

2016 Alberta CreekWatch

A Report Card on Urban Creek Water Quality Overview

Report prepared by

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CREEKWATCH A Report Card on Urban Creek Water Quality, 2016

RANK	CREEK		s	SCORE		LOCATION	20	15
2016	Fish Creek			85%	Ca	Calgary		
2	Oldman Creek			76%	S	Strathcona County		
3	Pine Creek			74%	C	Calgary		2
4	Wedgewood Creek			73%	F	Edmonton		
5	Blackmud Creek			72%		Edmonton		3
6	Waskasoo Creek			70%		Red Deer Edmonton		
7	v	Whitemud Creek		69%				4
	1	West Nose Creek	(58%		Calgary		5
		Nose Creek		56%	Calgary			7
	2	Mill Creek		54%		Edmonton		6
					-		1	
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Executive Summary

The second annual CreekWatch Report Card examines the state of urban creeks in Alberta based on the water quality data collected through the use of citizen science, water quality technicians and lab analysis. We are sharing our findings with the public, governments, and water quality professionals to collaboratively work towards the consistent monitoring and improvement of our urban creeks in Alberta.

Urban creeks function as conduits for stormwater runoff, and top rankings denote greater overall water quality, while lower rankings signify lesser overall water quality. See Table 1.

Table 1 Overall urban creek rankings

Rank 2016	Creek	Score	Location	Rank 2015
1	Fish Creek	85%	Calgary	1
2	Wedgewood Creek	79%	Edmonton	
3	Pine Creek	74%	Calgary	2
4	Oldman Creek	73%	Strathcona County	
5	Blackmud Creek	72%	Edmonton	3
6	Waskasoo Creek	70%	Red Deer	
7	Whitemud Creek	69%	Edmonton	4
8	West Nose Creek	58%	Calgary	5
9	Nose Creek	56%	Calgary	7
10	Mill Creek	54%	Edmonton	6

A Report Card on Urban Creek Water Quality, 2016

In 2016, between the months of March and October, there were 68 trained volunteers and two science technicians in Edmonton, Red Deer and Calgary whose work combined for 338 site visits, over 3,100 collected data points, and an estimated 350 hours total time spent monitoring ten urban creeks.

The CreekWatch monitoring program suggests that Edmonton, Red Deer and Calgary have a range of water quality exemplified in their stormwater creeks. It would be important to investigate the best management practices employed in the top ranked creeks for potential emulation into the management practices of the lower ranked creeks.

Of special note, the top ranked creek, Calgary's Fish Creek, contains multiple constructed wetlands that collect stormwater runoff from the streets of the surrounding communities. These networks of engineered wetlands function to allow sediment to settle and pollutants to be removed before water moves downstream. On the opposite end of the rankings, the two lowest ranked creeks, Edmonton's Mill Creek and Calgary's Nose Creek, drain significant land areas



Calgary's Fish Creek was ranked first for best water quality

without sufficient wetlands to settle out the runoff. A significant portion of Mill Creek is also currently buried, preventing ecosystem functions as the water travels underground. Red Deer's Waskasoo Creek, while not ranking high or low, has nearly 100 stormwater outfalls whose impacts are mitigated with headwater wetlands.

To achieve improved urban creek water quality in the future, it is recommended to:

- increase public and industry education, making people aware that a.) stormwater runoff from our streets, homes, businesses, and parking lots travels through storm drains largely untreated into our waterways, and b.) their stewardship actions can make a positive difference;
- consider stormwater impacts in any new snow removal planning involving calcium chloride, to-the-pavement scarping or localized snow dumps;
- uncover (daylight) and remove pipes and culverts from buried creeks, reinstating open-air ecosystem functions
- increase constructed/engineered wetlands as a means for stormwater treatment



Introduction

CreekWatch comprises of a citizen science network for the collection of useable, cost-effective and publicly available data on urban creek stormwater quality. The primary goal of CreekWatch is to collect baseline water quality data on urban stormwater creeks in Alberta. Urban stormwater tributaries face unique stressors that already make them some of the most highly impacted local waterways, and consequently, they are of interest and importance to communities and watershed managers.

With increasing residential and industrial development, many urban surfaces are now impermeable, allowing snowmelt and rainwater to move much more quickly over these areas rather than soaking into the soil. Along this surface run-off journey, stormwater collects various contaminants from vehicles, roadway maintenance, industries, pet waste and neighborhood yards that ultimately discharges into creeks that impact river ecology and urban sustainability. See Table 2 for total stormwater outfalls per monitored creek.

Table 2 Total number of urban stormwater outfalls per monitored creek

	Calgary				Edmonto	Red Deer				
	Fish Creek	Nose Creek	West Nose Creek	Pine Creek	Whitemud Creek	Blackmud Creek	Mill Creek	Wedgewood Creek	Oldman Creek	Waskasoo Creek
Total Outfalls	14	53	14	2	16	11	46	1	0	99*

Urban Stormwater Outfalls per Creek

Source: City of Calgary Water Resources, 2016; City of Edmonton Drainage Services, 2016, City of Red Deer Environmental Services, 2017. *Waskasoo Creek has 73 stormwater outfalls and is joined by Piper Creek that has an additional 26 stormwater outfalls.

Justification

The first two years of CreekWatch aimed to establish a framework and tools for incorporating public participation in science research (citizen science) to address existing issues and research gaps in stormwater monitoring. Contributions were made to address issues and research gaps including:

- the number and frequency of stormwater creeks being monitored
- baseline data for stormwater quality
- reliability of volunteer citizen science data
- the cost-efficiency of monitoring programs
- the public availability of online data
- and the engagement of a public able to understand and contribute to the management of rivers and streams.

Site Information

Sampling sites were identified on urban tributaries of the North Saskatchewan River in Edmonton, the Red Deer River in Red Deer, and the Bow River in Calgary. Sites were selected based on the consideration of accessibility, perceived value of tributary importance, the extent of our resources to collect data, and the advice and suggestions from other water quality professionals. Samples were collected at the mouth of each selected tributary. See Appendices 7 - 16 for individual creek descriptions.

Study Design

Three levels of data collection were undertaken in 2016 as means to involve citizen science volunteers, increase the number of sampling events, and to provide quality assurance.

Level One data was obtained through trained citizen science volunteers using manual equipment, as seen in Photo 1. This involved the use of Hach testing kits housed in wheeled coolers for ease of transport and access (See Photo 2). Expectations were that each volunteer would collect data on their own free time at least 2–4 times through the open-water season. We had 25 volunteers in Edmonton, 7 in Red Deer, and 36 volunteers in Calgary. Water sampling occurred between the months of March and October 2016.









Level Two data was collected by CreekWatch Technicians on a weekly basis between March-October (See Photo 3). This involved the use of a YSI Professional Plus instrument capable of measuring a wide range of parameters. Also included in the equipment were two separate LaMotte 1200 Colorimeters, one for nitrate-nitrogen and one for phosphorus. See Photo 4.

The collection of **Level Three** data happened once in 2016, and this involved the submission of water samples to Exova for laboratory-based testing. All three levels of data were collected at the same time, allowing for a unique comparison between the three different data levels to verify accuracy and consistency. See Appendix 3 for detailed explanations on equipment and levels of monitoring, and see Appendix 4 for a comparison of data across three levels of data.



Table 3 Total sampling events in 2016

	Calgary				Edmonton	Red Deer					
	Fish Creek	Nose Creek	West Nose Creek	Pine Creek	Whitemud Creek	Blackmud Creek	Mill Creek	Wedge- wood Creek	Oldman Creek	Waskasoo Creek	Total Events
Level One	5	13	9	28	7	3	8	1	1	18	93
Level Two	26	39	25	23	41	22	22	18	18	2	235
Level Three	1	1	1	1	1	1	1	1	1	0	9
Total Events	30	53	35	52	49	26	31	20	20	20	338

Sampling Events per Creek

All volunteers and technicians were provided a unique PIN to access the data entry portion of the CreekWatch website. This information could be entered on a computer or mobile device, and once submitted, it was available for public viewing in real-time. Please see Appendix 5 for a description of the data viewing and entry platform.

General Observations

All ten monitored creeks contained flowing water throughout the open-water season in 2016.

- A very dry drought-like spring turned into a very wet summer across much of the province.
- Severe weather was particularly common across much of Alberta, with many events of large hail, strong winds, and heavy rain.
- Two counties declared states of agricultural disaster due to extreme precipitation.
- Total precipitation across Alberta was above average, with the Calgary region experiencing the wettest July in 89 years.

The comparability of our three levels of data was shown to be an effective way to determine the accuracy of each method of data collection. By means of these comparisons, we can speak to the accuracy of the data we are collecting. With the data collected in Level One and Two being relatively close, there is definitely a trade-off for the cost effectiveness of using volunteer water quality monitoring equipment as a valuable means to collect data.

Graphing the individual water quality parameters showed that there is a general pattern in the life of creeks and there are many direct correlations between the parameters that we are monitoring. See the box-and-whisker plots in Appendix 6. For instance, temperature had a



direct correlation with dissolved oxygen levels. As temperature increased, dissolved oxygen levels decreased. Another interesting pattern was the pH levels that were noticeably similar within each city's creeks, although widely different between Edmonton and Calgary.

In creating a report card summary of stormwater creek water quality, it became apparent that there is a range of creek water quality in Edmonton, Red Deer and Calgary. This report functions as baseline water quality data for the 2016 open-water season and will be used going forward to compare differences in water quality over the years.

Stewardship Action

In June 2016, a stewardship project was coordinated along a section of Nose Creek in Calgary. This was coordinated with the help of the City of Calgary and volunteers spent an afternoon removing invasive plants from selected areas. The target plant for the day was Common tansy (*Tanacetum vulgare*), which has taken up residence along much of the Bow River and its tributaries in Calgary. Listed as a noxious weed in Alberta, this plant grows in dense 1.5m tall stands with yellow button-like flowers. As seen in the photos below, our volunteers had a great time removing this plant and look forward to more events in 2017. In addition to this event, volunteers in Edmonton planted over 150 native trees along Gold Bar Creek.



Volunteers were well equipped by the City of Calgary to properly remove the entire plant.

Photo 5 Common Tansy (Tanacetum vulgare) at the confluence of Nose Creek



Analysis

While each study creek had a different source area, the data might be best compared for changes along the length of a particular creek. Ranking creeks with each other was the chosen comparison method in this first year of establishing a volunteer network. Other comparison methods such as the Canadian Council for Ministers of the Environment (CCME) Water Quality Index were considered and will be considered again. It is of interest to note that the highest ranked creek (Fish Creek, Calgary) is known for its constructed stormwater treatment wetlands while the lowest ranked creek (Mill Creek, Edmonton) receives discharges from the Town of Crossfield and City of Airdrie before even entering the City of Calgary

In 2016, between the months of March and October:

- there were 68 trained volunteers and two science technicians in Edmonton, Red Deer and Calgary
- a combined 338 total sampling events
- over 3,100 collected water sample data points
- an estimated 350 hours total time spent on ten urban creeks
- fourteen portable water monitoring kits were distributed
- 18 sampling locations were monitored across urban creeks in Edmonton, Red Deer and Calgary.

Conclusion

The key CreekWatch objective is to provide valuable, low-cost community stormwater data to support informed decisions on urban watershed management, and to make this data readily available in a timely manner to watershed managers and the public. An annual report card on the water quality of urban stormwater creeks is one method to accomplish this objective. See Table 1 for the 2016 CreekWatch Report Card. The second year of CreekWatch March – October 2017 further established a framework and tools for incorporating and communicating public participation in science research (citizen science).

Three key success strategies were again applied during CreekWatch Year Two:

- 1. Monitoring equipment required constant kit maintenance, upkeep, and the replacing of consumables throughout the season for both Level One and Level Two equipment.
- 2. Data accuracy was checked again this year by collecting three levels of data on the same day to compare our equipment results against lab results.
- 3. The engagement of volunteers was ongoing throughout the season with frequent program updates, friendly reminders, and technical support for equipment and online data entry.



Next Steps

Looking ahead to the 2017 season, CreekWatch is taking steps to expand the project scope to allow:

- The inclusion of additional urban creeks and additional sampling sites on currently monitored creeks.
- The addition of more volunteers to complement the current volunteer base established in 2015-2016 through collaboration with other corporate and community groups.
- A protocol for replicate sampling in the case of outlier data points.
- Earlier monitoring of the spring freshet with experienced volunteers.
- Data analysis for the total area of all combined outfalls for each creek.
- The purchasing of additional equipment for additional groups of volunteers.

Recommendations

Of special note, the top ranked creek, Calgary's Fish Creek, contains multiple constructed wetlands that collect stormwater runoff from the streets of the surrounding communities. These networks of engineered wetlands function to allow sediment to settle and pollutants to be removed before water moves downstream. On the opposite end of the rankings, the two lowest ranked creeks, Edmonton's Mill Creek and Calgary's Nose Creek, drain significant land areas without sufficient wetlands to settle out the runoff. A significant portion of Mill Creek is also currently buried, preventing ecosystem functions as the water travels underground. Red Deer's Waskasoo Creek, while not ranking high or low, has nearly 100 stormwater outfalls whose impacts are mitigated with headwater wetlands.

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Acknowledgements

CreekWatch was made possible through HSBC Water Programme funding and HSBC volunteers in a collaborative effort with the RiverWatch Institute of Alberta.



The enthusiasm and time donated by citizen science volunteers was amazing. Sixty-eight trained volunteers used a loan-pool of monitoring equipment to collect data from their local creeks in Edmonton, Red Deer and Calgary. Volunteers were recruited from the following organizations:

HSBC Bank Canada Keepers of Mill Creek GE Water Trace Associates Ann and Sandy Cross Conservation Area EPCOR Waskasoo Neighborhood Community

Advice and support was received from organizations and professionals across Alberta to help plan, develop, manage and analyze CreekWatch data collection, and include the following:

Alberta Environment & Parks City of Calgary Water Resources City of Edmonton Drainage Services City of Red Deer Environmental Services Bow River Basin Council North Saskatchewan Watershed Alliance EPCOR Water Canada Web3 Marketing Exova Salmo Consulting Victoria Hansen & Miranda Lisowski

Thank you everyone.

Technical Data is published as separate Appendices at www.creekwatch.ca