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Stormwater
Asset Management Plan

March 2022

Version 1.1

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Introduction

Background

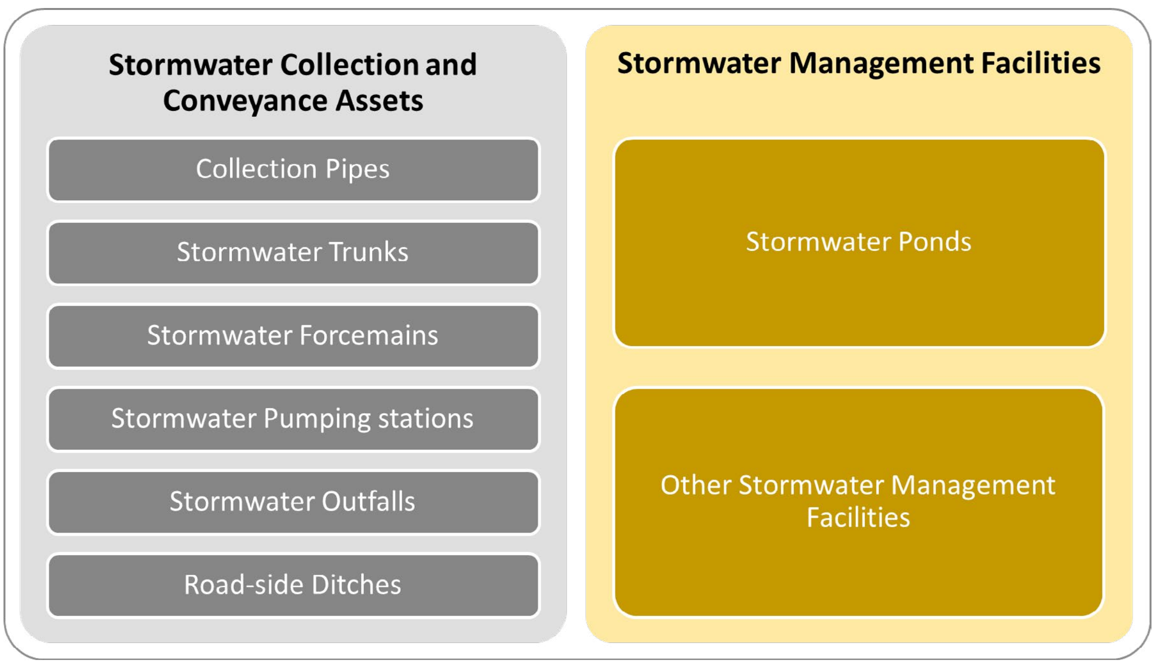
Ontario Regulation 588/17: Asset Management Planning for Municipal Infrastructure requires all municipalities to prepare baseline asset management plans for their core municipal infrastructure assets supporting the delivery of: drinking water, wastewater, stormwater and transportation. The City of Ottawa has a well-developed Comprehensive Asset Management program that is well beyond the baseline and over the past 20 years has established a clear picture of its infrastructure assets and maintained them responsibly, balancing affordability, risk and service levels. The Provincial regulation requires the City shift its reporting slightly to present the cost of maintaining all core assets in their present state, with no changes to the service level, for the next 10 years.

To meet the Provincial requirements, the City has created this first version of its **Stormwater Asset Management Plan (Stormwater AMP)**. It reports the current state of the assets, levels of service provided, strategies and activities applied by the City, historical and forecasted financial details and potential improvement actions. It is a strategic document that provides a snapshot of current conditions and establishes a basis for future asset management planning and decision making.

Asset Categories and Types

The Stormwater AMP satisfies the Provincial requirements for stormwater management assets that relate to the collection, transmission, treatment, retention, infiltration, control or disposal of stormwater. These assets enable and support the collection and conveyance of water to watercourses in all parts of the City whether it is an urban, suburban, or rural area. Meltwater and runoff are contained or controlled to protect properties, roads and local waterways from flooding and erosion and also to mitigate water quality impacts to the natural environment.

Stormwater Asset Categories and Types



State of Local Infrastructure

Inventory and Valuation

The assets covered in the Stormwater AMP have a replacement value of approximately $12.7 billion. This includes an inventory of approximately 3,000 kilometres of pipes, 14 pump stations, nearly 1,700 outfalls, up to 6,000 kilometres of roadside ditches, 167 ponds, and 95 other facilities.

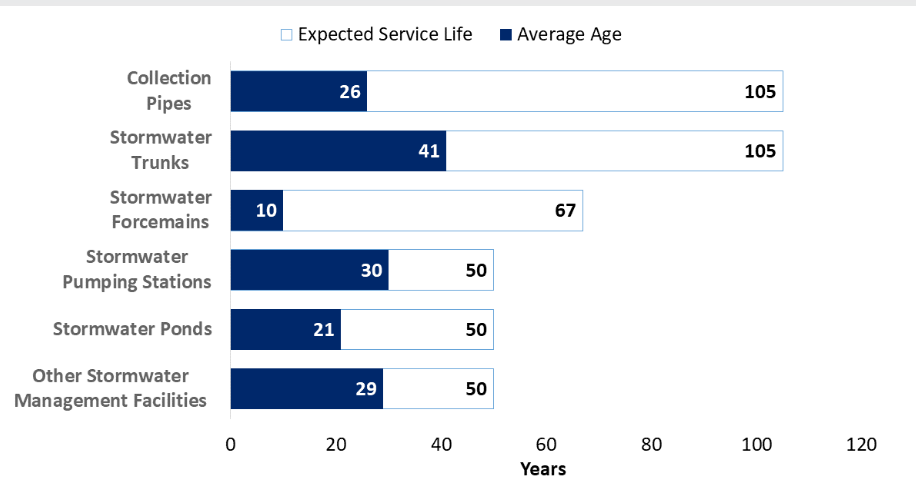
	Stormwater Collection and Conveyance Assets	Stormwater Management Facilities
Inventory	• 2,919 kilometres of Collection Pipes • 88 kilometres of Stormwater Trunks (2,100 mm diameter or greater) • 3 kilometres of Stormwater Forcemains • 14 Stormwater Pump Stations • 1,686 Stormwater Outfalls • 3,500 – 6,000 kilometres of roadside ditches (estimate)	• 167 Stormwater Ponds • 95 Other Stormwater Management Facilities such as underground storage, oil-grit separators, low impact development facilities, diversion structures and open channel flow control structures
Replacement Costs	$12.2 Billion	$460 Million

State of Local Infrastructure

Age and Condition

The age of an asset gives a sense of how close it is to the end of its service life and what renewal interventions may be appropriate. The average age of the City's stormwater assets is shown in the figure below.

Average Age – Stormwater Assets



State of Local Infrastructure

The City assesses the condition of its stormwater assets on a regular basis using a variety of techniques, as summarized in the table below.

Asset Category	Condition data collection techniques	Frequency
Storm sewers (<2100mm diameter)	Closed Circuit TV inspection	1-to-20-year cycle, dependent on level of risk; some sewers have annual inspection requirements
Storm trunks (>2100mm diameter)	Walkthrough inspection on storm trunks deemed to be nearing end of life; preceded by Closed Circuit TV if less than 3000mm diameter	As required in advance of expected lifecycle replacement
Storm pumping stations	Visual inspection and condition assessment of electrical, mechanical and structural components	Going forward, intention is to complete a 5-year basis
Forcemains	Closed Circuit TV inspection; possible transient and hydraulic analysis; opportunistic pipe and soil sampling; external corrosion detection	Variable
Outfalls	Visual inspection and condition assessment	Variable
Roadside ditches	Inspection is carried out when reactive ditch cleaning work is requested	Variable
Stormwater ponds	Environmental Compliance Approval compliant major and minor inspections; ongoing infiltration monitoring	Once per year
Oil and grit separators	Visual inspection and sediment depth measurement	Once per year
Low impact development	Environmental Compliance Approval compliant inspection (plus informal inspections and monitoring for new pilot projects)	Once per year (or monthly for pilot projects)
Flow control structures	Visual inspection	Once per year

State of Local Infrastructure

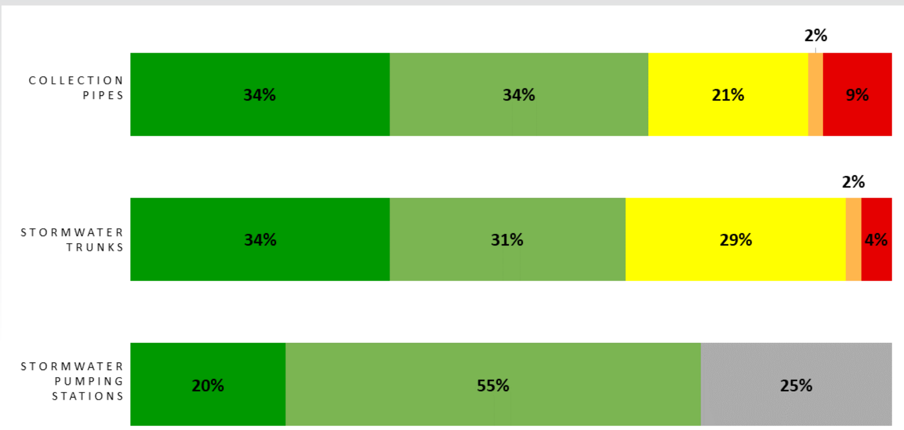
Based on condition data, supplemented by subject matter expert knowledge and professional judgment, the condition of assets is rated on a scale from "Very Good" to "Very Poor" as shown in the table below.

Rating	Rating Description	Percent Life Consumed	Asset Category / Type Metric (Condition Indices)			
			Collection Pipes and Trunks (Percent of Expected Life)	Stormwater Collection and Conveyance Assets		Stormwater Management Facilities (Condition Grade)
				Forcemains (Percent of Life Consumed)	Stormwater Pump Stations (Percent of Expected Life)	
Very Good	**Very Good – Fit for Future** Well maintained, good condition, new or recently rehabilitated	0% to 19%	80% to 100%	0% to 19%	80% to 100%	5
Good	**Good – Adequate for Now** Acceptable, generally in early to mid-stage of expected service life	20% to 39%	60% to 79%	20% to 39%	60% to 80%	4
Fair	**Fair – Requires Attention** In mid-life. Signs of deterioration, requires attention, some elements exhibit deficiencies	40% to 59%	40% to 59%	40% to 59%	40% to 60%	3
Poor	**Poor – Increasing potential of affecting service** Approaching end of service life, condition below standard, large portion of system exhibits significant deterioration	60% to 79%	20% to 39%	60% to 79%	20% to 40%	2
Very Poor	**Very Poor – Unfit for Sustained Service** Near or beyond expected service life, widespread signs of advanced deterioration, some assets may be unusable.	80% or more	0% to 19%	80% to 100%	0% to 20%	1

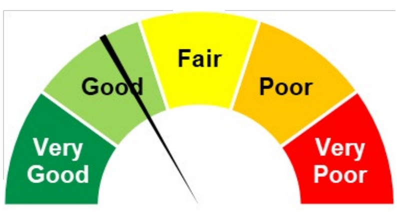
State of Local Infrastructure

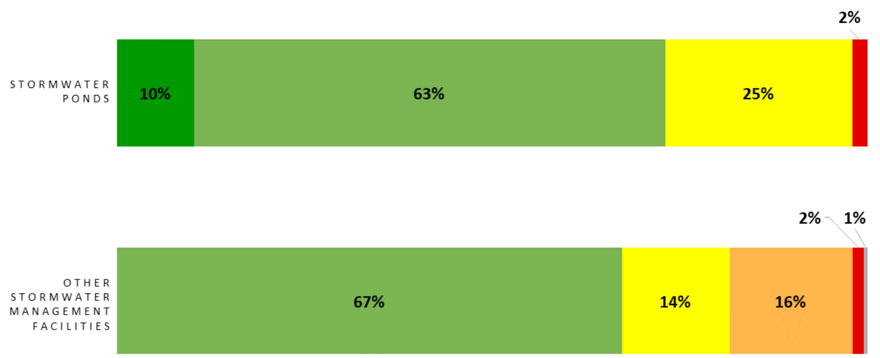
The overall condition of stormwater assets is Good and a breakdown for the various asset types is shown in the figures below.

Stormwater Collection and Conveyance Assets



Stormwater Management Facilities





Legend:

- Very Good
- Good
- Fair
- Poor
- Very Poor
- Condition Data not Available

Levels of Service

The City's assets exist to deliver service to customers. Levels of service measure the actual service delivered so that decisions can be made about the assets based on the service that they provide rather than simply on their condition.

The Stormwater AMP establishes preliminary level of service measures and the current level of service being provided. The measures align with both City goals and Provincial requirements and recognize that stormwater assets should:

- Protect the public from surface flooding, basement flooding, overland flooding and riverine flooding during storm events; and
- Protect receiving body water quality.

A future version of the Stormwater AMP will go a step further and include City Council's target service levels for each measure and may include level of service measures to address other service attributes such as safety, sustainability and reliability.

"The City's assets exist to deliver service to customers."

Levels of Service

Preliminary Stormwater Level of Service Measures

Service attribute	Community levels of service	Technical levels of service	Detailed measure	Current
Scope	The extent of the protection provided by the municipal stormwater management system[1]*	% of the municipal stormwater management system resilient to a 1:5 year storm (minor system) *	Storm sewers that will not surcharge to the surface in a 1:5 year storm	94.7%
		% of the municipal stormwater management system resilient to a 1:100 year storm (minor system) *	Buildings that will not experience basement flooding in a 1:5 year storm[2]	86.7%
		% of properties in municipality resilient to a 1:100 year storm (major system) *	Buildings that will not experience basement flooding in a 1:100 year storm[2]	43.6%
		% of properties in municipality resilient to 1:100 year riverine flooding event *	Buildings that will not experience overland flooding in a 1:100 year storm	81.6%
			Buildings that will not experience riverine flooding in a 1:100 year storm	99.4%
Quality	Minimize the presence of material detrimental to water quality	Water Quality Index at major river sites		Excellent: 8 Good: 55 Fair: 29 Marginal: 34 Poor: 7

** Required by Ontario Regulation 588/17.*
(1) See Appendix 1 for maps of areas of the municipality that are protected from flooding.
(2) These Level of Service measures indicate sewer performance but not necessarily flood risk since many homes built after 1977 have backwater valves installed.

Climate change is a significant factor affecting the City's long-term ability to deliver levels of service and each of the level of service measures were considered against the impacts of a changing climate. The most significant risks that were identified relate to increased rainfall intensity and flood risk.

Asset Management Strategy

Practices, Procedures and Tools

The City has well-established overall principles, framework and decision-making approaches for asset management and these are presented in the 2017 Strategic Asset Management Plan. They provide a holistic approach to asset management as demonstrated by the capital investment prioritization process that drives the decision-making towards meeting the desired levels of service at the lowest lifecycle cost.

Future Demand and Service Enhancement

Ottawa's population is expected to increase to 1.4 million people by 2046, a significant increase of 40% over the next 25 years. The City's Official Plan provides the vision for the future growth of the City including areas identified for intensification. The Official Plan is supported by an Infrastructure Master Plan that is currently being updated to ensure that stormwater services will be available to support future growth.

	2046 Projection	Growth since 2018
Population	1,409,650	402,150
Private Households	590,600	194,800
Jobs	827,000	189,500

Source: New Official Plan report to Council (ACS2021-PIE-EDP-0036), October 2021

In addition to the growth and enhancement objectives of the City's master plans, asset management planning also needs to consider the Climate Change Master Plan goals for both resiliency to changing climate and reduction of greenhouse gas emissions. Existing assets must be maintained and new assets brought into service, to meet these various growth and service enhancement objectives.

Asset Management Strategy

Lifecycle Management and Risk

Lifecyle management activities refer to the set of planned activities and actions undertaken to maintain the current levels of service and achieve good economic life of the assets. The activities undertaken range from operations and maintenance activities, including planned and reactive maintenance, renewal activities (such as condition assessments and rehabilitations), disposal activities and non-infrastructure solutions (such as policies and processes that reduce costs, mitigate risks or maintain/enhance service delivery).

The Stormwater AMP contains a preliminary estimate of the future cost to maintain existing levels of service for stormwater assets. The estimate is based on models of the lifecycle behaviour of the assets and estimates of the costs of renewal. The lifecycle activities that will be required over the 10-year period are based on the asset management strategies detailed in Chapter 4 of the City's Strategic Asset Management Plan. For stormwater assets, this includes operational and maintenance strategies, asset management decision making, intervention strategies, lifecycle cost and value optimisation, options analysis, ageing assets strategy, non-infrastructure solutions, capital investment planning, condition assessment programs, shutdowns/outage strategy and optimisation, as well as consideration of mobility impacts, facility shutdowns and impacts to other services.

The City uses a risk-based approach to prioritizing asset investments. The risk assessment frameworks and methods vary across the different types of assets, but are generally based on the importance of each asset in terms of service delivery/continuity and the number of users who could be impacted.

Financing Strategy

The City continues to invest responsibly in maintaining infrastructure and has been increasing its capital investments to align with long-range financial plans. The City's existing funding model keeps the City on track to maintain critical infrastructure in a state of good repair. There is no need to change the current funding model until new service levels are defined in the next version of the asset management plans, which are due in 2025.

Expenditure History

The City has made significant investments on all types of infrastructure and has put a priority on investing in critical infrastructure.

	Expenditure/Budget (millions)				
	2016	2017	2018	2019	2020
Operating Expenditures	$12.4	$13.0	$12.1	$14.2	$14.1
Capital Budget - Renewal	$27.2	$49.4	$49.4	$44.4	$41.5
Capital Budget - Growth, Enhancement & Strategic Initiatives	$1.2	$13.5	$7.5	$4.7	$0.7

Expenditure Forecast

Over the next 10 years, the City will continue investing in infrastructure to support operational expenses, respond to renewal needs, serve growth and provide enhancements.

	Expenditure/Budget Forecast (millions)										
	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Total
Operating Expenditure	$13.1	$13.7	$14.2	$14.7	$15.3	$15.8	$16.3	$16.8	$17.4	$17.9	$155.2
Capital Budget – Renewal	$54.1	$56.1	$34.0	$64.9	$70.6	$48.8	$51.2	$46.6	$55.2	$47.6	$529.1
Capital Budget - Growth, Enhancement & Strategic Initiatives	$1.8	$7.9	$5.8	$9.1	$7.8	$7.5	$7.6	$7.6	$7.7	$7.8	$70.6

Financing Strategy

Renewal Funding Difference

The City's current asset management investment strategy, based on the 2017 Long Range Financial Plan, focuses on the cost of keeping critical infrastructure assets (such as arterial roads, bridges, trunk sewers, primary watermains, and key facilities) in a state of good repair. By contrast, as required by Provincial legislation, the Stormwater AMP forecasts the cost to keep all stormwater infrastructure assets in their present state for the next 10 years. This Stormwater AMP forecast is compared against current budget forecasts to determine the 10 Year Renewal Funding Difference.

Ten Year Planned Investments and Estimated Preliminary Costs for Stormwater Assets

Asset Category / Type	Planned Investment to Maintain State of Good Repair on Critical Infrastructure (per Long Range Financial Plan)	Estimated Preliminary Cost to Maintain All Infrastructure at Current Level of Service	10 Year Renewal Funding Difference
Storm Sewers (Collection Pipes)	$397.2 M	$1,069 M	$579.1 M
Stormwater Trunks	$92.7 M		
Stormwater Outfalls	-	$8.5 M	See note 1
Stormwater Pumping Stations and Forcemains	-	$9.7 M	See note 1
Roadside Ditches	-	-	See note 1
Stormwater Management & SWM Facilities	$16.0 M	$16.0 M	-
Natural Assets	$7.2 M	-	See note 1

1. There was insufficient financial forecast data to provide an accurate 10 Year Renewal Funding Difference for outfalls, stormwater pumping stations and forcemains, roadside ditches and natural assets.

Financing Strategy

The 10 Year Renewal Funding Difference estimated for stormwater assets only includes storm sewers and stormwater trunks. The estimated preliminary costs for these assets have evolved since the Long Range Financial Plan and billing structure changes were approved in 2017 and stormwater infrastructure is increasingly important in the context of climate change and risk of flooding.

There may also be future funding pressures related to meeting level of service targets (which are not yet established), enhancements for resilience to flooding and climate change and additional growth expenditures and strategic initiatives. The City will continue to balance service levels, costs and risk by exploring strategies that: lower the cost of renewal, optimize which pipes are renewed, manage risks with non-pipe solutions, examine policies that affect renewal cost, preserve non-pipe (ditch) drainage systems, determine and manage impacts to the stormwater rate, adjust levels of service as part of the solution, improve the number of rate payers per metre of sewer and create internal capacity to address funding needs.

Improvement and Monitoring Plan

Based on the snapshot of current conditions and existing plans presented in the Stormwater AMP, areas of potential improvement include:

- Data and systems improvement
- Flood resilience
- Target level of service consultations
- Deeper integration with long-range financial planning
- Infrastructure renewal
- Climate change resiliency
- Equity and inclusion

The Stormwater AMP will be reviewed and updated on a regular basis and over time these improvements will be reflected in future versions of the plan.

More Information

For more information about comprehensive asset management, or to learn more about the City's Comprehensive Asset Management Program, please visit Ottawa.ca.

Appendix 1:

Areas of the Municipality that are Protected from Flooding

The City is exposed to precipitation events of varying intensities and durations (indicated by the storm return period) and associated stormwater runoff primarily from impervious areas. Furthermore, historic patterns are expected to change due to Climate Change. From a flooding perspective, the overall Level of Service provided by the City's stormwater system can therefore be considered in terms of the number of properties exposed to flood risk for each stated return period including a stress test for Climate Change.

Effective urban stormwater management uses a combination of lot level, conveyance and end of pipe controls to manage runoff volumes and rates and influence both flood risk potential and receiving water quality. Whilst investment in public infrastructure assets is a key tool that can be used to manage flood risk, it must be recognized that other factors such as groundwater, lot grading and internal plumbing of properties also contribute to flood risk and these cannot necessarily be influenced through public infrastructure investment. A holistic approach is therefore required which also incorporates a range of private-side measures and non-infrastructure solutions such as risk avoidance (e.g. policy that prevents new vulnerable development in floodplains) and risk transfer (e.g. insurance) to best manage storm flooding risks and incentive measures such as grants and rebates. It should noted that no combination of investment in public infrastructure, private infrastructure and non-infrastructure solutions will truly eliminate flood risk and make properties or buildings "flood proof". Instead, this range of solutions serves to reduce risk as far as reasonably practical and affordable within the constraints associated with historic development practices and other environmental conditions.

From a public infrastructure perspective, modern stormwater system design uses the "dual drainage" concept and the overall stormwater system is comprised of both a minor system and a major system. The minor system consists of sewers and ditches designed to convey runoff from more frequent rainfall events. The major system represents the overland route that the excess runoff will follow when the minor system capacity is exceeded. The major system includes features such as natural and constructed open channels, streets and roadways and overland drainage easements.

This dual drainage concept has not always been applied in the design of new subdivisions and so the design parameters for the stormwater systems vary across the City, depending primarily on age. In general, for those areas built before the 1980s the design standard is typically a minor system with a 1:2 or 1:5 year return period capacity and no designed major system. More modern areas are likely to have a 1:2 year design standard for the minor system and a major system engineered to a 1:100 year design standard. They also typically include backwater valves to protect homes from storm sewer basement flooding. These modern systems are designed so that excess runoff will be conveyed to the major system when the minor system reaches capacity. Surface flooding therefore commonly occurs in streets and roadways and there is often a misconception amongst the general public that such drainage is unplanned and therefore undesirable.

The following sets out the flood risk associated with the:

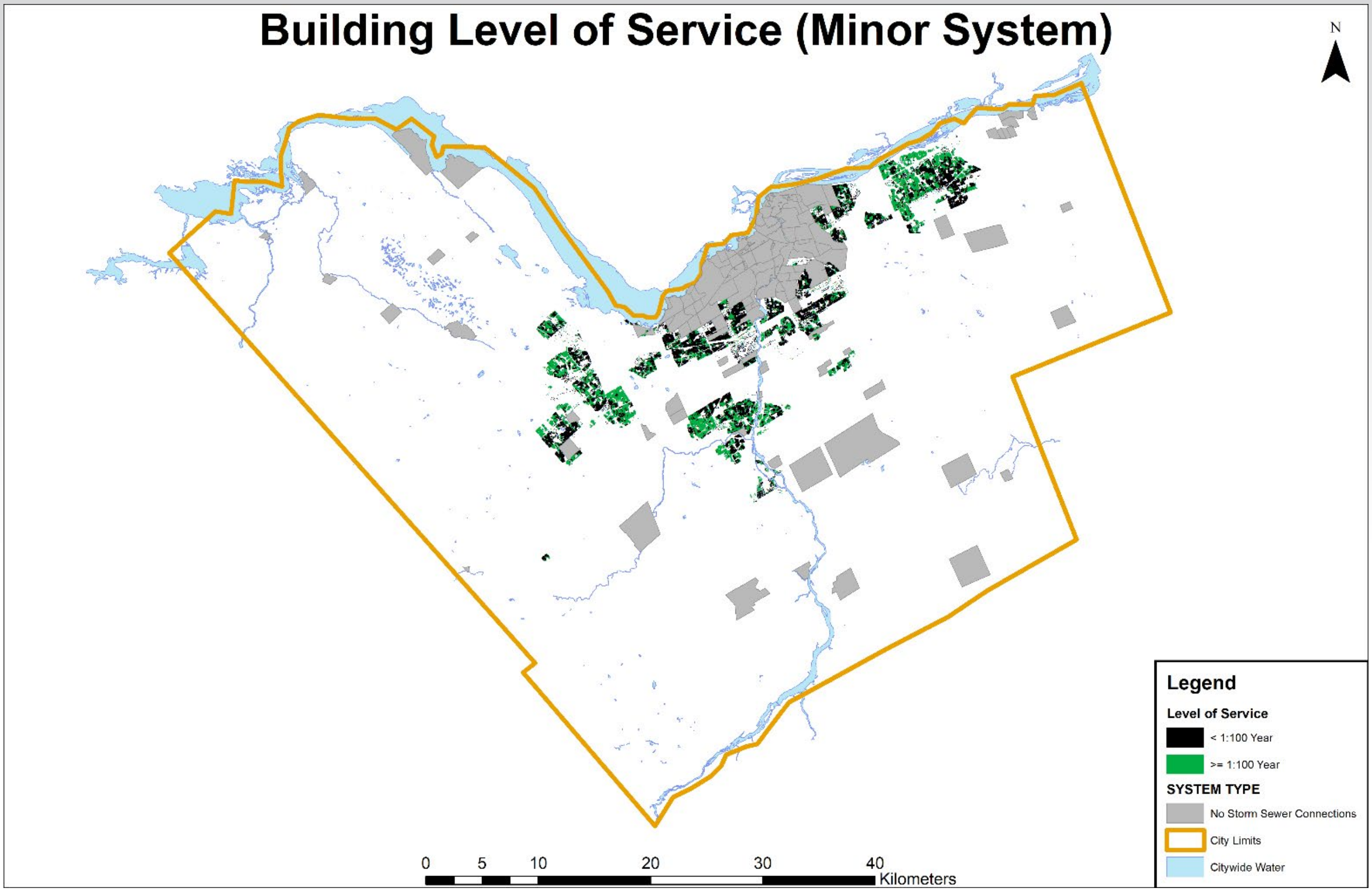
- Minor system
- Major system
- Riverine systems

Appendix 1:

Minor System

Figure 1 shows the location of all buildings which are estimated to be resilient to storm sewer (minor system) performance in a 1:100-year return period event. These the buildings shown in black in this figure are buildings that are less resilient to the storm sewer performance, though not necessarily at risk of flooding. Many homes built after 1977 have backwater valves which mitigate flood risk by preventing water from the storm sewer from entering the home.

Figure 1: Minor System Building Level of Service



Notes:

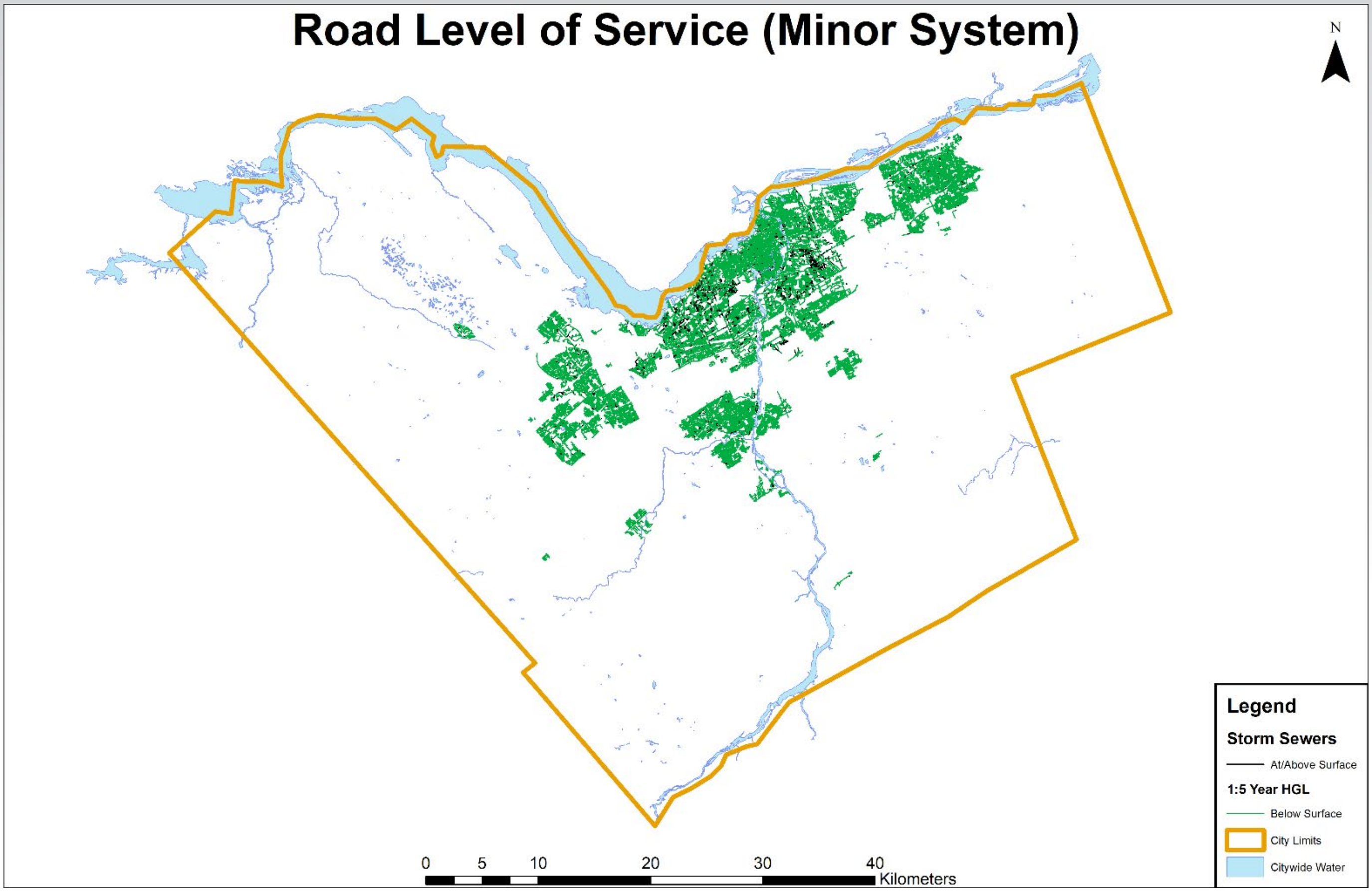
1. Buildings in black areas are less resilient to the storm sewer performance, though not necessarily at risk of flooding. Many buildings built after 1977 are equipped with backwater valves which increase flood resilience.
2. Buildings in green areas are resilient to minor system flooding in a 1:100 year event.
3. Grey areas have building within 50 m of a storm sewer, but those buildings are not connected to a storm sewer. These areas are also resilient to minor system flooding in a 1:100 year event.
4. White areas have very few buildings and have no storm sewers. These areas are also resilient to minor system flooding in a 1:100 year event.

Appendix 1:

An alternative view of minor system resilience is the number of storm sewers are expected to surcharge to the ground surface during a 1:5 year return period event.

The pipe sections resilient to a 1:5 year event are shown in green in Figure 2 below.

Figure 2: Minor System Hydraulic Grade Line Level of Service



Notes:

1. Black pipes have hydraulic grade line (HGL) at or above surface in a 1:5 year event.
2. Green pipes have hydraulic grade line (HGL) below surface in a 1:5 year event.
3. White areas have very few buildings and have no storm sewers.

Appendix 1:

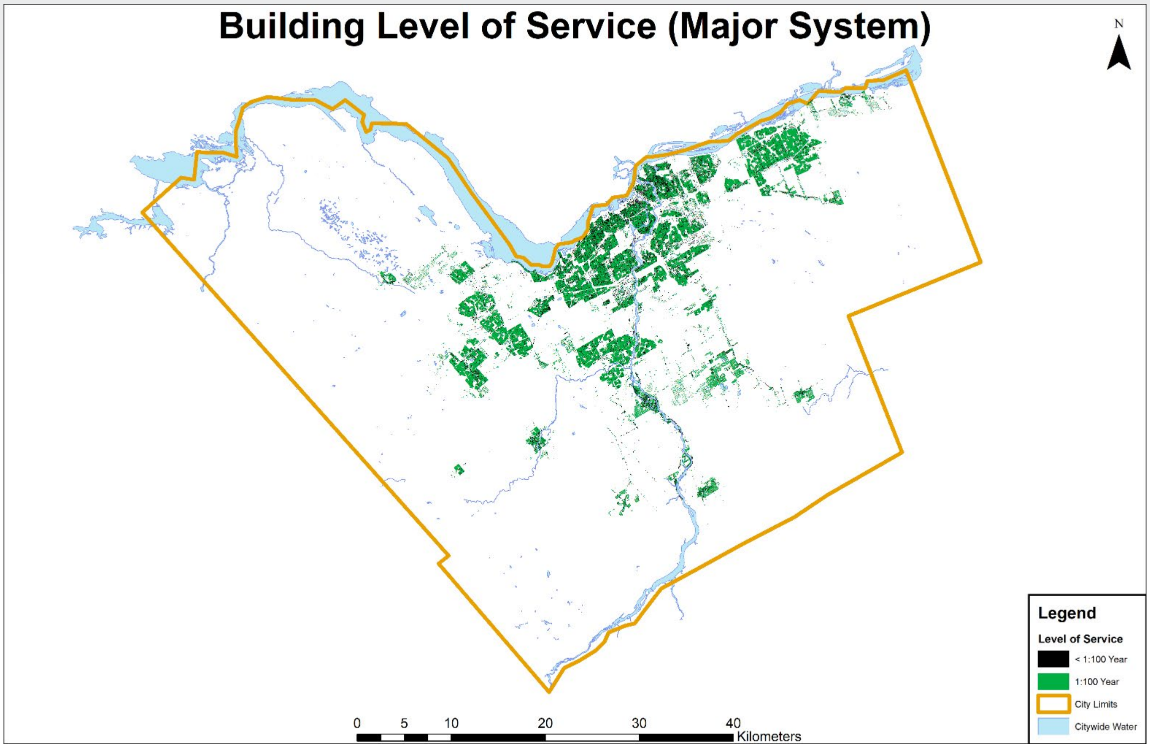
Major System

In addition to the minor system, the City's major system poses a potential property flooding risk. The major system represents the overland route where the excess runoff will flow when the minor system capacity is exceeded. The major system includes such features as natural and constructed open channels, streets and roadways and overland drainage easements.

Before the 1980s, neighbourhoods were not designed with the principles of dual drainage. In other words, a rigorous review of the capacity of overland flow routes to convey excess runoff was not conducted. As a result, excess runoff in the pre-1980 neighbourhoods may spill at undesirable locations such as between homes or pond to a depth where they may cause inconvenience or damage before continuing along the right-of-way.

Overall, approximately 81.6% (approximately 156,000) buildings are resilient to a 1:100 year return period event and these are shown in green on Figure 3.

Figure 3: Major System Level of Service



Notes:

1. Black buildings are not resilient to major system flooding in a 1:100 year event
2. Green buildings are resilient to major system flooding in a 1:100 year event.
3. White areas have no buildings.

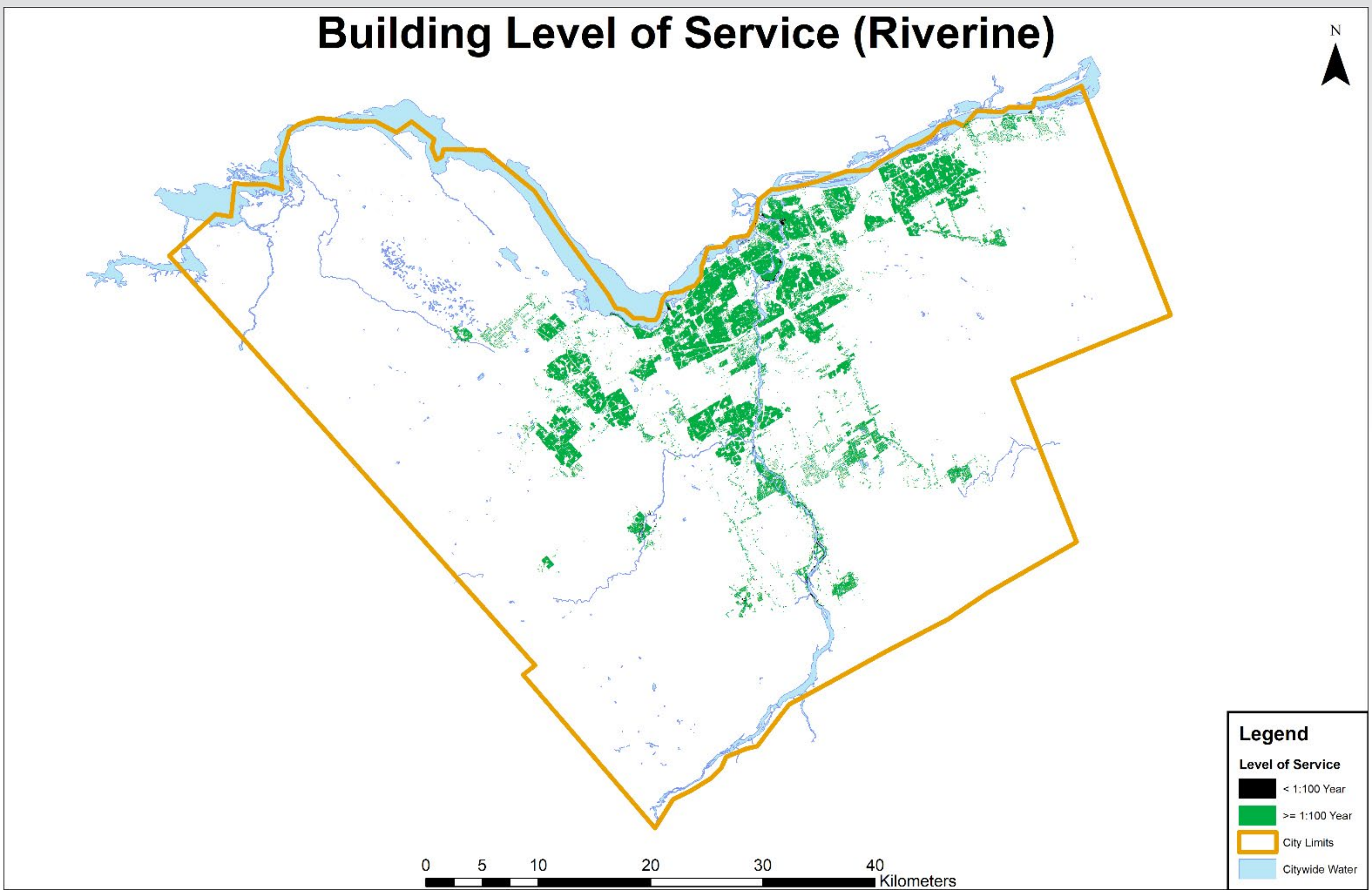
Appendix 1:

Riverine Systems

Riverine flooding can be considered as a special case of major system flooding. It is often useful to distinguish between the two because the river watershed is typically much larger than the major system drainage area and the watershed may not be contained within City limits. The City contains a vast network of riverine systems that are part of either the Ottawa River, Rideau Valley, South Nation or Mississippi Valley watersheds.

The majority of buildings (99% or 192,704 out of 193,874) are resilient to a 1:100 return period riverine event. The buildings that are resilient are illustrated in green in Figure 4.

Figure 4: Riverine Level of Service



Notes:

1. Black buildings are not resilient to riverine flooding in a 1:100 year event
2. Green buildings are resilient to riverine flooding in a 1:100 year event.
3. White areas have no buildings.