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Wastewater
Asset Management Plan

March 2022

Version 1.1

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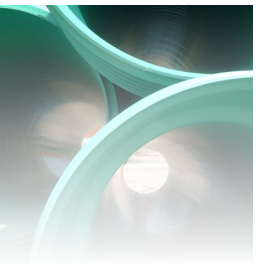
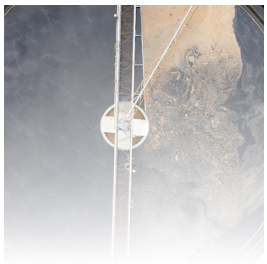


Introduction

Background

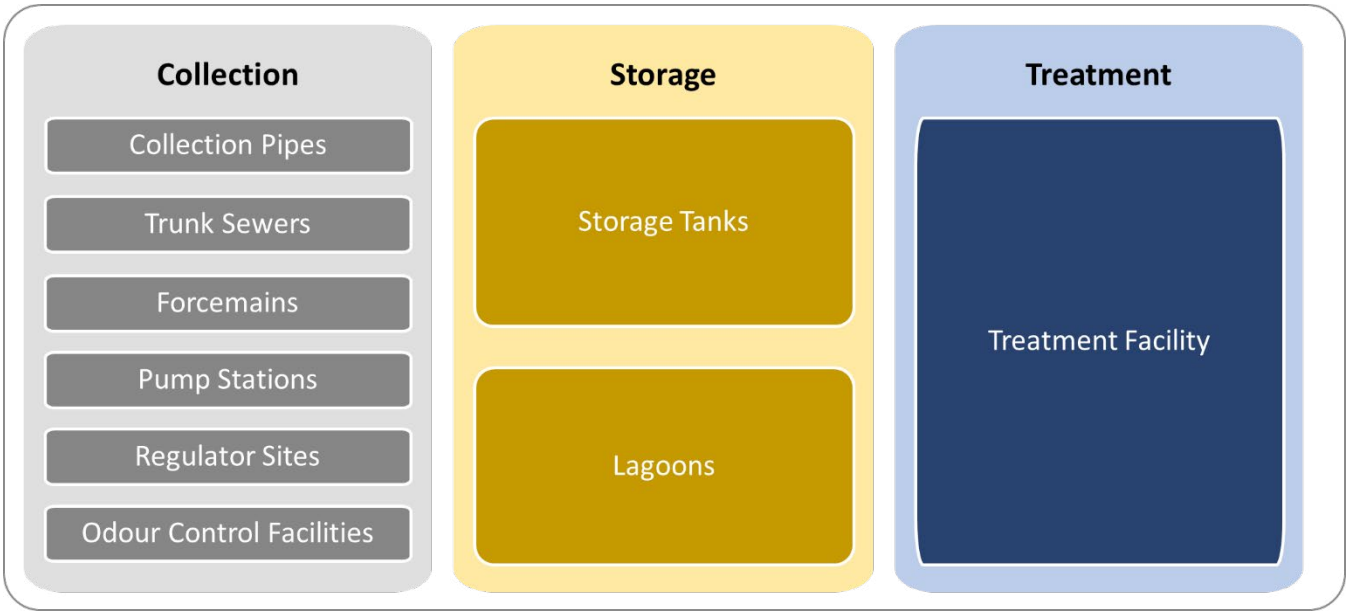
Ontario Regulation 588/17: Asset Management Planning for Municipal Infrastructure requires all municipalities to prepare baseline asset management plans for their core municipal infrastructure assets supporting the delivery of drinking water, wastewater, stormwater and transportation. The City of Ottawa 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 of Ottawa has created this first version of its **Wastewater Asset Management Plan (Wastewater 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 Wastewater AMP satisfies the Provincial requirements for wastewater assets that relate to the collection, transmission, treatment or disposal of wastewater, including any wastewater asset that from time to time manages stormwater. This includes collection pipes, trunk sewers, forcemains, a wastewater treatment facility, pump stations, storage tanks, lagoons and other facilities. These assets support the City's role in collecting, treating and releasing the water used and discharged by homes, businesses, industries and institutions.

Wastewater Asset Categories and Types



State of Local Infrastructure

Inventory and Valuation

The assets covered in the Wastewater AMP have a replacement value of approximately $12.8 billion. This includes an inventory of 2,900 kilometres of sewers, 96 kilometres of forcemains, one treatment facility (the Robert O. Pickard Environmental Centre), 55 pump stations, 4 regulator sites, 2 odour control facilities[1], 3 storage tanks, and 2 lagoons.

	Wastewater Collection	Wastewater Storage	Wastewater Treatment
Inventory	• 2,623 kilometres of collection pipes • 277 kilometres of trunk sewers • 96 kilometres of forcemains • 55 pump stations • 4 regulator sites • 2 odour control facilities[1]	• 3 storage tanks • 2 lagoons	• 1 treatment facility
Replacement Costs	$11.4 Billion	$19.5 Million	$1.4 Billion

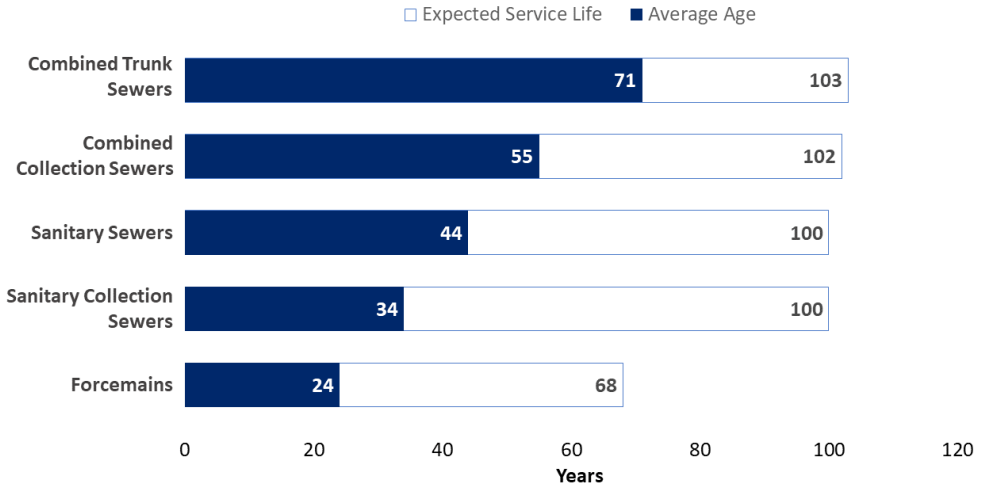
1) Four odour control facilities were constructed in 2020 in conjunction with the Combined Sewage Storage Tunnel (CSST) but were not included within the Wastewater AMP Asset Inventory at the time of this report.

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 sewers and forcemains are shown in the figure below. The City's wastewater facilities' construction dates generally range from the late 1960's to present. Since construction, various assets within the facilities have been renewed, replaced or otherwise maintained to ensure reliable operation, so the average age of facilities cannot be calculated on a per-asset basis. For the City's wastewater treatment plant (the largest and most expensive facility in the City's wastewater inventory), a Master Plan for capital improvement projects has been initiated that will provide additional details on the facility's assets.

Average Age – Wastewater Sewers and Forcemains



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

Asset Category	Condition data collection techniques	Frequency
Collection pipes and trunk sewers	Closed Circuit TV Inspection; multi sensor inspections	1-to-20-year cycle, dependent on level of risk; some sewers have annual inspection requirements
Forcemains	Hydraulic analysis	Varies
Collection facilities	Building condition and equipment assessments	Every 5 years
Storage	Equipment assessments	Varies
Treatment facility	Condition assessments (facility, electrical, process piping, HVAC, etc.); work order records from maintenance work	Condition assessment frequencies vary (the City strives to complete these assessments every 5-years); work order records are ongoing

State of Local Infrastructure

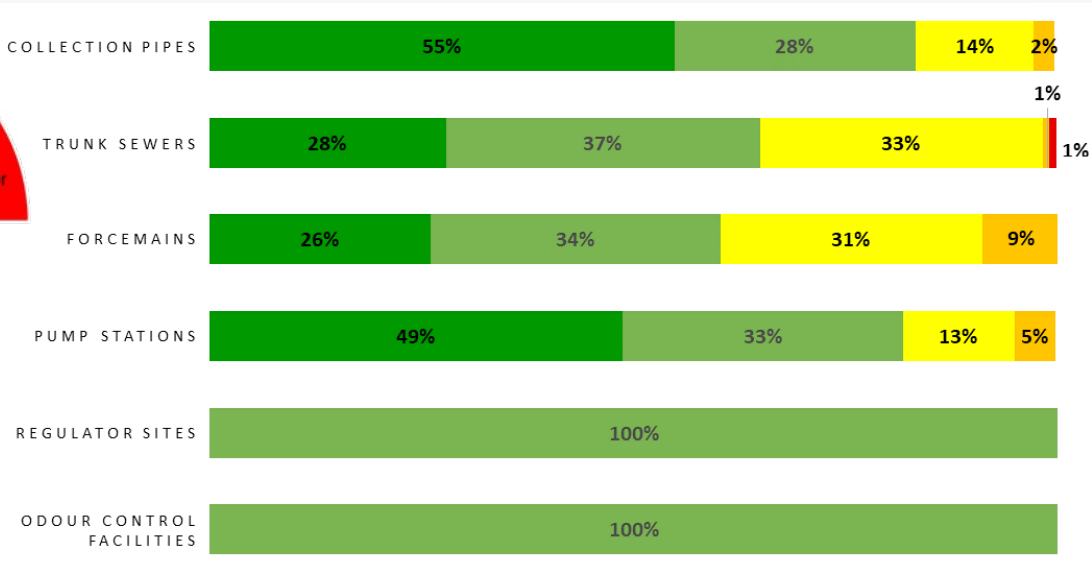
Based on condition data, supplemented by subject matter expert knowledge and professional judgment, the condition of assets is rated on a scale from "Very Good" to "Very Poor" as shown in the table below.

Category	Rating Description	Life Consumed	Asset Class / Type Metric (Condition Indices)	
			Sewers	Facilities
Very Good	**Very Good – Fit for Future** Well maintained, good condition, new or recently rehabilitated	0 to 19%	80 to 100	Subject matter expert knowledge and professional judgment
Good	**Good – Adequate for Now** Acceptable, generally in mid stage of expected service life	20% to 39%	60 to 79	
Fair	**Fair – Requires Attention** Signs of deterioration, requires attention, some elements exhibit deficiencies	40% to 59%	40 to 59	
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	
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	

State of Local Infrastructure

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

Wastewater Collection

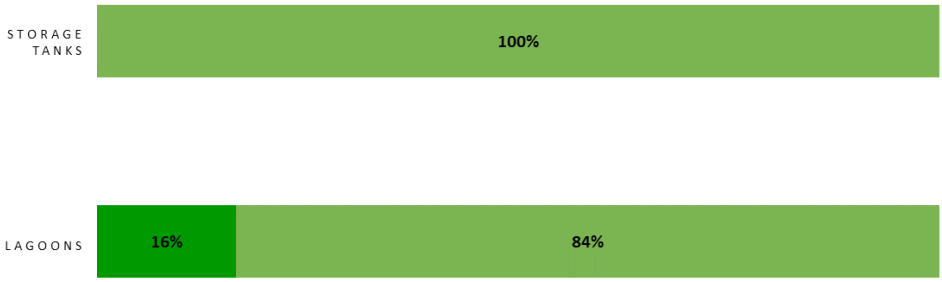


Legend:

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

State of Local Infrastructure

Wastewater Storage

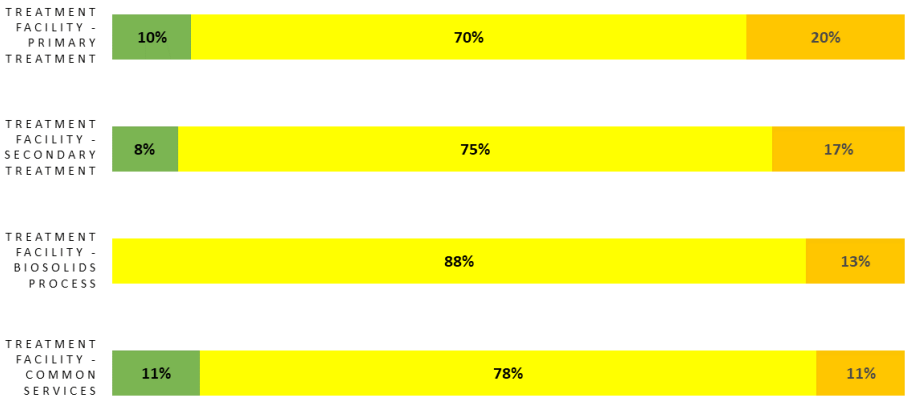


Legend:

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

Wastewater Treatment

Treatment facility (Robert O. Pickard Environmental Centre)



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 Wastewater 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 wastewater assets should:

- Reliably capture, convey and treat wastewater while minimizing overflows and backups
- Treat sewage before discharge to the river
- Recycle biosolids into the environment
- Use biogas to heat the City's anaerobic digester and fuel its co-generation facility
- Be maintained in a state of good repair
- Be periodically inspected to identify needs

A future version of the Wastewater AMP will go a step further and include City Council's target service levels for each measure.

"The Wastewater AMP establishes preliminary level of service measures and the current level of service being provided. "

Levels of Service

Preliminary Wastewater Level of Service Measures

Service attribute	Community levels of service	Technical levels of service	Detailed measure	Current
Scope	Description, which may include maps, of the user groups or areas of the municipality that are connected to the municipal wastewater system(1)*	Percentage of properties connected to the municipal wastewater system*	Total number of properties being charged the sewer surcharge as a percentage of total number of properties	85%
Reliability	Description of how combined sewers in the municipal wastewater system are designed with overflow structures in place which allow overflow during storm events to prevent backups into homes(1)*	The number of events per year where combined sewer flow in the municipal wastewater system exceeds system capacity compared to the total number of properties connected to the municipal wastewater system*	Total number of Combined Sewer Overflows / Total number of properties being charged the sewer surcharge	30 overflow events / 234,000 properties
		The number of connection-days per year due to wastewater backups compared to the total number of properties connected to the municipal wastewater system*	The sum of the number of properties that had reduced service due to a wastewater backup multiplied by the number of days of reduced service as a percentage of the total number of properties being charged the sewer surcharge	0.20%
	Description of the frequency and volume of overflows in combined sewers in the municipal wastewater system that occur in habitable areas or beaches(1)*	See Appendix 1		
	Description of how stormwater can get into sanitary sewers in the municipal wastewater system, causing sewage to overflow into streets or backup into homes(1)*	See Appendix 1		

Levels of Service

Service attribute	Community levels of service	Technical levels of service	Detailed measure	Current
Reliability	Description of how sanitary sewers in the municipal wastewater system are designed to be resilient to avoid events described above(1)*	See Appendix 1		
	Description of the effluent that is discharged from sewage treatment plants in the municipal wastewater system(1)*	The number of effluent violations per year due to wastewater discharge compared to the total number of properties connected to the municipal wastewater system*	The number of combined sewer overflows violations divided by the total number of properties being charged the sewer surcharge	0
Sustain-ability/ Environ-mentally Conscious	Sewage will be treated before discharge to the river	Treatment plant average operating capacity	Average daily flow rate less recycled stream as a percentage of rated capacity	78%
		Treatment plant peak design flow ratio	Ratio of peak flow to rated capacity	2.5:1
	Biosolids are recycled into the environment	Percentage of biosolids that are repurposed through the Beneficial Reuse Program		100%
	Biogas is used to heat anaerobic digester and fuel co-generation facility	Percentage of biogas used		70%
Reliability/ Quality	The sewer system is maintained in a state of good repair	Annual replacement rate of wastewater pipes		0.3%
		Percentage of maintenance hours that are reactive maintenance and proactive maintenance at sewage collection remote facilities		13% (reactive) 87% (proactive)
		Percentage of maintenance hours that are reactive maintenance and proactive maintenance at sewage treatment facility		8% (reactive) 92% (proactive)
		Percentage of wastewater pipes that were hydraulically cleaned annually		30%
		Percentage of sewer network (linear) assets in poor and very poor condition		3%
	Assets are periodically inspected to identify needs	Percentage of wastewater network inspected with Closed Circuit TV annually		6.1%

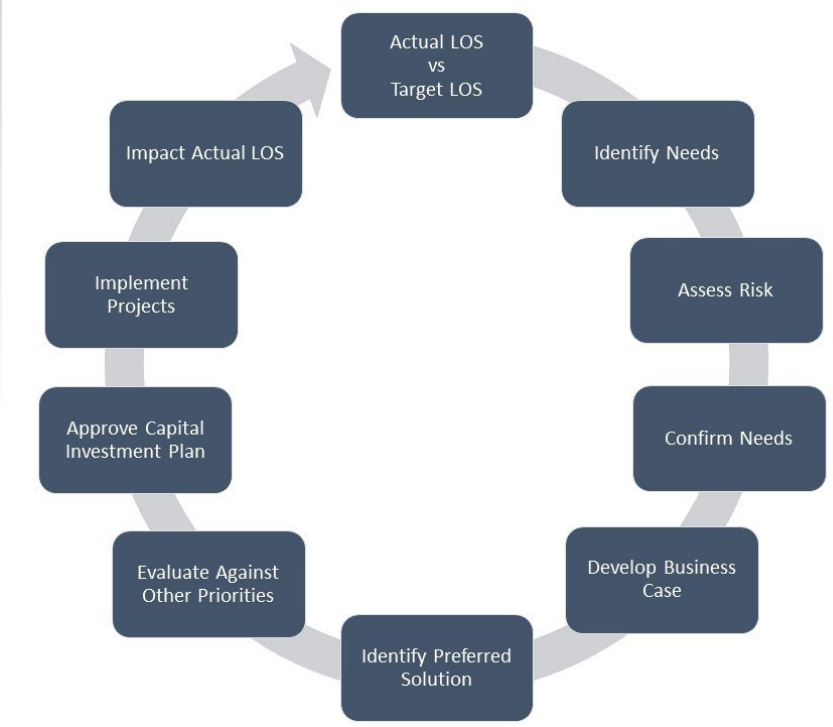
* Required by Ontario Regulation 588/17.
(1) See Appendix 1 for descriptions of the Community Levels of Service required by Ontario Regulation 588/17.

Climate change is a significant factor affecting the City's long-term ability to deliver levels of service. The effects of climate change are predicted to include higher temperatures, more frequent and intense rainfall events, more frequent freeze thaw cycles and an increased risk of extreme weather. These effects may drive a need for upgrading pipe sizes, implementing temporary storage within the system, sewer separation, and increasing capacity at the wastewater treatment facility.

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 wastewater 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).

In developing the Wastewater AMP, a preliminary estimate of future costs was generated based on the City's budgeted 10-year capital forecast which, at this time, provides the best available information for generating this estimate. It was developed through a collaborative effort of staff input and aligns with the City's current decision-making and asset capital expenditure processes. 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 wastewater 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, sewer service impacts, facility shutdowns and impacts to other services.

The City applies a risk-based approach to prioritizing asset renewals. 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 immediate 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	$35.8	$34.4	$39.6	$39.9	$42.1
Capital Budget – Renewal, Growth & Service Enhancement	$112.4	$129.3	$60.2	$130.5	$91.5

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	$44.8	$47.2	$49.5	$51.9	$54.2	$56.6	$58.9	$61.3	$63.6	$65.9	$553.9
Capital Budget – Renewal	$73.7	$64.5	$70.4	$84.8	$70.0	$92.7	$86.0	$81.5	$89.2	$80.4	$793.2
Capital Budget - Growth	$8.0	$23.7	$22.9	$21.6	$21.9	$66.3	$25.7	$13.3	$1.4	$1.0	$205.8
Capital Budget - Service Enhancement	$1.2	$1.2	$1.2	$1.2	$1.7	$1.7	$1.7	$1.7	$1.7	$1.2	$14.5
Non-Infrastructure	$2.9	$3.9	$3.9	$4.1	$4.1	$4.2	$4.3	$4.4	$4.0	$4.1	$39.9

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.

As required by Provincial legislation, the Wastewater AMP forecasts the cost to keep all wastewater infrastructure assets in their present state for the next 10 years. This forecast is based on the City's budgeted or allocated 10-year capital forecast, which provides the best available information for generating this estimate. Therefore this Wastewater AMP does not identify a renewal funding difference at this time. Future investments will be required to address the wave of renewals expected for infrastructure built in the post-war era (beyond the 10-year horizon). In addition, other impacts, such as climate change, have the potential to impact long-term costs.

Wastewater facilities and their associated assets are managed through a program that combines the expertise and knowledge of the City's facilities asset specialists, with external subject matter expertise, through periodic inspections and assessments, to obtain an understanding of condition and asset needs. Work is currently being undertaken to further assess the wastewater facilities' future capital needs. However, at this time there is insufficient information to project an estimated preliminary cost beyond the allocated 10-year capital forecast.

Improvement and Monitoring Plan

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

- Asset information and data quality
- Condition data tracking and asset valuation
- Lifecycle renewal needs forecasting
- Climate change resiliency
- Equity and inclusion

The Wastewater 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:

Descriptions of Community Levels of Service

Description of Wastewater System

The City's wastewater collection system has been developing since the late 1800s. The system, which consists of combined sewers, partially separated sewers and sanitary sewers now extends almost 3,000 km. Combined sewers were designed to convey all sanitary flows, as well as a portion of wet weather (rainfall) derived flows. The City has worked to separate many combined sewers outside the ultimate combined sewer area and does not construct new combined sewers outside the ultimate combined sewer area. Today, the City has only 100 km of combined pipes (3% of system total).

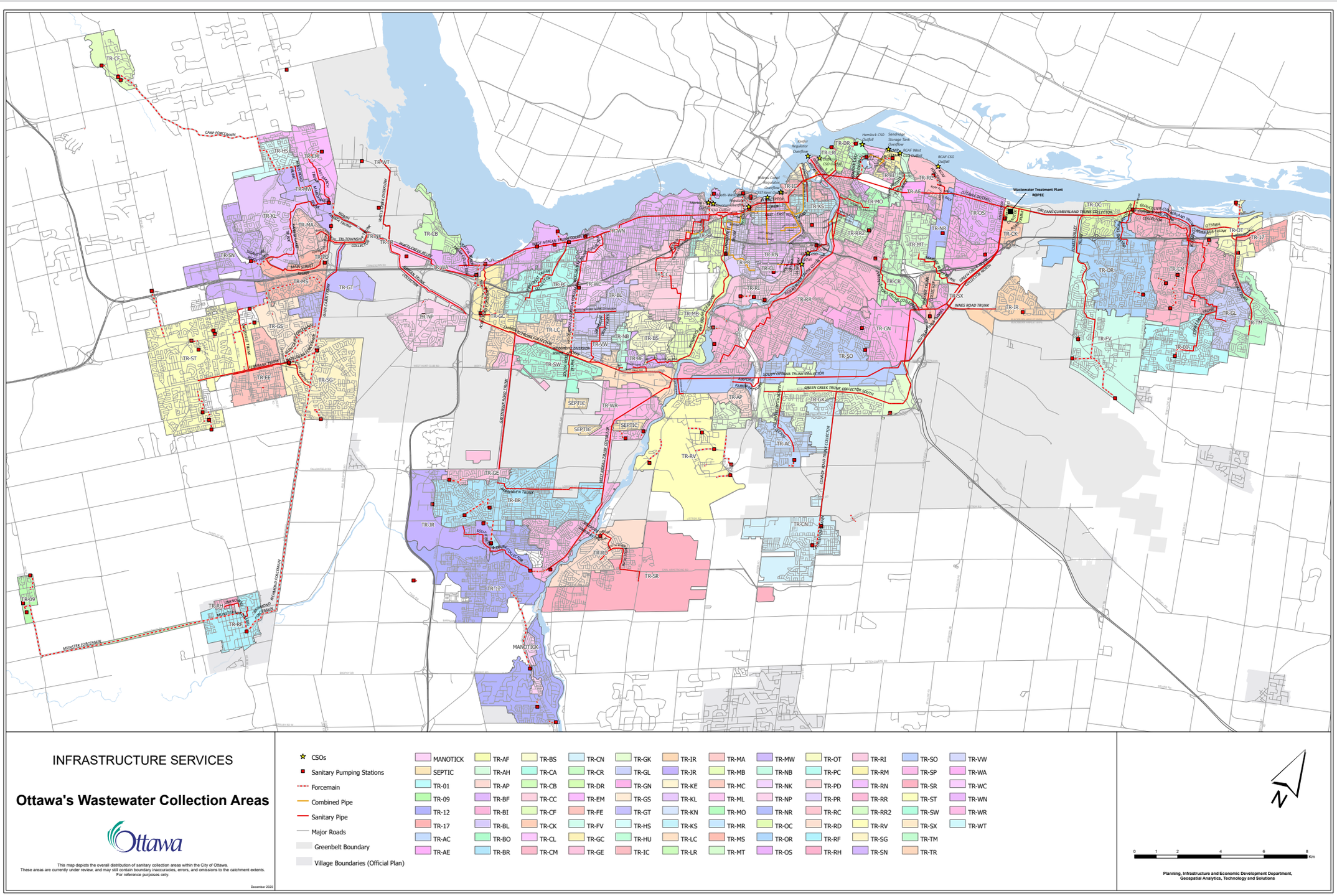
Between the 1860s and 1950, it was accepted practice for sewers to discharge to the Ottawa River and the Rideau river through large collector sewers. In the early 1960s, the Interceptor/Outfall Sewer was constructed to intercept all flows to the Ottawa River and redirect flows to the Sewage Treatment Plant. Flow at the interception points of the original outfalls and the interceptor sewer was controlled by regulating system overflows to provide system relief. The overflows were critical to prevent overwhelming the treatment plant and preventing sewer backup into basements. The frequency and volume of overflow directly relates to wet weather (rainfall) events or snow melt.

Since the late 1960s, the City has been completing sewer separation projects. Sewer separation in conjunction with the implementation of flow regulators has significantly reduced the amount of combined sewer overflows (CSO) events and the overall CSO volume. Although the City's population has been increasing, CSO volume has decreased from 41 million cubic metres in 1962 (population of 260,000) to 800,000 cubic metres in 2005 (population of 800,000). In 2006, 77% of storm events caused CSOs and in 2019 only 28% of storm events caused CSOs. In the last ten years, CSO volume has been reduced by two thirds and CSO frequency has been cut in half.

The City improved the control of the regulators through real-time controls in the early 2010s. At the time of writing this document, the City was putting into operation the newly constructed Combined Sewage Storage Tunnel (CSST), completed in November 2020. The CSST will greatly reduce the frequency of sewage overflows during storms from entering the Ottawa River, and will help protect the river. These tunnels will hold up to 43,000m^3 of sewer overflow during major rainfalls, the equivalent capacity of approximately 18 Olympic sized pools. Once rainfall has subsided, this water will then be treated and returned safely to the Ottawa River.

Appendix 1:

A map illustrating the extent of the wastewater network across the geographic area is provided below.



Appendix 1:

Description of the frequency and volume of overflows in combined sewers in the municipal wastewater system that occur in habitable areas or beaches

Frequency and volume vary based on intensity and duration of wet weather events. From 2015 to 2019, the average frequency of CSO events was 30/year and the median volume was 645,000 m^3/year. The CSST will dramatically reduce the risk of any overflow to the river during wet weather flows.

The performance objective for the CSST is compliance with the City Council mandated CSO control objectives for the Ottawa River Action Plan (ORAP) and the relevant Ontario Ministry of Environment, Conservation and Parks (MECP) CSO control policy. The City Council mandated CSO control objectives for ORAP is based on capturing and treating all of the potential overflows during the swimming season (June 1 to September 30) in an average year while accepting some overflows during years with more severe wet weather than the design year and/or during very large rain events. The MECP Beach Protection overflow frequency requirements are less stringent than the City Council mandated CSO control objective and allows two overflow events per swimming season for an average year with the combined total duration of the CSOs at any single CSO location being less than 48 hours.

This objective is achieved by storing excess combined sewage originating from four overflow locations associated with four major collectors (Booth Street Sewer, Cave Creek Collector, Rideau Canal Interceptor and Rideau River Collector) and the Kent Street Sewer and releasing the sewage by gravity back to the Interceptor Outfall Sewer (IOS) when capacity is available. The City's predicted performance is in the order of 0.75 to 1.75 overflow events per year. This performance is compared to the design year of 1980 in terms of average rainfall.

Description of how stormwater can get into sanitary sewers in the municipal wastewater system, causing sewage to overflow into streets or backup into homes

Stormwater can enter sanitary sewers via extraneous flow. Extraneous flow has two distinct components: inflow and infiltration. Infiltration is water entering the sanitary system through sources such as rainfall river water, groundwater, snowmelt, or infiltrated rainfall. The pathways for infiltration include defects and damage, such as cracks in sewers, maintenance hole and laterals. Infiltration typically enters the system slowly over time with gradual changes in flow rates. Inflow is typically water entering the sanitary system through sources such as rainfall, runoff, river water and groundwater. Inflow enters sanitary systems via direct connections to sewers through floor drains, foundation drains, roof drains, cross-connections, internal overflows, maintenance hole covers, building catchbasins and unsealed openings in a construction site. Inflow typically enters the system with a fast response and can cause fast and extreme changes in flow rates. Infiltration uses baseline sewer capacity but rarely causes flooding or overflows by itself. Inflow is the primary cause for sewer capacity to be exceeded for short periods of time, causing flooding and overflows to occur.

Stormwater enters combined sewer systems via all of the above means and via catch basins as it is designed as a storm drainage system as well. To prevent flooding from the combined system, strategically placed overflows are used to direct excess flow to outlets, such as rivers or lakes.

Note that the City has made significant investments to reduce CSOs and to reduce the impacts on rivers and other receiving watercourses. These investments include the recent construction of the CSST.

Appendix 1:

Description of how sanitary sewers in the municipal wastewater system are designed to be resilient to avoid events described above

To minimize sewage overflow and flooding, the City of Ottawa has established comprehensive design standards and specifications and established approaches to infrastructure planning to ensure resilience and avoidance of overflow and flooding events.

For new construction, sanitary sewer systems are designed and constructed to be resilient in the following ways:

- Sizing includes extraneous flows for a range of conditions including extreme rainfall events
- Design of the sewers may be altered to use pressure rated piping where groundwater is known to be high
- Homes are equipped with backwater valves
- Pumping stations are designed with overflows and hydraulic grade line analysis is required to check for flood risk
- Leakage testing of new sanitary sewers required for development approval
- For renewal and flood mitigation in existing communities, resilience approaches include:
- Sewer separation, Combined Sewage Storage Tunnel, Real Time Control, Floatable Control, Inlet Control, Trunk Sewer Twinning
- Residential Protective Plumbing Program
- Inspection and condition assessment
- Maintenance hole cover replacements
- Depressed driveway disconnections
- Pipe lining and replacements
- Pipe upgrades (increase size)
- Foundation drain disconnections
- Roof leader disconnections

The City continues to review the effectiveness of the above resiliency measures as part of continuous improvement. The City is currently undertaking a climate vulnerability and risk assessment to assess whether additional measures are required to build resilience to changing climate conditions.

Description of the effluent that is discharged from sewage treatment plants in the municipal wastewater system

All final effluent from the City's wastewater treatment plant have documented compliance limits and objectives. Measured criteria includes flow rates, total suspended solids, phosphorus, ammonia, E. Coli and Biological Oxygen Demand. All compliance limits and design objectives were met in 2019. There are no trends in deteriorating final effluent quality.