

2023

CORPORATE ASSET MANAGEMENT PLAN UPDATE Storm Water Infrastructure

INTRODUCTION

The Storm Water Asset Management Plan (AMP) contributes to achieving the City of Saskatoon's (City) goals for citizen quality of life, asset and financial sustainability, and environmental leadership. The plan contributes to a long-term lowest lifecycle asset management costing approach to provide effective and efficient resource use that meets citizen expectations.

CURRENT INVENTORY

The Storm Water Utility's **minor system** consists of piping, manholes, catch basins, and outfall structures that convey runoff from more frequent, lower intensity storm events (up to a "1-in-2-year" storm).

The **major system** consists of overland street drainage, 10 dry ponds, 32 wet ponds (including nine naturalized wetlands), ditches, swales, and any other land that is required to convey runoff from less frequent, higher intensity storms that produce runoff in excess of what the minor system typically handles.

The City's storm water infrastructure has a replacement value of approximately \$3.0 billion. The inventory for each asset was sourced from the City's Geographical Information System (GIS) database up to January 31, 2023.

Replacement values were updated to take into account contract costs up to and including 2022 contracts. Values may have changed from previous reports due to variations in costs, system growth, and updated data.

Table 1 – Storm Inventory and Valuation

Asset	Inventory	Replacement Value
Storm Mains	755 km	\$ 2,576M
Manholes	9,344 ea	\$ 133M
Valves	424 ea	\$ 1.6M
Force Mains	4 km	\$ 11M
Service Connections ¹	2,879 ea	\$ 24M
Catch Basins	13,897 ea	\$ 62M
Leads	160 km	\$ 80M
Dry Ponds	10 ea	\$ 16M
Wet Ponds	32 ea	\$ 85M
Culverts	9 km	\$ 5M
Outfalls ²	90 ea	\$ 4M
Sub-Drainage ³	45 km	\$ 14M
Oil and Grit Separators	1 ea	\$ 0.05M
Lift Stations	2 ea	\$ 23M
Total		\$ 3.0 Billion

¹ Service connections are responsibility of private property owners, included for reference only.

² Includes City-owned and maintained storm water outfalls only. This does not include sanitary outfalls, or storm water outfalls owned and maintained by private owners or agencies.

³ The sub-drainage system, which includes 43.4 km of roadway subdrainage and 1.7 km of riverbank subdrainage, is currently an unfunded asset.

*The City's
storm water
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Dundonald Pond

CONDITION OF ASSET

The physical condition of storm water assets have been assessed and rated based on a sample of CCTV inspections for the storm water mains (2022), catch basin leads (2022), and visual inspections of storm water ponds (2021) and outfalls (2022). Approximately 20% of the City’s linear storm infrastructure network has been rated.

Physical condition of storm water assets vary by each asset type and the defect used to develop the condition rating. The physical condition grades are assigned on a five-point scale from “A” to “F”. The grading system developed is shown in Table 2 below:

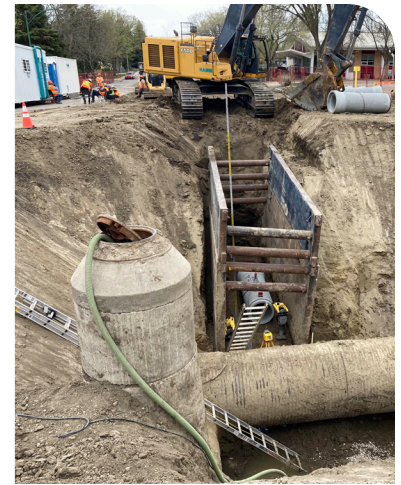
Table 2 – Storm Water Asset Grading System

Grade	Implication	Action
“A”	No structural problems evident	Ongoing monitoring and maintenance only.
“B”	Some structural deficiencies noted	Ongoing monitoring and maintenance only.
“C”	Sewer main showing deterioration	Some rehabilitation may be recommended for highly critical mains. Less critical mains should be flagged for increased monitoring.
“D”	Physical condition is near failure	Rehabilitation likely necessary in 5 to 10 years and should be taken into account for long-term budgeting.
“F”	Physical condition has failed	Rehabilitation or replacement is recommended. Mains should be prioritized for annual rehabilitation programs based on defect severity, main criticality, and budget availability.

4 | STORM WATER INFRASTRUCTURE

Table 3 – Storm Infrastructure Physical Condition Information

Asset	Description	Rating	Number	Percent
Storm Water Mains – Collectors	Known condition of Collector Mains. Rated A, C, and F as very good, fair, and very poor respectively as of January 31, 2023.	A: Very Good	103.8 km	15.2%
		C: Fair	19.7 km	2.9%
		F: Very Poor	1.7 km	0.3%
		Not Rated	556.7 km	81.6%
		Total	681.9 km	100%
Storm Water Mains – Trunks	Known condition of Trunk Mains. Rated A, C, and F as very good, fair, and very poor respectively as of January 31, 2023.	A: Very Good	10.6 km	14.6%
		C: Fair	0.5 km	0.7%
		F: Very Poor	0.1 km	0.1%
		Not Rated	61.4 km	84.6%
		Total	72.6 km	100%
Catch Basin Leads	Known condition of Catch Basin Leads. Rated A, C, and F as very good, fair, and very poor respectively as of January 31, 2023.	A: Very Good	0.4 km	0.2%
		C: Fair	0.1 km	0.1%
		F: Very Poor	0.0 km	0.0%
		Not Rated	159.5 km	99.7%
		Total	160.0 km	100%
Ponds	Comprehensive storm water pond inspections were completed in 2021. Visual assessment was based on the condition of inlet and outlet pipes, structures, and grates, culverts throughout the park area (as applicable), shoreline and water appearance, erosion control, overland drainage/ sump pump discharge, sediment buildup, invasive species, algae, and any other visual concerns. Ponds were assigned a condition of good, average, poor, and under construction based on the number and severity of action items required at the pond. <i>*Note: two ponds have been added to the inventory since the 2021 report.</i>	Good	4	10.0%
		Average	30	75.0%
		Poor	5	12.5%
		Under Construction	1	2.5%
		Total	40	100%
Outfalls	Condition based on 2022 visual inspections of outfall and ranked based on condition and maintenance required. Inspection ratings incorporate outfall pipe and structure condition, handrail and grate condition, and any factors impeding outflow or causing erosion such as overgrowth, sedimentation, or lack of erosion protection.	A: Good	13	14.4%
		B: Average	47	52.2%
		C: Poor	16	17.8%
		D: Very Poor	8	8.9%
		Not Rated	6	6.7%
		Total	90	100%



Installing Storm Sewer in W.W. Ashley District Park



Manhole Under Construction near Churchill Neighbourhood Park

Manholes and catch basins are not currently assigned a rating, but rather deficiencies are noted in maintenance logs. Implementing a rating system for manholes and catch basins will be explored in the future based on guidance from the National Association of Sewer Services Companies (NASSCO). Condition assessments are not currently documented for valves, force mains, culverts and sub-drainage. Cleaning of oil and grit separators is completed as required. The condition assessment of lift stations was last documented by an external consultant in 2018. Overall, one lift station is in good condition, while the other will require moderate investment within the next 10 years..

LIFECYCLE PROGRAMS

Asset Creation

New storm water infrastructure will be constructed between 2019 and 2028 through the \$54 million Flood Control Strategy (FCS). Through nine projects, the FCS will reduce the flooding impacts for at least ten areas with a high risk of flooding. W.W. Ashley Park and Churchill Park dry ponds are now in service to reduce flooding for at least 88 nearby properties. Construction of the third project, a dry pond at Weaver Park to reduce flooding for approximately 26 properties, began in early 2023. Design of the fourth project is underway to address flooding near the intersection of Early Drive and Tucker Crescent, which if approved by City Council, is planned to be constructed in 2024.

New storm water infrastructure funded by developers is continually being constructed in new neighbourhoods. Additional guidance for storm water drainage in newly constructed neighbourhoods has been developed by the City as part of its Drainage Regulation and Compliance Project, including a new lot drainage webpage and residential property lot grading guidelines. New storm water systems also will incorporate storm water ponds and natural drainage patterns to address the City's Green Infrastructure Strategy objectives.

Asset Renewal

Linear Storm Water Infrastructure

Storm water sewer mains will continue to be inspected and rated under the storm water asset preservation program. Storm water pipes will be prioritized for the addition of cured-in-place pipe (CIPP) lining to lengthen lifespans and minimize lifecycle costs.

Taylor Street Storm Trunk Remediation

The Taylor Street storm trunk is a critical main for storm water collection for the southeast storm water catchment area of the City. The 1.8 kilometres main was constructed in 1954 of 1500 mm diameter corrugated steel, while a stainless steel liner was installed in 1960. Inspections have identified deficiencies with the stainless steel liner that could lead to significant blockages. In 2023, the Technical Services department will be hiring a consultant to assess the structural condition of the main and evaluate and recommend options for remediation. Remediation is anticipated to take place in 2024. A budget of \$3.5 million has been allocated for this project.

23rd Street Storm Trunk Repair

Full replacement of a 27 metre long section of the 1912 storm trunk on 23rd Street is required due to the heavily deteriorated condition of the pipe. This repair is scheduled for fall of 2023 with an estimated budget of \$350,000.

Overland Drainage System

The \$8 million Montgomery Place Drainage Improvement Project will reconstruct ditches/swales and replace or add culverts under driveways on the public right-of-way from 2022 to 2026. This project will restore drainage paths for snow melt and intense rain events. Phase I of the project, which included drainage improvements in the northeast area of Montgomery Place, was completed in 2022 with a small amount of remaining work to be completed in 2023. Phase II is planned for the southeast area of the neighbourhood is expected to be constructed in 2023 and 2024. Phase III locations will be finalized after the Phase II contract is awarded with construction planned for 2025-2026.

The City will also complete ditch/swale reconstruction and culvert additions and replacements in the CN Industrial neighbourhood in 2023 and 2024. The project is to be completed over two years on Melville Street, Portage Avenue, and Jasper Avenue to restore the compromised drainage path for the area.

Storm Ponds and Outfalls

Storm pond bathymetric surveys will continue to determine pond sedimentation levels and impacts on performance to develop the most cost-effective maintenance program. To monitor sediment levels, Saskatoon Water plans to continue surveying four to five ponds per year in the future, with the program to be incorporated into the future storm water asset management plan.

Longstanding deficiencies at storm pond and outfall locations, including, but not limited to excess sediment, excess vegetation, separated pipes, and lack of erosion protection (which were previously identified in the 2021 Storm Pond Visual Assessment Report) will be addressed in 2023 and 2024 through upcoming external contractor work.

The City's outfall network was inspected in 2022 with repairs to identified deficiencies planned to be completed in 2023 and 2024.



*Churchill Park Dry Storm
Pond Inlet/Outlet*



Storm Water Outfall

OPERATIONS AND MAINTENANCE (O&M) PROGRAM

The level of storm water related maintenance activities, including televising storm water sewers, cleaning and inspecting infrastructure, and repairing or replacing storm sewers, manholes, and catch basins decreased in 2022, partly due to equipment availability, human resources, and catch basins decreased in 2022, partly due to equipment and labour availability. The operations and maintenance activities completed in 2021 and 2022 are shown in Table 4.

Table 4 – Storm Infrastructure Maintenance

Activity (unit)	2021	2022
Storm Sewer Flushing (metres)	N/A ¹	N/A ³
CCTV of Storm Mains (metres)	6,937 ²	8,400
CCTV of Catch Basin Leads (metres)	N/A ¹	1,520
Catch Basin Leads Cleaned and Flushed (each)	227 ²	N/A ³
Catch Basin Inspections (each)	1,021 ²	591
Catch Basin Cleanings (each)	N/A ¹	N/A ³
Catch Basin Repairs (each)	208	163
Catch Basin Replacements (each)	28	17
Manhole Inspections (each)	441 ²	292
Manhole Repairs (each)	133	102
Manhole and CB Grouting (each)	14	8
Outfalls Inspected (each)	N/A ¹	8
Storm Pond Maintenance (each)	N/A ¹	N/A ³

¹ Not reported in 2021

² Only includes data from April 2021 to December 2021

³ Not reported in 2022

The current operations and maintenance plan for storm sewer infrastructure is to complete emergency and complaint-driven response tasks, and then execute planned tasks (catch basin inspections, cleanings and repairs, manhole inspections and repairs, outfall inspections, algae removal) with the remaining budget and resources. The intent of the operations and maintenance plan is to document current levels of service for each asset through SAP. Once documented, level of service targets can be set based on current budget, risk, and resources. Required adjustment to the levels of service will be made in future years through budget adjustments. The overall approach is to shift from a reactive to proactive approach over the coming years.

Information regarding current operations and maintenance targets and processes for storm water infrastructure are provided below:

- Storm outfalls (annually) and storm water ponds (biannually and complaint driven) are inspected for maintenance priorities with a detailed visual assessment and reporting completed by Saskatoon Water staff every three years.
- Algae removal and water quality testing is also completed at select locations in the storm water pond network.
- Approximately half of the catch basin inventory is inspected annually (with this planned to be increased to three quarters of the catch basin inventory in 2023) with repairs or replacements made as required.
- Storm sewers are also inspected and cleaned in conjunction with the Roadways Rehabilitation Program, or as required on an emergency basis.
- The City is currently exploring options to expand the storm water system cleaning work to include pro-active cleaning of storm sewers in addition to the existing cleaning approach. This work is in accordance with City Council direction for the City's response to the June 20, 2022 rain event.
- The fall street sweep will continue to utilize a tree density and flood risk approach to maximize the debris captured during the sweep and provide optimal flood risk reduction per kilometre swept.
- Goldfish, an invasive species known to harm local waterways, are removed at storm ponds on a complaint-driven basis. Goldfish removal was most recently completed from three storm ponds (Dundonald Pond, George H. Clare Pond, and Bev M. Dyck Pond) in 2022.

Research

Storm Water Quality

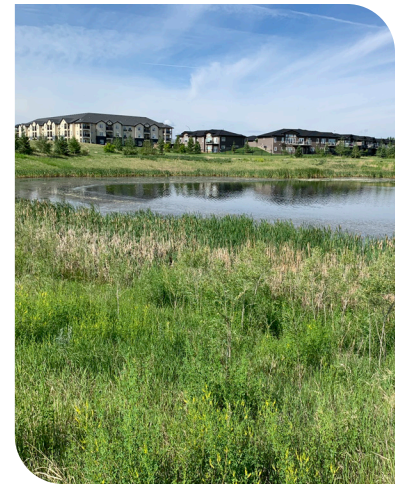
The University of Saskatchewan (USask) and the City are currently executing a research project regarding storm water quality improvements through adsorption techniques. The project is being completed over 2022-2023. The initial research appears to be positive, and the remaining research will focus on scalability.

Debris Capture

USask and the City installed two debris capture bags on outfalls located on the South Saskatchewan River in April 2023. The research project will analyze the amount and volume of debris prevented from reaching the South Saskatchewan River.

Sediment Removal and Capture

USask and the City are currently developing a proposal for research funding to study sediment removal methodology from storm ponds and to improve design standards to enhance sediment capture and removal in new and existing storm ponds.



Hyde Pond



Debris Capture Bag

SERVICE LEVELS

Service Expectations

Citizens expect the following for our storm water infrastructure:

- *Available:* Sufficient capacity prevents flooding during snow melt and intense rain events.
- *Reliable:* Service requests for maintenance are promptly completed.
- *Responsive:* Citizens feel they are heard and are treated with empathy and respect.
- *Cost Effective:* Storm water costs are affordable, and assets are managed for lowest lifecycle costs.
- *Safe:* Citizens and staff are safe when using and working with storm water assets.
- *Suitable:* Storm ponds are multi-functional, providing passive and/or active recreation opportunities and habitat for native species.
- *Sustainable:* Storm water assets minimize damage to the environment.

Service level targets will be set as part of the asset management planning process.

Asset Management Gaps

- Maintenance and preservation are currently unfunded for outfalls, sub-drainage, culverts, and storm sewer cleaning.
- The culvert inventory near the edges of City limits remains in development and is currently incomplete.
- Existing levels of service for inspections are not documented for storm sewer flushing and cleaning, catch basin cleanings, manhole inspections, outfall inspections, ditch inspections, force main inspections, and storm pond inspections. These assets are inspected based on emergencies, complaints, or utilizing existing resources.
- Maintenance levels of service are not documented for manhole repairs, outfall repairs, sub-drainage, oil and grit separators, ditches, lift stations, and storm pond maintenance. Maintenance is completed based on an emergency or complaint-driven basis.
- Storm pond sediment accumulation is increasing in the wet pond network. Wet ponds are designed to capture sediment to prevent it from discharging into the South Saskatchewan River. Over time these wet ponds will need to be dredged (i.e., cleaned out). This comes at a significant cost of approximately \$75/m³ of sediment.
- The City has two unique overland drainage neighbourhoods (Montgomery Place and CN Industrial) that rely on ditch and culvert drainage. Formal asset preservation has been lacking for these ditch and culvert drainage systems. The Storm Water Utility is currently restoring drainage paths for these two neighbourhoods through capital programs. A long-term asset preservation plan needs to be developed to preserve these assets.



Montgomery Place Ditch and Culvert

- Sediment and erosion control design and construction guidelines for new developments could be improved. Other municipalities across Canada implement debris diversion or capture at source to reduce cleaning requirements for storm sewers.
- Invasive fish species are currently handled and removed from the storm water system on a complaint-driven basis with no regular monitoring or asset management plan in place.

Potential Plan to Address Funding Gap

The Storm Water Utility successfully applied for federal and provincial funding that will contribute up to \$27.5 million between 2021 and 2028 to address storm water capacity issues: The Disaster Mitigation and Adaptation Fund (\$21.6 million) for the Flood Control Strategy will contribute to new storm water assets in high flood risk areas, and the Investing in Canada Infrastructure Fund (\$5.9 million) will help fund drainage restoration for the Montgomery Place neighbourhood's ditch/swale and culvert network.

Additionally, the Storm Water Utility is currently in the process of applying for further federal funding to construct storm water infrastructure, including restoration of the CN Industrial neighbourhood's ditch/swale and culvert network (\$3.9 million in federal funding). Other federal funding opportunities are also being considered for future flood mitigation projects.

INFRASTRUCTURE RESILIENCE AND CLIMATE CHANGE ADAPTATION STRATEGY

A research study completed in 2020 to quantify climate change risks for intense rain events and the potential impact on storm water infrastructure concluded that the future holds greater uncertainty and risk for more intense 1-in-100-year rain events. The following storm water asset management practices will help adapt to future uncertainties and provide greater resiliency for our climate change strategy:

- On-site storm water management requirements for new developments
- Incorporation of green storm water infrastructure in new neighbourhoods
- Low Impact Development Guidelines
- Flood Control Strategy
- Overland drainage system improvements
- Drainage Regulation Project
- Incorporation of new Intensity-Duration-Frequency (IDF) curves for design storms, and reduced roadway ponding depth allowances into the storm water system design standards

Improvements

- An algae removal device is being purchased in 2023 to reduce the time and cost of algae removal. This will allow operational departments additional time to complete other services.



Lakewood Pond

- A project is underway (2022-2023) to survey culverts near the edge of City limits to be included in the City's GIS database.
- A bathymetric survey program was initiated to monitor sediment levels in wet ponds throughout the City. This will help plan and budget future dredging activities.
- The City is participating in a steering committee (along with other stakeholders across Canada) to develop publicly available specifications for the testing and verification of oil and grit separators and storm water filtration devices. The specifications will help standardize requirements for the devices in the country.



Montgomery Place Ditch and Culvert

THE PATH FORWARD

- The current physical condition of storm water assets will continue to be assessed with an emphasis on maintaining and preserving the infrastructure to prevent higher future costs. Annual asset and preservation funding for storm water sewers has increased recently to provide more emphasis on pipe lining to achieve lowest lifecycle costs. Required storm water asset maintenance activities will be assessed and prioritized.
- The second phase of the Montgomery Place Drainage Improvement Project is being constructed in 2023 and 2024. The total project will include \$8 million in drainage improvements for the neighbourhood before 2027.
- The CN Industrial Drainage Improvement Project is planned to be constructed over 2023 and 2024 including an estimated \$6.4 million in construction costs.
- The \$54 million Flood Control Strategy will be implemented to protect as many properties as possible from flooding within the available budget by 2028. The third and fourth projects will include construction of underground infrastructure and dry ponds/storm water storage in Weaver Park and Brevoort Park (subject to a feasibility assessment and approval) in 2023 and 2024 respectively.
- Although most of the City's storm water ponds are relatively new, sedimentation building up in older ponds will require removal to maintain performance. The amount allocated to storm pond preservation is increasing to fund this future required work.
- Creation of a capacity condition assessment is needed to document storm sewer capacity issues for the City, particularly in older neighbourhoods that were constructed to different design specifications (prior to 1989).
- Documenting existing levels of service for current storm sewer maintenance, operations and preservation is critical in forming the path forward. Levels of service can then be optimized utilizing current funding and improvements can be planned in future budgets while balancing other initiatives.



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



City of
Saskatoon