

2023

CORPORATE ASSET MANAGEMENT PLAN

Water Distribution

INTRODUCTION

This report outlines the state of Saskatoon’s water distribution system by providing information on asset inventory, replacement value, condition, lifecycle programs, and expenditure levels.

The source of information is from the City of Saskatoon’s (City) Geographical Information System (GIS), asset management database, past contract values and operation and maintenance records. Records up to December 31, 2022 have been used for this report.

The City’s water distribution infrastructure has a replacement value of over
\$4 billion.

CURRENT INVENTORY AND VALUE

The City’s Water Distribution Network consists of Distribution Mains, Primary Mains, Valves, Hydrants and Service Connections.

Table 1 – Inventory and Valuation

Asset	Type	Inventory	Replacement Value (\$M)
Water Mains	Distribution	1,085 km	\$ 2,622
	Primary	126 km	\$ 382
Valves	Distribution	14,971 ea	\$ 213
	Primary	351 ea	\$ 41
Chambers		217 ea	\$ 37
Hydrants		7,553 ea	\$ 74
Service Connections		71,311 ea	\$ 692
Total			\$ 4,061

**Replacement Values have been updated to take into account increased contract costs up to and including 2022 contracts. Values may have decreased or increased from previous reports due to normal variations in costs. All costs are on existing assets and not proposed.*

Water distribution inventory managed by the Public Private Partnership are not included above.



Connection Replacement

ASSET PERFORMANCE

This section outlines how the condition and performance of assets are determined.

Distribution Mains

Physical condition of distribution mains is assessed by counting the number of breaks that have occurred on a main. Water and Waste Operations provides break data information recorded when a repair is performed on a main.

Physical condition grades are assigned on a five-point scale from “A” to “F”. The grading system developed is shown in the table below.

Table 2 – Physical Condition Grades

Grade	Physical Condition	Number of Breaks
“A”	Very Good	0
“B”	Good	1 or 2
“C”	Fair	3 to 5
“D”	Poor	6 to 8
“F”	Very Poor	9 or more

The table below shows the physical condition of distribution mains by length.

Table 3 – Physical Condition of Distribution Mains by Length

Condition	Length (km)	Percentage by Length	Replacement Value (\$M)
A	888.0	83.0%	\$ 2,145
B	124.0	12.0%	\$ 300
C	41.0	3.8%	\$ 99
D	11.0	1.0%	\$ 27
F	3.5	0.3%	\$ 8
Total	1,067.5		\$ 2,579



Anode Retrofit Installation

Capacity condition of water mains is determined using the City’s water model, which estimates a level of “friction” inside each water main in the network to determine the capability of that main to deliver required flows. This friction affects the flow condition and correlates with the pressure and flow measurement made in the field.

Ninety-two percent (92%) of water mains meet flow requirements and are considered in “Good” capacity condition and 8% do not meet requirements and are considered in “Poor” capacity condition.

Primary Mains

Due to the importance of primary water mains, regular proactive condition assessment projects are performed.

A risk rating has been assigned to all primary water mains and this ranking system is used to select condition assessment projects. A total of 21 kilometres of primary water mains were inspected between 2017 and 2020.

Based on these condition assessments, necessary repairs were performed on the critical 42nd Street Reservoir feeder main.

Non-urgent structural concerns have been identified on the Acadia Reservoir feeder main and remediation plans are being developed. An alternate feed to the Acadia Reservoir is tentatively scheduled for 2023 as part of a reservoir upgrade project. This alternate feed is necessary for the future repairs to the feeder main. A decision quality analysis will be undertaken in 2023 to determine the best repair method and estimated costs for the feeder main, with repair expected in 2024.

Service Lines

The overall condition of service connections is considered “Good”. Approximately 93% of service connections are made of copper or plastic and have low failure rates. There are approximately 1,657 connections that are made of lead, which tend to have higher failure rates of approximately 50 failures per year. Lead connections can also potentially leach lead into drinking water. Health Canada sets limits for acceptable levels of lead in drinking water and random tests in Saskatoon have found locations where these limits are being exceeded. The City is dealing with lead connections through customer education and a lead connection replacement program.

LIFECYCLE PROGRAMS

The water distribution system is managed through asset preservation and operation and maintenance programs. The established levels of service for these programs are to provide potable water for consumption, provide water to the Saskatoon Fire Department for fire suppression purposes, provide sufficient flow for residential and commercial use, protect the environment, and maintain fiscal responsibility.



Old Cast Iron Pipe

ASSET PRESERVATION

This section outlines programs that ensure the performance and maintenance of assets, or replace failed assets.

Distribution Mains

Water mains are replaced and rehabilitated through two programs: the Preservation Program and the Capacity Program. Pipes are replaced by open trench excavation or are lined using Cured-In-Place Pipe (CIPP).

Preservation Program

The Preservation Program addresses the physical condition of water mains. A water main is considered to be in “Poor” physical condition if it has had six or more breaks in the past 25 years. The City has set a level of service goal to replace water mains once they reach “Poor” condition. The City currently has 14.5 kilometres of water mains with six or more breaks.

Funding for water main preservation is approximately \$8.0 million and 4 kilometres are replaced annually.

Capacity Program

The Capacity Program focuses on improving system flow rates by upsizing mains and adding looping to the water main system. The program is currently focused on areas with high density or lead service lines in order to align with the lead service line replacement program.

Funding for capacity water main replacement is approximately \$6.5 million and 3.5 kilometres are replaced annually.

Primary Water Mains

Primary water mains are inspected and assessed as described in the asset performance section above. Based on these assessments, various rehabilitation and replacement projects may be undertaken.

In addition to the Acadia Reservoir feeder main repairs mentioned above, primary water mains selected for rehabilitation or replacement over the next three years include College Drive, Avenue C, and Ruth Street. These mains have been selected based on repair history and to align with other initiatives such as Bus Rapid Transit.

Currently identified projects are adequately funded by past contributions to the primary water main preservation capital project budget. Future inspection and monitoring of primary water main performance may identify future work that will require one-time funding requests.

Primary water mains are also preserved using a method called cathodic protection. Electrical currents are used to prevent corrosion of the water mains. Saskatoon has various cathodic protection systems installed since the 1990s. Inspection of the cathodic system is done annually and repairs are completed as necessary.

Lead Service Lines

Lead service lines are replaced either in emergency situations or on planned programs. Planned replacements are done in advance of roadway reconstruction and as part of the capacity water main replacement



Valve and Pipe Installation

program. Starting in 2017, funding levels were set so that all remaining lead service lines would be replaced by the end of 2026. Current funding is approximately \$870,000 per year for emergency lead service line replacements and \$3.7 million for planned lead service line replacements. From 2017 to the end of 2022, approximately 2,925 lead service lines were replaced. Approximately 1,657 lead service lines are remaining.

OPERATIONS AND MAINTENANCE PROGRAM

The operation and maintenance programs ensure the water system is inspected, operated and maintained within the requirements of the Permit to Operate a Waterworks as issued by the Water Security Agency.

Operations and Inspection

Operations and maintenance programs include the provision of emergency response services to ensure that breaks are turned off in a timely manner protecting both residents and property, support for the turn on/off water service connections when work is taking place on private property, the replacement of water distribution/service valves and fire hydrants as they fail, provision of underground utility location services for the water distribution system, and valve inspection programs.

Repairs

One of the most common causes of a water disruption is a break on a water distribution main, primary water main, water service connection, valve or fire hydrant. Repairs are undertaken with water typically being restored within 24 to 48 hours. Any water disruption in the system will result in a Drinking Water Advisory (DWA) and lab testing before the advisory can be lifted, which ensures water is safe for consumption. DWAs are provided to all homes and businesses affected. Alternative water supplies are provided to those affected within eight hours of the issue remains unresolved and typically consist of an emergency water supply trailer.

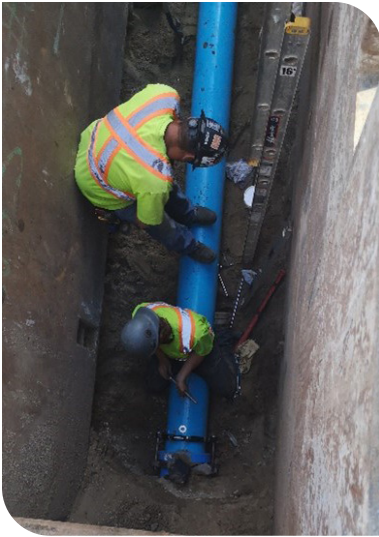
Hydrant Inspection

Fire hydrants are inspected to ensure they are operating at capacity, highly visible and accessible in the case of an emergency. There are two separate inspection programs for fire hydrants: summer and winter. The annual goal is to ensure that 100% of hydrants are inspected in the winter season and 50% of hydrants are inspected the summer season.

In periods of above average water main breaks, frozen connections, or increased call outs, the fire inspection level of service is reduced to prioritize the supply and operation of the water services.



Water Main Installation



Water Main Installation

SERVICE EXPENDITURE LEVELS

The Administration evaluates the condition of the City’s assets in order to develop an annual program to maintain the assets at a minimum lifecycle cost. Where feasible, condition assessments are conducted and used to establish condition and develop annual capital improvement plans.

The level of service for each type of asset is defined differently but as the level of service increases for the asset, so does the cost of maintaining the asset.

In order to compare all assets equally, five levels of expenditure are identified below.

“A” represents the highest level of expenditure and “F” represents no expenditure.

Table 4 – Levels of Expenditures

Expenditure Level	Asset Condition	Description
“A”	Getting Better Quickly	Sufficient expenditures to keep asset in top condition and to increase asset condition/value quickly over time.
“B”	Getting Better	Sufficient expenditures to keep asset in top condition and to increase asset condition/value slowly over time.
“C”	Maintain Asset in Current Condition	Sufficient expenditures to keep asset in constant condition over time.
“D”	Getting Worse	Insufficient expenditures to maintain asset condition. Over time asset condition will deteriorate.
“F”	Getting Worse Quickly	No expenditures. Asset condition/value decreased rapidly.

Using the above criteria and physical condition desired, the Administration has identified the following expenditure service levels for asset preservation, capacity, and operation and maintenance lifecycle programs.

Table 5 – Asset Performance and Funding

Asset Program	Current Performance	Desired Performance	Approved Expenditure Level	Required Annual Funding	Existing Annual Funding	Annual Funding Gap
Distribution Water Main Preservation	83% Very Good					
	12% Good					
	4% Fair	Good	B	\$ 10.6M	\$ 8.0M	\$ 2.6M
	1% Poor					
Distribution Water Main Capacity	0.3% Very Poor					
	92% Very Good	Very Good	B	\$ 9.5M	\$ 6.4M	\$ 3.1M
8% Poor						
Primary Water Main Preservation*	Good	Good	C	\$ 1.8M	\$ 1.8M	\$ 0.0M
Primary Water Main Capacity**	Excellent	Excellent	C	\$ 0.0M	\$ 0.0M	\$ 0.0M
Service Connection Preservation	93% Very Good	Good	B	\$ 6.2M	\$ 4.7M	\$ 1.5M
	7% Very Poor					
Water Operations and Maintenance	Good	Good	C	\$ 18.0M	\$ 16.5M	\$ 1.5M

* The Primary Water Main Preservation program's performance is evaluated based on recent inspection programs and general break rates.

** Primary Water Main Capacity is evaluated as excellent in capacity for the existing primary water main system and does not take into account plans for future development.

Funding Gap

Currently, there is \$19.1 million allocated for preservation programs and \$16.5 million for operations and maintenance. The current funding level aims to maintain the distribution network and improve its condition by gradually addressing the backlog of poor locations.

In 2022, the water main preservation and capacity programs experienced a significant increase in tender pricing, surpassing 20%. However, due to the substantial carryover work from 2021, it was unclear whether this was a continuing trend or an isolated short-term pricing fluctuation.

For the 2023 program, rates from 2022 were used, but unfortunately, initial tenders for 2023 have further increased. As a result of these cost escalations, the scope of the 2023 water main replacement and lead service line replacement programs had to be reduced by an additional 25% during the procurement process.

The cumulative increase in tender prices since 2021 has created a shortfall of approximately \$7.2 million in capital funds and \$1.5 million in operational funds to maintain the current service levels. To accurately reflect these changes, future reports to City Council will present potential options for

adjusting the water utility rate. The options will include details on reducing service levels or increasing funding to maintain the current service standards.

Additionally, discussions are underway with industry stakeholders to explore changes in the tendering process for water main work, aiming to identify cost savings. Some considerations include reviewing tendering timelines, additional projects with reduced scope, flexible schedules, excluding adjacent sidewalk work, and restoring only the impacted trench rather than performing full roadway treatments as was done prior to the Building Better Roads program.



Water Main Installation

THE WAY FORWARD

The SAP Enterprise Asset Management (EAM) system was implemented in spring 2022. The implementation has been successful, with the initial focus being on the citizen-facing aspects of Water and Sewer Asset Operations and Maintenance, specifically complaint and defect resolution. Our teams are dedicated to continuously improving processes and programs within the water distribution system. The following are the key areas of focus:

- Water and Sewer Operations will continue developing data capturing mechanisms within SAP to enhance the value and availability of operations and maintenance data for rehabilitation and replacement planning. Opportunities to eliminate redundant reporting and tracking systems related to data capture and maintenance will be explored.
- Review and improve methods for preservation treatments, with a specific focus on cast iron water mains. Approximately 200 kilometres of existing cast-iron water mains do not have any physical or capacity condition concerns. Cost-effective ways to preserve these mains are being analyzed, thereby delaying or avoiding expensive replacement costs.
- Explore potential modifications to the contract tendering process for water main rehabilitation work, with an emphasis on reducing the costs associated with maintaining the City's water distribution network.

INFRASTRUCTURE RESILIENCE AND CLIMATE CHANGE ADAPTATION STRATEGY

Proper maintenance of existing water infrastructure and the rehabilitation or replacement of failed water infrastructure results in reduced water leakage from the water distribution system. Having a more reliable and leak-resistant distribution system is important to meet water consumption demands, and reduce costs and energy demands to treat and distribute potable water.

*We strive to maintain and fund
our key infrastructure assets to
minimize total lifecycle costs.*

