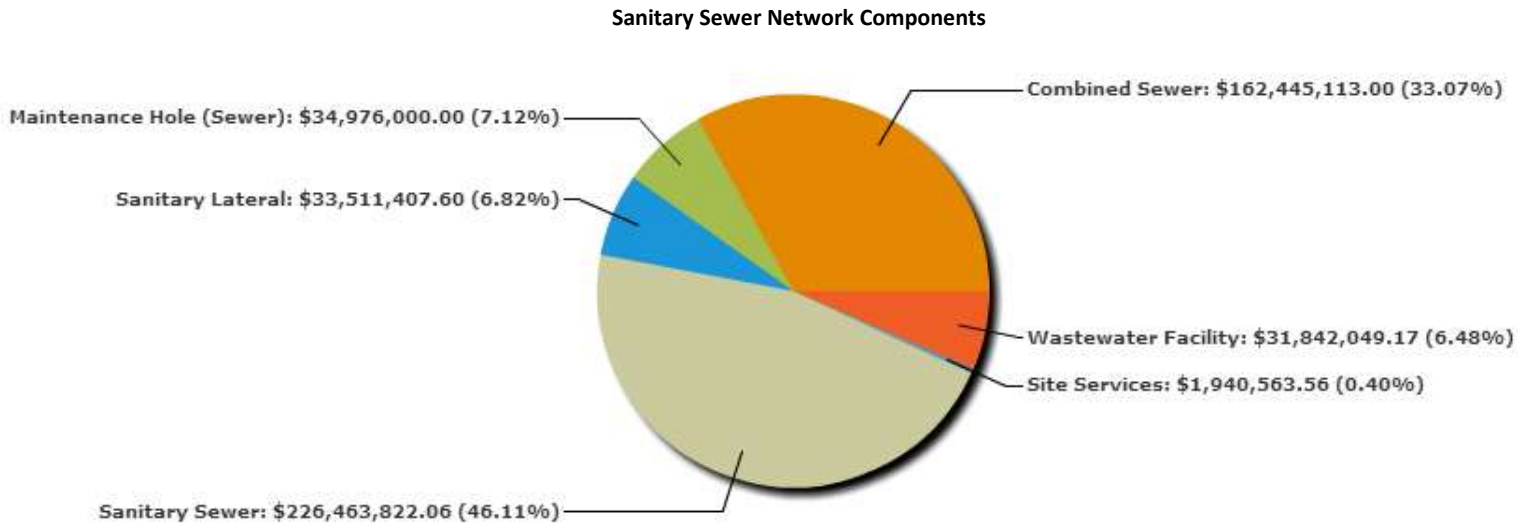
3.6.3 What condition is it in?

According to an age based assessment, approximately 49% of the City's sanitary sewer assets are in fair to excellent condition. As such, the City received a Condition vs. Performance rating of 'D+'.

Sanitary Mains, Sanitary Laterals and Combined Sewer Condition by Length (m)
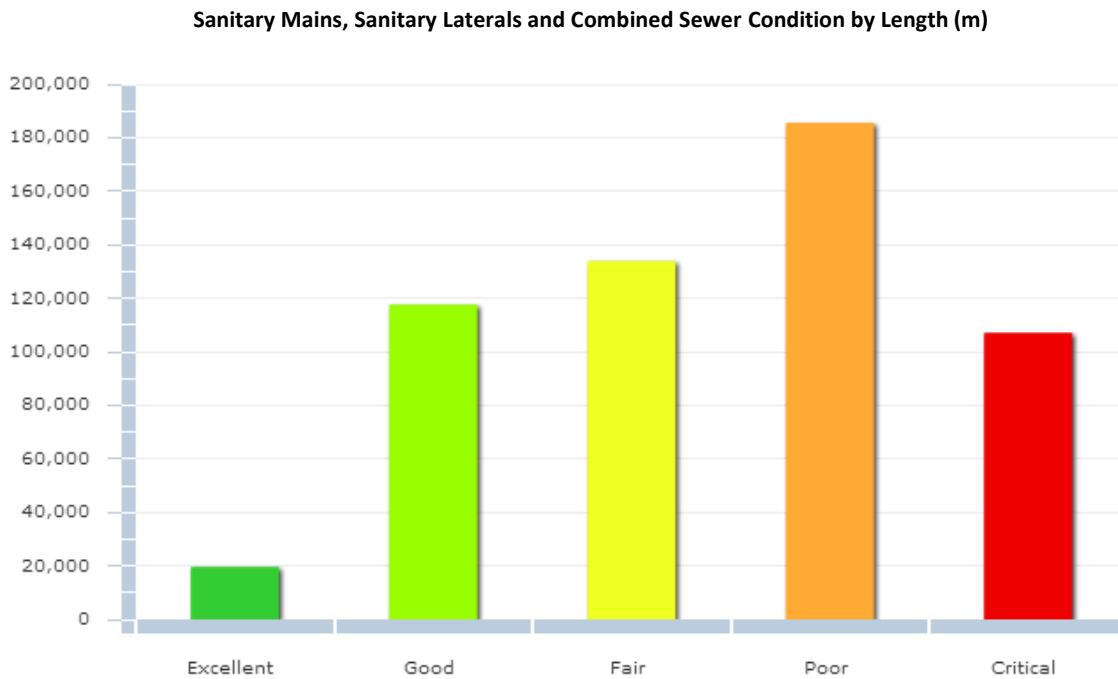
Wastewater Facility Condition by Cost ($)
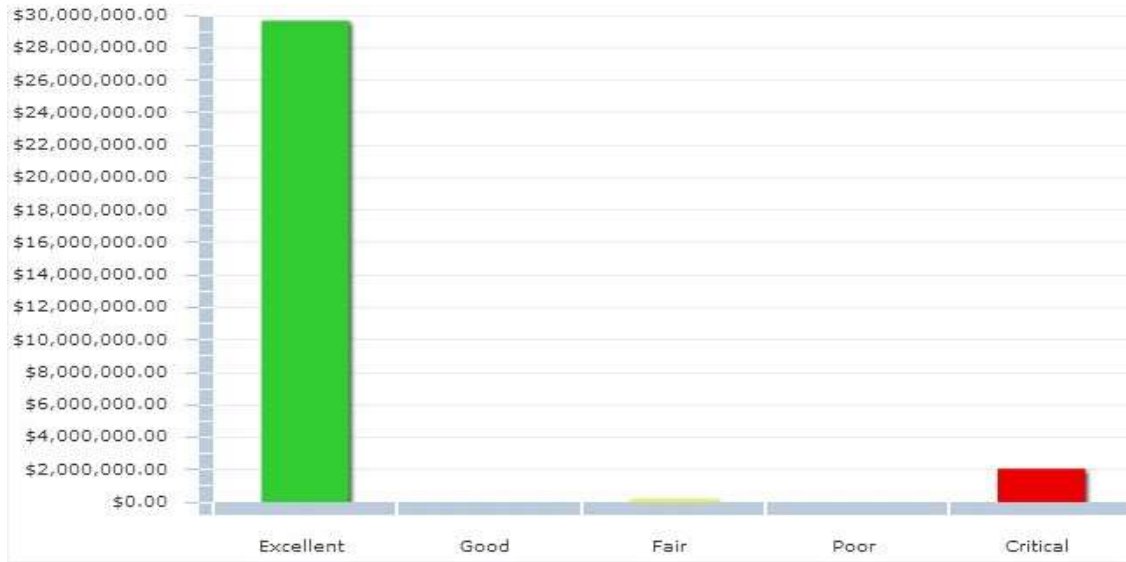
3.6.4 What do we need to do to it?

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

3.6.5 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
Sanitary Sewer Network	Maintenance Hole (Sewer)	80
	Sanitary Lateral	75
	Sanitary Sewer - Local (less than 300mm)	80
	Sanitary Sewer - Local (larger than 300mm)	80
	Sanitary Sewer - Local (unknown diameter)	50
	Site Services	50
	Wastewater Facility & Equipment	50

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 main replacements based on the age of the asset only.

Sanitary Sewer Network Replacement Profile
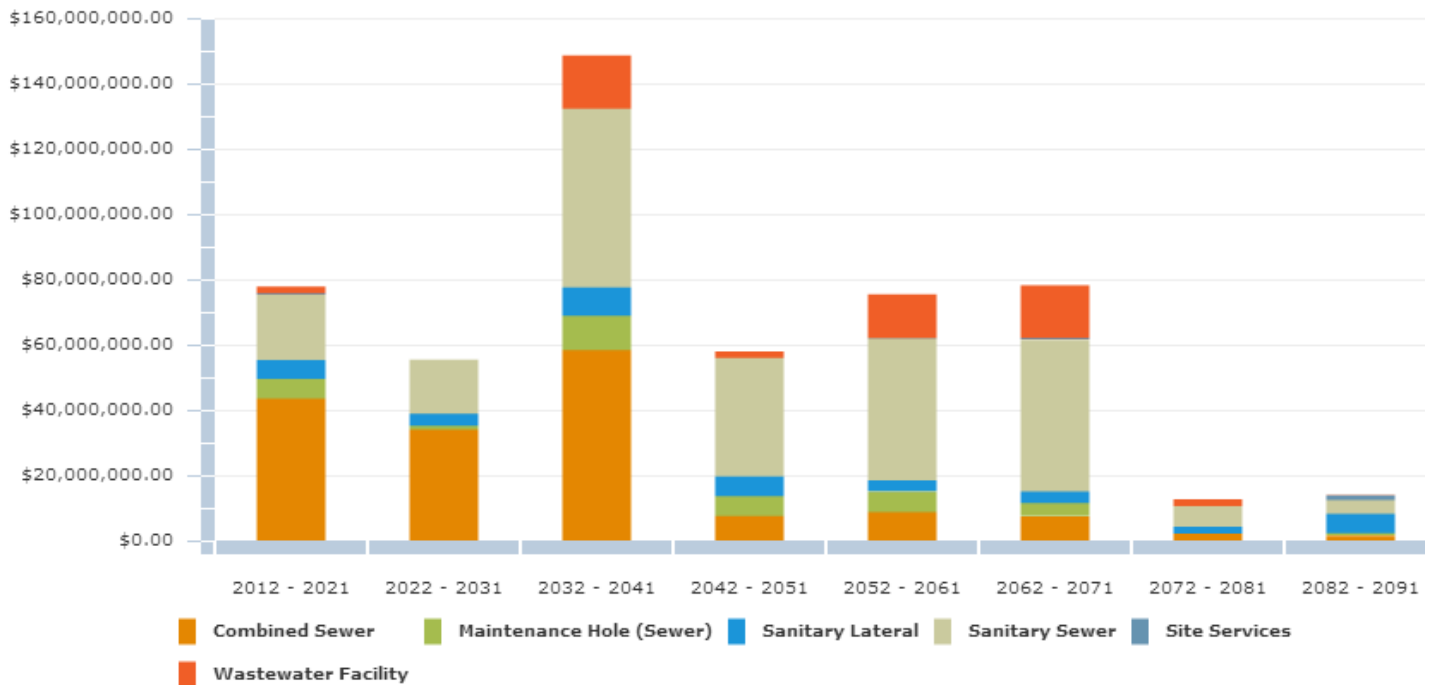
3.6.6 How much money do we need?

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 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.

3.6.7 How do we reach sustainability?

Based upon the above assumptions, the average annual revenue required to sustain Niagara Falls' sanitary sewer network is approximately **$6,496,000**. Based on Niagara Falls' current annual funding of **$4,730,000**, there is an annual **deficit of $1,766,000**. As such, the City received a Funding vs. Need rating of 'C'. The following graph presents five year blocks of expenditure requirements against the sustainable funding threshold line.

Sustainable Revenue Requirements
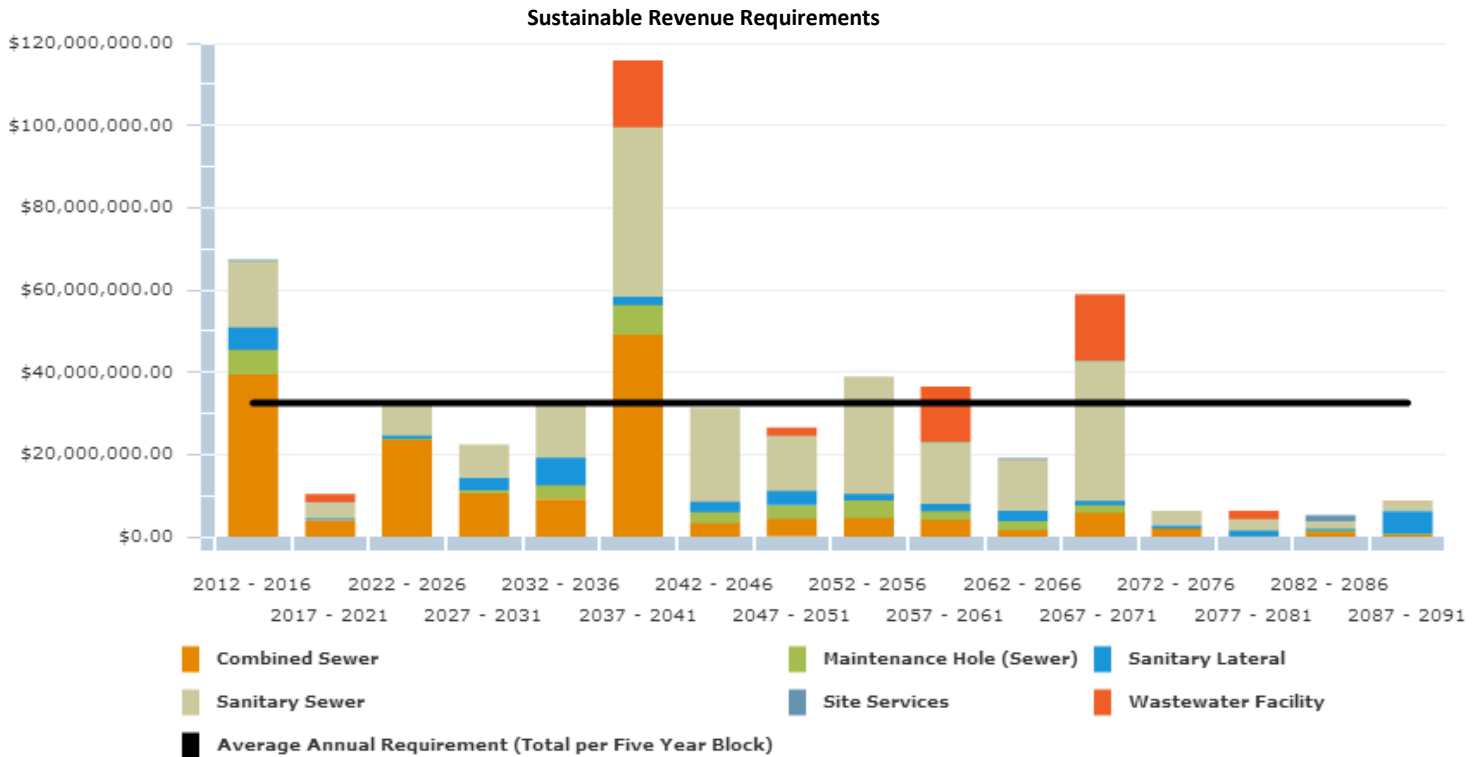
In conclusion, the sanitary sewer network, from an age based analysis only, is generally in poor condition while the facilities are in excellent condition. There are needs to be addressed within the next 5 years totaling approximately $67 million. A condition assessment program should be established 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 City 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 10% 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.

3.7 Storm Sewer Network

INFRASTRUCTURE REPORT CARD GRADE
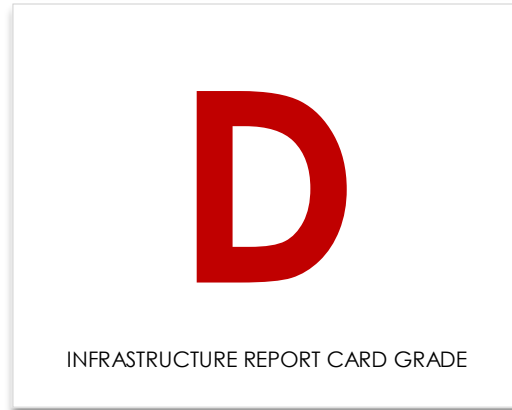
3.7 Storm Sewer Network

3.7.1 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 279 km of sewer mains.

Asset Type	Asset Component	Quantity
Storm Sewer Network Inventory (Detailed)		
Asset Type	Asset Component	Quantity
Storm Sewer Network	Catchbasin	7,750
	Catchbasin Lead	385,123.08m
	Maintenance Hole (Storm)	3,721
	Outlet Structure	1
	Storm Lateral	24,731.63m
	Storm Management	68
	Storm Sewer	279,307.42m

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

3.7.2 What is it worth?
The estimated replacement value of the storm sewer network, in 2012 dollars, is approximately $507 million. The cost per household for the storm sewer network is $14,418 based on 35,199 households.

Asset Type	Asset Component	Quantity	2012 Unit Replacement Cost	2012 Overall Replacement Cost
Storm Replacement Value				
Asset Type	Asset Component	Quantity	2012 Unit Replacement Cost	2012 Overall Replacement Cost
Storm Sewer Network	Catchbasin	7,750 units	$2,250 ea.	$17,437,500
	Catchbasin Lead	385,123.08m	$175/m	$67,396,539
	Maintenance Hole (Storm)	3,721 units	$9,600 ea.	$35,721,600
	Outlet Structure	1 unit	NRBCPI	$5,430
	Storm Lateral	24,731.63m	$190/m	$4,699,010
	Storm Management	68 units	$15,000 ea.	$1,020,000
	Storm Sewer (less than 600 mm diameter)	134,460.37m	$950/m	$127,737,351.50
	Storm Sewer (greater than or equal to 600 mm diameter)	144,807.45m	$1,750/m	$253,413,037.50
	Storm Sewer (unknown diameter)	39.6m	$1,350/m	$53,460
				$507,483,928

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

Storm Sewer Network Components

Storm Management: $1,020,000.00 (0.20%)
Storm Lateral: $4,699,009.70 (0.93%)
Outlet Structure: $5,429.96 (0.00%)
Maintenance Hole (Storm): $35,721,600.00 (7.04%)
Catchbasin Lead: $67,396,539.00 (13.28%)
Catchbasin: $17,437,500.00 (3.44%)
Storm Sewer: $381,203,849.00 (75.12%)
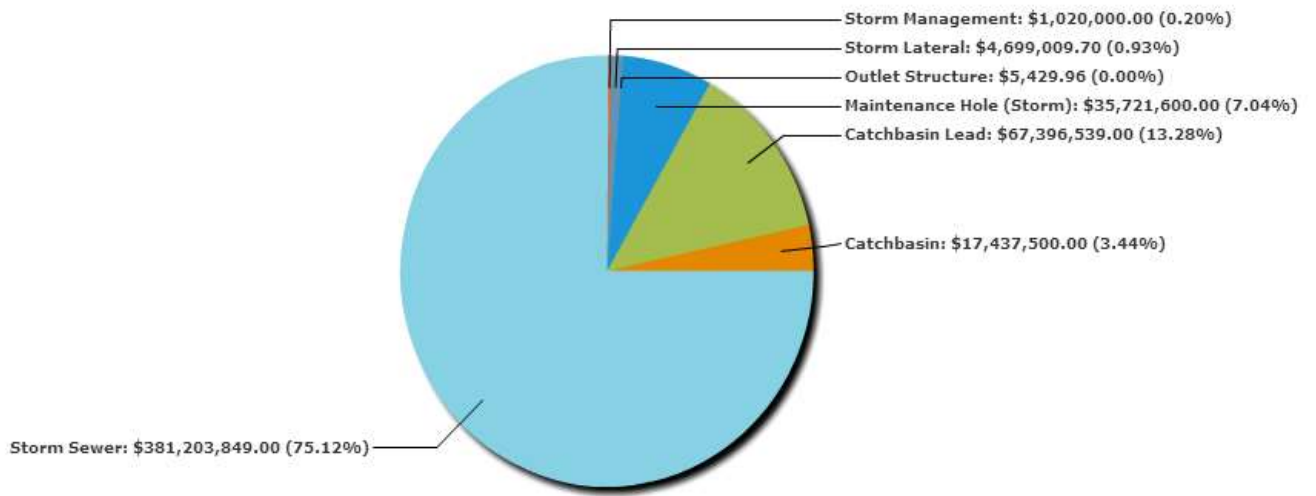
3.7.3 What condition is it in?

According to an age based analysis, approximately 81% of the City's storm sewer mains are in fair to excellent condition. As such, the City received a Condition vs. Performance rating of 'C'.

Catchbasin Lead, Storm Sewer and Lateral Network Condition by Length (metres)
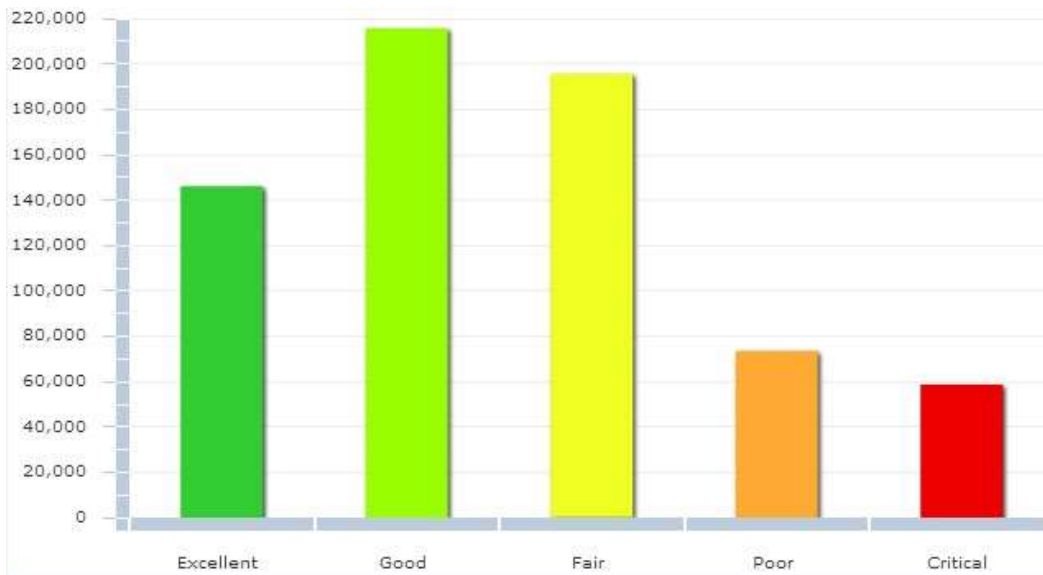
3.7.4 What do we need to do to it?

There are generally four distinct phases in an assets life cycle. These are presented at a high level for the 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

3.7.5 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
Storm Sewer Network	Mains - Local (Less Than 450mm)	80
	Mains - Trunks (Larger Than 450mm)	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 main replacements based on the age of the asset only.

Storm Sewer Network Replacement Profile
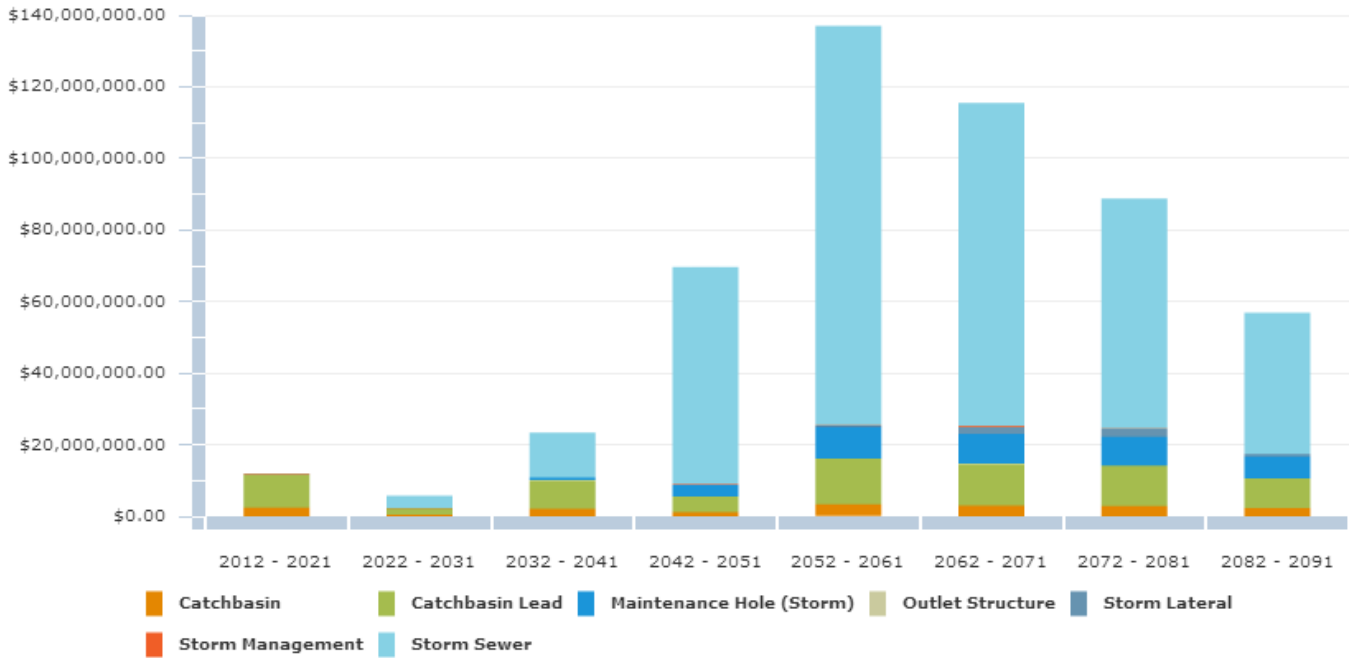
3.7.6 How much money do we need?

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 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 a 60 year period to ensure all assets went through 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 Niagara Falls' storm sewer network is approximately **$6,387,000**. Based on Niagara Falls' current annual funding of **$2,004,000**, there is an annual **deficit of $4,383,000**. As such, the City received a Funding vs. Need rating of 'F'.

45

Storm Sewer Network Replacement Profile
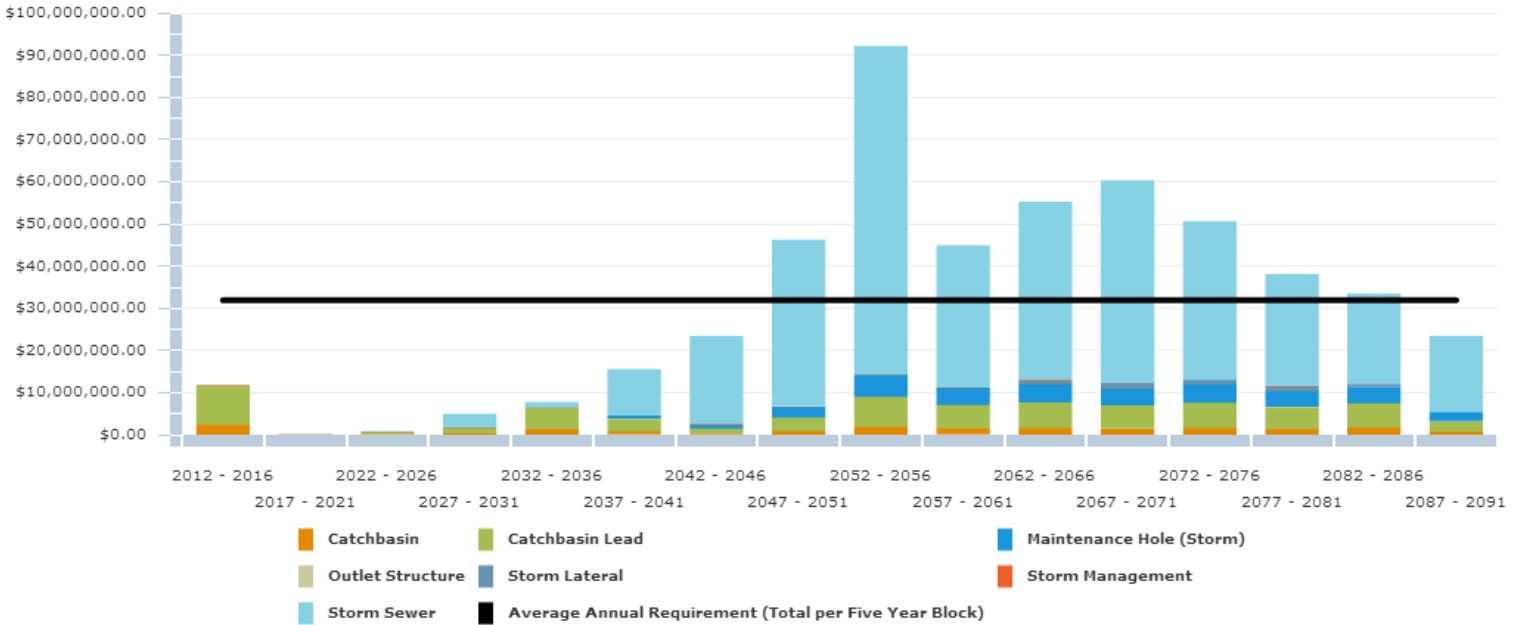
In conclusion, Niagara Falls' storm sewer collection network, based on age data only, is generally in good to fair condition overall. There are some needs to be addressed in the next 5 years totaling approximately $12 million. A condition assessment program should be established to aid in prioritizing 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.

3.7.8 Recommendations
The City 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	Infrastructure Report Card
C	**The City of Niagara Falls**

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 details on the grade of each asset category on the Condition vs. Performance dimension.
3. See the "*How do we reach sustainability*?" section for details on the grade of each asset category on the Funding vs. Need dimension.
4. The 'Overall Rating' below is the average of the two ratings.

Asset Category	Condition vs. Performance	Funding vs. Need	Overall Grade	Comments
Road Network	D+	F	**F**	The majority, 89%, of the City's road network is in fair to excellent condition, with the remaining 11% in poor to critical condition. The average annual revenue required to sustain Niagara Falls' road network is approximately **$11,614,000** and **$1,682,000** for sidewalks. Based on Niagara Falls' current annual funding of **$2,779,000** for roads and **$300,000** for sidewalks, there is an annual **deficit of $9,135,000** for roads and an annual deficit of **$1,382,000** for sidewalks.
Bridges & Culverts	C+	A	**B**	The majority, 85% of the City's bridges & culverts are in fair to excellent condition. The average annual revenue required to sustain Niagara Falls' bridges & culverts is **$1,689,000**. Based on Niagara Falls' current annual funding of **$1,539,000**, there is an annual **deficit of $150,000**.
Water Network	B	C	**C**	The majority, 84% of the City's water mains are in fair to excellent condition, with the remaining in poor to critical condition. The average annual revenue required to sustain Niagara Falls' water network is approximately **$6,077,000**. Based on Niagara Falls' current annual funding of **$4,100,000**, there is an annual **deficit of $1,977,000**
Sanitary Sewer Network	D+	C	**D+**	Approximately 48% of the City's sanitary sewer assets are in fair to excellent condition. The average annual revenue required to sustain Niagara Falls' sanitary sewer network is approximately **$6,496,000**. Based on Niagara Falls' current annual funding of **$4,730,000**, there is an annual **deficit of $1,766,000**.
Storm Sewer Network	C	F	**D**	Approximately 81% of the City's storm sewer mains are in fair to excellent condition. The average annual revenue required to sustain Niagara Falls' storm sewer network is approximately **$6,387,000**. Based on Niagara Falls' current annual funding of **$2,004,000**, there is an annual **deficit of $4,383,000**.

5.0 Desired Levels of Service

Desired levels of service are high level indicators, comprising many factors, as listed below that 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 capacity of a city 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 city 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 city 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). 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.

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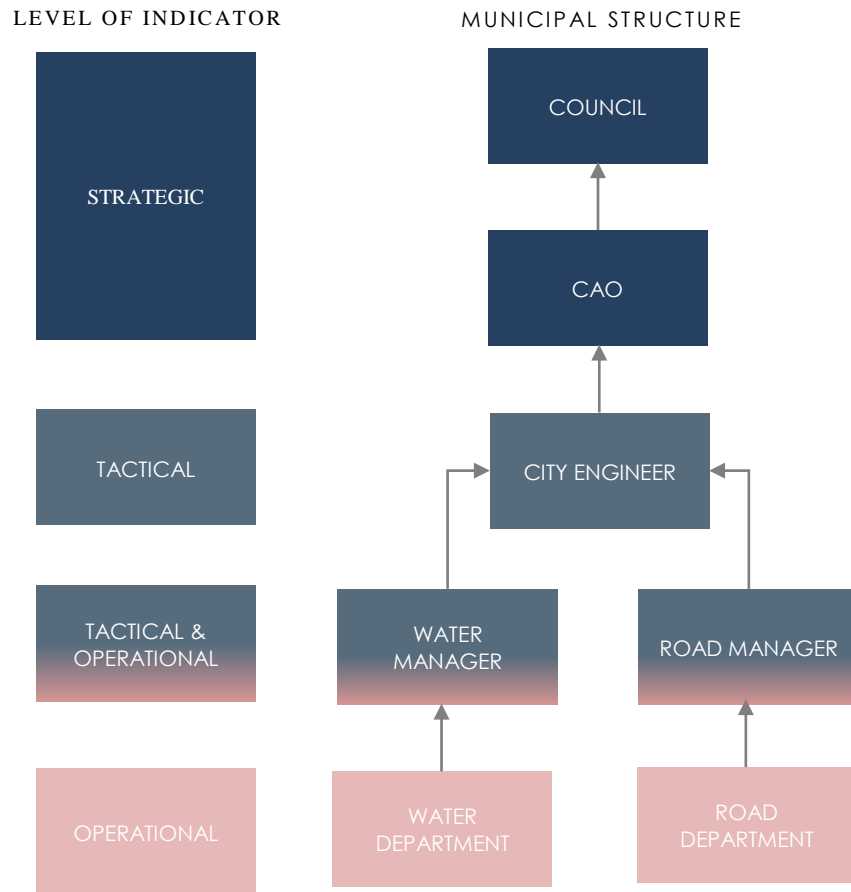
As a note, a caution should be raised over developing too many performance indicators that may result in data overload and lack of clarity. It is better to develop a select few that focus in on the targets of the asset management plan.

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 approximately 3,931,822.66 m2 of paved road, 75 bridges, 75 large culverts, 746,262 sq. metre of sidewalk, and the associated curbs, lane markings, traffic signals, signs and street lights.

Together, the above infrastructure enables the city 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 441 km of water main, 2,729 hydrants, and over 4,000 valves. The waste water network comprises 411 km of sanitary sewer main and 5,465 man holes and various facilities. The storm water network comprises 279 km of storm main, 3,721 man holes and 7,750 catch basins.

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

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 city'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 city 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 city 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 city 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 city.

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, which means it would cost the city approximately $52,000 for the 520 centreline km of paved road network.

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 City establish a pavement and sidewalk condition assessment programs and that a portion of capital funding is dedicated to this.

6.3.2 Sidewalk Inspections

As part of the requirements for Minimum Maintenance Standards (MMS), the City inspects their sidewalks annually to identify and mitigate pedestrian hazards. Additional information could be acquired regarding deteriorated and cracked panels to establish a relative condition rating on sidewalk segments. This, in turn, could be used to develop and prioritize a sidewalk repair, rehabilitation and replacement program.

6.3.3 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 city, there are 75 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 city'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 city'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.

Sanitary and Sewer Inspection Cost Estimates				
Sewer Network	Assessment Activity	Cost	Metres of Main / # of Manholes	Total
Sanitary	Full CCTV	$10 (per m)	411,000m	**$4,110,000**
	Zoom	$300 (per mh)	5,465 manholes	**$1,639,500**
Storm	Full CCTV	$10 (per m)	279,000m	**$2,790,000**
	Zoom	$300 (Per mh)	3,721 manholes	**$1,116,300**

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 Niagara Falls' entire sanitary and storm networks.

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 city 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 city 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.

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 city 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 city may wish to run the same analysis with a detailed review of city 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.
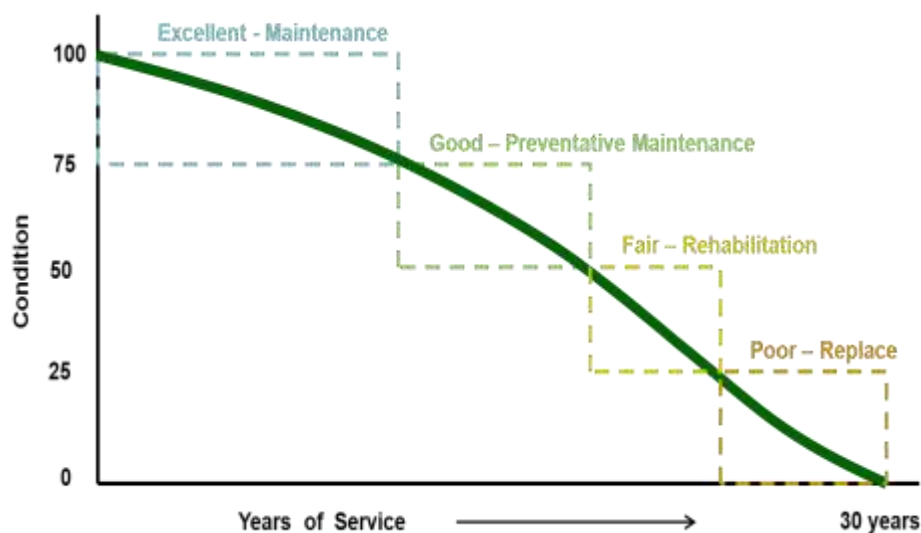
As shown above, during the road's life cycle there are various windows available for work activity that will maintain or extend the life of the asset. These windows are: maintenance; preventative maintenance; rehabilitation; and replacement or reconstruction.

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)	100-85	■ maintenance only
Good Condition ([preventative maintenance phase)	84 - 70	■ crack sealing ■ emulsions
Fair Condition (rehabilitation phase)	69 -55	■ resurface - mill & pave ■ resurface - asphalt overlay ■ single & double surface treatment (for rural roads)
Poor Condition (reconstruction phase)	54 - 40	■ reconstruct - pulverize and pave ■ reconstruct - full surface and base reconstruction
Critical Condition (reconstruction phase)	0-39	■ 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 city may wish to review the above condition ranges and thresholds for when certain types of work activity occur, and adjust to better suit the city'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 city 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	50	25 - 0	$6.83
Urban Resurfacing	$84	25	50 - 26	$5.60
Rural Reconstruction	$135	50	25 - 0	$4.50
Rural Resurfacing	$40	25	50 - 26	$2.67
Double Surface Treatment	$25	10	50 - 26	$2.50
Routing & Crack Sealing (P.M)	$2	0	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 city 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 city 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 Sidewalks
Most current Municipal Best practices consist of identifying and repairing/mitigating any sidewalk deficiencies. Various repair methodologies are utilized including: grinding, saw-cutting, ramping and mud jacking, to address pedestrian hazard and accessibility concerns. Once preventive maintenance measures become ineffective, then selective or complete panel replacement along a sidewalk segment is required. As such, a detailed assessment of sidewalk segment condition, identified deficiencies, operational and accessibility concerns is required to create an effective sidewalk repair and replacement program.

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 city may wish to run the same analysis with a detailed review of city 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.
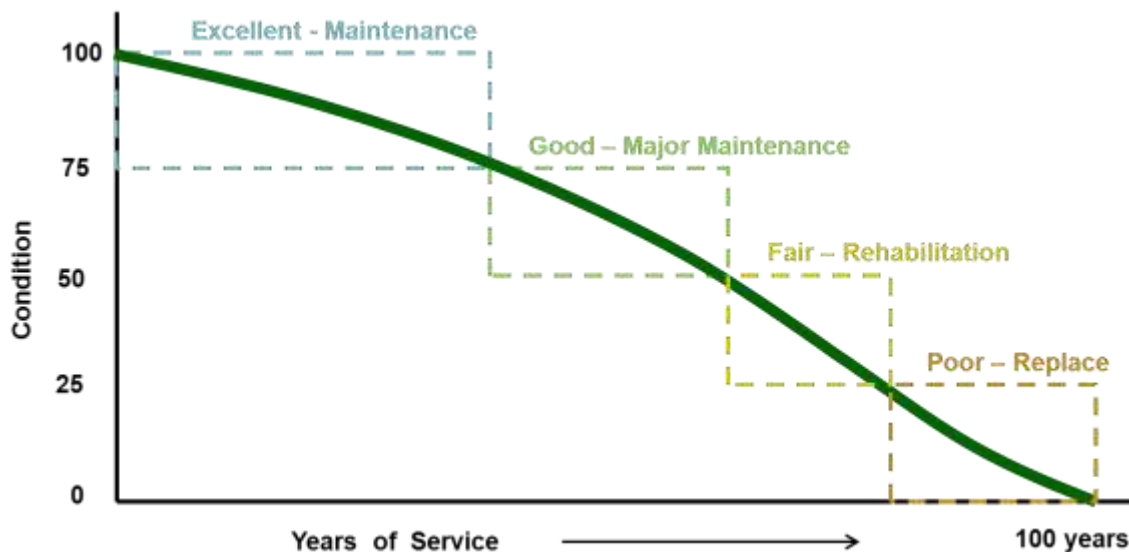
As shown above, during the sewer main's life cycle there are various windows available for work activity that will maintain or extend the life of the asset. These windows are: maintenance; major maintenance; rehabilitation; and replacement or reconstruction.

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 city may wish to review the above condition ranges and thresholds for when certain types of work activity occur, and adjust to better suit the city'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 city 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.

Typically this diameter range would account for over 95% of sanitary sewer mains and 75% 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.

6.4.4 Bridges & Culverts (greater than 3m span)

The best approach to develop a 10 year needs list for the city'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 0.6m) 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.
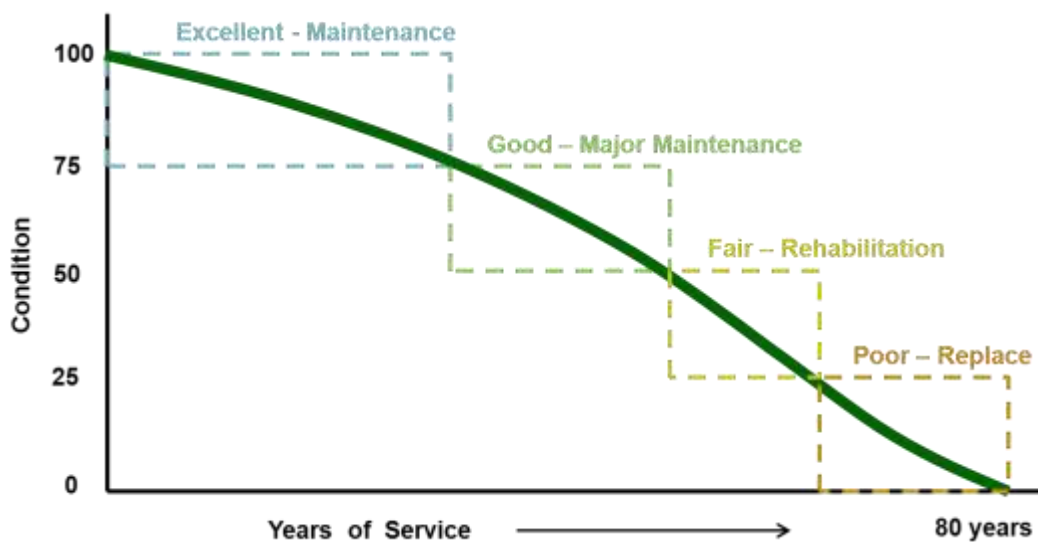
As shown above, during the water main's life cycle there are various windows available for work activity that will maintain or extend the life of the asset. These windows are: maintenance; major maintenance; rehabilitation; and replacement or reconstruction.

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 or Very Good 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 or Very Poor 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 city only utilize water main structural lining when the road above requires rehab or no work.

6.5 Growth and Demand

Typically a city 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 city 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 city'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 city 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 $500k	Score of 2
$501 to $1 million	Score of 3
$1 million to $4 million	Score of 4
$4 million 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
Rural	score of 1
Urban	score of 3

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
150mm	Score of 2
200 – 250mm	Score of 3
300 – 350mm	Score of 4
400 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 – 500mm	Score of 2
501 – 800mm	score of 3
801 – 1200mm	score of 4
1,201mm 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 Niagara Falls 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.
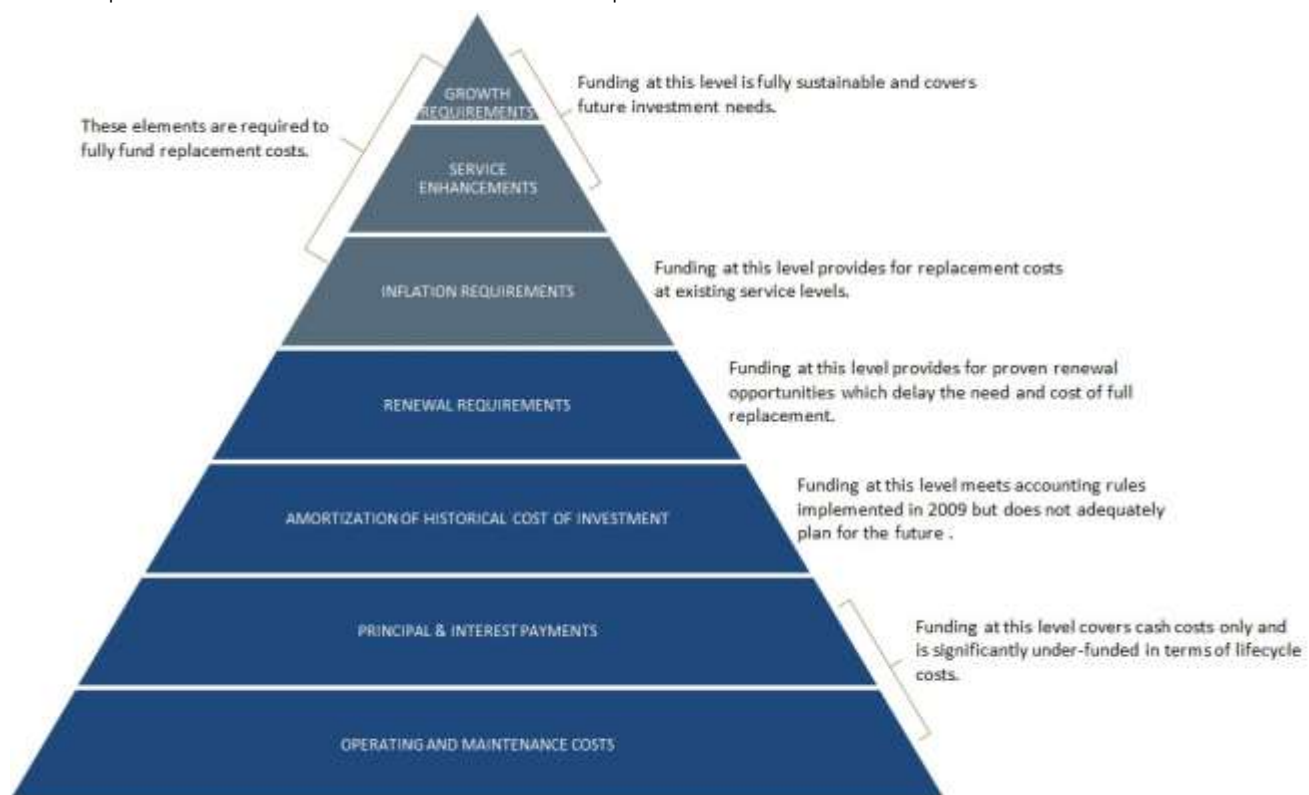
This report develops such a financial plan by presenting several scenarios for consideration and culminating with final recommendations. As outlined below, the scenarios presented model different combinations of the following components:

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 City'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 Niagara Falls' AMP

7.2.1 Funding objective
We have developed scenarios that would enable Niagara Falls to achieve full funding within 5 to 10 years for the following assets:

a) **Tax funded assets**: Road Network; Bridges & Culverts; Storm Sewer Network
b) **Rate funded assets:** Sanitary Sewer Network; Water 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, reserves and debt.

7.3 Tax funded assets

7.3.1 Current funding position
Tables 1 and 2 outline, by asset category, Niagara Falls' average annual asset investment requirements, current funding positions, and funding increases 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	Other (see note below)	Total Funding Available	
Road Network (includes sidewalk)	13,296,000	1,739,000	1,002,000	38,000	2,779,000	10,517,000
Bridges & Culverts	1,689,000	20,000	1,519,000	0	1,539,000	150,000
Storm Sewer Network	6,387,000	0	0	2,004,000	2,004,000	4,383,000
Total	**21,372,000**	**1,759,000**	**2,521,000**	**2,042,000**	**6,322,000**	**15,050,000**

Note: Other funding in table 1 includes the following:
   a) Road network: $38,000 of taxes going to the Capital Reserve.
   b) Storm sewer network: $2,004,000 of revenue from the Other Revenue (outside) category.

7.3.2 Recommendations for full funding

The average annual investment requirement for paved roads, bridges & culverts, and storm sewers is $21,372,000. Annual revenue currently allocated to these assets for capital purposes is $6,322,000 leaving an annual deficit of $15,050,000. To put it another way, these infrastructure categories are currently funded at 30% of their long-term requirements.

In 2013, Niagara Falls has annual tax revenues of $54,615,000. 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	19.2%
Bridges & Culverts	0.3%
Storm Sewer Network	8.0%
Total	**27.5%**

As illustrated in table 9, Niagara Falls' debt payments for these asset categories will be decreasing by $1,331,000 from 2013 to 2017 (5 years). Although not illustrated, debt payments will decrease by $1,664,000 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 this concept and presents a number of options:

Table 3. Effect of Reallocating Decreases in Debt Costs				
	Without Reallocation of Decreasing Debt Costs		With Reallocation of Decreasing Debt Costs	
	5 Years	10 Years	5 Years	10 Years
Infrastructure Deficit as Outlined in Table 1	15,050,000	15,050,000	15,050,000	15,050,000
Change in Debt Costs	N/A	N/A	-1,331,000	-1,664,000
Resulting Infrastructure Deficit	**15,050,000**	**15,050,000**	**13,719,000**	**13,386,000**
Resulting Tax Increase Required:				
Total Over Time	**27.6%**	**27.6%**	**25.1%**	**24.5%**
Annually	5.5%	2.8%	5.0%	2.5%

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

a) when realized, reallocating the debt cost reductions of $1,664,000 to the infrastructure deficit as outlined above.
b) increasing tax revenues by 2.5% 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 $2,521,000 of gas tax revenue as illustrated in table 1.
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 back log investment demand of $104,452,000 for the road network, $4,888,000 for bridges & culverts, and $11,779,000 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, Niagara Falls' 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	6,496,000	12,403,000	-7,673,000	0	4,730,000	1,766,000
Water Network	6,077,000	11,723,000	-7,623,000	0	4,100,000	1,977,000
Total	**11,231,000**	**24,126,000**	**-15,296,000**	**0**	**8,830,000**	**2,401,000**

7.4.2 Recommendations for full funding
The average annual investment requirement for sanitary services and water services is $11,231,000. Annual revenue currently allocated to these assets for capital purposes is $8,830,000 leaving an annual *deficit* of $2,401,000. To put it another way, these infrastructure categories are currently funded at 79% of their long-term requirements.

In 2013, Niagara Falls has annual sanitary revenues of $12,403,000 and annual water revenues of $11,723,000. 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	14.7%
Water Network	16.9%

As illustrated in table 9, Niagara Falls' debt payments for sanitary services will be decreasing by $231,000 from 2013 to 2017 (5 years). Although not illustrated, debt payments for sanitary services will be decreasing by $364,000 from 2013 to 2022 (10 years). For water services, the amounts are $0 and $0 respectively. Our recommendations include capturing those decreases in cost and allocating them to the applicable infrastructure deficit.

Tables 6a and 6b outline the above concept 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	1,766,000	1,766,000	1,977,000	1,977,000
Change in Debt Costs	n/a	n/a	n/a	n/a
Resulting Infrastructure Deficit/Surplus	**1,766,000**	**1,766,000**	**1,977,000**	**1,977,000**
Resulting Rate Increase Required:				
Total Over Time	**15.0%**	**15.0%**	**16.9%**	**16.9%**
Annually	3.0%	1.5%	3.4%	1.69%

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	1,766,000	1,766,000	1,977,000	1,977,000
Change in Debt Costs	-231,000	-364,000	0	0
Resulting Infrastructure Deficit/Surplus	**1,535,000**	**1,402,000**	**1,977,000**	**1,977,000**
Resulting Rate Increase Required:				
Total Over Time	**12.4%**	**12.0%**	**16.9%**	**16.9%**
Annually	2.5%	1.2%	3.4%	1.69%

Considering all of the above information, we recommend the 5 year option in table 6b that includes the reallocations for sanitary services and the 10 year option for water services. This involves full funding being achieved over 5 years and 10 years by:

a) when realized, reallocating the debt cost reductions of $231,000 for sanitary services to the applicable infrastructure deficit.
b) increasing rate revenues by 2.5% for sanitary 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.
c) increasing rate revenues by 1.69% for water services each year for the next 10 years solely for the purpose of phasing in full funding to the asset categories covered in this section of the AMP.
d) ensuring that any surpluses experienced are allocated to the appropriate reserves.
e) increasing existing and future infrastructure budgets by the applicable inflation index on an annual basis in addition to the changes recommended above.

Although this option achieves full funding on an annual basis in 5 years for sanitary services and 10 years for water service 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 $66,724,000 for sanitary services and $23,959,000 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%
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:

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

Historical Prime Business Interest Rate
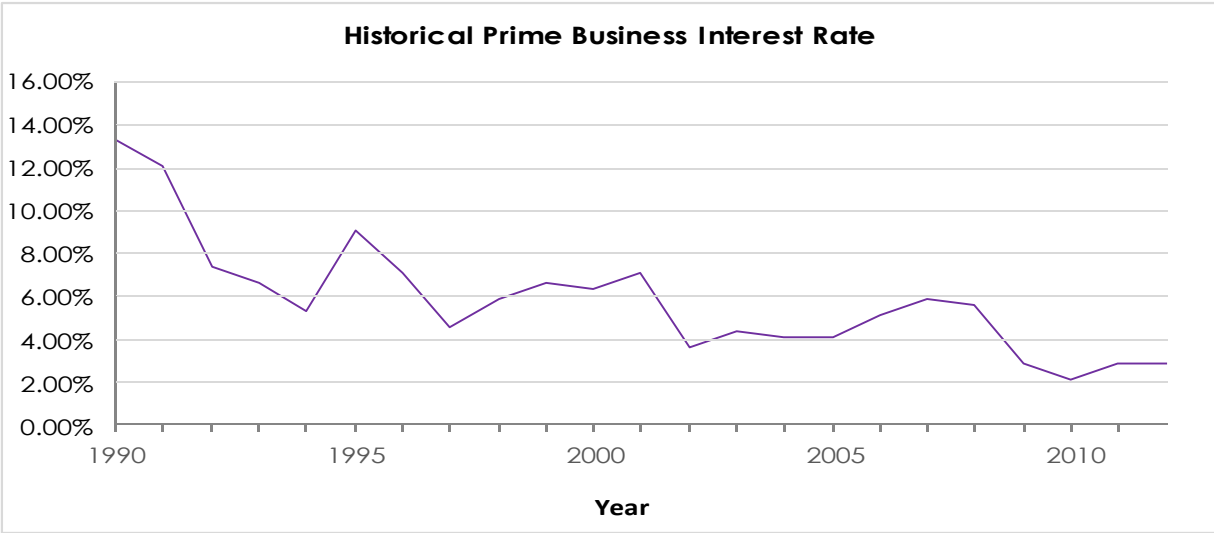
As illustrated in table 7, a change in 15 year rates from 3% to 6% would change the premium from 26% to 54%. Such a change would have a significant impact on a financial plan.

Tables 8 and 9 outline how Niagara Falls has historically used debt for investing in the asset categories as listed. There is currently $14,745,000 of debt outstanding for the assets covered by this AMP. In terms of overall debt capacity, Niagara Falls currently has $67,526,000 of total outstanding debt and $8,129,000 of total annual principal and interest payment commitments. These principal and interest payments are well within its provincially prescribed annual maximum of $28,217,000.

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	2,649,000	700,000	0	0	0	0
Bridges & Culverts	0	0	0	0	0	0
Storm Sewers	1,918,000	0	1,797,000	0	0	0
Total Tax Funded	4,567,000	700,000	1,797,000	0	0	0
Sanitary Sewer Network	10,178,000	0	11,974,000	0	0	0
Water Network	0	0	0	0	0	0
Total rate Funded	10,178,000	0	11,974,000	0	0	0
Total AMP Debt	14,745,000	700,000	13,771,000	0	0	0
Non AMP Debt	52,781,000	2,260,000	34,972,000	3,776,000	0	3,300,000
Overall Total	**67,526,000**	**2,960,000**	**48,743,000**	**3,776,000**	**0**	**3,300,000**

Table 9. Overview of Debt Costs					
	Principal & Interest Payments in the Next Five Years				
Asset Category	2013	2014	2015	2016	2017
Road Network	1,153,000	913,000	561,000	561,000	55,000
Bridges & Culverts	0	0	0	0	0
Storm Sewer Network	426,000	427,000	428,000	429,000	247,000
Total Tax Funded	1,579,000	1,340,000	989,000	990,000	302,000
Sanitary Sewer Network	1,068,000	1,044,000	1,014,000	989,000	963,000
Water Network	0	0	0	0	0
Total Rate Funded	1,068,000	1,044,000	1,014,000	989,000	963,000
Total Amp Debt	2,647,000	2,383,000	2,003,000	1,979,000	1,265,000
Non Amp Debt	5,783,000	5,745,000	5,585,000	5,405,000	4,805,000
Overall Total	**8,430,000**	**8,129,000**	**7,588,000**	**7,384,000**	**6,070,000**

The revenue options outlined in this plan allow Niagara Falls 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 Niagara Falls.

Table 10. Summary of Reserves Available	
Asset Category	Balance at December 31, 2013
Road Network	696,000
Bridges	0
Storm Sewers	369,000
Total Tax Funded	**1,065,000**
Water Network	6,833,000
Sanitary Sewer Network	3,707,000
Total Rate Funded	**10,540,000**

There is considerable debate in the municipal sector as to the appropriate level of reserves that a city 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 Niagara Falls' 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 Niagara Falls 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, unadjusted star rating) **x** *(% of total replacement value)*

3. "Overall Rating"

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

Grade Cuttoffs

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

1. Condition vs. Performance

Total category replacement value	$350,548,031		Segment replacement value	$67,163,597		Segment value as a % of total category replacement value	19.2%
Segment	Condition	Letter grade	Star rating	Quantities (m2) in given condition	% of Assets in given condition	Weighted, unadjusted star rating	Segment adjusted star rating
Sidewalk	Excellent	A	5	25,539	3%	0.17	
	Good	B	4	57,066	8%	0.31	
	Fair	C	3	102,585	14%	0.41	0.3
	Poor	D	2	66,872	9%	0.18	
	Critical	F	1	494,199	66%	0.66	
			Totals	**746,261**	**100%**	**1.73**	

Total category replacement value	$350,548,031		Segment replacement value	$283,384,434		Segment value as a % of total category replacement value	80.8%
Segment	Condition	Letter grade	Star rating	Quantities (m2) given condition	% of Assets in given condition	Weighted, unadjusted star rating	Segment adjusted star rating
Road Base, Road Top, Road Granular Sub-Base	Excellent	A	5	2,026,031	17%	0.83	
	Good	B	4	4,272,912	35%	1.40	
	Fair	C	3	3,730,571	31%	0.92	2.8
	Poor	D	2	1,675,899	14%	0.28	
	Critical	F	1	479,773	4%	0.04	
			Totals	**12,185,186**	**100%**	**3.47**	

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

2. Funding vs. Need

Average annual investment required	2013 funding available	Funding percentage	Deficit			Category star rating	Category letter grade
$13,296,000	$2,779,000	20.9%	$10,517,000			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**

1. Condition vs. Performance

Total category replacement value	$94,631,462			Segment replacement value	$94,631,462		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	18	8%	0.41	
	Good	B	4	141	64%	2.54	
	Fair	C	3	31	14%	0.42	3.6
	Poor	D	2	29	13%	0.26	
	Critical	F	1	3	1%	0.01	
			Totals	**222**	**100%**	**3.64**	

	Category star rating	Category letter grade
	3.6	**C+**

2. Funding vs. Need

Average annual investment required	2013 funding available	Funding percentage	Deficit			Category star rating	Category letter grade
$1,689,000	$1,539,000	91.1%	$150,000			4.9	**A**

3. Overall Rating

Condition vs Performance star rating	Funding vs. Need star rating	Average star rating	Overall letter grade
3.6	4.9	4.2	**B**

1. Condition vs. Performance

| Total category replacement value | $198,611,674 | | Segment replacement value | $198,611,674 | | Segment value as a % of total category replacement value | 100.0% |

Segment	Condition	Letter grade	Star rating	Quantities (m) given condition	% of Assets in given condition	Weighted, unadjusted star rating	Segment adjusted star rating
Mains	Excellent	A	5	285,502	65%	3.23	
	Good	B	4	12,759	3%	0.12	
	Fair	C	3	74,301	17%	0.51	4.1
	Poor	D	2	36,179	8%	0.16	
	Critical	F	1	32,619	7%	0.07	
			Totals	**441,359**	**100%**	**4.09**	

	Category star rating	Category letter grade
	4.1	**B**

2. Funding vs. Need

Average annual investment required	2013 funding available	Funding percentage	Deficit			Category star rating	Category letter grade
$6,077,000	$4,100,000	67.5%	$1,977,000				
						2.9	**C**

3. Overall Rating

Condition vs Performance star rating	Funding vs. Need star rating	Average star rating	Overall letter grade
4.1	2.9		
		3.5	**C**

1. Condition vs. Performance

Total category replacement value	$454,036,421			Segment replacement value	$422,194,372		Segment value as a % of total category replacement value	**93.0%**

Segment	Condition	Letter grade	Star rating	Quantity (m) in given condition	% of Assets in given condition	Weighted, unadjusted star rating	Segment adjusted star rating
Sanitary Mains, Combined Sewers and Sanitary Laterals	Excellent	A	5	19,607	3%	0.17	
	Good	B	4	117,642	21%	0.83	
	Fair	C	3	133,924	24%	0.71	**2.4**
	Poor	D	2	185,456	33%	0.66	
	Critical	F	1	107,009	19%	0.19	
			Totals	**563,638**	**100%**	**2.57**	

Total category replacement value	$454,036,421			Segment replacement value	$31,842,049		Segment value as a % of total category replacement value	**7.0%**

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	$29,647,295	93%	4.66	
	Good	B	4	$0	0%	0.00	
	Fair	C	3	$143,581	0%	0.01	**0.3**
	Poor	D	2	$0	0%	0.00	
	Critical	F	1	$2,051,173	6%	0.06	
			Totals	**$31,842,049**	**100%**	**4.73**	

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

2. Funding vs. Need

Average annual investment required	2013 funding available	Funding percentage	Deficit			Category star rating	Category letter grade
$6,496,000	$4,730,000	72.8%	$1,766,000				
						2.9	**C**

3. Overall Rating

Condition vs Performance star rating	Funding vs. Need star rating	Average star rating	Overall letter grade
2.7	2.9		
		2.8	**D+**

Storm Niagara Falls

1. Condition vs. Performance

Total category replacement value	$453,299,398		Segment replacement value	$453,299,398		Segment value as a % of total category replacement value	100.0%

Segment	Condition	Letter grade	Star rating	Quantities (m) given condition	% of Assets in given condition	Weighted, unadjusted star rating	Segment adjusted star rating
Catchbasin Lead, Storm Lateral & Mains	Excellent	A	5	145,963	21%	1.06	
	Good	B	4	215,642	31%	1.25	
	Fair	C	3	195,472	28%	0.85	3.5
	Poor	D	2	73,395	11%	0.21	
	Critical	F	1	58,690	9%	0.09	
			Totals	**689,162**	**100%**	**3.46**	

	Category star rating	Category letter grade
	3.5	**C**

2. Funding vs. Need

Average annual investment required	2013 funding available	Funding percentage	Deficit			Category star rating	Category letter grade
$6,387,000	$2,004,000	31.4%	$4,383,000			1.0	**F**

3. Overall Rating

Condition vs Performance star rating	Funding vs. Need star rating	Average star rating	Overall letter grade
3.5	1.0	2.2	**D**

Infrastructure Replacement Cost Per Household
Total: $51,747 per household (excludes gravel)

Road Network
Total Replacement Cost: $364,194,367
Cost Per Household: $10,347

Sidewalk
Total Replacement Cost: $67,163,597
Cost Per Household: $1,908

Sanitary Sewer
Total Replacement Cost: $491,178,957
Cost Per Household: $13,954

Storm Sewer Network
Total Replacement Cost: $507,483,928
Cost Per Household: $14,418

Water Network
Total Replacement Cost: $296,807,895
Cost Per Household: $8,432

Bridges & Culverts
Total Replacement Cost: $94,631,462
Cost Per Household: $2,688

Daily Investment Required Per Household for Infrastructure Sustainability

Daily infrastructure investment: **$2.15**

Daily cup of coffee: **$1.56**

Road Network: $1.03
Bridges & Culverts: $0.13
Water Network: $0.47
Sanitary Sewer Network: $0.51
Storm Sewer Network: $0.50