

Peterborough Environmental Advisory Committee Meeting Agenda

November 19, 2020

5:30 p.m.

Council Chambers, City Hall

500 George Street North

	Pages
1. Call to Order	
Land Acknowledgement	
2. Confirmation of Minutes	
2.a. October 21, 2020	1 - 3
3. Disclosure of Pecuniary Interest	
4. Reports and Communications	
4.a. Community Climate Change Resilience Strategy Report PEAC20-010	4 - 91
4.b. Public Engagement Platform Update Report PEAC20-011	92 - 93
5. Other Business	
5.a. Verbal Update on Community Recovery and Resilience Task Force	
5.b. Verbal Update from Data Committee	
5.c. Discussion - Housing	
6. Next Meeting - To be Determined	
7. Adjournment	

Peterborough Environmental Advisory Committee Minutes

October 21, 2020

Present	Dana Jordan Mary Elizabeth Konrad Peter Lafleur Chris Magwood Craig Mortlock Sandra Orsatti, Chair Stephanie Rutherford Fraser Smith Councillor Zippel
Regrets	Craig Mortlock
Staff	Natalie Garnett, Deputy Clerk Michael Papadacos, Manager, Infrastructure Management

Call to Order

The Chair called the meeting to order at 5:30 p.m. in the Council Chambers, City Hall.

Confirmation of Minutes

Moved by Chris Magwood

That the minutes of the meeting of February 19, 2020 be approved.

Carried

Disclosure of Pecuniary Interest

There were no disclosures of Pecuniary Interest.

Consent Agenda

No items were passed as part of the consent agenda.

Public Engagement Platform

PEAC20-007

Sharron Hayton, Customer Service Coordinator, provided a presentation on ConnectPeterborough

Moved by Councillor Zippel

That the PEAC approve the recommendation outlined in Report PEAC20-007 dated October 21, 2020 of the Manager of Infrastructure Management Division, as follows:

That the presentation from Communication Services staff be received for information and discussion.

Carried

Update on Community Recovery and Resilience Task Force

PEAC20-009

Moved by Fraser Smith

That the PEAC approve the recommendation outlined in Report PEAC20-009 dated October 21, 2020 of the Manager of Infrastructure Management Division, as follows:

- a) **That the update from the PEAC Chair be received for information; and**
- b) **That future agendas have a standing item for an oral report on this topic.**

Carried

Climate Actions Update Report

PEAC20-008

Moved by Peter Lafleur

That the PEAC approve the recommendation outlined in Report PEAC20-008 dated October 21, 2020 of the Manager of Infrastructure Management Division, as follows:

That the report be received for information.

Carried

Other Business

The Committee advised that they would be agreeable to a December meeting if necessary.

It was decided that the Land Acknowledgement be read at the start of the PEAC meeting.

The data committee has not yet met recently, but they will reconvene and provide an update at the November meeting.

If time permits, the Committee decided to discuss the topic of housing at the November meeting.

Next Meeting - November 19, 2020

Adjournment

Moved by Dana Jordan

That this meeting adjourn at 7:15 p.m.

Carried

Natalie Garnett

Deputy Clerk

Sandra Orsatti

Chair



City of
Peterborough

To: **Members of the Peterborough Environmental Advisory Committee**

From: **Michael Papadacos, Manager of Infrastructure Management Division**

Meeting Date: **November 19, 2020**

Subject: **Report PEAC20-010
Community Climate Change Resilience Strategy**

Purpose

A report to inform the PEAC the Infrastructure Management staff will make a presentation at the November 19, 2020 meeting and provide the PEAC with a final draft of the Community Climate Change Resilience Strategy report for their review and comment.

Recommendation

That the PEAC approve the recommendation outlined in Report PEAC20-010 dated November 19, 2020 of the Manager of Infrastructure Management Division, as follows:

That the presentation from Infrastructure Management staff and the Community Climate Change Resilience Strategy report be received for information and comments be provided at the January 20, 2021 PEAC meeting.

Budget and Financial Implications

There are no budgetary or financial implications associated with the recommendation.

Background

Development of Peterborough's Community Climate Change Resiliency Strategy (CCCRS) was facilitated by the City's participation in ICLEI Canada's Adaptation Changemakers project. The goal of this strategy is to build the adaptive capacity of the community, and to begin to integrate climate change considerations into long-term planning and day-to-day operations. The impacts and actions reflect priority climate change risks for the community's social, built, economic, and natural systems. Many climate-related risks extend beyond municipal jurisdiction, requiring the collaboration of important community service providers, local partnerships and other levels of government. As such, the climate actions presented in this strategy were developed using the knowledge and experience of municipal staff and community partners.

Development of the CCCRS was guided by ICLEI Canada's Building Adaptive and Resilient Communities (BARC) program. BARC is a five-milestone planning framework for local governments aimed at preparing communities for the impacts of climate change. The comprehensive planning methodology guides municipalities through areas of research and climate impact assessment methods, strategy development, action-setting processes, implementation planning, and monitoring and review strategies

The strategy will guide adaptation efforts undertaken by the community, in a collaborative effort with the City of Peterborough and its partners. The CCCRS was created with input from a Stakeholder Working Group composed of community organizations, local experts, and city staff to develop an actionable plan. The Working Group identified and prioritized the most salient risks to prioritize in the resiliency strategy. The foundation of the strategy is defined by seven objectives that aim to better manage the risks posed by climate change:

1. Reduce flood risk and protect water quality and quantity from changing climate and extreme weather.
2. Reduce damage and/or disruptions to built infrastructure due to extreme weather and improve safety of travel on roads and sidewalks.
3. Protect and enhance natural heritage, tree canopy, natural vegetation, and wildlife from extreme weather and climate related risks.
4. Support the agricultural community and local food producers in adapting to climate risks and identifying new opportunities.
5. Educate and prepare Peterborough's residents, businesses, and institutions for changing climate conditions and risks.
6. Increase the adaptive capacity of Peterborough's local economy to anticipate changing climate conditions and extreme weather.

7. Integrate climate change into municipal decision-making processes that inform the way Peterborough is planned, developed, used, restored and maintained.

The Working Group developed 20 direct actions with 62 supporting actions along with estimated implementation timelines, lead organizations, and potential indicators to monitor adaptation progress.

Staff will provide a brief overview of the report and requests that PEAC provide comments for consideration at the January 20,2021 PEAC meeting.

Submitted by,

Michael Papadacos
Manager, Infrastructure Management Division

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Attachment:

Appendix A - City of Peterborough Community Climate Change Resilience Strategy



CITY OF PETERBOROUGH COMMUNITY CLIMATE CHANGE RESILIENCY STRATEGY

FINAL DRAFT

March 2020

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Funding

The Adaptation Changemakers project was delivered by ICLEI Canada and funded through the Federation of Canadian Municipalities' Climate Adaptation Partner Grants available through FCMs Municipalities for Climate Innovation Program (MCIP). MCIP, delivered by FCM and funded by the Government of Canada, is a five-year, \$75-million program designed to support and encourage municipalities to reduce greenhouse gas emissions and adapt to climate change.

Executive Summary

Climate change is a defining issue of this century. The United Nations has concluded that drastic alterations to the climate system are occurring and will negatively impact communities worldwide. Overcoming this challenge is paramount to lowering the risks to human health and society.

Peterborough, like all communities in the province, is vulnerable to a variety of localized climate-induced hazards. Flooding caused by severe rainfall or rain-on-snow events causing high flows in the Otonabee River pose serious risks for residents and businesses throughout the city. Extreme heat during the summer is becoming more common, threatening the health of the most vulnerable members of the community. Rising temperatures and extreme weather is wreaking havoc on the city's natural assets, habitats, and watersheds.

The Peterborough community participated in the development of a Community Climate Change Resiliency Strategy (CCCRS) as a response to this crisis. The strategy will guide adaptation efforts undertaken by the community, in a collaborative effort with the City of Peterborough and its partners. The CCCRS was created with input from a Stakeholder Working Group composed of community organizations, local experts, and city staff to develop an actionable plan. The Working Group identified and prioritized the most salient risks to prioritize in the resiliency strategy. The foundation of the strategy is defined by seven objectives that aim to better manage the risks posed by climate change:

1. Reduce flood risk and protect water quality and quantity from changing climate and extreme weather.
2. Reduce damage and/or disruptions to built infrastructure due to extreme weather and improve safety of travel on roads and sidewalks.
3. Protect and enhance natural heritage, tree canopy, natural vegetation, and wildlife from extreme weather and climate related risks.
4. Support the agricultural community and local food producers in adapting to climate risks and identifying new opportunities.
5. Educate and prepare Peterborough's residents, businesses, and institutions for changing climate conditions and risks.
6. Increase the adaptive capacity of Peterborough's local economy to anticipate changing climate conditions and extreme weather.
7. Integrate climate change into municipal decision-making processes that inform the way Peterborough is planned, developed, used, restored and maintained.

The Working Group developed 20 direct actions with 62 supporting actions along with estimated implementation timelines, lead organizations, and potential indicators to monitor adaptation progress. The resiliency strategy will be led by the City of Peterborough with various City Divisions and Community Organizations leading individual actions.

The CCCRS is intended to guide Peterborough in the on-going effort to adapt to a changing world.

Message from the Mayor

Climate change is the greatest crisis of our times worldwide, harming human and animal populations through extreme storms, severe flooding, record heat waves, prolonged droughts, and other natural disasters. The City of Peterborough is working alongside residents, community groups, and other governments to protect our community, its economy, and its eco systems from climate change.

It is in this context that I take great pride in introducing the City of Peterborough and local partners' Community Climate Change Resiliency Strategy. This strategy will guide how adaptation and risk prevention will be carried out in order to lessen the adverse effects climate change will have on our community. In doing so, Peterborough has taken a leadership role in Ontario by planning for and mitigating hazards associated with climate change.

In 2019, City Council took a tremendous step forward by declaring a Climate Emergency to raise awareness about the urgent need to act and further reduce the amount of greenhouse gas emissions created in our city. The resiliency strategy complements this declaration by identifying vulnerabilities to adverse weather and addressing how they will be overcome. This strategy will strengthen our community's economy, public health, food systems, infrastructure, and natural heritage to successfully weather the storms of the future.



Mayor of Peterborough, Diane Therrien

Acknowledgements

This Community Climate Change Resiliency Strategy (CCCRS) was driven by the dedication and enthusiasm of the City of Peterborough, Otonabee Region Conservation Authority, Peterborough Public Health, and several other community stakeholders and non-governmental organizations who shared their time and knowledge throughout this process. The range of community perspectives and on-the-ground experience provided by those who live and work in Peterborough have shaped the development of robust adaptation goals, objectives and actions to lay the foundation to address local climate change impacts. The City of Peterborough is grateful to all those who contributed to the development of the CCCRS and acknowledge the following individuals and organizations for their dedication to the process:

Project Team

Michael Papadacos, Manager, Infrastructure Management Division, City of Peterborough

Ian Boland, Senior Watershed Project Manager, Infrastructure Management Division, City of Peterborough

Christina Schwantes, Climate Change Project Coordinator, ICLEI Canada

James Byrne, Climate Change Coordinator, Infrastructure Management Division, City of Peterborough

Participating Organizations

City of Kawartha Lakes	Drew Monkman, Community Adaptation Leader
City of Peterborough	Otonabee Region Conservation Authority
Climate Reality Hub	Parks Canada
County of Peterborough	Peterborough Chamber of Commerce
Curve Lake First Nation	Peterborough Distribution Inc.
For Our Grandchildren	Peterborough Public Health
Fleming College	Peterborough Utilities Group
Green Communities Canada	Relmage Peterborough
GreenUP	Sustainable Peterborough
Enbridge Gas	Selywn Township
Fleming College	Transition Town Peterborough
Leap Manifesto Peterborough	Trent University

Glossary of Terms

Adaptation: Includes any initiatives or actions in response to actual or projected climate change impacts and which reduce the effects of climate change on built, natural and social systems.

Adaptive Capacity: The ability of built, natural and social systems to adjust to climate change (including climate variability and extremes), to moderate potential damage, to take advantage of opportunities, or to cope with the consequences.

Climate: The weather of a place averaged over a period of time, often 30 years. Climate information includes the statistical weather information that tells us about the normal weather, as well as the range of weather extremes for a location.

Climate Change: Climate change refers to changes in long-term weather patterns caused by natural phenomena and human activities that alter the chemical composition of the atmosphere through the buildup

of greenhouse gases which trap heat and reflect it back to the earth's surface.

Climate Projections: Climate projections are a projection of the response of the climate system to emissions or concentration scenarios of greenhouse gases and aerosols. These projections depend upon the climate change (or emission) scenario used, which are based on assumptions concerning future socioeconomic and technological developments that may or may not be realized and are therefore subject to uncertainty.

Greenhouse Gas (GHG) Emissions: Greenhouse gases are those gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and emit radiation at specific wavelengths within the spectrum of thermal infrared radiation, emitted by the Earth's surface, the atmosphere itself, and by clouds. Water vapour (H₂O), carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), ozone (O₃), and chlorofluorocarbons (CFCs) are the six primary greenhouse gases in the Earth's atmosphere in order of abundance.

Climate Impact: The effects of existing or forecast changes in climate on built, natural, and human systems. One can distinguish between potential impacts (impacts that may occur given a projected change in climate, without considering adaptation) and residual impacts (impacts of climate change that would occur after adaptation)

Impact Statement: Climate-related impact statements are concise statements that outline locally-relevant projected threats and how those changes are expected to affect the built, natural, social, and economic systems of the municipality.

Mitigation: The promotion of policy, regulatory and project-based measures that contribute to the stabilization or reduction of greenhouse gas concentrations in the atmosphere. Renewable energy programs, energy efficiency frameworks and substitution of fossil fuels are examples of climate change mitigation measures. Resilience: The capacity of a system, community or society exposed to hazards to adapt, by resisting or changing in order to reach and maintain an acceptable level of functioning and structure.

Risk: The combination of the likelihood of an event occurring and its negative consequences. Risk can be expressed as a function where $\text{risk} = \text{likelihood} \times \text{consequence}$. In this case, likelihood refers to the probability of a projected impact occurring, and consequence refers to the known or estimated outcomes of a particular climate change impact.

Sensitivity: Measures the degree to which the community will be affected when exposed to a climate related impact. Sensitivity reflects the ability of the community to function (functionality) as normal when an impact occurs.

Vulnerability: Vulnerability refers to the susceptibility of the community to harm arising from climate change impacts. It is a function of a community's sensitivity to climate change and its capacity to adapt to climate change impacts.

Weather: The day-to-day state of the atmosphere, and its short-term variation in minutes to weeks.

Acronyms

BARC – Building Adaptive and Resilient Communities

CCCRS – Community Climate Change Resiliency Strategy

EMS – Emergency Medical Service

ICLEI – International Council on Local Environmental Initiatives

GHG – greenhouse gas

GPA – Greater Peterborough Area

LHIN – Local Health Integration Network

MNRF – Ministry of Natural Resources and Forestry

MOECP – Ministry of the Environment, Conservation and Parks

MTO – Ministry of Transportation

Introduction

As temperatures rise globally, the City of Peterborough has already experienced the increasing pressures of climate change. Extreme weather and changing climatic conditions have brought hotter and drier summers, severe flooding, the spread of invasive species and vector-borne diseases to Peterborough and the surrounding region. The impacts felt today have been caused by GHG emissions produced from 20 to 40 years ago and are largely unavoidable – as are the impacts that we will experience into the 2020s. If global emissions continue unabated, warming will persist, and the ensuing climate impacts will amplify, creating more frequent and intense climate events for the rest of the century. It is imperative to prepare for future climatic changes and adapt our community to this new normal.

The City of Peterborough has a long-standing commitment to both climate change mitigation and adaptation that were born out of firsthand experiences to extreme weather events. Severe and precedent-setting flooding in the mid-2000s pushed the City to invest in long-term flood risk reduction initiatives to lower the vulnerability of residents and businesses to this threat. In 2012, Sustainable Peterborough was established to prioritize climate change, environment, and sustainability for the Greater Peterborough Area municipalities and local partners. The City demonstrated its commitment to reducing emissions through its 2016 Corporate and Community Climate Change Action Plans. In 2019, the City joined hundreds of municipalities across Canada in declaring a climate emergency. This Resiliency Strategy represents a key step for our community to prepare for unavoidable current and future climate change impacts.

The goal of this strategy is to build the adaptive capacity of the community, and to begin to integrate climate change considerations into long-term planning and day-to-day operations. The impacts and actions reflect priority climate change risks for the community's social, built, economic, and natural systems. Many climate-related risks extend beyond municipal jurisdiction, requiring the collaboration of important community service providers, local partnerships and other levels of government. As such, the climate actions presented in this strategy were developed using the knowledge and experience of municipal staff and community partners.

Adaptation Changemakers

Development of Peterborough's Community Climate Change Resiliency Strategy was facilitated by the City's participation in ICLEI Canada's Adaptation Changemakers project. Supported by technical guidance from ICLEI Canada and regional experts, Adaptation Changemakers was a two-year initiative that engaged eight communities across Canada to build local capacity for climate change resilience and advance efforts on adaptation. Delivered through a cohort model, the Changemakers project brought the eight participating communities together over the course of the project, gathering at three national workshops to network, learn, and share experiences about adaptation planning.



Each Changemakers municipality followed Milestones 1 – 3 of ICLEI Canada’s Building Adaptive and Resilience Communities (BARC) program – a five milestone planning framework that supports the development and implementation of a municipal climate change resilience strategy. The process involved identifying local climate change projections and impacts, facilitating a risk and vulnerability assessment, and identifying community actions to increase resilience to projected changes. Each step built upon the findings of the other, culminating in the production of a strategy that is supported by community stakeholders.

Central to the Adaptation Changemakers project was the requirement for each resiliency strategy to include non-municipal partners in action planning and implementation. The City serves as the coordinator and champion of the Strategy, and various actions and programs that will be informed by the CCCRS will be led and implemented by non-municipal stakeholders. This collaborative co-governance model allows the burden of responsibility to be shared amongst key partners and increases resilience in areas outside the direct control of the City. More information pertaining to the BARC program and the methodology for strategy development can be found in the Strategy Development section.

Adaptation vs. Mitigation

Climate change refers to changes in long-term weather patterns caused by natural phenomena and human activities. Addressing climate change requires a two-pronged approach: reducing greenhouse gas emissions (mitigation) and preparing for the impacts of climate change (adaptation).

Mitigation refers to the implementation of policy, regulatory and project-based measures that contribute to the stabilization or reduction of greenhouse gas concentrations in the atmosphere. These include transitioning to low-carbon energy sources and improving energy efficiency. While mitigation efforts work to contain the long-term impacts of global warming, adaptation measures are needed to address the climate change impacts that are already happening. Adaptation should not replace or undermine mitigation efforts, rather adaptation complements local government efforts to protect and improve their long-term sustainability. Climate change adaptation refers to any initiative or action that increases the resilience of social, ecological, physical, and economic systems to changing climate conditions.

ADAPTATION = managing the unavoidable
MITIGATION = avoiding the unmanageable

Adaptation and mitigation are not mutually exclusive. Many actions can contribute to resilience and adaptation while reducing GHG emissions. For example, using low impact development and green stormwater infrastructure can reduce runoff, erosion, contamination, and flood risk. Natural areas can also sequester carbon more than grey infrastructure, and there are fewer emissions and costs related to the installation and maintenance of natural infrastructure compared to a traditional ‘hard’ material.

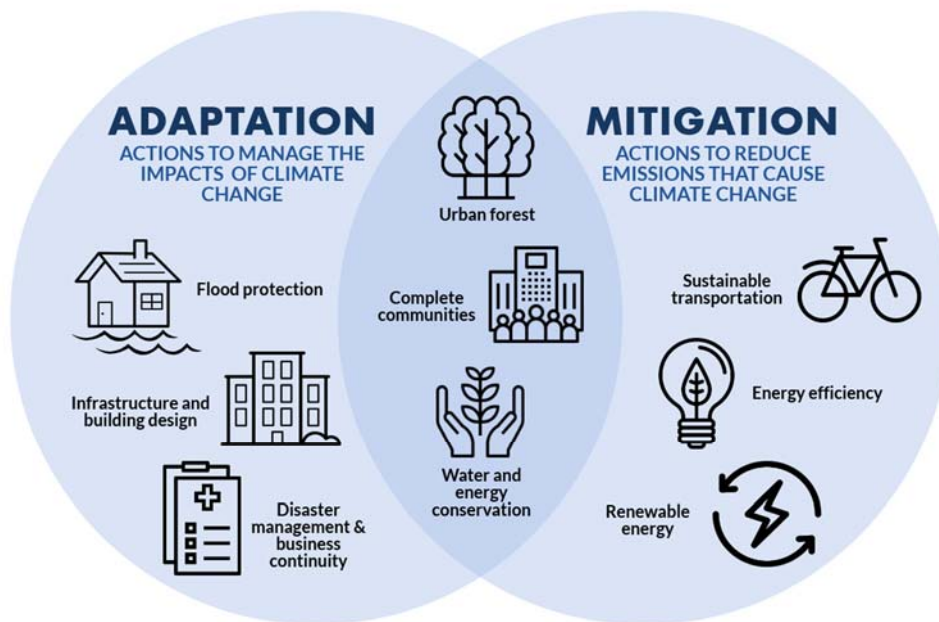


FIGURE 1: INTERCONNECTIVITY OF ADAPTATION AND MITIGATION ACTIONS

Source: City of Waterloo Corporate Climate Change Adaptation Plan, 2019

Federal Policy Direction on Climate Adaptation

At the 2015 United Nations Climate Change Conference (COP 21), 195 countries including Canada adopted the Paris Agreement, an attempt to limit the global average temperature rise to “well below” 2°C from preindustrial levels, and pursue efforts to limit the increase to 1.5°C.ⁱ According to the IPCC, the 1°C of warming already experienced will have long-lasting consequences for human and natural systems, and limiting global warming to 1.5°C (as opposed to 2°C) would allow more time to adapt to climatic changes such as sea level rise and ocean acidification.ⁱⁱ The Agreement also established a goal to enhance adaptive capacity, strengthen resilience and reduce vulnerability to global climate change.

In 2016, the Government of Canada launched the Pan Canadian Framework on Clean Growth and Climate Change to guide the country’s emissions reductions and climate resilience, in alignment with its Paris commitment. The framework recognizes the important role that Canadian municipalities must play in implementing climate solutions locally. The Framework emphasizes the need to build climate resilient infrastructure, protect and improve human health and well-being, and reduce climate-related hazards and disaster risks.

The Government of Canada has taken several steps to support Canadian municipalities in adapting to a changing climate, including:

- Creation of Expert Panel on Climate Change Adaptation and Resilience tasked with providing expertise and guidance on how to measure progress on adaptation and climate resilience.
- Creation of the Federal Adaptation Policy Framework, which brings the consideration of climate change risks into federal decision-making.

- Creating the Canadian Centre for Climate Services, which provides public information on understanding and adapting to climate change.
- Dedication of funding through Infrastructure Canada to finance climate adaptation in municipalities through grants and programs.
- Development of the Infrastructure Climate Lens to embed resilience in large-scale infrastructure projects as a funding requirement.

Provincial Policy Direction on Climate Adaptation

The Province of Ontario has also provided direction for municipalities to adapt to and mitigate climate change. Provincial policy requires municipalities to include climate change in Official Plans and integrate climate vulnerabilities as part of asset management programs.

The Province of Ontario's "Made-in-Ontario Environment Plan" (2018) contains actions that will reduce greenhouse gas emissions from across the economy, stimulate clean innovation and growth, and build resilience to the impacts of climate change. The plan includes multiple actions to build resilience to climate change impacts. These include:

- Building climate resilient infrastructure;
- Addressing climate change-related health issues;
- Supporting the resilience of agriculture, aquaculture, and forestry sectors; and
- Pursuing education and community outreach.

While federal and provincial governments provide strategic focus, standards, and potential funding streams for adaptation, it is important for local governments to tailor adaptation efforts to the unique community members, climate conditions and risks they will experience as a result of climate change.

City of Peterborough's Commitment to Climate Change Action

The City of Peterborough has already felt the impacts of climate change locally, in many different ways. Significant weather events that have befallen Peterborough in recent years include:

- A severe summer storm that generated +70 mm of rain over 24 hours causing damage to properties in 2002.
- A major flood resulting from an unprecedented 240 mm of rainfall that devastated the downtown core of the city in 2004. A total of \$95 million in insured losses was recorded by the Insurance Board of Canada with the City spending an additional \$21 million to repair damaged/destroyed infrastructure that encompassed roads, bridges, culverts, and municipal buildings (Image 1).



IMAGE 1: SUBMERGED STREET DURING 2004 FLOOD

- A ten-month drought from 2016 to 2017, which at its worst (from May to August), saw only 83.5 mm of rain compared to the average of 241.02 mm for that same time period. This caused regional rivers to be classified with a Level II Low Water Condition rating, with Jackson Creek reaching extremely low water flows that summer. Ultimately, this drought was noted as the second driest year on record (Image 2).



IMAGE 2: LOW WATER LEVELS IN JACKSON CREEK



IMAGE 3: DOWNED TREE FROM APRIL 2013 ICE STORM

- A significant ice storm affected Peterborough on April 12, 2013 that brought down trees as well as power lines that affected 18,000 homes (Image 3). Another substantial ice storm in December 2013 also induced power outages, but the epicenter of that event was localized to the GTA.



IMAGE 4: DAMAGED HYDRO POLE AFTER STORM

- A strong windstorm caused by a rapid moving thunderstorm impacted Peterborough and Southern Ontario on May 4, 2018. Recorded wind speeds of 102 km/h inflicted power outages to 15,530 customers because of downed trees and hydro poles. One resident was injured after her roof collapsed at the height of the storm (Image 4).



IMAGE 5: RESPITE DURING 2018 HEATWAVE AT BARNARDO PARK

- July 2018, a heat wave that spanned five days recorded daytime highs of +30°C (Image 5).

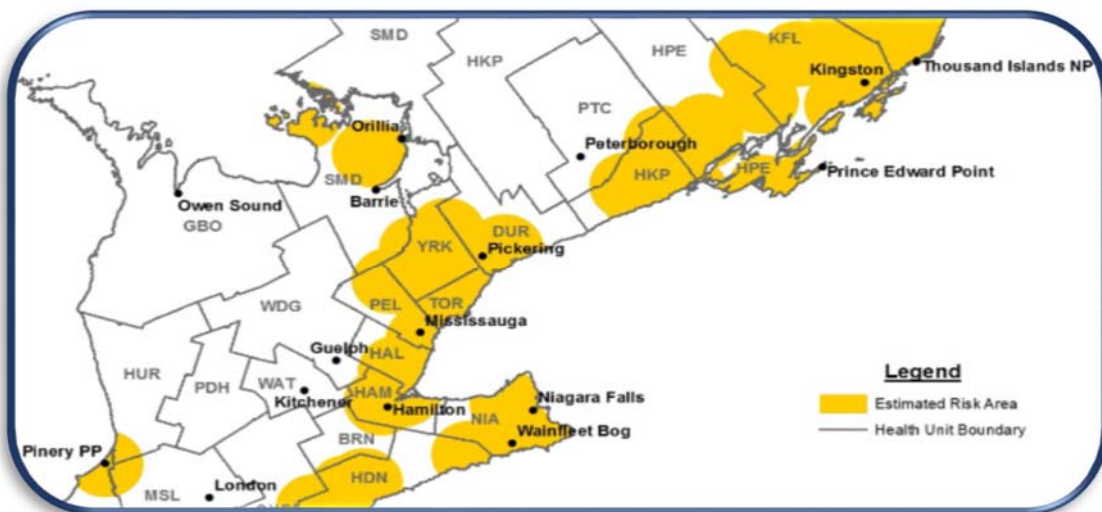


IMAGE 6: LYME DISEASE RANGE IN 2019

- The changing climate has led to favourable conditions for the spread of the blacklegged tick with Lyme disease into Peterborough County. Currently, Peterborough Public Health is monitoring ticks to identify where the first case of the disease could enter the city. In 2019, the risk of contracting Lyme disease is low and found south of Peterborough city center (Image 6).

These events and subsequent impacts associated with climate change have made community action on adaptation and mitigation more urgent than ever before.

The City of Peterborough has been working on climate change adaptation for nearly a decade (Table 1). Faced with several extreme temperature and precipitation events, the City has undertaken multiple initiatives to better understand and plan for localized risks.

In 2012, the Integrated Community Sustainability Plan – *Sustainable Peterborough* - was developed for the entire GPA. Within the Community Sustainability Plan, climate change was identified as one of the eleven key focus areas. Since then, communities within the GPA have been working collectively to achieve the following vision, as originally identified as climate change goals in the Plan: *We will reduce our contributions to climate change while increasing our ability to adapt to climate change conditions.*

In 2014, the GPA member municipalities joined hundreds of communities across Canada to address climate change through participation in the Partners for Climate Protection (PCP) program aimed at reducing GHG emissions from corporate operations and community sources. In 2016, the City of Peterborough completed its Corporate and Community Climate Change Action Plans which described the pathway to achieving a GHG reduction target of 30 percent by 2031.

TABLE 1. CLIMATE CHANGE ADAPTATION AND MITIGATION INITIATIVES IN THE CITY OF PETERBOROUGH

Initiative	Year
City of Peterborough Flood Reduction Master Plan	2005
City of Peterborough Urban Forest Strategic Plan	2011
Sustainable Peterborough Community Sustainability Plan	2012
City of Peterborough Comprehensive Transportation Plan	2012
Greater Peterborough Area Climate Change Action Plan	2014
City of Peterborough Emergency Response Plan	2016
Sustainable Urban Neighbourhoods Program (partnership with GreenUP)	2017
Sustainable Peterborough Report Card	2018
SaveOnEnergy Corporate Building Energy Mitigation Strategy	2014-2018
City-wide Streetlight LED Replacement Program	2018-2019
City of Peterborough Climate Emergency Declaration	2019
Peterborough Environmental Advisory Committee (founded)	2019
Peterborough Environmental Advisory GHG Sub-Committee (founded)	2019
Our Watershed, Our Blueprint – Peterborough Watershed Planning Study	2019
Green Economy Peterborough Hub (founded)	2020
Peterborough Community GHG Inventory Review	2020
Peterborough Corporate GHG Inventory Review	2020
Community Climate Change Resiliency Strategy	2020
Peterborough Official Plan	2020

This Resiliency Strategy was created to help organizations, institutions, businesses, vulnerable populations, and individuals of all ages adapt to current and future climate-related risks and opportunities. Simultaneously, multiple community stakeholders (such as Peterborough Public Health and Otonabee Conservation) are completing organizational climate change vulnerability and adaptation planning processes to prepare their organizations for climate change – work that can complement the delivery of this strategy.

Strategy Development

Development of the CCCRS was guided by ICLEI Canada's Building Adaptive and Resilient Communities (BARC) program. BARC is a five-milestone planning framework for local governments aimed at preparing communities for the impacts of climate change. The comprehensive planning methodology guides municipalities through areas of research and climate impact assessment methods, strategy development, action-setting processes, implementation planning, and monitoring and review strategies (see Figure 2). As part of the Changemakers project, Peterborough worked through and completed Milestones 1 – 3 of the Framework, which resulted in the creation of this Resiliency Strategy.

Milestone One – Initiate: Communities identify a variety of stakeholders to participate in the adaptation planning process. Stakeholders then review existing information on how the climate is changing and begin to identify local climate change impacts.

Milestone Two – Research: The second milestone is meant to further develop the community's understanding of climate change impacts and the major systems which are likely to feel these impacts most acutely. Within this milestone, a municipality will scope the climate change impacts for the region and conduct both a vulnerability and risk assessment.

Milestone Three – Plan: The third milestone provides guidance on how to establish a vision, set adaptation goals and objectives, identify adaptation options, and examine possible constraints and drivers to various actions. From there, the community will draft a Local Adaptation Strategy. Baseline data is collected and recorded, financing and budget issues start to be considered, a preliminary implementation schedule is drafted, implementation responsibilities are determined, and progress and effectiveness indicators are proposed in the Plan.

Milestone Four – Implement: In the fourth milestone, communities work to ensure that they have the approval and support of council, municipal staff and the community in order to move forward on implementation. Communities will also make sure they have the appropriate implementation tools to ensure the ongoing success of the Strategy.

Milestone Five – Monitor & Review: The fifth and final milestone serves to assess whether the goals and objectives of the Strategy have been achieved, and helps communities identify any problems that have been encountered and develop solutions. Additionally, the fifth milestone helps communities communicate their progress to council and the general public.

Climate Change Projections and Impacts

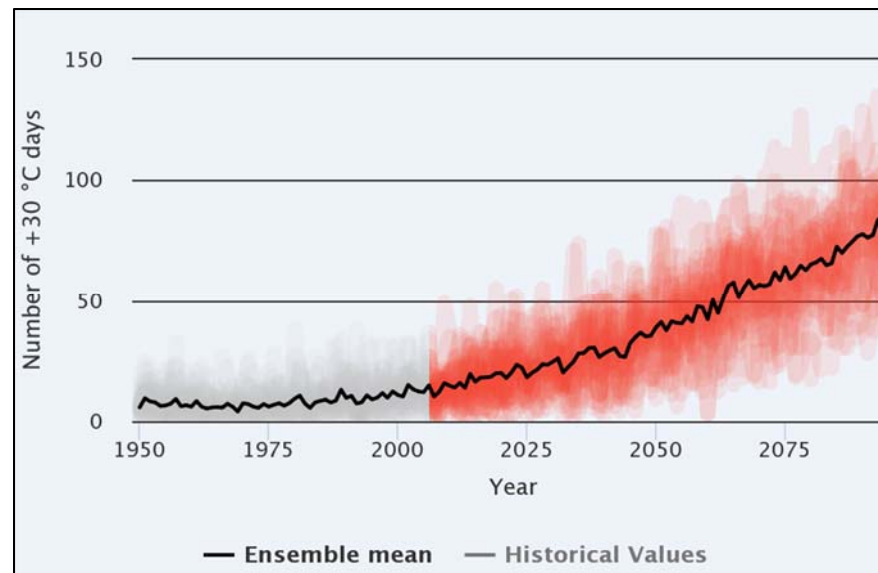
Climate Change Science

Climate change is defined as any change in global or regional climate patterns. The Intergovernmental Panel Climate Change (IPCC) is the UN body tasked with assessing the science related to climate change, its impacts and potential future risks, and possible response options. In the 2014 Fifth Assessment report, the IPCC declared with certainty the widespread impact of human-caused climatic changes. The report stated: “Human influence on the climate system is clear, and recent anthropogenic emissions of greenhouse gases are the highest in history. Recent climate changes have had widespread impacts on human and natural systems.”ⁱⁱⁱ

To limit warming, there must be “rapid and far-reaching” transitions in how we use our lands, energy, industry, buildings, transportation and the design of our cities.^{iv} To stay on track for only 1.5°C of warming, emissions would need to drop to roughly half of 2010 levels by 2030, nearing zero by 2050.^v The UN Environment’s Emissions Gap Report published in 2018 found that emissions pathways reflecting current commitments from the Paris Agreement would constitute warming of 3°C by 2100.^{vi} If the emissions gap is not closed by 2030, it is very plausible that the goal of “well-below 2°C temperature increase” is also out of reach.^{vii}

Since the late 1800s, the Earth’s temperature has risen by 1°C largely due to human activities.^{viii} As fossil fuels continue to be burned around the world, the warming is accelerating faster than before. Earth’s average surface temperature in 2018 was the fourth hottest year on record since record-keeping began in the 1880s.^{ix} As of 2019, the five warmest recorded years have occurred during the past five years, and the 20 warmest years on record have occurred over the past 22 years.^x Figure 3 shows RCP 8.5 forecasted climate models (ensembles) with historical climate observations. The red represents the variability found within the 24 individual models assembled to generate the black line, which depicts mean number of days above 30°C in Peterborough.

FIGURE 3. HIGH CARBON EMISSIONS PROJECTION SCENARIO FOR DAYS OVER 30°C IN PETERBOROUGH



Now more than ever, it is crucial that cities adapt to help community members prepare for increasing intensity of climate-related risks. The IPCC recommends a mix of adaptation and mitigation options to limit global warming to 1.5°C, implemented in a participatory and integrated manner.^{xi}

Climate Change in Canada

Since 1950, the overland temperature in Canada has increased by 1.5°C.^{xii} This rate of warming is almost double the global average reported over the same period. The years 2011 and 2012 were 1.5°C and 1.9°C warmer than the 1961-1990 average in Canada, with 2019 now standing as the warmest year on record globally.^{xiii} Canada has also become wetter during the past half century, with more frequent and intense extreme events over the last 50-60 years than ever before. These events come in the form of extreme heat days, more instances of extreme precipitation and flooding, windstorms, and ice storms. In Canada, projections show more frequent extreme events in the future.^{xiv}

Climate Change Projections

Regional effects of global warming vary in nature. When the global temperature changes, the changes in climate are not expected to be uniform across the Earth. As such, it's important to downscale climate data to determine how the climate is projected to change in Peterborough until the end of the century.

Projecting future climate conditions requires historical weather station data from the City of Peterborough as well as an ensemble of global climate models, which provide the best available scientific assessment of how future social and economic conditions will influence the climate system. Future conditions are modeled using climate scenarios which are assumptions of future atmospheric composition of the effects of increased atmospheric concentrations of GHG, particulates, and other pollutants. Producing scenarios requires estimates of forecasted population levels, economic activity, the structure of governance, social values, and patterns of technological change. To account for multiple future climate change scenarios, the IPCC developed four scenarios, called Representative Concentration Pathways (RCP), as part of the Fifth Assessment Report. RCP stands for Representative Concentration Pathway and is a greenhouse gas (GHG) concentration trajectory adopted by the Intergovernmental Panel on Climate Change. RCP8.5 represents the trajectory where GHG emissions continue to rise through the 21st-century.

TABLE 2: RCP CLIMATE CHANGE SCENARIO DESCRIPTIONS (SOURCE: IPCC, 2014)


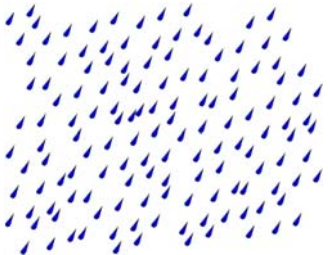

Scenario	Description
RCP 2.6	Lowest projected GHG concentrations, resulting from dramatic climate change mitigation measures implemented globally.
RCP 4.5	Moderate projected GHG concentrations, resulting from substantial climate change mitigation measures.
RCP 6.0	Moderate projected GHG concentrations, resulting from some climate change mitigation measures.
RCP 8.5	Highest projected GHG concentrations, resulting from business-as-usual emissions.

While it is not possible to anticipate future climate changes with absolute certainty, climate change scenarios create plausible representations of future climate conditions. Scenarios help inform what future climatic events may occur which will help advise a proactive response by City of Peterborough officials and staff. However, there is uncertainty factored into climate change scenarios, models, and data, and reflects the complex reality of environmental change and the evolving relationship between humans and the planet.

Peterborough Climate Change Projections

The table below summarizes some projected changes for Peterborough, based on models and emissions scenarios from the IPCC Fifth Assessment Report (AR5). Multiple global climate models were used, and the high emissions scenario was selected because if current emissions trends continue, RCP8.5 and associated temperature increases will likely apply. The information was retrieved from the Climate Atlas of Canada. Please see Appendix 1 for more detailed climate projections.

TABLE 3: CLIMATE CHANGE PROJECTIONS FOR PETERBOROUGH

Climate Driver	Summary of Projected Changes
<p>Temperature</p> 	<ul style="list-style-type: none"> • Average annual temperatures are expected to increase 2.2°C between 2021-2050, and 4.4°C between 2051-2080 range • The largest seasonal temperature increase will be in the winter • Average number of days >30°C will more than double from ~9.6 days/year historically, to 26.8 days by 2050s and 52.3 days by the 2080s
<p>Precipitation</p> 	<ul style="list-style-type: none"> • Average annual precipitation is expected to increase by 7% in the 2021-2050 period, and 10% between 2051-2080 • The largest seasonal precipitation increase will be in the Winter and Spring, whereas Summer months are expected to become slightly drier on average • Precipitation is expected to become more intense and frequent • The max 1-day precipitation is projected to rise by 10% during 2021-2050, and by 14% in the 2051-2080 time period
<p>Water</p> 	<ul style="list-style-type: none"> • Trent-Severn Waterway surface water temperature is expected to increase to 2.5°C by 2070 that will impact fish spawning and evaporation rates • Warmer winters will lead to partial melting of the snow pack between snowfalls and/or more rain instead of snowfall that will cause runoff to rivers to increase by 20-70%

Climate Change Impacts

The physical, social, economic, and ecological health of Peterborough is influenced by our changing climate in a variety of complex and interdependent ways. Exploring the effects of climate change on

these systems is the foundation of BARC Milestone 2. The CCCRS will address a wide range of climate impacts that may pose risks to systems and sectors across the community.

The Stakeholder Working Group collaborated through workshops to develop a list of local climate change impacts and consequences. The climate change impacts were drafted based on historical events and future climate projections provided by ICLEI. Impacts were contextualized for Peterborough and validated using the subject matter expertise of the stakeholders involved. Impact statements are intended to capture:

- A climatic threat/change (e.g. rising temperatures)
- The outcome of the climatic change (e.g. extreme heat event)
- The consequences associated with this outcome (e.g. heat stress)

A total of 98 impact statements were developed through this activity. Workshop participants and the Project Team refined the impacts over the course of August and September 2018, which resulted in a total of 74 impacts that moved forward into the rest of the planning process.

Impact Prioritization

The community climate impacts were then prioritized based on Vulnerability and Risk Assessments also conducted by the Stakeholder Working Group. Each impact was ranked based on its total social, economic, and environmental consequences, its overall risk ranking, and its vulnerability level. Based on the results of the Vulnerability and Risk Assessments, high scoring impacts were identified as priorities. All impacts ranking medium-low or higher in Risk are presented in this strategy. The impacts that received the highest Vulnerability and Risk Scores are marked with an asterisk.

Built and Physical Impacts

Climate change impacts will affect the built infrastructure in Peterborough, from roads and bridges, buildings, transportation systems, energy systems, parks, and public spaces. More frequent and extreme temperatures and precipitation events will increase maintenance needs, replacement costs, and can cause expedited damage and/or loss of critical infrastructure for the community. Increased precipitation will have a direct impact on stormwater (e.g. stormwater pond capacity) and transportation infrastructure (e.g. road washouts). Cultural sites, parks, and community centres such as rinks, pools, soccer fields and trails are at risk of damage or closure due to temperature and precipitation changes. Public health and safety can be impacted by these conditions in public spaces and within the transportation network. Local governments must ensure that risks to their built systems are monitored and adaptive measures are put in place to protect community infrastructure and those who use it.

The Stakeholder Working Group identified the following climate impacts for built systems/service areas in Peterborough:

Increase in average temperature and hot days over 30 °C, contributing to:

- Reduced surface water quality, causing increase demand on the water supply (potable) and sewage system
- Increased power consumption for cooling, causing increased power grid demand and disruptions or failure

Increase in intensity and frequency of precipitation events, contributing to:

- Flooding and closure of roads and bridges, leading to disruptions to transportation services and mobility (including access for emergency services)
 - Damage to built infrastructure (e.g. energy systems and roads) causing more public health and safety risks
 - Wind, rain, ice damage to buildings and power infrastructure causing damage and disruptions to transportation network
 - Damage to trees, leading to greater risk of power infrastructure damage and power outages
 - Capacity of storm water management network could be exceeded, contributing to flooding
 - Increased instances of flooding, causing sewer backups and/or STP bypasses
 - Increased instances of flooding, causing more roadside erosion
 - Increased instances of flooding, causing an increase in basement flooding
-

Increasing climate variability and extremes, contributing to:

- Frazil ice, rain or snow, freezing rain causing increased property damage
 - Frozen ground with no/low absorption followed by rainfall, contributing to increased overland flow
-

Social Impacts

Climate and weather-related impacts have both direct and indirect effects on the complex social systems in the City of Peterborough. Changing temperature and precipitation patterns have been linked to an increased spread of vector-borne diseases, food insecurity, and human health implications such as physical and mental illnesses and injuries. Extreme precipitation creates dangerous conditions in homes, workplaces, schools, and outdoors on roads and sidewalks. Power outages can limit our ability to communicate and get help during emergencies. Hot days can exacerbate respiratory problems and heat-related sickness in the chronically ill, seniors, children, and other vulnerable populations. More than ever, mental health and physiological stress have been linked to climate change and weather-related disasters. As a result, extra pressure is placed on the healthcare providers due to increased demand resulting from weather-related hazards.

To appropriately address the social consequences of climate change, communities need to understand the unequal distribution of vulnerability.^{xv} Climate change impacts do not affect all social systems and groups equally. Those most vulnerable may include community members who are low income, chronically ill, lack a social network, those living in isolated dwellings, or facing other systematic barriers.^{xvi} These groups are typically more vulnerable to harm from climate impacts because they have fewer resources to understand, prepare for, and recover from changing conditions and risks. Each community is unique, and effort is required to identify and support those who are more vulnerable to climate-related risks. When municipalities take on adaptation actions that promote equity and inclusivity, we can help remove the barriers that prevent vulnerable groups accessing resources and knowledge.

The Stakeholder Working Group identified the following climate impacts for social systems and health in the Peterborough community:

Increase in average temperature and hot days over 30 °C, contributing to:

- Poor air quality causing health risks for vulnerable populations (e.g. elderly, low income residents, those without AC, those with existing respiratory diseases) *
- Extreme heat and poor air quality can mean limited options for indoor and outdoor cooling and/or an inability to access cooling, especially for vulnerable populations*
- Lower surface water quality and/or quantity, combined with intensification and clustering development, could lead to a loss of single use wells with a need to develop communal water services
- Poor growing and harvesting conditions for First Nations traditional crops, contributing to loss of tradition and culture and the sharing of Traditional Ecological Knowledge (TEK)
- Increased risk of water and food-borne diseases such as salmonella, campylobacter, and E coli
- Extreme heat and poor air quality leading to reduction in outdoor recreation among children and vulnerable groups
- Extreme heat and poor air quality can limit opportunities for free outdoor physical activity, creating an inequity between those who can afford climate-controlled physical activity (e.g. gym memberships) and those who cannot.

Increase in intensity and frequency of precipitation events, contributing to:

- Overland flooding in urban areas leading to displacement and/or evacuation of residents from homes and workplaces
- Flooding of properties can cause increase in mold, and the various health related issues due to prolonged exposure
- Damage to roofs/exterior structure at the home can lead to loss of basement apartments and personal property
- Weather damage, flooding, power outage, or snow accumulation on property adding mental/physical stresses for rural or vulnerable populations
- More stagnant water sources, leading to higher risk of vector-borne diseases (e.g. West Nile)

Increasing climate variability and extremes, contributing to:

- Increased hazards for outdoor recreation, particularly for youth and vulnerable populations
- Unpredictable levels of service for maintenance workers leading to higher fatigue, loss of productivity, and/or schedule changes to the workforce

Occurrence of cold days below -10°C, contributing to:

- Exposure of vulnerable populations to extreme cold, leading to hypothermia and various other health and safety concerns, specifically in places of heat/utility poverty in rural areas
 - Occurrence of cold events and increase in precipitation intensity during cold periods limits the ability to travel, which can cause isolation and stress on rural or vulnerable populations
-

Economic Impacts

The net damage costs and economic losses resulting from climate change are significant and will continue to rise.^{xvii} Climate impacts will have both immediate and long-lasting impacts on the flow of goods and services through the community in Peterborough. Local revenue sources such as energy, agriculture, tourism, recreation, freshwater fisheries, and transportation will experience losses that are likely to be felt within the short and medium term.^{xviii} Local businesses may experience operational losses, business continuity issues, and disruptions to essential services (e.g. power, telecommunications) which are relied upon to deliver products and services. The economic and recreational benefits of seasonal activities such as outdoor skating rinks and marinas are already challenged by rising temperatures and an increase in extreme weather. The agricultural and local food industry in the Greater Peterborough Area may experience stress or supply losses due to warmer and drier conditions in summer, and heavier precipitation. Real estate development and affordability will also be impacted as insurance premiums rise and damage to properties increases as a result of extreme weather events.

Municipalities need to understand the impacts of climate change on the local economy in order to protect important revenue sources and enhance resilience across industries and sectors. Fortunately, there may be positive opportunities that could arise as the climate changes, particularly for tourism industries, so it is important to proactively plan for the impacts (and opportunities) of climate change. To enable action, municipalities and business alike must embed adaptation within existing governance structures and strategic planning, working collectively to improve risk management and make resilient investments.^{xix}

The Stakeholder Working Group identified the following climate impacts for the local economy and financial systems in the Peterborough community:

Increase in average temperatures and intensity of precipitation events, contributing to:

- Wind, rain, ice damage to buildings and power infrastructure, putting an increased financial burden on community due to losses and insurance claims
 - More frequent power outages leading to loss of local business and public services
 - Damage to roofs/exterior structure at the home, creating financial strain caused by inability to afford the costs to upkeep structures, replace infrastructure, etc.
 - Increasing intensity of precipitation events, combined with intermittent dry periods, can create conditions where the ground is less able to absorb the rain (reduced infiltration). In these instances, there is a higher crop washout risk which can cause loss of current crop varieties and food supply
-

Ecological/Natural Impacts

Peterborough's ecological systems provide bountiful natural capital and ecosystem services, which contribute to human health and well-being as well as the productivity of a wide range of economic sectors.^{xx} Peterborough's natural areas and the value they provide to the community are already under stress as a result of human activities such as development and pollution. Climate change creates opportune conditions for habitat loss, increased fire risk, spread of invasive species, and spread of

insects and disease. Impacts on ecological systems often cascade into socioeconomic and built systems wherein the consequences will be felt across the community for the long term. For example, warmer temperatures and lower summer precipitation can cause low water levels, leading to reduced availability of soil moisture for forests and agricultural land, introducing a wide range of concerns such as loss of shading, carbon sequestration, and lumber, and damage to crops and livelihood of the agricultural community. Lower water levels and warmer water temperatures reduces the wetland water budget and threatens the rich biodiversity of vegetation, birds and fish communities. Ecological impacts should be of concern to communities as ultimately the risk of ecosystem damage and loss of biodiversity will diminish the ecosystem services and socioeconomic benefits provided to the community.^{xxi}

The Stakeholder Working Group identified the following climate impacts for the natural systems in Peterborough:

Warmer temperatures and longer dry periods, contributing to:

- Higher tree mortality, contributing to loss of urban tree canopy and decreased shading*
- Increased spread of invasive species, causing damage or stress on trees and natural areas
- Reduced infiltration for short duration events, creating increased water demand for trees and turf
- Warming temperatures in streams and creeks, leading to loss of cold-water species
- Low baseflow in creeks and wetlands, leading to changes to wetland boundaries and species composition
- Low baseflow in creeks and wetlands, leading to stress on food and crop production
- Low baseflow in creeks and wetlands leading to less water available for plants, trees, gardens
- Increased fire risk and more frequent fire bans
- Lower lake and river levels, causing stress on plants and aquatic ecosystems
- Rapid freeze and thaw, especially in winter, leading to stress on tree health of sensitive species

Increase in intensity and frequency of precipitation events, contributing to:

- Rapid changes to stream morphology, causing increased risk of flooding, sedimentation, and contamination of streams*
- Increased runoff from roads and agricultural land, leading to contamination of source water
- Freezing rain events leading to more salt use and causing higher chloride contamination risks to water
- Increased instances of flooding, leading to increased erosion and sedimentation of streams/creeks
- Stress on stormwater management system, causing contaminant loading in water sources

Long-term changes in temperature and precipitation patterns, contributing to:

- Loss of iconic trees and plant species, local characteristics, landscapes, seasonal traditions (e.g. backyard rinks, decreased intensity of fall colours), causing decline in the quality of our experience of the natural world*

- Changes in composition, ecology and structure of Peterborough's natural areas, creating Opportunities for new (non-invasive) species such as Carolinian species
-

Vulnerability Assessment

Before the Risk Assessment and as the next part of the planning process, community stakeholders were invited to participate in a Climate Change Vulnerability Survey. The Stakeholder Working Group, which included everyone who took part in the Impact Identification workshop, and any additional stakeholders to be invited to the Risk Assessment, were invited to participate in the Vulnerability Survey. The survey was available online for approximately three weeks prior to the Risk Assessment Workshop and was completed by representatives from the City of Peterborough, local conservation authorities, community organizations, Trent University, Fleming College, and the County of Peterborough.

The survey asked participants to rank each impact statement based on how vulnerable they believed the community was to harm or damage if that impact were to occur today. The survey was categorized by socioeconomic, natural, and built infrastructure impacts so that those with certain expertise (e.g. engineering) could fill out the most relevant survey. Participants were provided with a hyperlink to the online form with detailed instructions on how to complete the activity. For each impact statement, participants were asked to consider the following:

- Considering both adaptive capacity and sensitivity, select a vulnerability ranking for each impact statement (Low vulnerability impacts mean that the community is not very sensitive or would be able to adapt to this change with ease. High vulnerability impacts mean the community is at risk of significant harm or damage from the impact).
- Add justification for their choice, and any comments or concerns about the impact statement in the text box below. If the adaptive capacity is high, that means the community can respond/adjust to the impact relatively easily.

Results from the Climate Change Vulnerability Survey provided an initial prioritization of impacts before Risk was explored in depth. Vulnerability rankings indicate the impacts to which the City is sensitive or has low adaptive capacity (ability to cope/recover). Therefore, impacts that received a Low ranking were not carried forward into the Risk Assessment process, as the community was not highly sensitive to these impacts and possesses enough existing adaptive capacity to manage these concerns. This left a total of 52 impacts (of Medium and High ranking) that were further analyzed.

Risk Assessment

The next steps in the Milestone Two impact prioritization process was the community Risk Assessment, based on the results of the Vulnerability Assessment. Impacts that received a Medium-Low or higher in any risk category (e.g. environmental, natural, or social) were brought forward into planning and are displayed above.

Like vulnerability, risk is a function of two criteria – namely the likelihood of the impact occurring and its negative consequences. It can be expressed as a function of *risk = likelihood x consequence*.

Likelihood measures the probability of the climate-related event occurring. Likelihood ratings are scored on a scale of 1 – 5, with 1 being ‘rare’, and 5 being ‘almost certain.’ These ratings were informed both by the localized climate change projections, as well as City staff and stakeholder knowledge and expertise.

Consequence refers to the known or estimated consequences of each impact. To determine consequences, the Stakeholder Working Group assessed each impact across twelve different consequence criteria, which were divided by type of consequence (social, economic, environmental).

TABLE 4: *RISK ASSESSMENT CONSEQUENCE CATEGORIES*

Social Consequences	Economic Consequences	Environmental Consequences
Health & Safety	Property Damage	Air
Displacement	Local Economy & Growth	Soil and Vegetation
Loss of Livelihood	Community Livability	Water
Cultural Aspects	Public Administration	Ecosystem Function

Each impact received a risk score for each consequence category (social, economic, environmental), as well as an overall risk score. This is intended to demonstrate that while certain impacts may not rank high in one area, it may have significant consequences in another. Each of the twelve criteria also received a score from 1 – 5, ranking from ‘negligible’ to ‘catastrophic.’ To improve the Risk Assessment’s accuracy, the Project Team tailored the criterion for levels 1-5 of each consequence to fit the Peterborough context. With the impacts prioritized, the Project Team and Stakeholder Working Group had clear direction to create objectives and adaptation actions that could reduce the community’s risks.

Action Planning Process

To provide a strategic framework and direction for the CCCRS, a community vision, theme areas, and seven objectives were identified. The vision, objectives and actions presented in this strategy are a combination of measures that have been developed by the Project Team and Stakeholder Working Group to address Peterborough’s climate impacts and risks. For each action a proposed implementation table outlining the lead and supporting roles, timeline, supporting actions, and monitoring metrics can be found in Appendix 4.

Action Identification

With a complete list of impacts, the process moved into Milestone Three of BARC wherein the next step was to identify adaptation actions that the community could take to address climate risks. Effective adaptation actions are those that address climate change risks and improve the adaptive capacity and people, assets, and services. Adaptation actions in this strategy were scoped using the following criteria:

- Must be implementable in the City of Peterborough (meaning the actions are local actions, not region-wide)
- Must address priority impacts of climate change or extreme weather
- Must include non-municipal partners in planning and implementation

An action identification workshop was held with the Stakeholder Working Group in May 2019. At the workshop, participants were presented with a list of best practices, identified by the Project Team and ICLEI Canada. The adaptation options were intended to be used as an information tool, which participants could review and pull from to tailor actions that suited Peterborough's context and climate impacts.

In the workshop, it was important to acknowledge that adaptation actions can take many forms. When drafting new actions, participants were asked to consider different types of responses, such as:

- Research and monitoring
- Early warning systems
- Hazard information provision
- Awareness raising and education
- Alterations to operations and practices
- Supporting existing plans
- Bylaws, policies or plans
- Technologies
- Infrastructure (hard and soft)
- Economic instruments
- Forming partnerships

A total of 30 actions were identified by the Stakeholder Working Group and City staff. All actions were then further reviewed by the Project Team to coalesce, edit, and streamline the actions where necessary. These were then circulated and reviewed by the working group, as well as City senior staff. The final number of actions included in the strategy is 20 and can be found in the Actions section below.

Implementation Planning

While Peterborough has made strides in community adaptation through the development of the CCCRS implementing the Strategy is crucial to see the results of increased adaptive capacity. To ensure the implementation is prompt and effective, implementation tables were developed for each adaptation action.

The implementation tables are intended to be living documents and will be further refined as implementation progresses. Updates should be made to account for changes in policies, staff or financial resources, and as new climate-related threats emerge. Taking an adaptive management for implementation of this Strategy will ensure the City and its community partners are not limited by current practices, encouraging the City to lead in innovation and progress as new opportunities for adaptation arise.

The implementation tables were developed as a starting point to identify resources required to implement adaptation actions. Alongside every action, the implementation table includes:

- Action name – the description of the action
- Supporting actions – Sub-actions that can help the delivery of the action/program
- Estimated timing – The timeline of when implementation would take place for each action
- Relevant opportunities – Existing initiatives/programs/policies that could be leveraged in support of the actions
- Lead organization – The organization(s) that is best positioned to lead implementation
- Supporting organization(s) – The organization(s) that is best positioned to support implementation

- Monitoring metric– Indicator(s) that illustrates progress on implementation or on achieving the identified objectives

Adaptation Actions

The actions included in this strategy are the result of a collaborative effort of the Stakeholder Working Group, City of Peterborough Project Leads, and ICLEI Canada. The actions are organized by theme and objective. As implementation work progresses additional actions could be contemplated. The complete implementation tables for each action can be found in Appendix 4.

Objectives

1. Reduce flood risk and protect water quality and quantity from changing climate and extreme weather
2. Reduce damage and/or disruptions to built infrastructure due to extreme weather and improve safety of travel on roads and sidewalks.
3. Protect and enhance natural heritage, tree canopy, natural vegetation, and wildlife from extreme weather and climate related risks
4. Support the agricultural community and local food producers in adapting to climate risks and identifying new opportunities.
5. Educate and prepare Peterborough's residents, businesses, and institutions for changing climate conditions and risks (e.g. drought, flood, heat).
6. Increase the adaptive capacity of Peterborough's local economy to anticipate changing climate conditions and extreme weather
7. Integrate climate change into municipal decision-making processes that inform the way Peterborough is planned, developed, used, restored and maintained.

Refer to Appendix for the complete list of supporting actions with implementation timings, lead organization and partners, and indicators.

Theme: Water

Envisioning how climate change will alter Peterborough's relation with water is the primary driving factor within the Resiliency Strategy. Understanding how too much precipitation or the lack of it will affect the community is vital in adaptation planning. Preparing for the variety of impacts associated with water will reduce the vulnerability of residents and businesses over the long-term.

Actions:

- 1.1. Encourage responsible salt use for roads, parking lots and walking surfaces across the City to reduce the amount of salt used during freezing rain/snow events.
- 1.2. Improve sediment and erosion control from construction activities through improved inspections, reporting, and operational controls.
- 1.3. Enhance water conservation methods and programming.
- 1.4. Increase flood risk awareness and adaptive capacity of residents and small businesses.
- 1.5. Improve Peterborough's stormwater management system to accommodate future climate change projections.

- 1.6. Encourage low impact development (LID) features and green infrastructure on development areas and redevelopment projects, updating planning requirements, where feasible, to encourage uptake.
- 1.7. Implement actions identified in Flood Reduction Master Plan and Stormwater Quality Master Plan.
- 1.8. Update and expand flood risk data and management practices to reduce flood risk.

Theme: Infrastructure

Taking into consideration how extreme weather events will impact Peterborough's transportation network and energy grid is essential in developing a robust adaptation strategy. The Actions listed will reduce the damage and disruption to the built environment and lessen the risk to residents and businesses.

Actions:

- 2.1. Consider stronger regulatory measures to accelerate adaptation of roads, culvert, and bridge infrastructure.
- 2.2. Protect power supply, communication infrastructure and electrical equipment from extreme weather, flooding, and associated disruptions.

Theme: Natural Environment

The natural world will be directly affected by an altered climate. This is especially concerning because of the many co-benefits and services that the environment provides to communities will be impaired. Bolstering management strategies will enable natural infrastructure assets to overcome any disruptions.

Actions:

- 3.1. Work with local partners to encourage property maintenance practices that promote a healthy natural environment while improving community resilience to climatic risks (e.g. flooding, extreme heat).
- 3.2. Continue to identify, monitor, develop, and implement planning and management strategies to protect, enhance, and restore sensitive natural assets and areas.

Theme: Food Production/Urban Agriculture

Global agriculture production is projected to be negatively impacted by climate change. This will lead to increased instability of harvests and the reduction of the amount of food shipped to locales around the world. To counter this, enhanced resiliency designed to lessen food disruptions will require local agriculture to take on a greater share of food consumed in the city.

Actions:

- 4.1. Support local farmers in developing and implementing sustainable and resilient management practices.
- 4.2. Support the generation, enhancement, and distribution of local food.

Theme: People and Health

Climate change will have significant impacts on residents. More frequencies of intense storms, heat waves, and floods are forecasted for Peterborough. It is vital to enact and deploy strategies to lower vulnerabilities from extreme weather.

Actions:

- 5.1. Provide culturally appropriate and accessible (e.g. multiple languages, AODA compliant, etc.) resources to educate the community about the impacts of climate change.
- 5.2. Reduce urban heat island effect and improve access to shade in public spaces.

Theme: Economy

Embedding resiliency into local businesses will allow Peterborough to withstand tremors caused by disruptions in production, supply chains, resources, and customer access caused by extreme weather events. Supporting businesses to reflect upon how climate disruption will impact operations is necessary to establish a robust business community.

Actions:

- 6.1. Encourage community organizations, institutions, and businesses to develop their own adaptation strategies and to include climate risks in emergency operations protocols.

Theme: Enabling Activities

Planning, integrating, and monitoring adaptation actions is an integral endeavor to ensure that resiliency is achieved. Incorporating resiliency strategies into existing plans, policies, and by-laws will promote the advancement of the CCCRS.

Actions:

- 7.1. Integrate climate change priorities into existing plans and policies (e.g. Official Plan, Transportation Master Plan, Asset Management Plan, Stormwater Quality Master Plan, Housing and Homelessness Plan, Emergency Management Plan, Parks and Open Space Plan, etc.).
- 7.2. Embed climate change into financial planning processes where feasible.
- 7.3. Monitor and track implementation of this climate adaptation plan and report on progress annually.

Implementation

Governance

The CCCRS is intended to guide the City of Peterborough and community stakeholders to prepare for and respond to the impacts of climate change. Changes to federal and provincial legislation and regulations, as well as technological advances, and new climate hazard data are anticipated over the plan horizon, which will impact long-range strategies, underscoring the importance of periodic review and adjustments to the CCCRS. Clear governance and oversight of this strategy is essential for effective implementation and regular updates.

The CCCRS will be **municipally led and community supported**. This model enables the City to take a leadership role, while also sharing the responsibility and costs of implementation with its partners. A community-wide approach also allows for the leveraging of additional capital for those actions that are beyond municipal responsibility.

The Infrastructure Management Division will be responsible for coordinating the implementation of this strategy. This will include working with action “leads” and their staff to refine the actions and implementation tables, encouraging them to integrate the actions into workplans and timelines in a productive way. Having one team lead the Strategy oversight helps centralize data and keep track of planning processes across departments, existing and future city projects, and community opportunities where actions in the strategy can be leveraged.

The oversight role also includes monitoring climate change projections for the City and identifying when additional corporate and community vulnerability and risks assessments are required to ensure that the City of Peterborough is aware of possible impacts from a changing climate.

The Stakeholder Working Group will be provided with an opportunity to reconvene to get updates on the progress of this plan. This will be scheduled to accommodate existing reporting schedules for providing updates on climate change initiatives to Council, typically annually. Any external partners that undertake actions will be required to provide updates to the City as part of this reporting cycle. This process will be standardized and refined through the development of implementation plans.

Communication and Outreach

Establishing a shared understanding of the scientific basis of climate change, how it will affect Peterborough, and what the City, the community, and residents can do to prepare, will be vital to the success of the CCCRS. It is recommended that the City of Peterborough, working with community partners, develop a Communications Strategy that keeps City staff, the Stakeholder Working Group, and the broader community well-informed about the progress of the CCCRS.

Funding

The City should take advantage of the multiple streams of funding that have emerged for municipal climate change adaptation. There is currently funding available for projects that resemble many of actions identified in the CCCRS. For example:

- Federation of Canadian Municipalities (e.g. Municipalities for Climate Innovation Fund, Green Municipal Fund)
- Infrastructure Canada (e.g. Investing in Canada Infrastructure Program, Disaster Mitigation and Adaptation Fund, Climate Lens);
- Natural Resources Canada (e.g. Building Regional Adaptation Capacity and Expertise Program);
- TD Canada (e.g. Friends of the Environment Foundation Grant)
- Trees Canada (e.g. Community Tree Grants).
- Forest Ontario grants

As funding opportunities are constantly changing, it will be important for City staff and community partners to continually research and monitor available opportunities to leverage for implementation.

Monitoring and Review

Tracking progress is an important part of the BARC Framework as it enables the community to assess whether the actions in the Resiliency Strategy are producing the desired results. It sets the stage for longevity, as it allows the City and the community to build upon the networks created and lessons learned throughout development. Since adaptation is a moving target, a monitoring framework also ensures that the community can assess whether local risks and vulnerabilities are changing and make required adjustments to the adaptation actions.

Indicators can be categorized by two types – process-based indicators and outcome-based indicators. Process-based indicators measure activities and outputs, while outcome-based indicators measure whether expected effects/changes are being achieved. In many cases, process-based indicators are easier to identify, and easier to measure. As such, many indicators identified are process-based. Where feasible outcome-based indicators have been identified, especially for indicators that the City or community are already tracking.

For each action, one or more monitoring metric has been proposed. These indicators will be measured and tracked by lead and supporting organizations as identified in the action. Indicators can be found in the implementation tables in Appendix 4.

As implementation progresses, it will be important for the City and its community stakeholders to develop indicators that measure if actions are succeeding in reducing vulnerability to climate change.

Strategy Review

Check-ins with lead and supporting organizations/divisions will occur on a regular basis (e.g. annual) to measure progress. Lead and supporting organizations will be responsible for providing updates to the Strategy coordinator on the status of action implementation, timelines, costs, indicators, and other additional reporting details as needed. The Strategy coordinator may prepare an annual progress summary for distribution to community organizations, City of Peterborough Senior Administration and Council.

A formal review of the Community Climate Change Resiliency Strategy is planned to occur every five years, with an implementation update occurring on an annual basis once implementation begins. This schedule is intended to be flexible and may change according to perceived need and resources. The Stakeholder Working Group will be reconvened to support the five-year refresh of the strategy to reconsider potential actions in light of emerging trends and progress.

Next Steps

The City of Peterborough will begin to work with partners to refine actions of the CCCRS according to the proposed implementation schedule. Priority will be given to actions that can be mainstreamed into current planning schedules and existing operations. For example, Business Continuity Planning can be adapted to incorporate the considerations identified in this strategy. Priority will also be given to actions that have long-term consequences which could “lock in” maladaptive conditions (e.g. large-scale infrastructure design).

Identifying resource needs to mobilize these actions will be a critical step. Resource planning will be completed by engaging with the community partners and internal municipal stakeholders to first leverage existing resources and identify critical gaps that would require additional investments. Planning from a budgeting and work plan perspective for the mid-to-longer term actions will also begin.

Once the Strategy is finalized it will be the starting point for developing detailed implementation plans with specific City departments and divisions who will be leading appropriate actions. External partners will be engaged to develop implementation plans for actions that rest outside of municipal jurisdiction.

Endnotes

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- ⁱ IPCC (2018). Summary for Policymakers. In: *Global warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty* [V. Masson-Delmotte, P. Zhai, H. O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J. B. R. Matthews, Y. Chen, X. Zhou, M. I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, T. Waterfield (eds.)]. In Press.
- ⁱⁱ IPCC (2018). Summary for Policymakers. In: *Global warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty* [V. Masson-Delmotte, P. Zhai, H. O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J. B. R. Matthews, Y. Chen, X. Zhou, M. I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, T. Waterfield (eds.)]. In Press.
- ⁱⁱⁱ IPCC (2014). *Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland, 151 pp.
- ^{iv} IPCC (2018). Summary for Policymakers. In: *Global warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty* [V. Masson-Delmotte, P. Zhai, H. O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J. B. R. Matthews, Y. Chen, X. Zhou, M. I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, T. Waterfield (eds.)]. In Press.
- ^v IPCC (2018). Summary for Policymakers. In: *Global warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty* [V. Masson-Delmotte, P. Zhai, H. O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J. B. R. Matthews, Y. Chen, X. Zhou, M. I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, T. Waterfield (eds.)]. In Press.
- ^{vi} UNEP (2018). The Emissions Gap Report 2018. United Nations Environment Programme, Nairobi
- ^{vii} UNEP (2018). The Emissions Gap Report 2018. United Nations Environment Programme, Nairobi
- ^{viii} IPCC (2014). *Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland, 151 pp
- ^{ix} NASA (2019). 2018 fourth warmest year in continued warming trend, according to NASA, NOAA. Retrieved from <https://climate.nasa.gov/news/2841/2018-fourth-warmest-year-in-continued-warming-trend-according-to-nasa-noaa/>
- ^x NASA (2019). 2018 fourth warmest year in continued warming trend, according to NASA, NOAA. Retrieved from <https://climate.nasa.gov/news/2841/2018-fourth-warmest-year-in-continued-warming-trend-according-to-nasa-noaa/>
- ^{xi} IPCC (2018). Summary for Policymakers. In: *Global warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty* [V. Masson-Delmotte, P. Zhai, H. O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J. B. R. Matthews, Y. Chen, X. Zhou, M. I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, T. Waterfield (eds.)]. In Press.
- ^{xii} Bush, E.J., Loder, J.W., James, T.S., Mortsch, L.D. and Cohen, S.J. (2014). An Overview of Canada's Changing Climate; in *Canada in a Changing Climate: Sector Perspectives on Impacts and Adaptation*, (ed.) F.J. Warren and D.S. Lemmen; Government of Canada, Ottawa, ON, p. 23-64
- ^{xiii} Bush, E. and Lemmen, D.S., editors (2019): *Canada's Changing Climate Report*; Government of Canada, Ottawa, ON. 444 p.

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- ^{xiv} McBean, G. and Henstra, D. (2009): Background Report: Climate Change and Extreme Weather: *Designing Adaptation Policy*.
- ^{xv} United Way (2013): From Crisis to Resiliency: A guide for partners in flood recovery. Accessed from <http://www.calgaryunitedway.org/images/uwca/our-work/communities/public-policy-research/flood-report/from-crisis-to-resiliency-flood-report-full-report.pdf>
- ^{xvi} Health Canada (2018): Climate Change and Health: Populations at Risk. <https://www.canada.ca/en/health-canada/services/climate-change-health/populations-risk.html>
- ^{xvii} IPCC (2014). *Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland, 151 pp
- ^{xviii} Warren, F.J., and Egginton, P.A. (2008): Background Information; in *From Impacts to Adaptation: Canada in a Changing Climate* 2007, edited by D.S. Lemmen, F.J. Warren, J. Lacroix and E. Bush; Government of Canada, Ottawa, ON, p. 27-56
- ^{xix} National Round Table on the Environment and the Economy (2012): Facing the Elements: Building Business Resilience in a Changing Climate (Advisory Report).
- ^{xx} Nantel, P., Pellatt, M.G., Keenleyside, K. and Gray, P.A. (2014): Biodiversity and Protected Areas; in *Canada in a Changing Climate: Sector Perspectives on Impacts and Adaptation*, (ed.) F.J. Warren and D.S. Lemmen; Government of Canada, Ottawa, ON, p. 159-190.
- ^{xxi} Chiotti, Q. and Lavender, B. (2008): Ontario; in *From Impacts to Adaptation: Canada in a Changing Climate*, 2007, edited by D.S. Lemmen, F.J. Warren, J. Lacroix and E. Bush; Government of Canada, Ottawa, ON, p. 227-274

References

- Bruce, J.P., Egner, M., and Noble, D. (2006): *Adapting to Climate Change: A Risk Based Guide for Ontario Municipalities*.
- Bush, E. and Lemmen, D.S., editors (2019): *Canada's Changing Climate Report*; Government of Canada, Ottawa, ON. 444 p.
- Bush, E.J., Loder, J.W., James, T.S., Mortsch, L.D. and Cohen, S.J. (2014). An Overview of Canada's Changing Climate; in *Canada in a Changing Climate: Sector Perspectives on Impacts and Adaptation*, (ed.) F.J. Warren and D.S. Lemmen; Government of Canada, Ottawa, ON, p. 23-64
- Chiotti, Q. and Lavender, B. (2008): Ontario; in *From Impacts to Adaptation: Canada in a Changing Climate*, 2007, edited by D.S. Lemmen, F.J. Warren, J. Lacroix and E. Bush; Government of Canada, Ottawa, ON, p. 227-274
- Chu, Cindy (2015): *Climate Change Vulnerability Assessment for Inland Aquatic Ecosystems in the Great Lakes Basin, Ontario*.
- Expert Panel on Climate Change Adaptation (2009): *Adapting to Climate Change in Ontario. Report of the Expert Panel on Climate Change Adaptation*.
- Health Canada (2018): *Climate Change and Health: Populations at Risk*. <https://www.canada.ca/en/health-canada/services/climate-change-health/populations-risk.html>
- IPCC (2014). *Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland, 151 pp.
- IPCC (2018). Summary for Policymakers. In: *Global warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty* [V. Masson-Delmotte, P. Zhai, H. O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J. B. R. Matthews, Y. Chen, X. Zhou, M. I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, T. Waterfield (eds.)]. In Press.
- McBean, G. and Henstra, D. (2009): *Background Report: Climate Change and Extreme Weather: Designing Adaptation Policy*.
- Nantel, P., Pellatt, M.G., Keenleyside, K. and Gray, P.A. (2014): Biodiversity and Protected Areas; in *Canada in a Changing Climate: Sector Perspectives on Impacts and Adaptation*, (ed.) F.J. Warren and D.S. Lemmen; Government of Canada, Ottawa, ON, p. 159-190.
- NASA (2019). 2018 fourth warmest year in continued warming trend, according to NASA, NOAA. Retrieved from <https://climate.nasa.gov/news/2841/2018-fourth-warmest-year-in-continued-warming-trend-according-to-nasa-noaa/>
- National Round Table on the Environment and the Economy (2012): *Facing the Elements: Building Business Resilience in a Changing Climate* (Advisory Report).

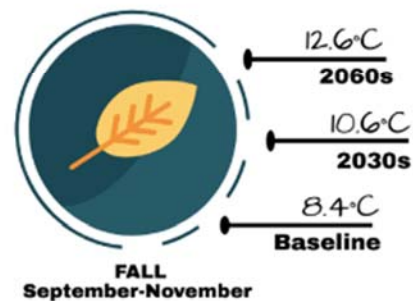
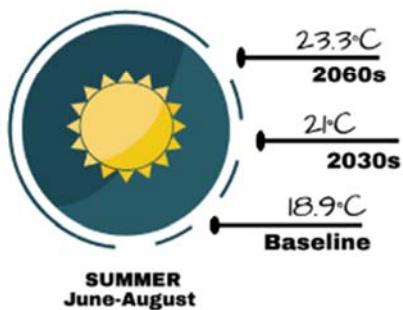
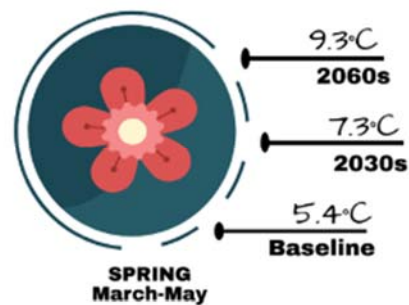
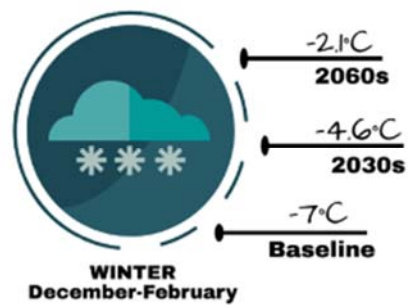
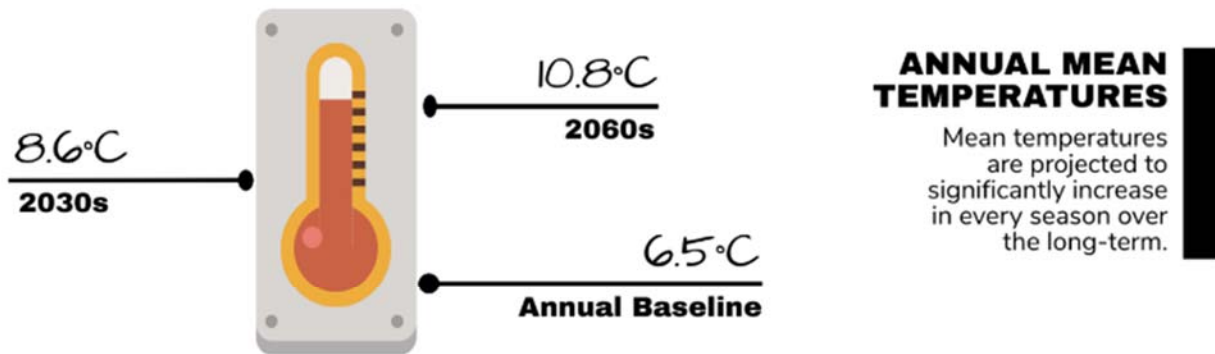
UNEP (2018). The Emissions Gap Report 2018. United Nations Environment Programme, Nairobi

United Way (2013): From Crisis to Resiliency: A guide for partners in flood recovery. Accessed from <http://www.calgaryunitedway.org/images/uwca/our-work/communities/public-policy-research/flood-report/from-crisis-to-resiliency-flood-report-full-report.pdf>

Warren, F.J., and Egginton, P.A. (2008): Background Information; in *From Impacts to Adaptation: Canada in a Changing Climate* 2007, edited by D.S. Lemmen, F.J. Warren, J. Lacroix and E. Bush; Government of Canada, Ottawa, ON, p. 27-56

Appendices

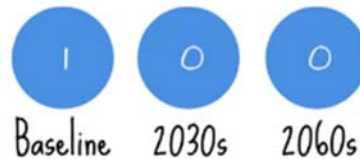
Appendix 1 – City of Peterborough Climate Change Infographic



DAYS ABOVE 30°C



DAYS BELOW -30°C



TEMPERATURE EXTREMES

More extreme hot days, close to no extreme cold days.

ANNUAL MEAN FREEZE-THAW DAYS



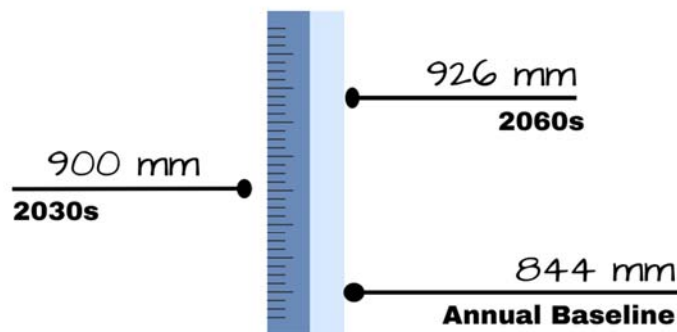
FREEZE-THAW CYCLES

There will be a decrease in freeze-thaw cycles, where the daily max. temperature is higher than 0 °C and the daily min. temperature is less than or equal to -1 °C.



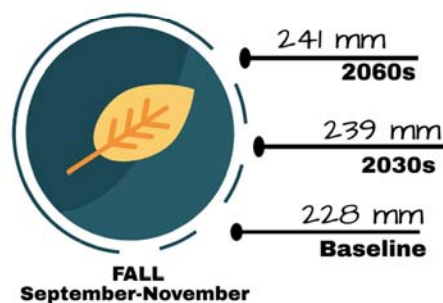
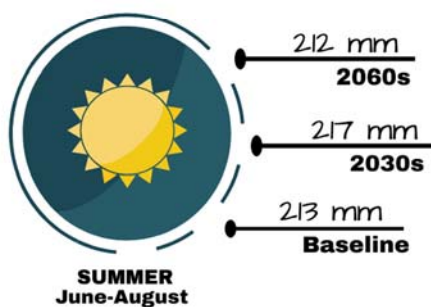
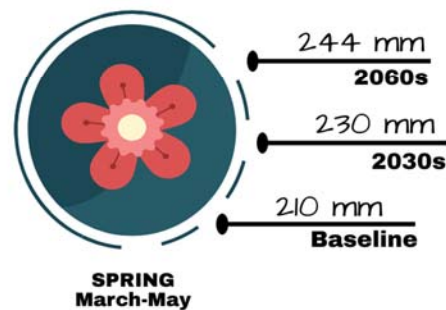
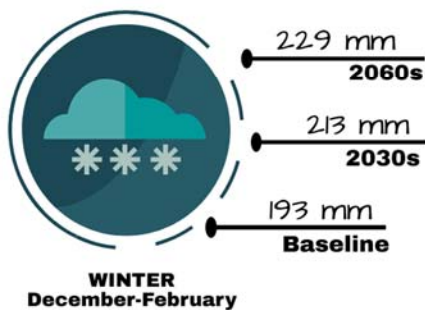
GROWING SEASON

First frost dates will be later, and last frost days will be earlier.



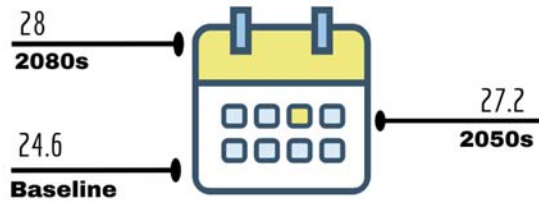
ANNUAL MEAN PRECIPITATION

Annual precipitation is expected to increase. Winter and Spring are projected to get significantly wetter, with a slight decline in the Summer.



SEASONAL MEAN PRECIPITATION

DAYS WITH PRECIPITATION OVER 10 mm



EXTREME WEATHER EVENTS

Days with precipitation over 10mm and 20mm are considered Heavy Rainfall days, and are projected to increase.



Precipitation will fall at a faster rate (mm/h)



Shorter storms will have an increasingly high intensity

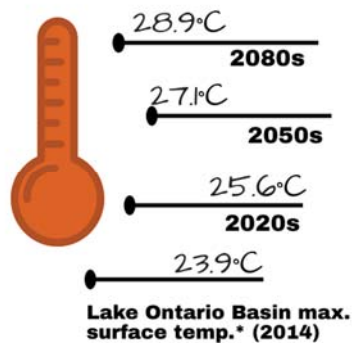


Return periods of heavy storms will shorten, meaning increased frequency

PRECIPITATION EVENTS

Precipitation events in general are projected to become more intense and extreme.

MAXIMUM SURFACE TEMPERATURE



23%

Loss of coldwater (<19°C) stream habitat

WATER TEMPERATURES

Lake Ontario basin temperatures will increase. This can negatively impact wetlands, habitats, and biodiversity.

*This includes all wetlands and tributaries

WATER LEVELS

Lake Ontario water levels are expected to be lower as water shortages and temperatures increase. Ice cover break-up dates are expected to be earlier while freeze-up dates are expected to be later. Projected warming, particularly in winter months, and less ice cover results in greater loss of water through evaporation.



In the long term, projections of warmer temperatures translate into expectations of lower water levels in the Great Lakes system.



Loss of wetland water budget and abundance of wetland vegetation, birds, and fish communities.

Climate infographic references and notes

* Baseline period: 1990s (1976-2005); Projection periods: 2030s (2021-2050), 2060s (2051-2080).

*Water Temperatures section - Baseline period: 1990s (1981-2010); Projection periods: 2020s (2011-2040), 2050s (2041-2070), 2080s (2071-2100).

Sources

Canadian Climate Data and Scenarios Network. Climate Atlas of Canada Tool.

Chu, Cindy. (2015). Climate Change Vulnerability Assessment for Inland Aquatic Ecosystems in the Great Lakes Basin, Ontario. Ontario Ministry of Natural Resources and Forestry, Science and Research Branch, Peterborough, Ontario.

Appendix 2 – Vulnerability Assessment

Vulnerability refers to the susceptibility of a given service area to harm arising from climate change impacts.

Vulnerability is a function of:

1. A service area's **sensitivity** to climate change impacts
2. A service area's capacity to adapt, or cope, with those impacts (also known as **adaptive capacity**)

Vulnerability Matrix

Vulnerability Matrix

	High S3	Medium Vulnerability V3	High Vulnerability V4	Extreme Vulnerability V5
	Medium S2	Low Vulnerability V2	Medium Vulnerability V3	High Vulnerability V4
	Low S1	Insignificant Vulnerability V1	Low Vulnerability V2	Medium Vulnerability V3
		High AC3	Medium AC2	Low AC1

Adaptive Capacity

Vulnerability Assessment Survey Screenshot

1 How vulnerable is the community of Peterborough if the impact below were to happen today?

Climatic threat	Outcome	Consequence
Increase in intensity of precipitation events	Capacity of storm water management network could be exceeded	Overland flooding

- ☐ Low vulnerability
- ☐ Medium vulnerability
- ☐ High vulnerability

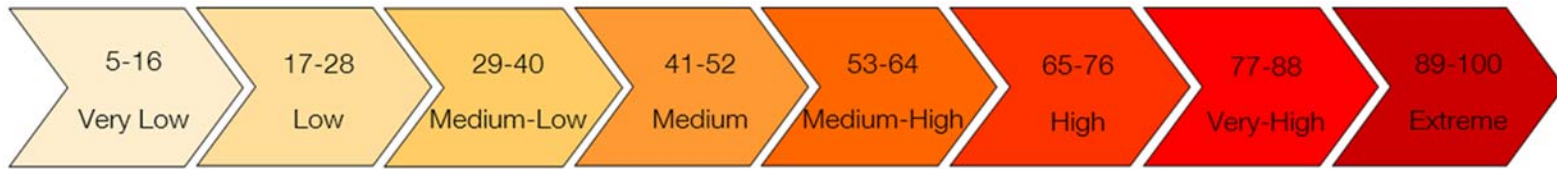
Comments/justification

Appendix 3 – Risk Assessment

Likelihood Guide

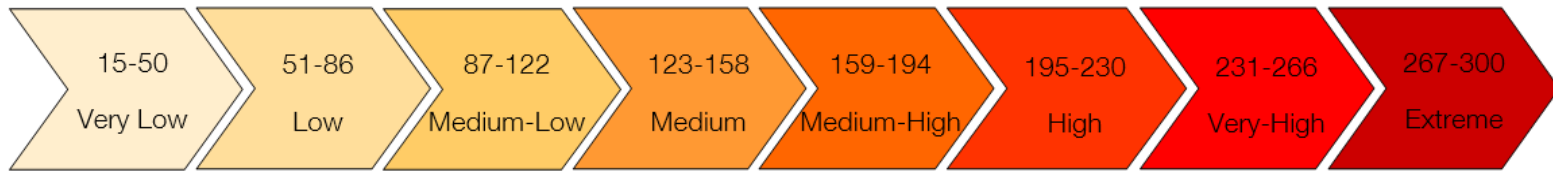
Likelihood Rating	Recurrent Impact	Single Event (definitive-only occurs once)
Almost Certain (5)	Could occur several times per year	More likely than not – probability greater than 50%
Likely (4)	May arise about once per year	50/50 chance
Possible (3)	May arise once in 10 years	Less likely than not but still appreciable – probability less than 50% but still quite high
Unlikely (2)	May arise once in 10 years to 25 years	Unlikely but not negligible – probability low but noticeably greater than zero
Rare (1)	Unlikely during the next 25 years	Negligible – probability very small, closer to zero

Consequence Subcategory Risk Score



Consequence Subcategory Risk Score	Consequence Subcategory Risk Level
5-16	Very low
17-28	Low
29-40	Medium-low
41-52	Medium
53-64	Medium-high
65-78	High
77-88	Very high
89-100	Extreme

Total Risk Score



Consequence Subcategory Risk Score	Consequence Subcategory Risk Level
15-50	Very low
51-86	Low
87-122	Medium-low
123-158	Medium
159-194	Medium-high
195-230	High
231-266	Very high
267-300	Extreme

Risk Assessment Matrices - Consequence Ratings: Social Factors

CONSEQUENCE RATING	SOCIAL FACTORS			
	Public Health & Safety	Displacement	Loss of Livelihood	Cultural Aspects
Catastrophic	Large number of fatalities or serious injuries, or permanent illness	Large number of permanently displaced people	Large disturbances leading to permanent changes in people's normal routines and way of life (> 1 month and causing daily changes)	Unprecedented loss of cultural identity (i.e. traditions and customary practices) across the wider community (i.e. cancellation of flagship annual event)
	5	5	5	5
Major	A fatality, serious injuries, or long-term illness	Isolated instances of permanently displaced people	Large disturbances leading to prolonged changes in people's normal routines and way of life (> 1 month but not necessarily daily)	Significant loss of cultural identity (i.e. traditions and customary practices) for multiple social groups
	4	4	4	4
Moderate	Small number of injuries or cases of illness	Isolated instances of temporary displaced people on a widespread scale	Moderate disturbances leading to short-term changes in people's normal routines and way of life (1 week to 1 month)	Moderate impact on cultural identity (i.e. traditions and customary practices) for multiple social groups
	3	3	3	3
Minor	Near misses or minor injuries	Isolated instances of temporary displaced people in localized areas	Minor and short-term changes to people's normal routines and way of life (<1 week)	Minor impact on cultural identity (i.e. traditions and customary practices) for a small number of social groups
	2	2	2	2
Negligible	Appearance of a threat but no actual harm	Appearance of a threat but no actual displacement	No changes to people's normal routine and way of life	Appearance of a threat but no actual impact on cultural identity (i.e. traditions and customary practices)
	1	1	1	1

Consequence Ratings: Economic Factors

CONSEQUENCE RATING	ECONOMIC FACTORS			
	Property Damage	Local Economy & Growth	Community Livability and Services	Public Administration
Catastrophic	Catastrophic damage and costs incurred by the owner (\$\$\$\$ - >\$50,000)	City-scale decline leading to widespread business failure, loss of employment and hardship (ex. shutdown of large employer for a prolonged period of time).	Permanent decline in services, causing the city to be seen as unattractive, and not providing essential services to the community	Public administration would require assistance from other levels of government
	5	5	5	5
Major	Major damage and costs incurred by the owner (\$\$\$\$ - \$10,000 - \$49,999)	City-scale stagnation such that businesses are unable to thrive (ex. shutdown of moderate employers for a prolonged period of time or temporary (>1 week for a major employer)).	Severe decline in services and quality of life within the community	Public administration would struggle to remain effective with current resources (ex. effects would go to CAO, finance department for assistance)
	4	4	4	4
Moderate	Moderate damage and costs incurred by the owner (\$\$\$ - \$5,000 – \$9,999)	Isolated areas of reduction in economic performance relative to current forecasts (temporary shutdown of moderate employers)	Isolated but noticeable examples of decline in services	Public administration would be under severe pressure on several fronts (ex. effects more than 1 department)
	3	3	3	3
Minor	Minor damage and costs incurred by the owner (\$\$ - <\$5,000)	Inconveniences that cause minor shortfall relative to current forecasts	There would be minor areas in which the community is unable to maintain its current services	There would be minor instances of public administration being under more than usual stress (ex. effects 1 department)
	2	2	2	2
Negligible	No damage and costs incurred by the owner (\$)	No real impact to the local economy and growth	No real pressure on current services	No real stress on public administration
	1	1	1	1

Consequence Ratings: Environmental Factors

CONSEQUENCE RATING	ENVIRONMENTAL FACTORS			
	Air	Water	Soil and Vegetation	Ecosystem Function
Catastrophic	Very frequent periods of reduced air quality.	Irreversible reduction in water quality/quantity	Irreversible, impacts to soil or vegetation	Major loss of ecological functions and irrecoverable damage (ex. loss of natural heritage areas)
	5	5	5	5
Major	Considerable increase in periods of reduced air quality in the medium term	Major, widespread reduction in water quality/quantity in the medium/long-term	Major, widespread impacts on soil or vegetation in the medium/long-term	Severe and widespread loss of ecological functions and damage that could be reversed with intensive efforts (ex. introduction of tree disease – similar to Emerald Ash Borer)
	4	4	4	4
Moderate	Moderate increase in periods of reduced air quality in the short/medium term	Moderate reduction in water quality/quantity in the short/medium-term	Moderate impacts on soil or vegetation in the short/medium-term	Isolated but moderate instances of damage to the ecosystem that could be reversed with intensive efforts
	3	3	3	3
Minor	Minor increase in periods of reduced air quality in the short term	Minor, localized reduction in water quality/quantity in the short-term	Minor, localized impacts on soil or vegetation in the short-term	Isolated but minor instances of damage to the ecosystem that could be reversed
	2	2	2	2
Negligible	Appearance of a threat but no real impact to air quality	Appearance of threat but no real reduction in water quality/quantity	Appearance of threat but no real impacts on soil or vegetation	Appearance of a threat but no real damage to the ecosystem and its functions
	1	1	1	1

Appendix 3 – Climate Change Impacts, Vulnerability and Risk Scores

Climatic Threat (If this happens...)	Outcome (Then... this would happen)	Consequence (So... what does this mean?)	Vulnerability	Likelihood	Risk
Increase in average temperature and hot days over 30 °C	Lower surface water quality	Increase demand within city & fringe on the water supply (potable) and sewage system	Medium	4	Medium-low
Increase in intensity and frequency of precipitation events	Capacity of storm water management network could be exceeded	Overland flooding	High	4	Medium
Increase in intensity and frequency of precipitation events	Flooding and closure of roads and bridges	Disruptions to transportation services and mobility (including access for emergency services)	Medium	4	Medium-low
Increase in intensity and frequency of precipitation events	Wind, rain, ice damage to buildings and power infrastructure	Damage and disruption to transportation network	Medium	5	Medium-low
Increase in temperature and hot days over 30 °C	Increased power consumption for cooling	Increased power grid demand/failure.	Medium	4	Medium-low
Increase in intensity and frequency of precipitation events	Increased instances of flooding	STP Bypasses	Medium	4	Medium-low
Increase in intensity and frequency of precipitation events	Increased instances of flooding	Increased roadside erosion	High	5	Medium
Increase in intensity and frequency of precipitation events	Increased instances of flooding	Increase in basement flooding	High	4	Medium-low
Increase in intensity and frequency of precipitation events	Increased instances of flooding	Increase in sewage backups	High	5	Medium
Temperature variability and	Frozen ground with no/low absorption	Increased overland flow	Medium	4	Medium

extremes (high->low)					
Seasonal variation in climate	Frazil ice, rain or snow, freezing rain	Increased property damage	Medium	4	Medium-low
Increase in intensity and frequency of precipitation events	Wind, rain, ice damage to buildings and power infrastructure	Increased financial burden on community due to losses and insurance claims	High	4	Medium-low
Increase in average summer temperatures and increase in intensity of precipitation events	More frequent power outages	Loss of local business and public services	Medium	4	Medium-low
Increase in average temperatures and changes in precipitation patterns	Lower lake/river levels	Stress on plants & aquatic ecosystems	Medium	4	Medium-low
Longer, dryer periods with increased temperature	Increased spread of invasive species	Damage or stress on trees and natural areas	Medium	5	Medium
Increase in average annual temperatures	Warming temperatures in streams and creeks	Loss of coldwater species	Medium	5	Medium-low
Increase in intensity and frequency of precipitation events	Increased runoff from roads and agricultural land	Contamination of source water	Medium	4	Medium-low
Increase in average temperatures and precipitation	More stagnant water sources	Higher risk of vector-borne diseases (e.g. West Nile)	Medium	4	Medium-low
Increase in frequency and duration of drought events	Low baseflow in creeks and wetlands	Changes to wetland boundaries and species composition	High	5	Medium-low

Increase in frequency and duration of drought events	Low baseflow in creeks and wetlands	Stress on food and crop production	High	5	Medium-low
Increase in frequency and duration of drought events	Low baseflow in creeks and wetlands	Higher tree mortality	High	5	Medium
Increase in frequency and duration of drought events	Low baseflow in creeks and wetlands	Less water available for plants, trees, gardens	Medium	5	Medium
Increase in temperature and increased frequency + duration of drought events	Drier conditions	Increased fire risk and more frequent fire bans	Medium	3	Medium-low
Increase in temperatures and extreme precipitation events	Loss of iconic trees and plant species, local characteristics, landscapes, seasonal traditions (e.g. backyard rinks, decreased intensity of fall colours)	"Marked decline in the quality of our experience of the natural world" (Kawartha Lakes Steward Association, "Climate change in Kawarthas", p.13)	High	5	Medium-high
Increase in high-intensity precipitation events	Rapid changes to stream morphology	Increased risk of flooding, sedimentation, and contamination of streams	High	5	High
Seasonal variation in climate	Rapid freeze and thaw, especially in winter	Stress on tree health of sensitive species	High	5	Low
Increased average annual temperatures	Changes in composition, ecology and structure of Peterborough's natural areas	Opportunities for new (non-invasive) species such as Carolinian species	High	5	Low
Increased average annual temperature and hot days over 30°C	Higher tree mortality	Decreased shade from loss of urban tree canopy	High	5	Medium-high

Seasonal variation in climate and precipitation	Damage to trees	Greater risk of power infrastructure damage and power outages	Medium	5	Medium
Longer, dryer periods with increased temperature	Reduced infiltration for short duration events	increase water demand for trees and turf	High	5	Medium-low
Increase in temperature during winter and increased intensity of precipitation events	Freezing rain events	Salt use causing higher chloride contamination risks to water	Medium	5	Low
Increase in intensity and frequency of precipitation events	Increased instances of flooding	Increased erosion and sedimentation of streams/creeks	Medium	4	Medium-low
Increase in intensity and frequency of precipitation events	Stress on stormwater management facilities	Contaminant loading in water sources	High	5	Medium
Temperature variability and extremes (high->low)	Unpredictable levels of service for maintenance workers	Higher fatigue, loss of productivity, and/or schedule changes for workforce	Medium	5	Medium-low
Increase in average temperature and hot days over 30 °C	Lower surface water quality	Combined with intensification and clustering development, could lead to a loss of single use wells with a need to develop communal water services (plants)	Medium	4	Medium
Increase in high-intensity precipitation events	Damage to built infrastructure (hydro, roads)	More public health and safety risks	Medium	4	Medium-low

Seasonal variation in climate	Increased incidences of temperature and precipitation extremes	Increased hazards with outdoor recreation, particularly for youth and vulnerable populations	Medium	4	Medium
Increase in intensity and frequency of precipitation events	Overland flooding in urban areas	Displacement and /or evacuation of residents from homes	High	4	High
Increase in hot days over 30 °C	Extreme heat and poor air quality	Health risks to vulnerable populations (e.g. elderly, low income residents, those without AC) (such as respiratory diseases, conditions are exacerbated and these individuals will find themselves at the ER)	High	5	Medium-high
Increase in intensity of precipitation events	Flooding of properties	Increase in mold and the various health related issues due to prolonged exposure	Medium	4	Medium
Increase in hot days over 30 °C	Extreme heat and poor air quality	Limited indoor and outdoor cooling areas for the vulnerable and/or an inability to access cooling	High	5	Medium-high
Increase in intensity and frequency of precipitation events	Damage to roofs/exterior structure at the home	Damage to or loss of basement apartments and personal property	Medium	5	Medium
Increase in intensity of precipitation events and/or wind	Damage to roofs/exterior structure at the home	Financial strain caused by inability to afford the costs to upkeep structures, replace infrastructure, etc.	High	5	Medium
Increased average annual temperatures	Increased risk of water and food-borne diseases	Health risks such as salmonella, campylobacter, and E coli	Medium	3	Medium-low

Increased average annual temperatures and hot days over 30 °C	Extreme heat and poor air quality	Children and various groups who cannot spend time outdoors because of increased heat	Medium	5	Medium-low
Increase in intensity of precipitation events, combined with intermittent dry periods	Dry conditions where the ground is less able to absorb the rain (Reduced infiltration)	Increased crop washout risk causing loss of current crop varieties and food supply	Medium	4	Medium
Occurrence of cold days below -10°C	Exposure of vulnerable populations to extreme cold	Hypothermia and various other health and safety concerns, specifically in places of heat/utility poverty in rural areas	Medium	4	Medium-low
Occurrence of cold events and increase in precipitation intensity during cold periods	less ability to travel; mobility issues (especially county/rural residents)	Isolation and stress on rural or vulnerable populations	Medium	4	Medium
Increase in average annual temperature, hot days, and climate variability	Poor growing and harvesting conditions for First Nations traditional crops	Loss of tradition and culture and the sharing of Traditional Ecological Knowledge (TEK)	High	4	Medium
Increased average annual temperatures and hot days over 30 °C	Extreme heat and poor air quality	Limited free outdoor physical activity creating an inequity between those who can afford climate-controlled physical activity (e.g. gym memberships) and those who cannot.	High	4	Low
Increase in average temperature and intensity of precipitation events	Weather damage, flooding, power outage, or snow accumulation on property	Mental/physical stresses for rural or vulnerable populations	Medium	5	Medium-low

Increase in intensity and frequency of precipitation events	Increased instances of flooding	Increase in property damage and relocation of residents for workplaces and/or homes	High	4	Medium
Increased average annual temperatures and hot days over 30 °C	Stress on city infrastructure	Deterioration of critical roads	Low		

Low vulnerability impacts (not carried forward into Risk Assessment)

Climatic Threat (If this happens...)	Outcome (Then... this would happen)	Consequence (So... what does this mean?)	Vulnerability
Increase in average annual temperature and intensity of precipitation events	Increased contamination of lakes and rivers	Closure of beaches and recreational water areas	Low
Increase in hot days over 30 °C and/or increase in intensity of precipitation events	Mobility issues/ transportation disruptions	Loss of access to key services, hubs, and resources (e.g shopping areas, places of worship)	Low
Increase in average temperature and hot days over 30 °C	Increase in summer tourism	Increased demand for parks, campgrounds, and water centric tourism areas	Low - Opportunity
Warmer winter temperatures causing decrease in the number of freeze/thaw cycles	Less salt, sand use	Decreased long-term salt contamination in natural environment	Low - Opportunity
Increase in average temperature and hot days over 30 °C	Longer, warmer growing season	Greater variation of food production and increase in variety /diversity of crops	Low - Opportunity
Increased average annual temperatures	Longer growing season	Ability to grow more food, contributing to local food security	Low - Opportunity

Dry periods followed by high intensity precipitation	Opportunities for new stormwater management technology and low impact development	Increased green infrastructure and new habitat	Low - Opportunity
Increase in average annual temperature	Longer building /construction seasons	Increased productivity of construction, maintenance, and operations	Low - Opportunity
Increase in average temperature and hot days over 30 °C	Lower surface water quality	Increase demand within city & fringe on the water supply (potable) and sewage system	Medium

Appendix 4 – Implementation Tables

Tables begin on the following page. This page has been left intentionally blank.

THEME: WATER			
Objective #1: Reduce flood risk and protect water quality and quantity from changing climate and extreme weather.			
Action 1.1	Encourage responsible salt use for roads, parking lots and walking surfaces across the City to reduce the amount of salt used during freezing rain/snow events.		
Supporting Action(s)	<ul style="list-style-type: none"> Consider a requirement of training/certification for responsible salt use Incorporate site-specific salt management into design standards for site plan approvals Host “Smart About Salt” workshops on responsible salt use and reporting for business owners and/or contractors, and provide certification Engage with Chamber of Commerce and BIA to assess opportunities for workshops or presentations at existing meetings or events regarding winter maintenance best practices. Communicate with residents about the proper use of salt and the consequences of irresponsible salt use Investigate feasibility of and application of salt alternatives 		
Estimated timing of implementation	Short term (<2)	Medium (2-5 years)	Long term (5+ years)
Relevant opportunities (ongoing/upcoming programs, funding opportunities, relevant projects, studies, etc.)	<ul style="list-style-type: none"> GreenUP has a “Safe Salt” educational program Peterborough’s Rethink the Rain program could incorporate salt use information 		
Lead organization and department	City of Peterborough		
Supporting Organization(s)	Downtown Business Improvement Area, Chamber of Commerce, Otonabee Conservation, Ministry of the Environment, Conservation and Parks, GreenUP, Sustainable Peterborough		
Possible indicators or monitoring metrics	<ul style="list-style-type: none"> Number of community outreach and/or training events Number of contractors/drivers with salt management training 		

THEME: WATER			
Objective #1: Reduce flood risk and protect water quality and quantity from changing climate and extreme weather.			
Action 1.2	Improve sediment and erosion control from construction activities through improved inspections, reporting, and operational controls.		
Supporting Action(s)	<ul style="list-style-type: none"> Require all design and construction inspectors, consultants, and/or contractors responsible for site monitoring to have Certified Inspector of Sediment and Erosion Control (CISEC) training. Research and evaluate tools for tracking spills, erosion, and addressing non-compliance issues. Evaluate feasibility of only allowing phased soil stripping during development Evaluate feasibility of increasing erosion and sediment control requirements and compliance for development projects. Evaluate feasibility of implementing a Site Alteration By-law 		
Estimated timing of implementation	Short term (<2)	Medium (2-5 years)	Long term (5+ years)
Relevant opportunities (ongoing/upcoming programs, funding opportunities, relevant projects, studies, etc.)	<ul style="list-style-type: none"> Existing environmental guidelines from TRCA, CVC, and other conservation authorities 		
Lead organization and department	City of Peterborough		
Supporting Organization(s)	City of Peterborough, Ministry of Environment Conservation & Parks, Otonabee Conservation		
Possible indicators or monitoring metrics	<ul style="list-style-type: none"> Number of complaints for infractions or issues Creation of (or update to) erosion and sediment control requirements Creation of Site Alteration By-law Number of CISEC certifications issued 		

THEME: WATER			
Objective #1: Reduce flood risk and protect water quality and quantity from changing climate and extreme weather.			
Action 1.3	Enhance water conservation methods and programming.		
Supporting Action(s)	<ul style="list-style-type: none"> Continue existing water conservation program (Peterborough Utilities Group Water Conservation Program and Otonabee Conservation Low water response) Promote the collection, recycling, and use of greywater and stormwater on private property and City facilities. Encourage water conservation in development processes and enhance water conservation measures in developed areas Continue to support education and outreach related to water conservation tools with links to climate change and water programs on web site Continue data collection and publication of Watershed Report Cards by Otonabee Conservation Investigate water storage and conservation best practices in other communities. 		
Estimated timing of implementation	Short term (<2)	Medium (2-5 years)	Long term (5+ years)
Relevant opportunities (ongoing/upcoming programs, funding opportunities, relevant projects, studies, etc.)	<ul style="list-style-type: none"> GreenUP – WaterWise program Our Watershed, Our Blueprint – Peterborough Watershed Planning Study 		
Lead organization and department	Peterborough Utilities Group		
Supporting Organization(s)	City of Peterborough, GreenUP, Otonabee Conservation, Kawartha Lakes Stewards Organization		
Possible indicators or monitoring metrics	<ul style="list-style-type: none"> Number of outreach campaigns and materials related to water conservation Monitor water meter usage through Peterborough Utilities Group (PUG) Amount of greywater/stormwater collected and/or recycled on City property 		

THEME: WATER			
Objective #1: Reduce flood risk and protect water quality and quantity from changing climate and extreme weather.			
Action 1.4	Increase flood risk awareness and adaptive capacity of residents and small businesses		
Supporting Action(s)	<ul style="list-style-type: none"> • Increase public knowledge about flood risk, helping them understand their risk and how to manage it • Provide resources and training for residents about flood risk reduction actions for their homes • Consider expanding existing incentives for home resilience measures such as rain barrels, backflow valves, sump pump installation • Investigate the availability of a home audit program such as the Home Adaptation Assessment Program, and identify opportunities to streamline with Home Energy Audits • Improve communications to the public regarding flood risk, road conditions, and municipal operations during extreme weather. 		
Estimated timing of implementation	Short term (<2)	Medium (2-5 years)	Long term (5+ years)
Relevant opportunities (ongoing/upcoming programs, funding opportunities, relevant projects, studies, etc.)	<ul style="list-style-type: none"> • Consider combining with existing energy audit program • Alignment with Flood Risk Reduction Plan • Our Watershed, Our Blueprint – Peterborough Watershed Planning Study 		
Lead organization and department	City of Peterborough		
Supporting Organization(s)	Fleming College, GreenUP, Otonabee Conservation, Green Economy Hub Peterborough,		
Possible indicators or monitoring metrics	<ul style="list-style-type: none"> • Percentage of all Peterborough “homes” audited (many include small businesses) • Number of incentive program users • Number of training workshops and materials distributed 		

THEME: WATER			
Objective #1: Reduce flood risk and protect water quality and quantity from changing climate and extreme weather.			
Action 1.5	Improve Peterborough's stormwater management system to accommodate future climate change projections.		
Supporting Action(s)	<ul style="list-style-type: none"> • Include climate change projections in updated regulatory flood mapping, flood risk mapping, and storm sewer modeling to identify at-risk infrastructure • Consider providing training and incentives for developers and contractors for on-site stormwater management • Consider creating a SWM drain adoption program to ensure local clearing of drains for extreme weather • Consider establishing a SWM utility fee and credits for onsite surface water mitigation • Integrate climate change risks and adaptation recommendations in new and updated stormwater management plans, maintenance, and inspections programs. • Inventory and assess storm structures to determine vulnerability to increased intensity of precipitation and flooding. 		
Estimated timing of implementation	Short term (<2)	Medium (2-5 years)	Long term (5+ years)
Relevant opportunities (ongoing/upcoming programs, funding opportunities, relevant projects, studies, etc.)	<ul style="list-style-type: none"> • Alignment with Flood Reduction Master Plan, Stormwater Quality Master Plan, and Watershed Plan 		
Lead organization and department	City of Peterborough		
Supporting Organization(s)	Otonabee Conservation		
Possible indicators or monitoring metrics	<ul style="list-style-type: none"> • Number of on-site stormwater management trainings provided to development community • Creation of SWM drain adoption program • Creation of SWM utility fee • Number of users of SWM incentive programs • Number of developments or redevelopments incorporating green stormwater infrastructure 		

THEME: WATER			
Objective #1: Reduce flood risk and protect water quality and quantity from changing climate and extreme weather.			
Action 1.6	Encourage low impact development (LID) features and green infrastructure on development areas and redevelopment projects, updating planning requirements, where feasible, to encourage uptake.		
Supporting Action(s)	<ul style="list-style-type: none"> Establish a green infrastructure target Investigate existing and develop, where feasible, incentives and rebates for integration of Low Impact Development and green stormwater infrastructure Develop and promote LID and green infrastructure pilot projects in prominent public spaces, employing a coordinated approach that integrates stormwater management with public parks and open spaces Develop targeted trainings/communications materials on LID options for different types of land and properties Develop educational signage to showcase LID/green infrastructure benefits and promote acceptance 		
Estimated timing of implementation	Short term (<2)	Medium (2-5 years)	Long term (5+ years)
Relevant opportunities (ongoing/upcoming programs, funding opportunities, relevant projects, studies, etc.)	<ul style="list-style-type: none"> Low impact development is encouraged in the Official Plan Connection to existing flood mitigation programs such as the downspout disconnect program 		
Lead organization and department	City of Peterborough		
Supporting Organization(s)	Otonabee Conservation, GreenUP, City of Peterborough Planning		
Possible indicators or monitoring metrics	<ul style="list-style-type: none"> Number of LID projects implemented by City of Peterborough Measure change in impermeable surface area on City property Volume of stormwater diverted by LID or GSI Number of developments or redevelopments incorporating LID or green stormwater infrastructure 		

THEME: WATER			
Objective #1: Reduce flood risk and protect water quality and quantity from changing climate and extreme weather.			
Action 1.7	Implement actions identified in Flood Reduction Master Plan and Stormwater Quality Master Plan		
Supporting Action(s)	<ul style="list-style-type: none"> Continue to encourage budgeting and workplanning for the implementation of actions in Flood Reduction and Stormwater Quality Master Plans Monitor and evaluate implementation of both plans to determine successes and actions that may require revision or update Update Flood Reduction and Stormwater Quality Master Plans with new flood risk mapping, climate projections and recommendations from the Watershed Plan as they become available Update vulnerability and risk assessments for critical infrastructure to support flood reduction investment Reassess alternatives for stormwater quality control at untreated outfalls/catchment areas in the City, which may include more innovative approaches than originally proposed in the Stormwater Quality Master Plan 		
Estimated timing of implementation	Short term (<2)	Medium (2-5 years)	Long term (5+ years)
Relevant opportunities (ongoing/upcoming programs, funding opportunities, relevant projects, studies, etc.)	Our Watershed, Our Blueprint – Peterborough Watershed Planning Study FCM Green Municipal Fund – Stormwater Quality		
Lead organization and department	City of Peterborough		
Supporting Organization(s)	City of Peterborough e.g. Engineering, City Buildings, Planning		
Possible indicators or monitoring metrics	Apply recommended indicators based on actions identified in FRMP and SQMP. <ul style="list-style-type: none"> Number of projects completed Number of buildings with reduced flood risk Area or % of land with stormwater quality treatment 		

THEME: WATER			
Objective #1: Reduce flood risk and protect water quality and quantity from changing climate and extreme weather.			
Action 1.8	Update and expand flood risk data and management practices to reduce flood risk.		
Supporting Action(s)	<ul style="list-style-type: none"> Support and share results of Otonabee Conservation regulatory flood plain mapping and consider expanding projects to include flood risk and vulnerability mapping Support updates and enforcement of Otonabee Conservation regulations related to development and flood risk management Explore options to maintain or enhance Otonabee Conservation flood forecasting warning program Ensure updated regulatory flood plain mapping and flood risk products inform City planning and infrastructure decisions 		
Estimated timing of implementation	Short term (<2)	Medium (2-5 years)	Long term (5+ years)
Relevant opportunities (ongoing/upcoming programs, funding opportunities, relevant projects, studies, etc.)	<ul style="list-style-type: none"> Otonabee Conservation's floodplain mapping is currently being funded through Natural Disaster Mitigation Fund, and will be integrated into existing approvals process Our Watershed, Our Blueprint – Peterborough Watershed Planning Study 		
Lead organization and department	Otonabee Conservation		
Supporting Organization(s)	City of Peterborough, Hydro One, Peterborough Utilities Group		
Possible indicators or monitoring metrics	<ul style="list-style-type: none"> % of updated regulatory flood maps % of area with flood risk maps 		

THEME: TRANSPORTATION			
Objective #2: Reduce damage and disruptions to built infrastructure due to extreme weather, and improve safety of travel on roads and sidewalks.			
Action 2.1	Consider stronger regulatory measures to accelerate adaptation of roads, culvert and bridge infrastructure		
Supporting Action(s)	<ul style="list-style-type: none"> • Upgrade road monitoring networks to anticipate future temperatures and precipitation intensities • Develop an inspection policy to identify damage from extreme weather events (event-based monitoring networks). Where available, track climate change costs for infrastructure. • Consider improving planning and engineering requirements for roads requiring embankments or granular shoulders (e.g., consider flatter slopes, vegetated and reinforced slopes, or reinforced shoulders). • Consider materials that could be more resilient to future climatic conditions • Consider establishing one dig policy (if a road needs repair, coordinate so that it only needs one dig) • Coordinate all utility projects with major construction opportunities • Apply for grants and subsidies to improve climate resilience of built infrastructure 		
Estimated timing of implementation	Short term (<2)	Medium (2-5 years)	Long term (5+ years)
Relevant opportunities (ongoing/upcoming programs, funding opportunities, relevant projects, studies, etc.)	<ul style="list-style-type: none"> • Updated storm sewer and pluvial flood modelling • Alignment with future Watershed Plan 		
Lead organization and department	City of Peterborough		
Supporting Organization(s)	Peterborough Utilities Commission		
Possible indicators or monitoring metrics	<ul style="list-style-type: none"> • Number of road, bridge, culvert projects where climate projections are integrated into design/maintenance/assessment • Number of new regulatory measures created or amended to include climate adaptation measures 		

THEME: ENERGY	
Objective #2: Reduce damage and disruptions to built infrastructure due to extreme weather, and improve safety of travel on roads and sidewalks.	
Action 2.2	Protect power supply, communication infrastructure and electrical equipment from extreme weather, flooding, and associated disruptions.
Supporting Action(s)	<ul style="list-style-type: none"> Identify and assess buildings and facilities that are vulnerable to outages and/or serve vulnerable populations (e.g. seniors, hospitals, rural or isolated areas). Explore feasibility of on-site back-up power (clean/renewable where feasible), with priority given to facilities in higher risk areas and those serving vulnerable populations. Establish redundancy in power systems to support vulnerable populations Educate and communicate with residents and business owners about how to build in resiliency and preparedness for outages and disruptions Develop neighborhood/industry/business plans to share generators when required and continue to promote neighbourhood awareness of backup systems (e.g. businesses that have generators, can they help other businesses). Where feasible, consider burying new power infrastructure to protect it from disruptions.
Estimated timing of implementation	<p>Short term (<2) (promote and awareness, already in place now through social media)</p> <p>Medium (2-5 years)</p> <p>Long term (5+ years) (medium and long term should focus on planning and development)</p>
Relevant opportunities (ongoing/upcoming programs, funding opportunities, relevant projects, studies, etc.)	<ul style="list-style-type: none"> Already underway through PDI with lists of all facilities for vulnerable populations; with back up generators, tested annually.
Lead organization and department	Peterborough Utilities Group.
Supporting Organization(s)	City of Peterborough, Hydro One, Enbridge Gas, Peterborough Public Health, Peterborough Emergency Management, LHIN and Community Care, Community Services and Housing
Possible indicators or monitoring metrics	<ul style="list-style-type: none"> Number of incidences where power disruption occurs due to weather (complaint calls or logs) Number of back up power generators available to support City infrastructure

THEME: NATURAL ENVIRONMENT			
Objective #3: Protect and enhance natural heritage, tree canopy, natural vegetation, and wildlife from extreme weather and climate related risks			
Action 3.1	Work with local partners to encourage property maintenance practices that promote a healthy natural environment while improving community resilience to climatic risks (e.g. flooding, extreme heat).		
Supporting Action(s)	<ul style="list-style-type: none"> Educate residents on best practices for property maintenance and land stewardship (e.g. managing stormwater, limiting pesticide use, green infrastructure, stormwater landscaping, etc.). Determine and promote strategic trees for planting (e.g. age diversity, species diversity, locations for shade, etc.). Provide guidance materials on species selection, root growth, soil requirements, etc. Encourage increased tree maintenance to prevent damage. Provide community gardening tools, design, and maintenance workshops for residents in collaboration with community partners. Adapt property maintenance bylaws and clarify regulations for front yard and boulevard naturalization, in order to promote property management practices that build a healthy and resilient environment (e.g. moving away from turf, grass, and lawn management toward native, biodiverse plantings; stormwater landscaping; limiting pesticide use, etc.). Continue to support and communicate opportunities to visit naturalized yards and other LID demonstration sites on public and private property Support landowners to access subsidies for native tree planting, and undertake stewardship projects on public and private land. 		
Estimated timing of implementation	Short term (<2)	Medium (2-5 years)	Long term (5+ years)
Relevant opportunities (ongoing/upcoming programs, funding opportunities, relevant projects, studies, etc.)	<ul style="list-style-type: none"> Forest Gene Conservation Association (FGCA) seed banking and assisted migration pilot GreenUP Sustainable Urban Neighborhood program, rain gardens, and de-pave programs Our Watershed, Our Blueprint – Peterborough Watershed Planning Study Parks and Open Space Master Plan City of Peterborough Corporate Policy on Community Gardens 		
Lead organization and department	City of Peterborough		
Supporting Organization(s)	Otonabee Conservation, GreenUP, Peterborough Pollinators, Nourish, Horticultural societies, Fleming College, Trent University, FGCA, Peterborough Stewardship Council		

Possible indicators or monitoring metrics	<ul style="list-style-type: none">• Number of tree damage complaints• Changes in property maintenance and boulevard design criteria that promote healthy and resilient natural environment• Percent of canopy cover• Percentage of greenspace area• Uptake of community programs such as workshops or gardening program users
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THEME: NATURAL ENVIRONMENT			
Objective #3: Protect and enhance natural heritage, tree canopy, natural vegetation, and wildlife from extreme weather and climate related risks			
Action 3.2	Continue to identify, monitor, develop, and implement planning and management strategies to protect, enhance, and restore sensitive natural assets and areas.		
Supporting Action(s)	<ul style="list-style-type: none"> • Work with conservation authorities and other partners to identify, inventory, monitor and restore ecologically sensitive areas. • Consider conducting a vulnerability assessment to determine the natural assets, areas, and linkages at risk of climate change impacts. • With guidance from the Watershed Plan develop and implement development-driven monitoring programs in partnership with Otonabee Conservation and local municipalities, to assess the impacts of development on natural heritage features and develop best practice recommendations for development • Foster community-wide partnerships to deliver integrated pest management and invasive species management for public and private land. • Support implementation/utilization of Kawartha's Naturally Connected information to target areas for protection/restoration etc. • Support watershed health monitoring program undertaken by Otonabee Conservation and as recommended through the Watershed Plan to assess ecological integrity of watershed • Explore best practices (such as the Municipal Natural Assets Initiative) for integrating natural assets into Asset Management planning • Apply recommendations from Watershed Planning Study to future Official Plan, Secondary Plans, Master Plans and Asset Management plans 		
Estimated timing of implementation	Short term (<2)	Medium (2-5 years)	Long term (5+ years)
Relevant opportunities (ongoing/upcoming programs, funding opportunities, relevant projects, studies, etc.)	<ul style="list-style-type: none"> • Otonabee Conservation watershed health monitoring program(s) already underway, collaboration required to continue • Kawartha Land Trust hopes to expand youth/student citizen science program; invasive species management is currently volunteer driven. • Our Watershed, Our Blueprint – Peterborough Watershed Planning Study • Municipal Asset Management Program - Federation of Canadian Municipalities 		
Lead organization and department	City of Peterborough		

Supporting Organization(s)	Otonabee Conservation, Pathway to Stewardship, Kawartha Land Trust, Peterborough Pollinators, GreenUP, Otonabee Conservation, Peterborough Field Naturalists, Ministry of Natural Resource and Forestry, Peterborough Public Health, FOCA, Invasive Plant Council
Possible indicators or monitoring metrics	<ul style="list-style-type: none"> • Number/Size of sensitive natural assets/areas • Number of protection/restoration projects • Number of sites monitored • Number of invasive species/pest education campaigns • Ranking of watershed health (through report card or monitoring) • Number of recommendations from Watershed Planning study integrated into plans and policies

THEME: FOOD PRODUCTION/AGRICULTURE		
Objective #4: Support the agricultural community and local food producers in adapting to climate risks and identifying new opportunities.		
Action 4.1	Support local farmers in developing and implementing sustainable and resilient management practices.	
Supporting Action(s)	<ul style="list-style-type: none"> Facilitate collaboration among conservation authorities, local agricultural community, and academic institutions to share resources and best practices for adaptation Support networking amongst producers to share resources, tools, and knowledge about efficient and resilient agricultural practices. 	
Estimated timing of implementation	Short term (<2)	Medium (2-5 years) Long term (5+ years)
Relevant opportunities (ongoing/upcoming programs, funding opportunities, relevant projects, studies, etc.)	<ul style="list-style-type: none"> Environmental Farm Plan has programs that local farmers can access East Central Farm Stewardship Collaborative → Report currently being drafted by farms at work on stewardship and climate change actions Farms at Work website provides resources such as land use study, grocery store study, and recommendations for increased production and consumption of local food 	
Lead (Convener) organization and department	Sustainable Peterborough Future of Food and Farming Working Group	
Supporting Organization(s)	Peterborough Agriculture Roundtable, Otonabee Conservation, Trent University, Fleming College, Farms at Work, Landowners, Nourish, Community Garden Network, OMAFRA	
Possible indicators or monitoring metrics	<ul style="list-style-type: none"> Number of agricultural network events focused on climate adaptation 	

THEME: FOOD PRODUCTION/AGRICULTURE		
Objective #4: Support the agricultural community and local food producers in adapting to climate risks and identifying new opportunities.		
Action 4.2	Support the generation, enhancement, and distribution of local food	
Supporting Action(s)	<ul style="list-style-type: none"> • Support the development of agribusiness opportunities • Support the expansion of farmers' markets, urban agriculture, community gardens in the City • Plant edible tree species to promote local food security • Identify specific risks to city populations access food supply related climate change throughout PTBO foodshed • Educate the public about the risks and the benefits of supporting the local food system and food shed 	
Estimated timing of implementation	Short term (<2)	Medium (2-5 years) Long term (5+ years)
Relevant opportunities (ongoing/upcoming programs, funding opportunities, relevant projects, studies, etc.)	<ul style="list-style-type: none"> • Ongoing initiatives, like the Sustainable Peterborough working group • As outlined in Official Plan, support food and agricultural sustainability by increasing opportunities for residents to produce their own food (e.g. food producing community gardens) 	
Lead organization and department	Sustainable Peterborough Future of Food and Farming Working Group	
Supporting Organization(s)	Peterborough Agriculture Roundtable, City of Peterborough, Nourish, Community Garden Network, Peterborough Public Health, Urban Forestry, Peterborough Food Action Network (PFAN), Chambers of Commerce, Current members of roundtable, Transition Town and Farmers at Work Peterborough & the Kawarthas Economic Development – Rural Economic Development Officer	
Possible indicators or monitoring metrics	<ul style="list-style-type: none"> • Change in food supply risk level • Number of public education events/materials on local food resilience • Number of local food production programs and program uptake among community • Number of community gardens • Number of farmers markets • Number of urban farms 	

THEME: PEOPLE AND HEALTH			
Objective #5: Educate and prepare Peterborough's residents, businesses, and institutions for changing climate conditions and risks (e.g. drought, flood, heat).			
Action 5.1	Provide culturally appropriate and accessible (e.g. multiple languages, AODA compliant, etc.) resources to educate the community about the impacts of climate change.		
Supporting Action(s)	<ul style="list-style-type: none"> Collaborate with Peterborough Public Health, Emergency Management, Otonabee Conservation and other organizations (GreenUP, post-secondary) to deliver information sessions and/or materials about preparing for extreme weather Partner with local businesses, community service providers, and other organizations to provide emergency preparedness kits (or instructions for building emergency preparedness kits) at community-wide events, festivals and at high-traffic community hubs such as churches, businesses, etc. Target areas and/or groups of the community that are most vulnerable to climate impacts Provide resources that help organizations integrate climate change risks into their own operations (e.g. summer camps, neighbourhood associations, faith groups, etc.) Create or link to online resources and/or webpages that serve as a centralized place to access climate change programs, information, and opportunities Enhance and promote vulnerable persons' registries to guide emergency responders and/or other assistance programs to reduce health impacts in extreme weather events. Establish a help-your-neighbour program to implement during extreme weather events. Educate public on using Environment Canada existing extreme weather alert system and weather spotter program. Continue to provide warming and cooling centers, updating shelters and services based on warming and cooling needs. Support Peterborough Public Health's Climate Change Adaptation Assessment, sharing information and recommendations to help community prepare for climate impacts 		
Estimated timing of implementation	Short term (<2)	Medium (2-5 years)	Long term (5+ years)
Relevant opportunities (ongoing/upcoming programs, funding opportunities, relevant projects, studies, etc.)	<ul style="list-style-type: none"> Ongoing Peterborough Public Health Climate Change Adaptation Assessment Existing vulnerable person's registry 		
Lead organization and department	City of Peterborough)		

Supporting Organization(s)	<p>Peterborough Public Health, Green Economy Hub Peterborough, Otonabee Conservation</p> <p>Possible Partners: New Canadian Centre, Green OP, Family Health Teams, Sustainable Peterborough Coordinating Committee, Age-Friendly Peterborough, New Canadians Centre, Peterborough Family Health Team</p>
Possible indicators or monitoring metrics	<ul style="list-style-type: none"> • Webpage traffic if online resources are created • Number of emergency kits distributed • Emergency calls during extreme weather • Number of programs and sessions occurring • Number of warming and cooling centers, as well as the number of people accessing them, and the frequency and rate of access and activation

THEME: PEOPLE AND HEALTH		
Objective #5: Educate and prepare Peterborough's residents, businesses, and institutions for changing climate conditions and risks (e.g. drought, flood, heat)		
Action 5.2	Reduce urban heat island effect and improve access to shade in public spaces.	
Supporting Action(s)	<ul style="list-style-type: none"> • Conduct heat mapping with vulnerable population map overlays to identify high risk areas, and target locations for additional community services, new green spaces, parks, and trees. • Increase shade requirements for parking lots, urban parks, squares • Increase presence of trees and shade structures in parks, bus stops. • Promote passive cooling design features in homes and buildings (can be included with home energy retrofit recommendations). • Continue de-paving and reducing impermeable surface areas • Protect, enhance, and restore tree canopy, natural assets and natural areas (see action 3.1 and 3.2 for further details) • Support Peterborough Public Health's Climate Change Adaptation Assessment, sharing information and recommendations to help community prepare for extreme heat and rising temperatures. • Encourage shading and greenspace requirements in Parks and Open Space Master Plan updates 	
Estimated timing of implementation	Short term (<2) Medium (2-5 years) Long term (5+ years)	
Relevant opportunities (ongoing/upcoming programs, funding opportunities, relevant projects, studies, etc.)	<ul style="list-style-type: none"> • Encourage shade trees in update to Urban Forest strategy (2021 update required) • GreenUP Sustainable Urban Neighbourhoods program • Alignment with Official Plan direction on shading • Fleming and Trent urban heat island mapping projects 	
Lead organization and department	City of Peterborough	
Supporting Organization(s)	Fleming and Trent (for mapping), Shade Working Group, Peterborough Utilities Group Otonabee Conservation, GreenUP, Peterborough Public Health	

Possible indicators or monitoring metrics	<ul style="list-style-type: none">• Creation of Bylaws or shading requirements• Changes to Peterborough based on Official Plan• Percent of area with greenspace/shade• Number of shade trees planted in public spaces• Number of shade structures in public spaces• Number of heat maps produced
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THEME: ECONOMY			
Objective #6: Increase the adaptive capacity of Peterborough's local economy to anticipate changing climate conditions and extreme weather.			
Action 6.1	Encourage community organizations, institutions, and businesses to develop their own Climate Adaptation Strategies and to include climate risks in emergency operations protocols.		
Supporting Action(s)	<ul style="list-style-type: none"> • Host educational events to help organizations identify needs and risks, in partnership with Chamber of Commerce Community Futures Network • Provide a check list for community organizations, institutions and businesses to improve climate resilience • Provide education on business continuity planning that considers cross-training of staff, identifying alternative suppliers, storing records, forms, computer data and other vital information off-site, succession planning, inventories, communication protocols, etc. • Identify and take advantage of new business and service opportunities and co-benefits associated with climate change and adaptation actions • Encourage on-site back-up power (clean/renewable where feasible) • Establish framework for collaboration and sharing knowledge of infrastructure (generators) etc. between businesses • Continue to support community programs that promote social resilience, such as GreenUP's Sustainable Urban Neighbourhood program and TRCA's Sustainable Neighbourhood Action Program 		
Estimated timing of implementation	Short term (<2)	Medium (2-5 years)	Long term (5+ years)
Relevant opportunities (ongoing/upcoming programs, funding opportunities, relevant projects, studies, etc.)	<ul style="list-style-type: none"> • Business continuity workshops are currently offered through Peterborough Emergency Management – ongoing education and presentations to community businesses and organizations • Economic Development Board already working on sustainability 		
Lead (Convener) organization and department	Chamber of Commerce, Peterborough and Kawarthas Economic Development Board		
Supporting Organization(s)	Downtown Business Improvement Area; Green Economy Hub Peterborough; Peterborough & the Kawarthas Economic Development, GreenUP, City of Peterborough, Fleming College (already planning strategies)		
Possible indicators or monitoring metrics	<ul style="list-style-type: none"> • Number of Community Futures events hosted • Number of climate adaptation strategies produced, as well as the number implemented (All businesses could have similar metrics; general assessment tools to follow, as well as common goals) 		

THEME: ENABLING ACTION		
Objective #7: Integrate climate change into municipal decision-making processes that inform the way Peterborough is planned, developed, used, restored and maintained.		
Action 7.1	Integrate climate change priorities into existing plans and policies (e.g. Official Plan, Transportation Master Plan, Asset Management Plan, Stormwater Quality Master Plan, Housing and Homelessness Plan, Emergency Management Plan, Parks and Open Space Plan, etc.).	
Supporting Action(s)	<ul style="list-style-type: none"> • Liaise with all City departments to develop inventory of all internal plans and policies that may need to have climate change considerations included. • Anticipate plan review schedules to allow for timely integration of new climate change considerations (up-to-date projections, etc.). • Work with responsible departments to analyze and incorporate climate change considerations as appropriate within their respective plans and/or policies during the next update. • Continually engage with community stakeholders (for example, see the list of supporting partners) to leverage relevant existing work and knowledge, and to increase partnerships for implementation. 	
Estimated timing of implementation	Short term (<2) Medium (2-5 years) Long term (5+ years)	
Relevant opportunities (ongoing/upcoming programs, funding opportunities, relevant projects, studies, etc.)	<ul style="list-style-type: none"> • Council and Climate Emergency declaration supports integrating climate lens into City business, policies, and plans • Peterborough Public Health Climate Change Adaptation Assessment • Official Plan has existing direction on climate change 	
Lead organization and department	City of Peterborough	
Supporting Organization(s)	The following partners can be engaged to leverage existing knowledge and work on climate change and to build partnerships for implementation of this action: Otonabee Conservation, Peterborough Public Health, Sustainable Peterborough, Green Economy Hub Peterborough, Future of Food and Farming Working Group, community and climate change organizations (e.g. For our Grandchildren), Trent University and Fleming College, GreenUP, PEAC, area municipalities and First Nations, Board of Governors	
Possible indicators or monitoring metrics	<ul style="list-style-type: none"> • Number of existing plans and policies that incorporate climate change considerations • Number of plans with climate change incorporated • Number of climate change adaptation-focused City projects 	

THEME: ENABLING ACTION			
Objective #7: Integrate climate change into municipal decision-making processes that inform the way Peterborough is planned, developed, used, restored and maintained			
Action 7.2	Embed climate change into financial planning processes where feasible.		
Supporting Action(s)	<ul style="list-style-type: none"> Integrate climate change considerations into procurement (e.g. encourage proposals to identify ways that climate change considerations will be incorporated into deliverables) Identify adaptation actions from this plan for inclusion in the annual budgeting process Implement a scoring system to evaluate how projects and proposals consider adaptation and mitigation, and use scores to inform capital budgeting decisions Ensure that new Asset Management plan and budgeting, accounts for climate risks and the costs/benefits of adaptation and mitigation measures to protect and maintain vulnerable assets Continue to leverage internal sources of financing that incorporate adaptation and in regular infrastructure upgrading cycles, and leverage reserve funds for larger capital investment projects. Investigate innovative financing solutions (e.g. a green bond to increase access to private capital for funding climate change adaptation and resilience projects) 		
Estimated timing of implementation	Short term (<2)	Medium (2-5 years)	Long term (5+ years)
Relevant opportunities (ongoing/upcoming programs, funding opportunities, relevant projects, studies, etc.)	<ul style="list-style-type: none"> Upcoming Asset Management Plan 		
Lead organization and department	City of Peterborough		
Supporting Organization(s)	The following partners may support the implementation of action by adopting it into their respective organization's internal procedures: Sustainable Peterborough, Green Economy Hub Peterborough, GreenUP, community and climate change organizations, Trent University Peterborough and the Kawarthas Economic Development		
Possible indicators or monitoring metrics	<ul style="list-style-type: none"> Inclusion of climate change impacts and/or adaptation requirements in procurement processes Inclusion of adaptation/mitigation scoring system for capital budget planning Number of adaptation-related projects funded per year Dollars allocated to adaptation-related projects 		

THEME: ENABLING ACTION			
Objective #7: Integrate climate change into municipal decision-making processes that inform the way Peterborough is planned, developed, used, restored and maintained.			
Action 7.3	Monitor and track implementation of this climate adaptation plan and report on progress annually.		
Supporting Action(s)	<ul style="list-style-type: none"> • Prepare annual reports to Council and the public to provide an update on the status of implementation. The report should include the status of each action (i.e. initiated, underway, complete) as well as a brief commentary on what was achieved and what is anticipated in the coming year. • Include Climate Change Action Plan strategies in annual work plans • Develop and monitor indicators of climate change adaptation adoption and report on progress. 		
Estimated timing of implementation	Short term (<2)	Medium (2-5 years)	Long term (5+ years)
Relevant opportunities (ongoing/upcoming programs, funding opportunities, relevant projects, studies, etc.)			
Lead organization and department	City of Peterborough		
Supporting Organization(s)	Supporting organizations should include all community stakeholders and organizations that are leading or supporting actions in this strategy. For example, Sustainable Peterborough, Green Economy Hub Peterborough, community organizations, Trent University, Fleming College, ORCA, PPH, Chamber of Commerce		
Possible indicators or monitoring metrics	<ul style="list-style-type: none"> • Number of actions implemented 		

Appendix 5 - Image Sources

Flood – City of Peterborough. (2004). Staff image.

Drought - Otonabee Region Conservation Authority. (2016). *Low Water Conditions and Drought*. Retrieved from <https://www.otonabeeconservation.com/programs/water-programs/low-water-conditions-and-drought/>

Wind Storm – The Peterborough Examiner. (May 5th, 2018). *Cleanup, power restoration continues in Peterborough after winds hit 101.9 km/h during storm*. Retrieved from <https://www.thepeterboroughexaminer.com/news-story/8589239-cleanup-power-restoration-continues-in-peterborough-after-winds-hit-101-9-km-h-during-storm/>

Ice Storm – MyKawartha.com. (April 12, 2013). *Power outages 'a little bit crazy' | UPDATE*. Retrieved from <https://www.mykawartha.com/community-story/3716249-power-outages-a-little-bit-crazy-update/>

Heat Wave – The Peterborough Examiner. (July 15, 2018). *Heat alert for Peterborough and area*. Retrieved from <https://www.thepeterboroughexaminer.com/news-story/8742626-heat-alert-for-peterborough-and-area/>

Lyme Disease – Public Health Ontario. (2019). *Ontario Lyme Disease Map 2019 Estimated Risk Areas*. Retrieved from <https://www.publichealthontario.ca/-/media/documents/lyme-disease-risk-area-map-2019.pdf?la=en>



City of
Peterborough

To: **Members of the Peterborough Environmental Advisory Committee**

From: **Michael Papadacos, Manager of Infrastructure Management Division**

Meeting Date: **November 19, 2020**

Subject: **Report PEAC20-011
Public Engagement Platform Update**

Purpose

A report to inform the PEAC that Infrastructure Management staff will present a preliminary draft of a Climate Change Action Plan page on the City of Peterborough's public engagement platform (connectptbo.ca).

Recommendation

That the PEAC approve the recommendation outlined in Report PEAC20-011 dated November 19, 2020 of the Manager of Infrastructure Management Division, as follows:

That the presentation from Infrastructure Management staff be received for information and discussion.

Budget and Financial Implications

There are no budgetary or financial implications associated with the recommendation.

Background

At the October 21, 2020 meeting of PEAC, Communication Services staff provided an overview of the City of Peterborough's public engagement platform (connectptbo.ca) that can be used to engage with the public. The Committee provided preliminary input

that Infrastructure Management staff have incorporated into a draft for review and discussion.

Submitted by,

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Manager, Infrastructure Management Division

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