
Performance Audit of
Maintenance of the Linear
Water & Wastewater
Infrastructure

November 29, 2022

Final Report



OBJECTIVE

To assess the extent of regard for economy, efficiency and effectiveness within the maintenance processes for the City's linear water and wastewater (WWW) infrastructure.

BACKGROUND

The Distribution and Collection (D&C) Section of Linear Infrastructure Services maintains the City's 1,000 kilometers of water mains and 800 km of sewer collection pipes with support from the Infrastructure Capital Planning Division. The financial results for the D&C Section, which has 71 full-time staff and two full-time managers who report to the Director of the Linear Infrastructure Services Section, are shown below.

Table 1 - Revenues & Expenses (000s)	2018		2019		2020		2021		2022	
	Budget	Actual	Budget	Actual	Budget	Actual	Budget	Actual	Budget	Proj Actual
Revenues	30,927	30,393	34,639	34,743	41,136	40,816	38,556	37,979	34,726	34,291
Salaries & Benefits	3,776	3,186	4,015	3,648	4,929*	3,587	5,022	3,854	5,108	3,871
Materials & Other	962	703	1,023	921	1,013	798	1,037	935	1,038	1,137
Purchased Services	5,755	4,668	5,814	4,359	4,825	5,661	5,145	5,550	5,144	6,903
Indirect Costs	2,654	2,046	2,734	2,276	2,480	2,026	2,382	2,019	2,490	2,490
Labour Fringes	1,545	1,487	1,537	1,511	1,961	1,359	2,011	1,640	2,092	1,535
Engineering Costs	928	910	1,002	981	1,039	1,036	1,008	1,062	1,065	1,065
Internal Recoveries	1,016	1,043	1,093	1,176	1,129	1,427	1,196	1,458	1,244	1,686
Op'l Expenditures	16,636	14,043	17,218	14,872	17,376	15,894	17,801	16,518	18,181	18,687
Cap'l Contributions	14,291	14,291	17,421	17,420	23,760	23,760	20,755	20,755	16,545	16,545
Total Expenses	30,927	28,334	34,639	32,292	41,136	39,654	38,556	37,273	34,726	35,232
Net Expenses	0	2,059	0	2,451	0	1,162	0	706	0	941

*The operating budget for 2020 was increased to support the establishment of a week-end shift which was not fully implemented until May 2022.

METHODOLOGY & SCOPE

This audit included staff interviews, site visits, analysis of policies, processes and reports and tests of controls for the period January 1, 2018 to September 30, 2022.

EXECUTIVE SUMMARY

Operational maintenance processes for the City's linear WWW infrastructure are delivered with due regard for economy and effectiveness. While costs increased in 2022 to implement a weekend shift, the City's costs per kilometer of water main and sewer pipe are still in line with those in our municipal peers. This audit identified opportunities to improve performance reporting, to make greater use of long-term financing for major capital projects, and to improve the integration of various capital plans to more effectively identify and prioritize upgrades to this aging infrastructure.

AUDIT STANDARDS

We conducted our audit in accordance with Generally Accepted Government Auditing Standards which require that we adequately plan audits; properly supervise staff; obtain sufficient, appropriate evidence to provide a reasonable basis for audit findings and conclusions; and document audits. For further information regarding this report, please contact Ron Foster at the City of Greater Sudbury at 705-674-4455 extension 4402 or via email at ron.foster@greatersudbury.ca

OBSERVATIONS AND ACTION PLANS

A. Alignment with Corporate Strategic Plan

The City's 2019-2027 Corporate Strategic Plan relies on six values including foresight which it defines as acting today in the interests of tomorrow. The Corporate Strategic Plan is supported by seven strategic objectives including Asset Management and Service Excellence which include the following goals:

- Optimizing asset service life through the establishment of maintenance plans and
- Establishing sustainable asset service levels to assess results from maintenance and renewal efforts.

The 2018 Water and Wastewater (WWW) Asset Management Plan (AMP) which was prepared in accordance with Ontario Regulation 588/17, employed a risk-based prioritization framework to facilitate strategic infrastructure decision-making. This AMP indicated that 25% of the City's water mains and 50% of the wastewater pipes have reached or exceeded their expected service lives and identified areas for infrastructure renewal and replacement.

The 2019 WWW Long-Range Financial Plan that was approved by Council was prepared in accordance with Ontario Regulation 453/07 which requires WWW rates to be established in accordance with strict financial parameters. The Long-Range Financial Plan was also supposed to align with the provincial guideline "Towards Financially Sustainable Drinking-Water and Wastewater Systems" which contained 8 principles including:

- Life-cycle planning with mid-course corrections is preferable to planning over the short-term, or not planning at all;
- An asset management plan is a key input to the development of a financial plan; and
- A sustainable level of revenue allows for reliable service that meets or exceeds environmental protection standards, while providing sufficient resources for future rehabilitation and replacement needs.

The Long-Range Financial Plan that was approved by Council recommended a 20-year financial planning model with annual rate increases of 4.8% rather than one of the following alternatives:

Financial Planning Model	Annual Rate Increase
10 years	8.8%
15 years	6.2%
25 years	4.1%

Adopting the 20-year financial planning model exposed the City to higher risks of infrastructure failure than the 10-year model that the City had previously been using to set annual WWW rates.

Recommendation

Ensure that the next WWW Long-Range Financial Plan meets all regulatory requirements, aligns with the principles in the above-noted provincial guideline as well as the goals of the WWW Asset Management Plan and objectives of the Corporate Strategic Plan.

Management Response and Action Plan

Agreed. Work is underway on the update to the WWW Asset Management Plan and an RFP will be released shortly for the update to the WWW Master Plan. Upon the completion of these two studies, the WWW Long Range Financial Plan will be updated to reflect the funding required to meet the recommendations of the studies as well as meet the objectives of the Corporate Strategic Plan.

B. Alignment of Annual Capital Program with WWW Master Plan

In 2015, the City retained WSP to undertake the Water and Wastewater (WWW) Master Plan to identify long term replacements and/or expansion to the water and wastewater servicing networks. The following objectives were addressed in the Master Plan:

- to plan for safe, robust servicing systems;
- to accommodate planned growth within the community;
- to ensure system performance and efficiency within the servicing systems is maintained; and
- to comply with existing legal and regulatory requirements.

The Master Plan that was prepared in 2016 by WSP defined the water and wastewater infrastructure required to service existing and future development to 2041.

This audit indicated that approximately \$78 million of the \$98.5 million of the capital upgrades to the water mains and \$18 million of the \$30.7 million of capital upgrades to the wastewater sewer pipes that were recommended for completion by 2021 in the Master Plan have not been completed. The reasons for delays include:

1. Actual growth was approximately half of what was planned and was centred in Azilda and the Valley;
2. Onerous provincial legislation (*Ontario Regulation 588/17*) which requires detailed asset management plans to be prepared by July 2025;
3. The discovery of specific vulnerabilities within the infrastructure which required capital funding to address;
4. Revised capital planning processes which combined WWW projects with road projects;
5. Completion of strategic projects such as the \$17.7 million automated metering initiative; and
6. Lower annual increases to rates following the update of the WWW long range financial plan in 2019.

Recommendation

Ensure that the next WWW master plan is integrated more closely with the City's asset management planning process which will need to incorporate risk assessment, condition assessment and service level considerations when prioritizing water and wastewater projects for renewal or replacement.

Management Response and Action Plan

Agreed. Since 2017, staff have been developing and implementing a risk-based process to prioritize capital projects for the City's linear WWW assets to respond to Ontario Regulation 588/17. This Regulation focuses on asset renewal and not upgrades to meet growth related demands or strategic investments. The next updates to the WWW Master Plan and WWW Asset Management Plan will be more closely aligned and will help support the development of future capital programs. The updated WWW Asset Management Plan will utilize condition assessment findings, which includes risk assessment, to prioritize future asset renewal. In addition, through the work of the WWW Task Force, more condition data will be utilized from Cityworks and other data sources to help refine the prioritization of capital projects.

The City has made strategic investments in new technology, and studies to ensure that best available data is used when determining if additional efforts can be made to reduce per capita consumption of water, to identify and reduce unaccounted for water, and to reduce extraneous flow that enters the wastewater system. The WWW Task Force and the investment in a new Automated Water Meter System are examples where improved data will assist in the ability to prioritize capital projects.

C. Service Level Management Practices

As the average age of their infrastructures increases, municipalities are challenged to maintain levels of service while keeping water rates at affordable levels. Condition assessments help utilities meet this challenge by identifying more precisely where money is best spent, leaving in place water mains that have adequate integrity and preventing the unnecessary failures of others. By performing condition assessments of water mains municipalities can:

- estimate the likelihood that a water main may continue to provide satisfactory service by determining the remaining service life of the water main;
- make better decisions such as allowing some water mains to remain in service longer; preventing failures from occurring by intervening sooner with renewals or replacements; and
- discover and respond to leaks on a more timely basis.

Since 2016, the only physical condition assessment of the water supply and distribution system that has been completed was on the supply pipe from Lake Wanapitei to the Wanapitei water treatment plant. As a result, unexpected breaks are occurring to the water mains including a break in the Wanapitei trunk water main which could have caused a major service disruption. For 2022, \$1 million was budgeted for conducting a physical condition assessment on the water main trunk from the Wanapitei water treatment plant to the City and another million has been budgeted for 2023 to complete this work.

Other than the above-noted work, no physical condition assessments have been completed on the water distribution mains. As a result, the 2016 master plan, 2018 asset management plan and 2019 long-term financial plan for the water distribution systems were not informed by reliable condition assessments which are required to identify vulnerabilities and prioritize capital projects.

Recommendation

Physical condition assessments should be completed on critical components of the City's water distribution system including the supply pipes to the water treatment plants and trunk mains from these plants.

Management Response and Action Plan

Agreed. While physical condition assessments are being completed as part of water main break repairs, proactive physical condition assessments of the City's water distribution system are costly and only being done on critical or high risk water mains. Non-physical condition assessments continue to be completed through operational maintenance programs and are being completed on the remaining water mains through the WWW Task Force. These non-physical condition assessments and the water main break history are being used to help prioritize capital projects.

D. Alignment of Annual Capital Program with Asset Management Plan

The asset management plan that was prepared in 2018 for the WWW linear infrastructure employed risk assessments and break history to prioritize water mains for renewal and replacement. This plan indicated that 25% of the City's water mains had reached or exceeded their estimated service lives.

Prior to the issue of the 2019 update to the WWW Long Range Financial Plan which recommended adoption of a 20-year timeframe and annual rate increases of 4.8% for planning upgrades to the WWW infrastructure, a 10-year timeframe with annual rate increases of 7.4% was used to address the City's aging WWW infrastructure.

One of the consequences of revising funding levels available for WWW capital projects in 2020 and subsequent years is that only four of the 20 highest risk water main projects that were identified in the 2018 WWW asset management

plan were completed. Another consequence is that only 0.9 percent of the City's 1,000 kilometers of water mains have been lined since 2018.

Recommendation

Ensure that the City's annual capital program is more closely aligned with the WWW asset management plan which should incorporate physical condition assessments of the major components of the City's water distribution infrastructure.

Management Response and Action Plan

Agreed. The WWW Master Plan and WWW Asset Management Plan are being updated and in turn the WWW Long Range Financial Plan will be updated as well. As noted, the City has adopted the use of new technologies such as water main and lateral lining. These asset renewal techniques are a cost effective approach to extend the life of the asset without the need to replace the infrastructure. While these lining programs are cost effective, the industry is limited in the total quantity of lining that can be completed within a construction season. The City is working with our industry partners to continue to increase the amount of lining that can be completed on an annual basis. In addition, funding has been included in the proposed 2023 Water Capital Budget to complete additional condition assessments on the City's water distribution system.

E. Financing of Capital projects

In June 2019, Council approved the \$17.2 million Automated Metering Infrastructure project which was to be financed using \$4.2 million from the Capital Financing Reserve Fund and rate revenues in 2020, 2021 and 2022. While this funding approach was consistent with the Long-Range Financial (AMI) Plan for Water/Wastewater, it did not align with the best practice of using long-term debt to finance investments in long-term assets.

The 2021 BMA Final Study indicates that, in 2020, the City's Water Debt Interest Cover Ratio which is calculated as Debt Interest as a percentage of water revenues, was 0.3 percent compared to the municipal average of 2.0 percent; therefore, the City has additional borrowing capacity to finance major water capital projects. Using short-term financing to pay for the AMI project significantly reduced the amount of funds available for other linear water distribution asset renewal initiatives and depleted the Capital Financing Reserve Fund which is significantly underfunded according to the January 2020 staff report on Reserves and Reserve Funds.

Recommendation

Cash flow analysis should be performed prior to making significant investments in water distribution and wastewater collection assets to determine if long-term financing is necessary or desirable.

Management Response and Action Plan

Agreed. The City has borrowed externally for previous W/WW Capital projects, including the Biosolids plant and the purchase of wells from Glencore. In addition, there are several large projects that are being planned that will require significant cash flows and long term debt will be recommended as a funding source.

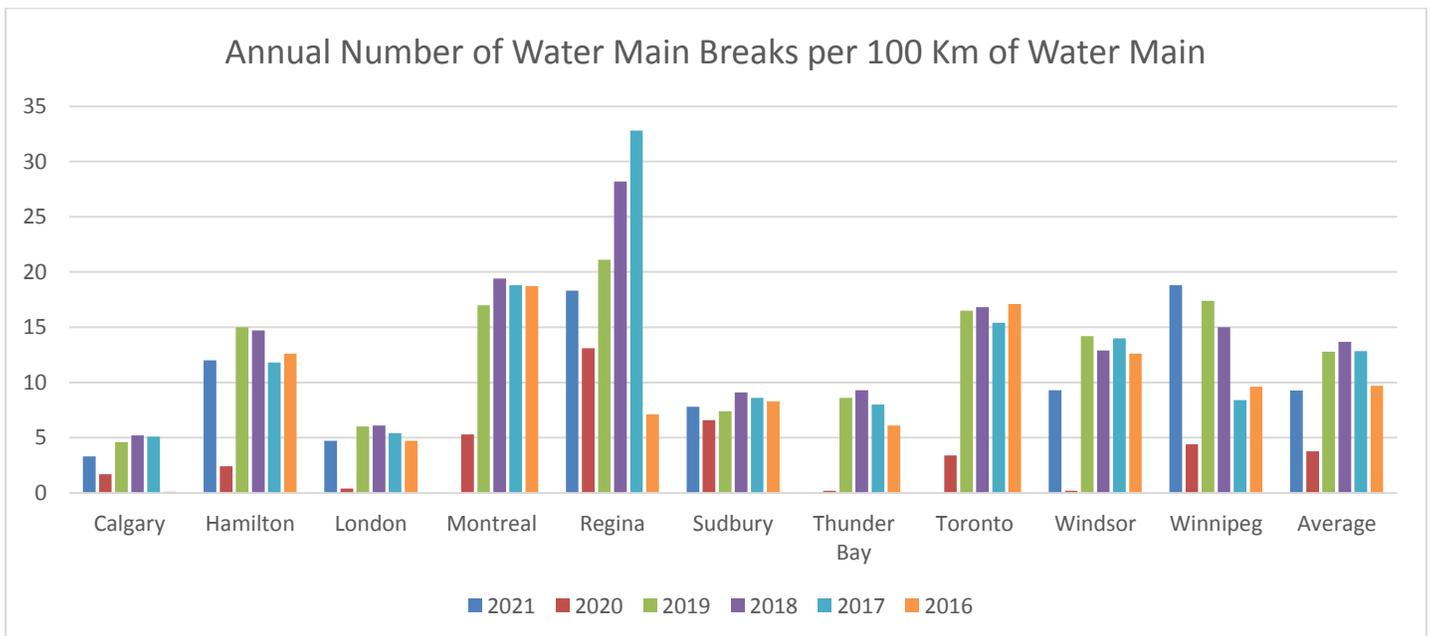
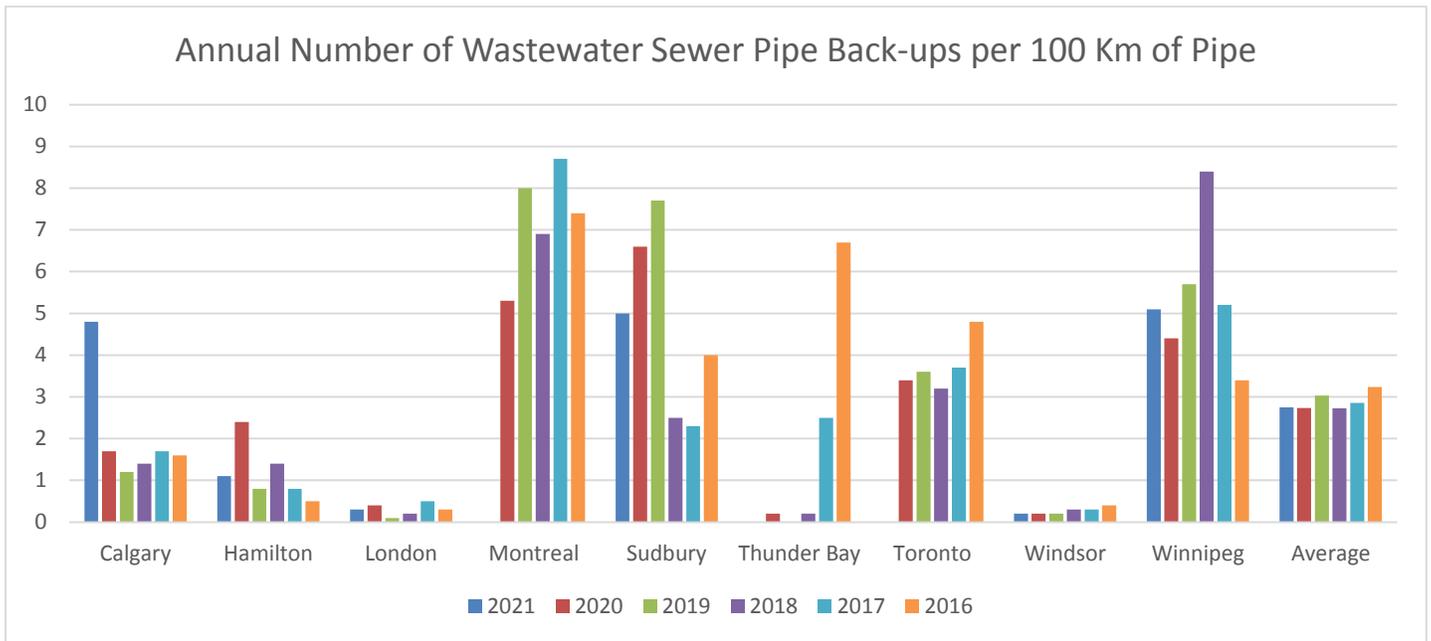
F. Performance Measures

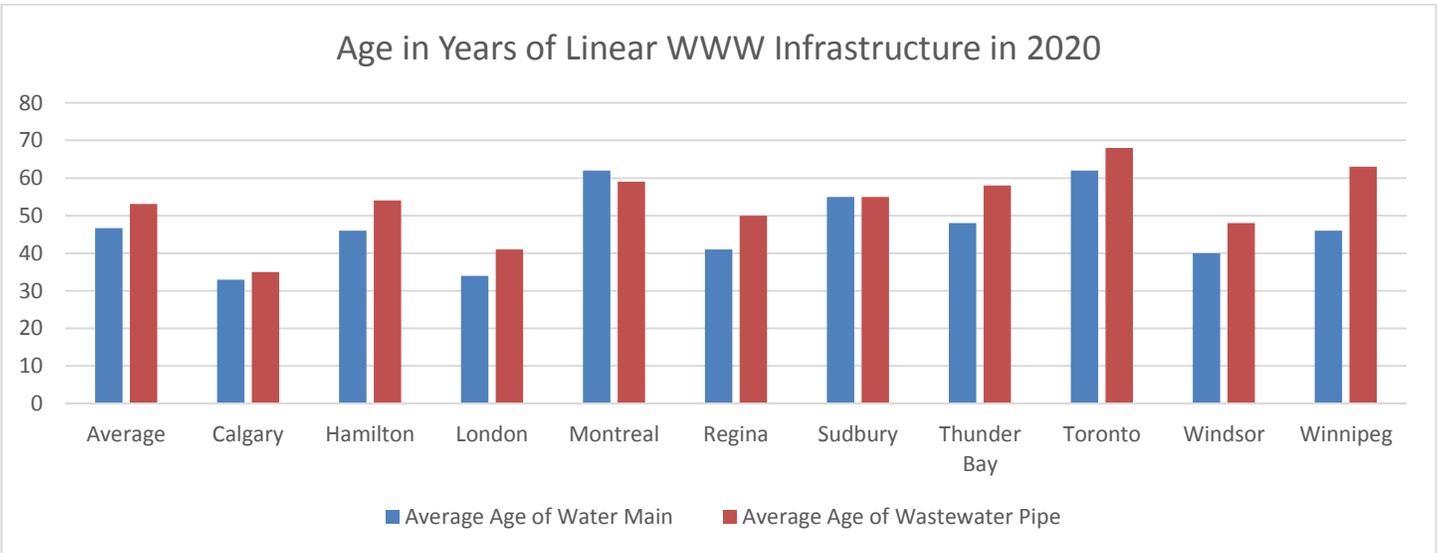
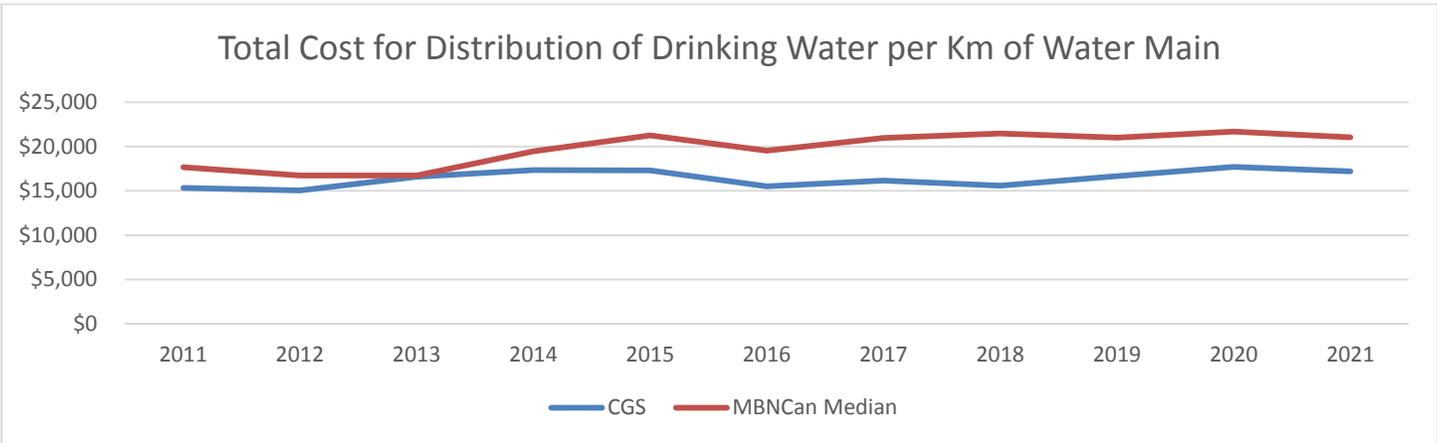
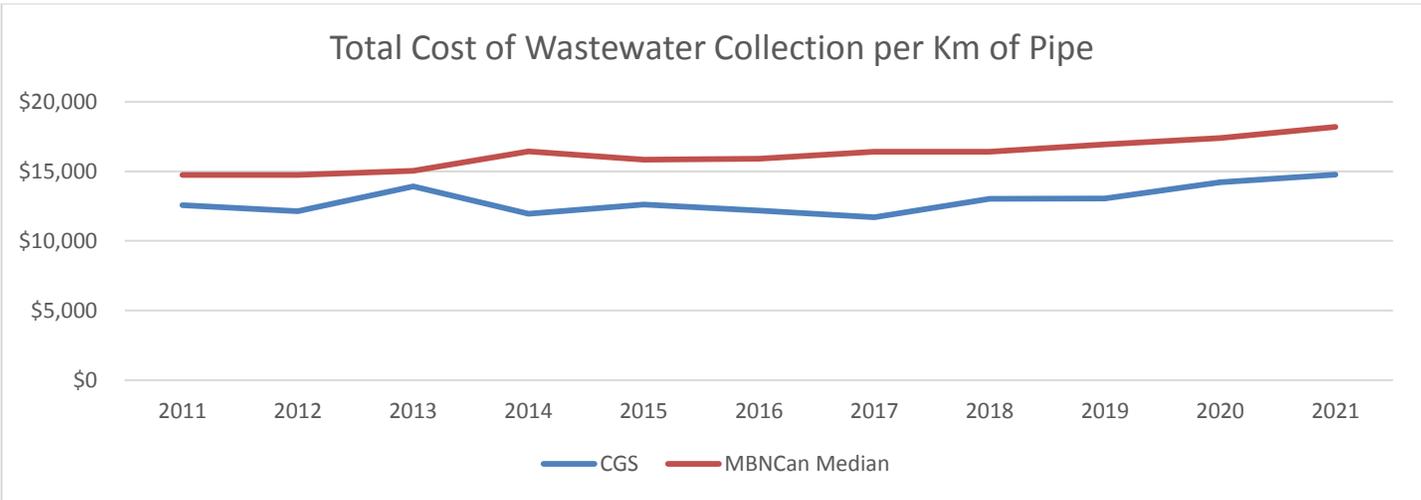
Management currently reports on service level expectations and actual service levels but does not include any key performance indicators (KPIs) or trends for the WWW distribution and collection systems to the Operations Committee.

Recommendation

Include performance reports for the following KPIs with benchmarks for municipal peers from the MBNCan performance report in annual reports to the Operations Committee to put some of the challenges the City faces maintaining its WWW linear infrastructure into perspective.

- Average Age of Wastewater Pipe – 55 years versus 53.1 years for peers
- Annual Number of Wastewater Pipe Back-ups per 100 Km of Pipe – 6.6 versus 3.3 for peers
- Cost of WW Collection and Conveyance per Km of Pipe - \$14,216 versus \$18,168 for peers
- Average Age of Water Mains – 55 years versus 46.7 years for peers
- Number of Water Main Breaks per 100 km of main – 7.1 versus 10 for peers
- Total Cost for Distribution of Drinking Water per Km of Main - \$17,697 versus \$21,875 for peers





Management Response and Action Plan

Agreed. An annual report will be developed jointly by staff from Linear Infrastructure Services and Infrastructure Capital Planning.

G. Accomplishments

During this audit, the following accomplishments were noted:

1. Utilization of GIS to track location of breaks in different types of water mains and wastewater pipes;
2. Completion of major components of the 2015 to 2018 Tactical Plan including a service level review, establishing and documenting service standards, creating and implementing response times for services such as water main breaks, and sewer back up response;
3. Creation of new Manager Linear Infrastructure Technical Support Services position to support planning and scheduling of maintenance activities in support of quality customer service outcomes and the Business Plan;
4. Implementation of CCTV processor which now integrates wastewater main condition assessment data with GIS through CityWorks;
5. Implementation of a cost-effective weekend shift to bolster preventative maintenance and emergency repairs;
6. Creation of a water distribution pipe degradation model using an updated water main break dataset; and
7. Mobile district metering and the pilot programs for leak detection have been implemented to gather additional condition assessment data.

Table 2 – Summary of Significant Risks

Risk	Total No. of Risks	Risks (Before Controls)			Residual Risks (After Controls)		
		High (15 to 25)	Med (9 to 14.99)	Low (1 to 8.99)	High (15 to 25)	Med (9 to 14.99)	Low (1 to 8.99)
Reputation (R)	1	1	0	0	0	0	1
Operational (O)	8	8	0	0	1	3	4
Financial (F)	8	8	0	0	1	3	4
Legal (L)	1	1	0	0	0	0	1
TOTAL	18	18	0	0	2	6	10

Table 3 – Significant Risks

Type of Risk	Description of Risk	Risk Before Controls	Residual Risk*
F1/O1	Capital maintenance processes may not align with the values, strategies and goals in the City's Strategic Plan.	25	13
F2/O2	Capital maintenance processes may not align with Enterprise Risk Management and Asset Management programs.	25	15
F3/O3	Capital maintenance processes may not align with the master plan and long term financial plan for water and wastewater.	25	13
F4/O4	Operational maintenance processes may not be delivered with due regard for efficiency.	20	10
F5/O5	Operational maintenance processes may not be delivered with due regard for effectiveness.	25	8
F6/O6	Operational maintenance processes may not be delivered with due regard for economy.	20	7
O7/F7	The performance of contractors may not be managed effectively.	18	8
O8/F8	Staff performance may not be managed effectively.	18	8
L1/R1	Legal and regulatory obligations may not be managed effectively.	18	7

*Note that it is not cost-effective to eliminate all residual risks.

Appendix 1 – Risk Assessment Criteria

Impact	Services	Technology	People	Strategic	Legal/Reputational	Financial
Very Minor (1)	<ul style="list-style-type: none"> • Less than 90% of service objectives achieved. 	<ul style="list-style-type: none"> • Minor disruptions of secondary systems or data loss or corruption. 	<ul style="list-style-type: none"> • Minor reportable employee injury. • Increase in number of union grievances. 	<ul style="list-style-type: none"> • Minor instances of actions that are at odds with strategic priorities. 	<ul style="list-style-type: none"> • Very minor non-compliance with regulations/legislation • Small amount of negative media coverage or complaints to City. • Non-lasting damage or no reputational damage • Theft or Fraud under \$1,000. 	<ul style="list-style-type: none"> • Uninsured loss, cost overruns or fines < \$10K • Insured loss < \$100K • Loss of replaceable asset.
Minor (2)	<ul style="list-style-type: none"> • Less than 75% of service objectives achieved. • Unable to perform non-essential service. 	<ul style="list-style-type: none"> • Disruptions of systems or data loss or corruption • Disclosure of non-confidential but embarrassing information. 	<ul style="list-style-type: none"> • Reportable employee injury. • Loss of key staff but able to recruit competent replacements • Significant increase (>10%) in number of union grievances. 	<ul style="list-style-type: none"> • Instances of actions at odds with strategic priorities. 	<ul style="list-style-type: none"> • Minor non-compliance with regulations/legislation • Complaints elevated to the Director level. • Short-term repairable damage to City's reputation • Public outcry for discipline of employee. • Moderate amount of negative media coverage • Theft or Fraud of \$1,000 to \$10,000. 	<ul style="list-style-type: none"> • Uninsured loss, cost overruns or fines of \$10K to \$100K • Insured loss < \$100K - \$1M • Inefficient processes • City's actions result in reduced economic development.
Moderate (3)	<ul style="list-style-type: none"> • Less than 60% of service objectives achieved. • Unable to perform essential service but alternatives exist. 	<ul style="list-style-type: none"> • Disruptions of significant systems or data loss or corruption • Recoverable loss from important system. 	<ul style="list-style-type: none"> • Multiple employee injuries or long-term disability from one incident. • Inability to retain or attract competent staff. • Increase in stress leave, sick leave or WCB claims. • Work-to-rule union disagreement or short-term strike. 	<ul style="list-style-type: none"> • Numerous actions are at odds with strategic priorities. 	<ul style="list-style-type: none"> • Non-compliance with regulations/legislation with moderate penalties • Public/media outcry for removal of management • Long-term damage to City's reputation • Citizen satisfaction survey indicates unacceptable performance. • Complaints elevated to Council level. • Results inconsistent with commitments made to citizens • Theft or Fraud under \$100,000. 	<ul style="list-style-type: none"> • Uninsured loss, cost overruns or fines of >\$100K to \$1M • Insured loss >\$1M to \$10M • Having to delay payments to contractors/suppliers. • City's actions results in lost revenue for significant number of City businesses.

Impact	Services	Technology	People	Strategic	Legal/Reputational	Financial
Major (4)	<ul style="list-style-type: none"> • Less than 45% of service objectives achieved. • Unable to perform an essential service where no alternative exists. 	<ul style="list-style-type: none"> • Unrecoverable loss or corruption of data from important system • External exposure of important information • Unavailability of significant systems 	<ul style="list-style-type: none"> • Serious injury of one or more employees • Legal judgment against the City in workplace matter. • Turnover of key employees • Sustained strike of staff. 	<ul style="list-style-type: none"> • Numerous actions are significantly at odds with the strategic priorities. 	<ul style="list-style-type: none"> • Non-compliance with regulations/legislation with major penalties • Public/media outcry for change in CAO or Council • Public or senior officials charged or convicted • Legal judgment against the City in a workplace matter • Integrity breach resulting in decreased trust in City Council or Administration. • Theft or Fraud >\$100,000 	<ul style="list-style-type: none"> • Uninsured loss, cost overruns or fines of >\$1M - \$10M • Insured loss of >\$10M - \$100M • Unable to pay employees and contractors on time. • City's actions impair local economic conditions.
Extreme (5)	<ul style="list-style-type: none"> • Less than 30% of service objectives achieved. • Unable to perform several essential services where no alternatives exist. 	<ul style="list-style-type: none"> • Unrecoverable loss or corruption of data from critical system • External exposure of confidential information • Unavailability of critical systems 	<ul style="list-style-type: none"> • Death of an employee • Major legal judgment against the City in workplace matter. • Significant turnover of key employees with ELT • Sustained strike of staff supporting key services 	<ul style="list-style-type: none"> • Many actions are significantly at odds with the strategic priorities. 	<ul style="list-style-type: none"> • Non-compliance with regulations/legislation with very significant penalties • Public/media outcry for change in CAO or Council • Senior officials criminally charged or convicted • Severe legal judgment against the City in a workplace matter • Major integrity breach resulting in complete loss of trust in City Council or Administration. • Theft/Fraud >\$1,000,000 	<ul style="list-style-type: none"> • Uninsured loss, cost overruns or fines >\$10M • Insured loss > \$100M • File for bankruptcy • Failure to maintain financial capacity to support current demands. • City's actions significantly impair local economic conditions.

Likelihood	Unlikely (1)	Possible (2)	Probable (3)	Likely (4)	Very Likely (5)
	Less than 20%	>20% but < 40%	>40% but < 60%	>60% but < 80%	80% or more
	Less frequent than every 10 years	May occur in the next 2 years	Will occur this year or next year at least once	May occur regularly this year	Will occur within months may reoccur often