Attachment 1

Storm Water Utility Business Plan

Saskatoon Water
Transportation & Utilities Department

City of Saskatoon

Contents

EXECUTIVE SUMMARY

Saskatoon's Storm Water Utility funds storm water management and flood protection services, including ongoing operations and maintenance of assets with an estimated replacement value of $3.4 billion. The Utility also has monitored and stabilized the east riverbank to protect strategic public property. The Storm Water Utility has a 2017 total budget of $6.2 million, which includes $3.5 million for system operating and maintenance expenses and a transfer to capital of $2.7 million.

An assessment over the last year has identified storm water challenges and priorities. The business plan focuses future resources on continued assessment, maintenance, and preservation of existing storm water infrastructure rather than capacity expansion. Highlights include the following:

- Assessing the current condition of storm water assets, and then maintaining and preserving existing storm water infrastructure to prevent higher future costs.
- Addressing unique ongoing drainage challenges throughout the Montgomery neighbourhood.
- Reducing risks and issues caused by sump pumps and cross connections with the sanitary sewer system.
- Updating and enforcing drainage bylaws.
- Incorporating the impacts of climate change, higher intensification of developable land, and increased hard surface ratios in storm water design standards for new developments.
- Monitoring groundwater and riverbank slope stability and developing a Slope Stability Management Framework.
- Implementing a communication plan to increase awareness of public and private responsibilities for storm water drainage.

The plan recommends that the Storm Water Utility continue to fund east riverbank monitoring and remediation, including a $3.0 million reserve for emergency slope remediation to protect strategic public infrastructure, such as bridges, Saskatchewan Crescent, and Meewasin Trail.

The plan recommends that the Flood Protection Program (FPP) levy, which is scheduled to end December 2018, be extended and phased out at the end of December, 2021, with an equivalent increase to the Equivalent Runoff Unit (ERU) used for Storm Water Management Charge. Total charges for single-family residential properties for storm water management and flood protection would be the same in 2022 as the annual charges from 2012 to 2018 ($107 annually). The minimum total FPP and ERU paid by multi-residential, industrial, commercial, and institutional properties would increase from $160 in 2018 to $214 in 2022, and the maximum would increase from $5,334 to $10,680.

Advantages to this approach include contributing to closing the gap for asset maintenance and preservation, simplification of Utility Bill charges by January 2022, and enhancement of the user-pay principle. Annual total funding is expected to increase from $10.4 million in 2018 to $13.7 million in 2022.

Year	FPP	Storm Water ERUs - Status Quo	ERU Additional Phase In	Total New Charges	Total FPP & ERU
2016 (Actual)	$3,899,055	$6,107,661	0	0	$10,006,716
2017	$3,957,541	$6,209,000	0	0	$10,166,541
2018	$4,016,904	$6,360,000	0	0	$10,376,904
2019	$3,057,868	$6,455,400	$1,654,477	$4,712,345	$11,167,745
2020	$1,996,604	$6,552,231	$3,358,588	$5,355,192	$11,907,423
2021	$1,013,276	$6,650,514	$5,113,451	$6,126,727	$12,777,241
2022	0	$6,750,272	$6,920,203	$6,920,203	$13,670,475

The following business plan outlines the Storm Water Utility's goals and objectives, its operating environment, key actions and responsibilities, and the funding strategy.

1.0 INTRODUCTION

Saskatoon's Storm Water Utility funds storm water management and flood protection services, including ongoing operations and maintenance of assets with an estimated replacement value of $3.4 billion. The Utility also has been tasked with monitoring and stabilizing the east riverbank to protect strategic public property from damages influenced by high groundwater levels. The Storm Water Utility has a 2017 budget of about $3.5 million for operating expenses and a transfer to capital of $2.7 million for a total budget of $6.2 million.

The Storm Water Utility Business Plan provides background on the utility and its challenges. Priorities and shared responsibilities are identified to more effectively utilize resources in managing storm water.

1.1 Background

The Storm Water Utility was established in 2002 with uniform rates for all types of properties, regardless of size or type to fund storm water services. The current "Storm Water Management Charge" rate structure was approved by City Council in August 2011 and implemented in January 2012, with charges for commercial properties reasonably proportional to the storm water generated based on property size and surface imperviousness.

The following divisions provide services funded by the Storm Water Utility.

Saskatoon Water (SW) provides overall storm water management including:

- Monitoring rainfall.
- Assessing runoff factors of multi-residential, commercial, industrial, and institutional facilities.
- Modelling storm system capacity relative to varying levels of rainfall volume and intensity.
- Engineering support for drainage projects.
- Community liaison for storm water issues.

Water & Waste Stream (WWS) provides the ongoing day-to-day operations and maintenance of storm water ponds, outfalls, and below ground storm water drainage and infrastructure.

Roadways and Operations (R&O) maintains above ground drainage including a fall street sweep and culverts.

Major Projects (MP) tracks the infrastructure inventory, completes condition assessment, and oversees the asset preservation program.

Construction & Design (C&D) operates the "Connection Desk" and provides project management services, including survey work and inspection, for storm water infrastructure construction projects.

Community Standards (CS) provides drainage inspections, drainage advice to residents and developers, bylaw updates, and bylaw enforcement.

Environmental & Corporate Initiatives (ECI) provides leadership in activities that contribute to storm water practices that protect our watershed and natural resources.

Communications (Comm) assists in initiatives to enhance citizen awareness and engagement to improve flood resiliency.

Corporate Revenue (CR) provides storm water billing and collection services.

Transportation & Utilities Business Administration (BA) provides accounting and administrative support.

Storm Water staff also support the work of other divisions, such as Planning & Development (P&D) and Building Standards (BSD).

1.2 Strategic Framework

Our Vision
The City of Saskatoon is a world leader in storm water design and asset management. We effectively collaborate with citizens and partners to utilize storm water as a resource and mitigate the risk of flooding.

Our Mission
The Storm Water Utility provides safe, efficient, and cost-effective storm water management to Saskatoon citizens through teamwork and innovation. We develop proactive strategies that ensure the effective long-term performance of our storm water systems, supported by sustainable, accountable, and responsive funding structures. Storm water management charges entrusted by citizens are used as effectively as possible to minimize storm water and snow melt impacts.

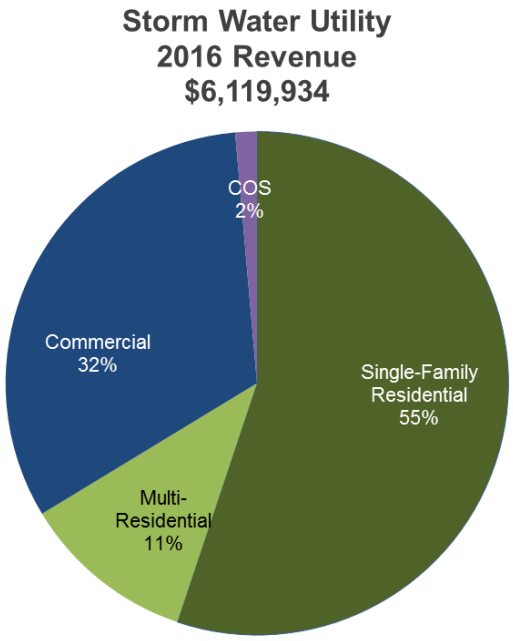
Our Corporate Values
- Trust
- Integrity
- Respect
- Honesty
- Courage

Leadership Commitments
- Reliable and Responsible Service
- Strong Management and Fiscal Responsibility
- Effective Communication, Openness and Accountability
- Innovation and Creativity

1.3 Our Customers

Storm water customers include residential, commercial, industrial, and institutional properties that generate storm water runoff to the City's storm sewer system. In 2016, storm water charges were applied to 63,800 single-residential properties; and 4,100 multi-residential, commercial, industrial, and institutional including City properties. Agriculture-zoned property, roads, right-of-ways, and City-owned parks were exempted from storm water charges.

With the user-pay rate system, commercial, industrial, and institutional properties account for 5% of the number of customers and one third of total revenues. Residential customers, including single and multi-residential, account for 95% of customers and two thirds of revenues.



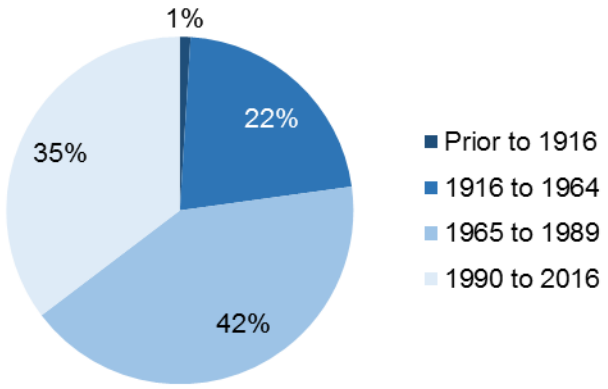
F1.4 Our Infrastructure

The replacement value of Saskatoon's storm water management infrastructure is estimated at over $3.4 billion. The storm water minor and major systems are described below.

The **minor system** consists of piping, manholes, catch basins, and outfall structures that are able to convey runoff from more frequent, lower intensity storm events, up to a "1-in-2-year" storm event. The system includes 734 km of storm sewer pipes, 4 km of force mains, 9,277 manholes, 13,367 catch basins, 2,941 service connections, and 93 outfalls. Two lift stations also support the system.

Asset	2016 Inventory[1]
Storm Water Sewers	734 km
Manholes	9,277
Catch Basins	13,367
Leads	13,207
Service Connections	2,941
Dry Ponds	9
Wet Ponds	25
Culverts	259 (8.2 km)
Water Outfalls	93
Sub-drainage	44 km
Oil & Grit Separators	1
Replacement Value	**$3.4 Billion**

Storm Water Infrastructure by Year Constructed



Approximately 1% of the storm water lines were constructed prior to 1916 and an additional 22% were constructed prior to 1965. About 35% of the storm water infrastructure was constructed since 1990.

The **major system** consists of overland street drainage, nine dry ponds, 25 wet ponds (including three natural ponds and two constructed wetlands), 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.

72 inch Sewer Pipe in Saskatoon, between 1912 and 1915 (Saskatoon Library, 2016)

[1] Source: ArcMap GIS

New neighbourhoods are designed so that roadways and drainage channels are used to convey runoff from storm events up to “1 in 100-years”.[2] Older neighbourhoods did not have the same design standard; therefore, water from higher intensity storms are more likely to encroach on properties, and in some cases, buildings at low sites in older neighbourhoods.

In addition to retaining runoff from larger rain events and reducing localized flooding, storm ponds also provide the following additional benefits:

- Improving the quality of runoff entering the South Saskatchewan River through removing pollutants and particulates.
- Attenuating the peak flow rate of storm water to reduce flooding.
- Providing natural areas to support biodiversity of plants, birds, and insects.
- Providing recreation opportunities such as non-motorized boating in the summer and skating in the winter.
- Improving quality of life through enhancing the neighbourhood’s aesthetics.

Wildwood Storm Water Pond

Sub-drainage to drain groundwater is installed along the riverbank (1.6 km) and under roadways (44.2 km). Riverbank sub-drainage includes 32 segments, which was mostly installed in the 1950s and 1960s.

[2] The utilization of surface for conveyance of storm water during greater than 1-in-2 year storm events began to be implemented in new neighbourhoods in 1989 after the Stanley Report.

1.5 Goals and Objectives

Asset and Financial Sustainability: Efficient Resource Use

- Conditions of storm water assets are known so effective maintenance and preservation is undertaken.
- Existing storm water infrastructure is protected through a lowest life cycle asset management costing approach.
- Divisions work collaboratively to implement storm water management strategies.
- Partnerships with community groups and expertise leverage City resources to achieve common goals for storm water management.
- Properties are fairly assessed for the storm water runoff they generate to maintain a fully funded user-pay utility.
- Activities funded by the Storm Water Utility are transparent.

Continuous Improvement: Protect Properties from Flooding

- Storm water infrastructure and drainage are maintained at approved levels of service to protect properties and enhance quality of life.
- Investments to expand storm water infrastructure are based on costs and available funding relative to economic and non-quantifiable benefits of reducing flood risk.
- Citizens and developers understand their responsibilities and take actions to use storm water as a resource and protect properties from flooding.
- The sanitary system is protected from storm water cross connections.
- Sump pumps are used effectively to protect properties without negatively impacting other infrastructure.
- Ongoing ponding and drainage issues during spring melt and rain events are minimized.
- Long-term storm water infrastructure planning for a more flood resilient community considers the impacts of climate change and increased urban densities (intensification of land use).

Quality of Life: Safety

- Citizens are protected from safety risks associated with flooded underpasses, intersections and manholes, storm ponds, and riverbank slumping, through awareness and emergency response strategies.

Quality of Life: Recreation

- Opportunities for recreation activities are incorporated with storm water ponds when feasible.
- Access to Meewasin Trails is maintained through riverbank slope management**.**

Environmental Leadership: Protect Water Quality and our Watershed

- Citizens are aware and supportive of preventing pollutants from entering the storm water system and draining to the river.
- Storm water infrastructure planning and design incorporates best management practices for high water quality.
- Appropriate bylaws are enacted and enforced to protect water quality.

- Monitoring and reporting of storm water quality reinforces citizen confidence in the quality of runoff draining to the river.

Moving Around: Roadway and Pathway Drainage

- Roadways and sidewalks drain effectively during spring melt and intense rain events to minimize disruptions to traffic and pedestrians.

Confederation and Laurier Drive Intersection

2.0 ENVIRONMENTAL SCAN

2.1 Seasonal Rainfall

Between 1900 and 2016, Saskatoon received an average seasonal rainfall of 265 mm per year. Seasonal rainfall has ranged from a low of 139 mm in 1941 to a high of 569 mm in 2010. The third and fourth highest annual seasonal recorded rainfalls occurred in 2012 and 2014, respectively. Four of the top ten highest rainfalls have occurred since 2005.[3]

Rain events are classified according to intensity, duration, and frequency (IDF)[4]. A rain event with a 1-in-2 year return period has a 50% chance of occurring in any year. A rain event with a 1-in-100 year return period has a 1% chance of occurring in any given year. See Appendix 1 for criteria for determining the return period of a rain event in Saskatoon. Return periods are used for design standards for major and minor components of Saskatoon's storm water infrastructure.[5]

In 2012, the City installed eight rain gauges to provide more real time rain data at locations throughout the city. Between 2012 and 2016, Saskatoon recorded 28 days with rain events exceeding a 1-in-2 year return period. Rain events with a return period of five years or more occurred in 2013, 2014, and 2015. (See Table below.) The rain events over the last five years resulted in minimal property damage.

Top 10 Highest Seasonal Rainfall Years in Saskatoon

2010	**569 mm**
1923	420 mm
2012	**401 mm**
2014	**391 mm**
1927	391 mm
1921	389 mm
1954	387 mm
1942	385 mm
2005	**385 mm**
1903	379 mm

Overall Frequency of Saskatoon Rain Events (2012 to 2016)

	Return Period	2012	2013	2014	2015	2016	Total
Overall	2 – 5 Year	8	5	6	3	3	25
	5 – 25 Year	0	1	1	0	0	2
	25 – 100 Year	0	0	0	1	0	1
	> 100 Years	0	0	0	0	0	0
	Total	**8**	**6**	**7**	**4**	**3**	**28**

[3] Seasonal rainfall is from April 1st to September 30th. Rainfall data prior to 2012 is from the Environment Canada rain gauge and caution is needed in relying on their data. As recent as 2016, Environment Canada reported annual rainfall which included "incomplete data". Seasonal rainfall data from 2012 to 2016 is an average of the eight City of Saskatoon rain gauges.

[4] The Intensity Duration Frequency (IDF) curves being used by the City are based on rainfall recorded at the Saskatoon International Airport by Environment Canada from 1926 to 1986.

[5] City of Saskatoon Design and Development Standards Manual: Section Six, Storm Water Drainage System. Available: https://www.saskatoon.ca/sites/default/files/documents/transportation-utilities/construction-design/new-neighbourhood-design/6._2017_section_six_-_storm_water_drainage_system.pdf [May, 2017]

Rain events are often localized and do not occur throughout the city. The eight rain gauges recorded an average of 11 rain events with a return period of more than 1-in-2 years over the last five years.

Saskatoon has recently experienced higher numbers and intensities of storm events than would be expected. The City is reviewing the return period criteria and the possibility of changing the requirement for the minor system design to handle a 1-in-5 year rain event because of the high likelihood of more intense rain events occurring as a result of climate change.

2.2 Benchmarking

Municipalities have different methods for charging for storm water, which make direct comparisons challenging. The 2017 Storm Water Utility Program Comparison report prepared by Saskatoon Water compared the Saskatoon's program with 13 other cities for different property types on the basis of costs and user-pay. Saskatoon was among the leading user-pay cities, ranking sixth among the 13 cities, which range from flat rates for all customers (e.g. Calgary) to charges for all customers based on area size and imperviousness (e.g. Mississauga). Some cities offer credit programs for properties where measures have been taken to reduce runoff.

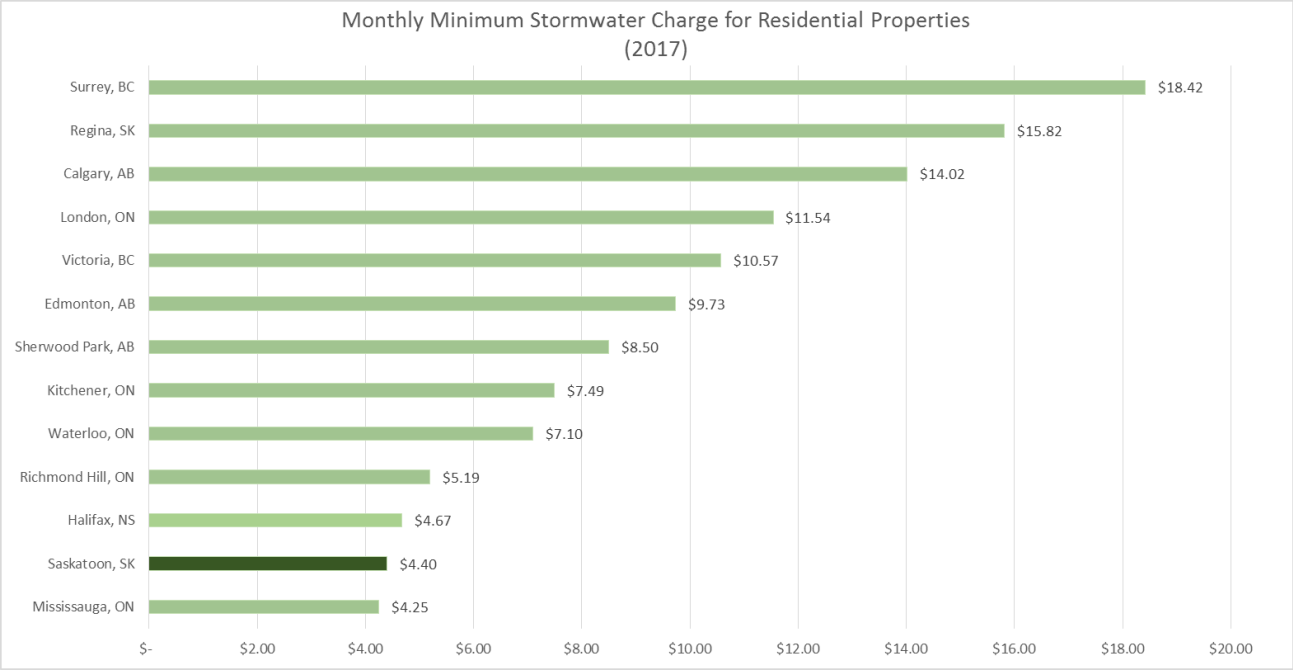
Among the 13 cities, Saskatoon has the second lowest storm water charge in 2017 for residential properties at $52.80.[6] Annual residential storm water charges for properties with buildings range from $51.00 in Mississauga, ON, to $221.00 in Surrey, BC, and are $190.00 in Regina, SK.

Saskatoon has between the fifth and eighth lowest charge for commercial properties, depending on the size and property characteristics. Annual storm water charges for a typical large shopping centre ranges from $102 fixed rate charge in Sherwood Park to $192,915 in Mississauga. Saskatoon's maximum annual storm water charge is $4,488 in 2017 and will increase to $5,280 in 2018. Unlike Saskatoon, which has a cap of 100 ERUs in 2018, some cities have no cap which results in higher charges. In 2016, Mississauga implemented a storm water charge with no cap, resulting in a 2017 charge of $3.24 million for the Pearson International airport.[7]

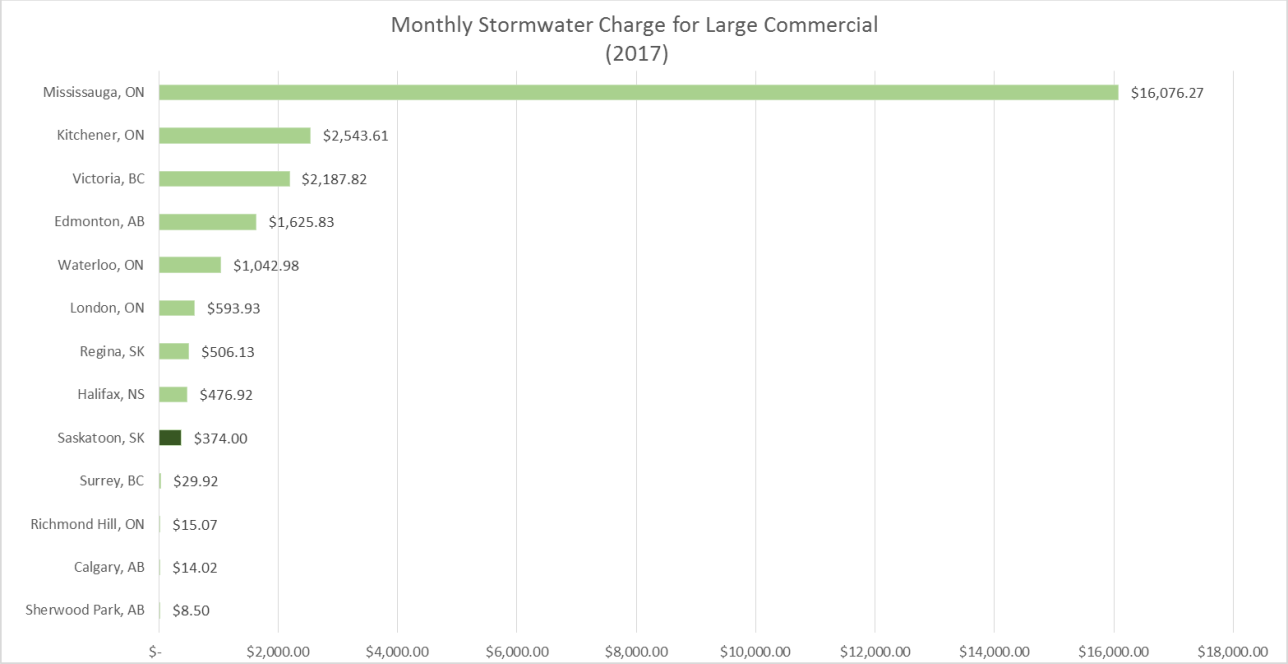
Winnipeg has no storm water utility; therefore, was not included in the benchmarking. Winnipeg has a charge of $71 for the connection of a sump pump to the sanitary system.

[6] Saskatoon's temporary Flood Protection Program annual levy of $54 per meter is not included.
[7] The storm water charges are being disputed by the property owner. https://www.mississauga.com/news-story/7225036-city-of-mississauga-sues-operators-of-pearson-airport-over-stormwater-fees/

Monthly Minimum Storm Water Charge for Residential Properties (2017)



Monthly Storm Water Charge for Large Commercial (2017) [8]



[8] Shopping Centre with an area of 46,426 m^2 and impervious area of 42,082 m^2. *Assumed zoning code of CB1.

2.3 Strengths

User-Pay Funding Model: Saskatoon has been a leader among Canadian municipalities in implementing a user-pay funding model for commercial, institutional, industrial, and multi-residential properties, phased in over seven years from 2012 to 2018. Storm water charges for these properties approximate the proportionate amount of runoff from their properties to the storm water system.

Robust Post-1989 Design Standards: In 1989, storm water standards for new neighbourhoods were established to handle 1-in-100 year storms, with streets designed to convey water during severe storms. Storm water ponds in low lying areas are used to manage runoff to prevent flooding and improve water quality prior to flowing into the river.

Best in Class Modelling: Saskatoon has strong in-house infiltration and modelling expertise that provides the necessary understanding of storm water runoff and the infrastructure necessary to manage it.

2.4 Weaknesses

Historical Design Standards: Surface flooding during high-intensity storms is an issue for many low lying areas that were developed prior to Saskatoon's new design standards adopted in 1989. The increased number of rain events that have been experienced in recent years suggest that the IDF curves based on past rainfalls, and used for design standards, must be updated to be representative of rainfalls that we may expect in the future due to climate change.

Condition of Older Infrastructure: Storm water infrastructure has a limited life expectancy. Over time, components such as pipes, culverts, and catch basins must be repaired or replaced. Some of Saskatoon's existing storm water infrastructure dates back to 1908. Improving our strategy to assess the condition of our infrastructure will ensure we are investing in rehabilitation and renewal for lowest life cycle costs.

Ongoing Maintenance: Storm water infrastructure requires ongoing maintenance to ensure that the system is operating at capacity. Further evaluation is needed to identify maintenance priorities and allocate resources to these areas.

Drainage Bylaw Enforcement: Neighbourhood storm water drainage is negatively impacted by properties which are developed contrary to approved design standards, resulting in flooding for homeowners and their neighbours. In the Montgomery neighbourhood, drainage ditches and culverts are often not properly maintained, particularly when new development occurs. Inspections when development occurs will help to minimize future problems.

Sump Pump Drainage: Over the years, various standards for weeping tiles and sump pump drainage have been in effect. Issues that currently impact citizens and neighbourhoods with high ground water include drainage from sump pumps that cause slippery sidewalks and ponding in yards. Drainage into the sanitary system increases

wastewater treatment costs and increases the risk of sewage back-ups during intense rain events.

2.5 Threats

More Frequent Intense Storms: Rainfall events are becoming more frequent and more intense. With increasing economic losses due to flooding, this trend is unlikely to subside. According to Environment Canada, severe weather events that used to happen every 40 years can now be expected every six years.[9]

Confederation Drive

Higher Groundwater Levels: Higher groundwater levels have changed drainage patterns as water is unable to seep into the ground. If high groundwater levels continue, they will impact neighbourhood drainage and contribute to east riverbank slumping and slope failure.

Infill Development: More infill reduces greenspace and increases surface runoff, placing a higher demand on existing storm water infrastructure. Cumulative impacts of infill development on existing storm water infrastructure need to be determined to ensure that appropriate policies and standards are in place to minimize surface flooding.

Regulatory Requirements: Evolving federal and provincial regulations may impact storm water runoff quality to the river, requiring new standards for storm water infrastructure.

Storm Water Pond Integrity: Sediment build-up in storm water ponds have the potential to put their effectiveness at risk, and will require significant costs in the future to maintain and remediate. The cost of regular maintenance is an important consideration when evaluating new storm water ponds.

2.6 Opportunities

Community Awareness: Communications can increase awareness of how residents can take actions that will make their properties more flood resilient, and understand responsibilities they have to minimize drainage from their properties to neighbours' properties.

New Technology: New technologies can be used to make the City more flood resilient. For example, live web cams can be used to monitor intersections that are at risk of flooding to dispatch staff and close roads in a timely manner to improve safety during

[9] Insurance Bureau of Canada (2015). "Toward a safer Saskatchewan: An Update from Saskatchewan's Home and Business Insurers," page 4. Available: http://assets.ibc.ca/Documents/Facts%20Book/Industry_Updates/2015/SK-SOI.pdf [2017, May]

intense rainfall events. Other new technologies can be used to enhance monitoring and improve the quality of water entering the river.

Low Impact Development (LID): *Low Impact Development: Design Guide for Saskatoon* was prepared by the City in 2016 to provide options to reduce runoff volume, improve runoff water quality, and delay peak runoff flows from entering the storm water system.[10]

Green Infrastructure: The development of the City's Green Infrastructure Strategy will contribute to storm water planning that incorporates natural systems and creates new designs to mimic natural features and processes.

2.7 Key Risks

The following safety, property damage, and environmental risks are associated with storm water and its related infrastructure.

Risks of injuries and fatalities associated with:

- Intersections and streets when they flood.
- Manhole lids coming off during intense rains and hitting pedestrians or vehicles
- Open manholes.
- Slippery sidewalks due to rain, snow, or discharge from sump pumps.
- Riverbank instability influenced by high groundwater levels.

Risks of public and private property damage associated with:

- Storm sewer capacity in some areas.
- Drainage in some areas.
- Riverbank instability.

Risks to the environment associated with:

- Outfalls and other infrastructure that may catch beavers and other small animals
- Spillage, dumping, and drainage of toxic materials into catch basins

> ***There will always be a chance of basement flooding, no matter what municipalities or private homeowners do to reduce the risk.***
>
> Institute for Catastrophic Loss Reduction

[10] City of Saskatoon (2016). *Low Impact Development: Design Guide for Saskatoon.* Available: https://www.saskatoon.ca/sites/default/files/documents/transportation-utilities/construction-design/new-neighbourhood-design/low_impact_development_design_guide.pdf [May, 2017]

3.0 STORM WATER MAINTENANCE AND PRESERVATION

3.1 Minor System

Condition Assessment

Storm Collector and Trunk Main conditions are determined by using a Closed Circuit Television (CCTV) inspection. Between 2013 and 2016, over 52 km or about 7% of storm sewers were cleaned and inspected, mostly as part of the roadways preservation work. A structural condition grade is assigned to each pipe based on a five-point scale from “A” to “F”.

In 2016, Major Projects contracted the cleaning and inspection of an additional 25 km of storm sewer mains. Priorities included storm water sewers servicing known flood risk areas and the east riverbank area, and a sample of storm sewers of various ages and types in different neighbourhoods.

Of the 25 km of pipes contracted, 11.5 km were completed in 2016 and 3 km could not be cleaned with available equipment. Approximately 2 km of pipes were given a grade of F. Inspections identified the following issues:

- High levels of sediment (50% or more blockage)
- Concrete, bricks, and rocks in the pipes
- Large pipe separations and missing walls
- Offset joint repairs
- Manhole drop structures
- A beaver dam

The remaining contracted sewer inspections were completed in early 2017.

The pictures shown on this page are of blocked storm water pipes.

Force Mains: Force mains cannot be assessed using CCTV inspection because there are no entry chambers. The overall condition is considered "Very Good" because the average age is 22 years old and the majority of the inventory is plastic.

Service Connections: The condition of plastic connections are considered to be "Good" based on low failure rates. The seven remaining fiber connections in the City are generally considered to be in "Poor" condition as they have a higher probability of failure.

Catch Basins & Leads: Catch basins are visually inspected and cleaned yearly.

Manholes: Manholes are visually inspected prior to road resurfacing projects and as part of an annual condition assessment program. In 2015, Major Projects inspected 1,000 manholes to develop future manhole rehabilitation and inspection programs.[11]

Culverts: Similar to storm mains, culvert conditions are determined through CCTV inspections prior to road resurfacing projects. A desk-top review of culverts in the Montgomery neighbourhood was completed in 2015.

Outfalls: In 2016, Saskatoon Water and WWS visually inspected and reported on all outfalls and developed an action plan for maintenance. Following the report, WWS removed debris from several outfalls in 2016, with additional maintenance planned for 2017.

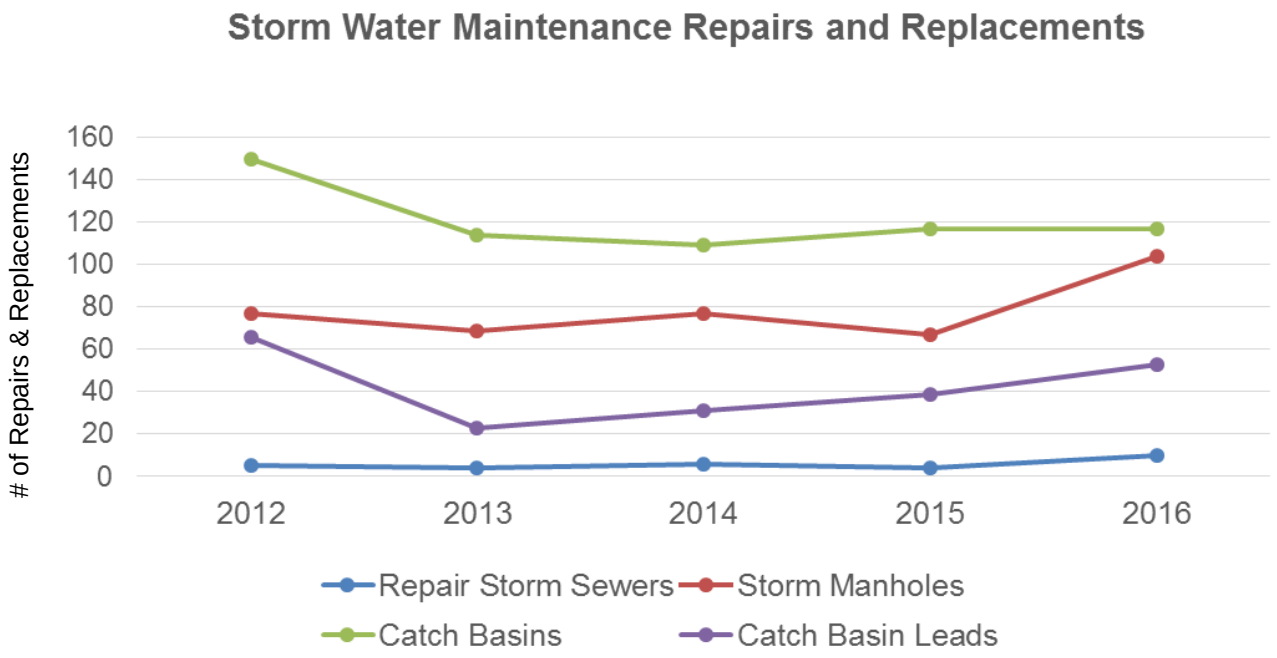
Maintenance and Operations

The Wastewater Treatment Plant (WWTP) maintains the Stonebridge and Idylwyld Storm Water Lift Stations.

R&O maintains and keeps the minor system's above ground storm water infrastructure (e.g. catch basin grates, culverts) in good operating condition. The fall street sweep is funded by the Storm Water Utility to minimize leaves and debris from blocking catch basins. The picture to the right is of a blocked catch basin.

WWS operates and maintains below-ground storm water infrastructure including sewer mains, catch basins, catch basin leads, manholes, and connections. Funding for the 734 km of storm water sewer maintenance is approximately one-quarter the funding allocated for the 1,075 km of waste water sewer lines. The chart below shows the number of WWS repairs and replacements of storm water infrastructure.

[11] Public Works contracted 32 manhole replacements in 2014 at a cost of $350K.



Preservation

Most of the City's storm water infrastructure preservation program has been reactive to address infrastructure failures, with emergency repairs being a priority for funding. For instance, in 2015, resources were allocated to an emergency storm water main repair at Mackie Crescent.

Some sewer mains have been rehabilitated using cured-in-place pipe lining, which is more cost effective than traditional open excavation replacement methods. No excavation is required as the liner is inserted through the manhole and lines the existing pipe with a new pipe. Force mains are replaced by open trench excavation.

Identifying our City's aging storm water system's current condition will provide the foundation for a proactive preservation plan, including funding requirements, to reduce the long-term life cycle costs of our assets.

Some areas throughout Saskatoon experience ongoing drainage issues with localized surface flooding and ponding, which results in ongoing maintenance costs absorbed by WWS and R&O. Each situation is unique – sometimes drainage issues and flooding risk can be significantly reduced with a relatively small investment in engineered design and grading or reconstruction of public property, such as lanes and easements. The economic payback, as a result of reduced maintenance costs, can be less than ten years for these sites.

Actions

- Develop a long-term annual inspection plan to strategically inspect storm sewers and report updates in an annual "State of Storm Water Infrastructure Report". (SW, MP)

- Complete annual visual outfall inspections and complete an “Outfall Assessment Report and Action Plan”. (SW, WWS)
- Prioritize the Fall Street Sweeping program to sweep neighbourhoods based on minimizing catch basin blockages. (R&O)
- Complete an asset management plan to rehabilitate strategic storm water mains including lining trunks based on the lowest life cycle cost. (MP, SW)
- Report annually on maintenance and preservation activities of storm water infrastructure. (SW, R&O, WWS, MP)
- Update the City culvert inventory, assess conditions, and prioritize culverts for maintenance and preservation. (SW, R&O)
- Develop and prioritize an annual list of drainage trouble spots that require ongoing maintenance to reconstruct within available budget. (SW, R&O, WWS)

3.2 Major System

Pond Condition Assessment

In 2016, Saskatoon Water, in conjunction with WWS and Parks, conducted a visual assessment and is reporting on all storm water ponds. WWS also conducts water quality monitoring. Dry ponds are visually inspected by WWS as necessary to ensure proper drainage. Ponds have not been thoroughly assessed to determine levels of sediment build-up which could impact effectiveness.

Maintenance and Operations

WWS is responsible for maintaining storm ponds to keep them working, as designed to convey storm water. Citizens living close to storm ponds expect that maintenance will be performed to enhance storm pond aesthetics and prevent odors. Fountains installed in some ponds for aesthetic purposes have high maintenance costs funded by storm water charges.

Invasive species, including goldfish and koi, have been identified in several storm water ponds. Several options are being considered by WWS and ECI to prevent the fish from spreading.

Preservation

Regular sediment removal is needed to keep storm water ponds in good working condition.[12] The cost of removing sediment will vary depending on the size and age of pond, whether it has a pond forebay, and the work required.[13] Other preservation measures also are required to maintain the integrity of the ponds (e.g. In 2016, the

[12] The United States Environmental Protection Agency Storm Water Technology Fact Sheet Wet Detention Ponds recommends removing the bottom sediments every two to five years. https://nepis.epa.gov/

[13] A presentation to the City of Saskatoon by CH2M HILL Canada Limited in October 2016 indicated that an assessment of 11 storm water ponds in Calgary identified average immediate remediation cost requirements of about $139,000 per pond, and future costs averaging $1.75 million per pond. In December, CH2M HILL Canada Limited estimated the cost to assess requirements for two Saskatoon storm water ponds at over $112,000 (does not include remediation).
The City of Guelph has estimated costs of moving sediments from two storm ponds to be $280,000 for one and $1 million for the second.

Storm Water Utility contributed to reconstructing the John Avant Storm Pond retaining wall).

Actions

- Complete annual visual storm pond inspections and complete a Pond Assessment Report and Action Plan. (SW, WWS)
- Complete more comprehensive technical assessments of storm water pond integrity. (SW, WWS, C&D)
- Develop level of service standards for maintenance of storm water ponds. (WWS)
- Implement a plan to eradicate invasive species from the storm ponds. (ECI and WWS)
- Develop a long-term, life-cycle plan with costs for removing sediment from the storm water ponds. (SW, WWS)

3.3 Montgomery

The Montgomery neighbourhood's drainage infrastructure of ditches and culverts is unique in Saskatoon, with distinct drainage and ponding challenges. Drainage issues often occur during spring melt when City crews are called on to thaw frozen culverts with a steamer and to pump out water. The number of calls from citizens requesting City assistance with drainage has varied from 4 in 2016 to up to 50 calls in spring 2017, with an average of about 20 calls annually over the last 6 years.

Drainage challenges may arise due to the following:

- Driveways are constructed that restrict drainage
- Culverts are not built to required standards
- Culverts are damaged
- Culverts become blocked with ice or debris
- Grading is not optimal for drainage
- Residents are unaware of their responsibilities for maintaining culverts in front of their properties

Spring melt in Montgomery Place, 2017

Over time, the sand used by the City in the winter to maintain road safety can fill in ditches, change grades, and reduce the capacity of culverts. Snow clearing operations may contribute to increased snow and debris in ditches.

Although administratively easy to apply, a singular approach to drainage requirements may not result in the most effective allocation of resources because of elevation and grading differences throughout the neighbourhood.

Actions

- Provide guidance for residents who want to modify an existing crossing or build a new crossing using the Private Driveway Crossing Permit process, including site assessment and advice on culvert size and elevations. (SW)
- Assess the feasibility and parameters for a program for rehabilitating Montgomery area drainage. (SW, R&O)

- Collaborate with Community Standards to review options for increasing compliance for private responsibilities for maintaining effective drainage. (CS, SW)
- Update the FAQs used by R&O customer service staff with the Driveway Crossing Permit process and provide to customer service groups for usage (Transportation, BSD, CS, SW, C&D, and R&O.)
- Develop communication flyers on City and citizen responsibilities for culvert drainage and distribute to Montgomery residents. Include this information on the City website. (SW, Comm)

3.4 Cross Connections

Storm and sanitary systems should be completely separate from one another. Inflow and Infiltration (I&I) describes ways that groundwater and storm water enters the sanitary system. Inflow is storm water that enters the sanitary system through a direct connection, such as a sump pump or roof drain that is improperly or illegally connected, or water entering manhole lids during a rain event. Some cross connections between sanitary and storm water systems may be due to errors during construction. Infiltration is groundwater that enters the sanitary system through cracks or leaks in manholes and sanitary sewer pipes caused by age-related deterioration, loose joints, installation or maintenance errors, poor design, and/or root penetration.
Cross connections can result in the following issues:

- Sanitary effluent entering the storm water system could flow untreated to the South Saskatchewan River and harm the environment.
- Sanitary sewers could back up into basements or through manholes onto streets if high volumes of storm water overload the system during intense storms. The average cost of flooding from sanitary sewers are significantly higher than the cost of flooding from overland water in Saskatoon.
- Unnecessary water treatment costs are incurred when clean storm water is transferred to the WWTP, and these costs are transferred to citizens through higher utility rates.
- Due to wet weather flow, the WWTP could experience capacity issues and require expensive capital expansion.

After intense rainfalls caused sanitary backups in 2005 and 2007, sump pumps and backflow devices were installed by residents in high risk zones to reduce damage during severe rain storms. Installation of “winter weather” bypass devices were approved to direct drainage from sumps into the sanitary system during the winter to reduce icy and dangerous sidewalks. Although these connections are to be disconnected in the spring, there is no enforcement.

High groundwater levels have been experienced throughout Saskatoon due to a decade of record rainfall. As a result, sump pumps that were intended to temporarily drain water from intense storms are constantly draining groundwater in some areas. Properties that are most likely to have sump pump issues are in low-lying areas with deep basements. Hampton Village, Willowgrove, and Briarwood are neighbourhoods with a concentration of sump pump issues. (See Appendix #2 for a map of areas with known sump pump issues.)

The following types of issues are associated with continually running sump pumps:

- Wet and slippery sidewalks in summer.
- Green algae growth on sidewalks.
- Icy and slippery sidewalks in the winter.
- Sumps draining to City parks resulting in boggy park areas, difficulty mowing, and rut damage.
- Unauthorized connections to floor drainage and sanitary systems and temporary winter connections not being disconnected in the summer are increasing the risk of sanitary backups during severe rainstorms, particularly as more sumps are connected to the sanitary system.
- Extra costs and strain on the WWTP capacity.
- Wet yards and drainage onto neighbours' properties causing disputes.

Actions

- Identify the extent and cost of inflow and infiltration issues in Saskatoon through quantifying I&I (peak, minimum, average flows) to the WWTP and the cost of treating additional groundwater or storm-related flow. (SW)
- Identify and map locations of cross connections with storm water flowing to sanitary sewers through implementing a plan with existing maps, as-builts, flow meters, CCTV monitoring, and testing. (SW)
- Utilize modelling to identify priorities for actions to eliminate cross connections. Develop and ensure new standards and policies that minimize issues related to sump pumps are followed for new neighbourhoods and areas with redevelopment. (SW, CS, BSD)
- Develop a communication piece for citizens on City of Saskatoon bylaws related to sump pump drainage, why they are important, and ways they can mitigate some of the negative impacts. Include this information on the City website. (See City of Winnipeg website.) (SW, CS)

4.0 STANDARDS, BYLAWS AND ENFORCEMENT

Saskatoon's storm water management is primarily impacted by the following bylaws and standards:

- *Bylaw No. 8379, The Drainage Bylaw, 2005* regulates the drainage of storm water between private properties to protect property and abate nuisances.
- *Bylaw No. 8987, The Storm Water Management Utility Bylaw, 2011* regulates the storm water collection and transmission, the Storm Water Utility, and the charges for all properties benefiting from the system.
- *Bylaw No. 5115, The Sewer Use Bylaw* regulates the use of storm sewers.
- *Bylaw 4785, Private Crossings Bylaw* requires a permit for the construction of driveways across City property.
- *The Design and Development Standards* (*Section Six)* provides updated information on storm water drainage requirements for new developments.

The Drainage Bylaw has not been consistently enforced, which has resulted in unresolved drainage issues and complaints from citizens. A defined process will provide more consistency in following up with complaints, inspections, using bylaw notices, and providing a time period for compliance. Some exceptions and flexibility will be needed to take into account specific circumstances. Community Standards has initiated a comprehensive study to increase drainage standards compliance and minimize runoff issues between neighbours.

The *Private Driveway Crossing Permit* managed by Transportation includes the specifications for a driveway crossing with a culvert. Some citizens may not have been aware of requirements and have installed non-compliant culverts. Information needs to be communicated and be easily available to residents, and a process implemented so that non-compliant crossings that are creating water issue for neighbours are resolved in a timely manner.

Saskatoon Water Engineering & Planning reviews and defines design storm water infrastructure standards for new developments and redevelopments. The standards provide for requisite system capacity and storm water runoff quality to maintain the integrity of the storm water system.

Actions

- Complete a comprehensive study to define a process for more consistency in applying drainage standards. (CS, SW)
- Update the Storm Water Management Utility Bylaw (property exemptions and changes to the ERU rate). (SW, Solicitors)
- Continue to review design standards for redevelopments and new developments to ensure a sustainable storm water conveyance system. (SW)
- Enhance awareness on driveway crossing requirements through flyers and enhanced website. (SW, Transportation, Communications)

5.0 LONGER TERM PLANNING

Storm water infrastructure modelling helps to ensure that adequate runoff capacity is maintained in the storm water system to support development in both greenfield areas and infill areas. Saskatoon Water's modelling capabilities are being applied to identify the storm water system capacity needed to support the *"Growth Plan"* for population growth to 500,000. The assessment identifies high level options and costs under various scenarios.

Longer-term planning also considers changes to design standards and storm water capacity required for more frequent and intense severe rain events. IDF curves identify the significance of rain events and how often it is likely to occur. New IDF curves are being evaluated to take into account climate change and will be incorporated into new design standards.
Other trends being incorporated in storm water capacity modelling and longer-term infrastructure requirements are land use intensification and greater proportion of impervious surfaces in new neighbourhoods and infill properties.

Actions

- Update the IDF curves for rain event return periods and runoff coefficients based on the impacts of climate change. (SW)
- Model the capacity of the storm water system to support short and long-term development using expected runoff based on updated hard surface ratios, infiltration tests, and new IDF curves. (SW)
- Incorporate the impacts of climate change in new storm water infrastructure design standards. (SW)

6.0 EAST RIVERBANK STABILIZATION

Saskatoon's east riverbank has a long history of slope instability influenced by several factors:

- Geology (soil composition and strength)
- Geometry (steep slope)
- Groundwater levels
- Landscaping and associated loading

Record high groundwater levels over the last decade have triggered slope failures and impacted public and private properties. Keeping high usage Meewasin trails and strategic roadways along the riverbank open and accessible is important for Saskatoon's quality of life and attractiveness as a place to live and visit. Over the last five years, remediation has been completed for the following:

- Meewasin Trail and Saskatchewan Crescent at 17th Street (2013)
- Storm sewer outfall due to erosion at 15th Street (2014)
- Meewasin Trail and Saskatchewan Crescent at 16th Street (2016)

The east riverbank is regularly assessed through an extensive spring visual reconnaissance, instrumentation readings, and more detailed and frequent monitoring and analysis of higher risk areas such as the 11th Street slope and between University and Broadway bridges. Regular monitoring reports are provided to local area residents in response to the 11th Street slope.[14]
If a concern related to slope stability is identified, the City identifies and addresses potential safety concerns through trail and road closures, evacuation alerts, and other measures. If more formal investigation is required, the project is considered relative to other priorities and available funding. Qualified external consultants are contracted for formal geotechnical assessment, conceptual designs, and detailed designs. Priority setting for assessment and remediation considers the value and importance of at-risk public infrastructure, expectations for timing of further slope failure, and assessment and mitigation costs. The City does not fund construction on private properties. Riverbank stabilization costs were not incorporated when setting and approving the current user-pay Storm Water Management charge. Although future riverbank slumping is likely, the timing, location, and severity is unpredictable. Based on recent projects, slope and roadway restoration costs range from about $1.5 million to $3.0 million per project.

Actions

- Develop a Slope Stability Management Framework in conjunction with stakeholders. (SW, BSD, P&D, Solicitors, ECI, Meewasin)
- Oversee instrumentation readings and a spring visual east riverbank reconnaissance and report. (SW)

[14] Between 2012 and 2016, over $900,000 has been expended by the Storm Water Utility on geotechnical expertise for the 11th Street slope.

- Oversee continued monitoring and reporting for the 11th Street slope. (SW)
- Collaborate in completing development policies for riverbank areas. (BSD, P&D, SW, Solicitors, Communications)
- Assess slope stability between the Broadway and University bridges using 3-D modelling. Evaluate the benefits and costs of reducing groundwater levels through sub-drainage in high-risk areas for lowest life-cycle costs. (SW, WWS)
- Leverage resources and expertise from Public Safety Canada to assess risks associated with riverbank slope instability. (EMO)
- Secure in-house geotechnical expertise to oversee east riverbank stabilization. (SW)
- Maintain riverbank area storm water infrastructure to high standards. (WWS)

7.0. CITIZEN AWARENESS AND ENGAGEMENT

Effective drainage and storm water management can only be achieved with citizen buy-in. Awareness of storm water challenges will help garner support for funding priorities. A communication and engagement strategy can utilize a variety of vehicles to convey the following information:

- Public and private responsibilities for storm water drainage.
- Best practices and actions that citizens and developers can take to use storm water as a resource and reduce property flood damage including use of Low Impact Development (LID) measures[15].
- Importance of maintaining and preserving storm water assets including ponds and out-of-sight underground infrastructure in order to prevent higher future costs for emergency repairs and replacement.
- Awareness of impending severe rain events and actions to protect safety and minimize property damage.
- Storm water drainage into the South Saskatchewan River and requirements to keep harmful materials from entering the storm water system.

Actions

- Develop and implement a communication action plan to meet the objectives and to include the following vehicles (SW, Communications, Media Relations):
  a. Flyers in targeted areas (11th Street, higher risk areas, Montgomery)
  b. Utility bill inserts
  c. Saskatoon.ca website
  d. Social Media
  e. Public Service Announcements
  f. NotifyNow
  g. Intersection signage
  h. Community meetings
  i. Community Association newsletters
  j. Trade shows (e.g. GardenScape)
  k. Public relations opportunities (e.g. Water Week)
- Participate in Local Area Planning community meetings to increase citizen understandings of neighbourage drainage. (SW, P&D)
- Develop and implement communications for Montgomery residents to increase awareness about drainage, crossing permits, and related bylaws (website and flyers). (Comm, Community Consultants, Community Associations)
- Partner with Meewasin Valley Authority (Meewasin), Trout Unlimited, Girl Guides, Saskatoon Schools, and Partners for the Saskatchewan River Basin to deliver the Yellow Fish Road Program. (ECI, SW, WWS)
- Partner with the University of Saskatchewan and Food Bank (33rd Street Community Garden) to create awareness of rain gardens through brochures, a demonstration project, and display. (ECI, SW, Communications)

[15] *Low Impact Development: Design Guide for Saskatoon* was developed with funding from the Storm Water Utility in 2016.

- Utilize NotifyNow, triggered by Environment Canada severe rainfall warning, to inform residents when precautionary measures to ensure personal safety and/or minimize damage to their property may be necessary. (EMO, R&O)
- Keep local area residents aware of any slope movement and associated risks through regular notices. (SW)
- Provide citizens with appropriate information about invasive species and the safety of storm ponds for recreation activities, such as skating including appropriate updated signage at all storm ponds. (CY, WWS, SW)
- Work with Community Standards to provide information to households on proper sump pump drainage. (CY, SW)

8.0 EMERGENCY RESPONSE PLANS FOR SEVERE STORMS

Robust planning and response plans for severe rain events are important to support public safety and mitigate damage to property from flooding. Flooded underpasses and intersections and risks associated with manhole covers that come off under high water pressure can cause injuries and fatalities. Fifteen locations have been identified to be dangerous during flooding.

R&Os' *Standard Operating Procedures for Water and Sewer: Severe Storm Response*[16] provides emergency procedures to ensure safety and minimize the impacts of flooding during major rain events. Key components include ensuring that flooded roadways are closed and flooded intersections are not left unattended. Challenges can arise when unexpected heavy rainfall causes flooding outside of regular working hours when R&O is unable to respond as quickly as needed to close intersections in a timely manner.

Confederation Drive/Laurier Drive and Idylwyld Drive/ Circle Drive have a history of significant surface flooding. Although it is not feasible to implement further engineering measures to prevent flooding at these intersections, it may be possible to limit the potential damage and hazard to vehicles and improve safety by implementing traffic control measures to alert drivers of potential danger.

Actions

- Update Standard Operating Procedures for Water and Sewer: Severe Storm Response and include protocol that protects public safety through a collaborative and timely response to unexpected severe rain events outside of R&O's and WWS's regular business hours. (WWS & R&O supported by Fire, EMO, Police, & SW)
- Develop protocol for NotifyNow to deploy R&O and WWS staff in a severe storm event after normal working hours to generate a quicker response time. (EMO, R&O, Environment Canada Meteorological Services)
- Develop an Emergency Measures Flood Response Plan to be activated in the event of a severe storm that produces multiple utility losses, catastrophic property damage, and a threat to public safety. (EMO, Corporate Risk, Fire, Police, R&O, WWS)
- Develop a plan for reducing risks associated with manholes and lids. (R&O, WWS, supported by SW)
- Develop a business case for video cameras at intersections with high risk of flooding to serve multiple needs, including triggering closure during flooding. (R&O, Transportation, SW, Police, EMO, SGI)
- Assess the feasibility of installing gates and warning lights at Idylwyld Drive/Circle Drive and Confederation Drive/Laurier Drive. (SW, R&O, Transportation)

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16 https://www.saskatoon.ca/sites/default/files/documents/transportation-utilities/saskatoon-water/SSRTrainersPresentation.pdf

WS-C02 Severe Storm Response does not apply to storms producing multiple utility lossess, catastrophic property damage or a serious threat to public safety.

9.0 STORM WATER QUALITY AND THE NATURAL ENVIRONMENT

Protecting our watershed and the sustainability of our natural environment is integral to overall storm water management. Prior to the 1990s, storm water management focused primarily on controlling water quantity. The focus has since expanded to more emphasis on water quality and the environment. Storm water runoff is increasingly seen not as a liability but as a resource. Saskatoon Water is collaborating with P&D, ECI, and other stakeholders in developing a Green Infrastructure Strategy that positions storm water as a multi-purpose resource. This long-term strategic framework also considers natural areas, climate change, and cumulative impacts of growth on our watershed in relation to storm water management.

Several City divisions, in addition to Meewasin and other federal and provincial bodies, have roles in protecting our watershed through regulating, planning, monitoring, reporting, and enforcing runoff quality, as well as operations and maintenance practices. An enhanced understanding of storm water runoff quantity and quality can be achieved through storm water monitoring and reporting against common standards.[17]

Actions

- Collaborate with stakeholders to complete the Green Infrastructure Strategy. (P&D, ECI, SW, Parks, Meewasin)
- Collaborate with Meewasin and other stakeholders to develop standards for measuring and reporting water runoff quality. (ECI, SW))
- Increase source control for storm water runoff through oil and grit separators and low impact development. (SW, MP, C&D)
- Review and revise bylaws to ensure they are effective in sustaining the quality of water entering our watershed. (ECI, SW)
- Review and revise a response plan to minimize hazardous spill materials from entering the storm water system and watershed. (ECI, R&O, WWS)

[17] Saskatoon Water's Environmental Laboratory completes regular water quality sampling testing, and reporting for eight major outfalls. Testing and analysis following recognized procedures is completed for factors such as temperature, residual chlorine, phosphorous, nitrate, pH, coliform, etc.

10.0 UTILTY BILLING AND MANAGEMENT

A thorough assessment of revenues completed in 2016 identified gaps in collected revenues due to dated aerial maps initially used to assess hard surfaces and related charges for commercial, industrial, institutional, and multi-residential properties; and previous years' billing gaps due to reorganization and computer programming glitches.

Managing and evaluating the Storm Water Utility operating and capital budgets is complex because several divisions allocate expenses to Storm Water accounts and have various priorities to balance. Continued efforts are needed to ensure that appropriate expenses are budgeted, charged, and approved to Storm Water accounts so it can operate as a transparent user-pay utility.

Actions

- Continue to monitor and review the process for assessment and billing in collaboration with Corporate Revenue to ensure that billings for multi-residential, commercial, industrial, and institutional properties incorporate changes that impact storm water charges. (SW, CR)
- Complete a full evaluation of runoff for commercial, industrial, institutional, and multi-residential properties after the aerial photo is updated in 2017. (SW)
- Collaborate with other divisions to determine a more effective process for approving and allocating costs to appropriate operating and capital accounts and job numbers to allow for more effective budget management. (BA, SW, CY, R&O, WWS, C&D)

11.0 FINANCIALS

11.1 Revenues

Storm Water Management Charge

The Storm Water Utility is funded by the Storm Water Management Charge. The unit of measure is an ERU, which is used by many municipalities for storm water utility billing. A single family residential dwelling is deemed to produce one ERU of storm water and represents 265.3 m^2 of impervious surface such as roofs, driveways, and sidewalks.

One ERU valued at $4.40 per month ($52.80 per year) is the amount charged to single family residential properties. Commercial, industrial, institutional, and multi-residential properties can generate significantly more storm water than single family residential properties generate. Therefore, they are charged multiple ERUs ranging from an annual minimum of two ERUs ($105.60) to a maximum of 85 ERUS ($4,488) in 2017.

The seven-year phase-in of ERUs charged to commercial sites began in 2012 with the annual caps shown in the table.

Year	Maximum Commercial ERUs	Annual Cost
2012	10	$ 528
2013	25	$1,320
2014	40	$2,112
2015	55	$2,904
2016	70	$3,696
2017	85	$4,488
2018	100	$5,280

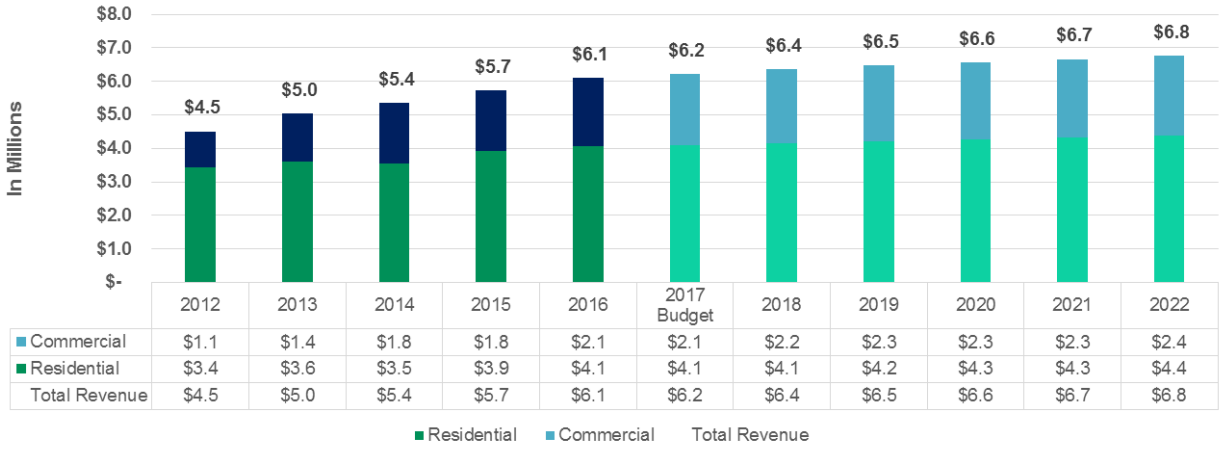
Roads, right-of-ways, and property zoned as agricultural are exempt from storm water charges. In 2014, the City exempted parks from future Storm Water Utility charges, which reduced Storm Water Utility revenues by about $200,000 per year.

Approximately one third of Storm Water Utility revenue is currently paid by commercial customers and about two thirds is paid by residential, including multi-residential, customers.

Revenues of $6.2 million are expected in 2017. The following graph shows actual revenues and future revenue projections if there were to be no change in fees based on the phase-in of the maximum commercial ERUs from 85 ERUs in 2017 to 100 ERUs in 2018 and 1.5% annual growth (about $100,000 per year) after that.[18]

[18] Saskatoon population growth projected by Conference Board of Canada is 1.5% annually.

Storm Water Utility Status Quo Revenue (In $ Millions)



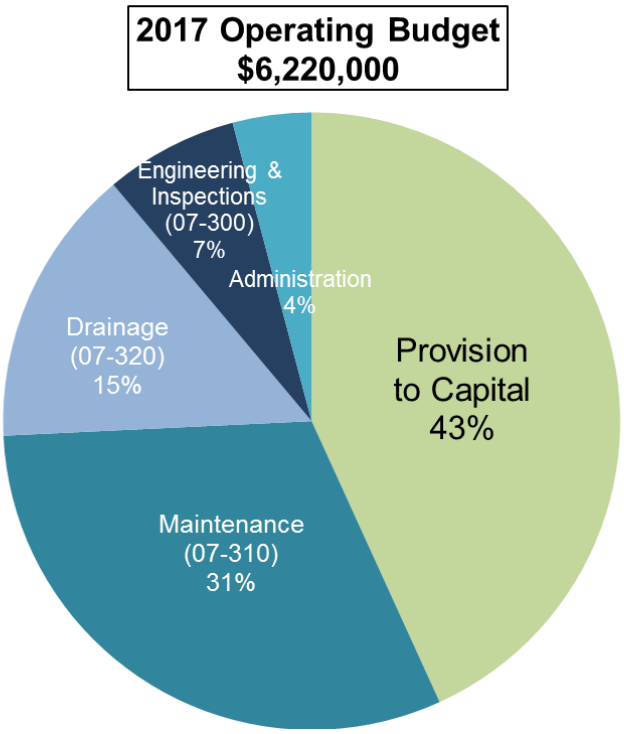
	2012	2013	2014	2015	2016	2017 Budget	2018	2019	2020	2021	2022
Commercial	$1.1	$1.4	$1.8	$1.8	$2.1	$2.1	$2.2	$2.3	$2.3	$2.3	$2.4
Residential	$3.4	$3.6	$3.5	$3.9	$4.1	$4.1	$4.1	$4.2	$4.3	$4.3	$4.4
Total Revenue	$4.5	$5.0	$5.4	$5.7	$6.1	$6.2	$6.4	$6.5	$6.6	$6.7	$6.8

Flood Protection Program

After intense rain events that caused sewer backups in 2005, a temporary Flood Protection Program was established with a $3.00 monthly charge on all water meters. The charge was increased to $4.50 in 2009. The program was extended and now is scheduled to sunset the end of 2018 after generating about $44 million in revenues to fund damage from the 2005 sewer backups, a program for sewer backup valve installation, and superpipes to reduce sewer backups during severe rain events. A deficit of about $0.3 million is projected for the initiatives already completed. The program has generated approximately $4 million annually.

11.2 Operating Expenses

The Storm Water Utility has a 2017 operating budget of $3.5 million for operating expenses and a transfer to capital of $2.7 million for a total of $6.2 million.

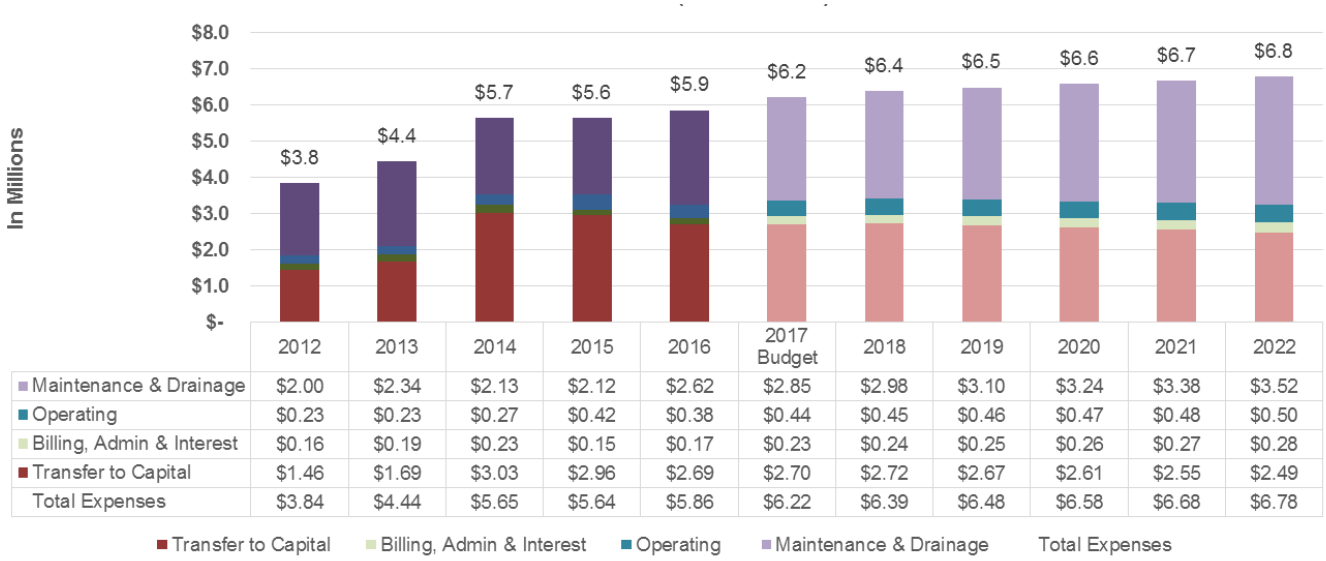


Major operating expense categories include the following:

- Maintenance and Drainage, of $2.8 million which includes:
  - $1.9 million provided to WWS to operate and maintain storm water infrastructure including storm water ponds, sewer mains, catch basins, manholes, and connections.
  - $0.9 million provided to R&O to maintain drainage, clear catch basin grates, and complete the fall street sweep.
  - Charges are expected to increase at approximately 4.3% annually, including inflation, growth, and higher operating costs as the city expands outward.
- Storm Water Engineering and Inspections includes salaries [(4.4 Full-Time Equivalents (FTEs)] and other operating expenses, such as administration cross charges, software, and vehicle expenses. Salaries include the following:
  - 2.0 FTEs for drainage inspectors with Community Standards.
  - 0.7 FTE for SW Engineering and Planning staff for management and engineering support.
  - 1.0 FTE for C&D for inspections and to support the Connections Desk.
  - 0.5 FTE for Major Projects for flusher truck operations.
  - 0.2 FTE for IT to help maintain the storm water infrastructure data in GIS.
  - Expenses are expected to increase at 4.3% annually for inflation and growth.
- Other Administration charges of $0.23 million include billings and collection of the storm water charge, administration cross charges, and insurance. These expenses are expected to increase at an average of 3% annually including growth and inflation. Interest revenue also is deducted from Administration charges.
- The Transfer to Capital is the difference between the annual estimated revenues and operating expenses and in 2017, was $2.7 million. The Transfer to Capital peaked in 2014 at about $3.0 million and based on status quo revenue, will decrease to $2.5 million in 2022 as storm water operating expenses increase at a higher rate than revenue increases.

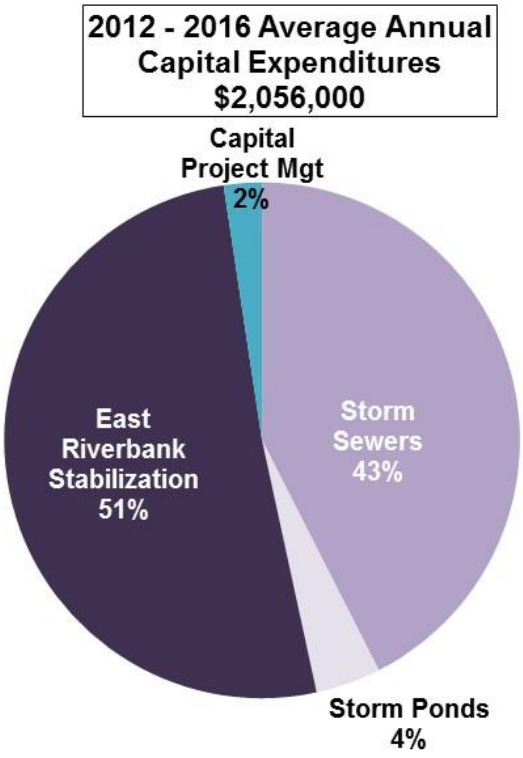
The graph below shows actual operating expenses between 2012 and 2016, the 2017 budgeted expenses, and projected operating expenses to 2022 based on status quo activities.

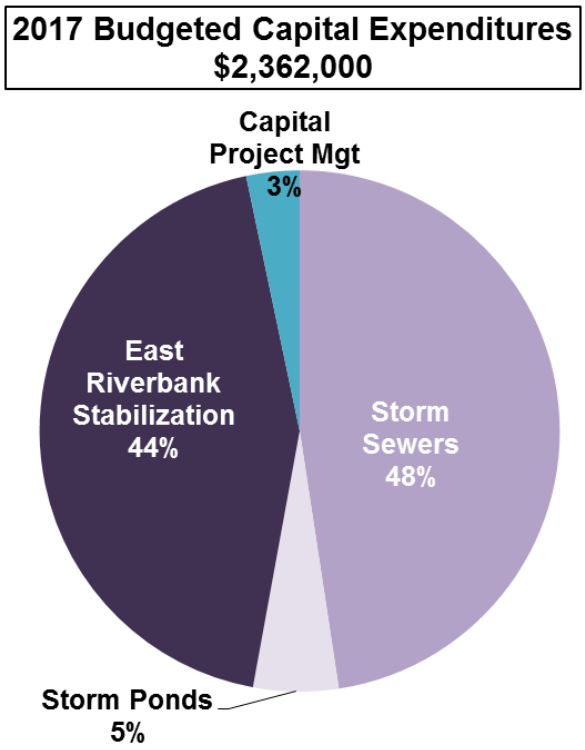
Storm Water Utility Status Quo Operating Expenses (In $ Millions)



	2012	2013	2014	2015	2016	2017 Budget	2018	2019	2020	2021	2022
Maintenance & Drainage	$2.00	$2.34	$2.13	$2.12	$2.62	$2.85	$2.98	$3.10	$3.24	$3.38	$3.52
Operating	$0.23	$0.23	$0.27	$0.42	$0.38	$0.44	$0.45	$0.46	$0.47	$0.48	$0.50
Billing, Admin & Interest	$0.16	$0.19	$0.23	$0.15	$0.17	$0.23	$0.24	$0.25	$0.26	$0.27	$0.28
Transfer to Capital	$1.46	$1.69	$3.03	$2.96	$2.69	$2.70	$2.72	$2.67	$2.61	$2.55	$2.49
Total Expenses	$3.84	$4.44	$5.65	$5.64	$5.86	$6.22	$6.39	$6.48	$6.58	$6.68	$6.78

11.3 Capital Expenditures





Between 2012 and 2016, the Storm Water Capital Reserve Fund was allocated an average of $2.4 million annually. On average, over the last five years, about $2.1 million has been expended annually for capital projects. The Capital Reserve Fund had $1.7 million at the end of 2016.

Budgeted and actual capital expenditures in any year fluctuate depending on the projects being undertaken and actual costs relative to estimated. If projects are completed and actual costs are less than budgeted, the unexpended funds are returned to the Storm Water Capital Reserve. Sometimes projects span more than one fiscal year – some projects funded in 2016 are being completed in 2017.

The following summarizes major capital expenditures for each major capital project category.

East Riverbank Stabilization (1493)

Between 2012 and 2016, an average of about $1.2 million annually expended on east riverbank monitoring and remediation of City-owned property accounted for about one half of the Storm Water capital expenditures. Riverbank monitoring and inspections are conducted annually to support the asset management plan for the City's east riverbank, up to and including some City streets. Significant projects have included monitoring and analysis of the 11th Street slope, and rehabilitation of Meewasin Trail and Saskatchewan Crescent. Restoration costs have been between $1.5 million and $3.0 million per project, with an average of one project every three.

The 2017 capital budget of $1.0 million includes monitoring costs, slope modelling, sub-drainage assessment, and rehabilitation of priority sub-drainage between 15th Street and 16th Street.

Projected capital budgets after 2017 annually include continued monitoring, improving storm water drainage along the riverbank, and setting up a reserve fund of $3.0 million for emergency repair of strategic infrastructure. The future capital costs for riverbank remediation projects will depend on rainfall levels, groundwater, and unpredictable slope failure.

Storm Sewers Trunks and Collection (1619)

Between 2012 and 2016, about $874,000 was spent annually on capital for network and drainage improvement projects, and preservation. Capacity improvement includes design and construction to enhance drainage in areas with recurrent flooding. The preservation program includes storm water sewer sediment removal, CCTV (camera) inspections and assessment of the storm water infrastructure, and lining of priority storm pipes to extend their life.

The 2017 storm sewers capital budget of $1.1 million includes $750,000 for the network management and capacity improvement and $370,000 for the preservation program. An additional $540,000 in capital funding was carried over from 2016 for preservation work which will fund the replacement of storm water pipes that have failed. The budget also includes the storm sewer flushing and CCTV work conducted by City crews and contractors. The condition assessment work is critical to develop a long-term maintenance and preservation program for the sewer pipes. Funding after 2018 anticipates increased preservation work to address the asset management backlog.

Storm Sewer Pond Preservation (1621)

Between 2012 and 2016, average annual capital spending for storm water ponds has been $84,000, which has included evaluation, planning, design, and small preservation projects, such as pond retaining wall restoration.

The 2017 storm water retention pond budget of $125,000 provides for high level assessments and prioritization of storm ponds for future rehabilitation. The capital budget for storm pond preservation is projected to increase to cover higher expected costs as our storm ponds age. The budget anticipates a larger scale pond remediation project in 2022. Increased funding for ongoing maintenance and preservation is expected to reduce higher cost future rebuilds. [19]

Storm Water Utility Billing and Management (1677)

Between 2012 and 2016, average costs for storm water utility billing and management was $49,000. The project includes modifications to the corporate billing system to update billing for storm water management charges based on property size and surface imperviousness.

[19] CH2M HILL Canada Limited presentation to City of Saskatoon estimated the average future construction costs for remediation (not including rebuilds) of 11 Calgary storm ponds to be $1.75 million. The cost to rebuild a Calgary storm pond was estimated to be over $6 million. (October 2016)

The 2017 capital budget is $78,000 for salaries, updated maps, and software with an annual increase of 2.5% projected for inflation and growth. The annual project budget is about $100,000 less than the previous average five-year annual budget, as funding is re-directed to higher priorities for maintaining the storm water system.

Wet Weather Inflow Remediation (1678)
This capital project has been funding through the Flood Protection Program levy described above. Since 2005, the program has been part of Wastewater's capital budget. The project funds the evaluation, development, and implementation of programs to mitigate basement and wastewater system flooding associated with wet weather inflow and infiltration (e.g. superpipes in neighbourhoods at risk of sewer back-ups.)

Extended funding will fund the $300,000 deficit expected in 2018, a superpipe for the Rosewood neighbourhood in 2020, and further risk assessments.

11.4 Funding Strategy

It is recommended that the FPP be extended and phased out from 2019 to the end of 2021, with an equivalent increase to the Storm Water ERU phased in. The extension of the FPP will provide $6 million over three years to allow for additional capital projects to reduce the risk of sewer back-ups and other flooding during high rain events. Advantages to this approach include the following:

- Total residential Utility Bills for storm water and flood protection remain the same from 2012 to 2022 at $107 annually.
- Residential charges for storm water drainage will continue to be significantly lower than in Regina, Calgary, and Edmonton (e.g. in 2017, Regina's minimum annual storm drainage charge for a single residential property is $190).
- Utility Bills are simplified by 2022 when the FPP is eliminated.
- The user-pay principle for drainage is enhanced as large commercial properties that contribute to more drainage pay a more proportionate share.
- The increase for all commercial properties will be phased in over four years to avoid significant increases in a single year.
- The current FPP expected deficit of $0.3 million will be funded.
- Annual funding to maintain and preserve Storm Water drainage will increase to an estimated $10.2 million in 2019 and to $12.3 million in 2022 to help fund infrastructure to reduce the risk of sewer back-ups during flooding and to reduce the backlog in existing infrastructure maintenance and preservation.
- Extending and phasing out the FPP in conjunction with increasing the ERU rate would add approximately $6.0 million more over three years compared to only increasing the ERU rate.

Residents would not see an expected overall decrease in their Utility Bill as the FPP is wound down. Commercial, industrial, and institutional customers would pay between $54 and $5,346 more in 2022 than they would pay without any changes, with a maximum increase of 25.6% per year.

Year	Annual Rate per ERU	Annual FPP Levy per Meter	Residential Annual Total Charge	Minimum Annual Cost for Commercial (1 Meter / 2 ERUs)	Maximum Annual Cost for Commercial (1 Meter / 100 ERUs)	Total Estimated Revenue
2018	$ 52.80	$ 54.00	$ 106.80	$ 159.60	$ 5,334.00	$10,388,904
2019	$ 66.30	$ 40.50	$ 106.80	$ 173.10	$ 6,670.50	$11,179,745
2020	$ 79.80	$ 27.00	$ 106.80	$ 186.60	$ 8,007.00	$ 11,919,423
2021	$ 93.30	$ 13.50	$ 106.80	$ 200.10	$ 9,343.50	$ 12,789,241
2022	$ 106.80	$ 0.00	$ 106.80	$ 213.60	$ 10,680.00	$ 13,682,475

The following projected financial statements summarize the FPP and Storm Water Utility's revenues, operating expenses, capital expenses, and capital reserve balances with the recommended extension and phase-out of the FPP and increase in the ERU rate.

Projected Financial Statements

	2016	2017	2018	2019	2020	2021	2022
Revenues							
Residential (Status Quo)	$ 3,367,542	$ 3,400,000	$ 3,434,000	$ 3,485,510	$ 3,537,793	$ 3,590,860	$ 3,644,722
Multi-Residential (Status Quo)	$ 683,190	$ 680,000	$ 737,000	$ 748,055	$ 759,276	$ 770,665	$ 782,225
Commercial (Status Quo)	$ 2,056,929	$ 2,129,000	$ 2,189,000	$ 2,221,835	$ 2,255,163	$ 2,288,990	$ 2,323,325
Late Charges	$ 12,272	$ 11,000	$ 12,000	$ 12,000	$ 12,000	$ 12,000	$ 12,000
Storm Water Total (Status Quo)	**$ 6,119,933**	**$ 6,220,000**	**$ 6,372,000**	**$ 6,467,400**	**$ 6,564,231**	**$ 6,662,514**	**$ 6,762,272**
Increase in ERUs	$ -	$ -	$ -	$ 1,654,477	$ 3,358,588	$ 5,113,451	$ 6,920,203
Total Revenue from ERUs	**$ 6,119,933**	**$ 6,220,000**	**$ 6,372,000**	**$ 8,121,877**	**$ 9,922,819**	**$ 11,775,965**	**$ 13,682,475**
Proposed FPP Phase-Out (2019 to 2021)	$ 3,899,055	$ 3,957,541	$ 4,016,904	$ 3,057,868	$ 1,996,604	$ 1,013,276	$ -
Total Storm Water & FPP Revenue	**$ 10,018,988**	**$ 10,177,541**	**$ 10,388,904**	**$ 11,179,745**	**$ 11,919,423**	**$ 12,789,241**	**$ 13,682,475**
Operating Expenses							
Operating Expenses (07-300)	$ 376,410	$ 435,900	$ 452,300	$ 471,749	$ 492,034	$ 513,192	$ 535,259
Storm Sewers Maintenance (07-310)	$ 1,804,527	$ 1,939,100	$ 2,018,300	$ 2,105,087	$ 2,195,606	$ 2,290,017	$ 2,388,487
Storm Sewers Drainage (07-320)	$ 814,177	$ 914,300	$ 950,000	$ 990,850	$ 1,033,457	$ 1,077,895	$ 1,124,245
Administration (07-330)	$ 194,820	$ 257,600	$ 263,600	$ 271,508	$ 279,653	$ 288,043	$ 296,684
Operating Expenses Before Interest	**$ 3,189,935**	**$ 3,546,900**	**$ 3,684,200**	**$ 3,839,194**	**$ 4,000,750**	**$ 4,169,146**	**$ 4,344,675**
Interest Expense (Revenue)	$ (24,800)	$ (23,200)	$ (23,500)	$ (23,200)	$ (23,200)	$ (23,200)	$ (23,200)
Operating Expenses Before Transfer to Capital Reserves	**$ 3,165,135**	**$ 3,523,700**	**$ 3,660,700**	**$ 3,815,994**	**$ 3,977,550**	**$ 4,145,946**	**$ 4,321,475**
Transfer to Capital Reserves	$ 2,691,300	$ 2,696,300	$ 2,711,300	$ 7,363,751	$ 7,941,873	$ 8,643,295	$ 9,361,000
Total Operating Budget	**$ 263,498**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
Capital Budget							
East Riverbank Stabilization (1493)	$ 3,200,000	$ 1,035,000	$ 1,060,000	$ 1,081,200	$ 1,102,824	$ 1,124,880	$ 1,147,378
Storm Sewers (1619)	$ 1,714,000	$ 1,124,000	$ 1,437,000	$ 3,001,740	$ 4,966,775	$ 5,382,110	$ 6,327,144
Storm Pond Preservation (1621)	$ 350,000	$ 125,000	$ 350,000	$ 457,000	$ 606,121	$ 618,243	$ 1,214,448
Utility Billing Management (1677)	$ 150,000	$ 78,000	$ 80,000	$ 81,600	$ 83,232	$ 84,897	$ 86,595
Drainage Regulation Project (2604)	$ -	$ 62,000	$ 63,000	$ -	$ -	$ -	$ -
Storm Water Capital	**$ 5,414,000**	**$ 2,424,000**	**$ 2,990,000**	**$ 4,621,540**	**$ 6,758,952**	**$ 7,210,131**	**$ 8,775,565**
Wet Weather Inflow Infiltration (1678)	$ 3,899,055	$ 3,957,541	$ 4,016,904	$ 3,057,868	$ 1,996,604	$ 1,013,276	$ -
Total Capital Budget with FPP	**$ 9,313,055**	**$ 6,381,541**	**$ 7,006,904**	**$ 7,679,408**	**$ 8,755,555**	**$ 8,223,407**	**$ 8,775,565**
Capital Reserve Balance							
Reserve Balance Beginning of Year	**$ 3,537,785**	**$ 1,720,852**	**$ 2,034,192**	**$ 1,755,492**	**$ 1,439,835**	**$ 626,153**	**$ 1,046,041**
Contribution from Operating	$ 2,691,300	$ 2,696,300	$ 2,711,300	$ 7,363,751	$ 7,941,873	$ 8,643,295	$ 9,361,000
Capital Budget	$ (5,414,000)	$ (2,424,000)	$ (2,990,000)	$ (7,679,408)	$ (8,755,555)	$ (8,223,407)	$ (8,775,565)
Adjustments	$ 905,767	$ 41,040	$ -	$ -	$ -	$ -	$ -
Reserve End of Year Balance	**$ 1,720,852**	**$ 2,034,192**	**$ 1,755,492**	**$ 1,439,835**	**$ 626,153**	**$ 1,046,041**	**$ 1,631,477**

Projected Financial Statements Assumptions

1. Residential Status Quo Growth: 1% in 2018 and 1.5% from 2019 to 2022
2. Multi-Residential Status Quo Growth: 1% in 2018 and 1.5% from 2019 to 2022
3. Commercial Status Quo Growth: Estimated increase in ERU cap from 85 to 100 in 2018 and 1.5% growth from 2019 to 2022
4. Late Charges: Similar to actual late charge revenue from 2018 to 2022 as in 2016
5. Increase in ERUs: ERU rate is $52.80 in 2018, $66.30 in 2019, $79.80 in 2020, $93,30 in 2021, and $106.80 in 2022
6. Proposed FPP Extension and Phase-Out: FPP rate per water meter is $54.00 in 2018, is $40.50 in 2019, $27.00 in 2020, $13.50 in 2021 and $0 in 2022. Note that the FPP Revenue has not previously been part of the Storm Water Utility budget, and is shown in the proformas from 2016 to 2018 for comparative purposes.
7. Operating Expenses: Includes expenses for Stormater engineering and inspections. 2018 includes preliminary budget with inflation and a $7,500 increase for communication. Increase of 4.3% from 2019 to 2022 to include growth (1.5%) and inflation (2.8%).
8. Storm Sewers Maintanence: Includes expenses for Water and Waste Stream. Assumes 2018 preliminary budget and increase of 4.3% from 2019 to 2022.
9. Storm Sewers Drainage: Includes expenses for Transportation and Operations. Assumes 2018 preliminary budget and increase of 4.3% from 2019 to 2022.
10. Administration Expenses: Includes billing services, administration cross charges and insurance. Assumes 2018 preliminary budget and 3.0% annual growth including inflation.
11. Interest Revenue: 2018 to 2022 is estimated to be similar to previos years.
12. Transfer to Capital Budget: Difference between budgeted revenues and other operating expenses.
13. East Riverbank Stabilization capital budget: Assumes similar average funding for monitoring and slope stabilization as previous years, with unspent capital returned to the Capital Reserve to maintain a reserve balance of $3.0 million to fund unanticipated emergency slope failures impacting strategic infrastructure. Assumes 2.0% annual inflation.
14. Storm Sewers capital budget: Assumes 2.0% inflation for monitoring, CCTV work, capital required by Water and Waste Stream, lift station preservation, and monitoring equipment. Assumes additional funding from the ERU rate increase for lining and preserving the existing network including Montgomery ($1.75 million increase in 2019, up to $4.1 million increase in 2022).
15. Storm Pond Preservation capital budget: Assumes additional funding for sediment removal and preservation as the storm ponds age. Additional funding of $0.1 million in 2019 up to $1.0 million more in 2022 for a major pond dredging.
16. Storm Water Utility Billing and Management capital budget: Assumes 2% annual inflation.
17. Drainage Regulation Project: Includes total commitment of $0.125 million over 2017 and 2018. Assumes sources other than the Storm Water Utility will fund future implementation.
18. Wet Weather Inflow Remediation capital budget is the same as the Flood Protection Program (FPP) revenue. It is noted that the FPP capital expenses have not previously been part of the Storm Water Utility budget.

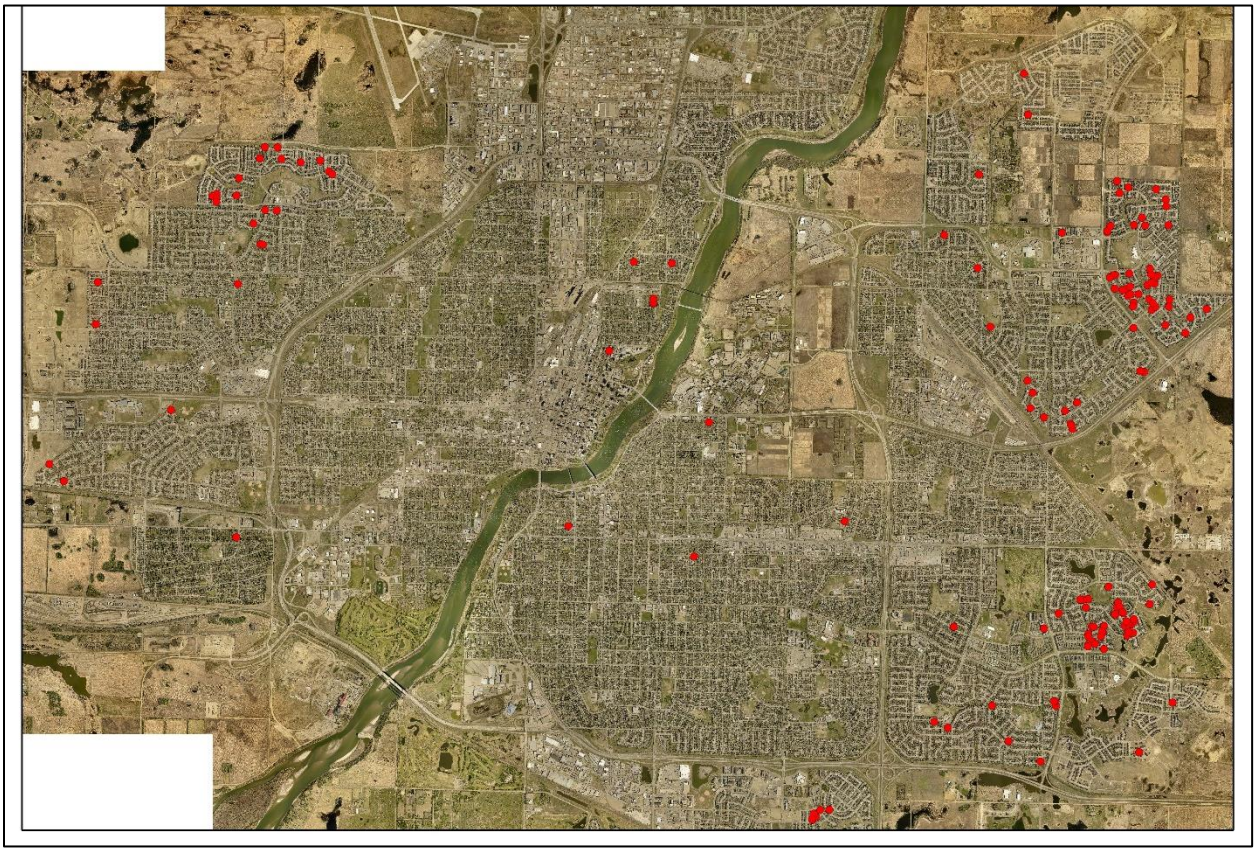
APPENDICES

Appendix #1: Criteria for Determining Return Period of a Rain Event

Time (minutes)	Intensity (mm/hr)			
	2-Year	5-Year	25-Year	100-Year
10	53	85	132	168
15	41	67	104	133
30	26.4	46.1	74	97
60	16.6	28.9	46.5	60
120	10.7	17.5	27.3	35
360	4.7	7.0	10.3	12.9
720	2.73	3.90	5.59	6.91
1440	1.56	2.18	3.07	3.76

The Intensity Duration Frequency (IDF) curves being used by the City are based on rainfall recorded at the Saskatoon International Airport by Environment Canada from 1926 to 1986.

Appendix #2: Locations with High Ground Water and Sump Pump Issues



City of Saskatoon, 2015

Appendix #3: Glossary

Abate: To reduce the amount or lessen the effect of.

Backflow Device: A backflow device or backflow valve is a device that prevents sewage from backing up into basements.

Capital Reserve: Funding that is reserved for long-term infrastructure projects to be undertaken in the future.

Catch Basin: A reservoir located at the point where street gutters discharge into a sewer. These are designed to catch matter that will not pass through the sewer.

Cross Connections: A point where the sanitary and storm sewers are connected and can overflow into one another.

Culvert: A pipe or channel to allow drainage to flow under a road, sidewalk, railroad, or similar obstruction.

Drop Structure: A device used in sanitary sewer collection systems to drop wastewater at a level in the manhole so that maintenance can be conducted during flow.

Dry Ponds: Storm water basins that temporarily store water during and after heavy rainfall events then slowly release the water and return to a dry state.

Effluent: Treated water discharged back into the river.

Force Main: Sewer pipes that utilize compressors or pumps to move liquid under pressure when the liquid cannot be moved with the use of gravity.

Imperviousness: Ability of a material (e.g. soil, pavement) to not allow fluid to pass through.

Infill (Development): Development of land within already developed areas.

Infiltration: Groundwater seeping into sanitary sewers through cracks and crevices such as defective pipe joints and broken pipes.

Inflow: Water flowing into the sanitary sewer through large openings such as cross connections and weeping tile.

Leads: Piping that connects the main sewer line to other infrastructure such as catch basins.

Lift Station: Facility designed to move wastewater or storm water from lower to higher elevations with pumps.

Outfall: A place where a sewer discharges to a body of water such as river or lake.

Return Period: The estimate of the likelihood of a rainfall event. A two-year rain event would have a 50% likelihood of occurring in any given year. A five-year rain event would have a 20% likelihood of occurring in any year.

Service Connection: The point of connection between the municipal sewer system and the customer's system.

Sub-drainage: Typically perforated pipe used to drain groundwater and seepage.

Sump Pump: A pump used to remove water that has accumulated in the water-collecting sump basin in basements.

Superpipe: A large sanitary storage tank to handle surcharged wastewater.

Weeping Tile: A porous pipe used to collect and discharge groundwater from the base of a footing.

Wet Ponds: Storage basins that permanently hold water throughout the year.