

City of St. Catharines

Asset Management Plan

2013



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EXECUTIVE SUMMARY

Asset management plans are long-term forecasts, typically over a ten year timeframe, that help municipalities make the best possible decisions regarding building, operating, maintaining, renewing, replacing and disposing of infrastructure assets.

The goals of the City of St. Catharines Asset Management Plan are:

- Ensure all City-owned infrastructure assets are sustainable into the future;
- Guide decisions related to infrastructure asset investment and divestment;
- Provide guidance in the development of standard maintenance and rehabilitation policies;
- Provide a framework for lifecycle and cost/benefit analyses; and,
- Promote better integration of infrastructure decisions within larger strategic, community and land-use goals.

The City of St Catharines Asset Management Plan describes the state, desired levels of service, management strategies and financing goals for each of the infrastructure categories mandated by the Ontario Ministry of Infrastructure:

- Bridges,
- Roads,
- Water, and
- Sanitary Sewers.

Findings within each of these infrastructure categories are summarized below.

Bridges

The City owns 80 bridge structures, the majority of which are pedestrian bridges. The current net book value of these bridges is \$6.6 million and the estimated replacement cost is \$39 million. Many of these bridges are reaching the end of their useful life, with 67.5 per cent of bridges in the last ten years of their service life.

Despite this aging bridge network, the City has been successful at extending the expected lifecycle of its bridges through strong preventative and regular maintenance. Of the City's 80 bridges, 72 meet or exceed the desired level of service. For those bridges that do not meet desired level of service, asset management strategies are in place to: replace the bridge with funding from the capital budget; demolish the bridge if levels of use are low; or repurpose the bridge to an alternative use.



Funding required for bridges can tend to spike from year to year as there are relatively few bridges owned by the City. The ten year forecast projects that funding will be sufficient to complete the asset management plan for bridges as presented.

Roads

The City owns and maintains 562 km of roadway or 1,148 km of traffic lanes. The current net book value of these roads is \$98.7 million and the replacement cost is estimated at \$624 million. Over 98 per cent of roadways are made up of asphalt, asphalt on concrete or concrete surfaces and have an average remaining life of approximately 14 years.

Of the City's roadways, 69 per cent are rated in excellent, good or fair condition, with 31 per cent rated in poor condition. Less than 0.5% of the roads have received a fail rating. Due to the age of the City's road network, failing grades could appear in ten years if funding remains at current levels of \$6.4 million annually. To avoid this scenario, the City recommends the implementation of a 4% annual funding increase. This increase will address the aging road network and work towards attaining desired levels of service.

Water

The City's water distribution system consists of 613 km of watermains and 41,200 water service connections. The current net book value of this system is \$64.7 million and the estimated replacement cost is \$460 million. Watermains generally have a service life of 50 to 100 years and the average age of the City's watermains is 44. The City has received perfect scores under the Ministry of the Environment's *Safe Drinking Water Act* requirements for four of the last five years with an average score of 98.4.

Five per cent of the water distribution system is considered in critical condition, not due to age but because of breaks and failures. While user fees address operating and maintenance needs, this revenue is currently insufficient to fund capital replacements.

While there are fluctuations from year to year, watermain breaks and break rates have generally been trending lower. Staff attribute the decrease in average break rates to increased watermain replacement budgets and increased effectiveness in targeting areas with higher risks of breakage. Cast iron and ductile iron watermains are susceptible to corrosion which will leave the pipe brittle and susceptible to breakages. As 41% of the City's watermains are constructed from these materials, there is an extremely high likelihood that breakage rates will reverse and there will be an upward trend in break rates unless funding is increased.



Over the next ten years it is recommended that total revenues from user fees be increased by 4.5% annually to gradually reduce the funding deficit and to work towards a self-sufficient water distribution system.

Sanitary Sewer

The City's sanitary sewer system consists of 561 km of sanitary mainline, 41,529 sanitary service connections and 8,477 manholes. The current net book value of this system is \$39.5 million and the estimated replacement cost is \$357 million. The majority of pipes (87.5 per cent) are in good to fair condition; nine percent are expected to fail within ten years and four per cent are expected to fail within five years.

To address current deficiencies and avoid deficiencies in the future, the City has employed several financing strategies. The City has previously used federal gas tax funding as well as funding from Niagara Region to remediate combined sewer overflows. As with the water distribution system, user fees address operating and maintenance needs.

An update of the City's Pollution Control Plan which will include a comprehensive condition assessment of all sewer assets as well as a technical analysis of system functions in dry and wet weather conditions is required before recommending wholesale changes to funding. One of the deliverables from the update to the PCP will be to identify the funding required to operate a sustainable sewer system.

Monitoring and Review

The Asset Management Plan will be reviewed and updated on an annual basis as part of the budget process. A full scale review of the asset management plan will be mandated in 2023, after the first ten years of operation.

New infrastructure categories will be included as sufficient and appropriate data is compiled. The City is preparing a facilities plan that will be integrated with the Asset Management Plan in 2014. In time, the Asset Management Plan will be expanded to account for a broader infrastructure complement that includes: traffic control signals, streetlights, sidewalks, storm sewers, pollution control facilities, the urban forest, heritage and cultural resources.



INTRODUCTION

Effective infrastructure is a prerequisite to a high quality of life in St. Catharines and communities everywhere. Infrastructure provides safe drinking water and wastewater capacity, powers economies through efficient movement of people and goods, provides venues for cultural expressions and community interaction and promotes healthy lifestyles.

Unfortunately, aging infrastructure and traditional low-density development strain municipal resources in St. Catharines. Despite continuous efforts, including capital forecasts and the creation of a Water and Wastewater Financial Plan, resources at the City's disposal are insufficient to address mounting challenges associated with aging infrastructure.

To overcome challenges associated with infrastructure sustainability, St. Catharines is becoming a place where long-term planning and effective resource allocation achieve a quality built environment. The St. Catharines Sustainability Strategy, approved in August 2011, establishes seven principles for infrastructure management:

- Long-term infrastructure outlook;
- Responsible community and land use planning;
- Reconcile operating and maintenance demands associated with new infrastructure;
- Strong priority setting based on local data and community engagement;
- Recognize all types of local infrastructure;
- Anticipate future challenges; and,
- Respect natural resources

The development of a corporate asset management plan is an important step in addressing municipal infrastructure challenges.

What is asset management?

An asset management plan is a long-term forecast, typically over a ten year timeframe, that helps municipalities make the best possible decisions regarding building, operating, maintaining, renewing, replacing and disposing of infrastructure assets. Asset management helps staff and elected officials understand the characteristics and conditions of infrastructure assets, make decisions regarding investments and



divestments, and build a financial plan to ensure community infrastructure remains sustainable in the future.

Goals of the Asset Management Plan

The goals of the City of St. Catharines Asset Management Plan are:

- Ensure all City-owned infrastructure assets are sustainable into the future;
- Guide decisions related to infrastructure asset investment and divestment;
- Provide guidance in the development of standard maintenance and rehabilitation policies;
- Provide a framework for lifecycle and cost/benefit analyses;
- Promote better integration of infrastructure decisions within larger strategic, community and land-use goals.

Infrastructure categories

The Asset Management Plan addresses the infrastructure categories mandated by the Ontario Ministry of Infrastructure, including: roads, bridges, water and sanitary sewers. The City is also preparing a facilities plan that will be integrated in the Asset Management Plan in 2014.

In time, the City of St. Catharines Asset Management Plan will be expanded to account for a broader infrastructure complement that includes: traffic control signals, streetlights, sidewalks, storm sewers, pollution control facilities, the urban forest, heritage and cultural resources.

Policy alignment

The Asset Management Plan directly relates to the following municipal policies and plans:

- Sustainability Strategy
- The Garden City Plan
- Annual capital and operating budgets
- Water and Wastewater Financial Plan
- Zoning by-law
- Emergency Management Plan
- Recreation Facilities Master Plan
- Creative Cluster Master Plan
- Sustainable Transportation Master Plan (under development)



- Corporate Energy Plan (under development)

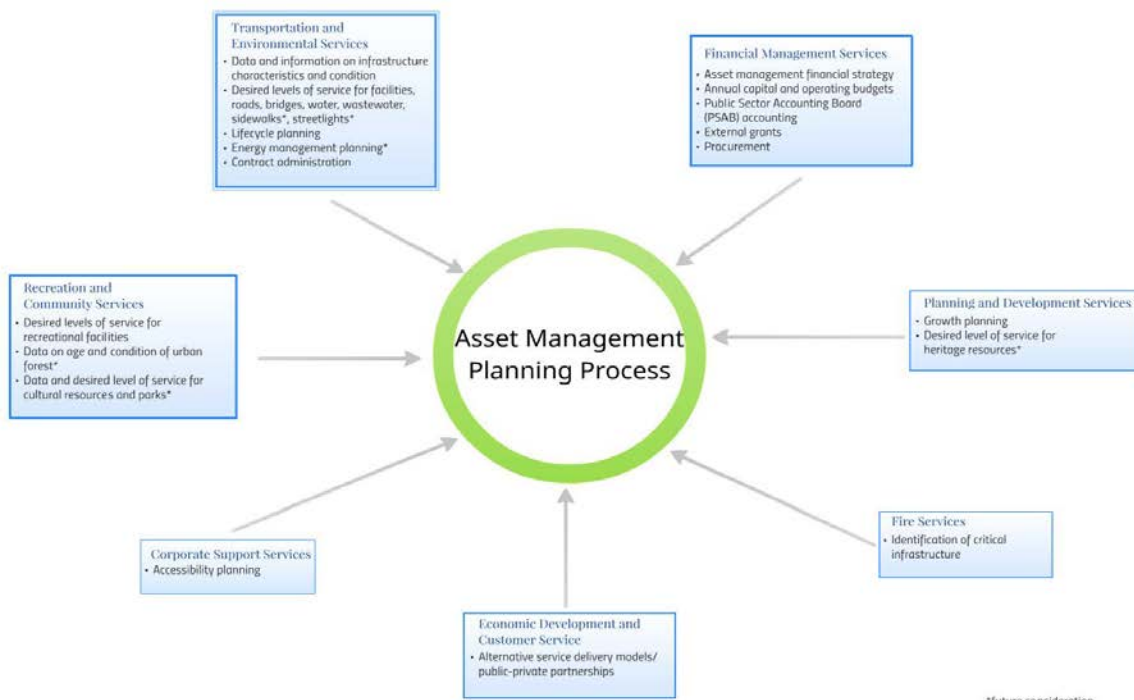
As new infrastructure categories are included, the Asset Management Plan will also guide investment decisions related to the following plans:

- Urban Forestry Management Plan
- Parks Policy Plan
- Culture Plan
- Facility Master Plan
- Facility Accommodations Master Plan

Asset management planning process

In the City of St. Catharines, every municipal department has a role to play in the asset management planning process. As the departments that maintain, manage, finance and procure municipal infrastructure assets, Transportation and Environmental Service and Financial Management Services play a leading role in corporate asset management planning.

Figure 1- City of St. Catharines Asset Management Planning Process





While these two departments are the asset management leads, other departments provide essential services, data and information. Planning and Development Services is responsible for growth planning, which influences where development will occur and associated infrastructure needs. Recreation and Community Services operate recreational facilities and parks, and manage the urban forest in coordination with Transportation and Engineering Services, and are key partners in identifying desired level of service in those areas. Fire Services is responsible for emergency management, and identifies critical infrastructure assets that require specific attention. Corporate Support Services is responsible for accessibility planning, a key consideration in municipal infrastructure. Lastly, Economic Development and Customer Service are involved in identifying alternative service delivery arrangements, particularly related to public-private partnership.

Departmental roles are explained further in Figure 1, City of St. Catharines Asset Management Planning Process.

Monitoring and review process

The asset management plan will be reviewed and updated on an annual basis as part of the budget process. New infrastructure categories will be included as sufficient and appropriate data is compiled.

Ten years is seen as the minimum timeframe for asset management plans. A full scale review of the plan will be mandated in 2023, after the first ten years of operation.

The City will set a long-term goal to integrate asset management data into Geographic Information Systems (GIS) and visualization tools in order to better facilitate decisions regarding the City's infrastructure assets. City staff is exploring asset management programs with the long term goal of procuring a comprehensive system that is able to integrate all infrastructure categories. These tools will provide snapshots of current infrastructure conditions and forecast future needs.

Options Analysis

The Ministry of Infrastructure ("MOI") requires municipalities to perform an options analysis to develop the strategy for the asset management plan. While an options analysis based on a net present value calculation using assumptions for inflation and the cost of borrowing can be a beneficial tool, using a quantitative analysis in isolation is ineffective in a municipal setting.



Municipal infrastructure projects often include various types of infrastructure; for example, a road replacement program may include watermain and sanitary sewer mainline replacements. Municipal infrastructure projects are also often performed in partnership with other bodies such as the Regional Municipality of Niagara, Provincial agencies and utility companies. The City in consultation with its partners may delay or expedite certain City projects to achieve economies of scale and to minimize service disruption. It is important to note that the City holds varying levels of influence but not control over the capital projects programs for their partners, therefore forecasting specific projects in an options analysis over the ten year period required by the MOI will lead to inaccurate results.

The bulk of the assets required by the MOI for the asset management plan are linear. Road, water and sanitary sewer assets are homogenous in nature, with standard unit costs and maintenance requirements. Therefore, performing an options analysis evaluating various options such as delaying or expediting asset replacement or forecasting a preventative maintenance program will likely provide little value.

The City constantly evaluates the state of all City infrastructure including bridges, by performing inspections and monitoring breakages and deficiencies to identify areas of priority.



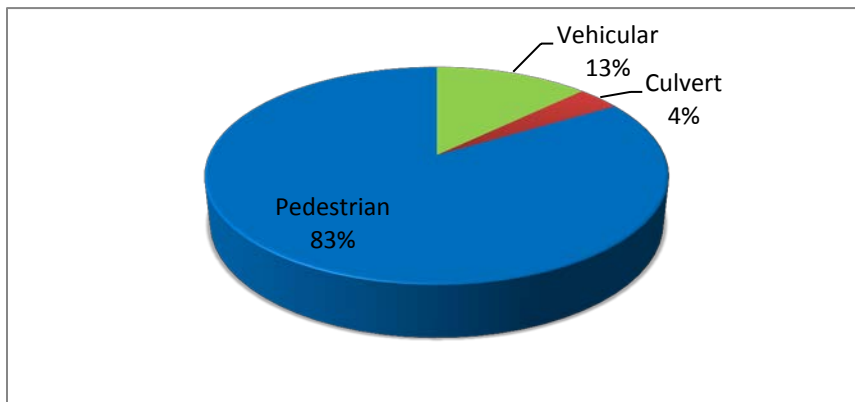
1. BRIDGES

STATE OF LOCAL INFRASTRUCTURE

Asset Types

The City currently owns 80 bridge structures with a total length of 1,284 metres. Bridges are subdivided into three categories: vehicular bridges (total length of 165m), culverts (46m) and pedestrian bridges (1,073m). Building materials used to construct bridges include wood, metal, prefabricated steel, stone and concrete with useful lives ranging from 30 to 50 years.

Figure 1.1 – City of St. Catharines - Bridge Structures in Metres



Financial Accounting Valuation

As at December 31, 2012, the total historical cost of the bridges was \$10.8 million with accumulated amortization of \$4.2 million giving a net book value of \$6.6 million. Depreciation is calculated on a straight line basis with the historical cost evenly spread out over the number of years of estimated useful life.

Replacement Cost Valuation

The estimated replacement cost valuation of the bridge structure assets owned by the City is approximately \$39 million.

Asset Age Distribution and Proportion of Expected Useful Life

Generally, pedestrian bridges have an estimated useful life of 30 years while vehicular bridges and culverts typically have an estimated useful life of 50 years. 67.5% of the City's bridges have less than ten years of useful life remaining.



Table 1.1 – City of St. Catharines – Bridge Structures Estimated Useful Life

Less than 10 years	10 – 19 years	20 – 30 years	Over 30 years
54	14	9	3

Given that the majority of City bridges are nearing the end of their estimated useful life cycles a reasonable assumption could be made that the City's bridge assets require substantial repairs and that funding should be made available for bridge replacement.

Before making this assumption, it is important to consider the condition of the assets as well as the bridge rehabilitation maintenance program which can extend the useful life of these assets.

Asset Condition

Bridges owned by the City are inspected according to *Ontario Regulation 104/97 Standards for Bridges*. Section 2(3) of the regulation states:

The structural integrity, safety and condition of every bridge shall be determined through the performance of at least one inspection every two years under the direction of a professional engineer and in accordance with the Ontario Structure Inspection Manual, published by the Ministry, as it may be amended from time to time.

All bridges are inspected every two years, at which time information regarding overall deficiencies and future maintenance requirements are updated. Bridge inspections are conducted using standard engineering practices by external consultants who specialize in bridge assessment.

DESIRED LEVELS OF SERVICE

Level of Service

The City has set a quantitative target for all bridge structures at a minimum Bridge Condition Index ("BCI") rating of 60. A BCI rating of 60 indicates that the bridge structure is in fair condition.

The City also strives for no disruptions to vehicular or pedestrian traffic due to load restrictions and travel routes are safe with no harmful environmental impacts.



Current Performance Relative to Targets

The average BCI rating for City owned bridges is 72 which indicates that the general condition of the City's bridge structures is "good".

Table 1.2– City of St. Catharines – Bridge Structures by BCI Ratings

BCI Ratings			
0-59	60-69	70-79	80+
8	12	57	3

Of the City's 80 bridges, 72 meet or exceed the targeted BCI rating of 60 or above. For the eight bridges listed with a BCI rating of less than 60, provisions have been made to either replace these bridges with funding from the Capital Budget or to dispose of bridges with low usage.

As previously noted, the majority of bridge assets are nearing the end of their useful life. As a result of preventative maintenance and rehabilitation of these assets, City staff have been able to extend the life of these assets in a cost effective manner.

External Trends

Bridge construction and rehabilitation must be in accordance with the design standards set in the Canadian Highway Design Bridge Code.

As identified in the City's Sustainability Strategy, there is a trend towards multi-modal transportation needs, specifically accommodating all users of a corridor ranging from pedestrians to mass transit. Future bridges will likely be constructed with additional amenities such as bike lanes, accessible pedestrian signals and curb extensions.

At its meeting of April 24, 2006, City Council mandated all City facilities and assets to meet standards outlined in the Facility Accessibility Design Standards ("FADS"). FADS is a technical design document originally developed by the City of London that has been adopted by municipalities throughout Ontario, including the City. The purpose of the FADS document is to enhance accessibility beyond the requirements of the Ontario Building Code. The City is committed to implementing FADS for all new facilities as well as with any rehabilitation or reconstruction of structures where feasible, both financially and practically.



ASSET MANAGEMENT STRATEGY

Planned Actions:

Non-infrastructure Solutions

The City cost shares capital projects with other agencies and other levels of government for repairs and construction. Communication with these agencies is vital when considering the City's list of capital priorities and work plan.

The City has also been successful in participating in funding programs made available to municipalities by both the Federal and Provincial levels of government. While this funding is not stable and predictable over the long term, it has provided the City with funds to improve infrastructure on a case by case basis.

Maintenance, Renewal and Rehabilitation Activities

The bi-annual bridge inspection program as required by *Ontario Regulation 104/97 Standards for Bridges* drives the maintenance program for the City's bridges. Deficiencies identified during the inspections are prioritized based on their impact to the bridge's structural integrity and their potential impact to service levels.

High risk deficiencies are addressed immediately to mitigate potentially adverse impacts. Any unexpected events are individually assessed and treated on a case by case basis.

Replacement Activities

At the end of the bridge's useful life, a structural analysis and feasibility study is completed to determine if the bridge should be replaced. Factors considered include current and projected traffic flows, environmental impacts, project budgets and emergency planning.

Disposal Activities

If possible, bridges are repurposed when the originally intended use is no longer feasible. For example, vehicular bridges could be converted to pedestrian bridges if they tie in with future walking paths.

If structures are due for total replacement and are deemed no longer necessary due to redundancy or other improvements in municipal, environmental and



economic infrastructure, they would be demolished and the site returned to its natural state. Public consultations are typically required prior to demolishing bridge infrastructure.

Expansion Activities

Bridge infrastructure is expanded in response to growth demands such as increased traffic flow, both vehicular and/or pedestrian. Population settlement patterns, communication with residents and developers and consultations with City departments allow the City to respond to expansion requirements.

Procurement Methods

Projects are undertaken according to the City's procurement policies to ensure transparency, fairness and equity. Wherever possible, the City cost shares capital projects with other agencies or levels of government that may have interests in expanding bridge infrastructure.

Overview of Risks Associated with the Asset Management Strategy

Costs of Maintaining an Aged Bridge System

With an aging bridge system, there is a risk that the cost of rehabilitation, replacements and disposals will increase beyond the current funding allocation.

Given the strong BCI ratings for the City's bridges as a whole, the current Asset Management Strategy of preventative and regular maintenance appears to be effective. City staff will continue to regularly monitor bridge structures and identify preventative maintenance activities to prolong the useful life of bridges.

FINANCING STRATEGY

The goal of the financial strategy as it relates to bridges is to be self-sustaining. For the next ten years bridges are projected to be self-sustaining. Any projected funding requirement is being met with a corresponding increase in tax revenue or debenture financing.

Funding requirements for bridges are affected by the following factors:

- Debt level
- Maintenance and replacement schedule
- Construction costs



The assumptions of the financial plan as it relates to bridges are as follows:

Debt Level

Ontario Regulation 403/02 limits annual debt charges to not more than 25% of the City's net revenue fund revenues. Using this guideline, the City could increase its debt by a further \$61.6 million based on interest rates of 7%, which is the rate which the Ministry of Municipal Affairs uses for illustrative purposes. Using the City's current estimated borrowing rate of 5%, this additional debt capacity would be \$68.9 million. Although there has never been a suggestion that this limit be approached, Council does have significant borrowing capacity available should circumstances warrant.

Replacement Schedule

The projected ten year maintenance and replacement schedule for bridges is:

Year	Asset Description	Structure Type	Acquisition Year	Action
2014	Burgoyne Woods Pedestrian Bridge	Pedestrian Bridge	1986	Demolish
2014	Burgoyne Woods Pedestrian Bridge	Pedestrian Bridge	1986	Demolish
2014	Spring Garden Creek Pedestrian Bridge	Pedestrian Bridge	1980	Rehabilitation
2014	Arthur Street Culvert	Culvert	1970	Replacement
2015	Third Avenue Louth Bridge (Box Culvert)	Vehicle Bridge	1960	Replacement
2016	Ball Avenue West Bridge	Vehicle Bridge	1960	Replacement
2017	Pelham Road Bridge	Vehicle Bridge	1966	Rehabilitation
2018	First Street Louth Bridge	Vehicle Bridge	1950	Rehabilitation
2019	South Service Road Bridge	Vehicle Bridge	1963	Demolish
2020	Glendale Ave Pedestrian Bridge	Pedestrian Bridge	1980	Rehabilitation
2021	Trillium Bridge over CN tracks	Pedestrian Bridge	1970	Demolish
2022	-	-	-	-
2023	-	-	-	-

Construction Costs

Construction costs are reviewed annually. Projections based on previously completed projects suggest that construction costs will grow at an estimated 3% per year.



Financing Summary

Funding required for bridges can tend to spike from year to year as there are relatively few bridges owned by the City. Funding required for bridge assets will be raised from general tax levies and debentures on an as needed basis.

\$125,000 was budgeted in 2013 for renewal and rehabilitation activities. The ten year forecast projects that funding for bridge infrastructure will be sufficient to complete the replacement schedule presented for 2014 – 2023.



2. ROADS

STATE OF LOCAL INFRASTRUCTURE

Asset Types

The City currently owns and maintains approximately 562 km of roadway or 1,148 km of traffic lanes.

The City's Road Infrastructure is broken down as follows:

Table 2.1 – City of St. Catharines - Road Environment

	Roadway KM		Lane KM	
Urban Roads	386.37	68.77%	798.76	69.57%
Semi- Urban Road	139.63	24.85%	278.58	24.26%
Rural Roads	35.82	6.38%	70.77	6.16%
Total	561.82	100.00%	1,148.11	100.00%

When segregated by surface material, roads are broken down as follows:

Table 2.2 – City of St. Catharines – Roadway by Surface Material

	Roadway KM	
Asphalt on Concrete	64.07	11.40%
Cold Mix	1.93	0.34%
Concrete	35.92	6.39%
Earth	0.14	0.02%
Gravel	1.02	0.18%
Asphalt	455.05	81.00%
Surface Treated	3.69	0.66%
Total	561.82	100.00%

The City also monitors road characteristics such as age, surface width, posted speed limit, functional and performance classifications and condition.



Financial Accounting Valuation

As at December 31, 2012, the total historical cost of the road assets owned by the City was \$258.4 million with accumulated amortization of \$159.7 million giving a net book value of \$98.7 million. Depreciation is calculated on a straight line basis with the historical cost evenly spread out over the number of years of estimated useful life.

Replacement Cost Valuation

The estimated replacement cost valuation of the road assets owned by the City is approximately \$624 million.

Asset Age Distribution and Proportion of Expected Useful Life

The expected life of a road varies based on the construction of the roadway, materials used and traffic volumes. Factors such as pavement thickness, strength of the subgrade and average annual daily traffic volumes determines the classification of the roadway, which is known as the "Pavement Class". There are sixteen individual Pavement Classes, each of which is assigned an expected useful life.

Table 2.3 – City of St. Catharines – Pavement Classes

Existing Pavement Classes					
The Pavement Class of the road section is assigned a code based on pavement thickness strength of subgrade and Average Annual Daily Traffic					
Class	Subgrade	GBE Range	AADT Range	Expected Life LCB / Other	
1	Strong	<500	<500	20	25
2	Strong	<500	500-1500	20	27
3	Strong	<500	>1500	17	25
4	Weak	<500	<500	10	27
5	Weak	<500	500-1500	13	25
6	Weak	<500	>1500	11	25
7	Strong	500-625	<500	20	38
8	Strong	500-625	500-1500	20	38
9	Strong	500-625	>1500	17	29
10	Weak	500-625	<500	10	35
11	Weak	500-625	500-1500	13	31
12	Weak	500-625	>1500	17	22
15	Strong	>625	>1500	17	28
18	Weak	>625	>1500	17	23



19	Concrete	n/a	53
20	Asphalt on Concrete	n/a	26

City staff monitor a number of control sections which represent the various pavement classes to forecast how each roadway will deteriorate. From the data accumulated, predicted deterioration curves have been developed for roadways by pavement surface type. The figures below depict the average age of the road and average remaining useful life by surface type of road.

Figure 2.1 – City of St. Catharines – Average Age of Road by Surface Type

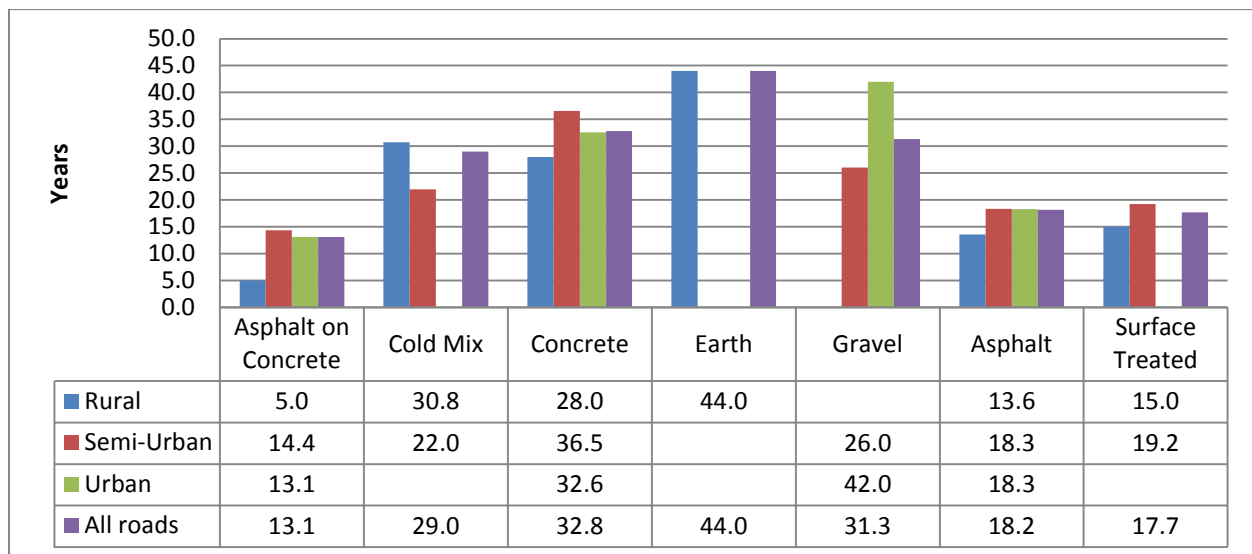
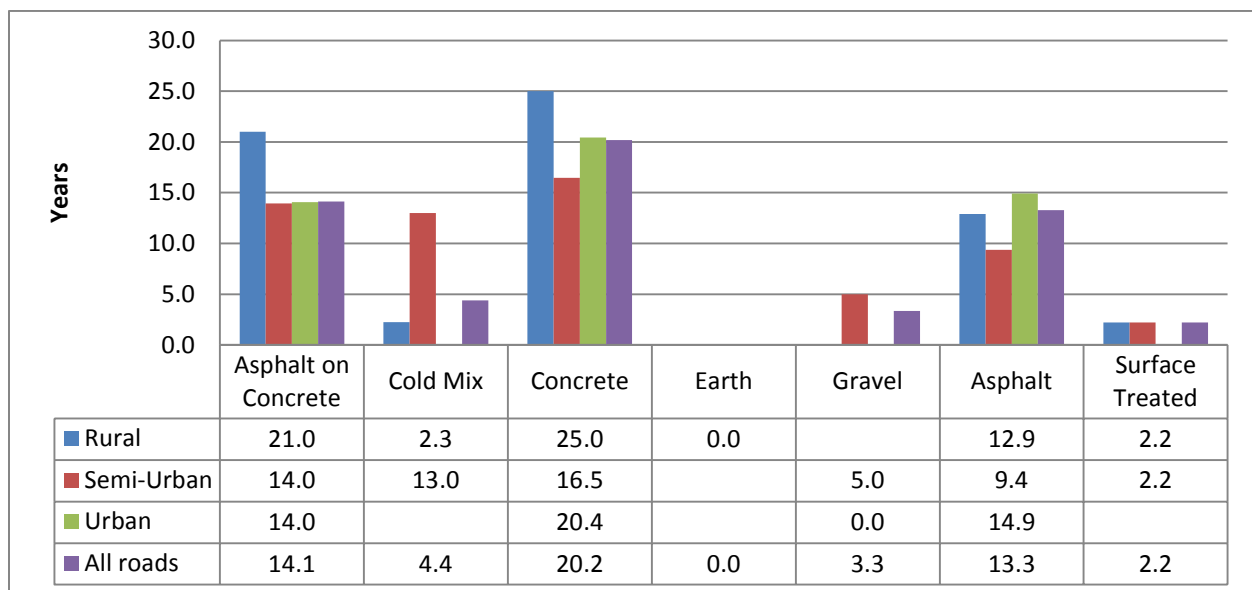


Figure 2.2 – City of St. Catharines – Average Remaining Life by Surface Type





As previously noted, 98.8% of City roadways are made of asphalt, asphalt on concrete and concrete pavement surfaces. With a weighted average useful life of less than 14 years, it is clear that City roadways are rapidly aging.

It is important to consider the condition of the assets as well as the road rehabilitation maintenance program which can extend the useful life of these assets.

Asset Condition

All roadways owned by the City are inspected every five years and are assigned a Pavement Condition Rating (“PCR”) for documentation. Heavily utilized roadways such as bus routes and certain control sections are inspected on an annual basis.

Pavement conditions are evaluated and a numeric PCR is assigned based on the deficiencies found by the inspection. The PCR values range from 1 to 100 with 100 representing the score for a newly constructed road.

Table 2.4 – City of St. Catharines – Condition Rating for Roads

Rating	Condition	Corresponding PCR	Description
1	Excellent	100-90	No potholes. No crack filling required. Complies with engineering standards
2	Good	90-75	Some potholes. Minimal crack filling complies with engineering standards
3	Fair	75-65	Evidence of deterioration. Has potholes and regular crack filling requirements
4	Poor	65-50	Pavement deteriorating. Extensive potholes and cracks. Joint failure. Needs resurfacing
5	Failing	50	Road bed and surface need replacing

The City utilizes pavement management software (“PMS”) to store road data such as inventory, PCRs and geometric information.

Roadways owned by the City are patrolled in accordance with *Ontario Regulation 239/02 Minimum Maintenance Standards for Municipal Highways*. The regulation provides the minimum standard for the frequency of patrolling of roadways which ranges from once every 30 days for low traffic volumes and posted speed limits to three times every seven days for higher traffic volumes and posted speed limits. By



conducting regular patrols in accordance with the regulation, the City is able to identify and correct any deficiencies thus preserving the road asset as well as minimizing the risk of injury and damages to the public.

DESIRED LEVELS OF SERVICE

Level of Service

The City has set a target PCR of 75 for the road network. A road with a PCR of 75 would typically be 10-20 years old with few cracks.

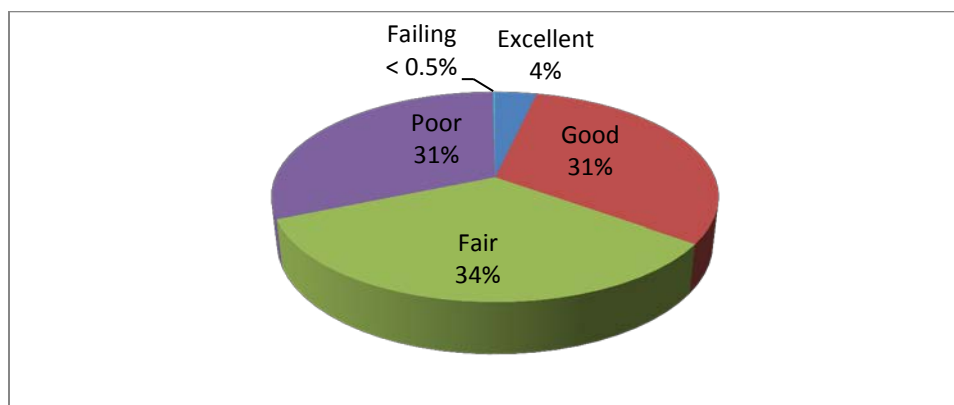
The primary objective of the road network is to safely and efficiently move people and goods throughout the City of St. Catharines.

The City also strives to meet or exceed the minimum maintenance standards outlined in *Ontario Regulation 239/02 Minimum Maintenance Standards for Municipal Highways* and to ensure that all roads are built in accordance with the City's engineering design standards.

Current Performance Relative to Targets

The average PCR rating for the City's road network is 71 which indicates that the general condition of the City's roads is "fair".

Figure 2.3 – City of St. Catharines – Current Condition of Roadways





External Trends

Official Plan – Greening, New Standards, Traffic Management, Alternative Forms of Transportation

The Official Plan states that the City shall continue to move to an allocation target of a minimum of 3% of the budget for all road reconstruction projects for greening purposes above and beyond normal landscaping requirements in order to move toward complete streets.

All existing roads will be brought up to meet current general standards now required for roads. The Official Plan did recognize that budgetary constraints require some time for roads to be updated. Priority will be given to those areas where the residents indicate that they are prepared to assist the City through shared costs or where it is desirable to carry out the improvements in conjunction with other public works in the vicinity.

The City shall consider various traffic calming and management measures (e.g. narrowing streets, on-street parking) to reduce through traffic and to promote safer streets for all users.

The Official Plan recognizes that in order to achieve a healthy and livable community, the transportation system needs to reduce reliance on the automobile in favour of more sustainable forms of connective transportation such as walking, cycling, and transit.

The City supports the development of a system level bicycle network on all arterial and collector roads identified on Schedule C 'Transportation Network' of the Official Plan. Where possible and practical, all arterial and collector roads should have bicycle lanes or shared use lanes, or a combination of both.

ASSET MANAGEMENT STRATEGY

Planned Actions:

Non-infrastructure Solutions

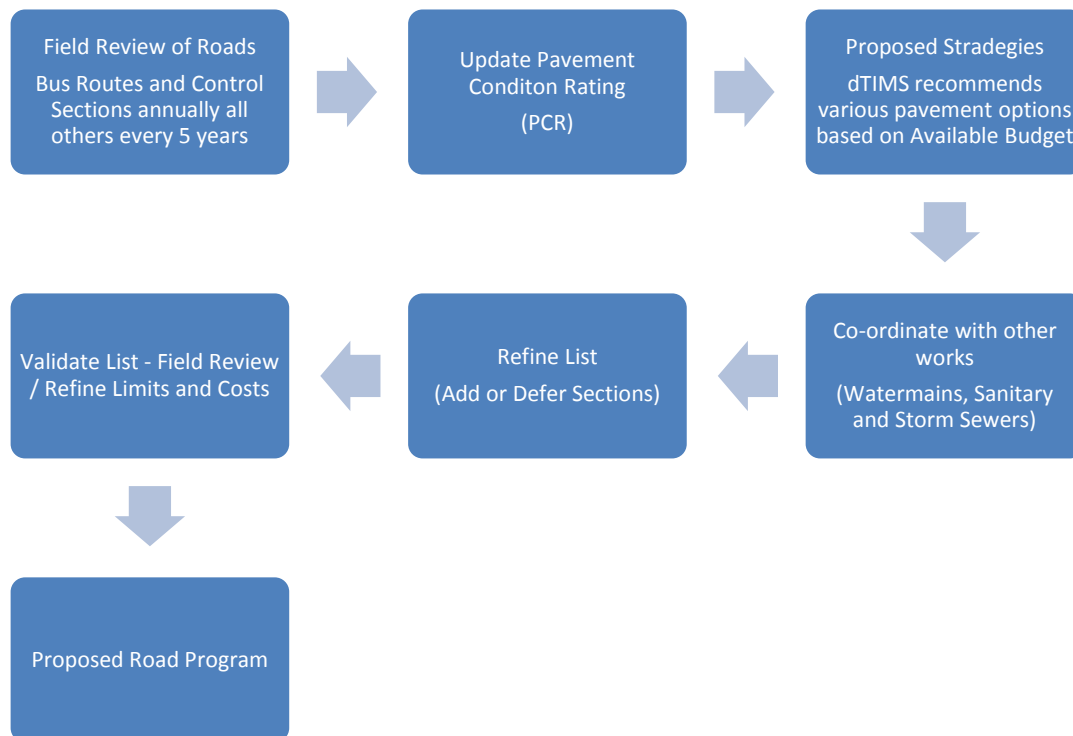
As previously mentioned, the City utilizes PMS to store road data such as inventory, PCRs and geometric information. The PMS is also used to model pavement and surface deterioration to generate a maintenance program for the City and to support decision making by using the current and anticipated condition of City roads, traffic demands and historical deterioration curves to predict PCRs in the future. This allows the City to make informed decisions regarding the life cycle costing of the road network and to optimize the



maintenance and rehabilitation programs based on the available levels of funding.

The City also co-ordinates the replacement of other utilities such as watermain, sanitary and storm sewer works within the City and the Region of Niagara and abutting municipalities which allows for the cost sharing of capital projects. As a result, the rehabilitation of sections of roadways recommended by the PMS may be deferred or accelerated. The following chart shows the selection process:

Figure 2.4 – City of St. Catharines - Road Selection Process for the Rehabilitation Program



Maintenance Activities

Routine maintenance activities include crack sealing, roller patching, shouldering and Minimum Maintenance repairs:

Crack sealing – Cracks that develop in pavement must be treated promptly as they create openings for moisture to penetrate pavement layers which leads to the accelerated deterioration of the roadway. Crack sealing refers to routing cracks and placing material on the routed channel or placing material in/on an uncut crack. Concrete roads that have been milled and resurfaced are crack



sealed 1-3 years later whereas other roads are typically crack sealed 3-5 years after resurfacing. This does not improve the PCR value but does slow deterioration.

Roller Patching – Interconnecting cracking in the asphalt layer that resembles the skin of an alligator is known as “alligator cracking.” When the roadway is not due to be resurfaced in the immediate future, roller patching is performed to provide a thin coat of asphalt over the cracking. This does not improve the PCR value but helps slow deterioration in the short term. Roller patching may also be performed to improve drainage

Shouldering – Improving the edge of the roadway helps provide pavement strength along the edge/border. Shouldering improves drainage, prevents washouts and general erosion which leads to the deterioration of the roadway. This does not improve the PCR.

Minimum Maintenance Repairs - Deficiencies identified during routine road patrols required under *Ontario Regulation 239/02 Minimum Maintenance Standards for Municipal Highways* have works orders issued immediately to address the deficiencies. The regulation provides timeframes for deficiencies to be addressed based on the class of highway and the severity of the deficiency. Deficiencies include the potholes, shoulder drop offs, cracks and removal of debris.

Renewal, Rehabilitation and Replacement Activities

The City prioritizes renewal and rehabilitation activities that are designed to significantly improve the PCR and extend the life of the asset. These activities are typically more extensive than general maintenance activities. The following treatments to the roadway are utilized based on the parameters and condition of the roadway: thin overlays, base repairs and overlays and reconstruction.

Thin Overlay - Typically carried out under an annual resurfacing contract and includes the milling of the existing road surface, repairs to curbs and road base, adjustments to manholes and catchbasins and paving a new layer of top asphalt

Base Repairs and Overlay - Similar to the thin overlay except there are more extensive curb and base repairs.



Reconstruction – Involve a total rebuild of the existing roadway. In an effort to maximize the roadwork budget, there is an emphasis on resurfacing projects. However, there are some roadways where resurfacing is insufficient and a complete reconstruction is required which is both more expensive and takes longer to complete. In these instances, the reconstruction of the roadway is co-ordinated with other underground utilities including watermains and sanitary sewer replacements.

The City's current PMS is used to assist in making recommendations for improvements. A number of strategies are generated for renewal based on set triggers for works and risks. Higher risk is assigned to roads with higher traffic volumes. These strategies are then compared to the budget available and a construction program is recommended to optimize the returns over the life of the assets.

Table 2.5 – City of St. Catharines – Condition Triggers for Remedial Works

	Trigger	Condition after work
Thin overlay Arterial. Or CCI Other	45<PCR<65 45<PCR<60	After work complete Reset PCR to 90
Base repairs and overlay Rural roads Semi- urban and urban Concrete	35<PCR<50 40<PCR<49 50<PCR<60	After work complete Reset PCR to 90
Reconstruction Rural Semi-urban and Urban	PCR<34 PCR<39	After work complete Reset PCR to 100

Disposal Activities

Road disposal may occur when a road is transferred to the upper tier municipality. In some instances, a roadway may service only one property and is functioning more as a driveway than as a roadway therefore the road may be sold to the abutting property owner.

Expansion Activities

Beyond private subdivision developments there are no identified opportunities for expansion to the existing road system. The City is currently working with the Regional Municipality of Niagara to complete a Transportation Master Plan which could provide recommendations for expansion in the future.



New roads constructed by developers in private subdivision developments and then assumed by the City upon development completion are reviewed by City staff to ensure that the roadway meets the current design standards of the City and are in excellent condition at the time of assumption.

Procurement Methods

The timing of releasing tenders to the market is important. The City has found that the resurfacing program have received favourable tender prices during the first quarter of the calendar year.

Some of the City's boundary roads has shared jurisdiction with neighbouring municipalities. When these boundary roads are ready for renewal the works are planned in conjunction with the abutting municipality and are called as one tender to maximize economies of scale.

When the opportunity arises to partner with developers for the reconstruction of existing roadways the City endeavors to enter into partnering agreements with the developer to share costs on road reconstruction.

Overview of Risks Associated with the Asset Management Strategy

The City's road network has approximately 2,030 individual sections. As traffic volumes are one of the key drivers for the prioritization of rehabilitation activities, there is a risk that low volume roads may be overlooked by the PMS.

As with any municipality, the City faces budgetary constraints and must therefore prioritize road projects. If sufficient funding is not made available, there is a risk that some roads may deteriorate to the point of reconstruction before the cost/benefit analysis undertaken by the PMS can recommend allocating funds towards those roadways. While this approach may be defensible using a cost/benefit analysis, this may not be politically acceptable. For this reason, the list of recommendations provided by the PMS must be closely reviewed by City staff for necessary adjustments.



FINANCING STRATEGY

Operating and capital expenditures for road infrastructure are typically funded from general tax levies. The current annual road budget for renewal/rehabilitation and replacement activities of \$6.4 million has been sufficient to maintain an overall PCR of 71 which indicates that the roadways within the City are in “fair” condition. The profile for an average road within the City is one that is approximately 10-20 years of age and has some evidence of deterioration and cracking.

With inflation as well as road assets weighted towards those approaching the end of their useful life, it is intuitive that maintaining the budget at \$6.4 million without any increases will result in an overall deterioration in the City’s roadways. Our pavement management software predicts that the average PCR would drop to 68 in ten years without any increases to the budget.

As part of the 2013 Capital Budget, city staff estimated that an expenditure of \$95 million is required over the next ten years to achieve the target PCR of 75.

Given current funding levels, an annual increase of 4% is required for the next ten years to reach the annual level of funding required to maintain an average PCR of 75. Note that while the overall road infrastructure will be maintained in a fair condition, the PCR target of 75 will not be met within ten years. While not meeting the desired level of service of 75 in the immediate future, an annual increase of 4% best balances budgetary constraints while working towards achieving the overall PCR target.



3. WATER

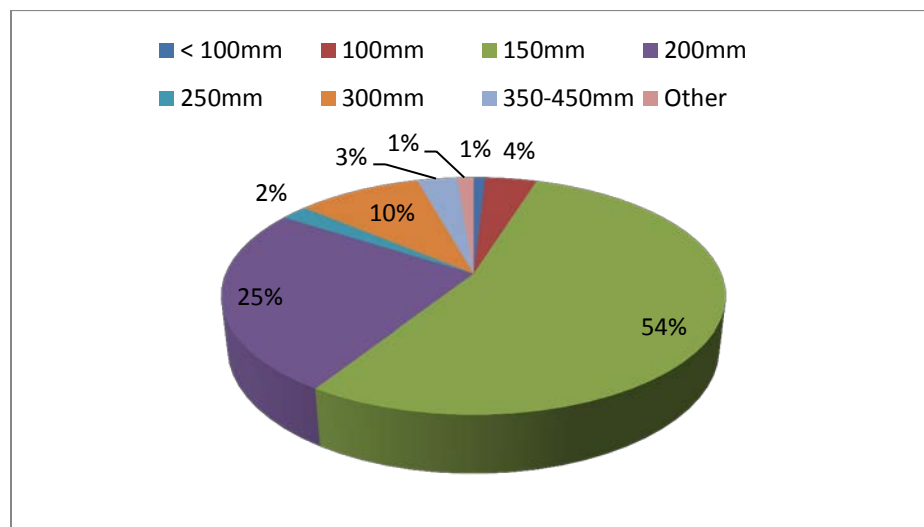
STATE OF LOCAL INFRASTRUCTURE

Asset Types

The City of St. Catharines water distribution system is one of several municipal networks serviced by the Decew Water Treatment Plant operated by the Regional Municipality of Niagara (the “Region”). Once treated, the Region supplies water to the local water distribution system owned by the City.

The City’s water distribution system consists of approximately 613 kilometres of watermains which services approximately 41,200 water service connections and mainly operates within three pressure zones. The following graph represents the various watermain diameters and the respective percentage of watermain lengths comprising the City’s water distribution system.

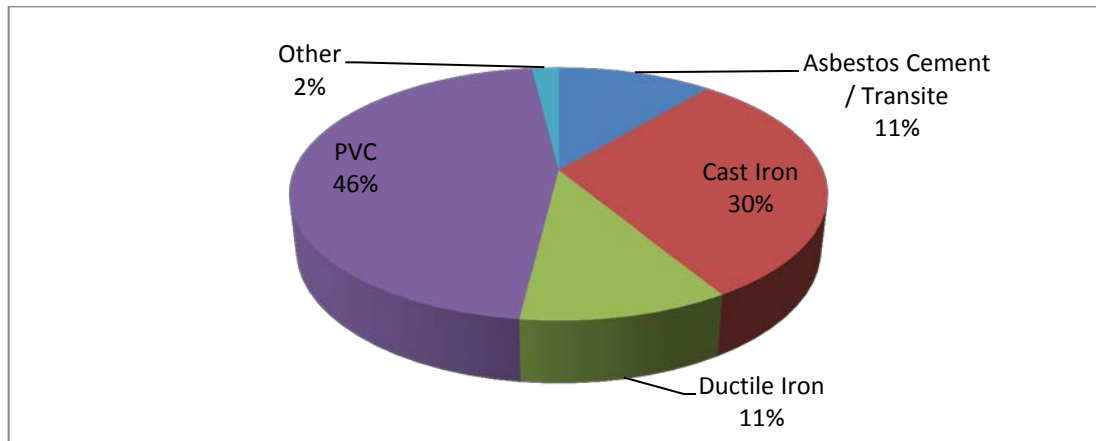
Figure 3.1 – City of St. Catharines – Watermains by Diameter



Watermains are constructed using a variety of materials. Newer watermains are typically constructed using polyvinyl chloride (“PVC”) which has an estimated useful life of 100 years. Other materials used for watermains include asbestos cement, cast iron and ductile iron with estimated useful lives that range from 50 to 100 years.



Figure 3.2 – City of St. Catharines – Watermain Composition



Financial Accounting Valuation

As at December 31, 2012, the total historical cost of the City's watermains was \$77.1 million with accumulated amortization of \$12.4 million giving a net book value of \$64.7 million. Depreciation is calculated on a straight line basis with the historical cost evenly spread out over the number of years of estimated useful life.

Replacement Cost Valuation

The estimated replacement cost valuation of the water distribution assets owned by the City is approximately \$460 million.

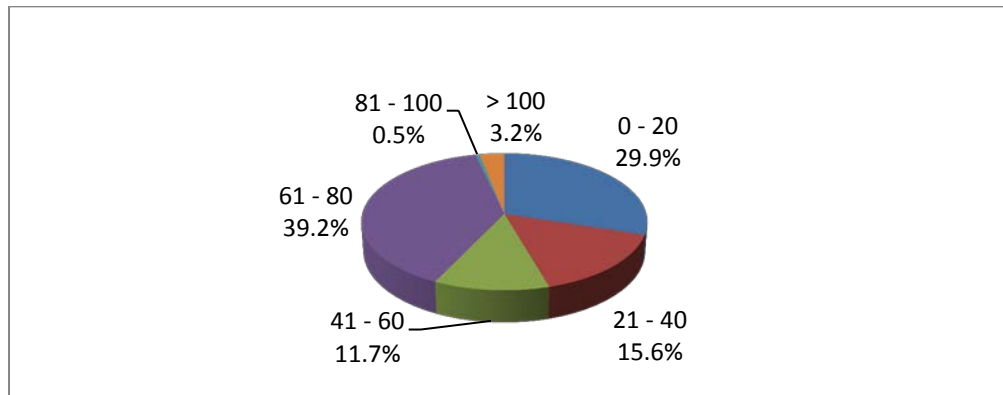
Asset Age Distribution and Proportion of Expected Useful Life

Generally, watermains have an estimated useful life of 50 to 100 years. Useful life for watermains made with the same material varies throughout the City as deterioration can be heavily influenced by various factors such as; soil conditions and composition, water pressure changes in the system (some neighbourhoods may experience different levels of pressure due to usage, location, etc), or ground temperature, among many other factors. Therefore, some watermains may be due for replacement much sooner than the estimated useful life of the pipe material may indicate whereas other watermains are functional for much longer than their estimated useful life.

The following graph represents the watermain ages and the respective percentage of watermains lengths comprising the City's water distribution system. The weighted average age of watermains considering respective lengths of the watermain sections is approximately 44 years.



Figure 3.3 – City of St. Catharines – Age of Watermains



Asset Condition

Since watermains are buried underground, inspections that are performed for other assets such as roads and bridges are not possible. It is impractical to comprehensively assess the condition of watermains based on visual inspection. As previously noted, the age of watermains may not be an accurate indication of asset condition due to many varying factors that influence the deterioration of these assets.

Therefore, to monitor the condition of watermains the City keeps a record of all the breaks and failures that occur. These records are then used to generate break rates and break scores for watermain sections. The break rate is calculated based on the number of breaks per kilometre of pipe length. Break scores are calculated based on the number of breaks and how recently the last break occurred. Watermain break scores are then used to prioritize watermains for replacement.

Records of water quality concerns are also maintained and taken into consideration in preparing the annual watermain replacement program in order to reduce water quality issues in the water distribution system. Generally speaking, incidents of water quality complaints occur on streets serviced by cast iron watermains.

The total length of watermain sections that have recorded breakages or failures is approximately 207 kilometres or 34% of the overall length of the water distribution system. Note that not all sections with a break history are considered to be in a critical condition. The estimated length of watermain sections that are currently considered to be in a relatively critical condition is approximately 33 kilometres or 5% of the overall length of the water distribution system. The assessment of these watermains as “critical” are based on the break records of watermains.



DESIRED LEVELS OF SERVICE

Level of Service and Current Performance Relative to Targets

At its meeting of November 17, 2008, City Council made the following commitment:

The City of St. Catharines is committed to:

- Ensuring a consistent supply of safe, high quality drinking water;
- Maintaining and continuously improving its Quality Management System; and
- Meeting or surpassing applicable legislation and regulations.

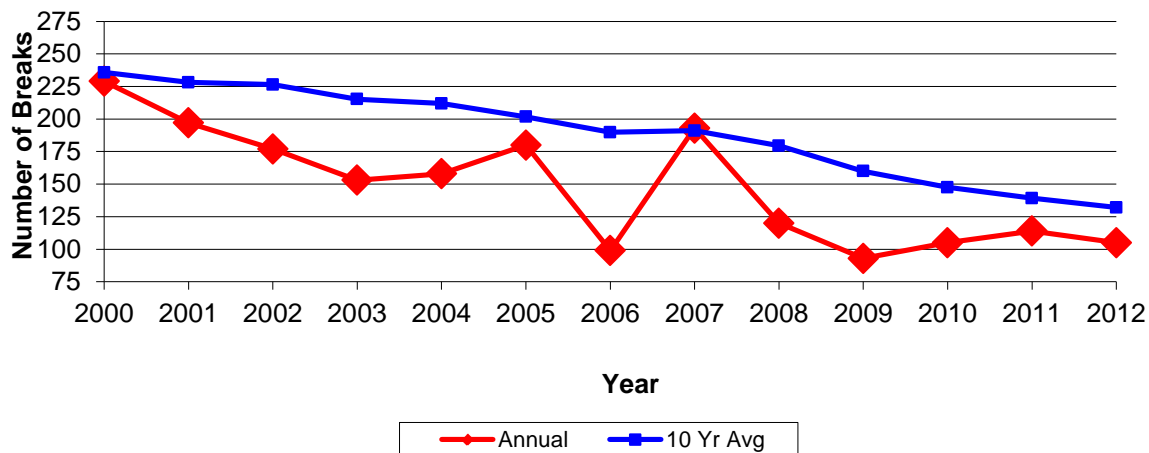
The Ministry of Environment (“MOE”) conducts an extensive annual inspection of the City’s water system, to determine compliance with requirements under the Safe Drinking Water Act and associated regulations. The inspection considers up to 14 inspection modules (the City typically has 9 modules considered as we do not treat water) and consists of approximately 120 regulatory questions. Once complete, MOE inspectors issue an inspection report which outlines their findings and assigns an inspection rating, with a maximum score of 100. The City has achieved a perfect score of 100 for four of the last five years, with an average score of 98.4 which clearly demonstrates the commitment towards ensuring a consistent supply of safe, high quality drinking water.

While no targets have been formally adopted for an acceptable level of watermain breakages, City staff focus on areas with higher break scores as this indicates a potentially greater level of deterioration in the existing watermains. It is difficult to obtain benchmarks for the desired level of service as break rates vary by municipality due to watermain composition, soil conditions, water pressure, ground temperatures among other factors. Therefore, staff have focused efforts on improving watermain break rates within the City by comparing results year over year. Staff acknowledges that focusing on watermain breakages is a reactive approach and are working to further develop an asset management strategy that is more predictive in nature.

The following chart provides information about watermain breaks since 2000.

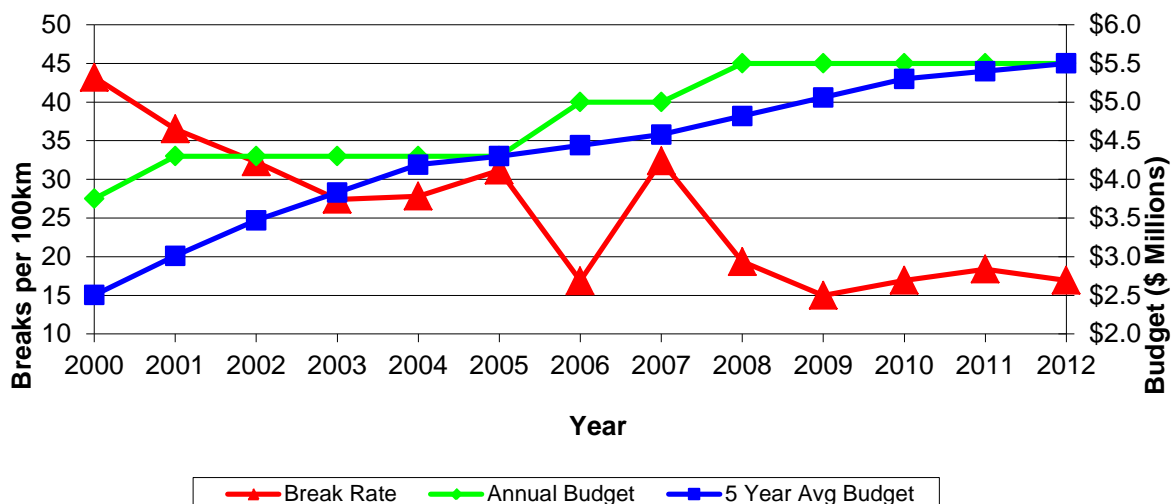


Figure 3.4 – City of St. Catharines – Watermain Breaks 2000 - 2012



While there are fluctuations from year to year, watermain breaks and break rates have generally been trending lower. Staff attribute the decrease in average break rates to increased watermain replacement budgets and increased effectiveness in targeting areas with higher risks of breakage. The following chart tracks break rates in comparison to annual watermain replacement budgets since 2000.

Figure 3.5 – City of St. Catharines – Watermain Breaks per 100 km Compared to Annual Watermain Replacement Budgets 2000 - 2012



Cast iron and ductile iron watermain pipes are susceptible to corrosion which will leave the pipe brittle and susceptible to breakages. As 41% of the City's watermain pipes are constructed from these materials, there is an extremely high likelihood that breakage



rates will reverse and there will be an upward trend in break rates unless funding is increased.

The City currently uses direct read meters to monitor water usage for the purpose of billing its customers. Direct read meters measure and display the total water usage based on the amount of water that passes through the meter and are usually installed in the basement of the building to help protect the meter from extreme weather conditions. While this protects the meter, this location makes it necessary for the City's meter reading staff to enter the building for the purposes of reading the meter.

Council recently approved the purchase of radio read drive-by meters to gradually replace direct read meters. Radio read drive-by meters involve the installation of radio transmitters on water meters. A reading device is mounted on a City vehicle and the meter reader drives throughout the City to obtain meter readings. The reading device collects and stores the data for upload to the billing system. Benefits to radio read drive-by meters include less disruption to water customers as readings can be obtained without physically entering the customer's property, obtaining consumption figures on a timelier basis and to help identify water leaks through unusual consumption patterns.

External Trends

Increased Regulation

On June 01, 2003, the Safe Drinking Water Act (SDWA) came into effect which outlined the regulations and requirements for public waterworks to follow with regards to sampling and testing, levels of treatment, accredited laboratories, licensing of staff, and notification to authorities and the public about water quality.

Under the SDWA, *Ontario Regulation - 170/03 Drinking Water Systems* regulates municipal water systems. In Ontario, all municipal water systems must be licensed under the MOE's municipal drinking water licensing program. The MOE has issued the City a Municipal Drinking Water License ("MDWL"), No. 23-101. The MDWL contains a number of conditions the City must meet. The Act and associated regulations sets standards such as frequency, method and expected results of testing, annual reporting, reporting of adverse results among many other factors.



One of the conditions is the implementation of a Drinking Water Quality Management System (“DWQMS”). The DWQMS includes a number of elements including:

- DWQMS Policy
- Description of the system
- Risk assessment process
- Infrastructure review process
- Management review process
- Procedures for sampling and monitoring

City staff has developed an Operational Plan with documented policies and procedures with a strong commitment to regular review and continual improvement.

The DWQMS must be accredited by a third-party accreditation agency. The City uses NSF-ISR International, an independent accredited organization that specializes in the certification of public health systems. NSF-ISR International performs an annual accreditation audit of the drinking water system, which is performed in addition to the MOE inspection described above.

Water quality tests that the City performs include:

- Random samples taken on a monthly basis from a cross section of the entire watermain network to test for microbiological parameters and free chlorine residual.
- Samples taken both up and downstream from locations where watermain / water service repairs have been made.
- Quarterly testing for Trihalomethanes, generally referred to as disinfection by-products.
- Lead testing performed at a minimum of 130 locations throughout the City. The City has implemented a Community Wide Lead Testing Program aimed at private properties.

In 2007, the Ministry of the Environment (MOE) implemented *Ontario Regulation 453/07 – Financial Plans* under the SDWA. This regulation is known as the “Financial Plans Regulation” as it requires all owners of municipal drinking water systems to prepare a Financial Plan as one of the five requirements in obtaining a Municipal Drinking Water Licence which was approved by Council prior to the July 1, 2010 deadline. The MOE has stated that “financial sustainability is needed to ensure that Ontarians continue to



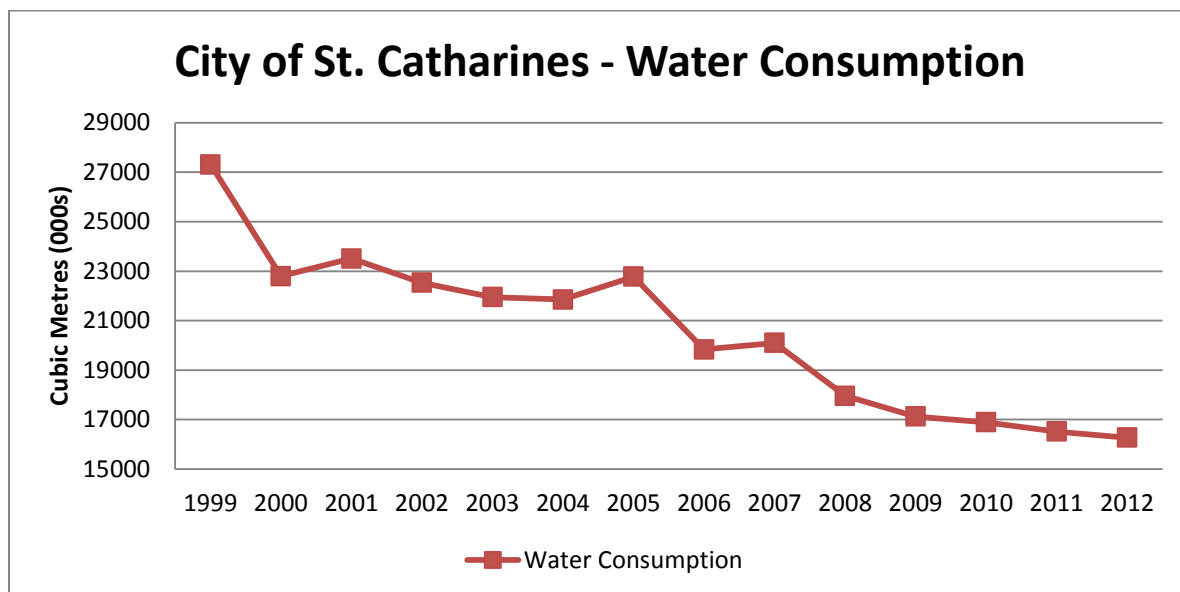
enjoy clean and safe drinking water, that water and wastewater services are reliable in the long term, and that environmental protection is maintained.”

The MOE has indicated in the past that full cost recovery is intended as part of financial sustainability. Although *Ontario Regulation 453/07 – Financial Plans* does not require municipalities to fully recover costs in their Financial Plans, the MOE continues to encourage full cost recovery as part of financial sustainability.

Declining Consumption

As previously reported to Council, declining water consumption has resulted in a significant reduction in the amount of water purchased from the Regional Municipality of Niagara. Since 1999 annual water purchases have decreased from 27.6 million cubic metres to 16.3 million cubic metres in 2012.

Figure 3.6 – City of St. Catharines – Water Consumption 1999 - 2012



While the trend in declining consumption has somewhat stabilized, City Staff expects the decline in consumption to continue and projects a minimum consumption threshold of 15.2 million cubic metres. In consultation with the Planning and Development Services Department, the population for the City of St. Catharines is estimated to grow by 1.58% from 2011 to 2016. City staff does not anticipate a material change in consumption patterns to result from this growth.



ASSET MANAGEMENT STRATEGY

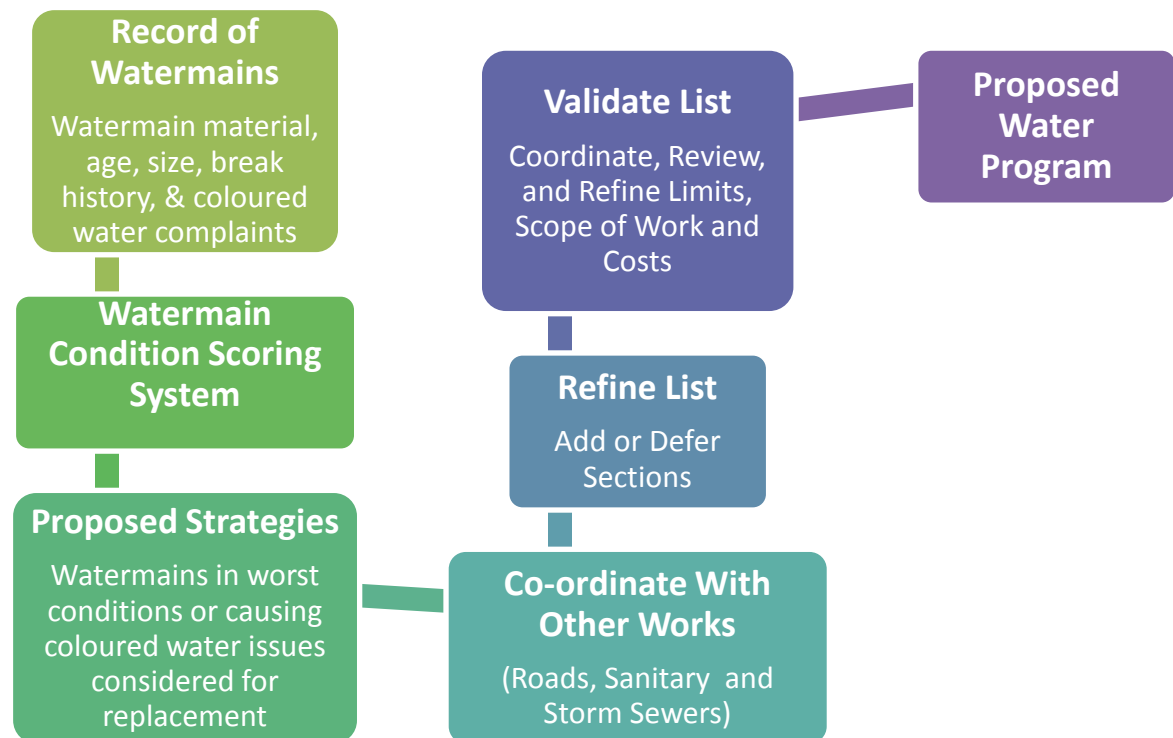
Planned Actions:

Non-infrastructure Solutions

As previously mentioned the City keeps track of the condition of its watermain by keeping a record of all the watermain breaks/failures and by generating break scores for all watermain. In addition, water quality complaints are also recorded and considered in watermain condition assessments. This allows the City to make informed decisions regarding the life cycle costing of the distribution watermain network and to optimize the maintenance and rehabilitation programs based on the available levels of funding.

The City also coordinates the replacement of other infrastructure such as sanitary and storm sewers and road works within the City and the Regional Municipality of Niagara which allows for the cost sharing of capital projects. As a result, the rehabilitation of sections of watermain determined to be replacements can be deferred or accelerated. The following chart shows the selection process

Figure 3.7 – City of St. Catharines - Watermain Selection Process for the Replacement Program:





Maintenance Activities

Routine maintenance activities include hydrant testing, flushing and maintenance, and exercising of valves. Maintenance activities also include repair of any valves or hydrants that do not work or are faulty. Fixing any leakages or breaks in the water distribution system are also a part of the maintenance activities. Addressing maintenance issues quickly ensures a smooth, reliable and safe operation of the water distribution system in compliance with the Safe Drinking Water Act (SDWA). Routine maintenance activities are further detailed in the City's DWQMS Operational Plan.

Replacement Activities

In addition to routine maintenance an annual watermain replacement budget helps in replacing watermain sections with the worst break records, size deficiencies or in coordination with other capital projects. All work under the annual water replacement budget is completed by outside contractors through an open bidding process.

Disposal Activities

The water distribution system is being optimized whenever there is an opportunity. Some road sections have multiple existing watermain sections which may have been installed in the past for security of supply or ease of water service installations on each side. Any such duplication is being removed from the system gradually. In addition, the connection of the distribution water system to the trunk water system is also being optimized when opportunities exist. Such changes usually require size increases at some locations but also results in size or watermain redundancies at other locations. Such size or watermain redundancies are being removed from the system as opportunities arise.

Expansion Activities

According to the City's Official Plan St. Catharines is not expected to grow laterally but rather grow by intensification of the existing urban areas. As such the water distribution system is not expected to grow much larger in size but rather become better integrated with watermains sized appropriately to fulfill future demands and comply with the required standards.

New watermains constructed by developers within private subdivision developments are being assumed by the City upon development completion.



Such watermain are reviewed and inspected by City staff to ensure that the watermain meets the current design, construction, and disinfection standards before such watermain are connected to the City's water distribution system.

Procurement Methods

Most of the routine maintenance requirements are fulfilled by the City's own operation and maintenance staff. In addition to its own staff, the City also engages services of contractors to help with repair or maintenance of the water distribution system on an as required basis in order to reduce response times. New watermain construction or replacements are mostly completed by outside contractors. Construction projects are undertaken in accordance with the City's procurement policies to ensure transparency, fairness and equity. Wherever possible, the City cost shares capital projects with other agencies.

Overview of Risks Associated with the Asset Management Strategy

The current level of funding for watermain replacement/renewal is not at the desired level. Ideally the funding should be a 2% of the value of the watermain system; however, currently the available annual funding is approximately 1.2% of the value of the watermain system. With condition tracking of existing watermain, maintenance activities, and careful prioritization of watermain for replacements the state of the watermain infrastructure seems to be in a reasonably good condition, however, the annual funding shortfall, as compared to the desired level, can potentially result in various issues down the road which may affect the expected level of service.

FINANCING STRATEGY

The goal of the financial strategy as it relates to water infrastructure is to be self-sustaining. As noted, the Ministry of the Environment has indicated that full cost recovery is intended as part of financial sustainability.

To become self-sustaining the revenue collected from user fees must equal the total cost of all maintenance, rehabilitation and replacement expenditures. While user fees collected have been sufficient to fund current operational expenditures such as maintenance and rehabilitation, funding has not been sufficient to meet the targeted capital replacement rate for the water system of 2%. External funding programs, when available, such as the Federal Gas Tax Program have been used to fund watermain replacement projects.



While watermain constructed from PVC and other materials have an expected life upwards of 100 years which would suggest a lower replacement rate than 2%, 41% of the City's watermain are constructed from cast iron and ductile iron which are prone to breakages due to corrosion. Break rates will inevitably increase as these pipes age, therefore a replacement rate of greater than 1.33% (replacement of system within 75 years) is necessary.

This is a relevant target given the challenges associated with cast iron pipes and meeting a desired level of service. This target must continue to be evaluated as we move forward and the composition of the City's watermain inventory changes due to longer lasting materials used for pipes.

An increase in user fees is necessary to meet increased funding requirements. As noted, the targeted replacement rate for the water system is 2%. To achieve a sustainable water system, rate increases are necessary to fund infrastructure gaps. The recommendation is to increase total revenues from user fees annually by 4.5% over the next ten years to increase replacement rates to sustainable levels.



4. SANITARY SEWERS

STATE OF LOCAL INFRASTRUCTURE

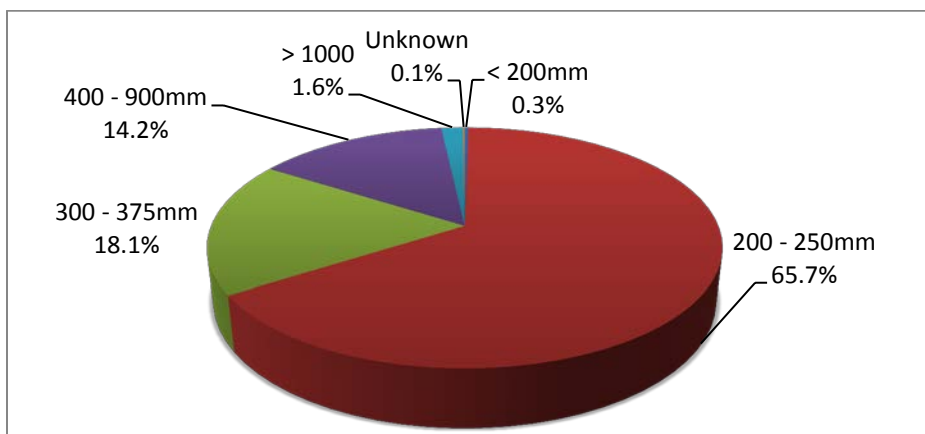
Asset Types

The City of St. Catharines' sanitary sewer system transports wastewater to trunk sewers and two sewage treatment plants owned and operated by the Regional Municipality of Niagara. Made up of both combined (carries wastewater and stormwater) and sanitary sewers (wastewater), the primary components of the sanitary sewer system are the sewer mainline, manholes and services. Property owners are responsible for the private sewer service which connects their property to the mainline. Wastewater drains from the services into the City owned sewers which convey the wastewater to the trunk collector sewer system. The trunk collector sewers convey the wastewater to the sewage treatment plants for treatment.

Excluded from the following sections is analysis of the existing storm relief sewers, combined sewer overflow pipes and independent storm sewers. Existing storm relief sewers and combined sewer overflow pipes are directly connected to the sanitary sewer system as they convey excess flows from the combined sewer system directly to the environment or storage facilities such as Combined Sewer Overflow ("CSO") tanks or stormwater management ponds during wet weather events. As noted previously asset management recommendations for the storm sewer system will be incorporated in the future versions of the asset management plan.

The sanitary sewer system consists of approximately 561 kilometres of sanitary mainline which services 41,529 sanitary service connections and 8,477 manholes. The following graph represents the various mainline diameters and the respective percentage of mainline lengths comprising the City's sanitary sewer system.

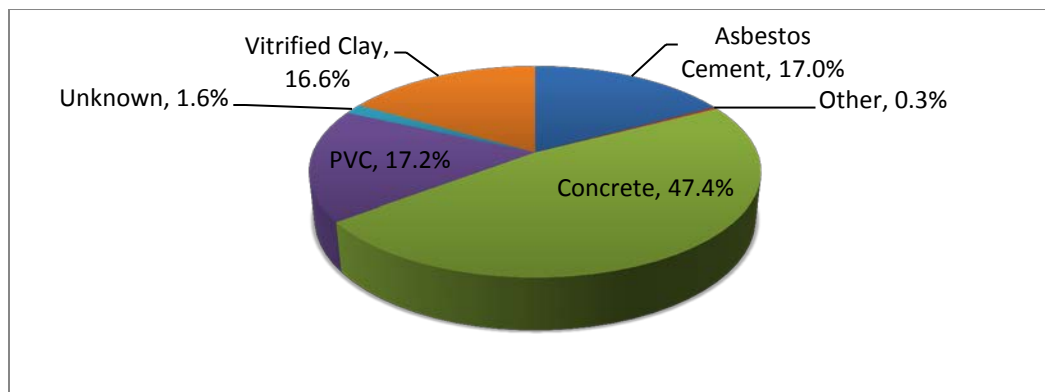
Figure 4.1 – City of St. Catharines – Sanitary Sewer Mainlines by Diameter





Sanitary mainlines are constructed using a variety of materials. Newer mainlines are typically constructed using polyvinyl chloride (“PVC”) which has an estimated useful life of 75 years. Materials used for mainlines mostly include concrete, PVC, asbestos cement, and vitrified clay with small portions composed of other materials. The estimated useful life for these assets is 75 years. Given the long lasting nature of these assets, the construction material used for a small percentage of the City’s mainlines are unknown as construction drawings for older assets could not be found.

Figure 4.2 – City of St. Catharines – Sanitary Sewer Mainline Composition



Financial Accounting Valuation

As at December 31, 2012, the total historical cost of the sanitary sewer system was \$64.2 million with accumulated amortization of \$24.7 million giving a net book value of \$39.5 million. Depreciation is calculated on a straight line basis with the historical cost evenly spread out over the number of years of estimated useful life.

Replacement Cost Valuation

The estimated replacement cost valuation of the sanitary sewer assets owned by the City is approximately \$357 million.

Asset Age Distribution and Proportion of Expected Useful Life

The sanitary sewer system has an anticipated useful life of 75-100 years. Similar to watermains, the useful life of mainlines can greatly fluctuate. The primary driver of useful life fluctuation is the level of corrosiveness of the wastewater that flows within the pipes. For example, industrial and commercial usage tends to generate sewage that is more corrosive than residential usages. Therefore, the mainlines that serve a greater proportion of industrial and commercial users may be due for replacement much sooner than the estimated useful life of the pipe material may indicate whereas some mainlines



are functional for much longer than their estimated useful life. Other factors that affects the longevity of sewer infrastructure is material type, installation conditions and geotechnical equipment.

The following table provides a summary on the age and expected useful life of the City's sanitary sewer mainline.

Table 4.1 – City of St. Catharines – Sanitary Sewer Asset Age Summary

	Length (km)	Avg. Pipe Age	Avg. Remaining Life	Min Installation Year	Max Installation Year
Sanitary Mainlines	561.2	45.6	29.4	1904	2012

Asset Condition

As mainlines are buried underground, visually inspections that are performed for other assets such as roads and bridges are not as easily obtainable. As previously noted, the age of mainlines may not be an accurate indication of asset condition due to varying factors that influence the deterioration of these assets.

To monitor the condition of mainlines approximately 6% of the City's mainlines are inspected annually for structural deficiencies using closed circuit television cameras ("CCTV"). Cameras are operated to travel through mainlines to assess the condition of the infrastructure. Independent contractors who are certified by the National Association of Sewer Service Companies ("NASSCO") are engaged to film sewer mainlines in accordance with Ontario Provincial Standard Specification 409 ("OPSS 409"). OPSS 409 outlines the requirements for the inspection of sanitary sewers and pipe culverts by CCTV including the media used to film, equipment used, resolution of cameras and the position and travel speed for cameras among many other requirements.

The City has useable CCTV inspection data of good quality for approximately 65% of the overall sanitary sewer system mainlines. At the date of report writing, an engineering firm has been engaged to analyze the results of the data set. Of the data set evaluated, we have the following condition ratings:

- 87% of the pipes are in good to fair condition
- 9% of the pipes have significant defects, such that the sewer is likely to fail in the next five to ten years and



- 4% have significant structural defects such that the sewer is likely to fail within five years

DESIRED LEVELS OF SERVICE

Level of Service and Current Performance Relative to Targets

Historically, the level of service for the sanitary sewer system has been driven by the following three broad objectives:

- Legislative Compliance – minimize untreated sewage overflow to the environment
- Quality of Life - prevention of basement flooding
- Asset Management – replacement of failed infrastructure

With respect to the first two objectives, the City is required to achieve the goals of the Ministry of the Environment's (MOE's) Procedure F-5-5. This procedure determines the treatment requirements for municipal combined and partially separated sewer systems. The primary tool for the management of these objectives is the development and maintenance of a system Pollution Control Plan (PCP). The City's efforts in this area have historically been proactive in both planning and implementation.

With respect to the third objective, the City maintains a set of data for the mainline sanitary sewers. This data set includes Geographic Information System ("GIS") base information, CCTV records and structural defect grades. The City rehabilitates all the sanitary sewers with significant structural defects indicating the sewer is likely to fail within five years. The City's efforts in this area have often been reactive and typically focused on immediate replacement needs.

The City currently follows the technical requirements as outlined in the City of St. Catharines Design Guidelines and the "*Design Guidelines for Sewage Works, 2008*" published by the MOE as a minimum standard for the design, review, approval and installation of sewage works. Currently, City staff is drafting design guidelines for future implementation.



External Trends

Increased Regulation

There is a likelihood is that the Ministry of the Environment or the Federal Government could implement increased regulations that change current design guidelines and pollution control standards. In recent years, the focus for the MOE has been on drinking water and City staff anticipate with the Safe Drinking Water Act and its associated regulations and requirements substantively in place, the focus will likely move towards sanitary sewers.

Climate Change

As identified in the City's Sustainability Strategy, there is increasing evidence that the climate is destabilizing and warming which for the purposes of the combined sewer portion of the sanitary sewer system could mean more intense and severe wet weather events.

In 2008, the City prepared a Pollution Control Plan which indicated no hydraulic capacity constraints during dry weather flow. The plan identified a number of wet weather concerns, specifically regarding peak flows and runoff of sewage. Mitigation of these wet weather concerns are identified as Storm Sewer or Pollution Control Plan projects in the City's budget documents and are funded outside of the sewer user rates.



ASSET MANAGEMENT STRATEGY

Planned Actions:

Non-infrastructure Solutions

As previously mentioned, the City has engaged an engineering firm to analyze the CCTV data compiled to date into a single database. Collecting better information regarding the condition of sanitary sewer assets provides the City with additional tools to assist in decision making processes. The City also shares data with the Regional Municipality of Niagara as well as adjacent municipalities and utility companies which provides more complete data as well as reduces costs for data collection and ultimately sanitary sewer rehabilitation programs.

The City provides a Water Conservation and Public Education Program (information displays, public information sessions, in-school presentations and media announcements) which encourages reductions in residential water use. Water conservation provides a subsequent reduction in dry weather flows.

The enforcement of existing sewer-use by-laws will limit the introduction of detrimental substances like fats, oils and grease. Historically, service blockages from these substances are responsible for the majority of service interruptions to sanitary sewer users.

Pollution Control Plan

The City's Pollution Control Plan is fundamental in the overall management of the sanitary sewer system. For the past several decades, the primary focus of the plan has been to comply with environmental and legislative regulations. The plan is scheduled to be updated in 2014. This update of the PCP must achieve a more balanced perspective with respect to quality of life considerations and traditional asset management principles. This transition of focus from compliance towards asset management principles will consider items such as the separation of combined sewers by building new storm sewers and will provide a more proactive asset rehabilitation and replacement program.



Maintenance Activities

Typically, sanitary sewer systems require less maintenance than the waterworks system as there are fewer moving parts or machinery. Routine maintenance includes the flushing of sewers, repair of manholes and CCTV investigations in response to customer concerns and short spot repairs.

Information gathered from the regularly scheduled CCTV inspections will track actual pipe degradation. Decisions regarding maintenance activities for the sanitary sewer system can be optimized to provide the most value to the City as maintenance activities can be prioritized for the areas that require the greatest levels of repair.

Renewal and Rehabilitation Activities

With technological advances, there are new methods of prolonging the useful life of mainlines available as alternatives to the traditional remove and replace approach. The no-dig options are designed to extend the useful life of sanitary sewer assets. In some instances, the mainline can be refurbished to add an additional 75 years without having to tear up the existing road infrastructure to replace the asset. If the existing mainline is structurally sound, Cured-in-Place-Pipe ("CIPP") lining can be added inside the mainline and sealed. While CIPP lining slightly reduces the diameter of the mainline, the lining is smoother which allows for greater flow rates, thus negating the reduction in size of the pipe.

Other renewal and rehabilitation activities include chemical grouting to seal sanitary sewer joints which decreases the inflow and infiltration of ground water, fold and form and sliplining which are similar to CIPP lining in terms of refreshing the lining material inside of mainlines and pipe bursting where the existing pipe is broken using an internal mechanically applied force via a bursting tool. At the same time, a new pipe of the same or larger diameter is pulled in to replace the existing pipe.

Replacement Activities

Once the sewer has deteriorated to the point where renewal and rehabilitation activities are no longer feasible, the sanitary sewer must be removed and replaced. Depending on the level of deterioration, it may be possible to perform a localized or spot repair.



The most costly and disruptive activity would involve the full removal and replacement of the sanitary sewer. Typically, the City would perform this activity in conjunction with the replacement of existing water and road assets to minimize the level of future disruption to area residents and businesses.

Disposal Activities

In the situation where the sanitary sewer has reached the end of its useful life and is no longer required to provide service, the City will dig and remove the abandoned sewer and backfill the trench. The sanitary sewer pipe is grouted or plugged at the ends of the pipe and the manhole cap would be removed and filled with granular material.

Expansion Activities

Expansion activities are required for areas where sanitary sewers currently do not exist such as areas where buildings are connected to their own sanitary system (septic system and/or holding tank) or rural areas. In areas with existing buildings, new sanitary sewers are financed by local improvement charges. Sanitary sewers for growth areas are funded by site servicing plans.

New sanitary sewers constructed by developers within private subdivision developments are being assumed by the City upon development completion. Such sanitary sewers are reviewed and inspected by City staff to ensure that the sewers meet the current design and construction standards before they are assumed as part of the City's sanitary sewer collection system.

Through the on-going development of the PCP, the City will consider and evaluate the benefits of sewer separation. Sewer separation typically does not result in the expansion of the sanitary sewer system. However, sewer separation does typically result in the introduction of new storm sewer assets. The funding of those new assets has historically been from sources outside of the sewer rates.

Procurement Methods

Where possible, the City endeavours to partner with the Regional Municipality of Niagara to share sewer rehabilitation cost savings. Typically, tendering partnerships can attract more competition for tenders leading to higher quality and more cost effective solutions.



Construction projects are undertaken in accordance with the City's procurement policies to ensure transparency, fairness and equity.

Overview of Risks Associated with the Asset Management Strategy

Any form of failure within the sanitary sewer system has a direct and negative impact on the quality of life of the users. Specific risks associated with the failure of sanitary sewer mains include the following:

- Environmental – Raw sewage runoff into the local environment including water sources
- Legal – Liability related to basement sewage back-ups and non-compliance with Provincial or Federal regulations leading to fines
- Safety – Sink holes caused by faulty sanitary sewers could lead pose a risk to public health and safety
- Economic – Loss of business resulting from back-ups or disruption of service

As noted, the overall state of the sanitary sewer system appears to be healthy with 87% of the assessed system in good to fair condition. To proactively address the risks identified, the City plans to continue with CCTV inspections to evaluate the state of the remaining local infrastructure to identify the areas to be addressed.

FINANCING STRATEGY

The Water and Wastewater Budget is fully funded by user rates with no reliance on property taxes. The water and wastewater rates fund both operating and capital expenditures.

The goal of the financial strategy as it relates to sewer infrastructure is to be self-sustaining. To become self-sustaining the revenue collected from user fees for wastewater must equal the total cost of all maintenance, rehabilitation and replacement expenditures for wastewater. Similar to the water system, user fees collected have been sufficient to fund current operational expenditures such as maintenance and rehabilitation but have not been sufficient to program the systematic replacement of current infrastructure.

The update of the City's PCP scheduled in 2014 will include a comprehensive condition assessment of all sewer assets, a technical analysis of system functions (hydraulic) and



the evaluation of system objectives. The updated PCP will establish the relative importance of three broad objectives (environmental compliance, quality of life, asset management) and ultimately identify the funding necessary for a self-sustaining system.

Funding requirements for sewer infrastructure are also affected by the following factors:

- Grant support levels
- Precipitation levels

Grant Support Levels

The City of St. Catharines currently benefits from two grant programs which are expected to maintain funding levels unadjusted to inflation for the duration of the forecast period. The two programs are the Federal Gas Tax Funding and Niagara Region Combined Sewer Overflow Cost Sharing Program.

The Federal Gas Tax Funding Program is designed to provide municipalities with a source of stable, predictable and long-term funding towards environmentally sustainable municipal infrastructure to help address infrastructure needs and meet sustainability objectives. Gas tax funding has been used in St. Catharines to fund sewer infrastructure.

The Niagara Region has a Combined Sewer Overflow cost sharing fund which contributes 50% to the cost of combined sewer studies and improvements. In the past St. Catharines has been successful in partnering with the Region on several projects.

Precipitation levels

Precipitation influences the City's infrastructure cost by increasing the regional portion of the wastewater cost. This situation arises from combined sewers which allow rain water to mix with waste in the sanitary sewer which must be treated. In 2012, the Region supplied the City with approximately 16.3 million cubic metres of potable water and treated 20.8 million cubic metres of wastewater. Should the City move in the direction of sewer separation and proactive asset management, sewage flows would be reduced as both objectives would result in the reduction of storm water in the sanitary system.



RECOMMENDED COURSE OF ACTION

An update of the City's Pollution Control Plan which will include a comprehensive condition assessment of all sewer assets as well as a technical analysis of system functions in dry and wet weather conditions is required before recommending wholesale changes to funding. One of the deliverables from the update to the PCP will be to identify the funding required to operate a sustainable sewer system.

As noted earlier implementation of the City's Pollution Control Plan as it relates to wet weather concerns and construction of independent storm sewers is currently funded outside of the Wastewater user rates. Hence projected storm sewer system funding requirements must be met with a corresponding increase in tax revenue or debenture financing which will be the subject of a future staff report.