Greener Together

Fostering Equality

Water Conservation Strategy

APRIL 2022

City of Saskatoon

saskatoon.ca/**waterconservation**

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EXECUTIVE SUMMARY

Providing the community with safe and high-quality drinking water is a top priority for the City of Saskatoon (City). A changing climate and aging water treatment infrastructure are risks to our water system. Water conservation can help ensure that we can meet the community's water needs in the long term, even with a growing population.

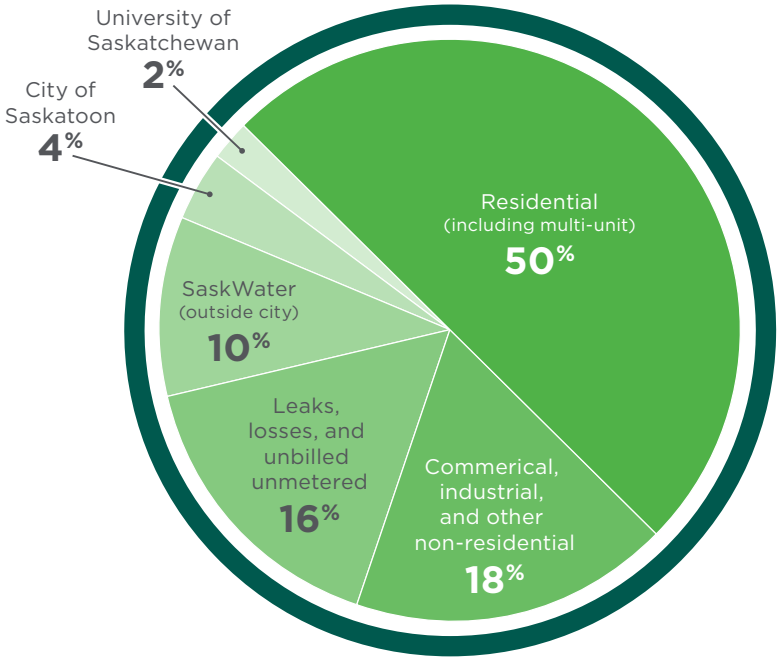
Saskatoon's Water Conservation Strategy provides a roadmap of actions that will help reduce water use in the community and in the City's own operations.

The Strategy is founded upon four main reasons for conserving water:

1. Help households and business moderate their water use.
2. The pressing need to reduce greenhouse gas emissions.
3. Increase water system resiliency and prepare for a changing climate.
4. Help manage water demand to ease the strain on the City's water system.

Water Use in Saskatoon

Saskatoon residents, businesses, and institutions use about 40 billion litres of water per year. Averaged out, that works out to 1,300 litres per second, every second of every day, or about eight bathtubs full every second.



Categorization of uses of water from the Water Treatment Plant, 2019–2021 averages
Source: City of Saskatoon, Corporate Finance Department; and Sustainability Department

We all have a role in reducing water

Here are some examples the City is currently exploring regarding how residents, businesses, and the City could save water:

Residents can:

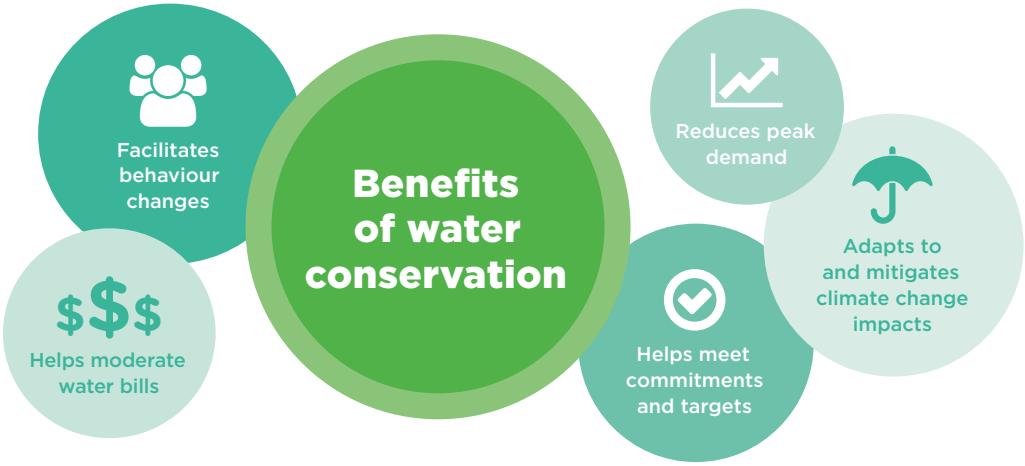
- Replace inefficient toilets, taps, showerheads, clothes washers, and dishwashers.
- Outdoors, use water wisely by tuning-up irrigation systems and not over watering.
- Use a broom instead of a hose when cleaning decks and driveways.
- Shut off taps when brushing teeth or shaving.
- Only run the dishwasher when it's full.
- Find and repair leaks.

Businesses can:

- Replace inefficient fixtures and appliances.
- Evaluate water use in production processes.
- Install water-saving irrigation control systems.
- Find and repair leaks.

The City can:

- Install water-saving fixtures in civic facilities
- Find and fix leaks in the underground distribution system
- Keep parks healthy using less water and naturalizing more areas; advanced irrigation control systems and weather monitoring technologies may be able to keep grass healthy with less water
- Develop incentive programs to help the community save water
- Help the community to better understand their water use through education programs and providing clear information

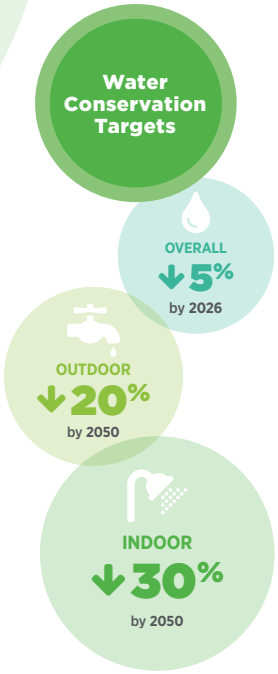


Water is a regional and collective resource, and water conservation has been identified in several of the City's strategic documents.

- The 2022-2025 Strategic Plan includes a key action to:

  "Implement innovative and efficient water conservation practises and programs for indoor and outdoor uses."

- The *Official Community Plan* (OCP) identifies a safe, clean water supply as a priority for the City, citing protection of water sources and watershed quality as important for citizens and downstream water users. The OCP commits to water conservation and the reduction of energy use and Greenhouse Gas (GHG) emissions that result as part of the process.
- The *Low Emissions Community Plan* (LEC Plan) includes actions and targets for water conservation reductions to reduce GHGs and meet our emissions reduction targets.
- The *Water Treatment Plant Long Term Capital Strategy* notes that water conservation efforts to reduce peak-day demands will improve the ability of the Water Treatment Plant to meet water production needs.



Water Conservation Targets

Targets for overall, indoor, and outdoor water conservation were set in the *LEC Plan* Actions 25 and 26, including a 5% reduction in absolute water demand by 2026 through efficiency, monitoring, and leak reduction; and a 20% reduction in outdoor water use and a 30% reduction in indoor water use by 2050 through residential and commercial education and water efficiency incentive programs.

Implementation and Prioritization

Water Conservation opportunities have been identified and prioritized using factors, values, and considerations included in this report. These include:

1. **Water conserved (cubic metres per year) and Greenhouse Gas Emissions Reduced:** Initiatives that target overall water use and progress towards *LEC Plan* targets of reducing volume pumped by 2026 and 2050 and reducing GHG emissions.
2. **Cost of water conserved (cents per litre per year):** The costs to the City compared to volume of water saved (see Figure 12). However, many programs also have conservation costs and benefits for residents, businesses, and institutions.
3. **Impacts on maximum daily demand reduced (cubic metres per day reduced):** Maximum daily demand is reduced, calculated in terms of cubic metres per day for each year the program operates.

4. **Addresses energy poverty and utility affordability:**
   Programs that tailor conservation to low and moderate-income households or those experiencing energy poverty, including affordable housing and multi-family housing incentives and income-qualified households.

5. **Public and industry preferences:**
   Public and industry respondents from a December 2020 survey were asked to rank the proposed programs by identifying the top three programs they feel the City should prioritize (see Figure 15).

The Plan

Phase 1 Actions
Already in planning stage

- Residential water use education program.
- Affordable housing energy & water conservation pilot.
- Residential rain barrels rebate review.
- Water conservation environmental grant review.
- Industrial Commercial and Institutional (ICI) building energy retrofit program.
- Civic water conservation - Maximize watering efficiency in parks.
- Civic water conservation - Irrigation network audit to increase naturalized areas in parks.
- Civic water conservation - Maximize water efficiency of spray pads, paddling pools and pools.
- Civic water conservation - Spray pad and paddling pool water reuse.
- Water conservation using AMI data and dashboard.
- Planning, land use and urban form to improve water conservation.

Phase 2 Actions
To be started in the next 3 years

- Residential toilet rebate.
- Residential showerhead rebate and give-away.
- Affordable and multi-family housing water conservation incentives and education.
- Income qualified water fixture replacement program.
- ICI water-use education program.
- ICI audit and fixture incentive program.
- ICI capacity buyback program.
- Civic water conservation - Maximize efficiency of facilities and operations.
- Civic water conservation - Non-potable water use for parks irrigation.

Phase 3 Actions
To be started in the next 4–6 years

- Residential water audit and coaching program.
- Residential irrigation system upgrade rebate program.
- ICI once-through cooling replacement incentive program.
- ICI irrigation system upgrade rebate program.
- Water pricing and rate structure review.
- Community gardens water-reduction support program.

Phase 4 Actions
To be started in the next 7+ years

- Residential irrigation community-based education program .
- Residential low-water landscaping program.
- ICI irrigation system assessments, training and accreditation.
- Grey-water strategy.
- Outdoor watering restrictions and bans review.

Saskatoon is located on Treaty 6 Territory and the Homeland of the Métis.

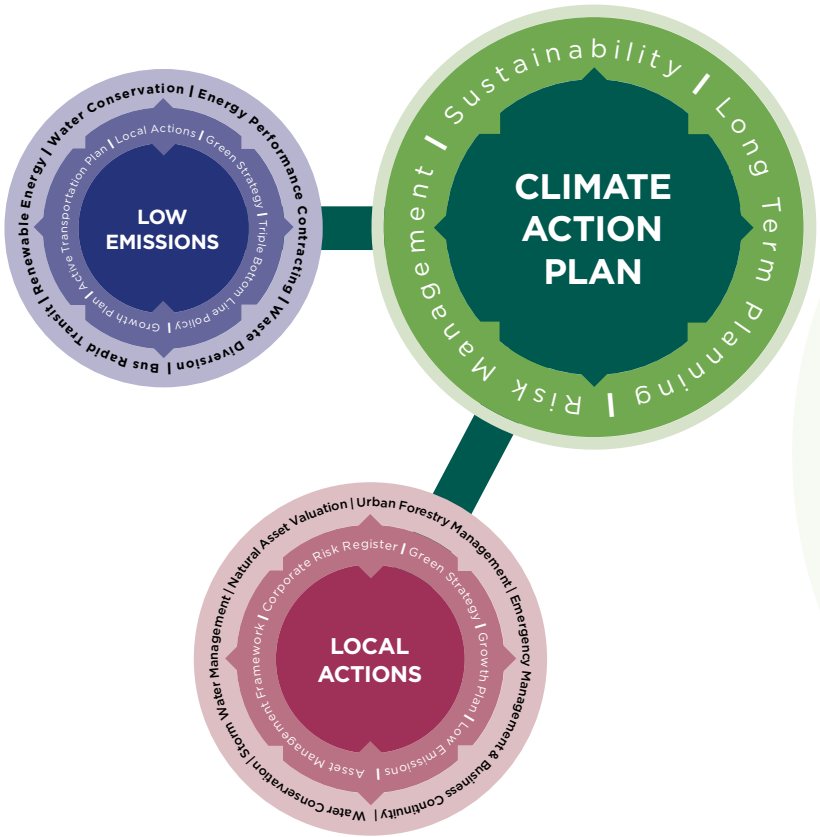
We pay our respects to the First Nations and Métis ancestors who, for thousands of years, cared for the land and water that sustains us. Through this Strategy, we take responsibility to care for the shared water systems that will support the needs and well-being of both present and future generations.

INTRODUCTION

Water is a regional and collective resource, and water conservation has been identified in several City of Saskatoon (City) strategic documents:

- The City of Saskatoon's *2022-2025 Strategic Plan* establishes Environmental Sustainablility as a priority, including the key action to "Implement innovative and efficient water conservation practises and programs for indoor and outdoor uses" so that "Greenhouse gases are reduced in a way that maximizes co-benefits and doesn't leave anyone behind."
- The *Official Community Plan* (OCP) identifies a safe, clean water supply as a priority for the City, citing protection of water sources and watershed quality as important for citizens and downstream water users. The OCP commits to water conservation and the reduction of energy use and Greenhouse Gas (GHG) emissions that result as part of the process.
- The *Low Emissions Community Plan* (LEC Plan) sets targets to reduce greenhouse gas emissions in part through water conservation.
- The *Water Treatment Plant Long Term Capital Strategy* notes that water conservation efforts to reduce peak-day demands will improve the ability of the Water Treatment Plant to meet water production needs.

Founded on these Plans, the *Water Conservation Strategy* (the Strategy) outlines indoor and outdoor conservation opportunities for the City, residents, businesses, institutions, and organizations. The Strategy provides both a broad context for water conservation as well as specific conservation initiatives that can be implemented in the coming decade and lead to reductions in water demand. It is part of the dual approach needed to address climate change in the City's Climate Action Plan.



Water's Myriad Roles

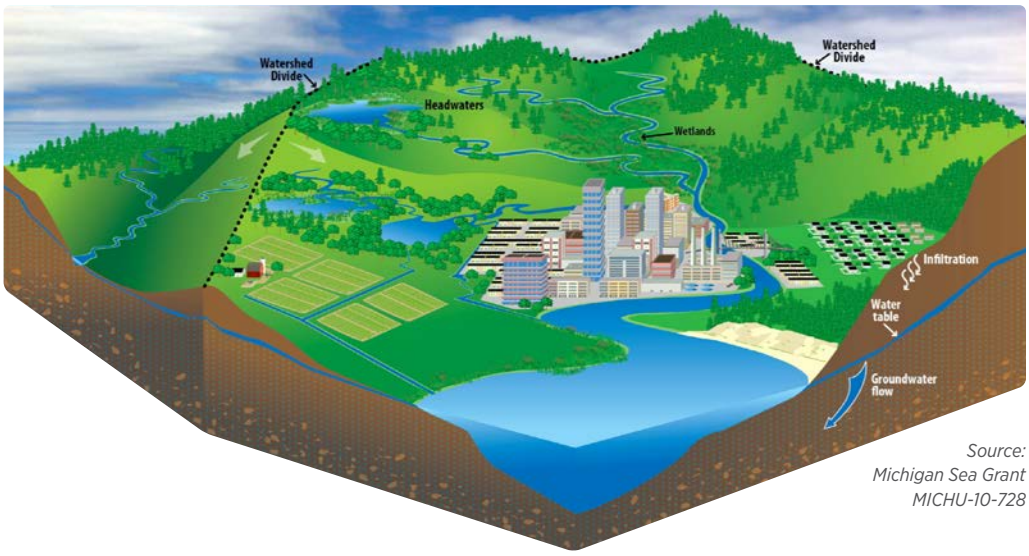
Originating in the Rocky Mountains, the South Saskatchewan River is Saskatchewan's single largest water source for drinking, irrigation, industrial uses, and recreation. Saskatoon lies along a bend in the river in a moist, mixed prairie ecoregion.

Water is a critical component of all ecosystems. When thinking about water, it's important to think about it as a *system*—an interconnected whole—reaching and stretching from mountain snowpacks, glaciers, and streams to our local river and wetlands. More than two million people in towns, cities, and First Nations communities rely on the South Saskatchewan River, as do industry and resource extraction and more than 650,000 hectares of irrigated agricultural land upstream.[1] Within and adjacent to the water are fish and aquatic organisms, the riverbed and riverbanks, all vital to the system. And lastly, it is important to consider our wastewater and storm water outflows and the effects on many ecosystems downriver.

Just as the river flows through our city, water flows through many aspects of our lives, such as our homes, workplaces, and places of recreation and enjoyment. Water touches everything, interweaving the landscape and economy. It is a critical part of the biosphere.

Our uses of water are innumerable and diverse, everything from healthcare and firefighting to cleaning and construction processes. The importance of water in all aspects of human life cannot be overstated. Good water management impacts all aspects of life and every corner of the community.

Because the community benefits immensely from a shared watershed, it is the community's responsibility to take care of it. City of Saskatoon water consistently receives high citizen satisfaction ratings, and citizen involvement in water conservation efforts will help maintain the high quality we have all come to expect.

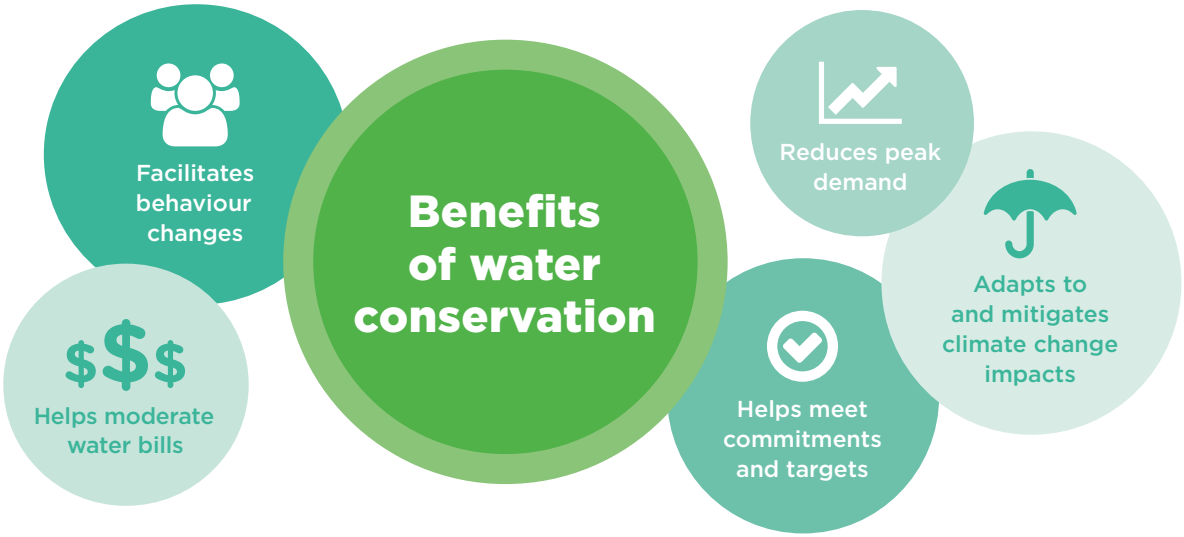


Source: Michigan Sea Grant MICHU-10-728

1 Partners for the Saskatchewan River Basin, *From the Mountains to the Sea: The State of the Saskatchewan River Basin* (Saskatoon: Partners, 2009) p. 5.

PURPOSE OF THE STRATEGY

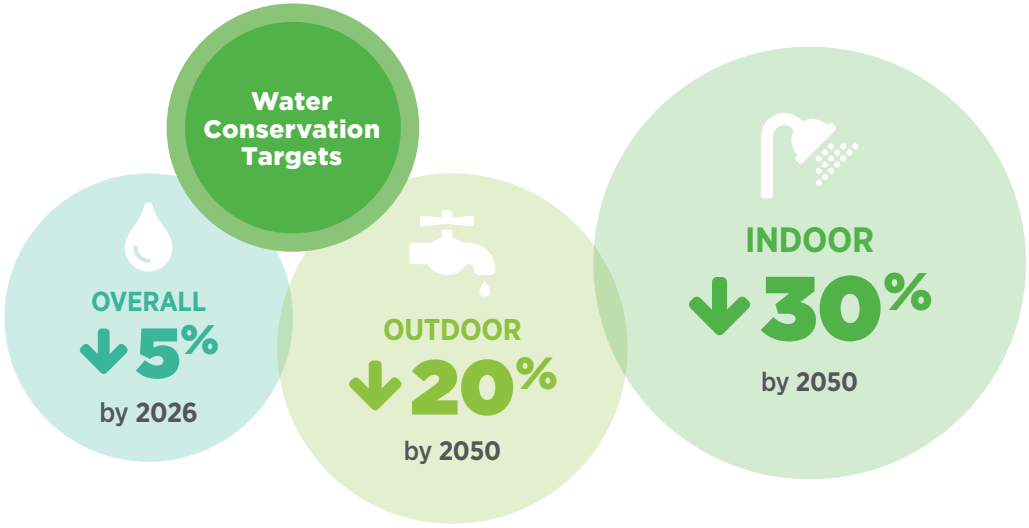
To realize the many benefits of water conservation, the City has prepared an integrated strategy to reduce water use in the community and in the City's own operations.



Though there are many reasons to conserve water in Saskatoon, four stand out:

1. The pressing need to reduce greenhouse gas emissions. Water and wastewater treatment accounted for a third of the City's total emissions in 2019, an increase of 8.3% from the 2014 baseline. The *LEC Plan* reaffirms Council's commitments to reduce emissions from the municipal government.
2. Help manage water demand — especially during summer peak periods. This will ease strains on our capacity-limited water systems and create opportunities to better manage and schedule our capital expenditures, potentially deferring or reducing spending.
3. Increase system resilience and maximize our capacity to deal with intensifying climate change.
4. Help households and businesses moderate their water use. This can relieve the utility burden on those most impacted by cost increases by placing equity and opportunity at the forefront of water conservation, making programs accessible.

The Strategy provides a roadmap of actions founded upon these four main reasons for conserving water. It targets the water system, from Water Treatment Plant to Wastewater Treatment Plant. Actions include reducing peak summer use to ease demand on capacity-limited infrastructure and meeting community goals regarding water conservation, emission reduction, water affordability, and capital-cost management. The Strategy also supports watershed protection, increasing biodiversity and improving green infrastructure as part of the *Green Infrastructure Strategy*.



Targets for overall, indoor, and outdoor water conservation were set in the *LEC Plan* Actions 25 and 26: reduce overall water use by 5% (2.4 million m^3) by 2026, reduce outdoor water use by 20% (1.4 million m^3) and reduce indoor water use by 30% (13 million m^3) by 2050.

The Strategy is an overarching plan that identifies opportunities and priorities; it is not a catalogue of fully researched and costed programs and initiatives. That said, many have been extensively researched, and estimates and assumptions have been checked against program performance in other jurisdictions. Nearly all the programs included here have been successfully implemented in other jurisdictions and with positive cost-benefit analyses.

Collaboratively designed and properly executed, an integrated suite of water conservation initiatives can protect and advance the interests of Saskatoon's residents, businesses, institutions, municipal government and its utilities. Conservation can yield environmental, social, and financial benefits. We can maintain our parks, reduce our emissions, enjoy aquatic recreation opportunities, and ensure a safe, stable, secure water supply into the future. This Strategy is an important step forward toward our many goals.

Throughout the Strategy, references to "water conservation" encompass the broader set of ideas and practices surrounding conservation, efficiency, demand management, leak and loss reduction, and, where appropriate and safe, water re-use and the substitution of raw water, storm water, rainwater, or other non-potable sources.

Many cities are implementing water conservation programs. Conservation programs in Calgary, for example, helped that city defer water treatment plant expansions for more than a decade. The Province of Saskatchewan's toilet-rebate program reduced emissions by 13,400 tonnes.[2]

Saskatoon's per capita water use is above comparable cities in Canada and other nations (see Water Demand). When we compare our city to its peers, large potential for water conservation becomes apparent. And when we consider the many benefits that conservation brings, this potential reveals itself as important opportunities.

2 Saskatchewan Water Security Agency, *2012–13 Annual Report: State of Drinking Water Quality in Saskatchewan, 2013*, p. 44.

The Benefits of Water Conservation

Conserving water has many benefits, including:

- Reduced average day demand, which in turn:
  - Reduces chemical use in the treatment process.
  - Reduces energy use and associated greenhouse gas emissions.
- Reduced peak-day demands on water and wastewater systems that may be nearing capacity, thereby creating opportunities to defer or avoid spending on capacity-expansion projects.
- Enabling residents and businesses to monitor their water consumption, facilitating changes in behaviour and supporting water affordability.
- Demonstrating care of the environment and wise use of resources.
- Improving climate change adaptation and increasing resilience.
- Helping our City and community move toward sustainability targets and commitments.

The Values that Underpin Our Work

In creating the Strategy, all aspects of water supply, use, planning, and protection were considered, but several values were foremost in our minds. These include:

- Human health, water safety, and water quality.
- Drinking water affordability and accessibility, including the effects of conservation on household water bills and rates.
- Water security and source-water protection.
- Efficient, dependable operation of all infrastructure, including treatment plants and distribution and collection systems.
- Short-term operational costs and revenues of water and wastewater systems; and long-term, life-cycle costs of managing water utilities, including infrastructure upgrades.
- Water as a critical part of ecosystems and the foundation of sustainability.
- Integration of the river, wetlands, natural and naturalized areas into land use plans to increase resilience to climate change and reduce water demand.
- Quality of life, recreation, enjoyment, and the beauty of our urban landscapes.
- Water as a key component of Saskatoon's economy and thriving business sector.
- Conservation of energy and the need to reduce emissions as highlighted in the *LEC Plan*.
- Climate change adaptation, as informed by the *Climate Projections and Impacts* report.
- Goals, targets, plans, and priorities contained in the *OCP*, the *Plan for Growth*, and the *2022–2025 Strategic Plan*.

To enable us to advance all these values, the Strategy was developed using collaborative design, inclusive community engagement, a commitment to equity and accessibility, an integrated water management approach, and a Triple Bottom Line (TBL) framework.

WHY IS WATER CONSERVATION IMPORTANT IN SASKATOON?

Meet Climate Commitments and Reduce Greenhouse Gas Reductions

The *LEC Plan* identifies that without emission reduction efforts, the City will not be able to meet our local and global commitments to reduce GHG emissions and build resiliency plans for our infrastructure and services. Water and wastewater treatment accounted for a third of total municipal government emissions in 2019. Decreasing water use in buildings and outdoors will relieve demand on the water system, resulting in lower energy use and fewer GHG emissions.

Because the City operates the Water and Wastewater Treatment Plants, all emissions from water and wastewater treatment and pumping are emissions attributed to the City. As shown in Figure 1, water-related emissions make up a third of total City emissions. The LEC Plan contains 40 emission-reduction actions, including two that would reduce water use in our city. Action 25 is a 5% reduction in absolute (i.e., not per capita) water demand by 2026. Action 26 is a 20% outdoor and 30% indoor water use reduction by 2050. The Strategy outlines how to achieve both water-related emission reduction targets.

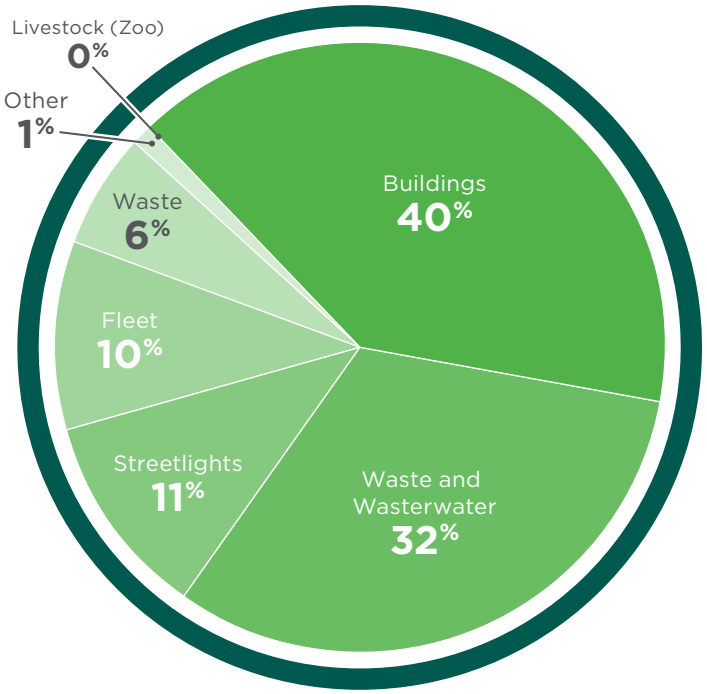


Figure 1: Municipal Government GHG Inventory 2019
Source: Sustainability Department

Build Resiliency and Mitigate Risks to the Water System

Climate Projections and Possible Impacts identifies that increased demand on the water and wastewater utility and delivery system due to warmer weather has a high risk to impact operations. The report states:

> "Temporal shifts in precipitation combined with generally warmer temperatures and an increasing number of very hot days (30°C or more) are likely to increase the risk of drought conditions for the city, increase the cost of green space watering, and could create demand stress on the water and wastewater treatment facilities and their delivery networks."

Local Actions: Saskatoon's Adaptation Strategy indicates that Saskatoon could double the number of hot days (25°C or more) and see six times the number of very hot days (30°C or more) annually under status quo emissions rates. This will lead to increased needs and higher costs for watering green spaces and for recreational water use. Changes in timing of peak precipitation to earlier in the year may also increase watering needs later in the summer due to heat and more frequent drought conditions. And we can expect changes in river flow patterns, where peak flows come earlier in the spring and summer flows are reduced due to warmer winter temperatures, loss of glacier ice, and a smaller snowpack.

Other climate change impacts due to warmer weather include a reduction in water availability. This has a medium risk rating in terms of loss of plant and urban wildlife diversity due to heat stress and a low-risk rating in terms of impact on quality and cost of water treatment. Reducing both overall demand and peak demand will reduce overall stress on the water system.

The *Water Treatment Plant Long Term Capital Strategy* identifies a risk that capacity expansion will be required sooner if water reduction measures are not implemented.

> "Hot weather peak demands coupled with a shortage of distribution system reservoir capacity requires the water treatment plant to produce water at rates higher than design capacity."

The strategy further recommends initiating peak demand reductions to reduce the pressure on the existing water treatment plant. Reducing peak-day demands by 15% would significantly improve the ability to meet water production needs.

Conservation, leak reduction, more efficient irrigation, and other steps that reduce water use can help us prepare for the less predictable precipitation, less dependable water flows, and more frequent droughts we expect to face in the future.

Integrate Water Management

Because water plays so many roles in our ecosystems, economies, homes, businesses, recreational spaces, and elsewhere, it is critical that we manage water in a way that takes full account of these interconnections. Water management cannot be reduced to a single focus or metric. Our plan for water conservation must be embedded within a much broader approach—an Integrated Water Management approach.

Integrated water management seeks to create synergies, to maximize the efficiencies and value of any given water management initiative, to find win-wins. An integrated approach takes seriously the idea that the hydrosphere, ecosystems, societies, and economies are interconnected, and that any change in one will trigger many attendant changes. In defining the concept, one source states that:

> "…an integrated water management approach has the potential to provide greater value to our communities by identifying and leveraging opportunities to optimize the outcomes of water-cycle planning and management. …(Integrated water management is) a collaborative approach to planning that brings together organizations that influence all elements of the water cycle, including waterways… wastewater management, alternative and potable water supply, storm water management and water treatment."[3]

Going further, Saskatoon-based Partners for the Saskatchewan River Basin contend that an integrated approach to water management *"means more than simple coordination. It implies a holistic yet strategic approach."*[4]

Finally, an integrated water management approach enables the City to efficiently integrate water conservation with its many other polices, responsibilities, goals, and priorities—and with land-use planning, park development, building performance standards, storm water management, and asset preservation and renewal. Many City departments and divisions make decisions that affect water use and protection. By using a one-City, integrated approach, we can conserve water and realize a range of co-benefits throughout our City, community, economy, and natural environment.

3 Victoria State Government, *Integrated Water Management Framework for Victoria* (Melbourne, State of Victoria, 2007).

4 Partners for the Saskatchewan River Basin, *From the Mountains to the Sea: The State of the Saskatchewan River Basin* (Saskatoon: Partners, 2009) p. 5.

Types of water

This Strategy takes a holistic approach to water conservation. While the purpose of the Strategy is to help our water system address climate risks and meet community needs, many types of water are part of an integrated approach to water conservation and management, not just drinking water. These include:

- **Drinking water**, also known as **potable water**, is water that is safe to drink or use for food preparation. It is water that has been treated and distributed from the Water Treatment Plant to homes and businesses.
- **Raw water** includes untreated water directly from the river.
- **Storm water** includes rainwater and snowmelt that flows overland. It enters the City's storm drain system, flows directly into a natural water body (e.g., the river, wetland), or is directed into a green infrastructure system (e.g., cisterns, storm ponds, bioswales, silva cells).
- **Grey water**, also called **recycled** or **reused water** is relatively clean wastewater that is captured from sources (e.g., pools, spray pads, washing machines, showers) and has potential for reuse (e.g., irrigation).
- **Wastewater** includes water from toilets, showers, and appliances that is sent down the drain into the sanitary sewer and carried to the Wastewater Treatment Plant, where it is cleaned and discharged back into the river.
- **Groundwater** includes water beneath the surface of the ground, such as in an aquifer.

Improve Triple Bottom Line Outcomes

Complementary to the integrated water management approach, City staff have used a TBL framework in developing the Strategy and framing individual initiatives. The TBL framework provides a way of evaluating approaches through a connected view of environmental, social, economic and governance costs and benefits. It minimizes adverse effects, highlights trade-offs, and helps guide decision-making in the face of trade-offs. Water conservation intersects with all four sustainability principles of the TBL Policy:

- **Environmental:** water and energy conservation, emissions reduction, climate change mitigation and adaptation
- **Social:** water costs and affordability, levels of service for community amenities, attractiveness of public spaces
- **Economic:** capital investments in system capacity, tax rates
- **Governance:** long-term effectiveness of service delivery, drawing on science, research, best practices

There is a strong financial, ecological, and social case to be made for making municipal government and community water conservation a priority. As we develop and implement the Strategy, we will strive to maximize benefits and synergies in all these areas.

Importantly, the TBL framework acts as a reminder that water conservation programs must be affordable and accessible for all residents and businesses, so everyone can have an equal opportunity to reduce water use and moderate their bills. TBL pushes its users to consider (and, where possible, quantify) financial implications to the City, households, businesses, and utilities. It leads the user to consider and quantify environmental benefits, including greenhouse gas-emission reductions.

The TBL framework systematizes and advances the broadest definition of sustainability—in this case, by developing water conservation initiatives that yield real environmental benefits, are affordable and cost-effective, advance equity and accessibility, and use good governance practices of inclusion, engagement, and collaboration.

Address Access, Equity and Energy Poverty

There is a growing body of research that highlights the disproportionate uptake of sustainability initiatives by higher income households and the disproportional impact of changing climate conditions on lower income communities in U.S. and Canadian municipalities. Inequity within communities is exacerbated by many factors, including income, race, ethnicity, citizenship, ability, age, and fluency with the dominant language. As such, intentionally applying equity considerations to program design and planning is critical to building a just transformation to a sustainable community.

From 2019 to 2021, the City participated in the Local Energy Access Partnership (LEAP) to develop equity-oriented climate and energy programs in participating communities and to address energy poverty. It was a multi-city, multi-sector initiative led by the Canadian Urban Sustainability Practitioners (CUSP) network, with funding from the Federation of Canadian Municipalities (FCM).

LEAP involved creating an equity mapping tool to understand the impacts of energy poverty and household energy burdens in Saskatoon and other Canadian communities. CUSP characterizes energy poverty as high home energy cost burdens, measured through the median home energy expenditure. Most households in Canada spend less than 3% of their after-tax income on their energy needs. Households that spend more than twice this value (i.e., more than 6% of their income) are experiencing energy poverty. LEAP shows that energy poverty rates in Saskatchewan are among the highest in Canada.

In this Strategy, energy poverty is defined as a household's ability to pay utility fees, including water, without limiting or impacting other essential goods and services. Figure 2 shows that 16% (13,580) of households in Saskatoon are experiencing energy poverty. Of these, approximately two thirds live in single detached dwellings.

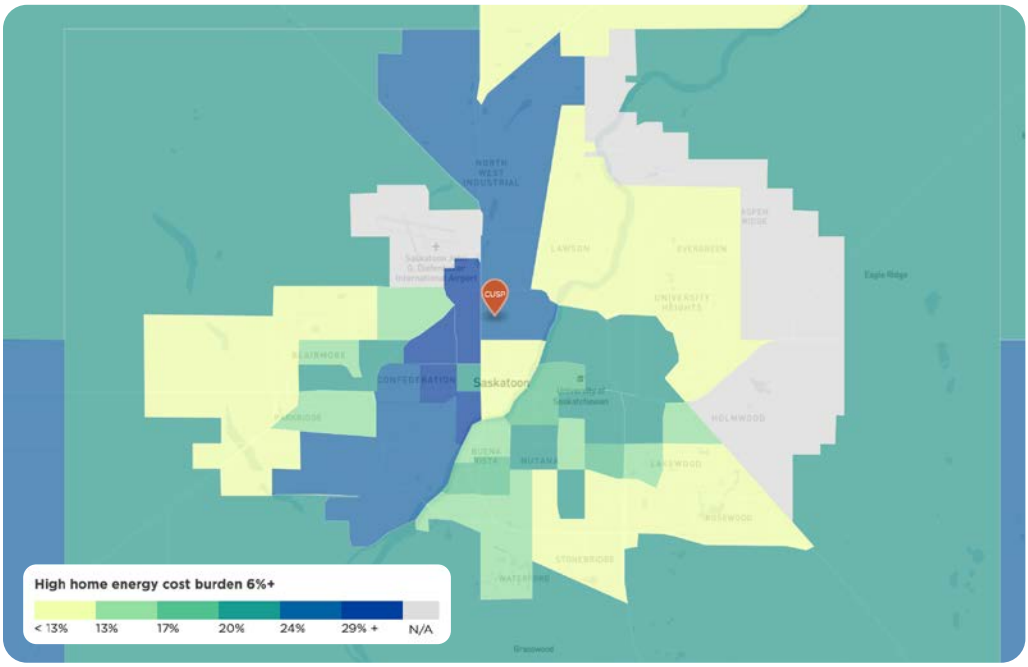


Figure 2: Saskatoon energy poverty mapping - neighbourhood level

Source: CUSP, https://energypoverty.ca/mappingtool

Households faced with energy poverty are more likely to be impacted by utility rate increases and have less ability to access water and energy conservation programs. While incentives are an important way to increase the likelihood of homes and businesses making improvements, incentive programs are often tailored towards middle and high income households, and they risk leaving out the financially disadvantaged or structurally excluded groups within our community.

Barriers to incentives and rebates include access to credit, split incentives between landlords and tenants, participation requirements, outreach and awareness, and other program-related barriers. For example, renters may not have access to incentives and rebates because landlords or condo boards do not track individual water use, and there is no incentive for a tenant to participate if the benefits stay with the property.

In the 2017 Environmental Awareness survey, not owning the property was the second most-cited reason (next to cost) for not installing water-efficient appliances. And in the 2021 Water Conservation Strategy survey, feedback emphasized working with non-profits and affordable housing providers to reach equity-deserving groups. Some Equity Toolkit engagement participants shared that they do not have capacity to participate in programs, even if programs are free, because they are focused on survival.[5]

Affordability programs that tailor conservation initiatives to low and moderate income households or those experiencing energy poverty include affordable housing, multi-family housing incentives, and income-qualified water fixture replacements.

Partnerships

The City cannot tackle water conservation on our own. By partnering with trusted community organizations, we can better engage with and deliver initiatives to the people served by our partners.

Many organizations are involved in various aspects of water conservation, from regulation to data collection and analysis, to education. Coordinating and collaborating with our partners will help align water-related initiatives and utilities management with the most current information and resources. It will also help deliver water conservation projects and programs throughout the community.

The *Corporate Climate Adaptation Strategy* Action D, Initiative 7 recommends working with the Global Institute for Water Security, Global Water Futures, and others to find ways to improve municipal government impact and risk assessment discussions, inform user-driven science, and aid in public education campaigns. Action I, Initiative 21, speaks to the Social Impacts of Climate Change by analyzing utility affordability and energy poverty from a social-equity lens. Feedback from public engagement urges partnering with affordable housing providers to complete energy and water assessments and to upgrade multi-unit and rental housing to benefit lower income households.

5 Equity in Sustainability Initiatives Toolkit Engagement Report, June 2021. https://pub-saskatoon.escribemeetings.com/filestream.ashx?DocumentId=138865

Public Engagement

There is broad public support for water conservation in Saskatoon. A 2017 survey[6] found that more than half of Saskatoon residents conserve water by taking shorter showers and reducing lawn and garden watering. Approximately 71% had installed appliances or fixtures that use less water. When questioned about the City's conservation programs, about half of respondents graded the City's conservation programs as fair or poor.

In December 2020, public and industry surveys were conducted seeking direct feedback to prioritize a list of water conservation initiatives for inclusion in the Strategy. The surveys found that most industry (79%) and public (66%) participants view water conservation as important (Figure 3)[7].

1. Reducing unnecessary water usage.
2. Caring for the environment.
3. Reducing my water bill.
4. Saving energy.
5. Reducing greenhouse gas emissions.

Figure 3: Top reasons for conserving water

6 Environics Research, "2017 Environmental Survey," Final Report, Aug. 2017, Prepared for the City of Saskatoon.

7 Water Conservation Strategy "What We Heard – Selecting Preferred Initiatives to Prioritize", February 2021.

WATER DEMAND

Water Use Now and in Recent Decades

Total annual water use in Saskatoon has not increased over the past four decades (see Figure 4). This is unexpected given our city's economic and population growth since the 1980s. Figure 4 shows total water used within Saskatoon by subtracting volumes purchased by SaskWater for use outside the city from the total water produced at the Water Treatment Plant. The data includes water lost to underground leaks and line breaks, water to flush lines, fire flows, and all other uses, metered and unmetered. Saskatoon households, businesses, institutions, civic operations, and system losses consume about 40 million cubic metres of water per year—about 1.3 cubic metres per second.

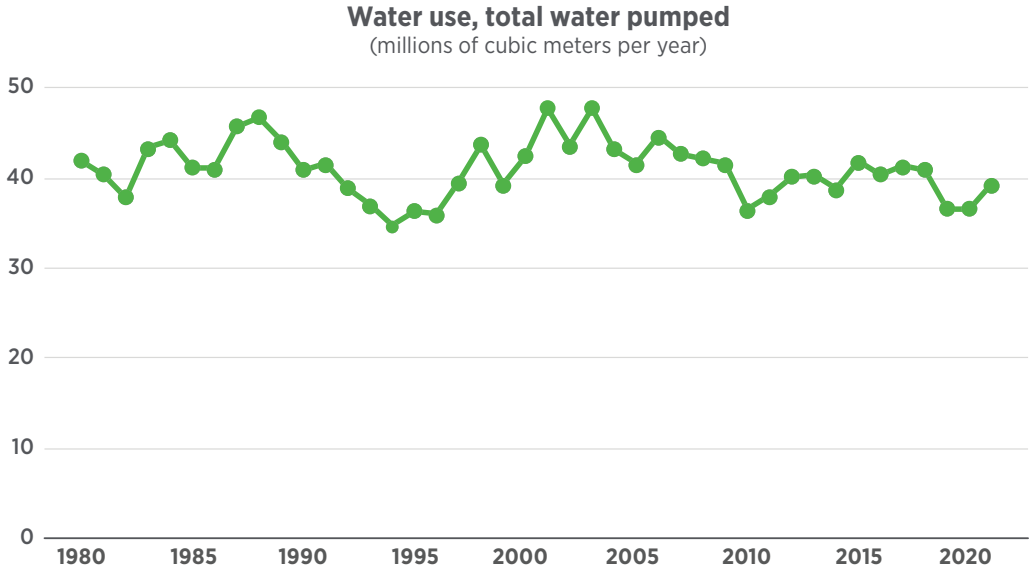


Figure 4: Total water production for use within Saskatoon, 1980–2021
Source: Saskatoon Water

Regulatory context

The Water Security Agency is responsible for regulating the province's water supply, protecting water quality, ensuring safe drinking water, and treating wastewater. The municipal government is responsible for constructing and operating water and wastewater facilities in compliance with the Water Security Agency. Regular updates and changes to water quality regulations can require water and wastewater facility upgrades and capital expenditures unrelated to demand and system capacity. As well, asset management requires ongoing maintenance and replacement due to asset conditions. In these cases, water conservation measures may not alleviate the need for upgrades and expenditures.

Per Capita Water Use

Figure 5 reveals why Saskatoon's total water use has remained constant despite a growing population and economy: per capita consumption has trended consistently downward—with per capita use today just over half its 1980 value. Per capita water use in Saskatoon in 2021 was 377 litres per day. This considers all water uses: residential, commercial, institutional, City operations, and system losses and leaks.

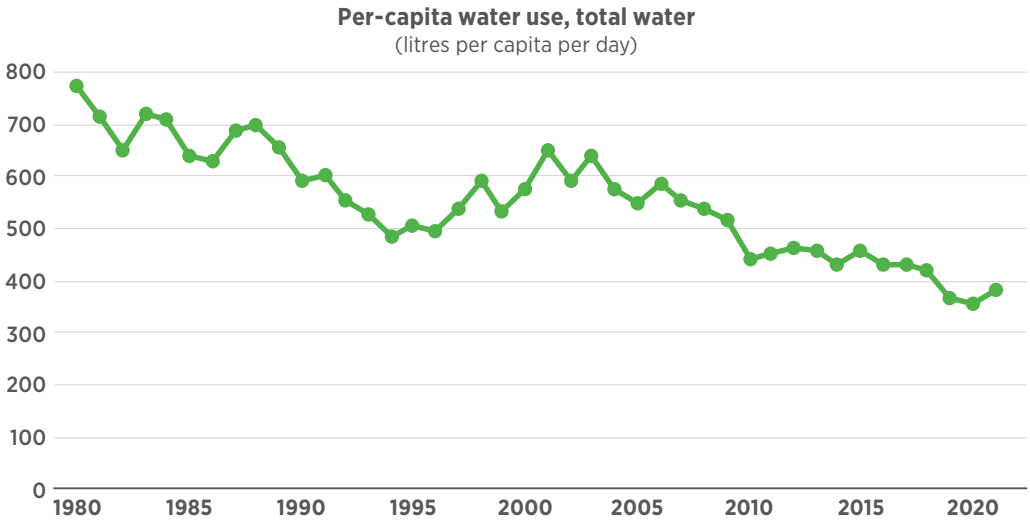


Figure 5: Per capita water use, Saskatoon, all water used within the city, 1980–2021
Source: Calculations based on data from Saskatoon Water

Figure 6 shows residential-only water use (i.e., water billed to households only) was about 210 litres per capita per day in 2021.

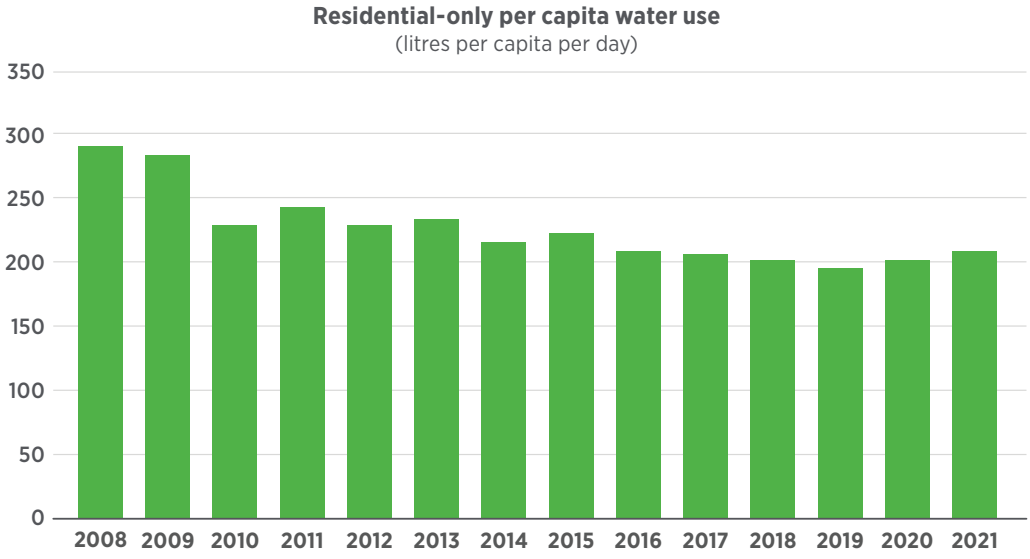


Figure 6: Residential-only per capita water use, Saskatoon, 2008–2021
Source: Saskatoon Water

The following factors influence the per capita decline in water use:

- As Saskatoon grows and adds new neighbourhoods, the new homes feature water-efficient fixtures and appliances, bringing down average per capita water use for Saskatoon. Newer residential lots may also have less lawn and plantings compared to older areas.
- As residents in older homes replace toilets, showerheads, clothes washing machines, and other fixtures and appliances, the replacements tend to be more water efficient. The 2015 National Plumbing Code now includes water efficiency requirements.
- The education, sustainability, and water conservation measures the City has already established are working. (How we're already conserving)
- Around the world, awareness of the need for conservation is growing, and this is causing people to be more thoughtful in their use of water, energy, paper, and other resources.
- Businesses and the City are taking steps to conserve water. For example, City buses are now washed largely using recycled water (Saskatoon Transit) or harvested rainwater (Access Transit), and the Parks Department has implemented computerized central control systems for watering.
- Continuous improvements and asset management by Saskatoon Water, Water and Waste Operations, and Technical Services – Asset Preservation are leading to reduced leakage, better metering, and more efficient processes.
- The rising cost of water is causing all users to think carefully about how to use less.
- The inclining block rate, introduced in 2010, incentivizes conservation by making high-volume use progressively more expensive.

This is all good news. In our future efforts to conserve water, reduce greenhouse gas emissions, and minimize water costs for residents, we can build on the many positive processes already underway.

> "Although the population has grown by 24.9% since 2009, demand has stayed relatively constant. This can be attributed to lower consumption per capita due to low-flow faucets and showerheads, low-volume toilets, more efficient clothes- and dish-washing machines, and an increased water conservation awareness."
>
> – City of Saskatoon, Water and Wastewater Utilities: 2018 Annual Report, 2019, p. 12.

Peak Demand

Figure 7 shows maximum daily demand (MDD) for Saskatoon from 1980 to 2021. As explained below, MDD represents peak summer demand on the Water Treatment Plant. Unlike Figure 4, Figure 5, and Figure 6, this graph *includes* water sold to SaskWater and distributed to rural utilities, providing a complete picture of the full demand being placed on our Water Treatment Plant.

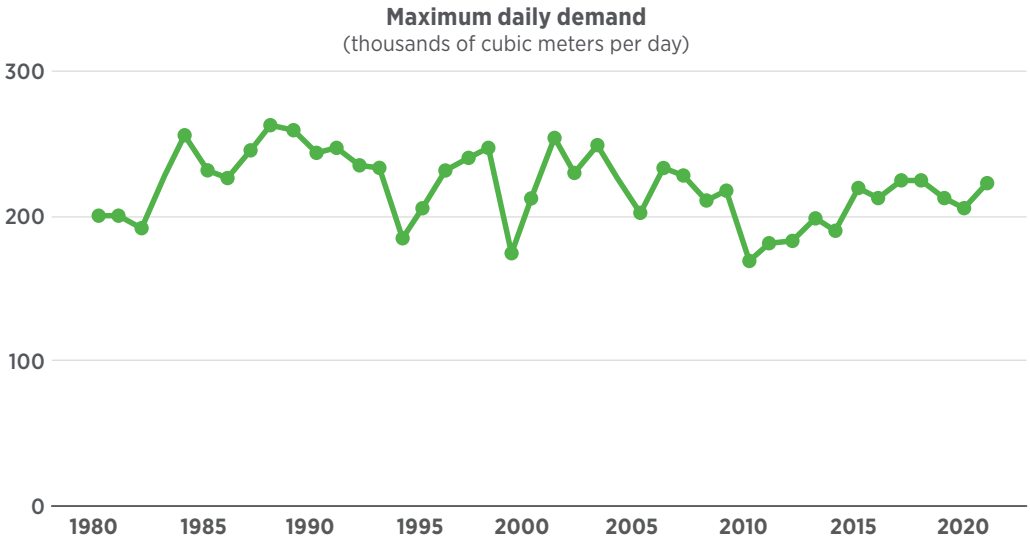


Figure 7: Maximum Daily Demand, Water Treatment Plant, 1980–2021
Source: Saskatoon Water

Figure 7 also shows that MDD fluctuates from year to year, but over the past decade is trending upward. Fluctuations are largely attributable to weather—with hot dry summers driving up MDD. While MDD has not reached the levels of the 1980s despite growth in the population and the economy, the trend is concerning because strain on water and wastewater systems due to increased demand is identified as the highest risk to city operations of climate change. And climate change projections show the likelihood of prolonged hot weather and drought conditions is increasing.

What is maximum daily demand and why does it matter?

The maximum daily demand (MDD) is the highest water flow through the water system during the year and is used for long term planning. When planning for plant capacity, a four-year average MDD, equalized for annual variations in weather, behaviour, and operations, is used to ensure there is enough system capacity and we are not needlessly increasing capacity to meet MDD.

MDD is a measure of aggregate peak demand (often reported as millions of litres per day). It is calculated based on consistent North American Standards determined by the American Water Works Association (AWWA). It is not simply the volume pumped on the day with the highest total flow; rather, it is an average daily flow based on the four consecutive days of highest demand each year. Using a four-day average reflects the fact that, because of reservoir storage, the challenge to Water Treatment Plant capacity is not meeting peak demand on one day but operating near capacity for several days straight. The main contributors to MDD are outdoor watering, cooling (some commercial systems use water as a cooling medium), and tourism/hospitality.

MDD is important because it tells us how close peak demand comes to treatment plant capacity. In other words, is our plant large enough to meet peak demands safely and consistently? In the medium term "as demand approaches plant capacity, the level of service to always meet MDD must be re-assessed and possible peak demand management initiatives implemented."[8] Longer term, if MDD increases, plant capacity may have to be expanded or, ultimately, a second plant may need to be built. (As a point of comparison, Calgary added a second treatment plant, the Bearspaw plant, in 1972 when that city's population reached 415,000.)

Capacity of the water treatment plant is currently 220 million litres per day.[9] Several sources have pointed to rising demand creating the potential need for a second treatment plant and sustaining capital works to the current plant in the next decade. A comprehensive assessment of the Water Treatment Plant in 2021 by independent consultant AECOM Canada Ltd.[10] concluded that peak demands (i.e., MDD) associated with outdoor water use during hot, dry conditions are the largest contributor to current capacity issues at the water treatment plant.

8 City of Saskatoon, *Water and Wastewater Utilities: 2018 Annual Report*, 2019, p. 14.

9 City of Saskatoon, "Water Treatment Plant", website.

10 City of Saskatoon, *Water Treatment Plant Long Term Capital Strategy*, 2021, internal document.

Figure 8 highlights the variability of flows throughout the year as well as summer demand peaks. The graph shows that summer water use from May through October, is up to twice as much as the baseline flow from November through April.

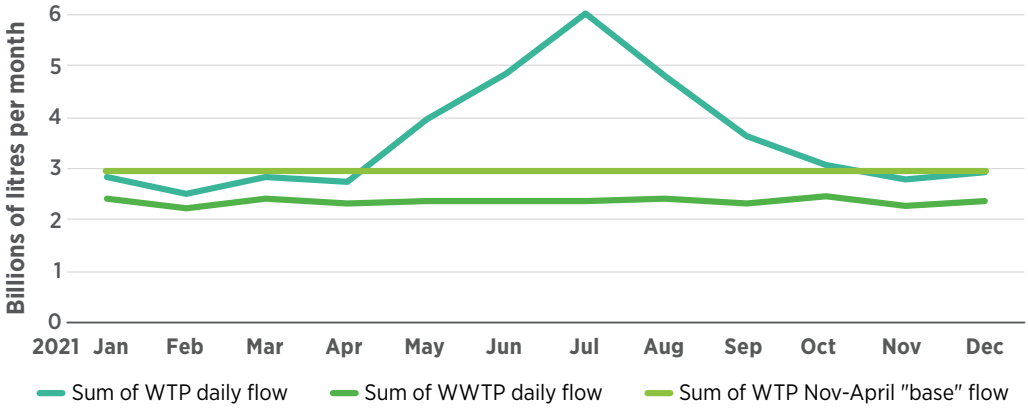


Figure 8: Comparison of flows through Saskatoon's Water and Wastewater Treatment Plants, 2021
Source: Saskatoon Water

Figure 9 categorizes water usage.

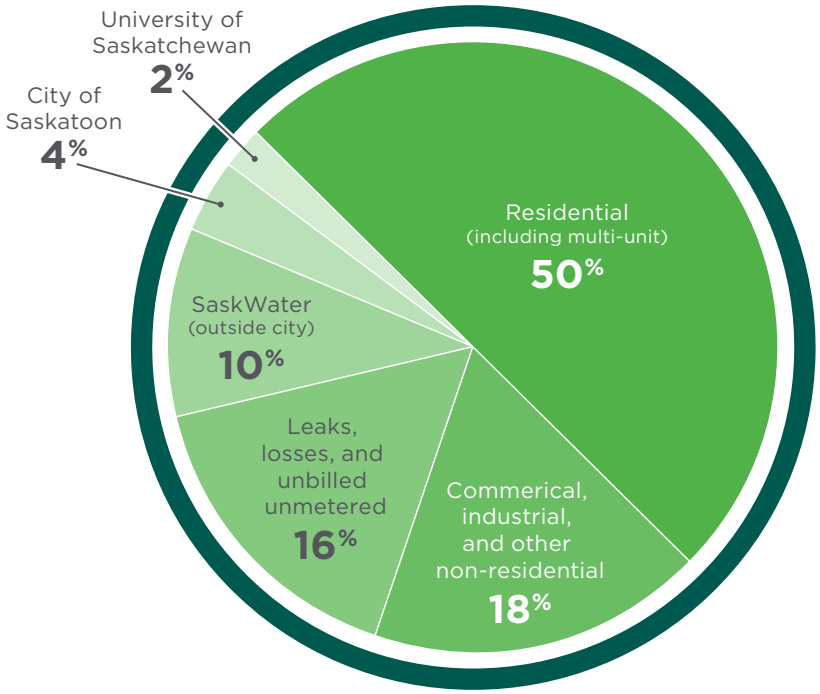


Figure 9: Categorization of uses of water from the Water Treatment Plant, 2019–2021 averages
Source: City of Saskatoon, Corporate Finance Department; and Sustainability Department

Figure 10 shows billed water use for civic facilities and operations.[11] Civic water use is dominated by irrigation of large landscapes; over half of the civic water use goes to irrigate parks, golf courses, the Forestry Farm, and other outdoor areas. Spray pads and paddling pools account for another 13%. In an average year, 70% to 75% of the water billed to the City is used outside in the summer when peak demand occurs at the water treatment plant.

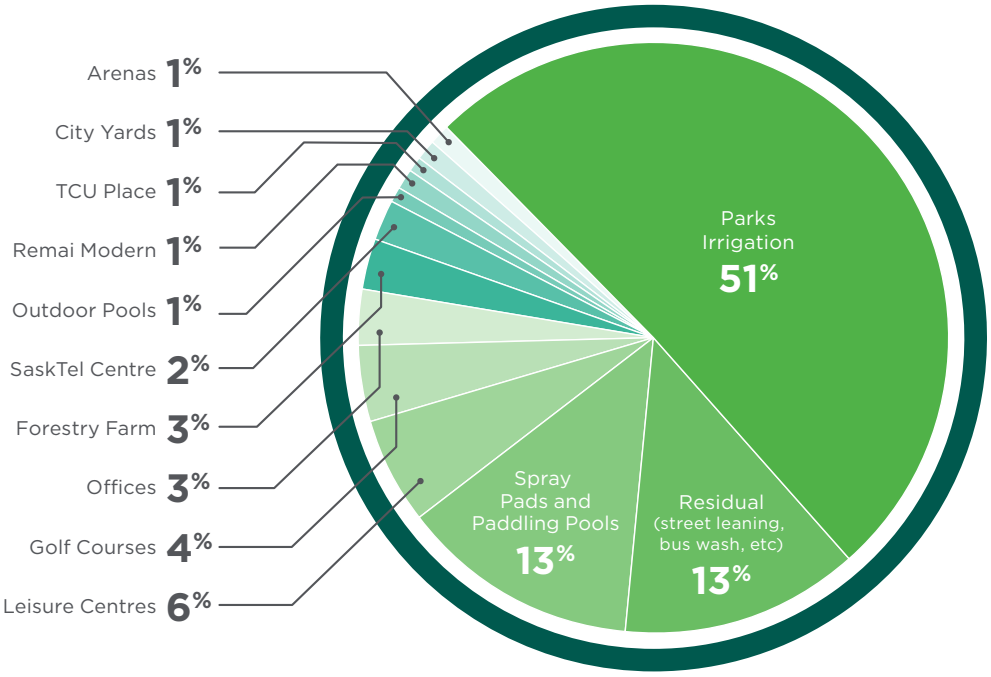


Figure 10: Sectoral breakdown of civic water use, 2019–2021 average
Source: City of Saskatoon, Corporate Finance Department; and Sustainability Department

Demand Management

There may be opportunities to use the Advanced Metering Infrastructure system to provide customer load management to control aggregate load on the water distribution system. Much of the capital planning work to date has focused on average day demand, but with our peaking factor at double the average, we still need capital development to support maximum daily demand. The application of time-of-use rates is one example of load management: water rates could be incentivised during periods of low utility demand, which could influence customer water consumption behaviour. Effective load management could help reduce the need to prematurely replace distribution infrastructure arising from capacity limitations.

11 With the addition of street cleaning, which is unbilled.

Rate Structure

Inclining block rates can help accomplish two goals. First, they can improve affordability and access by pricing a basic allocation of water at a lower price. Second, an inclining block rate can incentivise conservation by making high-volume use progressively more expensive. *"Saskatoon water rates are designed to encourage water conservation."*[12] Steeper rate inclines (reducing the prices on the lowest block while raising prices on the second and third block) can increase the effectiveness of inclining block rates in delivering both affordability and conservation. This would have to be done sensitively, so as not to inadvertently trigger increased instability in utility revenues or drive larger households (i.e., homes occupied by a higher number of people) into energy poverty.

A Three-Pronged Approach to Reducing Emissions: Reduce, Improve, and Switch

Reducing overall emissions requires reducing water-related emissions. This Strategy lays out a plan to reduce emissions by reducing water use. In line with the *LEC Plan*, there is also a need to diversify efforts to collectively reduce emissions by following the reduce-improve-switch approach (Figure 11). Achieving a balance between efficiency, renewable energy, and conservation is part of an integrated approach to emission reduction.

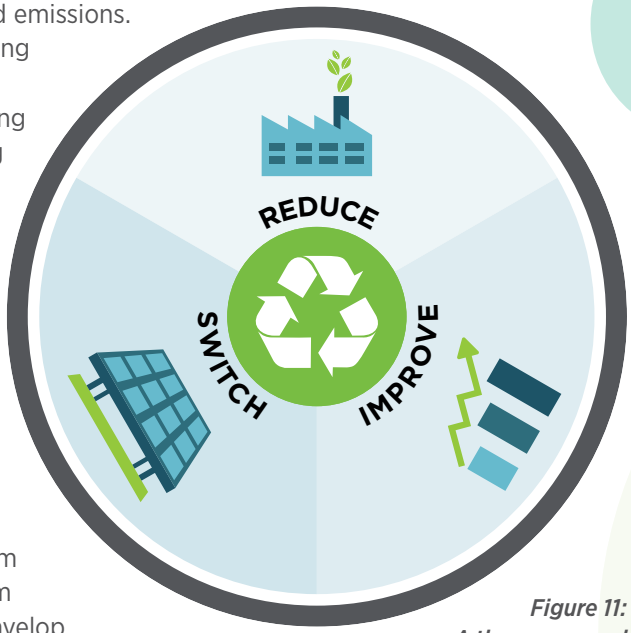


Figure 11: A three-pronged approach to reducing water-related emissions: reduce, improve, switch

Improving WTP and WWTP energy efficiency is being investigated through the Energy Management Project. Saskatoon Water recently embarked on the project to analyze energy data and manage plant energy use effectively. As the program is developed and more data is gathered, greenhouse gas emission reduction modelling for water conservation will be updated. In addition to emission reductions from lower water demand, the program will also identify reductions in water-related emissions from increased energy efficiency (such as pump and building envelop efficiencies) and a transition to low-emission renewable energy.

A renewable energy strategy to switch to low carbon energy sources is currently in development. It will provide an overview of the status, conditions, and challenges of renewable energy in Saskatoon as well as an action plan with recommendations for near and long-term actions to meet energy-related targets in the *LEC Plan*.

The Water and Wastewater Treatment Plants have an opportunity to integrate renewable energy technology, including solar photovoltaics and biogas production, to offset energy demand and potentially contribute to overall improvements in the emissions intensity of the power grid.

12 City of Saskatoon, Water and Wastewater Utilities: 2018 Annual Report, 2019, p. 23.

What is emissions intensity?

A lot of energy is required to pump and treat water from the river, as well as to collect and treat it again at the Wastewater Treatment Plant. For example, the large pumps at Saskatoon's Water Treatment Plant and reservoirs can produce a combined total of more than 7,350 Kilowatts (10,000 horsepower) and most run continuously at a significant fraction of their peak power.[13] All that energy use creates greenhouse gas emissions.

"Emissions intensity" is a measure of how many grams of emissions (carbon dioxide equivalents or CO_2e) are, on average, created per litre of water each year. While emission intensity enables us to make generalized calculations about the relationship between water quantities and emissions, certain limitations should be kept in mind. Emissions intensity will change as SaskPower's grid becomes cleaner and the efficiency of water operations improves. Nonetheless, emission intensity can help estimate emission reductions resulting from water volume reductions.

Greenhouse gas emission intensity of water heating

Conserving hot water has even larger effects on emissions because it avoids the need to heat the water. The emissions intensity of hot water is about 35 times more than cold water. Showers use 20% of all water in households (See Figure 15) and about 85% of that is hot water. Baths use 85% hot water, taps use 50%, clothes washers use 20%, and dishwashers use 100%. Thus, reducing water use in baths, showers, laundry, and dishwashers is important to reducing emissions. One distinction, though, is that emissions related to energy use for water treatment and pumping are recorded on the municipal government side of the ledger, while emissions related to water heating in homes are recorded on the community side.

13 Most pumps in Saskatoon's water distribution system are designed and controlled so that they run near peak efficiency across a wide range of flow requirements.

EVALUATING WATER CONSERVATION

"Being water efficient today helps us ensure future generations have the water they need."

– *City of Calgary*

Greenhouse Gas Emission Reductions

Water conservation initiatives reduce greenhouse gases by reducing the total water pumped. To compare the effectiveness of implementing this Strategy, Saskatoon Water modelled two 30-year water-energy scenarios. The comparison was meant to be high-level with a moderate level of accuracy.

The first scenario is based on reaching *LEC Plan* targets to reduce water use. The second scenario is based on business as planned, with no new water conservation programs. Modelling showed that by implementing the actions outlined in the first scenario, the City could save 14,387 tonnes compared to the business as planned scenario.

Cost Effectiveness

Water conservation requires investment capable of generating future savings. For example, a new toilet, equipment retrofits, or ambitious programs to find and fix underground leaks all require upfront capital but result in ongoing savings.

If the full benefits to residents, business, and the City were considered, many of the initiatives would have short payback periods and full-life-cycle savings that are multiples of initial costs or investments.

Examples of cost saving programs:

- An **irrigation pilot project** conducted in 2021 demonstrated that Evapotranspiration-based (ET-based) watering can save water while maintaining turf quality, potentially saving Park operations 178,750 cubic metres of water, $430,000 and 77 tonnes of CO_2e each year.
- A **toilet-rebate program** could cost the City $100–$200 per toilet replaced and residents an additional $300, but the program would save the household $1,565 over 20 years for each replacement. Most conservation initiatives not only pay for themselves, they also pay ongoing dividends.

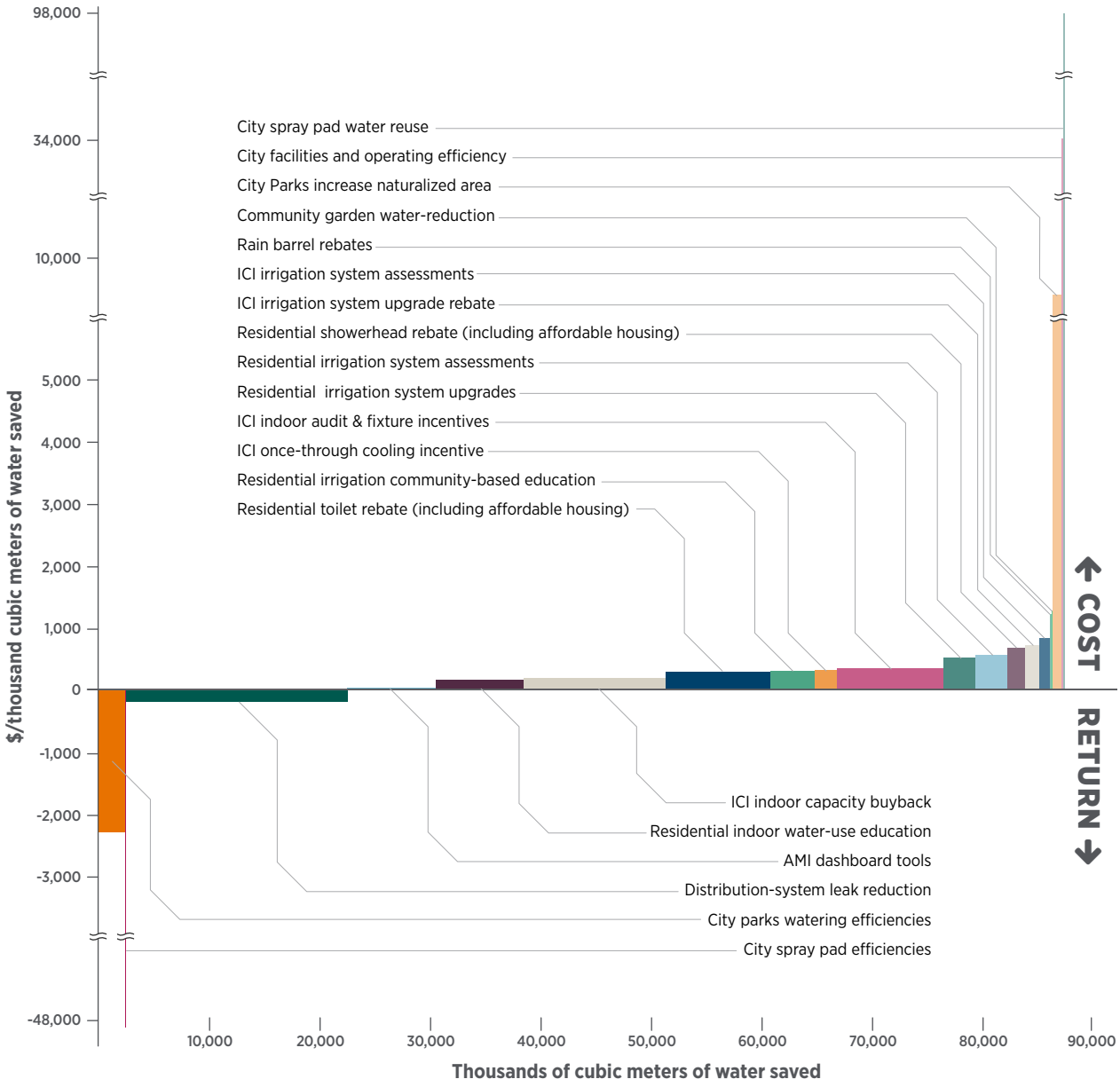


Figure 12: City cost of water conservation opportunities compared to water savings

The cost effectiveness of different water conservation initiatives was evaluated by comparing the cost to the City compared to the volume of water saved (Figure 12). A negative number (below the x-axis) indicates that the City will save money for each cubic metre of water reduced. A positive number (above the y-axis) indicates that the City will lose money for each cubic metre reduced. Wider bars indicate more overall water reductions.

This analysis only considered City costs and savings. For many programs, a large portion of the costs will fall on the City, while most of the benefits and savings will flow to residents, businesses, and institutions. This analysis also does not evaluate the impact of reduced revenues from water conservation.

Comparing Water Use in Saskatoon to other Cities

Experience with water conservation programming in other cities indicates that a reduction in absolute demand is possible, even with a growing population and economy. In assessing its water-conservation performance, the City of Guelph reported that between 2006 and 2014 the city's population increased by 13,686 persons (about 12%) while water production actually *decreased* by 5,900 cubic metres per day (almost 12%).[14]

While Saskatoon's per capita water use has fallen significantly (Figure 5), the same is true in other jurisdictions, such that Saskatoon's per capita use remains relatively high compared to other cities. Figure 13 shows per capita water use for total water for 2019.[15] Saskatoon's per capita use in 2019 was 365 litres per day — 33% above the average of 275 litres per day in western cities.

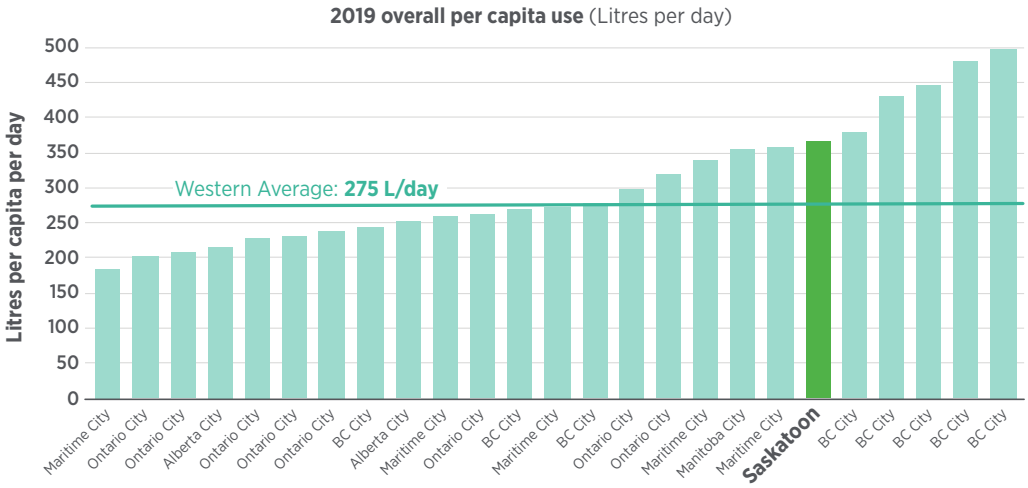


Figure 13: Per capita water use, all water, selected Canadian cities, 2019
Source: Created from data sourced from the National Water and Wastewater Benchmarking Initiative (NWWBI), online database. Values anonymized at the request of NWWBI and participating cities.

14 C3 Water and Gauley Associates, City of Guelph: Water Conservation and Efficiency Program Progress Report (2006–2014), March 2016, p. 7.

15 Includes residential, industrial, commercial, civic, leaks, losses, unbilled, etc., but excludes out-of-city exports; i.e., total water pumped from the water treatment plant less exports.

How We're Already Conserving

The Strategy outlines a comprehensive suite of effective conservation initiatives that may be able to reduce overall water demand and help meet *LEC Plan* targets. However, the City already has in place several initiatives that are conserving water, including the following programs:

- **Conservation-focused rates:** Residential inclining-block rates were implemented in 2010[16] with the aim of creating incentives to conserve water, while supporting affordability by maintaining lower water rates for basic levels of consumption.
- **Advanced Metering Infrastructure (AMI):** Advanced Metering Infrastructure (AMI) is an automatic system that collects water use data several times a day and transmits it wirelessly over a secure network to a central data-management system. AMI systems can detect water leaks in homes and businesses, enable customers to track use, support education, and help target and evaluate conservation initiatives. Plans are in place to enable customers to use internet tools to view their water usage data and potentially set threshold warnings or conservation goals.
- **Healthy Yards:** Focused on outdoor water conservation, this program was launched in 2015 as an expansion to Be Water Wise. The program includes educational materials, rain barrel and compost bin rebates, and a focus on low-water gardening and mulching and composting ("healthy soils hold water"). Adjunct programs include the Garden Patch demonstration site and a program by Saskatoon Land to offer compost bins and rain barrels to residents in selected neighbourhoods at no cost.
- **Environmental Grants:** In 2017, $10,000 was added to the Environmental Grant for projects related to protection and conservation of water resources. In the five years the water conservation grant has been offered, $50,000 has been awarded to support 13 projects and over $500,000 in funding has been leveraged from the community and other organizations.
- **Energy Assistance Program:** In partnership with SaskPower, this program provides energy and water efficiency education and free installation of energy and water saving measures to residents (both renters and owners) who have not traditionally been able to access other efficiency programs. Launching in late 2020, the program builds on SaskPower's 2019 pilot program to address energy poverty and barriers in investing in home efficiency upgrades.
- **Home Energy Loan Program:** This program helps homeowners improve energy efficiency, install renewable energy, or reduce water use by offering low interest loans to cover the upfront costs of these upgrades. Loans between $1,000 and $60,000 are available for eligible retrofits and are repaid through property taxes over 5-, 10-, or 20-year terms.
- **Storm Water Management Credit Program:** This program provides a reduction in storm water charges to multi-residential or non-residential property owners who have implemented storm water quality improvements and pollution prevention, or to owners who have reduced the quantity of storm water leaving their property. Eligible projects include storm water capture for re-use and enhanced vegetated retention areas.

16 Saskatoon Water and Wastewater Utility Rates and Return on Investment, report to Council, Nov. 30, 2015, page 315.

- **Industrial, commercial, and institutional sector audits and education:** In 2016, the City contracted the Saskatchewan Environmental Society to audit the water use of four hotels. In 2019, Saskatchewan Environmental Society completed a follow-up report detailing lessons learned and savings achieved. This pilot project will form the basis for planning future Industrial, Commercial, and Institutional sector audit and incentive programs.
- **Student Action for a Sustainable Future:** Designed and funded by the City and delivered by the Saskatchewan Environmental Society, the program builds capacity among grades 5 to 8 teachers to work with students on projects that help them understand, measure, and reduce greenhouse gas emissions, food waste, energy use, and water use. Participants are encouraged to quantify gains using before and after audits.
- **Irritable Sewer Syndrome:** Delivered by Partners of the Saskatchewan River Basin and in partnership with Meewasin, Irritable Sewer Syndrome provides education on appropriate use of the sanitary sewer system. The program discusses the impact of putting inappropriate substances into the sanitary sewer system, including pharmaceuticals, hazardous waste and foods containing fatty acids.

In addition to programs supporting conservation in the community, there are also several internal, City-focused initiatives, including:

- **Irrigation Efficiency Pilot Project:** In 2021, Parks and Sustainability conducted a pilot project to learn whether ET-based watering could save water while maintaining high standards of turf quality. The pilot was successful, based on comparisons with a control group of parks. The next step is to transition the irrigation network to ET-based watering.
- **Civic Water Revenue Loss Audit and Mitigation Project:** This project creates a more accurate picture of water uses, quantifies leaks, and lays a foundation for saving water and money.
- **Facility upgrades:** Ongoing washroom and facility upgrades improve plumbing fixture efficiency.
- **Green building certifications:** The City adopted a High Performance Civic Building Policy on January 1, 2022. The policy ensures that new buildings are designed and constructed to achieve reduced water and energy consumption. A BOMA Best[17] performance standard program is in development for existing City buildings.
- **Storm and raw water irrigation:** Sustainability Department is working with Saskatoon Land, Planning, Saskatoon Water, Parks, other departments, and developers to assess a proposed use of storm water for irrigation in the Brighton neighbourhood. A pilot project may follow.
- **Fleet washing:** City buses are washed using recycled water (75% is recycled at Saskatoon Transit[18]) or roof-captured rainwater (about half of wash water for Access Transit comes from rainwater[19]). Access Transit also uses rainwater for toilet flushing and irrigation.

17 BOMA Best is a voluntary program to provide building owners and managers with a consistent framework for assessing environmental performance and management of existing buildings.

18 Phil Tank, Civic Operations Centre Heralds New Era for Transit, Saskatoon StarPhoenix, Dec. 14, 2016.

19 *City of Saskatoon Access Transit Bus Storage Facility: Overview of Green Features*, undated, assumed to be an internal publication

- **Water conservation in parks and open space:** Naturalized areas in parks do not require regular watering of established trees and plants (15% of park area is naturalized). Maximum water application rates are being tested to decrease from one inch to 0.8 inch per week. Automated Irrigation Management Systems enable centralized control and use weather stations to automatically turn off parks irrigation when it rains.
- **Efficient watering:** Tree bags more efficiently water newly planted trees.
- **Low-water landscaping:** Xeriscaping at Fire Hall #8 and elsewhere creates attractive landscapes with reduced water use.
- **Alternatives to potable water:** Raw water irrigation at two of Saskatoon's three municipal golf courses (Holiday Park and Silverwood) conserves potable water and the energy required for water treatment. In some years, storm water from storm water retention ponds is used to water trees (1,700 cubic metres in 2018).
- **Conserving water at recreation amenities:** At spray parks, temperature sensors and maximum flow guidelines are moderating water use. Some of the newer spray pads have a single push button to cycle through multiple spray features and reduced run-times, resulting in lower water consumption.

As a result of conservation programs, improved standards, better technologies, smaller yards in new neighbourhoods, increasing density, and increasing awareness of the need to conserve resources, per capita water use in Saskatoon has fallen significantly in recent decades (see Figure 5). This has had the beneficial effect of keeping aggregate water use from rising, even as our economy and population have grown. In coming years, however, more ambitious and concerted conservation measures will be needed to reduce aggregate demand to meet emission-reduction goals.

Conservation Impacts on Utility

Water conservation leads to benefits and reduces consumption-related costs for customers, but also reduces sold volumes (revenues) for the City's water and wastewater utilities. To maintain the water utility, operating costs are categorized as fixed and variable. Fixed costs are needed to maintain the infrastructure and do not vary with changes in water demand or volume. Water utility revenue is only from selling water, so any decrease due to conservation increases the percentage of fixed costs. Increasing fixed costs, including any action associated with conservation, leads to water rate increases.

Conservation has reduced short-term demands on infrastructure, allowing for better long-term capital planning while enabling existing infrastructure to maintain service levels. Every year the City can delay large capital expenditures provides savings for utility ratepayers. The understanding that capital-cost deferral can yield significant savings is widespread and wholly accepted by independent consultants, other utilities, and Saskatoon Water.

Experience in other jurisdictions suggests that water and wastewater utility revenue reductions can be managed and mitigated. Indeed, many cities and their utilities have implemented programs that have driven water use and related revenues down. To give two examples, Guelph's conservation programs reduced absolute demand 12% between 2006 and 2014, and in Winnipeg, absolute water use declined 15% between 2006 and 2015—from 71 million cubic metres per year to 61 million cubic metres.

Conservation Impacts on Wastewater

Indoor conservation reduces water flows through the sanitary sewer system, but the mass of solids is unaffected. The concentration (solids-to-liquids ratio) increases as indoor water use falls. Higher concentrations may create problems at the Wastewater Treatment Plant or in the collection network, and it may require investment to deal with concentration changes.

Financial Planning

Sustaining the proposed multi-year water conservation programs will require stable funding. The Strategy uses TBL and Integrated Water Management approaches when considering the financial viability of the utilities and their continued ability to provide and invest in secure water and wastewater services.

The Water Conservation Strategy provides guidance for future work planning and budget forecasting. A more detailed examination of potential funding sources will be conducted as initiatives are brought forward to Council for deliberation throughout implementation.

WATER CONSERVATION ACTIONS

The set of opportunities described below will help mitigate risks and manage water demand. By reducing overall and peak water demand, these water conservation actions can, together, meet *LEC Plan* targets.

Indoor Residential Conservation

Residential indoor water use is key to the success of the conservation strategy. Half of the water used in Saskatoon is used by residential customers, and of that, nearly three-quarters is used indoors. Moreover, hot water use in residential showers, sinks, dishwashers, and clothes washers is responsible for a disproportionate amount of water-related GHG emissions.

Figure 14 shows the percentage breakdown of water use for an average home in Canada and the United States. The largest water users—and therefore the largest potential sources of conservation savings—include toilets, faucets, showers, clothes washers, and leaks. Better technologies and standards are already reducing water use in most of these fixtures and appliances.

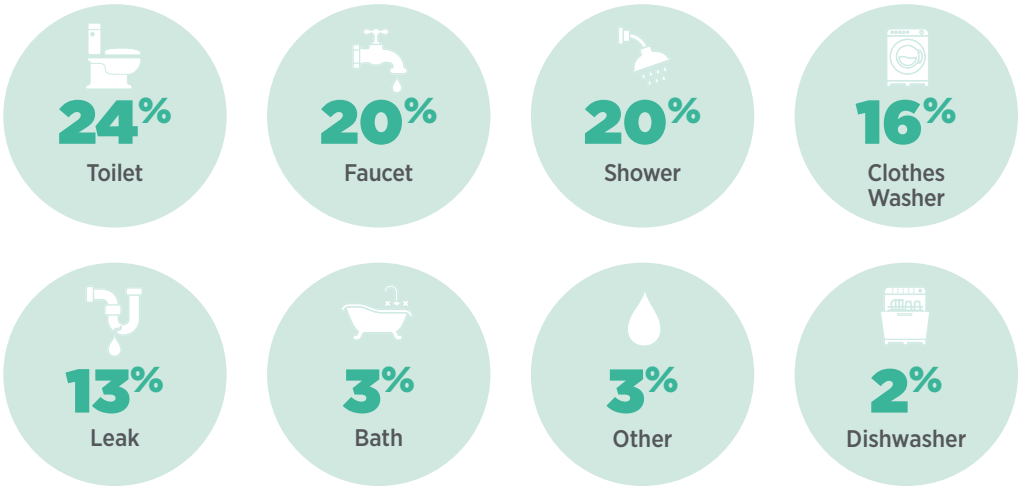


Figure 14: Canadian and US indoor household water use categorized by fixture or appliance
Source: Water Research Foundation and DeOreo et al., Residential End Uses of Water, Version 2: Executive Report, 2016. "Other" includes evaporative cooling, humidification, water softening, and other uses.

There are barriers to making homes and businesses more water efficient. In the 2021 survey on the Water Conservation Strategy, 41% of respondents say they don't know if they are currently using too much water and 24% say water conservation upgrades are too costly. Another 22% report that they have already made their home or business water efficient. It's encouraging to note that 54% of respondents indicate they were more likely to conserve water considering the proposed program options.

When asked about the best ways to educate the public on water conservation, survey respondents identified their water bill (57%), access to web-based tools to view their water use (55%), and providing online savings calculators, budgeting tools and checklists (53%). Making water bills more relatable and easier to understand would provide a more direct means of comparing the benefits of conservation efforts within homes and businesses.

Indoor Residential Opportunities

The initiatives below target about three quarters of indoor residential water use.

- **Residential toilet rebate:** A $75 rebate per replaced toilet, if funded for 10 years, could install up to 20,000 low-volume toilets and cut total water use in Saskatoon by 1.2%.
- **Residential showerhead rebate and give-away:** Rebates (up to $30) or give-aways of showerheads and faucet aerators, if funded for 10 years, could install up to 22,000 low-flow showerheads and cut total water use in Saskatoon by 0.2%.
- **Residential water-use education program:** Work with trusted community partners to deliver an education and advertising program that aims to reduce total water use in Saskatoon by 1.5%.
- **Residential water audit and coaching program:** Through an in-home audit, coach residents about potential conservation opportunities, such as recommended retrofits, repairs (ex. toilet/showerhead replacements, identifying leaks, etc.), and behaviour changes. The program may include give-aways for faucet aerators and showerheads and connect residents with other rebate/incentive programs.
- **Affordable and multi-family housing water conservation incentives and education:** A water efficiency program aimed at increasing conservation efforts and making rental homes more affordable by reducing water costs. This would include both tenant and building operator education and training.
- **Affordable housing energy and water conservation pilot:** Work with an affordable housing provider to improve both energy and water efficiencies. This work may include conducting audits and assessments, developing education and awareness material for building operators and tenants, applying for grants, and implementing upgrades. Cress Housing has expressed interest in exploring opportunities with the City through the Memorandum of Agreement between the City of Saskatoon and the Saskatoon Tribal Council.
- **Income-qualified water fixture replacement program:** Tailored toward lower-income households, this program would include retrofitting, repairs (e.g., toilet and showerhead replacement, identifying leaks, etc.), and behaviour changes.

Indoor Conservation in the Industrial, Commercial, and Institutional Sector

Almost a third of the water consumed in Saskatoon (SaskWater volumes excluded) is used in the industrial, commercial, and institutional sector: stores, offices, hotels, restaurants, care homes, maintenance buildings, schools, churches, hospitals, and other facilities. To meet water conservation goals, effective programs must be developed and implemented for this sector.

Industrial, commercial, and institutional sector opportunities

- **ICI audit and fixture incentive program:** Walk-through audits would quantify water use, identify potential savings, and provide toilet/fixture replacement incentives. This could lead to 483,000 cubic metres per year in water savings, which could reduce water demand by 0.1%.
- **ICI capacity buyback program:** An audit/incentive program that provides information on conservation-related costs, savings, and payback times. Organizations that implement recommended water-saving measures then receive a one-time payment for demand reduction. This could reduce overall water demand by 1.6%.
- **ICI once-through cooling replacement incentive program:** This program would locate once-through cooling equipment in Saskatoon and offer replacement incentives. This could result in 100,000 cubic metres per year in water savings.
- **ICI building energy retrofit program:** This program would build on the current Home Energy Loan Program (HELP) in the residential sector. It targets larger properties and includes a financing and/or incentive program, education/training materials, and networking opportunities for businesses. Water conservation opportunities may include subsidies or loans for low flow fixtures, energy management systems, and water savings technologies such as timers or sensors to reduce water usage in large buildings.
- **Water conservation environmental grant:** Increase the amount of money available to community organizations for water-related programs and projects, and broaden the criteria for eligible recipients beyond non-profit, cooperative, and charitable sectors to include businesses and community groups. Increase the total grant money available to support more ambitious, larger scale, or longer term initiatives.

Outdoor Conservation: Where and How Large are the Potential Savings?

In Saskatoon, 17% of water is used for irrigation, with most of that applied to residential yards.[20] More important, because irrigation demand is concentrated within a few months, it is the main contributor to summer maximum daily demand. Outdoor watering can double daily water demand during hot or dry periods (see Figure 8).

Outdoor water use is a critical focus of our conservation efforts for three reasons:

1. Outdoor use is primarily irrigation. Significant savings and efficiencies are possible since about *half* of irrigation water is wasted due to wind, evaporation, overwatering, and runoff caused by inefficient irrigation methods and systems.[21]
2. Outdoor use is the largest contributor to capacity-straining maximum daily demand peaks.
3. Outdoor use volume is very large: approximately 7.3 million cubic metres per year in Saskatoon — 200 litres per second when averaged over the year and 2,000 litres per second on peak-flow days.

As much as half of irrigation water is unnecessary or wasted. This is significant because irrigation is a main cause of the high-water demand straining water treatment plant capacity. Efficient watering and effective outdoor conservation can help reduce peak demand and avoid the need for capacity expansion upgrades.

Outdoor water conservation efforts can be divided into five conceptual categories:

1. Water less area (e.g., replace lawns with drought-tolerant native plants).
2. Water more efficiently and effectively (e.g., water at night to reduce evaporation, ensure sprinklers are not watering driveways and sidewalks, use drip irrigation).
3. Apply less water (e.g., reduce lawn watering below the oft-cited but often excessive one-inch-per-week guideline).
4. Find alternatives to potable water (e.g., use storm water harvesting or grey water).
5. Use soil and landscape amendments to reduce water requirements (e.g., use mulch to reduce evaporation or add compost to build water-retaining soils).

> An analysis of billing data from the Regions of Peel and Waterloo indicate that the average single-family customer applies only about 7 mm (less than 1/3 of an inch) of water each week. The commonly marketed message that lawns need "one inch of water per week" may promote overwatering. Municipalities may want to consider re-packaging the message to promote watering less than one inch per week.
>
> *– Ontario Water Works Association (OWWA), Outdoor Water Use Reduction Manual, June 2008.*

20 Assumption: 80% of (non-parks/non-City) irrigation water is applied to residential yards and 20% to industrial, commercial, and institutional properties. It may be possible to refine this estimate using AMI data (non-AMI data can't be used; billing is based on infrequent meter reads and estimates). Recall that nearly all golf courses are fed from non-potable sources and thus not included here.

21 US EPA, WaterSense: Statistics and Facts, website.

Outdoor opportunities

Outdoor conservation programs are targeted at households with irrigation systems. Also, programs such as Water Smart Irrigation Professionals (WSIP) that train and certify installers partly shift the focus of conservation work from property owners to irrigation system companies, "making efficient irrigation practices the new standard."

Public survey respondents expressed conflicting views on lawns. Some respondents stressed the importance of green grass, while the majority of comments supported moving away from lawns toward more natural plantings.

- **Residential irrigation system upgrade rebate program:** A $200 financial incentive to purchase best-available controllers and/or rain sensors for sprinkler systems, if funded for 10 years, could reduce total water use by 0.7%.
- **Residential irrigation community-based education program:** An education program that facilitates direct contact among community members and focuses on how to improve outdoor watering by changing behaviours (i.e., how often, duration, coverage, etc.), could reduce water usage by 0.5%.
- **Residential low-water landscaping program:** An education program combining custom yard plans, education/training workshops, advertising campaigns, policies/guidelines, and incentives promoting water efficient landscaping methods could reduce water usage by <0.5%.
- **Residential rain barrels rebate:** Increasing the City's existing rain barrel rebate from $20 to $30 could decrease water usage by a modest amount (<0.1%); more importantly, it could be an effective education tool.
- **Outdoor watering restrictions and bans review:** Watering restrictions and bans are implemented during periods of high-water demand that strain the capacity of the water treatment plant. Restrictions can include scheduled watering periods (e.g., odd and even-day watering, one-day-per-week watering), or prohibiting outdoor watering. This review will look for gaps and improvements for how and when the City uses water restrictions and bans.
- **Community gardens water reduction support program:** Funding community gardens to invest in water conservation and efficiency will conserve modest amounts of water (<0.1%); more importantly, it could be an effective education tool.
- **ICI irrigation system upgrade rebate program:** Provide incentives to replace older irrigation control systems with WaterSense-labelled, weather-based controllers and other upgrades (e.g., rain sensors). This would allow participants to reduce outdoor water consumption by as much as 20% and could reduce maximum daily demand by 0.3%.
- **ICI irrigation system assessments, training, and accreditation:** An irrigation-company training and certification program that advances water-efficient irrigation techniques and practices in the industry.

Civic Conservation

The City is also committed to improving our own water efficiency. Two thirds of the City's water use in facilities and operations is used outdoors in the summer, the majority for park and green space irrigation. Watering City parks, vegetation, and trees consumes the most amount of water (800,000 cubic metres per year) and accounts for more than half of the total water used in civic facilities and operations.

Some possible water conservation initiatives cannot be easily categorized as residential or industrial, commercial and institutional, or as outdoor or indoor. These initiatives, with more generalized effects, are also collected below.

Public survey respondents felt the City should lead by example and City parks and facilities should be a model for residents to follow.

Civic opportunities

- **Civic water conservation – maximize watering efficiency in parks:** Based on the results of the 2021 irrigation pilot project, upgrade irrigation equipment, fix leaks, update water application rates and reprogram control settings to optimize watering while maintaining healthy turf and vegetation. Creating an irrigation strategy would identify opportunities, costs and return on investment, and prioritize efforts. This could reduce water use in City parks by 10% to 20% (170,000 cubic metres) and save about $400,000 per year. This would also avoid 150–200 cubic metres per day of additional demand, on average, during the summer, increasing the resilience of the water system.
- **Civic water conservation – Irrigation network audit to increase naturalized areas in parks:** Conduct an irrigation network audit to identify areas that exceed park irrigation standards, areas of overspray, areas that can be transitioned to naturalized landscaping, and other opportunities. Naturalized parks require little to no supplemental water after establishment. Transitioning 5% (30 hectares) of current parks to a naturalized state could save 40,000 cubic metres per year.
- **Civic water conservation – non-potable water use for parks irrigation:** Where appropriate and safe, the substitution of raw water, storm water, rainwater, indoor and outdoor pool water, or other non-potable sources for irrigation purposes could reduce daily summer demand on the water system.
- **Civic water conservation – maximize water efficiency of spray pads, paddling pools and pools:** Changes to current functions, water usage rates, and technical specifications (i.e., timers, nozzles, etc.) for new construction spray pads and upgrades to existing spray pads could cut water use at these facilities, which account for 9% of total City water use. This could cut water use by 50% while still maintaining the play experience and result in about $245,000 per year savings.
- **Civic water conservation – spray pad and paddling pool water reuse:** Review public health restrictions and other regulatory requirements, then explore options for re-use in the landscape, such as the use of bioswales to capture and treat water with natural/green infrastructure and water capture via a cistern. Reusing spray pad and paddling pool water for irrigation could replace 160,000 cubic metres of potable water currently used for Park irrigation.

- **Civic water conservation – maximize efficiency of facilities and operations:** Set conservation targets for departments. Implement targets by replacing fixtures and equipment, recycling water (i.e., for vehicle washing), and finding and fixing leaks in underground distribution systems. A 10% reduction could result in $230,000 per year in savings.
- **Grey-water strategy:** Research best practices, identify current regulations, and set the stage for new policies/changes to codes to reuse water sent down the drain.
- **Water pricing and rate structure review:** Consider a steeper incline to reduce per-cubic metre costs for water for basic needs and raise costs for high-volume users, maximizing affordability, conservation and other improvements.
- **Water conservation using Advanced Metering Infrastructure (AMI) data and dashboard:** Ensure all conservation initiatives make maximum use of AMI data. Deploy education programs to ensure that residents and businesses are aware of AMI and its benefits. Explore opportunities to use AMI for load management by incentivising water rates during periods of low utility demand.
- **Planning, land use, and urban form to improve water conservation:** No specific conservation program is needed, but City plans and actions should be aligned with water conservation goals such that decisions about land use, lot sizes, density, and urban form all contribute to our goal of conserving water.

There is a lot of interest in reviewing grey water policies, laws, and practices. Currently, regulations limit uses of grey water (e.g., for landscape irrigation), and more research to understand the constraints is needed.

IMPLEMENTATION AND PRIORITIZATION

The opportunities identified above work best when combined in programs and initiatives. For example, education is an important component of most initiatives and can serve as the core of a large, integrated suite of conservation programs. The programs would be developed and phased in over the next decades.

The initiatives have been chosen and prioritized using the factors, values, and considerations demonstrated in this report, including:

1. **Water conserved (cubic metres per year) and Greenhouse Gas Emissions Reduced:** Initiatives that target overall water use and progress towards *LEC Plan* targets of reducing volume pumped by 2026 and 2050 and reducing GHG emissions.
2. **Cost of water conserved (cents per litre per year):** The costs to the City compared to volume of water saved (see Figure 12). However, many programs also have conservation costs and benefits for residents, businesses, and institutions.
3. **Impacts on maximum daily demand reduced (cubic metres per day reduced):** Maximum daily demand is reduced, calculated in terms of cubic metres per day for each year the program operates.
4. **Addresses energy poverty and utility affordability:** Programs that tailor conservation to low and moderate-income households or those experiencing energy poverty, including affordable housing and multi-family housing incentives and income-qualified households.
5. **Public and industry preferences:** Public and industry respondents from a December 2020 survey were asked to rank the proposed programs by identifying the top three programs they feel the City should prioritize (see Figure 15).

Figure 15: What we heard - public prioritization survey results

Opportunity	Public (%)	Industry (%)
Maximize watering efficiency in parks	38	33
Residential toilet rebate	35	37
Develop a grey-water strategy	33	19
Increase naturalized areas in parks	28	11
Maximize efficiency of City facilities and operations	22	26
Residential water use education program	21	19
Outdoor watering restrictions	17	11
Residential showerhead rebate and give-away	17	11
Residential water audit and coaching program	17	4

Figure 15 (continued)

Opportunity	Public (%)	Industry (%)
Residential rain barrels	17	n/a
Residential low-water landscaping program	16	22
Residential irrigation system upgrade rebate program	15	11
Maximize water efficiency of spray parks, paddling pools and pools	14	30
Residential irrigation community-based education program	5	0
Community gardens water-reduction support program	2	4
ICI audit and fixture incentive program	n/a	19
ICI capacity buyback program	n/a	7
ICI irrigation systems assessments, training, and accreditation	n/a	7
ICI irrigation system upgrade rebate program	n/a	15
ICI once-through cooling replacement incentive program	n/a	7

**n/a refers to the option not being included within either the Industry or Public surveys*

The amount of water conservation needed to achieve the *LEC Plan* water-related targets will require the City to employ an "all of the above" approach. This will target City and community use, indoor and outdoor, overall demand as well as peak summer demand.

The intent is to prioritize the initiatives, do additional program design based on priorities, implement initiatives as funding becomes available, and monitor progress and refine assumptions to keep the Strategy current. In any given year, 10 initiatives might be running. Some initiatives would end before others start; some would run on alternating years.

There are data gaps, such as detailed information about consumption by end use and prevalence and location of high-water-use fixtures, etc. Measuring reduction of water demand as initiatives are developed and implemented is important for monitoring progress towards water conservation targets.

Recommended Initiatives and Phasing

Recommended initiatives are assessed and prioritized in the following implementation schedule:

P1: Already in planning stage
P2: To be started in the next 3 years
P3: To be started in the next 4–6 years
P4: To be started in the next 7+ years

Opportunity	Indoor Residential	Indoor Industrial, Commercial and Institutional	Outdoor	Civic Infrastructure and Operations	Implementation
Residential water use education program	✔		✔		P1
Affordable housing energy & water conservation pilot	✔		✔		P1
Water conservation using AMI data and dashboard	✔	✔	✔	✔	P1
Planning, land use & urban form to improve water conservation	✔	✔	✔	✔	P1
Residential toilet rebate	✔				P2
Residential showerhead rebate and give-away	✔				P2
Affordable and multi-family housing water conservation incentives & education	✔		✔		P2
Income-qualified water fixture replacement program	✔				P2
Residential water audit and coaching program	✔		✔		P3
Water pricing & rate structure review	✔	✔	✔	✔	P3
Grey-water strategy	✔	✔	✔	✔	P4
Water conservation environmental grant		✔	✔		P1
ICI building energy retrofit program		✔	✔		P1
ICI water-use education program		✔	✔		P2
ICI audit and fixture incentive program		✔	✔		P2
ICI capacity buyback program		✔			P2
ICI once-through cooling replacement incentive program		✔			P3

Opportunity	Indoor Residential	Indoor Industrial, Commercial and Institutional	Outdoor	Civic Infrastructure and Operations	Implementation
Residential rain barrels rebate			✔		P1
Residential irrigation system upgrade rebate program			✔		P3
Community gardens water-reduction support program			✔	✔	P3
ICI irrigation system upgrade rebate program			✔		P3
Residential irrigation community-based education program			✔		P4
Residential low-water landscaping program			✔		P4
Outdoor watering restrictions & bans review			✔	✔	P4
ICI irrigation system assessments, training & accreditation			✔		P4
Civic water conservation - Maximize watering efficiency in parks				✔	P1
Civic water conservation - Irrigation network audit to increase naturalized areas in parks				✔	P1
Civic water conservation - Maximize water efficiency of spray pads, paddling pools and pools				✔	P1
Civic water conservation - spray pad and paddling pool water reuse				✔	P1
Civic water conservation - Maximize efficiency of facilities and operations				✔	P2
Civic water conservation - Non-potable water use for parks irrigation				✔	P2

P1: Already in planning stage
P2: To be started in the next 3 years
P3: To be started in the next 4–6 years
P4: To be started in the next 7+ years

CONCLUSION: Conservation in a broad triple bottom line & integrated water management context

Water conservation can be one part of a synergistic, integrated effort to advance toward our community's many sustainability goals. Conservation can help moderate water bills and make water more accessible. It can reduce greenhouse gas emissions and improve the resiliency of our water system. It can support efforts to maintain levels of service in City parks and pools even as we move forward to reduce energy use and emissions.

Conservation can be a part of our *Green Infrastructure Strategy*, helping maintain diverse natural spaces and forming part of innovative storm water management strategies. It can help us meet our needs in ways that have a smaller environmental footprint, such as watering landscapes with raw or re-used water, watering them less, and watering more effectively. It can enable existing infrastructure to accommodate population increases, infill, and expanded economic activities, helping us manage growth, increase density, and make our city more walkable and vibrant.

Water conservation is part of a larger suite of global changes in the 21st century, wherein societies refashion themselves to provide stability, security, employment, and enjoyment while drawing less from nature and emitting and discharging less waste and pollution. Finally, water conservation can position us to better withstand the intensifying impacts of climate change—impacts that will be especially severe on our prairie city.

The Strategy points the way to a reduction in water use; savings for Saskatoon residents, businesses, institutions, and organizations; a significant reduction in municipal government emissions; and initiatives that advance other City and community objectives.

The Strategy puts Saskatoon on a path that many other Canadian and American cities have already set out on. Saskatoon is proceeding as one jurisdiction in a much larger movement. Because of this, uncertainties and risks are significantly reduced. Water conservation is possible, affordable, cost effective, and compatible with strong, appropriately funded water and wastewater utilities. We have the good fortune of working with and learning from others. This Strategy has been informed by that experience.

The residents and businesses of Saskatoon want the City to do more when it comes to saving energy, conserving resources, protecting the river, and reducing emissions. The Water Conservation Strategy outlines a path forward. Through continued engagement with residents, businesses, institutions, and experts, the City will refine the initiatives in this Strategy and undertake to phase in a coherent set of conservation initiatives in the 2022–2050 period.

REFERENCED RESOURCES

- Climate Action Plan
- Climate Projections & Possible Impacts
- Corporate Climate Adaptation Strategy
- Equity Tool Kit for Projects
- From the Mountains to the Sea: The State of the Saskatchewan River Basin, Partners for the Saskatchewan River Basin
- Green Infrastructure Strategy
- High Performance Civic Building Policy
- Integrated Water Management Framework for Victoria, Melbourne, State of Victoria
- Local Actions: The City of Saskatoon's Adaptation Strategy
- Local Energy Access Partnership (LEAP)
- Low Emissions Community Plan (LEC Plan)
- Official Community Plan (OCP)
- Outdoor Water Use Reduction Manual, Ontario Water Works Association
- Plan for Growth
- Residential End Uses of Water, Version 2: Executive Report
- 2022–2025 Strategic Plan
- Saskatoon Water and Wastewater Utility Rates and Return on Investment
- Triple Bottom Line Framework (TBL)
- Triple Bottom Line Policy
- Water and Wastewater Utilities: 2018 Annual Report
- WaterSense: Statistics and Facts
- 2012–13 Annual Report: State of Drinking Water Quality in Saskatchewan, 2013, Saskatchewan Water Security Agency

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To ensure Saskatoon is a great place for everyone to live, work, learn, and play, care must be taken to manage water in a balanced way. Saskatoon has a diverse population with many different perspectives on water's role in their lives, homes, workplaces. As such, it was important to consult a variety of technical experts, internal stakeholders, and community members to ensure the Strategy reflects a broad vision for water conservation. The City would like to thank everyone who took the time to provide feedback and expertise.

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