CITY OF CORNWALL

ASSET MANAGEMENT PLAN

November 2016 | Version 2.0

Cornwall
ONTARIO CANADA

City of Cornwall Asset Management Plan (AMP)

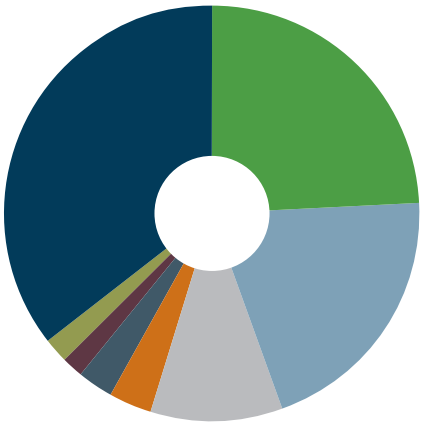
VERSION 2.0 – NOVEMBER 2016

The City of Cornwall updated and expanded its AMP to include all City-owned capital assets including for the first time its buildings and fleet assets. The AMP is based on the Ministry of Infrastructure of Ontario's *Building Together: Guide for Municipal Asset Management Plans (2012)*. The AMP will guide the City as it manages its assets between 2016 and 2025.

This infographic provides a summary level overview of the AMP and its key components. Residents and interested parties are invited to visit the City's website, **www.cornwall.ca** to download a copy of the complete AMP document.

2016 ESTIMATED REPLACEMENT VALUE

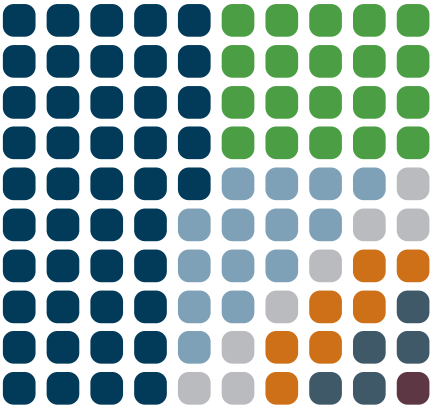
$1.3B



- **35.8%** Buildings & Process Equipment
- **24.2%** Sewer
- **20.2%** Roads
- **10.2%** Water
- **3.4%** Bridges, Culvert & Small Culverts
- **2.8%** Sidewalks & Recreational Paths
- **1.7%** Traffic Signals & Street Lights
- **1.7%** Fleet

CURRENT ASSET BACKLOG

- **44.7%** Water
- **20.0%** Buildings & Process Equipment
- **13.7%** Roads
- **8.6%** Fleet
- **7.3%** Sewer
- **4.7%** Sidewalks & Recreational Paths
- **0.6%** Traffic Signals & Street Lights
- **0.4%** Bridges, Culvert & Small Culverts



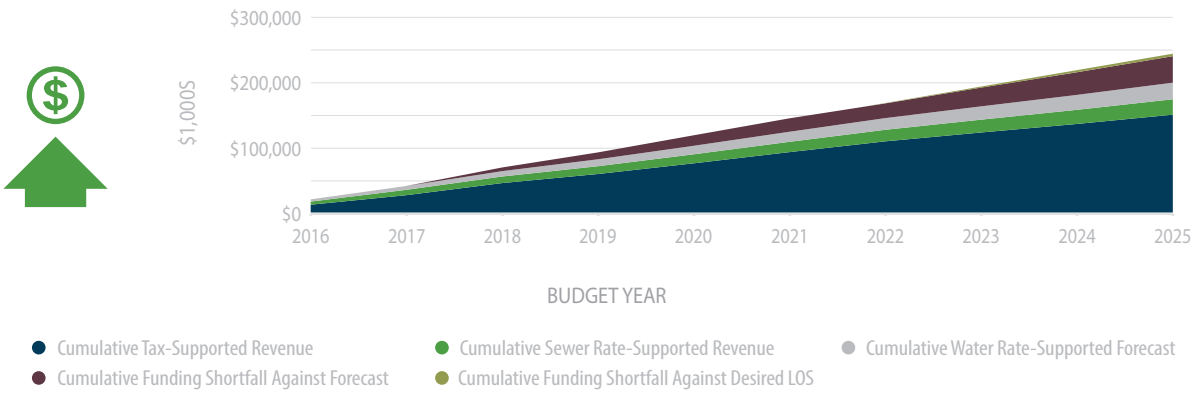
$92M

LEVELS OF SERVICE

The table below provides the desired Levels of Service (LOS) for each asset class included in the AMP, as well as the annual capital need required to achieve the LOS by 2025.

Asset Class	Desired LOS	Annual Capital Need
Buildings	Portfolio-wide 1-Year Facility Condition Index of 5%	$900,000
Roads & Sidewalks	Maintain an average Pavement Condition Rating of 70	$4,000,000
Recreational Paths	Renew recreational paths that are at or within 5 years of the remaining service life	$165,000
Bridges, Large Culverts & Small Culverts	Address the issues identified in the 2015 OSIM inspection report for Bridges and Large Culverts Invest 2% of the replacement value of small culverts into asset renewal	$830,000
Traffic Signals & Street Lights	Replace traffic signals at two intersections each year and replace all remaining non-LED Street Lights	$315,000
Fleet	All Emergency Service Vehicles will be within the Expected Service Life (ESL) No more than 20% of the Standard Service Vehicles will exceed their ESL	$2,250,000
Sewer	Renew pipes that have a Sewer Condition Rating of 4 (Poor) or 5 (Very Poor)	$2,150,000
Water	Renew pipes that have a Watermain Performance Index of less than 20 (Poor) within 20 years	$3,120,000
Total		**$13,730,000**

REVENUE & FUNDING SHORTFALL FORECAST



NEXT STEPS & IMPROVEMENT INITIATIVES

The City will update this AMP Infographic annually starting in 2017. The full AMP document will undergo an update no later than 2021, and will be extended to an updated 10-year planning horizon.

The following areas for improvement to the City's asset management processes were identified and will be reviewed and integrated where possible by the City during the implementation of the AMP:

- Finalize the City's Asset Management Strategy;
- Continued improvement of asset management training for City staff;
- Expanded integration of risk management considerations into the prioritization and decision making processes;
- Engage residents in the development of updated desired Levels of Service.

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1 INTRODUCTION AND PLAN OVERVIEW

1.1 PURPOSE, PLAN SCOPE AND TIMEFRAME

Facility Condition Assessment Portfolio eXperts Ontario Ltd. (FCAPX) was retained by the City of Cornwall (City) to develop an Asset Management Plan (AMP). In addition to its use for managing the assets, the AMP will also be used for the City's eligibility for provincial funding such as the Municipal Infrastructure Investment Initiative (MIII) program and other senior-level of government infrastructure funding programs that are available in the future. The AMP has been developed for years 2016 to 2025.

Eligibility rules for provincial funding indicate that municipalities must prepare an AMP to ensure that the funds provided by the Province are spent in a cost-effective manner. Municipalities must also prove, in their submission, that they have acquired suitable asset management tools that will assist staff in managing infrastructure assets in the future. Use of these tools and systems will identify priorities for capital investment, which will allow the City to continue to provide an appropriate Level of Service (LOS) to its residents and create a solid foundation for achieving the City's long-term vision.

The Ministry of Infrastructure of Ontario has recognized that public infrastructure is vital to prosperity and the quality of life, as municipalities deliver services that are critical to the public. Many of these services rely on well planned and maintained infrastructure. All levels of government understand also that they have an obligation to address the ever-increasing infrastructure challenges, to ensure that they can continue providing an appropriate LOS to tax payers.

In an effort to commence addressing these challenges, the Ministry has initiated a program and plan called *Building Together: Guide for Municipal Asset Management Plans (2012)*. This program is meant to assist municipalities in developing a municipal infrastructure strategy. This strategy provides an opportunity for municipalities to address current and emerging infrastructure challenges.

Asset management planning is the process of making the best possible decisions regarding the building, operating, maintaining, renewing, replacing and disposing of infrastructure assets. The objective is to maximize benefits, manage risk, and provide satisfactory levels of service to the public in a sustainable manner. Asset management requires a thorough understanding of the characteristics and condition

of infrastructure assets, as well as the service levels expected from them. It also involves setting strategic priorities to optimize decision-making about when and how to proceed with investments. Finally, it requires the development of a financial plan, which is the most critical step in putting the plan into action.

One of the main components of the strategy is to improve the current municipal infrastructure asset management practices. The first step for municipalities is to develop an AMP. The province has indicated that municipalities seeking provincial infrastructure funding must demonstrate that they have or are in the process of developing an AMP and how its proposed project funding requests fit within a detailed AMP. The AMP should not only address the current needs in infrastructure, but should also identify future needs through short and long-term financing strategies.

The AMP will assist the City in making the best possible decisions regarding the building, operating, maintaining, renewing, replacing and disposing of infrastructure assets. The intent of the plan is to make the best use of the funds available while managing risk and continuing to provide appropriate LOS to the public.

This plan represents an update of the 2014 City AMP, which addressed linear assets only, and has been expanded to also include Buildings and Fleet assets owned and managed by the City.

1.2 LIST OF ACRONYMS

FCAPX is pleased to provide the following list of acronyms that have been used throughout the AMP in Table 1 below.

Additionally, a Glossary of Terms providing definitions of terms used throughout the AMP document has been included in **Appendix A**.

Table 1 - List of Acronyms	
AMP – Asset Management Plan	**km** – kilometres
AODA - Accessibility for Ontarians with Disabilities Act	**LCA** – Lifecycle Cost Analysis
BCA – Building Condition Assessments	**LED** – Light Emitting Diode
BCI – Bridge Condition Index	**LOS** - Level(s) of Service
BSI PAS 55 – British Standards Institute Publicly Available Specification	**MIII** - Municipal Infrastructure Investment Initiative
CAMS – Capital Asset Management System	**MVP** – Multivariable Prioritization
CCTV - Closed-Circuit Television	**N/A** – Not applicable
CMMS - Computerized Maintenance Management System	**OCWA** – Ontario Clean Water Agency
CRV – Current Replacement Value	**OPC** – Opinion of Probable Cost
City – The City of Cornwall	**OSIM** – Ontario Structure Inspection Manual
ERV – Emergency Response Vehicle	**PB** – Potential for Blockage
ESL – Expected Service Life	**PCR** – Pavement Condition Rating
EUL – Expected Useful Life	**PACP** - Pipeline Assessment and Certification Program
FCAPX – Facility Condition Assessment Portfolio Experts Ontario Ltd.	**PM Program** – Preventative Maintenance Program
FCI – Facility Condition Index	**PMS** – Pavement Management System
GASB - Government Accounting Standards Board	**RSL** – Remaining Service Life
GIS – Geographic Information System	RUL – Remaining Useful Life
HVAC – Heating, Ventilation and Air Conditioning	**SC** – Structural Condition
Infraguide - National Guide to Sustainable Municipal Infrastructure (2002)	**SSV** – Service Support Vehicle
	TCA – Tangible Capital Asset
	UL – Useful Life
	WPI – Watermain Performance Indicator
	WPP – Water Purification Plant
	WWTP – Wastewater Treatment Plant

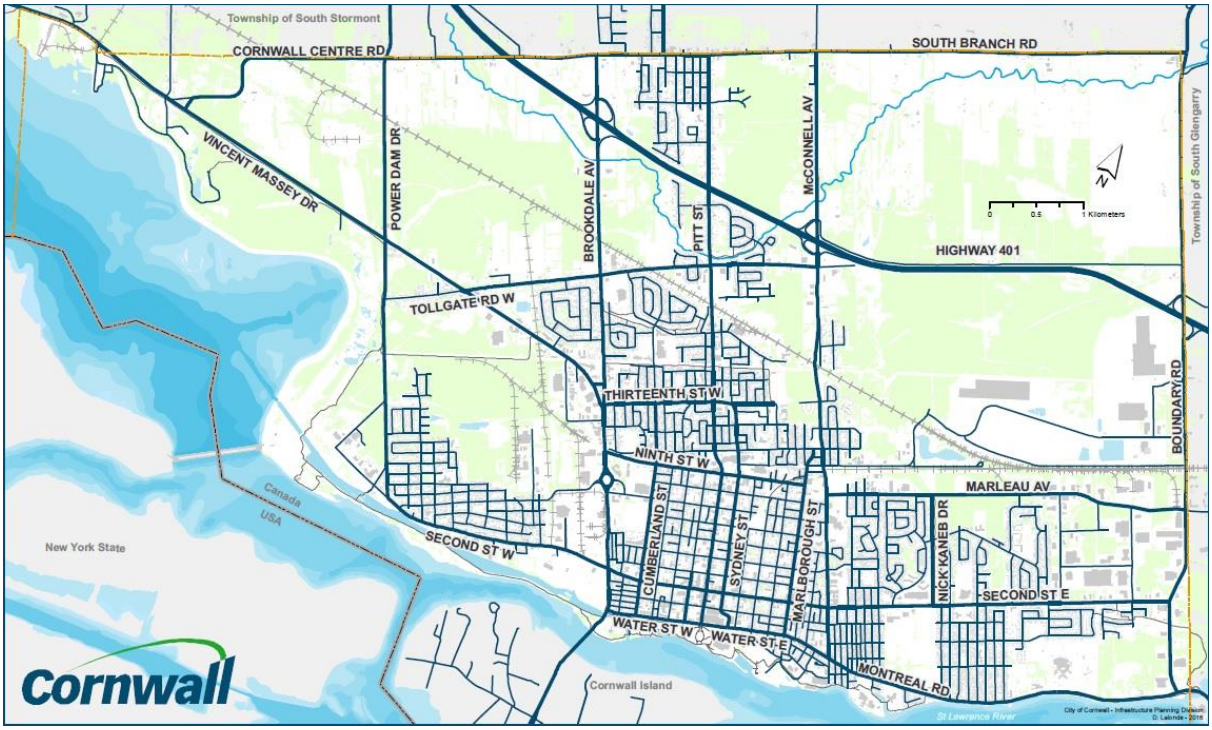
1.3 THE CITY OF CORNWALL

The City is located in eastern Ontario and is the seat of the United Counties of Stormont, Dundas and Glengarry. Cornwall is Ontario's easternmost city. It is located on the St. Lawrence River, in the Quebec City–Windsor Corridor along Ontario Highway 401 and is the urban centre for surrounding communities, including Long Sault and Ingleside to the west, Akwesasne to the south, St. Andrew's and Avonmore to the north, and Glen Walter, Martintown, Williamstown, and Lancaster to the east.

Cornwall lies on the 45th parallel, approximately 100 km southeast of Ottawa, the Nation's Capital. Cornwall has a population of approximately 47,000 and covers a land area of just over 60 km^2. The City Council is governed by an elected eleven-member municipal government composed of the Mayor and 10 Councillors representing the City as a whole.

Figure 1 - Eastern Ontario Regional Map

Figure 2 - Map of Cornwall



1.4 ALIGNMENT WITH CORPORATE VISION & OBJECTIVES

Asset Management and the approaches and processes outlined in this Asset Management Plan (AMP) are critical to supporting the City's Mission, Vision and Values as presented below.

Mission

The City of Cornwall provides relevant and inclusive municipal services and programs in partnership with our community

Vision

Proud of our heritage and focused on our future Cornwall strives to be the progressive, sustainable city of choice along the St. Lawrence River in Eastern Ontario

Values

Accessibility, Bilingualism, Collaboration, Inclusiveness, Innovation, Integrity, Leadership, Transparency and Respect

Within the City's Strategic Plan (below), Asset Management underpins each of the 4 pillars, and many of the specific goals outlined throughout the plan.

Figure 3 - City of Cornwall Strategic Plan

Cornwall ONTARIO CANADA

2016-2018 STRATEGIC PLAN

MISSION: The City of Cornwall provides relevant and inclusive municipal services and programs in partnership with our community

VISION: Proud of our heritage and focused on our future Cornwall strives to be the progressive, sustainable city of choice along the St. Lawrence River in Eastern Ontario

VALUES: Accessibility, Bilingualism, Collaboration, Inclusiveness, Innovation, Integrity, Leadership, Transparency and Respect

PILLAR 1 Quality of Life	PILLAR 2 Economic & Financial	PILLAR 3 Environment	PILLAR 4 Governance & Administration
A. Safe, Livable Community i. Continue support for police strategic plan ii. Implement fire master plan iii. Property standards **B. Active Living** i. Continue implementation of bike and pedestrian master plan ii. Enhance public spaces iii. Enhance transit services **C. Arts & Culture** i. Development of multidisciplinary facility/art centre **D. Quality Downtown & Le Village Main Streets** i. Continue to encourage development of Centretown plan **E. Accessible & Affordable Housing** i. Implementation of affordable housing plan **F. Seniors' Services** i. Development and alignment of programs and activities **G. Poverty Reduction** i. Develop advocacy strategy ii. Support primary service providers **H. Waterfront Master Plan** i. Reaffirm and continue implementation of waterfront master plan ii. Enable recreational usage iii. Future waterfront development	**A. Economic Development** i. Business attraction and development strategy ii. Continue youth engagement and retention strategy iii. Encourage labour force participation iv. Continue services for immigrants/new residents v. Increase access to postsecondary education vi. Complete tourism strategy (including events and festivals) vii. Complete marketing and communications strategy [cont. Community engagement strategy] viii. Continue to increase partnership opportunities to advance regional economic growth ix. Develop long term financial plan x. Continue diversification strategy **B. Waterfront Master Plan** i. Support private waterfront development outside Lamoureux Park ii. Develop acquisition strategy iii. Develop canal lands use strategy **C. Infrastructure Strategy** i. Infill & Brownfield redevelopment strategy ii. Complete development charges and financing strategies iii. Expansion of infrastructure for development iv. Continue to develop accessible infrastructure plan (e.g. bus stops, curbs) v. Building and property acquisition strategy vi. Continue linear asset management, energy efficiency plan, and develop building asset management	**A. Water & Waste** i. Review solid waste master plan ii. Urban water strategy iii. Develop key performance indicators **B. Climate** i. Prepare climate action initiatives ii. Promote local food iii. Urban tree strategy iv. Infill & Brownfield redevelopment strategy **C. Waterfront** i. Preservation ii. Protection iii. Support sediment strategy and remedial action plan	**A. Corporate Culture (Our People)** i. Investigate new tools for performance appraisals and succession planning ii. Continue operational review iii. Ongoing bilingual review iv. Develop community-minded leaders v. Culture of continuous innovation **B. Governance Model** i. Define roles and responsibilities ii. Review budget development process iii. Develop a culture of continuous innovation iv. Transparency and accountability v. Code of conduct vi. Policy review vii. Centrally organized archive system viii. KPIs **C. Community Engagement** i. Develop engagement strategy for consultation on key issues ii. Customer service and complaint tracking iii. Self-promotion and communications

Additionally, looking to the future, the City's Official Plan presents the 20-Year vision for Cornwall as follows:

The City is a vibrant, friendly, culturally inclusive community, with a high quality of life for people of all ages. It is a clean and beautiful city which people are proud of and proud to be from. The city has maintained its mix of urban and rural areas and serves as a hub for the surrounding counties and a key point of connectivity within Ontario. The City is viewed as a tourist destination and has a positive image tied to its distinct heritage and identity, 'destination waterfront', responsible environmental stewardship, robust culture, and thriving economy.

Residents of the City enjoy living in this evolving community and benefit from the pattern of good community planning. Cornwall's Official Plan promotes economic development and knowledge, which drives prosperity, promotes educational opportunities, generates wealth, and supports infrastructure. The City has an lively, pedestrian-friendly downtown and its safe neighbourhoods are liveable, accessible, reflect the strategic development and redevelopment that has taken place and are well connected to each other and to community amenities.

The Official Plan presented a series of Strategic Directions that would support the City in achieving its 20-Year Vision. Many of the Strategic Directions are directly related to Asset Management and will only be achieved through on-going and enhanced asset management as follows:

- Foster a beautiful, vibrant**,** and environmentally sound waterfront, achieved through strategic enhancements;
- Support redevelopment and enhancement of derelict and run-down residential areas/buildings;
- Support redevelopment of brownfield sites with particular emphasis on the former Domtar and Courtaulds Sites;
- Protect and rehabilitate heritage buildings;
- Maintain and enhance the multi-use trails network;
- Ensure new developments fit well with older buildings and the existing character of the community;
- Improve the connectivity of the downtown road network;
- Increase accessibility of Cornwall for people of all ages and abilities;
- Celebrate cultural diversity and increase intercultural exchanges; and
- Invest in infrastructure to enhance resilience to climate change impacts.

The key aspects of the strategic documents listed above were continually referenced as a cornerstone of the AMP.

1.5 Significance of Municipal Infrastructure

The majority of public infrastructure in Canada is the responsibility of municipal government and the importance of these assets is often taken for granted. It is recognized that many of these assets are hidden and knowledge of the features and functions may not be well understood. Adequate municipal infrastructure such as roads, bridges, and watermains and sewer pipes are essential to economic development, citizen safety, and quality of life. Well maintained infrastructure is also critical in sustaining a municipality as an attractive place to live and do business.

The recent *Canadian Infrastructure Report Card (2012)*, which addresses municipal roads and water systems, stated that approximately 30% of municipal infrastructure is in "fair" to "very poor" condition across Canada. The replacement value of these assets alone totals over $170 billion. In order to maintain safe and viable communities, municipalities must protect their investment in infrastructure and often must find creative financial solutions to do so. One of the solutions to Canada's infrastructure issues is improved asset management.

The present AMP report, along with the asset management tools delivered to the City will assist staff in making the most cost-effective decisions with regards to rehabilitation or replacement of infrastructure. It will also ensure that the limited funds made available for infrastructure renewal are spent wisely and planned over decades and that staff decisions are supported by sound technical data and analysis.

1.6 Project Team

To ensure that all technical and financial aspects of the plan were addressed, the City included representatives from all relevant departments in the project. The Project Team representatives from the following City departments participated at different phases in the preparation of the plan:

- Infrastructure Planning;
- Environmental Services;
- Municipal Works;
- Shared Services;
- Fire Services;

- Recreation Services;
- Planning and Development;
- Financial Services; and
- Human Resources.

The involvement of key stakeholders will continue in the future to ensure that the plan remains relevant and useful in properly managing the City's assets.

1.7 ASSETS INCLUDED IN THE AMP

This 2016 version of the AMP has been expanded from the 2014 plan to include the following key assets that are owned and managed by the City:

- 95 Buildings (added in 2016 Version);
- 272.1 km of paved Roads, 44.7 km that include Recreational Paths;
- 189 km of Sidewalks;
- 36.3 km of Recreational Paths;
- 135 km of Storm Sewer;
- 196 km of Sanitary Sewer;
- 62 km of Combined Sewer;
- 278.9 km of Watermain;
- 12 Bridges, 13 Culverts and 88 Small Culverts (less than 3 m in diameter);
- 68 Traffic Lights;
- 5,127 Street Lights; and
- 202 Fleet Assets (added in 2016 Version).

Detailed information about the linear and point assets can be found in the City's GIS system which was the main source of information for this project. Detailed information on the Buildings included in the AMP is housed within the consolidated Excel worksheet developed during the Building Condition Assessments (BCAs) completed for the City. Details of the City's Fleet Assets are managed through the Tangible Capital Asset (TCA) worksheet maintained by Financial Services.

This information was used as input in the asset management tools delivered to the City to assist them in updating the AMP in the future. It is important to understand that the AMP is a dynamic plan and it will need to be updated as infrastructure is maintained and rehabilitated. The condition of the assets will also need to be reviewed as the assets continue to deteriorate and are renewed over time.

1.8 Discussion of Mega Trends

As outlined in *Building Our Tomorrow: The Future of Ontario's Infrastructure* and highlighted in the article *The Future of Infrastructure in Ontario's Municipalities* from Municipal Monitor, Q4, 2015, there are a number of global and macro-economic mega trends that will have a major impact on Municipal Asset Management in the future. Given the long-term nature of infrastructure investments, it is critical that we don't build tomorrow's infrastructure with a myopic view of today's needs.

It is important that as part of the implementation and evolution of this AMP these trends are considered as the City selects the specific projects that will be undertaken. Some of the key mega trends that may impact the City include:

- Continued Aging of Infrastructure;
- Aging Demographic Trends;
- Urbanization;
- Globalization and Productivity;
- Changing Economy and Workplaces;
- New Political and Fiscal Currents;
- Impacts of Climate Change;
- Impact of Increased Cost of Debt;
- Evolving Asset Financing/Funding Responsibilities between Levels of Government;
- Scope and Pace of Technological Change;
- Demand for Energy and Conservation Measures; and
- Re-engineered Road-Intersections, Cycling, Pedestrian and Parking Arrangements.

The actual impact of any of these trends, as well as the timing of the impacts cannot be accurately determined. Additionally, many of the strategies to address these issues will be driven by Senior Levels of Government. However, it is recommended that the City consider these issues, and others that will arise over time, when making critical infrastructure decisions and to integrate flexibility and resiliency in design features.

1.9 AMP Limitations

The AMP is a tool, which is meant to be used to inform decision making. The results of our analysis are mostly based on physical and some functional characteristics of the infrastructure assets. It does not consider factors such as climate change or future development. In addition, triple bottom line considerations

should also be taken into account in planning capital investments. That is, decisions are not made purely based on an economic basis, but also on environmental and social factors. One of the challenges to this approach is financially quantifying and measuring social and environmental factors. The AMP should provide a foundation on which those decisions are made. Life cycle analysis can also be a useful method for comparing various options and establishing priorities.

It should also be understood that the usefulness of the AMP is directly related to the quality of data used in its analysis. Both the City Staff and FCAPX Team involved in the project were committed to data accuracy, yet some assumptions had to be made where noted herein. As a whole, the AMP provides an acceptable level of detail for planning the City's current and future infrastructure needs.

2 PROJECT METHODOLOGY

The general methodology we have adopted has been to follow the best practices from the *National Guide to Sustainable Municipal Infrastructure (2002)*, also known as the *InfraGuide*. The approach is described in five steps and was designed to help asset managers assess the LOS currently provided by their tangible assets. It allows asset managers to make fact-supported infrastructure investment decisions, while maximizing the effectiveness of available funds. In developing an AMP for the City, each of the five steps and their key elements were addressed. Each step is described in detail in the sections below.

1. **Infrastructure Data Inventory - *What infrastructure do you own?***
   - Analysis of existing data and optimization of data sources;
   - Transfer of physical characteristic information into databases;
   - Document inventory of all assets; and
   - Upload of information into graphical interface tools such as a Geographic Information System (GIS).

2. **Replacement Costs - *What is it worth?***
   - Define bench-marking unit prices for replacement;
   - Calculate replacement costs of all assets; and
   - Input information in analytical tools.

3. **Condition Assessment - *What is its condition and remaining service life?***
   - Review of condition assessment data;
   - Transfer of condition data to analytical tools;
   - Computing condition assessment indices where appropriate;
   - Statistical analysis of defects to assess life expectancy;
   - Determination of service life of all infrastructure assets; and
   - Comparison with industry standards and definition of an acceptable LOS.

4. **State of Local Infrastructure Analysis - *What needs to be done to rehabilitate, replace, operate and maintain these assets?***
   - Upload condition data in asset management tools and process information;
   - Review the effect of different repair alternatives;
   - Consideration of lifecycle costs and extension of service life; and
   - Determine financial requirements to address needs identified.

5. **Asset Management Strategy - *What should be done first and how much will it cost?***
   - Consideration of selected "what if" expenditure scenarios; and
   - Production of a prioritized short and long-term AMP.

The final part of this report which could be incorporated as an additional question to the list above is "How will you fund your plan?" To answer that question, we have reviewed a variety of funding strategies which could be implemented to address the needs of all assets while maintaining an acceptable LOS for the residents.

As described in the best practice document in the InfraGuide, LOS fall into two broad categories: those that are mandated by regulations (codes, standards, etc.) and those that result from community plans or objectives.

The LOS is established based on the unique criteria of the various linear infrastructure components. In this way, the defined LOS can be measured against performance criteria including, but not limited to: quality; quantity; reliability; responsiveness; environmental acceptability and life cycle cost.

Additional information regarding asset-specific methodologies is presented in Sections 4 through 7 of the AMP.

3 DESIRED LEVELS OF SERVICE

3.1 MANDATED LEVELS OF SERVICE

Regulations exist to ensure the health and safety of the users of public facilities or the products delivered by a utility to the public. These regulations are enforced through codes, standards, or guidelines adopted by government authorities.

The most common regulations that apply to infrastructure include:

- Ontario Structure Inspection Manual (OSIM);
- Minimum Maintenance Standards;
- Provincial Drinking Water Guidelines;
- Ontario Building Code; and
- Provincial Fire Code.

This list is not comprehensive and the managers of infrastructure need to be fully familiar with the regulations that apply to public facilities.

3.2 ENGAGING THE COMMUNITY

Detailed LOS targets from residents have not been acquired for this AMP and are based on internal consensus. The City has engaged the community for specific initiatives, where residents appear satisfied with the current LOS.

3.3 COMMUNITY GOALS & OBJECTIVES

Many communities have developed objectives on the expected quality of life in their community and a vision for the future. These are established either through a structured process (such as a comprehensive community plan) or by other means. The objectives and vision usually include elements of health and safety, social well-being, economic and cultural development and other factors. Community objectives rely heavily on the ability of the existing infrastructure to support such plans. In many instances, the objectives call for new infrastructure that the community will have to operate and maintain for generations.

The *InfraGuide* describes the steps required to successfully establish a community's LOS. The key elements that relate to the development of LOS as described in the *InfraGuide* best practice are illustrated in **Figure 4.**

Figure 4 - Levels of Services (Infraguide 2002)

Asset understanding refers to the knowledge about the inventory, condition and performance of infrastructure that provide the community its services: potable water, wastewater collection and treatment, solid waste management, roads and bridges, community buildings, etc. This information is provided by the AMP and is used to ensure existing and planned infrastructure can support the LOS established.

Consultation and communication are important elements of developing community LOS. Key stakeholders must be involved; including community leaders, operators of the assets, education and health professionals and other levels of government officials. The consultations should be properly managed to avoid creating a "wish list" as consultations have a tendency to raise expectations amongst those involved. Instead, the consultation process should provide adequate background material and the context and constraints (e.g., financial, environmental, material and human resources, etc.) which face the municipality. This will help the City in determining realistic LOS that the City can achieve and afford.

Levels of service have to be aligned to the *strategic direction* of the community. Appropriate LOS must consider the community's ability and willingness to *tolerate risk*. The costs associated with the LOS need to be established and evaluated in view of the capacity of the community to support them.

Ideally, each community should use this process to define their acceptable LOS. Once determined, all assets would need to be reviewed and compared to the community's expectations. Action plans on remedial measures would have to be developed to close the gap between expectations and reality, if physically and financially possible.

4 BUILDINGS AND PROCESS EQUIPMENT

This section of the AMP will provide asset-specific information on the 95 Buildings, totalling approximately 87,504 sq.m. (945,000 sq.ft.) that are owned and managed by the City as well as the process equipment associated with the Wastewater Treatment Plant (WWTP) and Water Purification Plant (WPP) and their ancillary components.

4.1 ASSET-SPECIFIC METHODOLOGY

4.1.1 General Asset Data Inventory

The City does not utilize a Capital Asset Management System (CAMS) to manage the capital needs of its Building or Process Equipment Assets. A CAMS is a commercial off-the-shelf software that allows building managers to develop detailed capital plans and funding scenarios based on their building data.

Further to the completion of this AMP the City stores general building information on a number of Excel-based spreadsheets, including the documents prepared as part of the 2016 Building Condition Assessment (BCA) process completed by FCAPX.

Information regarding the process equipment at the WWTP and WPP is managed within PM Expert, a Computerized Maintenance Management System (CMMS). PM Expert allows City staff to schedule and report on routine and preventative maintenance activities associated with the on-going operations of the equipment.

4.1.2 Condition Assessment Process

4.1.2.1 Buildings

The BCAs completed by FCAPX in the Summer of 2016 were generally performed in accordance with the requirements of the *ASTM Standard E2018-15: Standard Guide for Property Condition Assessments*.

In addition to the review of available documents and information provided by the City, the BCAs included a visual review of building components/systems based on the Uniformat II building nomenclature system including:

- Substructure (i.e. Foundations, Drainage, Basement Walls);
- Shell (i.e. Structural, Exterior Doors & Windows, Roof);
- Interiors (i.e. Partitions, Interior Doors, Wall, Floor and Ceiling Finishes);
- Services (i.e. Elevators, Plumbing, HVAC, Electrical, Fire Protection); and
- Building Sitework (i.e. Roadways/Parking Lots, Walkways, Retaining Walls/Fences).

Repair, renewal, and upgrade recommendations will be provided for each component.

No destructive testing was completed for any of the observed building systems.

FCAPX provided a streamlined report focused on providing the data to support the development of the AMP. An Opinion of Probable Cost (OPC) table was prepared for each building. The OPC table included asset and system-level narratives as well as capital cost (items with an estimated cost of greater than $3,000) recommendations over a 10-Year evaluation period. It should be noted that soft costs (design, permitting, contingency) were not included in the BCA OPC tables, but were included in the AMP funding forecast for buildings. Additionally, a photo log was provided which documented the observations of the asset and specific components for which recommendations were made.

A consolidated OPC table was prepared for the entire building portfolio. The table included the details of all recommendations over the 10-Year evaluation period, but did not include the summary narratives.

4.1.2.2 Process Equipment

In support of the AMP, the City commissioned a study by the Ontario Clean Water Agency (OCWA) to provide a Gap Analysis for the Capital Needs Assessment of the WPP and the WWTP in the City of Cornwall. The funding forecast included in the AMP was based on the information provided in the OCWA report. No condition assessment of the Process Equipment has been completed at the time of writing the AMP, however, it was a recommendation of the OCWA report.

4.1.3 Expected Useful Life

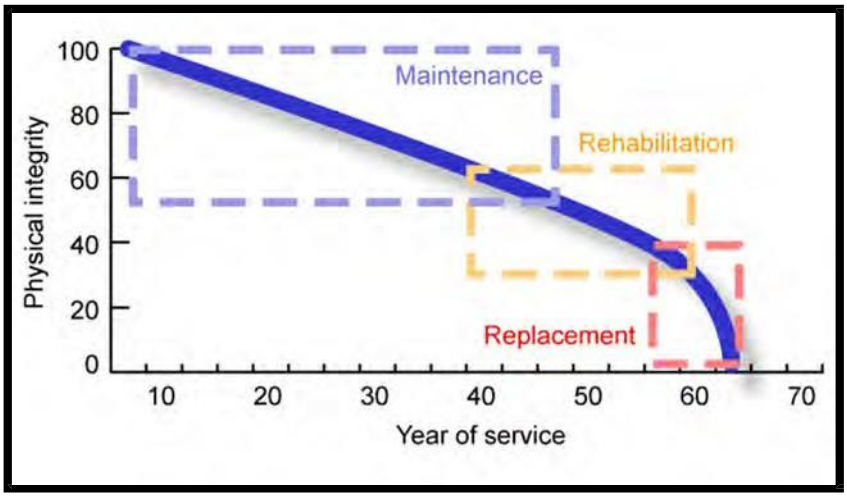
Given the complex nature and the number of components that make up a building, the BCAs utilized expected useful lives (EULs) for the various building components as per the ASTM standard approach, as opposed to assigning a useful life (UL) to the overall building.

The systems observed during the assessment were subdivided into major assets and were assigned a value for their EUL. The values for EUL are based on information provided in manufacturer's literature, industry standards, FCAPX observations of the assets and FCAPX's experience with similar materials and systems in similar locales. Based on the asset's overall reported and/or observed physical condition, an "Equivalent Age" was determined that represents the point within the asset's lifecycle based on the EUL. This is then used to determine the anticipated remaining useful life (RUL) within which to identify capital renewal event timing.

The EUL of assets is a theoretical number that is arrived at with estimation and is a function of the quality of materials used, manufacturing and installation, as well as frequency and intensity of service, the degree of maintenance afforded to the asset, and local weather conditions.

Also, the realization of an asset's EUL does not necessarily constitute its replacement. A detailed condition assessment or investigation may be a more prudent approach which may indicate a need for maintenance or refurbishment only, or may indicate adequate physical condition for an extended period. Risk, including safety or the cost of damage to the site and its use was considered in estimating the schedule for major repairs or replacements.

Figure 5 - Windows of Opportunity for Asset Management



During the BCAs, based on observed deficiencies and information reported by the City staff, the RUL of the component is determined by the site assessor. The RUL determines the year of the recommended repair or replacement. Components that have deficiencies and experience significant reactive maintenance will typically have an RUL less that its EUL. Components that do not have significant observed deficiencies or operational issues identified by City staff, expected for their age, will typically have an RUL that exceeds its EUL.

4.1.4 Current Replacement Value

For the purposes of the AMP, the City employed insurable value calculations utilized by the City during its insurance underwriting as the basis for the Current Replacement Value (CRV) for each building and the water and wastewater process equipment. These values were selected to allow for consistency with other City processes, and across the portfolio.

4.1.5 Asset Condition

4.1.5.1 Buildings

Facility Condition Index (FCI) is the de facto industry standard for benchmarking building condition across a portfolio of buildings.

$$FCI = \frac{\text{Sum of Renewal Needs in a Given Period of Time}}{\text{Current Replacement Value (CRV)}} \quad X100$$

The renewal needs for each building/site is based on the data collected during the BCAs. The CRV were developed from insurable value information as per Section 4.3.1.1.

1-Year FCIs were developed for each building/site. **Table 2** provides the Condition Rating (CR) based on ranges for 1-Year and 5-Year FCIs. For the purposes of the discussion of current asset condition, the City will use 5-Year FCI as the benchmark.

Table 2 - FCI Condition Rating		
1-Year FCI	**5-Year FCI**	**Condition Rating**
0 to 5%	0 to 10%	Good
>5% to 10%	>10% to 20%	Fair
>10% to 30%	>20% to 50%	Poor
>30%	>50%	Critical

A copy of the BC Housing Capital Asset Management – Asset Strategies Facility Condition Index document (2011) provides typical impacts and issues that exist with buildings and portfolios that fall within a given FCI-based Condition Rating has been included in **Appendix B**. Although the original intent was for usage with housing assets, the information remains relevant for other building types as well.

4.1.5.2 Process Equipment

No formal condition assessment process has been completed on the process equipment associated with the WPP and the WWTP. However, the OCWA report indicated that the equipment was well maintained in meeting the appropriate compliance requirements.

4.1.6 Asset Management Strategy

Utilizing the portfolio-wide FCI trend as the focus of the analysis, FCAPX has provided a series of funding scenarios that demonstrate the effect of differing levels of funding and/or funding outcomes over the 10-Year time frame of the AMP.

However, it should be noted that this macro analysis does not address specific needs associated with individual buildings. For example, for specific assets with high FCIs, an overall reduction in portfolio-wide FCI could be achieved through building divestment or demolition/reconstruction.

Whenever possible, major renewal of the process equipment at the WWTP and WPP are integrated with required renewal of building systems to minimize the disruption of the critical processes and to achieve economies of scale.

4.2 DESIRED LEVELS OF SERVICE

4.2.1 Determining Appropriate Level of Service for Cornwall

4.2.1.1 Mandatory/Legislated Requirements

The City is committed to addressing its immediate Fire & Life Safety issues immediately upon notification of the concern. This requirement is legislated and is non-optional.

For grandfathered issues such as code compliance or Accessibility for Ontarians with Disabilities Act (AODA), the City endeavours to address these issues during proposed condition-driven capital renewal projects wherever practical.

For buildings where designated substances are present, the City is committed to following the applicable Ontario Regulations when these materials are disturbed or removed during condition-driven capital renewal projects.

4.2.1.2 City-Driven Goals

The City would have preferred to select a LOS based on a 5-Year FCI. However, the BCAs completed only included an evaluation period of 10 years. Therefore, a 5-Year FCI cannot be calculated beyond a 5-Year planning horizon based on the BCAs. As a result, the City has selected the 1-Year FCI as the benchmark that it will use to measure its LOS throughout the implementation of this AMP.

Given the current levels of funding and the organization's capacity to complete capital renewal projects, the City has set a target 1-Year FCI at the end of the 10-Year AMP time frame of 5%, which would be decrease in the current LOS, but would remain within an overall "good condition" rating.

The LOS associated with the Process Equipment has been integrated with the Water and Sewer assets in Sections 5.6 and 5.7 of the AMP since the funding associated with the Process Equipment is integrated with in the distribution and collection infrastructure.

4.2.2 Current Performance

Table 3 below presents the 5-Year Renewal Need for the building portfolio by City Department. This represents the sum of the recommendations made in the BCAs between 2016 and 2020. It should be noted that the City recently invested approximately $57 Million at the WWTP. The project included the construction of many of the buildings, as well as major renovations of others. The buildings at the WWTP represent approximately 25% of the City's building portfolio, but have only 8% of the total 5-Year renewal need.

Table 3 - Building & Process Equipment Details

City Department	Number of Buildings	5-Year Renewal Need	Percentage of Renewal Need
Admin	6	$3,137,805	21.78%
Emergency Services (Police, Fire & Paramedic Services)	4	$1,440,000	9.99%
Home for the Aged	2	$1,399,505	9.71%
Parks	17	$593,785	4.12%
Recreation	18	$2,934,655	20.37%
Municipal Works	11	$2,616,000	18.15%
Transit	2	$544,750	3.78%
Solid Waste	7	$149,300	1.04%
Water	5	$449,060	3.12%
Wastewater	23	$1,145,220	7.95%
Total	**95**	**$14,410,080**	**100.00%**

Table 4 below provides the number of buildings that fall within each of the Condition Categories (as outlined in Section 4.1.5.1 above) based on the 5-Year FCI. As noted above, the project at the WWTP has resulted in a relatively large percentage of buildings being in good condition. A complete list of 5-Year FCIs for each of the building can be found in **Appendix C**.

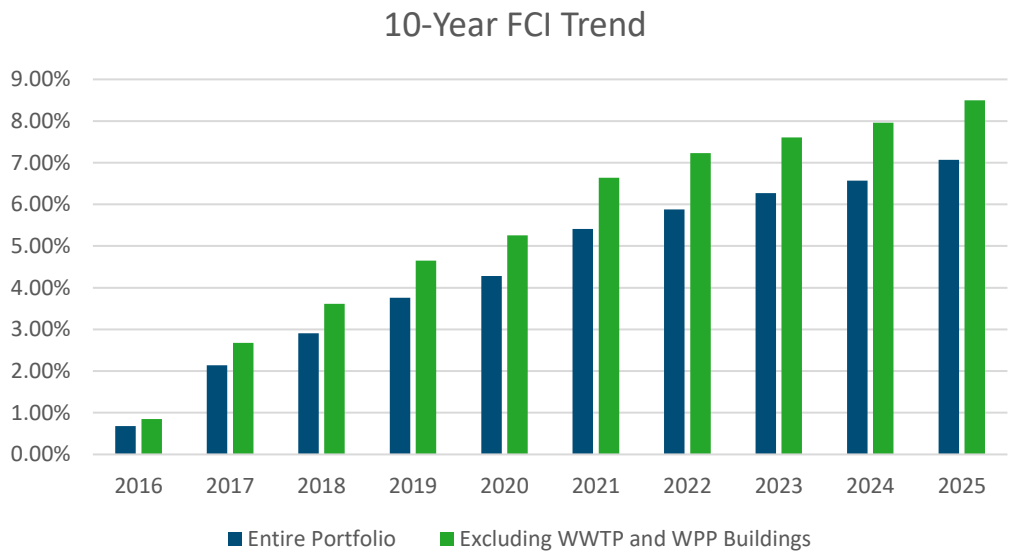
Table 4 – 5-Year FCI Condition Rating Distribution		
FCI Condition Rating	**Buildings**	**Percentage**
Good	57	60.00%
Fair	18	18.95%
Poor	15	15.79%
Critical	5	5.26%
Total	**95**	**100.00%**

FCI calculations do not include factoring in any levels of funding. They represent the capital needs of the asset relative to its CRV.

4.2.3 Trends

Figure 6 below presents the 10-Year trends for two scenarios for 1-Year FCI, the first for the entire portfolio, and the second, excluding the buildings associated with the WWTP and WPP. As demonstrated, when the WWTP and WPP buildings are excluded, the portfolio-wide FCI does increase by approximately 1.5% by 2025, generally a result of the recent $57-Million-dollar investment made at the WWTP. Both scenarios assume a $0 annual funding allocation for the entire portfolio, as well as only the tax-funded assets (excludes buildings associated with the WWTP and WPP). The purpose of this figure is to demonstrate the worst case scenario for how the condition of the portfolio will evolve between 2016 to 2025.

Figure 6 - 10-Year FCI Trend



4.3 STATE OF INFRASTRUCTURE

4.3.1.1 Estimated Current Replacement Value

Asset management best practice literature suggests that 2% to 4% of the value of an asset should be invested annually in order to ensure long-term sustainability of the asset. Without asset management tools, it is almost impossible to determine the long-term effect of inadequate budget allocations. Yet, it is important for an organization to determine if the current level of funding is appropriate to continue to provide an appropriate LOS to its residents.

For the City, the value of Buildings and Equipment assets included in the AMP is estimated at $473,772,250 as outlined in **Table 5** below.

Table 5 - Asset Value – Buildings & Equipment

Asset Type	Quantity	Estimated Replacement Value	2% Yearly Allocation
Buildings	95	$336,979,697	$6,739,594
Process Equipment	N/A	$136,792,553	$2,735,851
Total		**$473,772,250**	**$9,475,445**

Based on these results and the recommended 2% yearly investment in maintenance, ideally the City would allocate approximately $9,475,445 per year to ensure future sustainability of its buildings and process equipment assets. This value is based on the industry standard to provide for the life cycle renewal needs of the asset.

4.3.1.2 Physical Characteristics

Table 6 below outlines details of the City-owned buildings and process equipment that have been included in the AMP.

Table 6 - Building & Process Equipment Details		
Buildings		
City Department	**Number of Buildings**	**Percentage**
Admin	5	5.26%
Emergency Services (Police, Fire & Paramedic Services)	4	4.21%
Home for the Aged	2	2.11%
Parks	17	17.89%
Recreation	18	18.95%
Municipal Works	12	12.63%
Transit	2	2.11%
Solid Waste	6	6.32%
Water	5	5.26%
Wastewater	24	25.26%
Total	**95**	**100.00%**
Process Equipment		
Type of Process Equipment		**Capacity**
Wastewater Treatment Plant		55,000 m^3/day
Water Purification Plant		100,000 m^3/day

4.3.1.3 Current Needs Summary

4.3.1.3.1 Unlimited Budget Scenario

Table 7 below provides the current backlog of repairs for the buildings (sum of the renewal needs from 2016 to 2020, as per a 5-Year FCI) and the process equipment included in the AMP.

Table 7 - Immediate Backlog Repair Costs – Buildings & Equipment		
Asset Class	**Quantity of Repairs Required**	**Cost of Repairs**
Buildings	72	$17,264,650
Process Equipment	N/A	$1,200,000
Total		**$18,474,650**

4.4 AM STRATEGY

As outlined in Section 4.2.1.2, the City has selected a Desired LOS target for its building portfolio of a 1-Year FCI of 5% at the end of 2025. Achieving this goal will result in an increase in the overall portfolio-wide FCI (from current 0.68%), but should not have a material impact on the LOS provided to residents. **Table 8** below presents the total (10-Year) and annual (rounded up) funding required to achieve the LOS target. It should be noted that a 25% surcharge was applied to the capital costs developed during the BCAs to account for soft costs (project management, design, contingency, etc.).

Table 8 - Total Funding Required to Meet LOS - Buildings

Asset Class	10 Year Capital Need
Buildings	$8,732,823
WWTP Process Equipment	Included with Sewer
WPP Process Equipment	Included with Water
Total	**$8,732,823**
Annual Capital Funding	**$900,000**

4.4.1 Asset Management Activities, Procedures and Policies

4.4.1.1 Approach to Data Assembly

The City does not currently have a CAMS in-place. However, the consolidated OPC Table developed as part of the BCAs completed by FCAPX is intended to be the main database for building condition information. It is critical that as capital projects are completed that the consolidated OPC Table is kept up-to-date to allow for accurate capital planning and forecasting.

It is industry practice to conduct independent third-party BCAs on a five-year cycle. As such, we recommend that updated BCAs be conducted in 2021. Consideration could also be given to staging the BCAs so that a certain percentage of the portfolio is assessed each year (e.g. 20% of the portfolio assessed every year on a 5-Year Cycle).

Additionally, to integrate a broader range of capital costs, liabilities and opportunities associated with the building and site portfolio, we recommend that during the future BCA projects, the City expand the scope of work to potentially include Energy Audits, AODA assessments, integration of Designated Substance (e.g., Asbestos, Lead, etc.) and the development of a 30-Year Reserve Fund Study. This additional data will allow for a more complete tool with which to develop capital budgets.

Should the City's processes evolve beyond the capacity and capability of an Excel-based capital planning tool, consideration should be given to licensing a CAMS to enhance analytical and data management processes.

As per the OCWA report, a condition assessment of the process equipment associated with the WWTP and the WPP is recommended to develop a needs-based capital forecast.

4.4.1.2 Maintenance Activities

It should be understood that most infrastructure assets usually reach the end of their expected service lives even if routine maintenance is carried out on those assets while in service. As specified in the literature, 2% to 4% of the value of an asset should be spent on a yearly basis to ensure it reaches the end of its service life. Most municipalities spend less than 2% of the value of the asset on maintenance per year. Maintenance activities such as changing filters in furnaces or air handling units or inspecting and cleaning out roof drains should be carried out on a regular basis.

The City uses PM Expert, a CMMS for tracking and scheduling routine maintenance for the Process Equipment at both the WWTP and the WPP. We recommend that this usage of PM Expert continue, and consideration be given to implementing the software to manage the maintenance requirements for the City's buildings.

Additionally, it would be beneficial for the City to develop a formal Preventative Maintenance Program (PM Program) for its Buildings including regularly schedule maintenance activities and procedures, which would assist in extending the life of major Building and Equipment assets.

4.4.2 Integrated Rehabilitation

When developing multiyear capital plans, based on the data provided in the consolidated OPC table, consideration should be given to:

- Creating multi-component projects for specific buildings;
    - For example, replacing the roof, windows and HVAC systems in a single building;
- Creating multi-building programs for similar building components;
    - For example, replacing multiple roofs in a single project year across the portfolio.

The first project-based approach minimizes the disruption to the operations of the City buildings when compared to spreading projects over multiple years. Additionally, by designing integrated projects, the opportunity to improve the efficiency or functionality of the systems is enhanced. For example, if higher quality roof and windows are installed in a building then perhaps a more efficient or smaller capacity (i.e., more energy efficient) HVAC system would be required. This, for example, could result in both capital and operational cost savings.

A program-based approach, such as a roofing program, can result in reduced capital costs resulting from bulk purchasing, as well as streamlined project management for City resources as it is easier to manage a single contract across multiple sites than multiple contracts across multiple sites.

Wherever possible, to take advantage of economies of scale and minimize the disruption to on-going site activities, the City should integrate capital renewal work associated with the buildings at the WWTP with the relevant process equipment. The same approach should be used at the WPP.

4.4.3 Criticality of Infrastructure and Risk

Working collaboratively with FCAPX, the City developed a Multivariable Prioritization (MVP) system that has been applied to the BCA data for all City-owned buildings.

The MVP was designed to take into account both the Criticality of the Buildings as well as the Risk associated with building system/component failure. When applied to the consolidated OPC Table developed during the BCA, the MVP will provide a numerical priority score for each recommendation that can be rank-ordered to support the City in selecting specific projects that are included in annual capital plans.

The following Building and Component/System categories were used to develop the MVP:

- Building/Asset
  - Program/Use;
  - Type of Public Use;
  - Frequency of Public Use;
- Component/System;
  - Condition/Risk of Failure; and
  - Consequence of Failure.

The MVP matrix, with the categories, scoring and weighting for the above-noted criteria has been included in **Appendix D**.

4.4.4 Approach to Options Analysis

To enable more effective business decisions, and to assist in addressing the funding backlog that exists for its asset portfolio, the City should consider looking at the whole-asset replacement of specific assets as opposed to renewing or rehabilitating certain assets.

The buildings and sites with the highest 1-Year FCI values within the portfolio will be analyzed for potential redevelopment. By replacing a building in Poor or Critical condition, the newly constructed asset will provide a much greater LOS to residents, and will also result in a decrease in the overall portfolio-wide 5-Year FCI profile.

In many cases, the 1-Year FCI of many individual buildings will likely decrease over the evaluation period as capital dollars are invested. Conversely, some buildings and/or sites, which have relatively lower FCI's may be allowed to increase slightly based on their relative better condition. As an example, a building with a 1-Year FCI of 1% may be allowed to slip to 4%, which is still within the Good Condition range.

Additionally, certain sites within the portfolio likely have a higher potential value than that being achieved as a result of the current land use. Material value can be unlocked by selling a specific site or sites to entities that would redevelop the property.

For assets that do not fall into any of the above categories, renewal needs should be included in the on-going capital planning and asset management processes.

4.4.5 Future Demand

The City is not forecasting a major increase in demand that would require the expansion of existing Buildings or construction of new assets over the next ten years.

However, the following projects are being considered, mainly for operational needs and program expansion purposes, and have been factored into the City's 10-Year Capital Plan:

- Redevelopment project of the Municipal Works Yard;
- Construction of a new Fire Station;
- Construction of an Arts and Culture Centre (new); and
- Waterfront Development Project which will likely consist of the construction of new facilities.

Should this, or other new buildings be constructed, we recommend that they immediately be integrated into the on-going Asset Management processes that are employed by the City.

With regards to process equipment, the City recently completed a major expansion at its WWTP, which included a $57M expansion. As such, the City does not anticipate major increased demand for its process equipment over the next 10 years. However, should the City's mandate for providing services change, for example by regionalizing water and wastewater treatment, the need for expansion of the WWTP and/or WPP may arise over the next 10 years.

4.4.6 Lifecycle Management

As above, the City does not employ a formal PM Program for its Buildings. PM has been proven to extend the life of building and process equipment and systems. As such, the City should consider developing a PM Program for the appropriate asset classes and systems present across its portfolio. The resources required to implement a PM Program can be significant. Therefore, it is recommended that the City focus first on the most capital intensive equipment within the portfolio and then progress to implement a PM program for the remainder of the appropriate building systems.

Additionally, when installing new building systems or equipment, Lifecycle Cost Analysis (LCA) should be used to analyze different renewal options to determine which has the lowest cost of ownership over the lifetime of the systems.

4.5 EXPENDITURE HISTORY

Tables 9 and 10 below outline the Maintenance Spending and Capital Spending, respectively associated with the Buildings and Equipment for 2013 to 2015 and the 2016 Budget.

Table 9 - Historical Maintenance Funding - Buildings & Equipment

Asset Class	Description	Actual 2013	Actual 2014	Actual 2015	Budget 2016
Buildings	**Asset Maintenance**	**$964,011**	**$890,256**	**$1,069,636**	**$1,415,746**
	Taxation Funding	$939,887	$831,269	$1,025,359	$972,868
	Water Rate Revenue	$0	$0	$0	$15,000
	Sanitary Sewer Rate Revenue	$0	$0	$0	$15,000
	Federal Gas Tax	$0	$0	$0	$125,000
	Grants	$0	$0	$0	$0
	Financing	$0	$0	$0	$0
	County Revenue	$21,994	$23,092	$26,784	$37,878
	Reserves	$2,130	$35,895	$17,493	$250,000
	Total Funding	**$964,011**	**$890,256**	**$1,069,636**	**$1,415,746**
	Net Unfunded	**$0**	**$0**	**$0**	**$0**
Process Equipment at WPP & WWTP	**Asset Maintenance**	**$205,392**	**$142,758**	**$222,172**	**$255,591**
	Taxation Funding	$0	$0	$0	$0
	Water Rate Revenue	$115,879	$88,501	$82,128	$132,391
	Sanitary Sewer Rate Revenue	$89,513	$54,257	$140,044	$123,200
	Federal Gas Tax	$0	$0	$0	$0
	Grants	$0	$0	$0	$0
	Financing	$0	$0	$0	$0
	County Revenue	$0	$0	$0	$0
	Reserves	$0	$0	$0	$0
	Total Funding	**$205,392**	**$142,758**	**$222,172**	**$255,591**
	Net Unfunded	**$0**	**$0**	**$0**	**$0**

Table 10 - Historical Capital Funding - Buildings & Equipment					
Asset Class	**Description**	**Actual 2013**	**Actual 2014**	**Actual 2015**	**Budget 2016**
Buildings	**Asset Maintenance**	**$398,990**	**$438,942**	**$39,415,388**	**$964,500**
	Taxation Funding	$211,702	$86,273	$208,248	$362,600
	Water Rate Revenue	$0	$0	$0	$0
	Sanitary Sewer Rate Revenue	$0	$147,877	$1,721,347	$0
	Federal Gas Tax	$0	$0	$0	$0
	Grants	$0	$169,229	$24,796,622	$0
	Financing	$0	$0	$9,155,141	$500,000
	County Revenue	$9,578	$0	$15,993	$101,900
	Reserves	$177,711	$35,563	$3,518,037	$0
	Total Funding	**$398,990**	**$438,942**	**$39,415,388**	**$964,500**
	Net Unfunded	**$0**	**$0**	**$0**	**$0**
Process Equipment at WPP & WWTP	**Capital Expenditure**	**$1,199,550**	**$697,569**	**$18,828,519**	**$1,200,000**
	Taxation Funding	$0	$0	$0	$0
	Water Rate Revenue	$1,181,288	$543,160	$7,710	$0
	Sanitary Sewer Rate Revenue	$18,261	$154,408	$955,772	$1,200,000
	Federal Gas Tax	$0	$0	$0	$0
	Grants	$0	$0	$12,210,000	$0
	Financing	$0	$0	$4,021,536	$0
	County Revenue	$0	$0	$0	$0
	Reserves	$0	$0	$1,633,500	$0
	Total Funding	**$1,199,550**	**$697,569**	**$18,828,519**	**$1,200,000**
	Net Unfunded	**$0**	**$0**	**$0**	**$0**

5 LINEAR ASSETS

The City has developed detailed asset management processes and tools to support its linear infrastructure, which includes:

- Roads;
- Sidewalks and Recreational Paths;
- Sewer; and
- Water.

These assets have been managed in a consolidated manner and formed the foundation of previous versions of the AMP. As a result, these asset classes have been bundled in this version of the AMP into a single section of the document.

5.1 Linear Infrastructure Data Inventory

The City linear infrastructure inventory data stored in the GIS system. Therefore, no field data collection was required on this project. The FCAPX Team worked closely with staff to make best use of the valuable information they already have.

It is recommended to collect and store only data that supports internal asset management processes and analysis. Often, the financial investment and time spent keeping condition information current could be better used elsewhere in the execution of an AMP. The City has designed its data needs and processes to optimize the amount and type of data that are required to meet its asset management goals. If the data does not add any value to the business processes, it is not incorporated in the City's systems.

City staff had already created digitized and properly sectioned road, sidewalk, recreational paths, sewer and water networks in their GIS. The Project Team worked closely with staff to address missing data or to make educated assumptions where the information was not available.

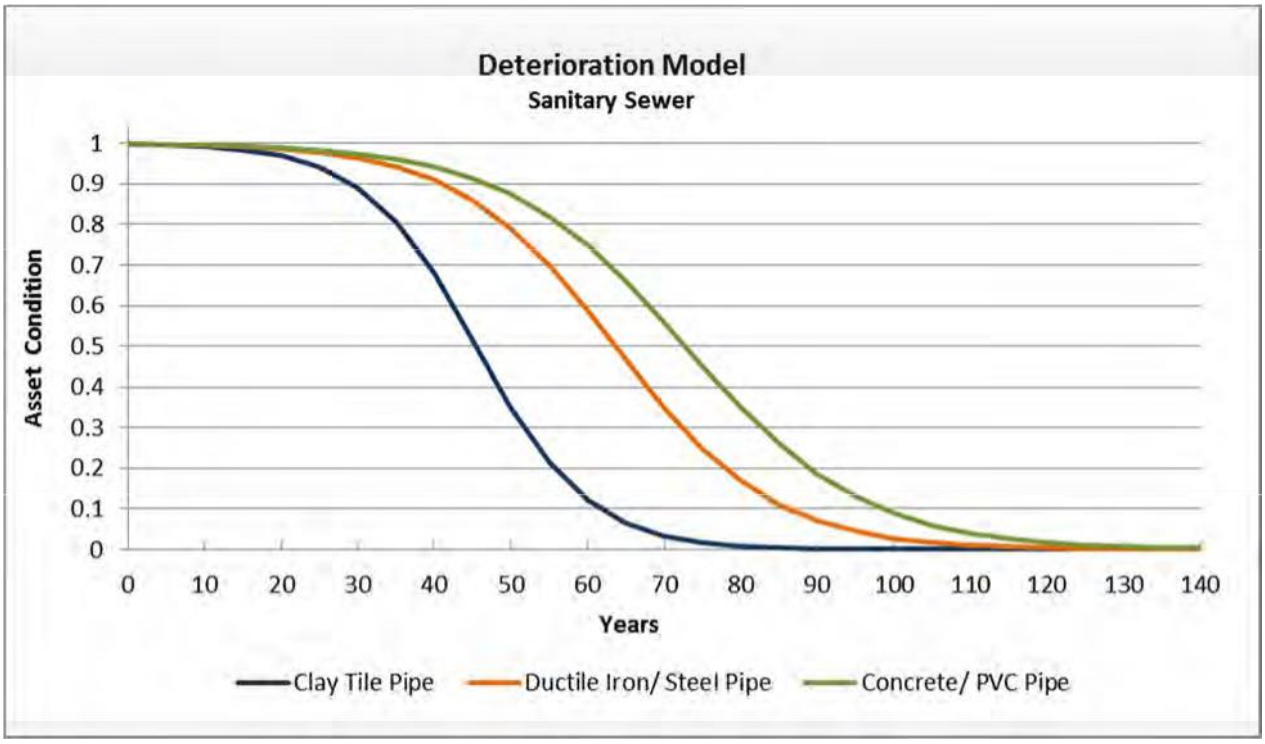
5.2 Linear Infrastructure Valuation

Calculating the replacement costs of infrastructure assets provides insight on the existing financial investments on municipal infrastructure networks. To calculate overall replacement costs, each type of linear infrastructure was assigned an average unit cost per meter or square meter of construction. Unit construction costs were developed in collaboration with City staff based on recent construction activities in the area or historical information.

5.3 General Linear Asset Condition Assessment

To predict performance of the assets over time, the City Team uses deterioration models that have been developed on other projects and published research where larger historical performance databases were available, based on the estimated useful service life of each type of infrastructure. The development of specific models using historical information from the City could be developed through time as the City moves towards a sustainable asset management approach. **Figure 7** illustrates examples of deterioration models used in the predictive analysis for underground linear assets, by material type.

Figure 7 - Network Deterioration Curves (Sanitary Sewer Example)



The generation of condition indices, using consistent and repeatable techniques is essential in comparing assets and identifying priorities in all types of infrastructure. These indices are used to track improvements to the LOS in the condition of the asset network in the form of financial investment. All condition indices for linear assets were assigned a rating. Once all assets were assigned a condition rating, knowledge of assets and technical expertise were used to determine the rating level which represented the minimal LOS that can be provided to the residents. This was determined in consultation with City staff. Any components of infrastructure rated below the minimal rating become in need of rehabilitation. The minimum rating, or LOS, is called the "Threshold of Acceptability" of an asset.

5.4 ROADS

5.4.1 Asset-Specific Methodology

5.4.1.1 Road Network Condition Assessment Process

Road Pavement Condition Rating (PCR) is measured using an inventory observation process and assignment of PCR based on a City developed system. A description of that system is presented in **Appendix E**. All road sections in

the network had an assigned current rating from 0 to 100 with 100 representing a newly constructed road. For analysis purposes, the PCR rating was used in our Deighton dTims software application to determine and identify current and future needs in the road network. Further details on PCR thresholds to identify needs in the network are presented in Section 5.4.2.2 of this report.

5.4.2 Desired Levels of Service

5.4.2.1 Determining Appropriate Level of Service for Cornwall

For the road network, City staff was satisfied that the current LOS, measured in terms of performance index, should be maintained. They indicated that residents appear satisfied with current roadway conditions, thus the objective is to maintain that condition. The PCR is measured using an inventory visual inspection process and assignment of PCR based on a City of Cornwall developed system. The current average PCR for the overall road network is just above 70 which would be described as the high range of satisfactory in the City's rating system. Any arterial roads rated below 55, collector roads below 45, and local roads below 40 were identified as requiring some type of rehabilitation in our analysis.

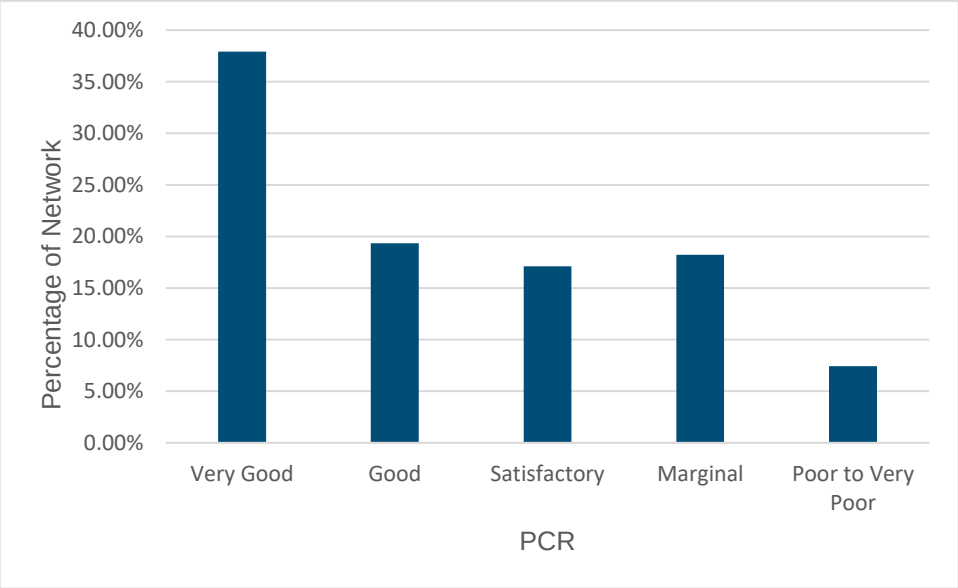
5.4.2.2 Current Performance

The condition of the road network using the PCRs is included in **Table 11** and **Figure 8** below. A description of each Condition Rating scale for roads has been provided in **Appendix E.**

Table 11 - Pavement Condition Rating (PCR) - Roads

Condition Rating	PCR	Length (km)	Percentage
Very Good	80-100	103.2	37.92%
Good	70-79	52.6	19.33%
Satisfactory	60-69	46.5	17.10%
Marginal	50-59	49.6	18.22%
Poor to Very Poor	<50	20.2	7.43%
Total		**272.1**	**100.00%**

Figure 8 - Pavement Condition Rating - Roads



5.4.2.3 Trends

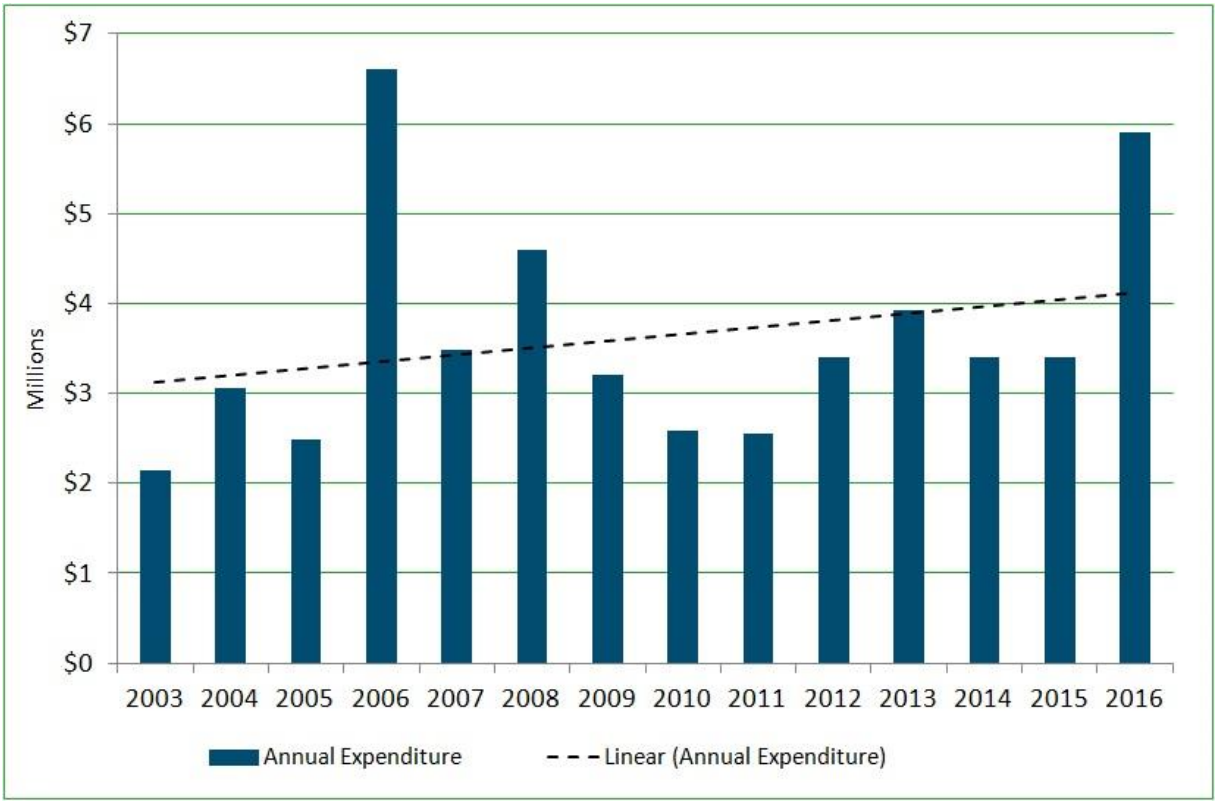
The condition rating system has been undertaken by the City since 1990, updated biennially from field inventory and annually within PMS. Data from the last 20 years indicates the yearly road rehabilitation program has resulted in improving the overall average condition of the road network. **Table 12** shows the average PCR by year. As shown by the data presented in this section, the condition of the road network has generally been improving over the years and with recent average rating in the high satisfactory to lower good condition range.

Table 12 - Overall Average PCR by Year

Year	PCR
1995	62.3
1998	64.9
2001	67.3
2003	68.6
2005	66.9
2007	67.7
2009	69.2
2011	68.6
2013	68.9
2015	70.2

Figure 9 below provides details of the historical capital funding associated with the City's road network from 2003 to 2016. As demonstrated, although there has been a high level of variance from year to year, the trend line shows that the annual funding has increased since 2003 to the current level of $4 Million, the required capital to achieve the City's desired LOS.

Figure 9 - Annual Capital Expenditure - Roads - 2003 to 2016



5.4.3 State of Infrastructure

5.4.3.1 Current Replacement Value

Table 13 below provides the estimate replacement value for the roads and bike lanes, as well as a 2% annual allocation for reinvestment.

Table 13 - Asset Value - Roads

Asset Type	Quantity (km)	Estimated Replacement Value	2% Yearly Allocation
Roads	272.1	$267,898,000	$5,357,960
Bike Lane	44.7		
Total	**272.1**	**$267,898,000**	**$5,357,960**

Please note that the length of bike lanes is included in the overall length of the roads.

Based on these results and the recommended 2% yearly investment in maintenance, ideally the City would allocate approximately $5,357,960 per year to ensure future sustainability of its roads.

5.4.3.2 Physical Characteristics of Roads

The City road network is made up of 272.1 kilometres of road. The roads within the City network are constructed with multiple different road surface materials. **Table 14** shows the breakdown of road length by material type.

Table 14 - Roads by Surface Material

Material	Length (km)	Percentage
Asphalt	206	75.74%
Asphalt on Concrete	59	21.69%
Concrete	6	2.21%
Other (Lanes, Park Roads)	1	0.37%
Totals	**272**	**100.00%**

The City has also attributed a class to each segment of road, based on the road usage. **Table 15** shows the breakdown of official plan road classes as part of the whole network.

Table 15 - Roads by Official Plan Class

Class	Length (km)	Percentage
Arterial	83	30.51%
Collector	43	15.81%
Local	143	52.57%
Other (Lanes, Park Roads)	3	1.10%
Totals	**272**	**100.00%**

5.4.3.3 Current Needs Summary

5.4.3.3.1 Unlimited Budget Scenario

Table 16 below provides the current backlog of repairs for the Roads, including recreational paths included in the AMP.

Table 16 - Immediate Backlog Repair Costs – Roads		
Asset Class	**Quantity of Repairs Required**	**Cost of Repairs**
Roads	18.42	$12,671,000
Total		**$12,671,000**

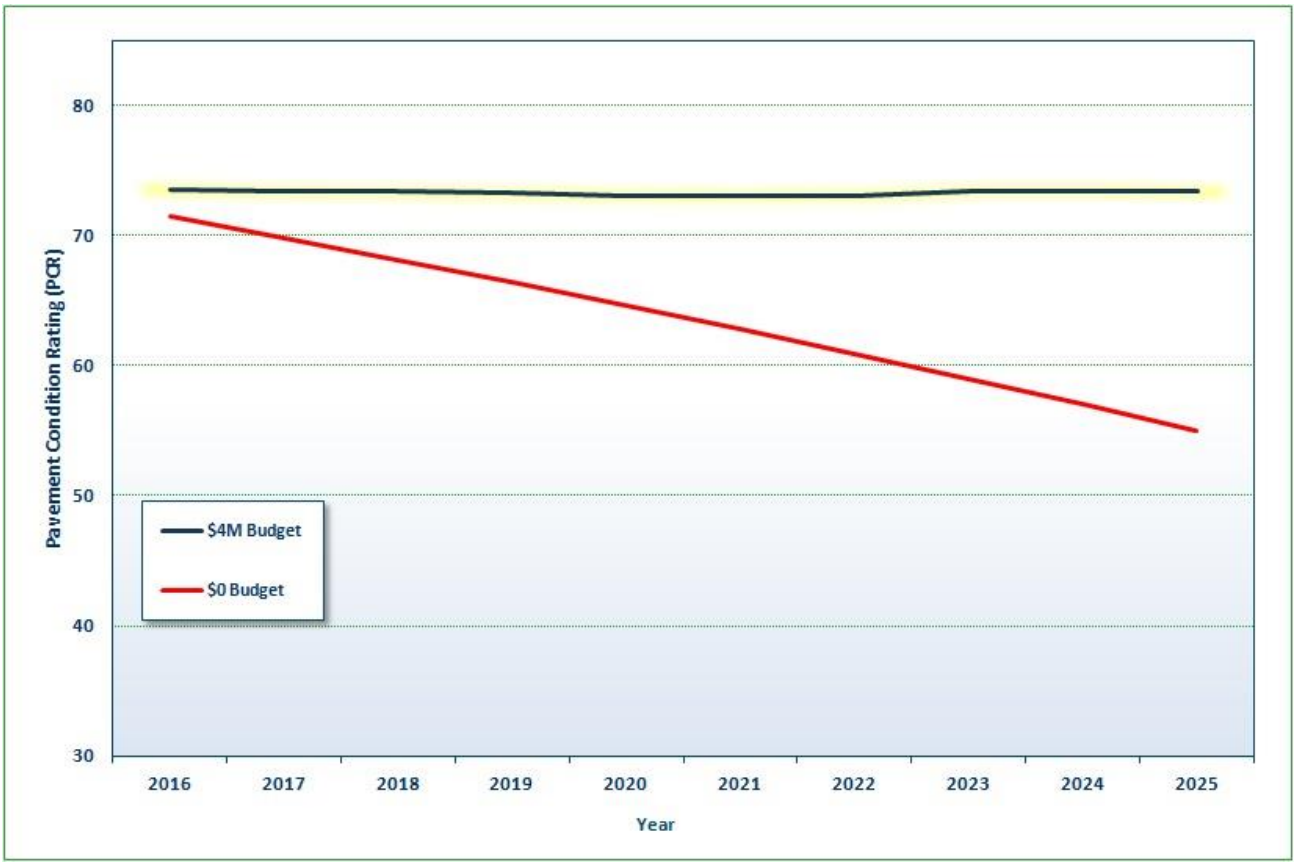
5.4.4 AM Strategy

The City has determined that maintaining the current average condition for the Roads Network will be the desired LOS for the AMP. As such, the City has developed a strategy to maintain the overall PCR of 70 throughout the 10-year time frame. **Table 17** below presents the total (10-Year) and annual (rounded up) funding required to achieve the LOS target, based on funding scenarios developed using the City's Pavement Management System (PMS).

Table 17 - Total Funding Required to Meet LOS - Roads	
Asset Class	**10-Year Capital Need**
Roads	$40,000,000
Total	**$40,000,000**
Annual Capital Funding	**$4,000,000**

Figure 10 below, generated by the City's Pavement Management System demonstrates the forecasted PCR for the period between 2016 and 2025, assuming the annual investment of the $4,000,000, recommended above to achieve the desired LOS for roads. Additionally, a $0 funding scenario is also provided for comparison purposes.

Figure 10 - PCR Trend Based on $4 Million Annual Funding



5.4.5 Expenditure History

Tables 18 and 19 below outline the Maintenance Spending and Capital Spending, respectively, associated with roads for 2013 to 2015 and the 2016 Budget.

Table 18 - Historical Maintenance Funding - Roads

Asset Class	Description	Actual 2013	Actual 2014	Actual 2015	Budget 2016
Roads	**Asset Maintenance**	**$573,811**	**$658,451**	**$582,861**	**$661,370**
	Taxation Funding	$539,843	$639,306	$561,793	$611,370
	Water Rate Revenue	$6,281	$0	$10,534	$0
	Sanitary Sewer Rate Revenue	$6,281	$3,266	$10,534	$0
	Federal Gas Tax	$21,406	$15,879	$0	$50,000
	Grants	$0	$0	$0	$0
	Financing	$0	$0	$0	$0
	County Revenue	$0	$0	$0	$0
	Reserves	$0	$0	$0	$0
	Total Funding	**$573,811**	**$658,451**	**$582,861**	**$661,370**
	Net Unfunded	**$0**	**$0**	**$0**	**$0**

Table 19 - Historical Capital Funding - Roads					
Asset Class	**Description**	**Actual 2013**	**Actual 2014**	**Actual 2015**	**Budget 2016**
Roads	**Capital Expenditure**	**$2,573,901**	**$3,524,647**	**$1,683,608**	**$6,103,800**
	Taxation Funding	$0	$533,810	$0	$205,000
	Water Rate Revenue	$173,216	$107,082	$245,354	$317,400
	Sanitary Sewer Rate Revenue	$279,960	$107,082	$245,354	$317,400
	Federal Gas Tax	$1,667,719	$2,054,286	$1,192,900	$2,595,000
	Grants	$194,197	$722,387	$0	$1,169,000
	Financing	$0	$0	$0	$1,500,000
	County Revenue	$0	$0	$0	$0
	Reserves	$258,809	$0	$0	$0
	Total Funding	**$2,573,901**	**$3,524,647**	**$1,683,608**	**$6,103,800**
	Net Unfunded	**$0**	**$0**	**$0**	**$0**

It should be noted that the capital expenditure for 2015 was lower than budget and previous years' expenditures, as a result of projects being carried forward into 2016. In 2016, the City budgeted an increase in capital as a result of the 9th/Marleau/McConnell intersection capacity expansion project.

5.5 Sidewalks and Recreational Paths

5.5.1 Asset-Specific Methodology

5.5.1.1 Sidewalk Network Condition Assessment Process

For the sidewalk network, a condition rating system was developed by staff which consists of rating each sidewalk section from 1 to 5 with a rating of 1 representing a newly constructed sidewalk. Sidewalk conditions are updated annually by City staff.

The City does not undertake a condition assessment process for its network of recreational paths. As such, Remaining Service Life (RSL) is being used as an alternative to a formal condition rating system.

5.5.2 Desired Levels of Service

5.5.2.1 Determining Appropriate Level of Service for Cornwall

To identify sections of sidewalk in need of repair, the City directed that any sections rated as a 4 or 5 should be identified for repairs. However, sidewalk renewal is integrated with road resurfacing or reconstruction. As such, sidewalk renewal is not specifically targeted based on the condition rating.

For recreational paths, the City has decided that all recreational paths that are at or within 5 years of reaching the RSL will require renewal during the 10-year time frame of this AMP.

It should be noted however, from a risk management point of view that the City immediately repair or rehabilitate sidewalks with significant safety hazards as noted in the Ontario Minimum Maintenance Standards.

5.5.2.2 Current Performance

Table 20 and **Figure 11** below provides the current Sidewalk Condition Rating for the City's network of sidewalks. As demonstrated, nearly 78% of the sidewalks have a condition rating less than 3, demonstrating that the sidewalk portfolio is in relatively good condition. A description of the Condition Ratings for Sidewalks has been included in **Appendix F**.

Table 20 - Sidewalk Condition Rating

Condition Rating	Condition Score	Length (km)	Percentage
Excellent	1	60.5	31.91%
Good	2	63.5	33.51%
Average	3	43.0	22.87%
Below Average	4	18.5	9.57%
Poor	5	3.5	2.13%
Totals		**189**	**100.00%**

Figure 11 - Sidewalk Condition Rating

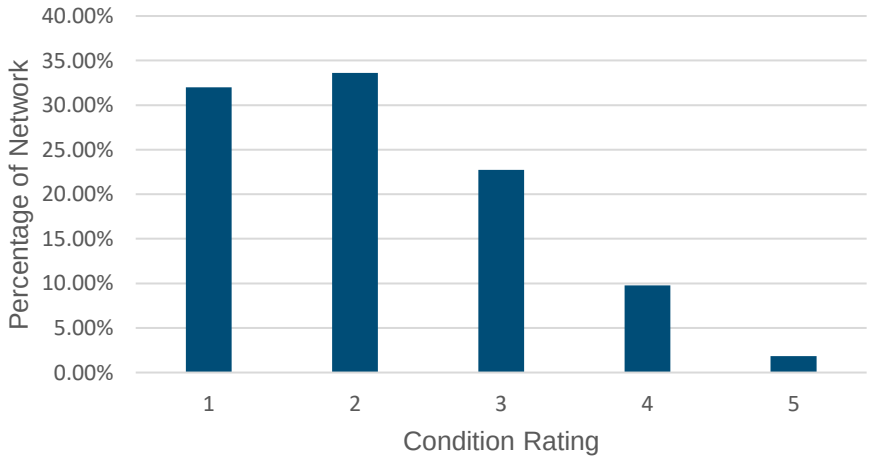
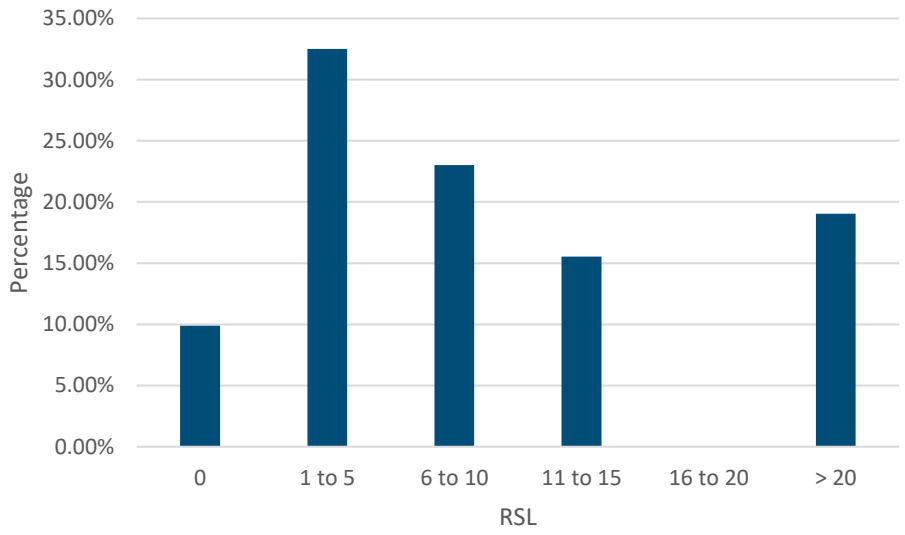


Table 21 and **Figure 12** below provides details of the RSL for the recreational paths included in the AMP. As indicated, over 40% of the pathway network is beyond or will reach its RSL within the next ten years. However, over 45% of the network has more than 20 years of service life remaining.

Table 21 - Pathway Remaining Service Life		
RSL (Yrs)	**Length (km)**	**Percentage**
0	3.59	9.90%
1 to 5	11.79	32.51%
6 to 10	8.34	23.01%
11 to 15	5.63	15.54%
16 to 20	0.00	0.00%
> 20	6.90	19.04%
Totals	**36.26**	**100.00%**

Figure 12 - Remaining Service Life of Recreational Paths



State of Infrastructure

5.5.2.3 Current Replacement Value

Table 22 below provides the estimate replacement value for the sidewalks, and recreational paths as well as a 2% annual allocation for reinvestment.

Table 22 - Asset Value – Sidewalks & Recreational Paths			
Asset Type	**Quantity (km)**	**Estimated Replacement Value**	**2% Yearly Allocation**
Sidewalks	189	$33,546,000	$670,920
Recreational Paths	36.26	$4,093,000	$81,860
Total	**225.26**	**$37,639,000**	**$752,780**

Based on these results and the recommended 2% yearly investment in maintenance, ideally the City would allocate approximately $752,780 per year to ensure future sustainability of its sidewalks and recreational paths.

5.5.2.4 Physical Characteristics of Sidewalks and Recreational Paths

The AMP includes 189 km of sidewalk and 36.3 km of recreational paths. As outlined in Section 5.5.2.2, the majority of the sidewalk infrastructure is between a rating value of 1-3, which indicates a network in good condition. The pathway network is generally within 10 years of reaching its RSL, or has more than 20 years of RSL.

5.5.2.5 Current Needs Summary

5.5.2.5.1 Unlimited Budget Scenario

Table 23 below provides the current backlog of repairs for the sidewalks and recreational paths included in the AMP.

Table 23 - Immediate Backlog Repair Costs – Sidewalks and Recreational Paths		
Asset Class	**Quantity of Repairs Required**	**Cost of Repairs**
Sidewalks	22 km	$3,904,000
Recreational Paths	3.7 km	$418,000
Total		**$4,322,000**

5.5.3 Asset-Specific AM Strategy

Currently, the City renews its sidewalks concurrently with resurfacing or replacement of the road network, based mainly on available funding. As such, there is not a specific AM strategy for sidewalks. One of the future goals of the City is to develop a renewal program that focuses specifically on its highest need sidewalks. It is expected that this approach will be integrated into a future version of the AMP.

Currently there are 14.57 km of recreational paths that will reach the expected service life within five years. The City has developed a strategy to renew these trails prior to 2025. **Table 24** below presents the total (10-Year) and annual (rounded up) funding required the achieve the LOS target.

Table 24 - Total Funding Required to Meet LOS - Sidewalks & Recreational Paths

Asset Class	10-Year Capital Need
Sidewalks	Included with Roads
Recreational Paths	$1,646,016
Total	**$1,646,016**
Annual Capital Funding	**$165,000**

5.5.4 Expenditure History

Tables 25 and 26 below outline the Maintenance Spending and Capital Spending, respectively, associated with the sidewalks and recreational paths for 2013 to 2015 and the 2016 Budget.

Table 25 - Historical Maintenance Funding - Sidewalks & Recreational Paths

Asset Class	Description	Actual 2013	Actual 2014	Actual 2015	Budget 2016
Sidewalks & Recreational Paths	**Asset Maintenance**	**$274,386**	**$281,227**	**$226,668**	**$352,283**
	Taxation Funding	$274,386	$255,173	$226,668	$272,283
	Water Rate Revenue	$0	$0	$0	$0
	Sanitary Sewer Rate Revenue	$0	$0	$0	$0
	Federal Gas Tax	$0	$26,054	$0	$80,000
	Grants	$0	$0	$0	$0
	Financing	$0	$0	$0	$0
	County Revenue	$0	$0	$0	$0
	Reserves	$0	$0	$0	$0
	Total Funding	**$274,386**	**$281,227**	**$226,668**	**$352,283**
	Net Unfunded	**$0**	**$0**	**$0**	**$0**

Table 26 - Historical Capital Funding - Sidewalks & Recreational Paths					
Asset Class	**Description**	**Actual 2013**	**Actual 2014n**	**Actual 2015**	**Budget 2016**
Sidewalks & Recreational Paths	**Capital Expenditure**	**$295,701**	**$719,339**	**$377,405**	**$378,400**
	Taxation Funding	$0	$0	$0	$0
	Water Rate Revenue	$36,800	$7,200	$68,376	$46,300
	Sanitary Sewer Rate Revenue	$36,800	$7,200	$68,376	$46,300
	Federal Gas Tax	$222,101	$704,940	$240,654	$206,900
	Grants	$0	$0	$0	$52,600
	Financing	$0	$0	$0	$26,300
	County Revenue	$0	$0	$0	$0
	Reserves	$0	$0	$0	$0
	Total Funding	**$295,701**	**$719,339**	**$377,405**	**$378,400**
	Net Unfunded	**$0**	**$0**	**$0**	**$0**

5.6 SEWER

5.6.1 Asset-Specific Methodology

5.6.1.1 Sewer Network Condition Assessment Process

The City completed a zoom camera inspection of its sewer network. For lengths of pipe that demonstrate potential failure or blockage during the initial inspection a more detailed Closed-Circuit Television (CCTV) inspection was completed to allow City staff to better understand the condition and potential for blockage associated with a specific length of pipe.

All sewers were graded according to the Pipeline Assessment and Certification Program (PACP) coding system which considers the Structural Condition (SC) of the pipe and the Potential for Blockage (PB) both rated using an index from 1 to 5 with 1 being excellent and 5 indicating that a pipe must be replaced immediately.

5.6.2 Desired Levels of Service

5.6.2.1 Determining Appropriate Level of Service for Cornwall

Pipes rated at 4 or 5 were identified for repairs which is consistent with the recommendation provided in the methodology of the PACP User Guide.

5.6.2.2 Current Performance

The sewer system was attributed a structural condition rating, on a scale of 1 to 5 with a 1 being the best condition, by the City. The results were totalled by km and

calculated as a percentage of the entire network, as shown in **Table 27.** A copy of the Sewer Condition Rating scale has been included in **Appendix G.**

Table 27- Sewer SC Grade			
Condition Rating	**Condition Grade**	**Length (km)**	**Percentage**
Excellent	1	282.10	71.77%
Good	2	61.13	15.55%
Fair	3	18.45	4.69%
Poor	4	9.05	2.30%
Very Poor	5	2.24	0.57%
Unknown	Unknown	20.11	5.12%
Total		**393.07**	**100.00%**

The sewer infrastructure was also rated based on the potential for blockage. A grade was attributed to each section from 1-5, with 1 being the best rating. The results are shown in **Table 28**.

Table 28 - Sewer PB Grade			
Condition Rating	**Condition Grade**	**Length (km)**	**Percentage**
Excellent	1	128.05	32.58%
Good	2	134.38	34.19%
Fair	3	68.93	17.54%
Poor	4	26.13	6.65%
Very Poor	5	10.67	2.72%
Unknown	Unknown	24.91	6.34%
Total		**393.07**	**100.00%**

The tables and figures demonstrate the relative good condition of the network, as the majority of infrastructure is rated a 3 or lower in both the structural condition and the potential for blockage.

5.6.3 State of Infrastructure

5.6.3.1 Current Replacement Value

Table 29 below provides the estimate replacement value for the Sewers, as well as a 2% annual allocation for reinvestment.

Table 29 - Asset Value - Sewer			
Asset Type	**Quantity (km)**	**Estimated Replacement Value**	**2% Yearly Allocation**
Storm Sewer	135	$137,028,000	$2,740,560
Sanitary Sewer	196	$122,446,000	$2,448,920
Combined Sewer	62	$61,953,000	$1,239,060
Total	**393**	**$321,427,000**	**$6,428,540**

Based on these results, and the recommended 2% yearly investment in maintenance, ideally the City would allocate approximately $6,428,540 per year to ensure future sustainability of its sewer network.

5.6.3.2 Physical Characteristics of Sewer Assets

The sewer network is composed of 393 linear kilometres of pipe, including 135 km of storm, 196 km of sanitary and 62 km of combined sewers. The full network is accessed through 5,044 manholes, including 2,460 sanitary manholes, 1,878 storm manholes, and 706 combined sewer manholes. Other infrastructure on the sewer network includes 4,728 catchbasins, and 5 pump stations.

The pipes within the sewer network consist of various material types, each with a unique service life value attributed to it. **Table 30** below compares the material type, service life and remaining lifespan of each sewer material type.

Table 30 - Sewer Pipe Service Life					
Material	**Length (km)**	**Percentage**	**Service Life**	**Average Age**	**Remaining Years**
Reinforced Concrete	112.81	28.70%	100	38	62
Polyvinyl Chloride	95.58	24.32%	110	19	91
Asbestos Cement	72.73	18.50%	70	49	21
Concrete Pipe	50.15	12.76%	100	56	44
Vitrified Clay	32.60	8.29%	100	71	29
Unknown	25.25	6.42%	100	54	46
HDPE	1.26	0.32%	100	4	96

Table 30 - Sewer Pipe Service Life					
Material	**Length (km)**	**Percentage**	**Service Life**	**Average Age**	**Remaining Years**
Concrete Pressure Pipe	1.14	0.29%	100	49	51
Corrugated Steep Pipe	0.58	0.15%	75	38	38
Stone	0.44	0.11%	100	116	0
Brick	0.42	0.11%	120	128	0
Other	0.12	0.01%	100	33	67
Total	**393.07**	**100.00%**	**Average**	**50**	**49**

5.6.3.3 Current Needs Summary

5.6.3.3.1 Unlimited Budget Scenario

Table 31 below provides the current backlog of repairs (flushing based on blockages and renewal based on condition) for the sewer network included in the AMP.

Table 31 - Immediate Backlog Repair Costs – Sewer			
Asset Class	**Quantity of Flushing Required (km)**	**Quantity of Repairs Required (km)**	**Cost of Repairs**
Storm Sewer	15.6	2.2	$1,225,521
Sanitary Sewer	13.83	5.5	$2,437,209
Combined Sewer	7.37	3.7	$3,111,830
Total	**36.8**	**11.4**	**$6,774,560**

5.6.4 Asset-Specific AM Strategy

Any sewers that currently receive a grade of 4 or 5, in one or both of the structural condition or potential for blockage will either be flushed or replaced during the 10-year time horizon. As the network continues to deteriorate over time, some pipes currently in SC grade 3 will drop below the threshold. It is the Infrastructure Planning Division's intention to develop deterioration models for sewer pipes so that the individual pipe segments that drop into the deficient category can be identified. However, since this is not available at this time, and to recognize that there will be some additional pipes added to the backlog each year, 0.25% of the network not currently in the backlog has been assumed to drop below SC grade 3 and into SC grade 4 annually over the 10-Year horizon of this AMP report.

The City has set aside $600,000 annually to address renewal work for the WWTP to maintain its current LOS. **Table 32** below presents the total (10-Year) and annual (rounded up) funding required the achieve the LOS target.

Table 32 - Total Funding Required to Meet LOS - Sewer	
Asset Class	**10-Year Capital Need**
Sewer	$15,500,000
WWTP	$6,000,000
Total	**$21,500,000**
Annual Capital Funding	**$2,150,000**

5.6.5 Expenditure History

Tables 33 and 34 below outline the Maintenance Spending and Capital Spending, respectively, associated with the sewer distribution network for 2013 to 2015 and the 2016 Budget.

Table 33 - Historical Maintenance Funding - Sewer					
Asset Class	**Description**	**Actual 2013**	**Actual 2014**	**Actual 2015**	**Budget 2016**
Sewer	**Asset Maintenance**	**$826,341**	**$807,879**	**$598,014**	**$999,439**
	Taxation Funding	$0	$0	$0	$0
	Water Rate Revenue	$0	$2,080	$0	$0
	Sanitary Sewer Rate Revenue	$826,341	$805,799	$598,014	$999,439
	Federal Gas Tax	$0	$0	$0	$0
	Grants	$0	$0	$0	$0
	Financing	$0	$0	$0	$0
	County Revenue	$0	$0	$0	$0
	Reserves	$0	$0	$0	$0
	Total Funding	**$826,341**	**$807,879**	**$598,014**	**$999,439**
	Net Unfunded	**$0**	**$0**	**$0**	**$0**

Table 34 - Historical Capital Funding - Sewer					
Asset Class	**Description**	**Actual 2013**	**Actual 2014**	**Actual 2015**	**Budget 2016**
Sewer	**Capital Expenditure**	**$1,212,282**	**$5,213,337**	**$3,450,525**	**$4,487,600**
	Taxation Funding	$0	$18,011	$0	$0
	Water Rate Revenue	$141,654	$177,671	$0	$0
	Sanitary Sewer Rate Revenue	$716,867	$3,491,032	$1,519,271	$1,087,600
	Federal Gas Tax	$105,649	$60,161	$0	$0
	Grants	$236,676	$1,466,462	$1,000,000	$0
	Financing	$0	$0	$931,254	$2,900,000
	County Revenue	$0	$0	$0	$0
	Reserves	$11,436	$0	$0	$500,000
	Total Funding	**$1,212,282**	**$5,213,337**	**$3,450,525**	**$4,487,600**
	Net Unfunded	**$0**	**$0**	**$0**	**$0**

As part of the 2014 Budget, Council approved a $15M, 3-Year plan for the Flood Reduction Initiative and Brookdale North Channel Bridge, which resulted in the increase in annual expenditures between 2014 and 2016.

5.6.6 Asset-Specific Methodology

5.6.6.1 Water Network Condition Assessment Process

City staff have created a Watermain Performance Indicator (WPI). The indicator is on a scale of 0-100 and is derived from the RSL with points taken off for frequency of breaks as well as hydraulic performance (hydraulic performance is assessed based on modeled fire flows of 5,000 L/m and resulting pressure.). The condition information is updated biennially by the City.

5.6.7 Desired Levels of Service

5.6.7.1 Determining Appropriate Level of Service for Cornwall

With regards to the LOS, City staff have determined that any pipes rated below 20 on the WPI should be replaced over the 10-Year time frame of the AMP.

5.6.7.2 Current Performance

Table 35 below provides the details of the watermain network by performance indicator value. As below, over 25% of the current network has a performance indicator of less than 20, which is deemed by the City to be in need of renewal.

This represents a considerable backlog associated with the water distribution network. A description of the PI Condition Rating scale is included in **Appendix H**.

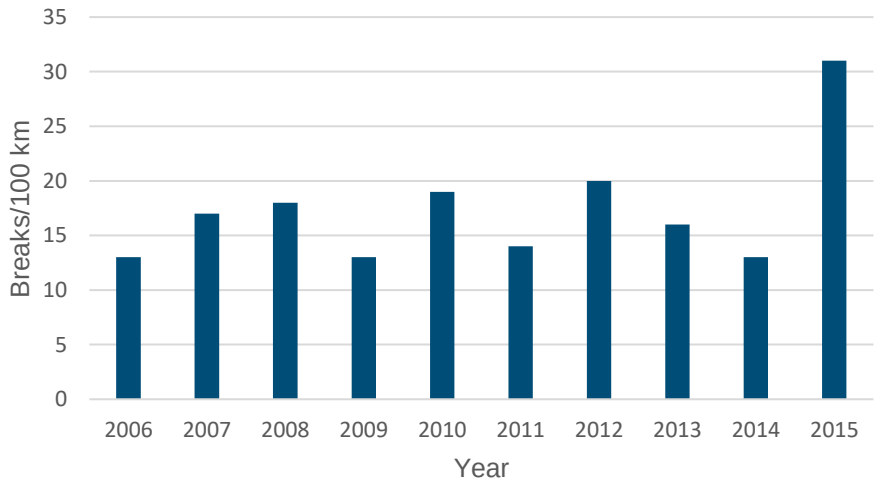
Table 35 - Watermain Performance Indicator			
PI Condition Rating	**PI Range**	**Length (km)**	**Percentage**
Excellent	80-100	55.68	19.96%
Good	60-80	70.95	25.44%
Satisfactory	40-60	54.06	19.38%
Marginal	20-40	26.12	9.36%
Poor	<20	72.08	25.85%
Total		**278.89**	**100.00%**

5.6.7.3 Trends

Table 36 provides a history of the frequency of watermain leaks/failures (per 100 km) dating back to 2006. As demonstrated, there has been a fair amount of variance in the break history. However, 2015 showed a significant increase in the frequency of failures, demonstrating a worsening overall condition of the network.

Table 36 - Watermain Failures		
Year	**Number**	**Breaks/100 km***
2006	36	13
2007	46	17
2008	51	18
2009	36	13
2010	52	19
2011	40	14
2012	55	20
2013	45	16
2014	35	13
2015	86	31

Figure 13 - Watermain Failures - Breaks/100 km*



5.6.8 State of Infrastructure

5.6.8.1 Current Replacement Value

Table 37 below provides the estimate replacement value for the Water network, as well as a 2% annual allocation for reinvestment.

Table 37- Asset Value - Water

Asset Type	Quantity (km)	Estimated Replacement Value	2% Yearly Allocation
Watermain	278.89	$134,989,000	$2,699,780
Total	**278.89**	**$134,989,000**	**$2,699,780**

Based on these results and the recommended 2% yearly investment in maintenance, ideally the City would allocate approximately $2,699,780 per year to ensure future sustainability of its watermain network.

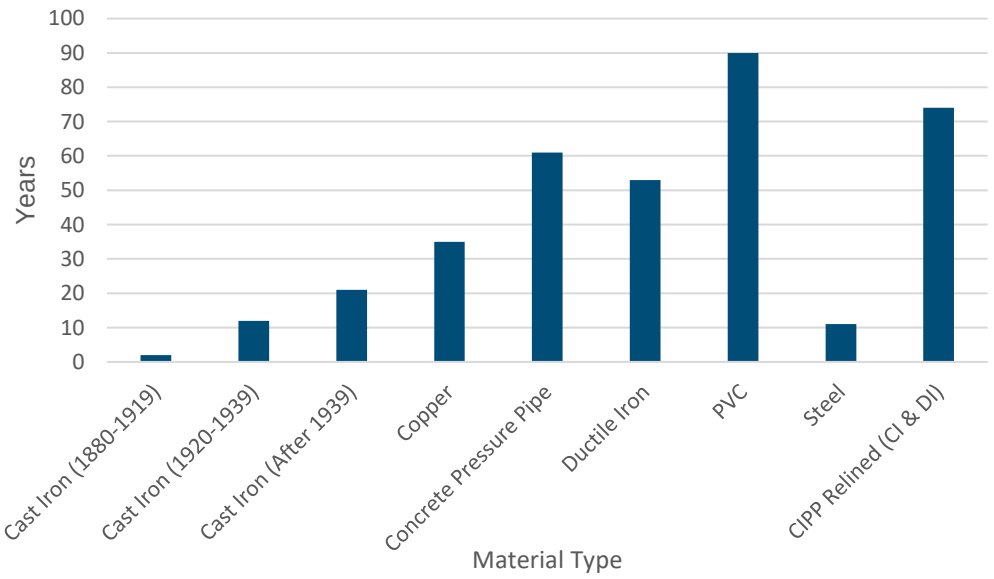
5.6.8.2 Physical Characteristics of Water Assets

The City water network includes 278.89 kilometres of watermain, constructed of varying materials. The materials vary largely depending on the year of construction of the particular segment. The longevity of a section of pipe is dependent on its material, as each material type has attributed to it an appropriate service life. The watermain network is not limited to the pipe and also includes 1,261 hydrants, 1,925 valves and 54 valve chambers. A summary of the watermain types, ages and service lives are shown in **Table 38** and **Figure 14** below.

Table 38 - Watermain Service Life					
Material	**Length (km)**	**Percentage**	**Service Life**	**Average Age**	**Remaining Years**
Cast Iron (1880-1919)	3.46	1.24%	120	126	2
Cast Iron (1920-1939)	28.64	10.27%	100	90	12
Cast Iron (After 1939)	62.42	22.38%	75	56	21
Copper	0.64	0.23%	100	67	35
Concrete Pressure Pipe	20.91	7.50%	100	41	61
Ductile Iron	48.01	17.21%	90	39	53
PVC	96.37	34.55%	110	20	90
Steel	2.12	0.76%	55	46	11
CIPP Relined (CI & DI)	16.32	5.85%	50*	4	46
Total	**278.89**	**100.00%**	**Average**	**54**	**40**

Note: Relining typically extends the life of a pipe by approximately 50 years beyond the RSL of the host pipe

Figure 14 - Watermain Remaining Service Life by Material



5.6.8.3 Current Needs Summary

5.6.8.3.1 Unlimited Budget Scenario

Table 39 below provides the current backlog of repairs for the watermain network included in the AMP.

Table 39 - Immediate Backlog Repair Costs – Watermain		
Asset Class	**Quantity of Repairs Required**	**Cost of Repairs**
Watermain	72.08 km	$41,190,000
Total		**$41,190,000**

5.6.9 Asset-Specific AM Strategy

Given the considerable renewal backlog that exists (over $41 Million), the City has determined that its LOS target for the watermain network is to address its current backlog over the next 20 years. As such, the 10-Year plan is to address 50% of the current backlog. As the network continues to deteriorate over time, some pipes above 20 will drop below this threshold. It is the Infrastructure Planning Division's intention to develop deterioration models for watermain pipes so that the individual pipe segments that drop into the deficient category can be identified. However, since this is not available now, and to recognize that there will be some additional pipes added to the backlog each year, 0.25% of the network not currently in the backlog has been assumed to drop below WPI 20 annually over the 10-Year horizon of this AMP report.

The City has developed an annual budget of $750,000 to maintain the current LOS for the WPP. **Table 40** below presents the total (10-Year) and annual (rounded down) funding required to achieve the LOS target.

Table 40 - Total Funding Required to Meet LOS - Water	
Asset Class	**10-Year Capital Need**
Water	$23,700,000
WPP	$7,500,000
Total	**$31,200,000**
Annual Capital Funding	**$3,120,000**

5.6.10Expenditure History

Tables 41 and 42 below outline the Maintenance Spending and Capital Spending, respectively, associated with the water distribution network for 2013 to 2015 and the 2016 Budget.

Table 41 - Historical Maintenance Funding - Water

Asset Class	Description	Actual 2013	Actual 2014	Actual 2015	Budget 2016
Water	**Asset Maintenance**	**$975,397**	**$941,634**	**$1,173,393**	**$1,002,374**
	Taxation Funding	$0	$0	$0	$0
	Water Rate Revenue	$975,397	$941,634	$1,173,393	$1,002,374
	Sanitary Sewer Rate Revenue	$0	$0	$0	$0
	Federal Gas Tax	$0	$0	$0	$0
	Grants (OCIF)	$0	$0	$0	$0
	Financing	$0	$0	$0	$0
	County Revenue	$0	$0	$0	$0
	Reserves	$0	$0	$0	$0
	Total Funding	**$975,397**	**$941,634**	**$1,173,393**	**$1,002,374**
	Net Unfunded	**$0**	**$0**	**$0**	**$0**

Table 42 - Historical Capital Replace/New and Funding - Water

Asset Class	Description	Actual 2013	Actual 2014	Actual 2015	Budget 2016
Water	**Capital Expenditure**	**$1,968,926**	**$1,952,906**	**$3,231,213**	**$2,872,600**
	Taxation Funding	$0	$0	$0	$0
	Water Rate Revenue	$1,266,596	$1,517,921	$1,731,213	$1,872,600
	Sanitary Sewer Rate Revenue	$111,694	$144,573	$0	$0
	Federal Gas Tax	$0	$0	$0	$0
	Grants	$90,636	$290,411	$1,000,000	$1,000,000
	Financing	$0	$0	$0	$0
	County Revenue	$0	$0	$0	$0
	Reserves	$500,000	$0	$500,000	$0
	Total Funding	**$1,968,926**	**$1,952,906**	**$3,231,213**	**$2,872,600**
	Net Unfunded	**$0**	**$0**	**$0**	**$0**

5.7 Overall Linear Asset Management Strategy

5.7.1 Asset Management Activities, Procedures and Policies

5.7.1.1 Approach to Data Assembly

The City currently manages a large amount of data and information stored in its GIS. It is recommended to continue that practice. The recommendation to use the Corporate GIS as the enterprise database is common practice in many municipalities across Canada. Data is maintained in one environment (SQL Server), and accessible by many users. Relevant information can be exported in external applications for processing of data. The results can then be imported back in the GIS database and accessed/displayed graphically which adds value to the information stored in databases. An enterprise database system reduces data redundancy and increases access to information across the organization.

Additionally, the City utilizes a Pavement Management System (PMS) to manage the maintenance and renewal of its roads. The PMS allows the City to develop deterioration models for its roads to better forecast capital and maintenance needs.

5.7.1.2 Maintenance Activities

5.7.1.2.1 Roads

The City tracks road conditions by means of a biennial condition inventory together with a computer model which deteriorates conditions over time and forecasts rehabilitation. This provides an up-to-date PCR and a preliminary construction program. Intervention strategies are identified ranging from crack sealing and skim patching, which are designed to prolong pavement life, to more extensive treatment such as resurfacing or complete reconstruction. Municipal Works also conducts regular road patrols to monitor and address pot-holes and other maintenance needs in accordance with the Ontario Minimum Maintenance Standard.

Road rehab strategies are coordinated with other linear sewer, water and sidewalk infrastructure when pavement condition falls below LOS targets. Resurfacing is the preferred strategy, along with any needed new curb, sidewalk or sewer/water spot repairs, unless the underground infrastructure condition or other circumstances indicates reconstruction is recommended.

5.7.1.2.2 Sidewalks and Recreational Paths

Adhering to Ontario's Minimum Maintenance Standard, the City completes an annual inspection of all sidewalks to assess their condition and to identify hazards. During the inspection, the following deficiencies are identified; trip edges, cracks, spalling and missing ramps. Trips edges are immediately painted to alert users' attention to the hazard. Maintenance staff routinely complete trip edge repairs as they are identified.

The inspection components derive a sidewalk condition rating of 1 - 5 (very good to very poor). Sidewalks in need of complete replacement are usually coordinated with the adjacent road work program.

5.7.1.2.3 Sewer

Sewer network investigation has determined the structural condition (SC Grade 1 to 5) and potential for blockage (PB 1 to 5), which applies to all sewer types (sanitary, combined and storm). Municipal Works also has a regular sewer flushing program whereby all sanitary and combined sewers are flushed biennially and problem areas are flushed more frequently.

Structural Condition grades 4 and 5 are programmed for repair or replacement, typically coordinated with roadway pavement renewal. Potential for Blockage (PB) grades 4 and 5 have been identified and a capital program established to address these deficiencies throughout the network. The current iteration of the PB program is expected to be completed in approximately 5 years, after which the review of the network will begin again.

5.7.1.2.4 Water

The City has developed a WPI based on remaining service life, break history and hydraulic performance. Typically, older cast iron watermains have the lowest WPI. Watermains with a WPI of 20 or less are programmed for rehabilitation or replacement, coordinated with roadway pavement renewal.

Municipal Works has a regular hydrant flushing program to monitor flow conditions and chlorine residual levels. In addition, watermain breaks are repaired on an as they occur basis.

5.7.1.3 Integrated Rehabilitation and Renewal

Based on current levels of funding, the City almost exclusively renews its sidewalks in conjunction with a road resurfacing or reconstruction project. This is the most cost effective way to address the road and sidewalk issues. However, the approach does not take into account the specific needs of the sidewalks in the worst condition.

Wherever possible, the City attempts to combine renewal activities for roads, sewer and water projects. In doing so, the City reduces the impact to residents and also avoids the unnecessary replacement of a road that is in good condition for the sole purpose of repairing or replacing underground infrastructure.

In some instances, the City conducts enhanced maintenance on infrastructure to extend its service life to better align with the RSL of co-terminus infrastructure. For example, road maintenance would be undertaken as opposed to a complete resurfacing/reconstruction in an instance where buried water or sewer pipes will require replacement within a 5-year time horizon. The reconstruction of the road, and the replacement of the underground infrastructure would be completed concurrently.

Additionally, the City has a program in-place that focuses on sewer separation, the removal of combined sewer and replacement with separate sanitary and storm networks.

During the annual budgeting process, a joint infrastructure budget is prepared to encourage the integrated approach to renewal of linear infrastructure across the City.

5.7.2 Criticality of Infrastructure and Risk

At present, the primary driver of priority for the City is condition, whether it be based on specific condition assessment information, or by using age as a proxy for condition.

As the AMP evolves, we recommend that a more formal integration of asset criticality and risk be applied to the linear assets as part of the prioritization of capital budget allocation.

5.7.3 Future Demand

The City is not predicting a significant increase in demand for its linear assets at this time. However, should the City's mandate for providing services change, for example by regionalizing water and wastewater treatment, the need for expansion of the sewer and watermain networks may arise over the next 10 years.

6 POINT ASSETS

6.1 POINT ASSET INVENTORY

The main source of information for the point assets was also from the GIS database. The FCAPX Team, in collaboration with staff, reviewed the information provided to ensure data accuracy and completeness.

6.2 POINT ASSET INFRASTRUCTURE VALUATION

Calculating the replacement costs of infrastructure assets provides insight on the existing financial investments on municipal infrastructure networks. To calculate overall replacement costs, each type of point asset was assigned an average unit cost. Unit construction costs were developed in collaboration with City staff based on recent construction activities in the area or historical information.

6.3 BRIDGES, LARGE CULVERTS & SMALL CULVERTS

6.3.1 Asset-Specific Methodology

6.3.1.1 Bridge and Culvert Network Condition Assessment Process

OSIM surveys were completed in 2015 for bridges and large culverts (span of 3 m of more). The database contained information on year of construction, service lives and replacement costs, which was used to forecast timing for rehabilitation and replacement of those assets. The forecasts were reviewed by staff and adjusted as a result of the actual condition of specific assets. Small culverts (span of less than 3 m) were assessed in 2016 to obtain a structural condition.

6.3.2 Desired Levels of Service

6.3.2.1 Determining Appropriate Level of Service for Cornwall

The City has determined the LOS target for bridges and culverts will be to address the recommendations provided by the Bridge and Culvert inspections completed in 2015.

For the Small Culverts, the City does not have a formal strategy for renewal and budgeting. As such, the City determined that the LOS target for the small culverts would be to budget 2% of the replacement value of the assets on an annual basis. The City recognizes that it needs to expand its asset management processes to better understand the needs of its small culverts prior to the next version of the AMP.

6.3.2.2 Current Performance

Table 43 provides the Bridge Condition Indices (BCI) for the bridges and culverts, based on the 2015 OSIM inspections. As demonstrated, the portfolio is generally in good condition with the majority of bridges and culverts having a BCI above 60%. A description of the BCI Condition rating scale has been included in **Appendix I**.

Table 43 - Bridge and Culvert Condition Indices

BCI Condition Rating	BCI Range	Bridges	Percentage	Culverts	Percentage
Excellent	81-100	1	8.33%	0	0.00%
Good	61-80	10	83.33%	8	61.54%
Fair	41-60	1	8.33%	1	7.69%
Poor	21-40	0	0.00%	3	23.08%
Very Poor	<20	0	0.00%	1	7.69%
Total		**12**	**100.00%**	**13**	**100.00%**

Table 44 below provides details of the SC Grade for the small culverts managed and maintained by the City. As indicated, the majority of the small culverts are in good condition, with a Grade of 3 or less. A copy of the small culvert condition rating scale has been included in **Appendix J**.

Table 44 - Small Culvert Structural Condition Grade			
Condition Rating	**Grade**	**Length (km)**	**Percentage**
Excellent	1	25	28.41%
Good	2	24	27.27%
Fair	3	12	13.64%
Poor	4	9	10.23%
Very Poor	5	10	11.36%
Not Avail.	Not Avail.	8	9.09%
Total		**88**	**100.00%**

6.3.3 State of Infrastructure

6.3.3.1 Current Replacement Value

Table 45 below provides the estimate replacement value for the bridges, culverts and small culverts, as well as a 2% annual allocation for reinvestment.

Table 45 - Asset Value - Bridges and Culverts			
Asset Type	**Quantity (each)**	**Estimated Replacement Value**	**2% Yearly Allocation**
Bridges	12	$32,846,000	$656,920
Large Culverts	13	$7,664,000	$153,280
Small Culverts	88	$5,026,000	$100,520
Total		**$45,536,000**	**$910,720**

Based on these results and the recommended 2% yearly investment in maintenance, ideally the City would allocate approximately $910,720 per year to ensure future sustainability of its bridges, culverts and small culverts.

6.3.3.2 Physical Characteristics of Bridges, Large Culverts & Small Culverts

Table 46 and **Figures 15** and **16** below provide the details of the bridge and culvert construction type.

Table 46 - Bridge and Large Culvert Construction Type		
Bridge Type	**Number**	**Percentage**
Double Cell Concrete Rigid Frame	1	8.33%
Prestressed Concrete Girders	1	8.33%
Concrete Slab on Concrete Girders	3	25.00%
Concrete Slab on Steel Girders	1	8.33%
Single Span Eagle Bridge	2	16.67%
Encased Steel Girders on Slab	1	8.33%
Concrete Rigid Frame	1	8.33%
Bailey Bridge	1	8.33%
Floating Pedestrian Bridge	1	8.33%
Totals	**12**	**100.00%**
Large Culvert Type	**Number**	**Percentage**
SPCSP	1	7.69%
Twin SPCSP	1	7.69%
Triple SPCSP	3	23.08%
SPCSP Ellipse	4	30.77%
Concrete Box	1	7.69%
Pre-Cast Concrete Box	1	7.69%
CSP Arch	2	15.38%
Total	**13**	**100.00%**

Figure 15 - Bridge Type

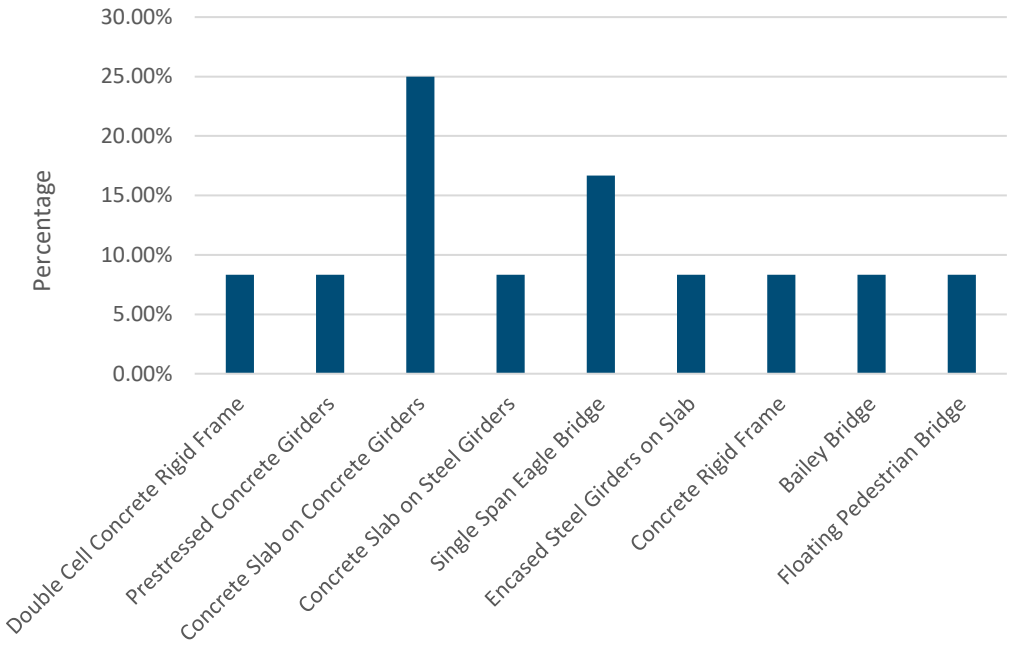
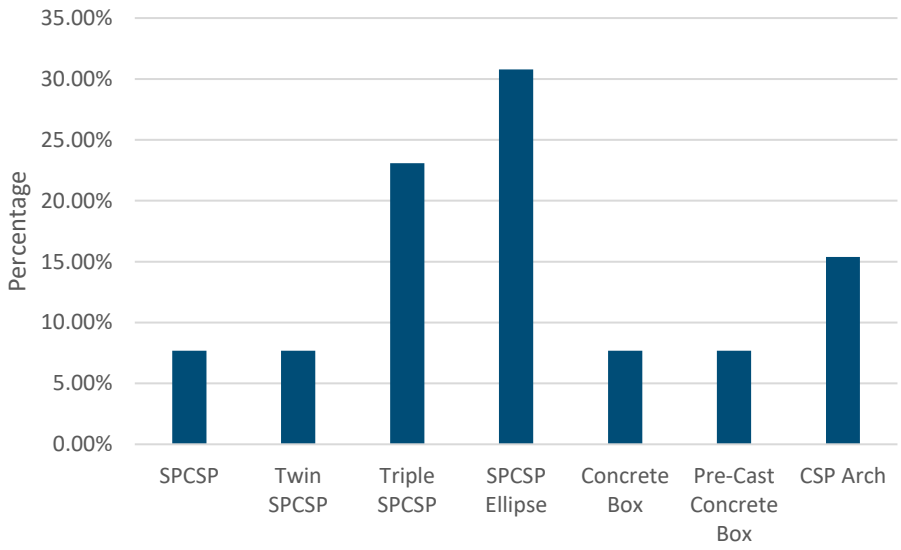


Figure 16 – Large Culvert Type



6.3.3.3 Current Needs Summary

6.3.3.3.1 Unlimited Budget Scenario

Table 47 below provides the current backlog of renewal for the Bridges, Culverts and Small Culverts included in the AMP, based on the 2015 OSIM inspections.

Table 47 - Immediate Backlog Repair Costs – Bridges, Large Culverts & Small Culverts

Asset Class	Quantity of Repairs Required	Cost of Repairs
Bridges	4	$73,000
Large Culverts	5	$68,000
Small Culverts	19	$190,000
Total		**$331,000**

6.3.4 AM Strategy

For the bridges and culverts, the City will complete all of the recommended renewal activities and engineering inspection costs outlined in the 2015 OSIM inspections. For small culverts, the City will budget 2% of the replacement value for the assets annually. **Table 48** below presents the total (10-Year) and annual (rounded down) funding required the achieve the LOS target.

Table 48 - Total Funding Required to Meet LOS - Bridges, Large Culverts & Small Culverts

Asset Class	10-Year Capital Need
Bridges	$4,308,000
Large Culverts	$2,979,000
Small Culverts	$1,005,200
Total	**$8,292,200**
Annual Capital Funding	**$830,000**

6.3.5 Expenditure History

Tables 49 and 50 below outline the Maintenance Spending and Capital Spending, respectively, associated with the Bridges, Culverts & Small Culverts for 2013 to 2015 and the 2016 Budget.

Table 49 - Historical Maintenance Funding – Bridges, Large Culverts & Small Culverts					
Asset Class	**Description**	**Actual 2013**	**Actual 2014**	**Actual 2015**	**Budget 2016**
Bridges, Large Culverts & Small Culverts	**Asset Maintenance**	**$7,841**	**$6,016**	**$10,625**	**$8,609**
	Taxation Funding	$7,841	$6,016	$10,625	$8,609
	Water Rate Revenue	$0	$0	$0	$0
	Sanitary Sewer Rate Revenue	$0	$0	$0	$0
	Federal Gas Tax	$0	$0	$0	$0
	Grants	$0	$0	$0	$0
	Financing	$0	$0	$0	$0
	County Revenue	$0	$0	$0	$0
	Reserves	$0	$0	$0	$0
	Total Funding	**$7,841**	**$6,016**	**$10,625**	**$8,609**
	Net Unfunded	**$0**	**$0**	**$0**	**$0**

Table 50 - Historical Capital Funding- Bridges, Large Culverts & Small Culverts					
Asset Class	**Description**	**Actual 2013**	**Actual 2014**	**Actual 2015**	**Budget 2016**
Bridges, Large Culverts & Small Culverts	**Capital Expenditure**	**$0**	**$0**	**$0**	**$269,000**
	Taxation Funding	$0	$0	$0	$100,000
	Water Rate Revenue	$0	$0	$0	$0
	Sanitary Sewer Rate Revenue	$0	$0	$0	$0
	Federal Gas Tax	$0	$0	$0	$169,000
	Grants	$0	$0	$0	$0
	Financing	$0	$0	$0	$0
	County Revenue	$0	$0	$0	$0
	Reserves	$0	$0	$0	$0
	Total Funding	**$0**	**$0**	**$0**	**$269,000**
	Net Unfunded	**$0**	**$0**	**$0**	**$0**

6.4 Traffic Signals & Street Lights

6.4.1 Asset-Specific Methodology

6.4.1.1 Traffic Signal and Street Light Condition Assessment Program

There is no specific condition assessment program conducted by the City for its traffic signals and street lights, however staff and respective maintenance contractors assess regularly (annually) for capital works prioritization.

6.4.2 Desired Levels of Service

6.4.2.1 Determining Appropriate Level of Service for Cornwall

For the last decade, the City has completed a program, which included the replacement of traffic signals at two intersections per year. The City is proposing to continue this program for the next 10 years to maintain the current LOS for traffic signals.

For the City's street lights, 4,433 lights were retrofitted in to Light Emitting Diode (LED) fixtures in 2016. For the Desired LOS, the City has determined that it will retrofit the remaining street lights to LED fixtures.

6.4.2.2 Current Performance

Traffic signals and street lights are maintained regularly by a third-party contractor. Detailed condition information on the condition and performance of the traffic signals and street lights is not available. However, any performance issues identified by the contractor are addressed on behalf of the City.

6.4.3 State of Infrastructure

6.4.3.1 Current Replacement Value

Table 51 below provides the estimate replacement value for traffic signals and street lights, as well as a 2% annual allocation for reinvestment.

Table 51 - Asset Value - Traffic Signals and Street Lights

Asset Type	Quantity (each)	Estimated Replacement Value	2% Yearly Allocation
Traffic Signals	68	$9,180,000	$183,600
Street Lights	5127	$13,828,000	$276,560
Total		**$23,008,000**	**$460,160**

Based on these results, and the recommended 2% yearly investment in maintenance, ideally the City would allocate approximately $460,160 per year to ensure future sustainability of its traffic signals and street lights.

6.4.3.2 Current Needs Summary

6.4.3.2.1 Unlimited Budget Scenario

Table 52 below provides the current backlog of repairs for traffic signals and street lights included in the AMP.

Table 52 - Immediate Backlog Repair Costs - Traffic Signals & Street Lights		
Asset Class	**Quantity of Repairs Required**	**Cost of Repairs**
Traffic Signals	1	$135,000
Street Lights	858	$441,851
Total		**$576,852**

6.4.4 AM Strategy

The City will continue its program of replacing traffic signals at two intersections per year for the duration of the 10-Year plan. For street lights, the City is planning to replace the remaining 858 street lights with LED fixtures. The retrofit of the street lights may be fast-tracked and not distributed over the 10-year time horizon of the AMP in the event that funding is available.

Table 53 - Total Funding Required to Meet LOS - Traffic Signals & Street Lights	
Asset Class	**10-Year Capital Need**
Traffic Signals	$2,700,000
Street Lights	$441,851
Total	**$3,141,851**
Annual Capital Funding	**$315,000**

6.4.5 Expenditure History

Tables 54 and 55 below outline the Maintenance Spending and Capital Spending, respectively, associated with the Traffic Signals & Street Lights for 2013 to 2015 and the 2016 Budget.

Table 54 - Historical Maintenance Funding - Traffic Signals & Street Lights					
Asset Class	**Description**	**Actual 2013**	**Actual 2014**	**Actual 2015**	**Budget 2016**
Traffic Signals & Street Lights	**Asset Maintenance**	**$675,472**	**$597,875**	**$322,772**	**$607,500**
	Taxation Funding	$554,983	$597,875	$322,772	$607,500
	Water Rate Revenue	$0	$0	$0	$0
	Sanitary Sewer Rate Revenue	$0	$0	$0	$0
	Federal Gas Tax	$0	$0	$0	$0
	Grants	$120,489	$0	$0	$0
	Financing	$0	$0	$0	$0
	County Revenue	$0	$0	$0	$0
	Reserves	$0	$0	$0	$0
	Total Funding	**$675,472**	**$597,875**	**$322,772**	**$607,500**
	Net Unfunded	**$0**	**$0**	**$0**	**$0**

Table 55 - Historical Capital Funding - Traffic Signals & Street Lights					
Asset Class	**Description**	**Actual 2013**	**Actual 2014**	**Actual 2015**	**Budget 2016**
Traffic Signals & Street Lights	**Capital Expenditure**	**$628,970**	**$848,312**	**$327,072**	**$350,000**
	Taxation Funding	$115,612	$636,338	$327,072	$350,000
	Water Rate Revenue	$0	$0	$0	$0
	Sanitary Sewer Rate Revenue	$0	$0	$0	$0
	Federal Gas Tax	$0	$0	$0	$0
	Grants	$468,024	$211,974	$0	$0
	Financing	$0	$0	$0	$0
	County Revenue	$0	$0	$0	$0
	Reserves	$45,334	$0	$0	$0
	Total Funding	**$628,970**	**$848,312**	**$327,072**	**$350,000**
	Net Unfunded	**$0**	**$0**	**$0**	**$0**

6.5 Overall Point Asset Management Strategy

6.5.1 Asset Management Activities, Procedures and Policies

6.5.1.1 Approach to Data Assembly

The City currently manages a large amount of data and information stored in GIS. It is recommended to continue that practice. The recommendation to use the Corporate GIS as the enterprise database is common practice in many municipalities across Canada. Data is maintained in one environment and

accessible by many users. Relevant information can be exported in external applications for processing of data. The results can then be imported back in the GIS database and accessed/displayed graphically which adds value to the information stored in databases. An enterprise database system reduces data redundancy and increases access to information across the organization.

6.5.1.2 Maintenance Activities

6.5.1.2.1 Bridges and Culverts

The City completes a biennial inspection on all bridges and culverts with a span of 3 metres or larger, as mandated by the province. The inspection follows the OSIM, which identifies each part of the bridge separately, to report on the final bridge condition with a BCI between 1 and 100. The condition of all components is evaluated and a time frame for intervention as well as an estimated budget are identified.

The City follows these recommendations in their renewal planning. Any bridge work that was recommended within 1 year was considered as requiring immediate attention.

6.5.1.2.2 Small Culverts

The City has undergone a visual inspection of all culverts that are less than 3 metres in span. The visual inspection consisted of looking at each culvert for deterioration of the following; invert condition (spalling, rust, perforations and scaling), joints and seams, cracking, scouring, alignment, blockages, embankment and roadway. The condition grade was a 1 to 5 score (1 being excellent, 5 being very poor). Any culverts that had a condition score of 4 or 5 are programmed for repair or replacement.

Inspections are expected to be completed biennially.

6.5.1.2.3 Traffic Signals

The City retains a contractor to routinely monitor traffic signals and respond to problems. The operating budget includes funds for replacement of components as necessary, including the controller on a frequency of approximately every 16 years. Complete reconstruction of signalized intersections is planned a rate of two per year, for a renewal cycle of approximately every 35 years.

6.5.1.2.4 Street Lights

The City retains a contractor to respond to street light outages. However, a majority of street lights, (4,433 of the cobra head style luminaires) have been replaced with LED fixtures which eliminates the light bulb and ballast replacements which were the primary maintenance needs. It is expected that the LED luminaries will have a maintenance free life expectancy of approximately 20 years.

The remaining street lights total 858 units and are post top and other decorative units. These are planned for replacement in the near term to take advantage of the maintenance and energy savings achieved with LED street lights.

6.5.2 Criticality of Infrastructure and Risk

At present, the primary driver of priority for the City is condition, whether it be based on specific condition assessment information, or by using age as a proxy for condition.

As the AMP evolves, we recommend that a more formal integration of asset criticality and risk be applied to the linear assets as part of the prioritization of capital budget allocation.

6.5.3 Future Demand

The City is not predicting a significant increase in demand for its point assets at this time. The future demand for traffic signals and street lights will be directly linked to any future expansion of the road network across the City.

7 FLEET

The City owns and operates a fleet of 202 fleet assets that support the services and programs provided by City departments.

7.1 ASSET-SPECIFIC METHODOLOGY

7.1.1 General Asset Data Inventory

The inventory of Fleet assets is managed through the City's TCA spreadsheet, which is maintained by Financial Services.

7.1.2 Condition Assessment Process

There is no specific assessment program developed for the various fleet assets owned by the City.

7.1.3 Expected Service Life (ESL)

As part of the TCA management process, the City maintains a listing of ESLs for each type of fleet asset that it owns, based on manufacturer recommendations, industry standards and the City's experience. The ESLs are used to depreciate the assets as well as project future capital needs.

7.1.4 Estimated Replacement Value

The estimated replacement value of the fleet assets was calculated by inflating the original purchase price by a compounded annual factor of 1.85%.

7.1.5 Asset Management Strategy

Generally, Fleet assets are in-service for at least the estimated service life of the asset. In some cases, where assets are in good operating condition, they continue to operate beyond the ESL.

7.2 Desired Levels of Service

7.2.1 Determining Appropriate Level of Service for Cornwall

7.2.1.1 Mandatory/Legislated Requirements

The City is legislated to provide Paramedic, Fire and Police Services, and must maintain a fleet of ambulances, fire trucks and police cruisers capable of providing these services. As such, due to the criticality of these fleet assets, the City has targeted a desired LOS that Emergency Response Vehicles (ERVs) will exceed their ESL by the end of 2025.

7.2.1.2 City-Driven Goals

The City requires additional fleet vehicles to deliver the additional programs and services to its residents. These assets include cars, trucks, road maintenance vehicles and heavy equipment. Although these assets are important to the City's on-going operations, they are not as critical as the ERVs. As such, the City has decided to allow a certain percentage of the Service Support Vehicles (SSVs) to operate beyond their ESL.

The Desired LOS for the SSVs is that no more than 20% of the assets (based on number of assets) exceed their ESL at the end of 2025.

7.2.2 Current Performance

Table 56 and Figure 17 below provides the age profile of the City's Fleet Assets for SSVs and ESVs.

Table 56 - Fleet Assets by Age				
Age	**SSVs**	**SSV Percentage**	**ESVs**	**Percentage**
New	11	7.53%	9	16.07%
2 to 5 Years	63	43.15%	35	62.50%
6 to 10 Years	33	22.60%	8	14.29%
11 to 15 Years	23	15.86%	4	7.14%
16 to 20 Years	7	4.79%	1	1.79%
Over 20 Years	8	5.48%	0	0.00%
Totals	**145**	**1**	**57**	**100.00%**

Figure 17 - Fleet Assets by Age

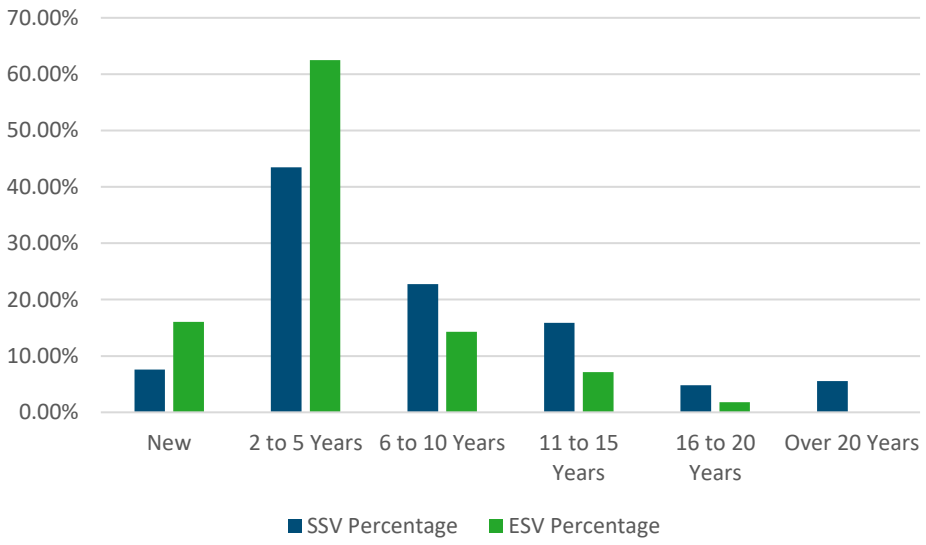
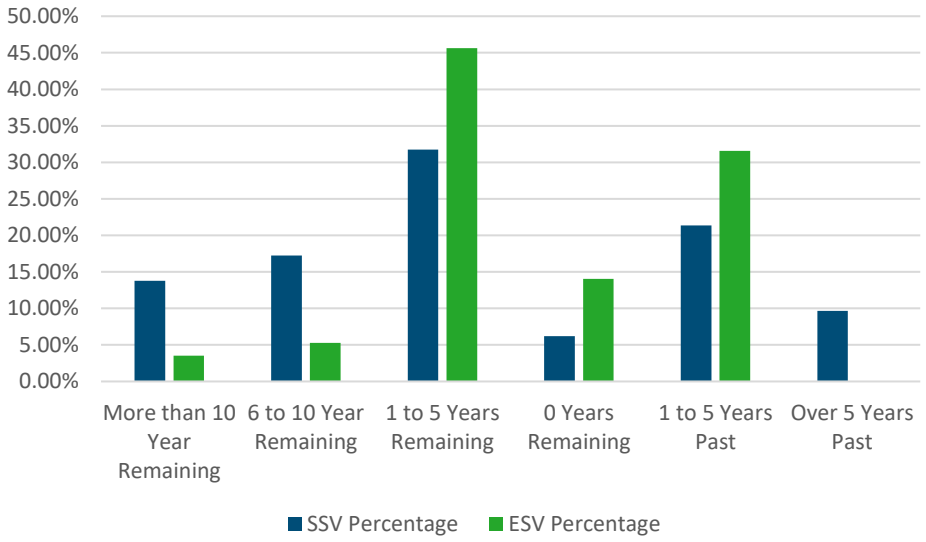


Table 57 and **Figure 18** below provide the details of the Remaining Service Life (RSL) for the City's Fleet Assets

Table 57 - Fleet Assets by Remaining Service Life				
Age	**SSV**	**ESV Percentage**	**ESV**	**SSV Percentage**
More than 10 Years Remaining	20	13.79%	2	3.51%
6 to 10 Years Remaining	25	17.24%	3	5.26%
1 to 5 Years Remaining	46	31.72%	26	45.61%
0 Years Remaining	9	6.21%	8	14.04%
1 to 5 Years Past	31	21.38%	18	31.58%
Over 5 Years Past	14	9.66%	0	0.00%
Totals	**145**	**100.00%**	**57**	**100.00%**

Figure 18 - Fleet Assets by Remaining Service Life



7.3 STATE OF INFRASTRUCTURE

7.3.1 Replacement Value

For fleet assets, asset management best practice literature suggests that 8% to 10% of the value of an asset should be invested back into the network annually, in order to ensure long-term sustainability of the assets. Without asset management tools, it is almost impossible to determine the long-term effect of inadequate budget allocations. Yet, it is important for an organization to determine if the current level of funding is appropriate to continue to provide an appropriate LOS to its residents.

Table 58 - Asset Value – Fleet			
Asset Type	**Quantity (each)**	**Estimated Replacement Value**	**8% Yearly Allocation**
Fleet	202	$22,736,362	$1,818,909
Total	**202**	**$22,736,362**	**$1,818,909**

Based on these results and the recommended 8% yearly investment in maintenance, ideally the City would allocate $1,818,909 per year to ensure future sustainability of its infrastructure assets.

7.3.2 Asset Inventory

Table 59 below provides details of the Emergency Response and other Fleet Assets included in the AMP.

Table 59 - Fleet Details by Type				
Fleet Type	**SSVs**	**ERVs**	**Total**	**Percentage**
Ambulance	0	14	14	6.93%
Boat	0	1	1	0.50%
Bus	27	0	27	13.37%
Cars and SUVs	27	33	60	29.70%
Dump Truck/Plow	18	0	18	8.91%
Fork Lift	2	0	2	0.99%
Front End Loader	3	0	3	1.49%
Miscellaneous	4	0	4	1.98%
Motorcycle	1	0	1	0.50%
Street Sweeper/Flusher	3	0	3	1.49%
Tractor	14	0	14	6.93%
Trailer	12	1	13	6.44%
Truck	11	7	18	8.91%
Utility Van	7	0	7	3.47%
Van	11	1	12	5.94%
Zamboni	5	0	5	2.48%
Total	**145**	**57**	**202**	**100.00%**

Table 60 provides the breakdown of the Emergency Response and other Fleet Assets by responsible City Department

Table 60 - Fleet Details by Department				
Department	**SSVs**	**ERVs**	**Total**	**Percentage**
Emergency Management Services	1	0	1	0.50%
Fire Services	5	10	15	7.43%
Home for the Aged	1	0	1	0.50%
Municipal Works	78	0	78	38.61%
Paramedic Services	6	14	20	9.90%
Parks and Recreation Services	8	0	8	3.96%
Police Services	16	33	49	24.26%
Transit Services	30	0	30	14.85%
Grand Total	**145**	**57**	**202**	**100.00%**

7.3.3 Current Needs Summary

7.3.3.1 Unlimited Budget Scenario

Table 61 provides the number of fleet assets (both ERVs and SSVs) that have exceeded their ESL (as of 2016) and the total replacement value (current year dollars) for those assets.

Table 61 - Immediate Backlog Replacement Costs – Fleet		
Asset Class	**Quantity of Assets for Replacement**	**Cost of Repairs**
Fleet	77	$7,927,443
Total		**$7,927,443**

7.4 AM STRATEGY

7.4.1 Maintain or Improve Level of Service

To achieve the Desired LOS outlined for ERVs (no assets beyond the ESL) and SSVs (no more than 20% of the assets beyond the ESL) assets by the end of 2025, an annual funding capital requirement of $2,250,000 will be needed as per **Table 62** below.

Table 62 - Total Funding Required to Meet LOS - Fleet	
Fleet LOS	**Annual Capital Need**
ERV Capital Need	$7,729,011
SSV Capital Need	$14,767,886
Total	**$22,496,897**
Annual Capital Funding	**$2,250,000**

For the purposes of the financial needs calculation, we assumed that the 20% of the SSVs that would be operated beyond their ESLs would be the newest assets within this grouping (assets that would meet or exceed the ESL between 2021 and 2025).

As there are currently 77 fleet assets that are at or have exceeded the ESL. Achieving these desired LOS would be a significant improvement from the current LOS for the Fleet Assets.

7.4.2 Asset Management Activities, Procedures and Policies

7.4.2.1 Approach to Data Assembly

Fleet data for Transit, Police and Paramedic Services' vehicles are housed within PM Expert, a computerized preventative maintenance program. Municipal Works currently uses a DOS based fleet management program (Fleet Plus), while Fire Services does not utilize a computerized fleet program. We recommend that departments using PM Expert continue and other departments utilize PM Expert by integrating their vehicle maintenance records into the program.

7.4.2.2 Maintenance Activities

The City utilizes PM Expert to coordinate routine maintenance for Transit, Police and Paramedic Services vehicles. Municipal Works will join the program in 2017. Conducting routine maintenance on the fleet vehicles will result in extension of the ESLs for the assets and reduce unexpected capital and operating costs.

7.4.2.3 Performance and Lifecycle Costs

Municipalities with large fleet inventories typically perform statistical analysis of fleet costs. The average yearly maintenance costs for an asset class is determined. Each asset's yearly costs are then compared to the average. Those assets whose costs are greater than the average are deemed to perform poorly and are slated for early disposal. This method assumes fleet class usage is similar if not identical between the assets in the class.

This is just one example of the type of performance analysis that can be done in order to guide asset management decision making for fleet assets.

7.4.2.4 Fleet Leasing Strategy

In addition to the owned Fleet vehicles, the City also leases the following vehicles to support on-going City operations:

- 1 Car;
- 18 Vans; and
- 31 Pick-Up Trucks.

The City will continue to utilize a combined ownership and leased model for select SSVs.

7.4.3 Future Demand

The City does not expect a material increase in demand for its Fleet Assets, which was key to developing a replacement-based Desired LOS for the asset class.

7.5 Asset-Specific Financing Strategy

7.5.1 Expenditure History

Tables 63 and 64 below outline the Maintenance Spending and Capital Spending, respectively, associated with Fleet for 2013 to 2015 and the 2016 Budget.

Table 63 - Historical Maintenance Funding - Fleet

Asset Class	Description	Actual 2013	Actual 2014	Actual 2015	Budget 2016
Fleet	**Asset Maintenance**	**$2,350,152**	**$2,451,464**	**$2,511,984**	**$2,430,855**
	Taxation Funding	$2,190,403	$2,273,135	$2,326,918	$2,277,855
	Water Rate Revenue	$0	$0	$0	$0
	Sanitary Sewer Rate Revenue	$0	$0	$0	$0
	Federal Gas Tax	$0	$0	$0	$0
	Grants	$0	$0	$0	$0
	Financing	$0	$0	$0	$0
	County Revenue	$159,749	$178,329	$185,066	$153,000
	Reserves	$0	$0	$0	$0
	Total Funding	**$2,350,152**	**$2,451,464**	**$2,511,984**	**$2,430,855**
	Net Unfunded	**$0**	**$0**	**$0**	**$0**

Table 64 - Historical Capital Funding - Fleet					
Asset Class	**Description**	**Actual 2013**	**Actual 2014**	**Actual 2015**	**Budget 2016**
Fleet	**Capital Expenditure**	**$2,428,045**	**$1,371,968**	**$1,405,786**	**$2,289,000**
	Taxation Funding	$291,974	$3,553	$85,424	$0
	Water Rate Revenue	$0	$0	$0	$0
	Sanitary Sewer Rate Revenue	$0	$0	$0	$0
	Federal Gas Tax	$0	$0	$0	$0
	Grants	$180,836	$0	$65,244	$0
	Financing	$1,444,696	$935,906	$746,267	$1,877,000
	County Revenue	$0	$0	$0	$0
	Reserves	$510,540	$432,509	$508,851	$412,000
	Total Funding	**$2,428,045**	**$1,371,968**	**$1,405,786**	**$2,289,000**
	Net Unfunded	**$0**	**$0**	**$0**	**$0**

8 OVERALL FINANCING STRATEGY

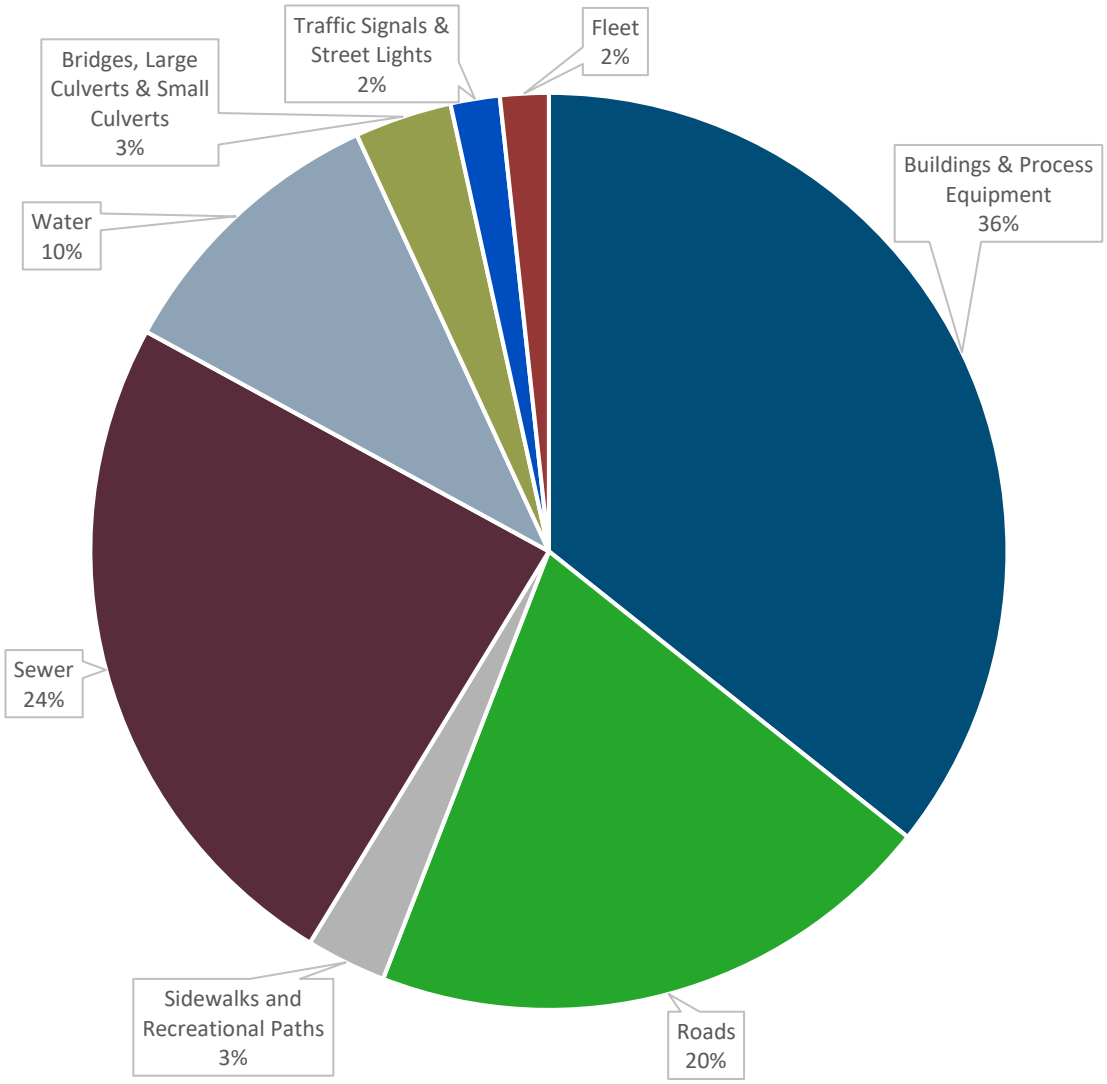
8.1 TOTAL PORTFOLIO CURRENT REPLACEMENT VALUE

Table 65 and **Figure 19** below provides the replacement values by asset class, as well as the 2% annual funding allocation for the entire portfolio of assets included in the AMP. As indicated, the City's asset portfolio is valued at approximately $1.33 Billion.

Table 65 - Current Replacement Value by Asset Type		
Asset Class	**Estimated Replacement Value**	**2% Yearly Allocation**
Buildings & Process Equipment	$473,772,250	$9,475,445
Roads	$267,898,000	$5,357,960
Sidewalks and Recreational Paths	$37,639,000	$752,780
Sewer (linear)	$321,427,000	$6,428,540
Water (linear)	$134,989,000	$2,699,780
Bridges, Large Culverts & Small Culverts	$45,536,000	$910,720
Traffic Signals & Street Lights	$23,008,000	$460,160

Asset Class	Estimated Replacement Value	8% Yearly Allocation
Fleet	$22,736,362	$1,818,909
Total	**$1,327,005,612**	**$27,904,294**

Figure 19 - Estimated Replacement Value for City of Cornwall ($1.33 B)

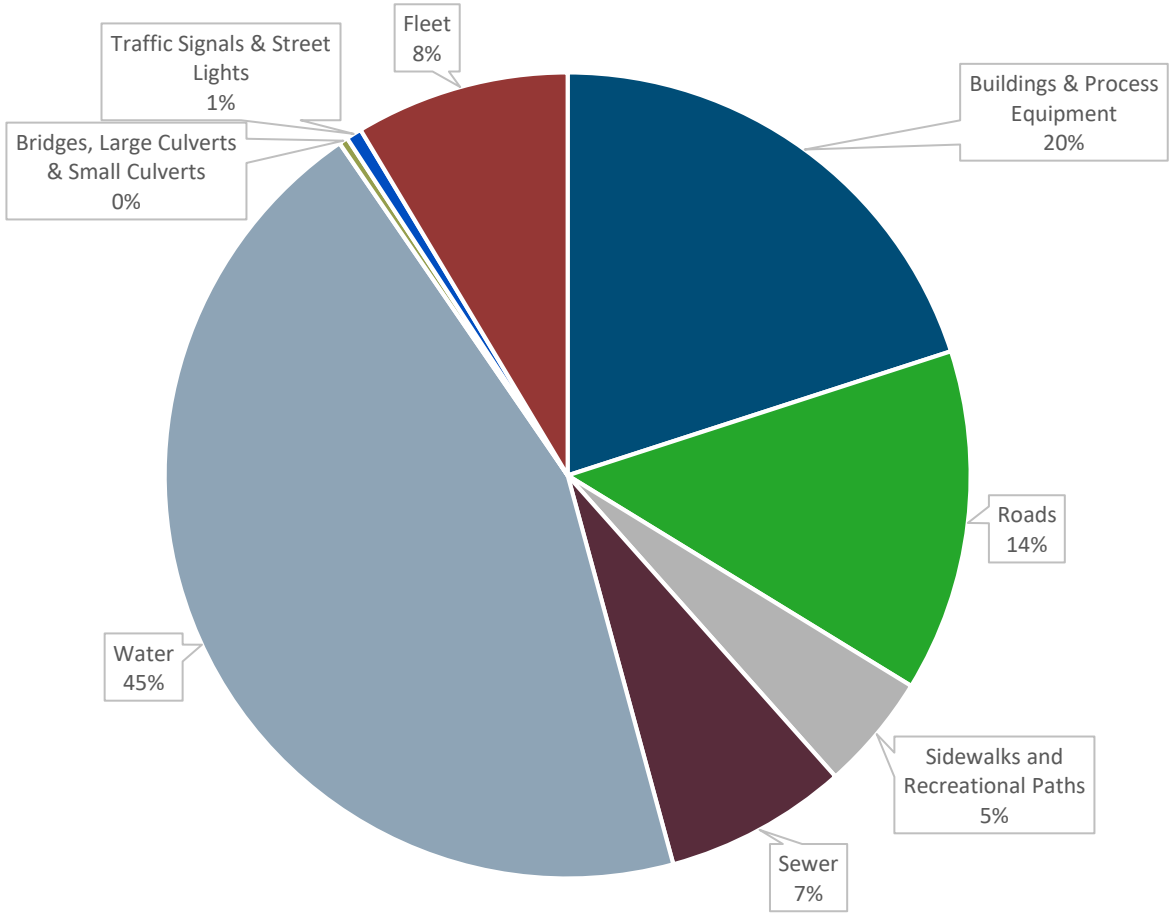


8.2 TOTAL PORTFOLIO CURRENT NEEDS SUMMARY

Table 66 and **Figure 20** below provides the summary of current needs for all the asset classes included in the AMP.

Table 66 - Immediate Backlog Replacement Costs	
Asset Class	**Cost of Repairs**
Buildings & Process Equipment	$18,464,650
Roads	$12,671,000
Sidewalks and Recreational Paths	$4,322,000
Sewer	$6,774,560
Water	$41,190,000
Bridges, Large Culverts & Small Culverts	$331,000
Traffic Signals & Street Lights	$576,842
Fleet	$7,927,443
Total	**$92,257,495**

Figure 20 - Immediate Backlog Repair Costs ($92 M)



Most municipalities in Canada are in a similar situation in terms of high infrastructure repair backlogs. Although municipalities are generally aware of the problem, it is challenging to properly assess the long-term effect of current funding levels on the sustainability of their infrastructure. The only way for a municipality to take control and properly manage its backlog, in a realistic manner, is through the implementation of asset management tools. These tools enable asset managers to assess the long-term effect of different levels of funding.

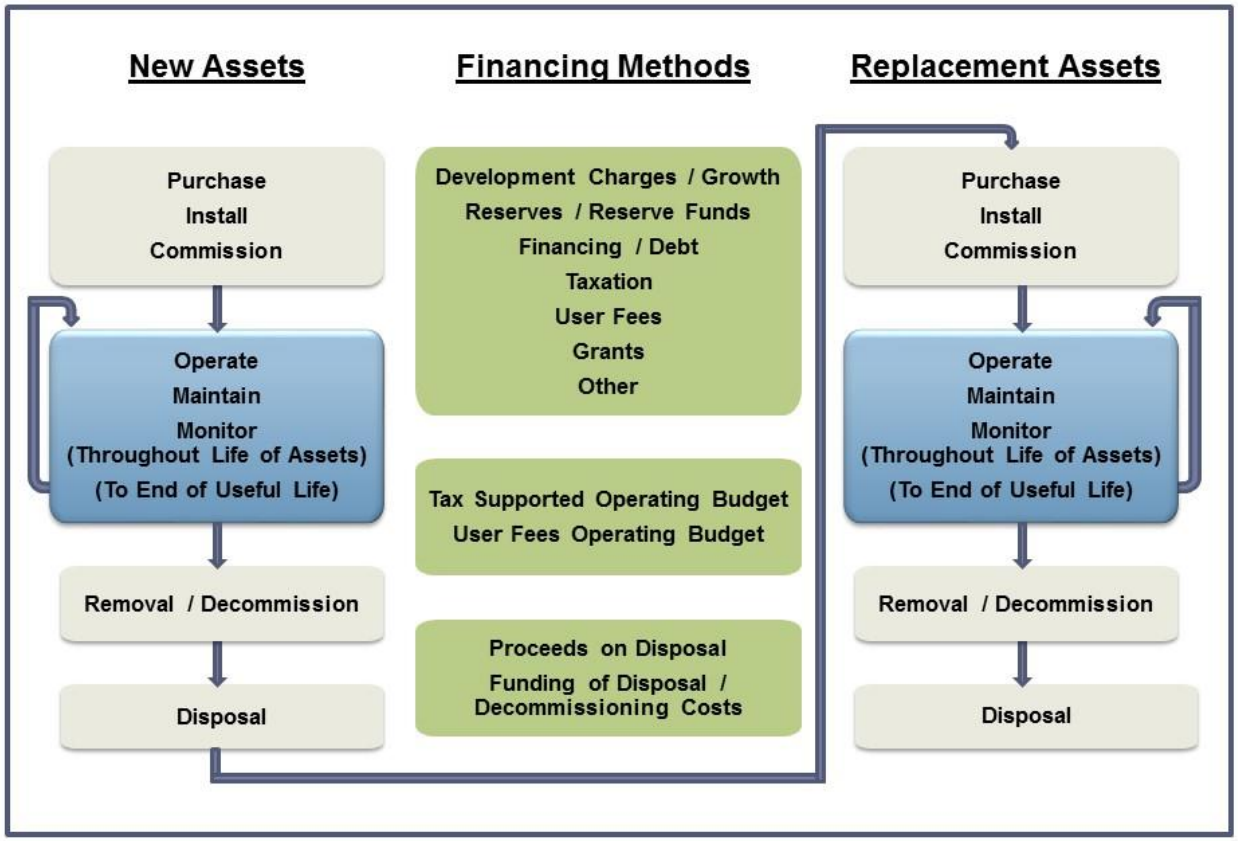
8.3 SCOPE & PROCESS

The financing strategy outlines the suggested financial approach to funding the recommended asset management strategy outlined in previous sections, while utilizing the City's existing budget structure. This section of the asset management plan includes:

- Annual expenditure forecasts broken down by:
  - Maintenance/non-infrastructure solutions;
  - Renewal/rehabilitation activities;
  - Replacement/disposal activities; and
  - Expansion activities.
- Actual or budgeted expenditures in the above named categories for 2013 to 2016;
- A breakdown of annual funding/revenue by source; and
- Identification of the funding shortfall, including how the impact will be managed.

The long-term financing strategy forecast (including both expenditure and revenue sources) was prepared, consistent with the City's departmental budget structure, so that it can be used in conjunction with the annual budget process. Various financing sources, including taxation, reserves, reserve funds, debt, user fees and grants were considered during the process. **Figure 21** below provides a visual representation of how various financing methods can be used for both initial asset purchases, as well as asset replacements.

Figure 21 – Financing Methods of Lifecycle Costs



8.4 CONSOLIDATED EXPENDITURE HISTORY

Table 67 outlines the historical maintenance amounts for 2013 to 2015, as well as the Budget for 2016. The majority of maintenance for assets was funded through taxation revenue for tax-supported assets, water revenue for water related assets and sanitary sewer revenue for sanitary related assets as well as supplements through grants, financing, county revenue, and reserves, based on the City's budget structure.

Table 67 - Historical Maintenance and Funding					
Asset Class	**Description**	**Actual 2013**	**Actual 2014**	**Actual 2015**	**Budget 2016**
Buildings	**Asset Maintenance**	**$964,011**	**$890,256**	**$1,069,636**	**$1,415,746**
	Taxation Funding	$939,887	$831,269	$1,025,359	$972,868
	Water Rate Revenue	$0	$0	$0	$15,000
	Sanitary Sewer Rate Revenue	$0	$0	$0	$15,000
	Federal Gas Tax	$0	$0	$0	$125,000
	Grants	$0	$0	$0	$0
	Financing	$0	$0	$0	$0
	County Revenue	$21,994	$23,092	$26,784	$37,878
	Reserves	$2,130	$35,895	$17,493	$250,000
	Total Funding	**$964,011**	**$890,256**	**$1,069,636**	**$1,415,746**
	Net Unfunded	**$0**	**$0**	**$0**	**$0**
Process Equipment at WWTP & WPP	**Asset Maintenance**	**$205,392**	**$142,758**	**$222,172**	**$255,591**
	Taxation Funding	$0	$0	$0	$0
	Water Rate Revenue	$115,879	$88,501	$82,128	$132,391
	Sanitary Sewer Rate Revenue	$89,513	$54,257	$140,044	$123,200
	Federal Gas Tax	$0	$0	$0	$0
	Grants	$0	$0	$0	$0
	Financing	$0	$0	$0	$0
	County Revenue	$0	$0	$0	$0
	Reserves	$0	$0	$0	$0
	Total Funding	**$205,392**	**$142,758**	**$222,172**	**$255,591**
	Net Unfunded	**$0**	**$0**	**$0**	**$0**
Roads	**Asset Maintenance**	**$573,811**	**$658,451**	**$582,861**	**$661,370**
	Taxation Funding	$539,843	$639,306	$561,793	$611,370
	Water Rate Revenue	$6,281	$0	$10,534	$0
	Sanitary Sewer Rate Revenue	$6,281	$3,266	$10,534	$0
	Federal Gas Tax	$21,406	$15,879	$0	$50,000
	Grants	$0	$0	$0	$0
	Financing	$0	$0	$0	$0
	County Revenue	$0	$0	$0	$0
	Reserves	$0	$0	$0	$0

Table 67 - Historical Maintenance and Funding					
Asset Class	**Description**	**Actual 2013**	**Actual 2014**	**Actual 2015**	**Budget 2016**
	Total Funding	**$573,811**	**$658,451**	**$582,861**	**$661,370**
	Net Unfunded	**$0**	**$0**	**$0**	**$0**
Sidewalks & Recreational Paths	**Asset Maintenance**	**$274,386**	**$281,227**	**$226,668**	**$352,283**
	Taxation Funding	$274,386	$255,173	$226,668	$272,283
	Water Rate Revenue	$0	$0	$0	$0
	Sanitary Sewer Rate Revenue	$0	$0	$0	$0
	Federal Gas Tax	$0	$26,054	$0	$80,000
	Grants	$0	$0	$0	$0
	Financing	$0	$0	$0	$0
	County Revenue	$0	$0	$0	$0
	Reserves	$0	$0	$0	$0
	Total Funding	**$274,386**	**$281,227**	**$226,668**	**$352,283**
	Net Unfunded	**$0**	**$0**	**$0**	**$0**
Sewer	**Asset Maintenance**	**$826,341**	**$807,879**	**$598,014**	**$999,439**
	Taxation Funding	$0	$0	$0	$0
	Water Rate Revenue	$0	$2,080	$0	$0
	Sanitary Sewer Rate Revenue	$826,341	$805,799	$598,014	$999,439
	Federal Gas Tax	$0	$0	$0	$0
	Grants	$0	$0	$0	$0
	Financing	$0	$0	$0	$0
	County Revenue	$0	$0	$0	$0
	Reserves	$0	$0	$0	$0
	Total Funding	**$826,341**	**$807,879**	**$598,014**	**$999,439**
	Net Unfunded	**$0**	**$0**	**$0**	**$0**
Water	**Asset Maintenance**	**$975,397**	**$941,634**	**$1,173,393**	**$1,002,374**
	Taxation Funding	$0	$0	$0	$0
	Water Rate Revenue	$975,397	$941,634	$1,173,393	$1,002,374
	Sanitary Sewer Rate Revenue	$0	$0	$0	$0
	Federal Gas Tax	$0	$0	$0	$0
	Grants	$0	$0	$0	$0
	Financing	$0	$0	$0	$0

Table 67 - Historical Maintenance and Funding					
Asset Class	**Description**	**Actual 2013**	**Actual 2014**	**Actual 2015**	**Budget 2016**
	County Revenue	$0	$0	$0	$0
	Reserves	$0	$0	$0	$0
	Total Funding	**$975,397**	**$941,634**	**$1,173,393**	**$1,002,374**
	Net Unfunded	**$0**	**$0**	**$0**	**$0**
Bridges, Large Culverts & Small Culverts	**Asset Maintenance**	**$7,841**	**$6,016**	**$10,625**	**$8,609**
	Taxation Funding	$7,841	$6,016	$10,625	$8,609
	Water Rate Revenue	$0	$0	$0	$0
	Sanitary Sewer Rate Revenue	$0	$0	$0	$0
	Federal Gas Tax	$0	$0	$0	$0
	Grants	$0	$0	$0	$0
	Financing	$0	$0	$0	$0
	County Revenue	$0	$0	$0	$0
	Reserves	$0	$0	$0	$0
	Total Funding	**$7,841**	**$6,016**	**$10,625**	**$8,609**
	Net Unfunded	**$0**	**$0**	**$0**	**$0**
Traffic Signals and Street Lights	**Asset Maintenance**	**$675,472**	**$597,875**	**$322,772**	**$607,500**
	Taxation Funding	$554,983	$597,875	$322,772	$607,500
	Water Rate Revenue	$0	$0	$0	$0
	Sanitary Sewer Rate Revenue	$0	$0	$0	$0
	Federal Gas Tax	$0	$0	$0	$0
	Grants	$120,489	$0	$0	$0
	Financing	$0	$0	$0	$0
	County Revenue	$0	$0	$0	$0
	Reserves	$0	$0	$0	$0
	Total Funding	**$675,472**	**$597,875**	**$322,772**	**$607,500**
	Net Unfunded	**$0**	**$0**	**$0**	**$0**
Fleet	**Asset Maintenance**	**$2,350,152**	**$2,451,464**	**$2,511,984**	**$2,430,855**
	Taxation Funding	$2,190,403	$2,273,135	$2,326,918	$2,277,855
	Water Rate Revenue	$0	$0	$0	$0
	Sanitary Sewer Rate Revenue	$0	$0	$0	$0
	Federal Gas Tax	$0	$0	$0	$0

Table 67 - Historical Maintenance and Funding					
Asset Class	**Description**	**Actual 2013**	**Actual 2014**	**Actual 2015**	**Budget 2016**
	Grants	$0	$0	$0	$0
	Financing	$0	$0	$0	$0
	County Revenue	$159,749	$178,329	$185,066	$153,000
	Reserves	$0	$0	$0	$0
	Total Funding	**$2,350,152**	**$2,451,464**	**$2,511,984**	**$2,430,855**
	Net Unfunded	**$0**	**$0**	**$0**	**$0**
Total Asset Maintenance		**$6,852,803**	**$6,777,560**	**$6,718,125**	**$7,733,767**
Total Funding		**$6,852,803**	**$6,777,560**	**$6,718,125**	**$7,733,767**
Total Net Unfunded		**$0**	**$0**	**$0**	**$0**

Table 68 outlines the historical capital budgets for 2013 to 2015 as well as the Budget for 2016, including renewal/rehabilitation, replacement/disposal, and expansion projects. The capital funding includes the use of reserves and/or reserve funds, debt, other revenue as well as contributions from the operating budgets.

Table 68 - Historical Capital Replace/New and Funding					
Asset Class	**Description**	**Actual 2013**	**Actual 2014**	**Actual 2015**	**Budget 2016**
Buildings	**Capital Expenditure**	**$398,990**	**$438,942**	**$39,415,388**	**$964,500**
	Taxation Funding	$211,702	$86,273	$208,248	$362,600
	Water Rate Revenue	$0	$0	$0	$0
	Sanitary Sewer Rate Revenue	$0	$147,877	$1,721,347	$0
	Federal Gas Tax	$0	$0	$0	$0
	Grants	$0	$169,229	$24,796,622	$0
	Financing	$0	$0	$9,155,141	$500,000
	County Revenue	$9,578	$0	$15,993	$101,900
	Reserves	$177,711	$35,563	$3,518,037	$0
	Total Funding	**$398,990**	**$438,942**	**$39,415,388**	**$964,500**
	Net Unfunded	**$0**	**$0**	**$0**	**$0**
Equipment	**Capital Expenditure**	**$1,199,550**	**$697,569**	**$18,828,519**	**$1,200,000**
	Taxation Funding	$0	$0	$0	$0
	Water Rate Revenue	$1,181,288	$543,160	$7,710	$0

Table 68 - Historical Capital Replace/New and Funding					
Asset Class	**Description**	**Actual 2013**	**Actual 2014**	**Actual 2015**	**Budget 2016**
	Sanitary Sewer Rate Revenue	$18,261	$154,408	$955,772	$1,200,000
	Federal Gas Tax	$0	$0	$0	$0
	Grants	$0	$0	$12,210,000	$0
	Financing	$0	$0	$4,021,536	$0
	County Revenue	$0	$0	$0	$0
	Reserves	$0	$0	$1,633,500	$0
	Total Funding	**$1,199,550**	**$697,569**	**$18,828,519**	**$1,200,000**
	Net Unfunded	**$0**	**$0**	**$0**	**$0**
Roads	**Capital Expenditure**	**$2,573,901**	**$3,524,647**	**$1,683,608**	**$6,103,800**
	Taxation Funding	$0	$533,810	$0	$205,000
	Water Rate Revenue	$173,216	$107,082	$245,354	$317,400
	Sanitary Sewer Rate Revenue	$279,960	$107,082	$245,354	$317,400
	Federal Gas Tax	$1,667,719	$2,054,286	$1,192,900	$2,595,000
	Grants	$194,197	$722,387	$0	$1,169,000
	Financing	$0	$0	$0	$1,500,000
	County Revenue	$0	$0	$0	$0
	Reserves	$258,809	$0	$0	$0
	Total Funding	**$2,573,901**	**$3,524,647**	**$1,683,608**	**$6,103,800**
	Net Unfunded	**$0**	**$0**	**$0**	**$0**
Sidewalks & Recreational Paths	**Capital Expenditure**	**$295,701**	**$719,339**	**$377,405**	**$378,400**
	Taxation Funding	$0	$0	$0	$0
	Water Rate Revenue	$36,800	$7,200	$68,376	$46,300
	Sanitary Sewer Rate Revenue	$36,800	$7,200	$68,376	$46,300
	Federal Gas Tax	$222,101	$704,940	$240,654	$206,900
	Grants	$0	$0	$0	$52,600
	Financing	$0	$0	$0	$26,300
	County Revenue	$0	$0	$0	$0
	Reserves	$0	$0	$0	$0
	Total Funding	**$295,701**	**$719,339**	**$377,405**	**$378,400**
	Net Unfunded	**$0**	**$0**	**$0**	**$0**

Table 68 - Historical Capital Replace/New and Funding					
Asset Class	**Description**	**Actual 2013**	**Actual 2014**	**Actual 2015**	**Budget 2016**
Sewer	**Capital Expenditure**	**$1,212,282**	**$5,213,337**	**$3,450,525**	**$4,487,600**
	Taxation Funding	$0	$18,011	$0	$0
	Water Rate Revenue	$141,654	$177,671	$0	$0
	Sanitary Sewer Rate Revenue	$716,867	$3,491,032	$1,519,271	$1,087,600
	Federal Gas Tax	$105,649	$60,161	$0	$0
	Grants	$236,676	$1,466,462	$1,000,000	$0
	Financing	$0	$0	$931,254	$2,900,000
	County Revenue	$0	$0	$0	$0
	Reserves	$11,436	$0	$0	$500,000
	Total Funding	**$1,212,282**	**$5,213,337**	**$3,450,525**	**$4,487,600**
	Net Unfunded	**$0**	**$0**	**$0**	**$0**
Water	**Capital Expenditure**	**$1,968,926**	**$1,952,906**	**$3,231,213**	**$2,872,600**
	Taxation Funding	$0	$0	$0	$0
	Water Rate Revenue	$1,266,596	$1,517,921	$1,731,213	$1,872,600
	Sanitary Sewer Rate Revenue	$111,694	$144,573	$0	$0
	Federal Gas Tax	$0	$0	$0	$0
	Grants	$90,636	$290,411	$1,000,000	$1,000,000
	Financing	$0	$0	$0	$0
	County Revenue	$0	$0	$0	$0
	Reserves	$500,000	$0	$500,000	$0
	Total Funding	**$1,968,926**	**$1,952,906**	**$3,231,213**	**$2,872,600**
	Net Unfunded	**$0**	**$0**	**$0**	**$0**
Bridges, Large Culverts & Small Culverts	**Capital Expenditure**	**$0**	**$0**	**$0**	**$269,000**
	Taxation Funding	$0	$0	$0	$100,000
	Water Rate Revenue	$0	$0	$0	$0
	Sanitary Sewer Rate Revenue	$0	$0	$0	$0
	Federal Gas Tax	$0	$0	$0	$169,000
	Grants	$0	$0	$0	$0
	Financing	$0	$0	$0	$0
	County Revenue	$0	$0	$0	$0

Table 68 - Historical Capital Replace/New and Funding					
Asset Class	**Description**	**Actual 2013**	**Actual 2014**	**Actual 2015**	**Budget 2016**
	Reserves	$0	$0	$0	$0
	Total Funding	**$0**	**$0**	**$0**	**$269,000**
	Net Unfunded	**$0**	**$0**	**$0**	**$0**
Traffic Signals & Street Lights	**Capital Expenditure**	**$628,970**	**$848,312**	**$327,072**	**$350,000**
	Taxation Funding	$115,612	$636,338	$327,072	$350,000
	Water Rate Revenue	$0	$0	$0	$0
	Sanitary Sewer Rate Revenue	$0	$0	$0	$0
	Federal Gas Tax	$0	$0	$0	$0
	Grants	$468,024	$211,974	$0	$0
	Financing	$0	$0	$0	$0
	County Revenue	$0	$0	$0	$0
	Reserves	$45,334	$0	$0	$0
	Total Funding	**$628,970**	**$848,312**	**$327,072**	**$350,000**
	Net Unfunded	**$0**	**$0**	**$0**	**$0**
Fleet	**Capital Expenditure**	**$2,428,045**	**$1,371,968**	**$1,405,786**	**$2,289,000**
	Taxation Funding	$291,974	$3,553	$85,424	$0
	Water Rate Revenue	$0	$0	$0	$0
	Sanitary Sewer Rate Revenue	$0	$0	$0	$0
	Federal Gas Tax	$0	$0	$0	$0
	Grants	$180,836	$0	$65,244	$0
	Financing	$1,444,696	$935,906	$746,267	$1,877,000
	County Revenue	$0	$0	$0	$0
	Reserves	$510,540	$432,509	$508,851	$412,000
	Total Funding	**$2,428,045**	**$1,371,968**	**$1,405,786**	**$2,289,000**
	Net Unfunded	**$0**	**$0**	**$0**	**$0**
Total Asset Maintenance		**$10,706,365**	**$14,767,020**	**$68,719,516**	**$18,914,900**
Total Funding		**$10,706,365**	**$14,767,020**	**$68,719,516**	**$18,914,900**
Total Net Unfunded		**$0**	**$0**	**$0**	**$0**

8.5 EXPENDITURE FORECASTS

8.5.1 Tax Supported Assets

Table 69 below provides the 10-Year Capital Budget for Tax Supported assets (Buildings, Roads, Sidewalks & Recreational, Bridges, Large Culverts & Small Culverts, Traffic Signals & Street Lights and Fleet).

Table 69 - Current 10-Year Budget - Tax Supported Assets

Budget Type	Year									
	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Maintenance	$2,429	$2,478	$2,526	$2,577	$2,629	$2,682	$2,735	$2,788	$2,845	$2,902
Capital - Rehabilitation	$6,912	$11,181	$8,789	$7,866	$8,734	$8,520	$7,287	$8,172	$7,055	$8,145
Capital - Expansion	$3,403	$2,098	$12,855	$7,488	$10,626	$10,591	$8,336	$9,461	$9,615	$9,701
Total Annual Expenditure	**$12,744**	**$15,757**	**$24,170**	**$17,931**	**$21,989**	**$21,793**	**$18,358**	**$20,421**	**$19,515**	**$20,748**
Total Expenditure										**$193,525**

Note: All Values are in $1,000s

Table 70 summarizes the recommended strategy to fund the asset related costs identified in Table 69. We have assumed an annual 1.0% increase in tax revenue starting in 2018 from the base 2017 budget amount. As demonstrated, the City currently has a funding shortfall of $32,074,000 for its tax-supported assets including in the 10-Year budget.

Table 70 - Revenue Forecast by Funding Type – Tax Supported Assets

Revenue Source	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Taxation Funding	$3,484	$3,957	$3,997	$4,037	$4,077	$4,118	$4,159	$4,200	$4,242	$4,285
Water Rate Revenue	$317	$276	$380	$460	$460	$460	$460	$460	$460	$460
Sanitary Sewer Rate Revenue	$317	$276	$380	$460	$460	$460	$460	$460	$460	$460
Federal Gas Tax	$2,581	$2,575	$2,800	$2,800	$2,800	$2,800	$2,800	$2,800	$2,800	$2,800
Grants	$1,501	$3,810	$250	$0	$3,000	$3,000	$3,000	$0	$0	$0
Financing	$3,877	$3,796	$10,954	$5,866	$5,961	$6,611	$5,984	$5,392	$5,305	$6,410
County Revenue	$255	$267	$246	$272	$258	$244	$241	$295	$213	$216
Reserves	$412	$800	$965	$1,085	$615	$815	$665	$1,010	$615	$650
Total Annual Revenue	**$12,744**	**$15,757**	**$19,971**	**$14,980**	**$17,631**	**$18,508**	**$17,769**	**$14,617**	**$14,095**	**$15,281**
Annual Unfunded	**$0**	**$0**	**-$4,199**	**-$2,951**	**-$4,358**	**-$3,285**	**-$589**	**$5,804**	**-$5,420**	**-$5,467**
Total Unfunded										**-$32,074**

Note: All Values are in $1,000s

These lifecycle costs are being recovered through several methods:

- Taxation funding is suggested for all maintenance costs;
- Water Rate and Sewer Rate funding addresses road rehabilitation that is required as part of joint infrastructure projects;
- Federal Gas Tax funding has been shown as a stable and long-term funding source for eligible capital projects;
- The City has assumed that it will be successful in securing considerable grants to fund major expansion projects;
- The City will be dependent upon maintaining healthy capital reserves/reserve funds in order to provide the remainder of the required lifecycle funding over the forecast period. This will require the City to proactively increase amounts being transferred to these capital reserves during the annual budget process.

While the annual funding requirement may fluctuate, it is important for the City to implement a consistent, yet increasing annual investment in capital so that the excess annual funds can accrue in capital reserve funds.

8.5.2 Sewer

Table 71 shows the Sanitary Sewer expenditure forecast for maintenance, renewal/rehabilitation, replacement/disposal and expansion for the 10-Year forecast period.

Table 71 - Sewer Rate Supported Expenditure Forecast

Budget Type	Year									
	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Maintenance	$123	$125	$128	$131	$133	$136	$139	$141	$144	$147
Capital - Rehabilitation	$1,803	$1,674	$1,796	$1,890	$1,940	$1,940	$1,940	$1,940	$1,940	$1,990
Capital - Expansion	$3,235	$1,885	$415	$715	$583	$500	$500	$500	$500	$500
Total Annual Expenditure	**$5,161**	**$3,684**	**$2,338**	**$2,736**	**$2,656**	**$2,576**	**$2,579**	**$2,581**	**$2,584**	**$2,637**
Total Expenditure										**$29,532**

Note: All Values are in $1,000s

Table 72 summarizes the recommended strategy to finance the asset related costs identified in Table 71. We have assumed an annual 1.0% increase in sewer revenue starting in 2018, from the base 2017 budget amount. As demonstrated, the City currently has a funding shortfall of $4,080,000 for its sewer rate-supported assets including in the 10-Year budget.

Table 72 - Revenue Forecast by Funding Type - Sewer Rate Supported Assets										
Revenue Source	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**
Taxation Funding	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Water Rate Revenue	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Sanitary Sewer Rate Revenue	$1,761	$1,984	2,004	2,024	2,045	2,065	2,086	2,107	2,128	$2,149
Federal Gas Tax	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Grants	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Financing	$2,900	$1,350	$0	$0	$0	$0	$0	$0	$0	$0
County Revenue	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Reserves	$500	$350	$0	$0	$0	$0	$0	$0	$0	$0
Total Annual Revenue	**$5,161**	**$3,684**	**$2,004**	**$2,024**	**$2,045**	**$2,065**	**$2,086**	**$2,107**	**$2,128**	**$2,149**
Annual Unfunded	**$0**	**$0**	**-$334**	**-$711**	**-$612**	**-$511**	**-$493**	**-$475**	**-$457**	**-$488**
Total Unfunded										**-$4,080**

Note: All Values are in $1,000s

These lifecycle costs are being recovered through several methods:

- Sanitary Sewer rate revenue is suggested for all maintenance costs.
- Debt financing is shown as required in years where significant capital needs are identified.
- The City will be dependent upon maintaining healthy capital reserves/reserve funds in order to provide the remainder of the required lifecycle funding over the forecast period. This will require the City to proactively increase amounts being transferred to these capital reserves during the annual budget process.

While the annual funding requirement may fluctuate, it is important for the City to implement a consistent, yet increasing annual investment in capital so that the excess annual funds can accrue in capital reserve funds.

8.5.3 Watermains

Table 73 shows the water expenditure forecast for maintenance, renewal/rehabilitation, replacement/disposal and expansion for the 10-Year forecast period.

Table 73 - Water Rate Supported Expenditure Forecast										
Budget Type	**Year**									
	2016	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**
Maintenance - Maintain Level of Service	$132	$135	$137	$140	$143	$146	$149	$152	$155	$158
Capital - Rehabilitation	$3,523	$2,534	$3,396	$3,490	$3,240	$3,240	$3,240	$2,990	$2,990	$2,990
Capital - Expansion	$0	$0	$550	$550	$250	$250	$250	$0	$0	$0
Total Annual Expenditure	**$3,655**	**$2,669**	**$4,083**	**$4,180**	**$3,633**	**$3,636**	**$3,639**	**$3,142**	**$3,145**	**$3,148**
Total Expenditure										**$34,927**

Note: All Values are in $1,000s

Table 74 summarizes the recommended strategy (for each scenario) to finance the asset related costs identified in Table 73. We have assumed an annual 1.0% increase in water revenue starting in 2018, from the base 2017 budget amount. As demonstrated, the City currently has a funding shortfall of $7,527,000 for its water rate-supported assets including in the 10-Year budget.

Table 74 - Revenue Forecast by Funding Type - Water Rate Supported Assets

Revenue Source	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Taxation Funding	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Water Rate Revenue	$2,655	$2,519	$2,544	$2,569	$2,595	$2,621	$2,647	$2,674	$2,700	$2,727
Sanitary Sewer Rate Revenue	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Federal Gas Tax	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Grants	$1,000	$0	$0	$0	$0	$0	$0	$0	$0	$0
Financing	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
County Revenue	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Reserves	$0	$150	$0	$0	$0	$0	$0	$0	$0	$0
Total Annual Revenue	**$3,655**	**$2,669**	**$2,544**	**$2,569**	**$2,595**	**$2,621**	**$2,647**	**$2,674**	**$2,700**	**$2,727**
Annual Unfunded	**$0**	**$0**	**-$1,539**	**-$1,611**	**-$1,038**	**-$1,015**	**-$992**	**-$468**	**-$444**	**-$420**
Total Revenue										**-$7,527**

Note: All Values are in $1,000s

These lifecycle costs are being recovered through several methods:

- Water rate revenue is suggested for all maintenance costs.
- The City was successful in securing a considerable grant through OCIF to fund a major watermain relining projects in 2016;
- The City will be dependent upon maintaining healthy capital reserves/reserve funds in order to provide the remainder of the required lifecycle funding over the forecast period. This will require the City to proactively increase amounts being transferred to these capital reserves during the annual budget process.

While the annual funding requirement may fluctuate, it is important for the City to implement a consistent, yet increasing annual investment in capital so that the excess annual funds can accrue in capital reserve funds.

8.6 TOTAL FUNDING SHORTFALL – 10-YEAR CAPITAL BUDGET

Based on the current 10-Year Capital Budget developed for 2016, and updated for 2017, the City is facing a funding deficit of **$43,681,000**, based on the revenue projections between 2016 and 2025.

8.7 Funding Shortfall – Desired Levels of Service

In addition to the funding shortfall associated with the current 10-year budget forecast, to the following section outlines the additional funding required to achieve the desired LOS for each asset type included in the AMP

Table 75 below provides the annual funding requirements to achieve the desired LOS for each Asset Class, sorted by funding source.

Table 75 - Total Annual Funding Required to Meet LOS

Funding Source	Asset Class	Annual Capital Need
Tax	Buildings	$900,000
	Roads and Sidewalks	$4,000,000
	Recreations Paths	$165,000
	Bridges, Culverts & Small Culverts	$830,000
	Traffic Signals and Street Lights	$315,000
	Fleet	$2,250,000
	Subtotal	**$8,460,000**
Sewer Rate	Sewer	$2,150,000
Water Rate	Water	$3,120,000
Total		**$13,730,000**

The dollar values presented in Table 75 are directly comparable to the rehabilitation budget line items in each of the funding forecasts.

Tables 76, 77 and **78** below present the annual funding shortfall, beyond that presented in Section 8.6 (10-Year Capital Budget), to achieve the desired LOS for tax-supported, sewer rate-supported and water-rate supported assets, respectively.

Table 76 - Tax Supported Funding Comparison to Achieve LOS

Budget	Year									
	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Capital - Rehabilitation Current 10-Year Budget	$6,912	$11,181	$8,789	$7,866	$8,734	$8,520	$7,287	$8,172	$7,055	$8,145
Capital - Desired Level of Service	$8,460	$8,460	$8,460	$8,460	$8,460	$8,460	$8,460	$8,460	$8,460	$8,460
Annual Difference	**-$1,548**	**$2,721**	**$329**	**-$594**	**$274**	**$60**	**-$1,173**	**-$288**	**-$1,405**	**-$315**
Total Difference										**-$1,939**

Table 77 - Sewer Rate-Supported Funding Comparison to Achieve LOS										
	Year									
Budget	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Capital - Rehabilitation Current 10-Year Budget	$1,803	$1,674	$1,796	$1,890	$1,940	$1,940	$1,940	$1,940	$1,940	$1,990
Capital - Desired Level of Service	$2,150	$2,150	$2,150	$2,150	$2,150	$2,150	$2,150	$2,150	$2,150	$2,150
Annual Difference	**-$347**	**-$476**	**-$355**	**-$260**	**-$210**	**-$210**	**-$210**	**-$210**	**-$210**	**-$160**
Total Difference										**-$2,648**

Table 78 - Water-Rate Supported Funding Comparison to Achieve LOS										
	Year									
Budget	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Capital - Rehabilitation Current 10-Year Budget	$3,523	$2,534	$3,396	$3,490	$3,240	$3,240	$3,240	$2,990	$2,990	$2,990
Capital - Desired Level of Service	$3,120	$3,120	$3,120	$3,120	$3,120	$3,120	$3,120	$3,120	$3,120	$3,120
Annual Difference	**$403**	**-$586**	**$276**	**$370**	**$120**	**$120**	**$120**	**-$130**	**-$130**	**-$130**
Total Difference										**$432**

As indicated above, there is a funding shortfall to achieve the desired LOS for tax-supported and sewer rate-supported assets and a surplus for water rate-supported assets. The minor surplus in water funding demonstrates the focus that the City has put on its watermain network in order to address the $41 Million backlog over the next 20years.

Overall, there is an additional funding shortfall of **$4,155,000** when comparing the 10-Year Capital Plan to the funding required to achieve the desired LOS for the AMP.

Given the relatively minor LOS funding shortfall relative to the 10-Year Capital Plan ($4.15 Million), it is clear that the City has been effective in managing its assets against the desired LOS that were developed during previous iterations of this AMP.

When you consider the shortfall of available funding for the 10-Year Capital Plan, as well as the shortfall to reach the desired LOS, the total funding shortfall that the City faces over the next 10 years is **$47,835,000**.

8.8 ADDRESSING THE FUNDING SHORTFALL

As mentioned above, Cornwall's asset managers responsible for the following asset classes: Engineering assets (linear – roads, water, sewer, storm), buildings, water and Wastewater treatment plants, fleet, bridges, have been effective at maintaining the condition of the assets. They have also, given the revenues the City has been generating, been efficient at directing those monies to activities that have maintained the current LOS.

However, there exists a backlog of assets in poor condition that will need to be addressed. As well, there is a need after revisiting the LOS for the assets, to reassess these service levels and optimize them against the asset lifecycle costs and risk levels. The goal of that exercise would be to lower risk and lifecycle costs as much as possible while maintaining an acceptable LOS.

It will, however take time, for the asset managers to assess and quantitatively measure risk and forecast lifecycle costs. The asset managers should consider evaluating all classes from a holistic receptive, ensuring that potential efficiencies are gained through the merging services and infrastructure.

Currently, based on the AMP, the City will make required adjustments in funding between various asset classes to achieve the desired LOS. This example of re-balancing of the asset expenditures allows the asset managers to intelligently make those types of funding reallocations and enable an understanding of the options that are available for reallocation. This 'borrowing from the infrastructure bank"[1], can be dangerous if not done with a realization of the impact that the re-allocation will have on the asset class from which money will be reallocated.

In order to address existing backlog, the funding options are more difficult to realize. Higher levels of government are being relied upon for large-scale investments in large capital projects. Typically, sewer and water can more easily generate revenues from rate increases. They do however rely upon the regional economic climate in being able to support those rate increases. Property tax increases are also to be considered. Cities have embarked on neighbourhood improvement projects, where subdivisions have their underground and above

[1] Roy Brander Quote City of Calgary

ground infrastructure rehabilitated/replaced en masse. This is accompanied by a specific levy. In this way, a significant amount of asset class inventory has its condition improved and age reduced dramatically. This changes the overall inventory's condition significantly, allowing existing funding to continue to maintain a much improved asset base.

With growth, redevelopment and potentially rezoning or infill, there could be opportunities to improve infrastructure in concert with the redevelopment.

One of the less desirable options is the reduction of the LOS and the taking out of service of some of the assets that are of low importance and usefulness. This reduces the costs of maintaining the assets and the service levels attached to those assets. There may be assets that are not required or that could be allowed to deteriorate to failure and disuse with little to no impact on the vast majority of citizens.

9 IMPROVEMENT PLAN

The combination of the ISO 55000 standard on asset management, the British Standard – PAS 55, and the seminal parts of the U.S. GASB 34 standards support improvements in the following areas of asset management:

9.1.1 Asset Management Strategy and Planning

The City should finalize its Asset Management Policy in combination with its strategic asset management direction. This should also take into consideration, at a qualitative level of detail, the impact of changes in demand for its infrastructure. This can be accomplished through a well-researched, planned and executed strategic 1 day facilitated workshop or through a series of 2 hour meetings with the various asset class managers. The intent is to review the strategy already in place and determine if changes are warranted.

9.1.2 Asset Prioritization and Decision Making

It is recommended that the City review its decision making process with regards to setting priorities for capital expenditures and operating expenditures. This should be done by also taking into consideration how; improved lifecycle cost forecasting, resourcing decisions and major or regularly scheduled expenditure programs, will impact or improve decision making. In essence, taking additional variables into account in order to improve decision making on the infrastructure front.

9.1.3 Asset Lifecycle Impacts as a Result of Operations

At the asset class level, there are many areas of improvement that can be acted upon during the lifespan of the asset. Typically, the areas to focus on are maintenance practice efficiencies, resource management, emergency response capabilities, reliability engineering and the review of technical standards and requirements. The City should determine areas of merit that would benefit from focused efforts on the part of asset managers.

9.1.4 Asset Data and Knowledge

As mentioned in the 2014 report, there are areas of improvement that can be pursued in the areas of information management of the asset data and the asset knowledge. The City's GIS and CMMS systems, along with the financial systems can always benefit from improvements in data quality and coordination or integration of the data.

9.1.5 The Asset Manager's capabilities and people's effectiveness

The Asset management culture in the City is impressive with its obvious focus on stewarding the assets. Investigations may be carried out to determine if contract or supplier arrangements can efficiently and effectively be leveraged to extend the capabilities of City staff. Human resource development with asset management training may also be of benefit for the City.

9.1.6 Risk Management, and the State of Asset Management

The City should extend the effectiveness of the critical asset review of 2006 by updating it with a review of the asset risks as they are assessed today, and include a cost estimating forecast. This would allow for risk to be easily integrated as a variable into the capital budgeting business process. Other areas of focus could also be in the areas of contingency planning and resiliency, and sustainability from a triple bottom line perspective.

There should be consideration given to a review of asset management performance and a management review of the City's achievements of asset management goals both from the perspective of optimal asset investments, as well as continual improvement of asset management best practices. An internal 'audit', or if the word audit is unpalatable, a management review is recommended.

It is recommended that a Lifecycle Costing exercise pilot be completed. Following a forecasting of lifecycle costs for a class of assets, the City would assess and determine the value of the pilot's deliverables based on impact to the financial budget and changes in prioritization of capital and operating expenditures.

10 CONCLUSIONS

This AMP was developed by FCAPX in collaboration with the City of Cornwall. The AMP Infographic (Communications document for wide public consumption), which replaced a traditional Executive Summary for the report, has been designed to allow for easy annual updates to report progress against the plan and demonstrate changes that have occurred relative to both the asset portfolio and the City's asset management practices, procedures and planning.

APPENDIX A

GLOSSARY OF TERMS

GLOSSARY OF TERMS

Active Transportation

Active transportation means non-motorized or lightly-motorized travel, including walking, cycling, roller-blading and movements with mobility devices. The active transportation network includes sidewalks, crosswalks, designated road lanes and off-road recreational trails to accommodate active transportation.

Asset

An asset is an object (physical or intangible) that has an identifiable value and a useful life greater than 12 months, that is or could be used by the entity responsible for it to provide a service.

Asset Accounting

Asset accounting is the accounting of the asset accounts such as: cash, accounts receivable, inventory, buildings, land, equipment and intangible assets.

Asset Category

An asset Category (also Asset Group) is a group of asset types with similar attributes. Resources controlled by an entity the value of which can be reliably measured and from which future economic benefits are expected to flow to the entity.

Asset Class

An asset class is a grouping of assets of a similar nature and use.

Asset Condition

Asset condition is a measure of the health of an asset.

Asset Condition Assessment

An asset condition assessment is the process of continuous or periodic inspection, assessment, measurement and interpretation of the resultant data to indicate the condition of a specific asset so as to determine the need for some preventative or remedial action. It is a crucial part of asset management to determine remaining useful life and an asset's capability to meet performance requirements.

Asset Condition Inspection

An asset condition inspection (also Asset Condition Survey) is an inspection carried out on an asset to determine its condition.

GLOSSARY OF TERMS

Asset Data Collection
Asset data collection is the process of collecting physical asset data.

Asset Database
An asset database is a database containing asset related information.

Asset Inventory
An asset inventory is a list of assets containing sufficient information about the assets to physically locate and identify them.

Asset Maintenance
Asset maintenance is a continuous process improvement strategy for improving the availability, safety, reliability and longevity of physical assets (i.e., systems, facilities, equipment and processes).

Asset Management (AM)
Systematic and coordinated activities and practices through which an organization optimally and sustainably manages its assets and asset systems, their associated performance, risks and expenditures over their life cycles for the purpose of achieving its organizational strategic plan.

AM is the combination of management, financial, economic, engineering and other practices applied to physical assets with the objective of providing the required level of service, in the most cost effective manner. It includes the management of the whole life cycle (best possible decisions regarding design, construction, commissioning, operating, maintaining, renewal, repairing, modifying, replacing, expansion, and decommissioning/disposal) of physical and infrastructure assets.

Asset Management Plan (AMP)
Actions, responsibilities, resources and schedules intended to implement the asset management strategy and deliver the asset management objectives
An AMP is a plan developed for the management of one or more infrastructure asset classes with a view to operating, maintaining and renewing the assets within the class in the most cost effective manner possible, while providing a specific level of service.

GLOSSARY OF TERMS

Asset Management Policy

Mandated requirements, overall intentions/principles and framework for control of asset management

An Asset Management Policy is a high level document that describes how an organization intends to approach asset management within the organization.

Asset Management Strategy

Long term optimized and sustainable direction for the management of the assets, to assist in delivery of the organizational strategic plan and apply the asset management policy

An Asset Management Strategy is a strategy for the implementation and documentation of asset management practices, plans, processes & procedures within an organization.

Asset Type

An asset type is a generic name assigned to a group of assets with a similar or identical function. It is usually an important field within an asset database / asset management system.

Backlog

A backlog is a buildup of work that needs to be completed.

Building

A building is a structure that is permanently attached to the land, has a roof, is partially or completely enclosed by walls, and is not intended to be transportable or moveable. For purposes of this AMP, a Building's cost includes its components; such as, HVAC systems, elevators, etc.

Capital Expenditure

Capital expenditure is an expenditure that creates an asset or that increases an existing asset's remaining useful life (RUL). The expenditure(s) will provide benefits that extend into future financial periods. It includes expenditures to acquire or enhance existing assets to provide expanded, or a higher, levels of service.

Capital Upgrade

A capital upgrade is any project (including a land purchase) that extends or upgrades an asset to cater for growth or additional (higher) service levels.

GLOSSARY OF TERMS

Capital Works Evaluation Framework
A Capital Works Evaluation Framework is a system used to assist in prioritizing projects for consideration within an organization's Capital Works Program.

Community Engagement
Although often used interchangeably with community consultation, engagement implies a mutual two-way process which can include consultation, extension, communication, education, public participation, participative democracy or working in partnership.

Community Service Level
A community service level / community level of service is a service level that specifies the level of service that is to be provided to the community.

Component
A component is a part of an asset that for any reason needs to be identified separately from its parent asset. Reasons may include a different useful life or maintenance regime.

Computer Maintenance Management System (CMMS)
A CMMS is software/program that is designed to record and track an organization's maintenance activities. The term Asset Maintenance Management System (AMMS) is often used to describe the same type of software.

Critical Asset
A critical asset is an asset for which the financial, business or service level consequences of failure are sufficiently severe to justify proactive inspection and rehabilitation. Critical assets have a lower threshold for action than non-critical assets.

Criticality
Criticality is the quality, state, or degree of being of the highest importance.

Current Replacement Value (CRV)
CRV (also known as replacement cost) is the price that an organization would pay to replace an existing asset at current market prices with a similar asset.

Current Needs
Current needs are the required investment to improve/replace infrastructure to a desired LOS.

GLOSSARY OF TERMS

Cyclical Maintenance

Cyclical maintenance or cyclic maintenance is maintenance which is repeated on a periodic basis.

Defect

A defect is an imperfection within an asset that could potentially lead to the premature failure of the asset.

Degradation Curve

A degradation curve is a graph of an asset's condition or remaining service potential plotted over time.

Expected Service Life (ESL)

ESL life is defined as the time between initial construction and the time when the asset reaches a minimum acceptable service level. ESL has been defined as the anticipated number of years that an asset will be functionally and structurally acceptable with only routine maintenance.

Expected Useful Life (EUL)

EUL is the average amount of time in years that an item, component, or system is estimated to function when installed new and assuming routine maintenance is practiced.

Facility

A facility is a defined area containing a number of assets that are associated in some way. A simple facility could consist of a single main building and the grounds and infrastructure (e.g. car parks and fencing) surrounding it. A more complex facility, (e.g. a depot or a water treatment plant) could contain many buildings and/or other types of assets.

Facility Condition Index (FCI)

The FCI is used in facilities management to provide a benchmark to compare the relative condition of a group of facilities. The FCI is primarily used to support asset management initiatives of federal, state, and local government facilities organizations.

Fixed Asset Register

A fixed asset register is a high-level, asset register (list) designed primarily to cater for the financial aspects of asset management rather than the engineering & operational aspects of asset management.

GLOSSARY OF TERMS

Infrastructure
A term used to describe physical assets such as roads, buildings, storm water drainage and community waste and water systems, etc.

Infrastructure Gap
The term Infrastructure Gap (also Infrastructure Funding Gap) describes the difference between the cost of renewing existing infrastructure assets to the desired levels of service, and the current expenditure on those assets.

Level of Service (LOS)
LOS (also Service Level) can be defined as the service quality for a given activity. LOS is often documented as a commitment to carry out a given action or actions within a specified time frame in response to an event or asset condition data. LOS parameters, or combination of parameters, reflect social, political, environmental and economic outcomes that the City delivers.

Lifecycle Cost
The term lifecycle cost (also Whole of Life Cost) refers to the total cost of ownership over the life of an asset including; planning, design, construction/ acquisition, operation, maintenance, renewal, finance and disposal costs.

Lifecycle Cost Analysis
Lifecycle cost analysis is a method of assessing which asset option, will be the most economical over an extended period of time.

Long-term Financial Forecast
A long-term financial forecast is a document that forecasts an organization's financial position over an extended period of time.

Long-term Financial Plan
A plan that projects a forecast of financial performance and position over a period of at least 10 years. The Long-term Financial Plan should be consistent with, actions required to implement strategies proposed in other City plans/documents.

Maintenance
Maintenance is any activity performed on an asset with a view to ensuring that it is able to deliver an expected level of service until it is scheduled to be renewed, replaced or disposed of.

Preventive Maintenance
Preventive maintenance is maintenance carried out at predetermined intervals, or corresponding to prescribed criteria, and intended to reduce the probability of failure, or the performance degradation of an asset.

GLOSSARY OF TERMS

Refurbishment
Refurbishment is the process of restoring an asset to near new condition.

Rehabilitation
Rehabilitation is works carried out to rebuild or replace parts or components of an asset, to restore it to a required functional condition and extend its life, which may incorporate some modification.

Remaining Service Life (RSL)
The concept of RSL has been around for decades and is well entrenched in the pavement community. The actual RSL of initial pavement construction and rehabilitation treatment depends on a variety of factors including type and composition of the traffic, timeliness of maintenance treatments, and environmental factors such as temperature and precipitation.

Remaining Useful Life (RUL)
RUL is a subjective estimate based on observations, or average estimates of similar items, components, or systems, or a combination thereof, of the number of remaining years that an item, component or system is estimated to be able to function in accordance with its intended purpose before warranting replacement. Such period of time is affected by the initial quality of an item, component or system, the quality of initial installation, the quality and amount of preventive maintenance exercised, climatic conditions, extent of use, etc.

Replacement
Replacement is the complete replacement of an asset that has reached the end of its life, so as to provide a similar or agreed alternative level of service.

Replacement Value
The replacement value of an asset (also Asset Replacement Value & Current Replacement Value) is the estimated cost of replacing an existing asset with a substantially identical new asset or a modern equivalent.

Scheduled Maintenance
Scheduled maintenance is preventive maintenance carried out to a predetermined interval of time, number of operations, kilometres, etc.

GLOSSARY OF TERMS

Strategic Planning

Strategic planning is an organization's process of defining its strategy, or direction, and making decisions on allocating its resources to pursue this strategy, including its capital and people.

Overall long term plan for the organization that is derived from and embodies its vision, mission, values, business policies, stakeholder requirements, objectives and the management of its risks.

Triple Bottom Line (TBL)

The TBL is an accounting framework that incorporates three dimensions of performance: social, environmental and financial.

Useful Life

The useful life (UL) of an asset is the estimated length of time during which the asset is able to deliver a given level of service.

Valuation

A valuation is the determination of the economic value of an asset.

APPENDIX B

COMMON IMPLICATIONS OF FCI TO BUILDING PORTFOLIOS

Appendix B - Common Implications of FCI to Building Portfolios				
FCI Level	**Impact to Buildings and Components**	**Examples of Component Issues**	**Occupant Complaints and Morale**	**Maintenance Staff Impact**
Good	- Facilities will look clean and functional - Limited and manageable component and equipment failure may occur	- Repairs and replacement are of more of an aesthetic or general nature, such as wall painting, carpet replacement, roof repair, window caulking.	- Occupant complaints will be low and manageable - Occupant morale will be positive and evident	- Facilities staff time will be devoted to regular scheduled maintenance
Fair	- Facilities are beginning to show signs of wear - More frequent component and equipment failure will occur	- Repairs and replacement of specific systems, i.e. boiler, window replacements, interior renovations.	- Occupant complaints will occur with higher level of frequency - Occupant morale may be affected	- Facilities staff time may at times be diverted from regular scheduled maintenance
Poor	- Facilities will look worn with apparent and increasing deterioration - Frequent component and equipment failure may occur. Occasional building shut down will occur	- Replacement of specific major systems required, such as heating and plumbing systems, complete interior renovations, building envelope restoration. - Shut down may affect some units (i.e. roof or pipe leakage)	- Occupant complaints will be high with increased level of frequency. - Concern about negative resident morale will be raised and become evident.	- Facilities staff time will likely be diverted from regular scheduled maintenance and forced into a “reactive” mode
Critical	- Facilities will look worn with obvious deterioration. - Equipment failure occurring frequently. Occasional building shut down will likely occur. Management risk is high. - Health and safety issues figure prominently	- Replacement of multiple systems required (i.e. Mechanical, Electrical, Architectural and Structural - Building heating system failure. - Evacuation of upper floor due to unaddressed roof leakage. - Structural issues including envelope replacement.	- Occupant complaints will be very high with an unmanageable level of frequency. - Lack of maintenance will affect occupant attitudes and morale.	- Staff will not be able to provide regular scheduled maintenance due to high level of “reactive” calls

APPENDIX C

FCI BY BUILDING

Appendix C - FCI by Building						
Building	**Department**	**Date of Construction**	**Size (sq.m.)**	**CRV**	**1-Year FCI**	**5-Year FCI**
JUSTICE BUILDING	Admin	1972	5,746.06	$19,203,964	1.99%	7.74%
CORNWALL PUBLIC LIBRARY	Admin	1953	3,762.00	$29,815,700	0.45%	4.89%
WOODHOUSE MUSEUM	Admin	1900	437.63	$2,728,874	2.81%	3.69%
RICHELIEU DAY CARE CENTRE	Admin	1974	619.09	$1,864,486	0.16%	2.63%
CITY HALL	Admin	1948	1,125.12	$4,173,815	0.00%	1.04%
RIVERDALE PARK CHANGE ROOM	Admin	1967	20.20	$147,951	0.00%	0.00%
				$57,934,790		
FIRE STATION NO. 2	Fire Services	1989	602.41	$2,441,073	0.94%	15.77%
PARAMEDIC SERVICES FACILITY	Paramedic Services	2009	2,390.00	$6,591,329	0.30%	14.13%
POLICE SUBSTATION	Police Services	1910	210.66	$489,147	2.98%	10.12%
FIRE STATION NO. 1	Fire Services	1970	810.94	$4,166,836	0.53%	1.77%
				$13,688,385		
GLEN STOR DUN LODGE	Home for the Aged	1993	8,897.13	$36,384,632	0.00%	3.85%
GLEN STOR DUN LODGE STORAGE SHED	Home for the Aged	2012	56.00	$84,678	0.00%	0.00%
				$36,469,310		
OPTIMIST PARK OFFICE/MAINTENANCE BLDG WORKSHOP	Parks	1973	646.80	$931,509	15.94%	28.13%
JOE ST.DENIS PARK - Three PORTABLE CLASSROOMS	Parks	2014	213.53	$185,582	0.00%	19.51%
LEGION BALL PARK BLD / ADDED JAN.1/08	Parks	1971	216.31	$450,902	0.00%	19.41%
OPTIMIST PARK STORAGE BUILDING FOR CHLORINE	Parks	1993	13.35	$20,075	0.00%	13.70%
GUINDON PARK WORKSHOP	Parks	1976	111.21	$204,791	0.00%	11.72%
BANDSHELL	Parks	1985	273.68	$791,362	3.60%	10.46%
CENTENNIAL PARK FOUNTAIN MEMORIAL PARK	Parks	1968	40.04	$537,767	0.00%	10.46%
OPTIMIST PARK WASHROOMS	Parks	1996	78.96	$142,144	0.00%	7.04%
GUINDON PARK FOREST WASHROOM	Parks	1976	146.34	$297,602	0.00%	3.56%
CLOCK TOWER	Parks	1992	18.54	$245,423	0.00%	3.26%
GUINDON PARK MIDDLE WASHROOM	Parks	1976	111.21	$297,602	0.00%	1.68%
LAMOUREUX PARK SPLASH PAD CHANGEROOM	Parks	2009	104.17	$819,143	0.00%	0.93%
GUINDON PARK WEST WASHROOM	Parks	1976	111.21	$461,851	0.00%	0.22%
GUINDON PARK STORAGE BUILDING	Parks	1984	134.38	$30,210	0.00%	0.00%
GUINDON PARK TOOL/MACHINE SHED	Parks	1976	89.62	$106,462	0.00%	0.00%
OPTIMIST PARK CLUBHOUSE	Parks	2000	246.06	$575,484	0.00%	0.00%
ROTARY GAZEBO - STRUCTURE ONLY	Parks	2005	13.90	$109,500	0.00%	0.00%
				$6,207,409		
BIG BEN	Recreation Services	1975	89.90	$25,000	0.00%	152.00%
KINSEN PARK BASEBALL FIELD (Electrical Panel Bld'g)	Recreation Services	1975	8.34	$10,000	0.00%	75.00%
KINSMEN MINOR SOCCER FACILITY	Recreation Services	1993	76.92	$196,712	0.00%	58.46%
MARINA 200	Recreation Services	1985	184.34	$553,584	0.00%	42.01%

Appendix C - FCI by Building						
Building	**Department**	**Date of Construction**	**Size (sq.m.)**	**CRV**	**1-Year FCI**	**5-Year FCI**
REG CAMPBELL PARK (GLENVIEW HEIGHTS) CHANGE ROOM	Recreation Services	1978	85.63	$250,152	0.00%	22.23%
KINSMEN PARK CHANGE ROOM	Recreation Services	1965	21.50	$117,537	0.00%	18.29%
ST. JOSEPH PARK CHANGE ROOM	Recreation Services	1967	73.86	$303,685	0.00%	17.95%
EQUIPMENT STORAGE	Recreation Services	1977	364.23	$823,991	3.64%	17.29%
TERRY FOX PARK CHANGE ROOM	Recreation Services	1982	75.16	$257,451	0.00%	14.22%
ST. FRANCIS CHANGE ROOM	Recreation Services	1980	73.59	$257,451	0.00%	12.27%
MATTICE PARK CHANGE ROOM	Recreation Services	1976	112.33	$304,902	0.00%	7.31%
ST. THERESA CHANGE ROOM	Recreation Services	1965	20.20	$118,751	0.00%	6.11%
PLAYGROUND PROGRAMMING (Eastside Boxing)	Recreation Services	1983	177.02	$300,517	0.00%	3.99%
CURLING CLUB CENTRE	Recreation Services	2005	2,246.52	$5,713,475	0.11%	3.16%
CIVIC COMPLEX (ARENA & ADMIN SECTION)	Recreation Services	1976	17,608.90	$54,103,014	0.90%	2.86%
AQUATIC CENTRE	Recreation Services	2005	2,485.45	$15,301,121	0.58%	1.71%
PLAYGROUND PROGRAMMING BLD (Youth Club)	Recreation Services	1983	177.02	$386,051	0.00%	0.78%
BENSON CENTRE	Recreation Services	2011	22,428.17	$36,365,955	0.38%	0.46%
				$115,389,349		
TIRE STORAGE BUILDING	Municipal Works	1977	74.14	$107,462	0.00%	57.32%
SALT SHED	Municipal Works	1976	222.43	$148,556	48.47%	48.47%
TRAFFIC AND PARKING SHOP	Municipal Works	1954	318.81	$261,122	26.81%	46.72%
MUNICIPAL WORKS GARAGE	Municipal Works	1969	1,374.24	$3,122,728	10.28%	45.61%
PURCHASING AND STORES BUILDING	Municipal Works	1981	576.55	$992,411	0.00%	42.52%
SAND SHED	Municipal Works	1975	222.43	$176,174	40.87%	40.87%
EQUIPMENT STORAGE (ROADS)	Municipal Works	1977	38.37	$451,974	0.00%	39.83%
FLASHER STORAGE BUILDING	Municipal Works	1958	580.07	$37,129	0.00%	26.93%
CARPENTER SHOP	Municipal Works	1967	271.46	$895,009	11.17%	20.85%
MUNICIPAL WORKS ADMINISTRATIVE BUILDING	Municipal Works	1964	899.91	$2,924,664	0.00%	2.24%
SNOW MANAGEMENT FACILITY	Municipal Works		-	$667,606	0.00%	0.00%
				$9,784,835		
SEVEN (7) STORAGE CONTAINERS	Solid Waste	2010-2014	259.50	$26,476	0.00%	30.22%
TWO WEIGH SCALES and CONTROL BUILDING AND CANOPY	Solid Waste	1984	30.03	$434,667	4.37%	22.20%
GAS COLLECTION BUILDING	Solid Waste	1991	74.14	$358,265	2.23%	8.09%
WASTE RECYCLING FACILITY	Solid Waste	2011	919.37	$2,272,872	0.00%	0.70%
GARAGE AND WORKSHOP	Solid Waste	1984	222.43	$401,477	0.00%	0.00%
LEACHATE PUMPING STATION	Solid Waste	2015	12.85	$438,404	0.00%	0.00%
SPECIAL WASTE DEPOT	Solid Waste	1998	265.99	$362,750	0.00%	0.00%
				$4,294,911		
BUS SHELTERS	Transit Services			$206,715	0.00%	49.83%
CORNWALL TRANSIT BUILDING	Transit Services	1975	2,825.58	$7,522,500	0.00%	5.87%

Appendix C - FCI by Building						
Building	**Department**	**Date of Construction**	**Size (sq.m.)**	**CRV**	**1-Year FCI**	**5-Year FCI**
				$7,729,215		
SEWAGE LIFT STATION - Fennel CR	Wastewater		0.93	$27,740	0.00%	72.10%
WWTP WEST DIGESTOR	Wastewater	1969	345.00	$103,590	0.00%	18.92%
WWTP EAST DIGESTOR	Wastewater	1969	345.00	$109,490	0.00%	13.79%
WWTP ADMIN. & WORKSHOP BUILDING	Wastewater	1968	449.95	$5,000,000	0.00%	13.36%
SEWAGE LIFT STATION - Queen & James	Wastewater	1994	19.93	$56,210	0.00%	13.16%
SEWAGE LIFT STATION - Harbour RD	Wastewater	1994	33.64	$70,202	0.00%	8.97%
WWTP STORAGE SHED 12'X20'	Wastewater	1998	47.91	$30,000	0.00%	5.00%
WWTP LABORATORY	Wastewater	1968	168.58	$3,000,000	0.03%	3.37%
ZEBRA MUSSEL FACILITY	Wastewater	1991	43.93	$300,000	0.00%	2.97%
WWTP CHLORINE BUILDING	Wastewater	1968	71.83	$5,000,000	0.00%	2.68%
WWTP MAIN SEWAGE PUMPING STATION	Wastewater	1969	250.79	$6,000,000	0.00%	1.95%
WWTP STORAGE SHED 10'X8'	Wastewater	2000	11.12	$30,000	0.00%	0.83%
WWTP DIGESTION BUILDING	Wastewater	1969	175.63	$8,000,000	0.00%	0.26%
WWTP SLUDGE DEWATERING FACILITY	Wastewater	1986	221.50	$6,000,000	0.00%	0.13%
WWTP GRIT REMOVAL BUILDING	Wastewater	2013	74.88	$3,000,000	0.00%	0.08%
WWTP BAF FACILITY	Wastewater	2013	656.44	$20,000,000	0.00%	0.08%
FLOW CONTROL BUILDING (Brookdale CSO Chamber)	Wastewater	1964	14.83	$34,918	0.00%	0.00%
SEWAGE LIFT STATION - Eleventh & McConnell	Wastewater	2016	35.00	$27,740	0.00%	0.00%
SEWAGE LIFT STATION - Saunders DR	Wastewater	1974	19.46	$89,546	0.00%	0.00%
WWTP SCREENING BUILDING	Wastewater	2013	405.00	$6,000,000	0.00%	0.00%
WWTP SLUDGE THICKENING BUILDING	Wastewater	2013	538.74	$5,000,000	0.00%	0.00%
WWTP STORAGE CONTAINER (1)	Wastewater	2013	74.51	$4,121	0.00%	0.00%
ZEBRA MUSSEL (VALVE HOUSE)	Wastewater	1956	14.92	$300,000	0.00%	0.00%
				$68,183,557		
WATERWORKS / SEWER STORAGE SHED	Water	1960	318.81	$450,276	3.00%	47.14%
WATER PURIFICATION FILTRATION PLANT - Shed	Water	1985	17.61	$55,000	9.09%	9.09%
PURIFICATION STATION RESERVOIR (+underground water reservoir)	Water	1972	147.82	$1,037,818	0.00%	4.26%
WATER PURIFICATION FILTRATION PLANT	Water	1956	2,423.45	$5,754,842	0.26%	2.84%
WATER TOWER	Water	1990	83.41	$10,000,000	0.00%	0.24%
				$17,297,936		
Totals			**87,503.59**	**$336,979,697**	**0.68%**	**4.28%**

APPENDIX D

MULTIVARIABLE PRIORITIZATION MATRIX

Appendix D - City of Cornwall BCA Priority Matrix				
Category-Type	**Category**	**Weighting**	**Subcategory**	**Score**
Building	Program/Use	20%	Water/Wastewater	10
			Lodge	9
			Emergency Services	8
			Recreation	6
			Admin	5
			Public Works	5
			Transit	5
			Parks	3
			Solid Waste	3
			Storage/Warehouse	2
	Public Use	15%	Active Usage	10
			Counter Service	8
			Back-Office	1
	Frequency of Public Use	10%	High	10
			Medium	8
			Low	3
			None	1
Component/System	Condition/Risk of Failure	25%	Critical	10
			Poor	8
			Fair	5
			Acceptable	3
			Good	1
	Likely Consequence of Failure	30%	Fire/Life Safety Issue	10
			Building Closure	8
			Service Interruption	5
			Nuisance	3
			No Impact	1

APPENDIX E

PAVEMENT CONDITION RATING DESCRIPTION

Appendix E – Pavement Condition Rating Description

90 – 100 ***Excellent***
- excellent rideability
- minimal or no deflection
- very minor to no cracking
- good road structure (ie. new road with appropriate base)

80 – 89 ***Very Good***
- excellent rideability
- very minor to no deflection
- very minor or no longitudinal or traverse cracking (less than 5% of section)
- may be recently resurfaced, but having an older structure

70 – 79 ***Good***
- generally smooth riding, may have a few minor humps/dips
- some roadway deflection, some longitudinal or traverse cracking (high 70's) (less than 5% of section)
- may be smooth riding with moderate amount of cracking (low 70's)
- no evidence of base failure

60-69 ***Satisfactory***
- somewhat uneven, possibly with localized humps/dips or, may be smooth riding with significant cracking
- may have some asphalt joint unravelling
- may have minor localized alligator cracking &/or very few potholes
- thin resurfacing would be considered for collector/arterial streets (low 60's)

50-59 ***Marginal***
- uneven to somewhat uneven ride or poor ride on structurally adequate concrete streets with slab settlement
- significant cracking on asphalt streets, may have some alligator cracking, few pot holes or other evidence of base failure
- resurfacing required now or within 5 years

40-49 ***Poor***
- uneven ride, surface deformation for majority of section length
- numerous pavement cracks possibly including alligator, pot holes or other base failure (potholes or evidence of pothole patching and/or joint unraveling)
- thick resurfacing or reconstruction is warranted now
- mill or pulverize with thick resurfacing is a viable repair (high 40's)
- if thick resurfacing is not suitable, decrease PCR (low 40's)

30-39 ***Very Poor***
- very uneven or rough ride, numerous cracks with broken and/or rocking slabs on concrete streets, may include large areas of base failure
- significant potholes or evidence of pothole patching
- reconstruction is required now

<30 ***N/A***
- non-typical urban road, very rough, barely passable or seasonal road

APPENDIX F

SIDEWALK CONDITION RATING DESCRIPTION

Appendix F – Sidewalk Condition Rating Description

80 – 100 ***Excellent***
- new, or like new

60 -80 ***Good***
- limited deterioration

40 – 60 ***Average***

20 – 40 ***Below Average***
- asphalt overlay, narrow, uneven

< 20 ***Poor***

APPENDIX G

SEWER CONDITION RATING DESCRIPTION

Appendix G – Sewer Condition Rating Descriptions

Structural Condition Grades (From PACP/Genivar Report)

Grade 1 ***Excellent***
- acceptable structural condition
- minor Defects

Grade 2 ***Good***
- minimal collapse risk
- defects that have not begun to deteriorate

Grade 3 ***Fair***
- collapse unlikely in near future
- moderate defects that will continue to deteriorate

Grade 4 ***Poor***
- collapse likely in foreseeable future
- severe defects that will become
- grade 5 defects within the foreseeable future

Grade 5 ***Very Poor***
- collapsed or collapse imminent
- defects requiring immediate attention

Potential for Blockage Grades

Grade 1 ***Excellent***
- no blockages found in pipe

Grade 2 ***Good***
- minor blockages that do not impede flow of pipe

Grade 3 ***Fair***
- moderate blockages, flow is blocked slightly

Grade 4 ***Poor***
- pipe has blockage that impedes most of the flow in the pipe

Grade 5 ***Very Poor***
- severely blocked
- no flow in the pipe due to blockage
- requires immediate attention

APPENDIX H

WATERMAIN PERFORMANCE RATING DESCRIPTION

Appendix H – Watermain Performance Description

80 – 100 ***Excellent***
- new watermain, or like new
- no signs of corrosion or deterioration
- expected to be in service for 80-100 years

60 -80 ***Good***
- limited deterioration
- expected to be in service for 60-80 years

40 – 60 ***Satisfactory***
- expected to be in service for 40-60 years

20 – 40 ***Marginal***
- service life remaining 20-40 years
- tuberculation probable in cast iron pipes, along with reduced flow

< 20 ***Poor***
- watermain is nearing or surpassed end of service life
- tuberculation probable in cast iron pipes, along with reduced flow

APPENDIX I

BRIDGES & CULVERTS RATING DESCRIPTION

Appendix I – Bridges and Culverts Condition Rating Description

BCI calculated using the method established by the Ministry of Transportation of Ontario. This method takes into account the quantities for poor, fair, good and excellent for each of the elements and determines the cost of the rehabilitation needs. The BCI is determined by dividing the remaining value of the bridge (value to the bridge less cost of the rehabilitation needs) by its initial value (in new condition).

Each element is divided into various categories: Abutments, accessories, approaches, barriers, beams, bracing, coating, decks, embankments, foundations, joints, piers, retaining walls, and each element is assessed separately for condition.

From the OSIM Manual it states the following, but this is still for each element. The BCI will vary based on what elements are in poor condition in a bridge. It doesn't translate into a range of BCI.

Grade 1 ***Excellent***

- refers to an element (or part of an element) that is in "new" (as constructed) condition
- no visible deterioration type defects are present and remedial action is not required
- minor construction defects do not count as visible deterioration type defects

-Examples

- "bug holes" in concrete barrier walls
- well-formed patina in atmospheric corrosion resistant (ACR) steel girders

Grade 2 ***Good***

- refers to an element (or part of an element) where the first sign of "light" (minor) defects are visible (usually occurs after the structure has been in service for a number of years)
- these types of defects would not normally trigger any remedial action since the overall performance of the element is not affected

-Examples

- light corrosion (no section loss)
- light scaling
- narrow cracks in concrete
- light decay in wood

Grade 3 ***Fair***

- refers to an element (or part of an element) where medium defects are visible
- these types of defects may trigger a "preventative maintenance" type remedial action (eg. Sealing, coating, etc)

-Examples

- medium corrosion (up to 10% section loss)
- medium cracks in concrete

Grade 4 ***Poor***

- refers to an element (or part of an element) where severe defects and very severe defects are visible
- in concrete, any type of spalling or delamination would be considered “poor” (these defects usually indicate more serious underlying problems in material, eg. corroding reinforcing steel)
- these types of defects would normally trigger rehabilitation or replacement if the extent and location affect the overall performance of the element

-Examples

- severe corrosion (greater than 10% section loss)
- spalling, delaminations, etc.

Grade 5 **Very Poor**

-Bridge or culvert experiences severe deficiencies, failure has occurred, or is imminent in the near future. Consideration should be taken to take the bridge out of service for public use. Replacement should occur in the next year.

APPENDIX J

SMALL CULVERT CONDITION RATING DESCRIPTION

Appendix J – Small Culvert Condition Rating Description

Grade 1 ***Excellent***
- culvert has little to no deterioration, structurally sound and functionally adequate

Grade 2 ***Good***
- functioning like new, with minro (and isolated) deterioration, but structurally sound and functionally adequate
- joints are sound and properly aligned

Grade 3 ***Fair***
- culvert has moderate deterioration
- joints have minor separation or misalignment
- culvert is structurally sound and functionally as intended

Grade 4 ***Poor***
- advanced deterioration and/or functional inadequacy
- requiring repair actions that should, if possible, be incorporated into the planned roadway project
- structural integrity and functional capacity of the culvert is reduced

Grade 5 ***Very Poor***
- serious deterioration
- conditions that indicate possible imminent failure that could threaten public safety
- requiring immediate repair action
- joints may have serious deterioration, misalignment, offset, separation of leakage

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