2024 SPRAY PAD PILOT PROJECT – FINAL REPORT

January 2025

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Introduction

Spray Pads are community playground installations that are a collection of water features. These are not only a fun and safe way for kids to enjoy water play, but they are also a great way to promote active play and healthy lifestyles and keep cool in the summer while promoting sustainability in a community.

Many flow-though spray parks are designed for a flow rate of about 265 to 568 liters per minute (lpm) when operating. This results in an average daily use of 37,854 to 94,635 liters of water and $25,000-$60,000 per year in water costs, depending on the flow rate, number of spray features, and overall size of the pad.

Saskatoon has the largest number of spray pads per '000 capita in Canada (***Figure 1***). Water use in spray pads has been steadily increasing over the years, but notably increased in 2021. The 2021 summer operating condition was prolonged hot weather, which increased the demand and community need for spray pads and led to increased water use, thereby exceeding the budget. In 2022, spray pad facilities became part of the City's Extreme Heat Response, and now their hours of operations are regularly extended during the heatwave periods declared by the City's Emergency Management Office (EMO) to help the community stay cool.

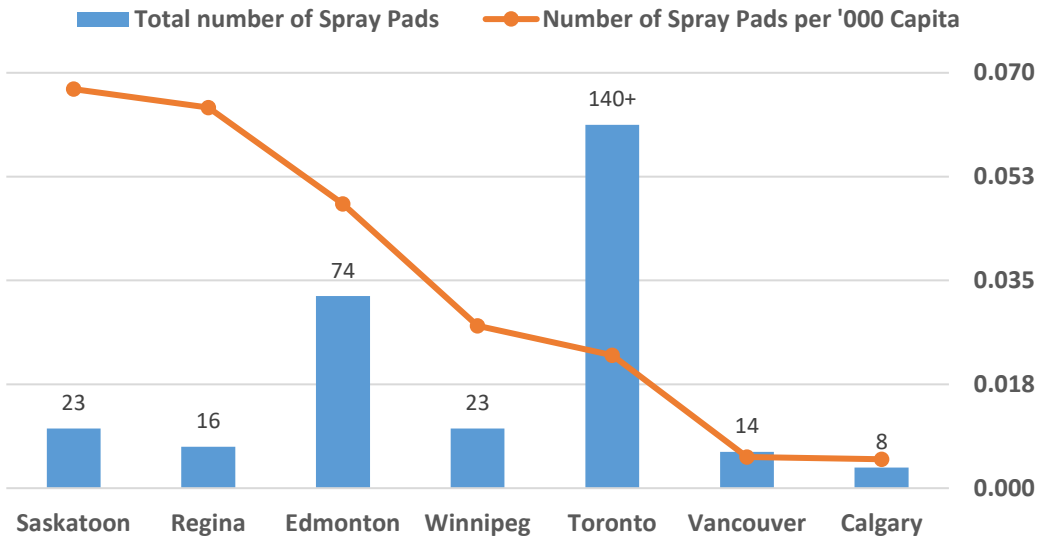


Figure 1. Total and Per '000 Capita Number of Spray Pads in 2023 in Some Major Canadian Cities.

Climate change projections show an increasing likelihood that we will experience prolonged hot weather conditions more often. Continued city growth and more frequent hot weather is expected to increase water demand, which can stress our municipal water system capacity because water-demand peaks in the summer. This has already been identified as a high risk situation in the City's Local Actions for Adaptation Plan.

Keeping this in mind, a pilot project was initiated in 2023 to test some nozzle upgrade options that are relatively inexpensive and can be done without disrupting regular operations or reducing service levels. These options included (a) lower-flow nozzles, (b) misting nozzles (commonly called 'misters'), and (c) winter blank nozzles, either in combination or individually, with the aim of reducing water use at spray pads. The 2023 pilot was conducted at seven (7) spray pad sites. Unfortunately, the misters did not work and, also because of procurement and operational delays, only two of the seven piloted sites could be used for final analysis.

In 2024, the pilot was extended to test (a) some newer lower-flow nozzles and misters at three spray pad sites (Briarwood, Stonebridge, River Heights) and (b) adding a network connection to the spray pad controller at Kensington to be able to remotely adjust spray pad schedules (this saves time on manually visiting each spray pad site to make the adjustment as is the current practice) and also change the sequencing of spray pad features (to further reduce water consumption).

The overall goals of this project were to:

- Help the City achieve its overall water use reduction by 5% by 2026 target – LEC Plan (Action 25)
- Help the City achieve its outdoor water use reduction by 20% by 2050 target – LEC Plan (Action 26)
- Help contribute to the City's greenhouse gas reduction targets – LEC Plan
- Help inform future business cases to maximize water efficiency in Spray Pad operations across the City

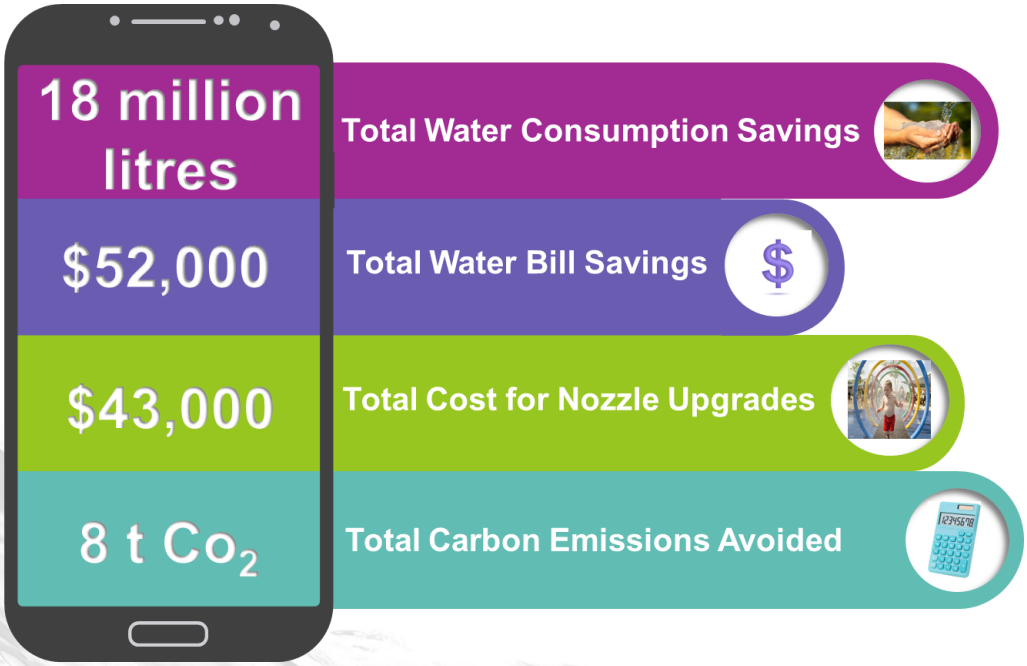
The pilot projects involved:

- Researching feasible improvements (timers, nozzles, cycling buttons, temperature sensors).
- Selecting pilot and control sites to test improvements.
- Setting up spray pad accounts in utility management software (EnergyCAP®).
- Installing technology improvements identified in the research including:
    - Replacing existing nozzles to reduce total flow rate without affecting the user experience.
    - Replacing existing nozzles to reduce total flow rate and provide unique user experience.
    - Providing network connection to the spray pad controller to remotely adjust schedules and sequencing of water features.
- Minimal disruptions to regular spray pad operations or reduction in service levels.
- Completing an analysis of costs and overall water savings from the improvements.
- Recommending next steps.

Key indicators identified to measure the success of the project included:

- Reduction in City's overall water use (liters) since 2016 baseline.
- Reduction in water system summer daily demand (liters/day) since 2016 baseline.
- Reduction in water use per user (liters per visit) since 2016 baseline.
- Maintaining user experience based on the summer play program leader feedback.

Summary Results



Results-at-a-glance for the 2024 Spray Pad Pilot Project Conducted at Three Spray Pads

Water Consumption Trends

A large variation in water consumption was observed both within and among the 23 spray pads across Saskatoon from 2021 to 2024 (***Figure 2***). Similarly, large variability in water consumption existed at seven top water-consuming spray pads for eight years (2016 to 2023) (***Figure 3***). This can be attributed to different number and types (flow rates) of spray features, number of users, and year to year variation in weather etc. However, such large variation also suggested that it is difficult to establish a baseline year to compare results.

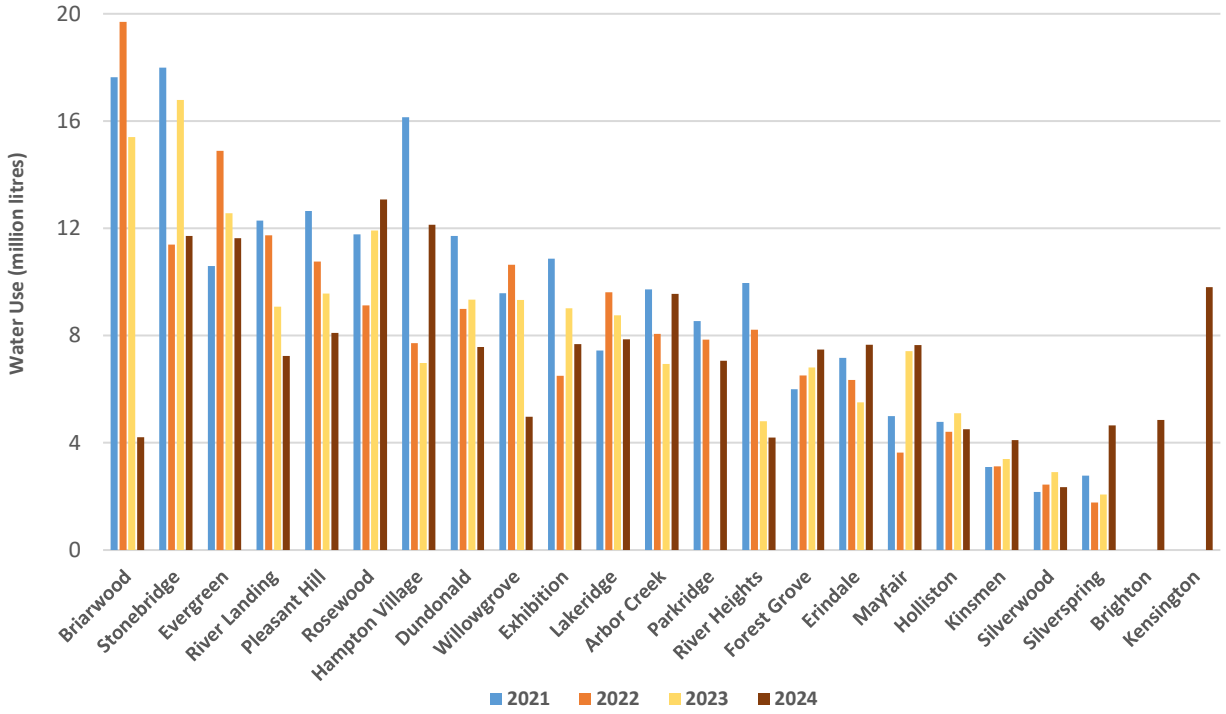


Figure 2: Consumption of Water in Spray Pads in 2021, 2022, 2023, and 2024.

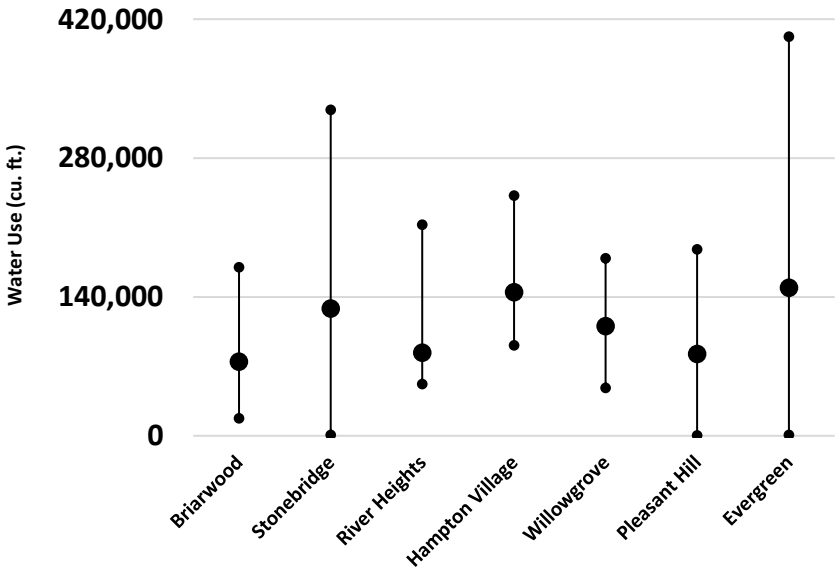


Figure 3: Minimum, Average, and Maximum Water Use (cu. ft.) in 8 Years (2016-2023) at 7 Spray Pad Sites.

Water consumption in 2024 across all 23 spray pads in Saskatoon revealed a worrying trend in that newly (built or renovated) spray pads are consuming increasing amounts of water (***Figure 4***). This is primarily due to higher number of spray nozzles/features and greater as-built flow rates in newer spray pads compared to the older ones. Therefore, it is recommended to have a standard spray pad design with a cap on maximum number of spray features and/or total flow rates when designing new spray pads.

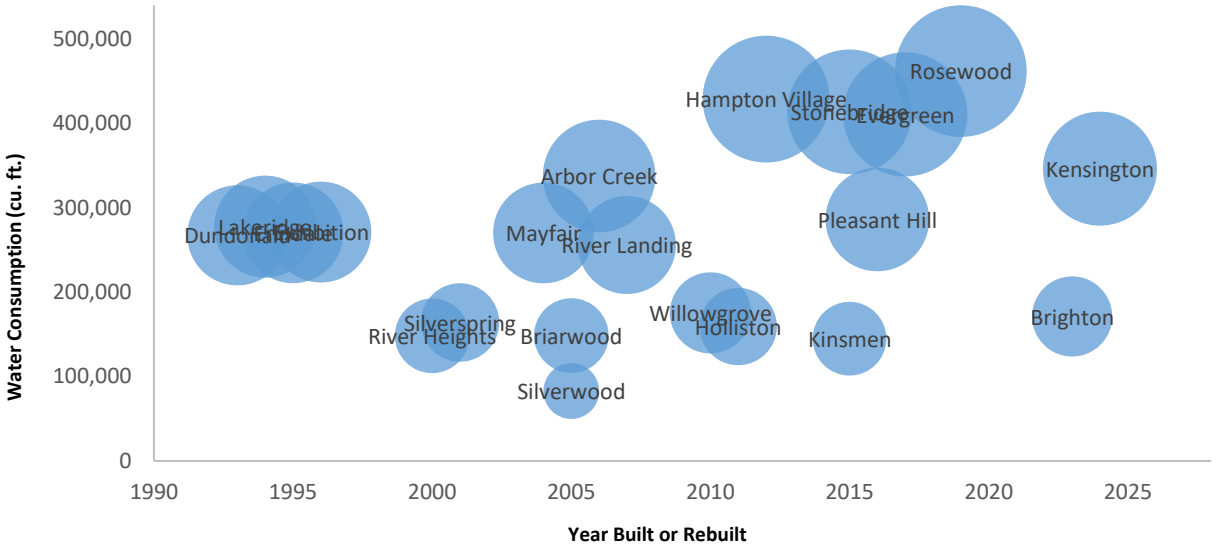


Figure 4: Total Water Consumption (ft^3) in 2024 at 23 Spray Pads across Saskatoon by Age of Spray Pads.

Kensington and Brighton neighborhoods have newly built spray pads that became operational only in 2024, so didn't have any historical averages to compare. However, a majority (12) of the other 21 spray pads in Saskatoon had lower water consumption in 2024 compared to their average water use in the 2021-23 period (***Figure 5***). This was likely due to the unusually wet and cool June 2024 compared to the June months of previous three and eight years, respectively (***Tables 1 and 2***).

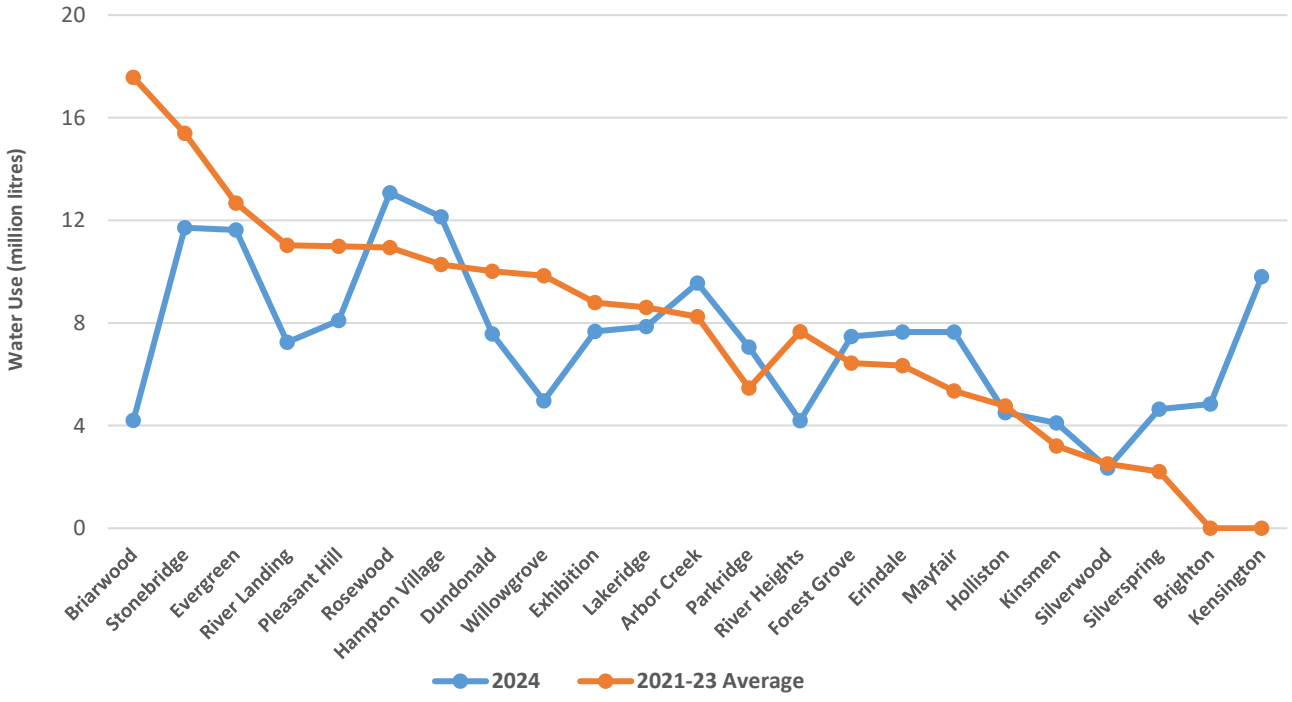


Figure 5: 2024 vs. 2021-23 Average Water Use in Spray Pads.

Table 1: Amount of Precipitation* (mm) in Saskatoon Summers from 2021 to 2024.

	2021	2022	2023	2024
June	28	69	52	127
July	14	42	21	23
August	50	32	57	61

Source: CoS Rainfall Reports.

Table 2. Average Summer Temperatures* in Saskatoon from 2016 to 2024.

Year	June Average Temperature (ºC)	July Average Temperature (ºC)	August Average Temperature (ºC)
2016	18	19	17
2017	16	20	18
2018	18	19	17
2019	16	18	16
2020	15	19	18
2021	19	21	17
2022	16	19	20
2023	19	18	18
Average 2016-23	**17**	**19**	**18**
2024	**14**	**20**	**19**
% Change (2024 vs. 2016-23 Average)	**-21%**	**5%**	**5%**

Source Link.

Methodology

Site-Selection

The 2024 pilot was conducted at three spray pad sites in Briarwood, River Heights, and Stonebridge (***Table 3***). These pilot sites were selected to include a variety of spray pads based on age (i.e., built prior to 2000, built between 2001 & 2010, built after 2010), number of spray features (<15, 15-20, >20), total number of nozzles (<20, 20-25, >25), average (2021-2023) water use per nozzle (<500, 500-750, >750 '000 litres), and % of the total number of nozzles upgraded (<50%, 50-75%, >75%). It is worth mentioning here that the upgrade plan had a total of 47 nozzles to be upgraded across the selected sites. However, due to some operational issues as are mentioned in 'What Didn't Work Well' in the 'Lessons Learned' section below, 39 nozzles were upgraded. Because all the upgrade nozzles in 2024 were OEM nozzles, there were no fitment issues, unlike in the 2023 pilot.

Table 3. Spray Pad Sites Selected for the 2024 Pilot Project.

Spray Pad Site	Year Built or Rebuilt	Number of Spray Features	Total Number of Nozzles	Average Water Use (2021-23, million litres)*	Average Water Use per Nozzle (2021-23, '000 litres)*	Number (and %) Nozzles Upgraded
Briarwood	**2005**	**21**	**21**	**17.6**	**838**	**19 (90%)**
Stonebridge	**2015**	**14**	**29**	**15.4**	**531**	**10 (34%)**
River Heights	**2000**	**18**	**18**	**7.7**	**427**	**10 (56%)**

1 m3 (cubic meter) = 1000 liters = 35.315 ft3 (cubic feet)

Control Spray Pads

Due to the large variation observed in water consumption across years and spray pad sites, attributable primarily to different number and types of spray features, sizes, flow rates etc., we compared the average water use trends in piloted vs. non-piloted spray pads to reduce the effect of these variables as well as of weather on final water saving calculations.

Calculating Water Use Savings

The savings in water use were calculated using the actual water consumption and billing data from monthly water bills, which have now been incorporated into a utility management software that was acquired in early 2024, called the EnergyCAP®. Sustainability is now using EnergyCAP® to track City's utility usage and costs, generate reports, and provide analysis to manage/optimize utility usage and costs.

A couple of adjustments had to be made to calculate monthly water usage and bills where utility bills were aggregated across months. This aggregation typically happens either during periods of meter changes or when a water meter loses communication with the meter-reading server, and therefore, usage readings in these cases are manually entered. The original billing data and data analysis are included in this spreadsheet.

Detailed Results

Impact of Nozzle Upgrades on Water Savings

Nozzle upgrades helped save 24-76% (average 48.5%) of water use in the piloted spray pads (***Table 4***). Adjusting these numbers for the average water savings in non-piloted spray pads in 2024 compared to the 2021-23 average, water use savings averaged 41% (18-71%). This adjustment was necessary to account for the effect of weather on water use in spray pads.

Table 4. Water Consumption Savings in Piloted Spray Pads.

Spray Pad Site	Water Consumption in 2024 (million litres)*	Water Consumption in 2021-23 (million litres)**	% Water Consumption Savings	Adjusted Savings*,**	% Water Consumption Savings (Adjusted)
Briarwood	4.2	17.6	76%	12.5	71%
Stonebridge	11.7	15.4	24%	2.8	18%
River Heights	4.2	7.7	45%	2.6	34%
AVERAGE	6.7	13.6	48.5%	6.0	41.3%
TOTAL	20.1	40.7	-	17.9	-

**Calculated from average water consumption in non-piloted spray pads, where water consumption declined by 0.85 million litres in 2024 compared to the 2021-23 average.*

***1m3 (cubic meter) = 1000 liters = 35.315ft3 (cubic feet).*

Overall, the 2024 pilot saved 17.9 million litres (or 0.63 million cubic feet) of water at three spray pad sites. This would equate to savings of $51,727 in water bill and 7.7 tonnes of carbon emissions avoided (*using a factor of 0.00043 t CO_2 e/m^3*).

Interestingly, a clear trend emerged of percent water savings closely following the percent nozzles changed at each spray pad site. This trend was observed regardless of the other factors, viz., age of spray pad, number of nozzles, number of spray features, water use per nozzle etc. For example, at the Briarwood spray pad where 90% of the nozzles were upgraded, water savings were 71%, at River Heights spray pad where 56% of the nozzles were upgraded, water savings were 34%, and at the Stonebridge spray pad where 34% of the nozzles were upgraded, water savings were 18%. This suggests that to maximize water savings, we should aim to maximize the number of nozzle upgrades at each spray pad site.

Impact of Nozzle Upgrades on User Experience

All nozzle upgrades in 2024 were done prior to June 1 when the spray pads open for the season. Therefore, the process of nozzle upgrades did not affect the user experience as it did not disrupt regular operations or reduced service levels. It only took a maximum of couple of hours at each site to do the nozzle upgrades. Therefore, even if we ever need to do the nozzle upgrades in-season, it can easily be done early in the morning as the spray pads do not open until 10 a.m. during the season.

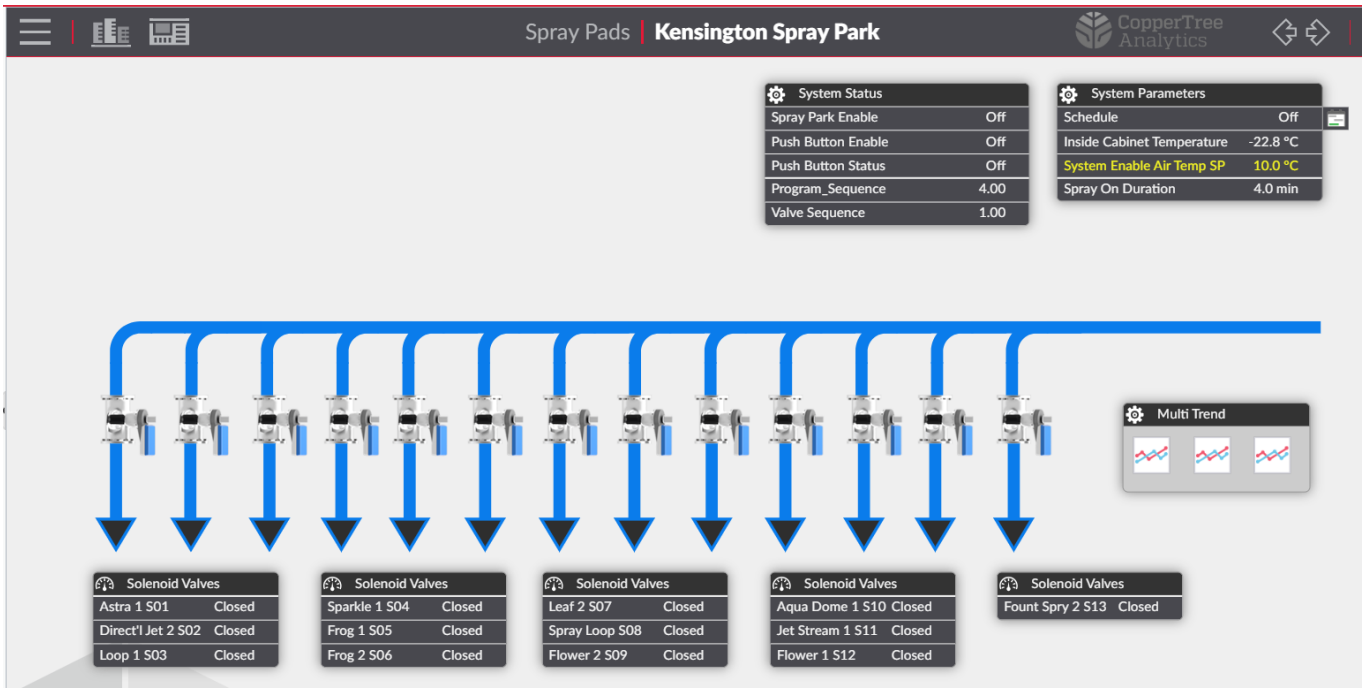
Input was gathered on the public awareness and satisfaction with the new nozzle upgrades from a cross-section of spray pad/paddling pool/play program participants. A general questionnaire was developed in Microsoft forms for all spray pad sites, including the non-piloted ones, to minimize any bias. Playground leaders were instructed to invite participants to complete the survey by accessing a QR code on site or through a paper copy that was to be entered once returned. A total of 44 surveys were completed in 2023-24.

86% of the respondents in 2023 and 2024 surveys did not notice any changes to their spray pad experience after the nozzle upgrades. Of those 14% that did notice some change, 50% said their experience was better, 33% said their experience was the same, and only 1 participant said that the experience was worse. This lone participant was in fact referring to a paddling pool experience, which was closed for the season. This makes it clear that the nozzle upgrades did not adversely affect user experience, and in fact, where noted, only led to an improvement in the user experience. Full results of the survey are available here.

Misting Nozzles Installed at Stonebridge Spray Pad to Enhance User Experience

Adding Network Connection at Kensington Spray Pad

A network connection was successfully added to the controller at Kensington spray pad to enable remote operation of spray features and remotely adjust spray pad timings as and when needed. The whole process went smoothly. IT donated the equipment for network connection, while the Building Management System (BMS) network vendor (Mikkelsen-Coward) that already employs a network system (known as enteliWEB®) for City buildings, helped with site configuration, programming BMS, and commissioning of the complete link for a reasonable cost. There was a small hiccup in establishing the connection, but a Controls Specialist with Facilities was able to quickly figure out the wrong configuration on the controller, and once corrected, connection was successfully established. Mikkelsen-Coward then uploaded the graphic to the central server and tested that everything was working fine. Sustainability commissioned the programming on site to test things out from the front end. Mikkelsen-Coward then conducted a training to train Facilities and Sustainability staff on using the software, answered questions, and improved graphics based on the feedback received.



enteliWEB® Software Graphic Showing Spray Features and Controls for Kensington Spray Pad. All features and controls can be turned on/off from within this software remotely, without needing to visit the site physically.

Lessons Learned

What Went Well

- Project planning went well through the development of an Upgrade Plan that showed every type of nozzle to be upgraded at each piloted site and it's cost.
- Low-cost solutions were implemented.
- The changes were well received by Saskatoon residents and there were no public complaints.
- Recreation leaders did not receive any negative feedback on the changes made.
- Results showed a sizeable reduction in water consumption and savings in water bill.
- Nozzle upgrades were identified as a feasible improvement to reduce water use. These upgrades are repeatable and reliable to maintain savings.
- The cost to add network connection at Kensington spray pad was reasonable ($3,000) as were able to save on modem, UPS, and licensing fee. Internet costs of $10/month plus any data charges were minimal and were accommodated by the IT. For future spray pads, we can pursue data connections with Parks as they get charged by Sasktel a minimal fee for their data connections.
- To enhance user experience, misters were installed at the Stonebridge spray pad site after a couple of tries. The challenge with "low" City water pressure was counteracted by installing misters on the entire spray feature that included a set of ground spray nozzles and turning up the volume of water.

What Did Not Go Well

- We were not able to install misters at Briarwood spray pad site. Spray pads use City water pressure, and the PEM 32 misting nozzles with a single hole couldn't overcome this pressure limitation to create mist despite turning up the volume of water.

Misters didn't work at Briarwood Spray Pad because of issues with City water pressure. Nozzle design didn't allow water pressure limitation to be overcome by increasing water volume.

Misters didn't work at Stonebridge spray pad initially, but because of the nozzle design, after a couple of tries, we were able to overcome the water pressure limitation by increasing water volume.

- A couple of existing nozzles could not be removed at Stonebridge spray pad because of tight/rusted bolts, so those were not replaced as planned.

- For the network connection at Kensington spray pad, once port forwarding was established, the connection didn't work as expected initially. Firewall was transferring info, but site response was getting scrambled and lost. To overcome the above issue, the controller had to be reconfigured with correct settings to make the connection work, which took additional time.

- Sustainability had to use a phone to hotspot for connection to the network. There was no cable to use to connect the laptop to the controller.

- While surveys are an excellent tool to get user feedback, sometimes the project characteristics don't lend well to public surveys. For example, it is unclear if the public would have recognized changes to the spray pads in this case because there weren't large scale changes to the spray pads. Therefore, in addition to surveys, we recommend intercept surveys for on-site, real-time feedback on the changes implemented.

Recommendations

1. A standard spray pad design is recommended with a cap on maximum number of spray features and/or total flow rates when designing new spray pads or replacing old ones. This will help with water conservation, manage operating increases, and ease of replacing nozzles and spray features. Therefore, edits/additions to the Design and Development Standards to cap the total flow rates of future spray pads are recommended.

2. Original Equipment Manufacturer (OEM) Nozzles had no fit issues within the existing spray features, but there are number of other factors that need to be considered before deciding on replacement nozzles. It is recommended to test any new nozzles before procuring the replacement nozzles. In the 2023 pilot, nozzles supplied by a non-OEM vendor did not fit and, despite sending the sample nozzle, was not as per specifications, and therefore, had to be returned, so it is best to stick with OEM nozzles only.

3. More information about the project should be displayed at the sites to educate patrons and Recreation Leaders.

4. There is a good opportunity for public water conservation education and awareness through the Summer Play Programs at spray pad sites.

5. In addition to surveys, any future upgrades to spray pads are also an opportunity to connect with the community associations and local user groups to see if there have been impacts to the experience.

6. Include comparison of economic analysis with paddling pools and recirculating systems in the next phases of spray pad improvement work.

7. There is a need to determine price of modem for network connection to spray pad controllers.

8. Connection from City devices (laptops) to network is required. A cable access to a port of the modem for connection to a City laptop could be considered as the best option.

9. If Wi-Fi connectivity is needed, a higher spec modem with Wi-Fi option and reworking of configuration is needed. Wi-Fi may be a security risk, so part of the rework will be sending it to the Cybersecurity team for advice. Having a Wi-Fi opens up the sites to some risks which will have to be scrutinized by the security team.