Climate Risk and Civic Operations

Collaborative risk analysis workshops were held throughout February 2019. City of Saskatoon (City) staff were present from a diverse set of internal expertise areas. The risk ranking protocol used by the Administration came from ICLEI Canada[1]. Given the internal scope of the Corporate Climate Adaptation project, items within the risk analysis focus on service areas the City currently has responsibility for.

Risk Analysis

The intent of the risk assessment is to connect each of the climate change impacts on civic operations with estimated consequence severity and likelihood of occurrence over the next 25 years through the Overall Risk Level (ORL) [2]. The ORL has a four point scale: high, medium, low, and very low.

Overall Risk Level – 4 Point Scale	
High	○ Consequences: "Major to Catastrophic" - Service area functionality would get worse and/or become unmanageable. Significant ($$$$) and/or substantial ($$$$$) staff and cost interventions would be required for correction. ○ Likelihood: "Likely to Almost Certain" – Event should occur about once per year and/or could occur multiple times per year.
Medium	○ Consequences: "Minor to Major" – Service area functionality could stay the same or become worse. Slight ($$) to significant ($$$$) staff and cost interventions would be required for correction. ○ Likelihood: "Possible to Almost Certain" – Event should occur once every ten years and/or could occur multiple times per year.
Low	○ Consequences: "Minor to Moderate" – Service area functionality could stay the same or become slightly worse. Slight ($$) to some ($$$) staff and cost interventions would be required for correction. ○ Likelihood: "Unlikely to Likely" – Event could occur once in the next 10 to 25 years and/or about once per year.
Very Low	○ Consequences: "Insignificant to Moderate" – Service and functionality will stay the same or become slightly worse. Little ($) to some ($$$) staff and cost interventions would be required for correction. ○ Likelihood: "Rare to Unlikely" – Event only occurs in exceptional circumstances within the next 25 years and/or could occur once in the next 10 to 25 years.

[1] ICLEI Canada. (2018). 5 Milestone Framework for Municipal Climate Adaptation. Retrieved from http://www.icleicanada.org/resources/item/79-adaptation-methodology

[2] The risk analysis presented does not consider "perfect storm scenarios" or "risk velocity". Perfect storm scenarios are those where a number of events considered 'rare' and having 'catastrophic' consequences occur together. Risk velocity adds a third dimension to traditional approaches and tracks "the speed at which exposure can impact an organization". Siew Quan, N.G. and Chiang, A. (2017). Risk management at the speed of business.

Figure 1: Ranked Risk Analysis Results

Rank	Climate Change Driver	Impact on Civic Operations	Overall Risk Level
1	*Warmer*	Increased demand on the water and waste water utility and delivery system	High
2	*Warmer*	Increased heat stress on plants and the urban forest	
3	*Wetter*	Increased demand on the storm water management system	
4	*Wilder*	Increased demand on the power utility and delivery system under highly variable and extreme conditions	
5	*Warmer*	Reductions in plant health overall and winter survival rates due to increasingly frequent freeze-thaw cycles	
6	*Wilder*	Increased stress on vulnerable populations in increasingly frequent heat waves, severe cold snaps, and declining air quality scenarios	Medium
7	*Warmer*	Increased heat stress for outdoor workers	
8	*Warmer*	Increases in vector borne diseases or illnesses due to increases in pest populations and diversity of species	
9	*Wilder*	Increased presence of conditions that can create convective summer storms (i.e. tornados, hail, strong plough winds and severe thunderstorms)	
10	*Warmer*	Loss of plant and urban wildlife diversity due to heat stress, water availability reductions and habitat losses	
11	*Wetter*	Severe heavy precipitation events could overwhelm the storm water management system and cause water to infiltrate the sanitary sewer system causing health concerns, property damage, environmental damage, and regulatory fines or consequences including and up to prosecution	
12	*Wilder*	Added stress on those without access to (or appropriately sized) heating, cooling and ventilation systems under more variable and extreme weather conditions	
13	*Warmer*	Drought conditions	
14	*Wetter*	Increased demand for civic staff and equipment to manage spring drainage challenges	
15	*Warmer*	Increased loss of plant and tree species due to larger and more diverse pest populations	
16	*Warmer*	Longer annual operation and maintenance periods for outdoor pools, golf courses, the Saskatoon Forestry Farm Park and Zoo, campgrounds, parks, green spaces, public lands, and right of way areas	
17	*Wilder*	Increased absenteeism and lower staff productivity due to heat waves, severe cold snaps, and declining air quality	
18	*Wetter*	Increased need for roadway and sidewalk salt and sanding due to increasingly frequent freezing rain or safe citizen mobility may be compromised	
19	*Warmer*	Increased instances of freezing rain can create challenges for tree limb stability and power line functionality	
20	*Wetter*	Public and private property damage due to overland flooding due to heavy precipitation events	Low
21	*Warmer*	Increased demand for Saskatoon Fire Department services in fighting grass, forest, brush fires in and around the municipality	
22	*Warmer*	Increased cost to maintain winter spaces in warmer weather (i.e. ice rinks, ski trails, Optimist Hill, etc.)	
23	*Wetter*	Increased demand for civic staff to respond to precipitation events (i.e. manage flooded intersections/roadways, address manhole cover displacements, operations when responding to severe precipitation events, etc.)	

Figure 1: Ranked risk analysis results (continued)

24	*Wetter*	Increased opportunity for mosquito and other water-borne pests to thrive in standing water	Low
25	*Warmer*	Potential need for alternative locations for outdoor playground programming with the frequency of daily temperatures reaching 30^{0}C and higher more often	
26	*Warmer*	Increased risk of heart attack and heart disease in vulnerable populations	
27	*Wilder*	Increases in calls for civic tax dollar support for those suffering property damage due to wind and rain event related infrastructure failures	
28	*Wetter*	Improved drainage planning and standards may be required to support park, public space, and sport field use more quickly after heavy rain events	
29	*Wilder*	Risk of revenue loss if civic buildings are impacted by increasingly frequent and extreme storms	
30	*Wilder*	Increased fleet and facility operation costs due to more frequent use of (and change in) air conditioning and heating needs especially in fringe seasons	
31	*Wilder*	Increases in use of leisure centres and sports complexes for persons displaced/evacuated from their home communities due to extreme weather events and/or natural hazards	
32	*Wilder*	Increased need for inspection and clean-up services "post-storm"	
33	*Warmer*	Reduced availability of water resources impacting quality and cost of water treatment	
34	*Wilder*	Increased presence of conditions that can create severe winter storms, freezing rain, and blizzard conditions	
35	*Wilder*	Forest, bush and grass fire conditions are present more often	
36	*Warmer*	Increased rate of deterioration for built (grey) infrastructure due to increases in freeze-thaw cycles	
37	*Warmer*	Increased percentage of household and business dollars going to cover health and heating/cooling costs	
38	*Wetter*	Slope stability concerns around river valley	
39	*Wilder*	Increase in civic building insurance costs	
40	*Warmer*	Reductions in soil health	
41	*Wilder*	Reduced availability of goods and services procured from regions experiencing sea level rise challenges or transportation network outages due to extreme weather events	
42	*Warmer*	Increased demand all emergency services as instances of violence increase with temperature rise	
43	*Wilder*	Loss of critical infrastructure or civic service delivery ability (power, water, sewer, transit, etc.)	
44	*Warmer*	Reduction in local food production capacity under extreme heat and dry conditions	
45	*Wetter*	Ground water level and frost line changes impacting the continued stability and depth of burial for subsurface assets (i.e. water lines, sanitary sewer lines, and other utilities)	Very Low
46	*Wetter*	High river levels creating water seepage into waste water treatment plant through storm water outfalls	
47	*Wetter*	Public and private property damage due to riverine flooding from heavy precipitation and/or early/intense mountain runoff	

Analysis of the results highlight the importance of heat strategies into the future as the majority of high and medium risks are driven by warmer overall temperatures and more frequent extreme heat.