

Community Climate Adaptation Plan

for Waterloo Region

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Community Climate Adaptation Plan please contact:



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The preparation of this plan was carried out with assistance from the Government of Canada and the Federation of Canadian Municipalities. Notwithstanding this support, the views expressed are the personal views of the authors, and the Federation of Canadian Municipalities and the Government of Canada accept no responsibility for them.



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Photo contributions: thanks to Avril Tanner, Kate Hagerman, Nicholas Cloet, Perry Weber, and Reep Green Solutions for providing a number of local photos included in this Plan

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1 How to read this document

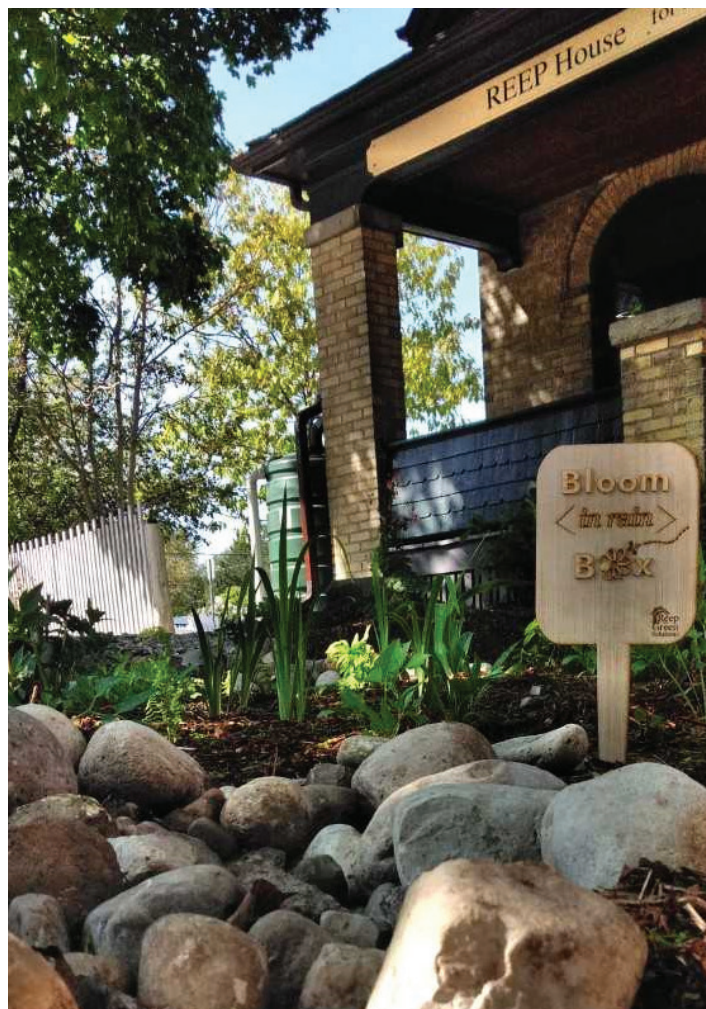
This document begins with the Plan Overview, which provides a summary of the key features and Actions of the Community Climate Adaptation Plan (CCA Plan). The Plan Overview can be read as a stand-alone description of the Plan.

The Plan Overview is followed by an acknowledgement of the community stakeholders that participated in the development of the Plan, listed as Project Team, Community Partners and Key Contributors, and an Introduction to the Plan, which provides the basic context in which the Plan was developed.

Following the Plan's Introduction, the main content of the Plan is written in two parts.

Part I focuses on the development of the Plan, including identifying the problems of climate change for our community, selecting the priorities and scope of the Plan, and developing the step-by-step components of the plan development process.

Part II outlines the substance of the CCA Plan: the Objectives that identify the general ways in which our community intends to overcome the priority impacts of climate change, and the Actions that identify specific steps to take.



2 Message from the Regional Chair



"Climate change adaptation
requires a community-wide effort."

- *Regional Chair Karen Redman*

Our climate is changing. More than a century of increasing greenhouse gas (GHG) emissions has created a world where climate change is already affecting us. While our community is working to reduce local emissions that contribute to climate change, we must also adapt to changing local conditions – which will include more extreme heat events, more intense rain storms, and more freezing rain.

Climate change adaptation requires a community-wide effort. We are fortunate in Waterloo Region to have the building blocks for a resilient community, including a diverse and innovative economy, strong public institutions, and vibrant community organizations. We have an opportunity to work together to create a sustainable and resilient future.

The Community Climate Adaptation Plan for Waterloo Region identifies how we expect climate change to affect our community, and includes 36 actions to inspire and involve community members in preparing for the local impacts of climate change.

The development of this Plan was a community effort facilitated by the Region of Waterloo and supported by municipalities, organizations, and community members from across Waterloo Region. We all have an important role to play in preparing for climate change, and this Community Climate Adaptation Plan will support these efforts as we take the crucial next steps together.

Sincerely,

A handwritten signature in black ink, reading "Karen Redman". The signature is fluid and cursive, with the first letters of the first and last names being capitalized and prominent.

Karen Redman, *Regional Chair*

3 Community Climate Adaptation Plan Overview

3.1 Plan Overview introduction

The purpose of the Community Climate Adaptation Plan (CCA Plan) is to continually improve Waterloo Region's resilience to extreme weather and climate change impacts through increased local adaptive capacity and collaboration among community stakeholders.

This document provides a high-level overview of the draft Plan including the following:

- ◆ the draft Plan's Objectives and Actions;
- ◆ the key features of the Plan development process;
- ◆ an explanation of the way in which climate change impacts were assessed and prioritized, and the way in which solutions were identified; and
- ◆ highlights of next steps and implementation considerations.

Where the CCA Plan fits in local climate change efforts

The CCA Plan will play a crucial role in the diverse climate change planning happening across Waterloo Region. The CCA Plan focuses on what the community as a whole needs to do to adapt to a changing climate here in Waterloo Region. Many stakeholders are completing corporate and organizational climate adaptation planning

work to prepare their organizations for climate change, including municipalities' corporate climate adaptation plans. The CCA Plan recognizes and connects these current practices, and demonstrates the collective efforts being made.

While this crucial work must be done to adapt to climate change, our community must also continue to work to mitigate climate change by reducing local greenhouse gas (GHG) emissions and removing carbon from the atmosphere. Community-level work to mitigate climate change is led by Climate Action Waterloo Region through the Climate Action Plan. Municipalities, businesses and other organizations continue to address their GHG emissions through corporate-scope plans and targets.

In addition to these organization-level efforts, individual community members are working hard to prepare for climate change, reduce their emissions and contribute to further action across Waterloo Region.

3.2 Summary of objectives and actions

The following list of Objectives and Actions outlines an action plan for the community as a whole to adapt to a changing climate here in Waterloo Region. The list is arranged into the following four impact areas: Health and Community, Built Environment, Natural Environment and Water, and Energy and Economy.



Health and community

Objective 1:

Help vulnerable populations avoid or reduce the health-related risks of extreme weather and temperatures.

Action 1.1: Raise awareness of policies and practices to protect workers from extreme temperatures and weather conditions



Health and community

- Action 1.2: Explore opportunities to expand current Cooling and Warming Centre programming
- Action 1.3: Explore opportunities to offer improved access to cooling and hydration in public spaces and at public events during hot summer months
- Action 1.4: Continue ongoing work to provide supportive and affordable housing as a means of reducing climate related impacts
- Action 1.5: Coordinate local efforts to address excessive indoor temperatures in rental housing
- Action 1.6: Include mental health considerations as part of emergency preparation and recovery-related information, and in overall climate adaptation messaging
- Action 1.7: Explore options to establish one or more vulnerable persons' registries to guide emergency responders and/or other assistance programs to reduce health impacts in extreme weather events

Objective 2:

Improve the personal preparedness of community members to respond to emergencies

- Action 2.1: Coordinate public outreach and education on the personal risks and best practices for responding to climate change and extreme weather impacts
- Action 2.2: Increase the uptake of household emergency kits

Objective 3:

Encourage community-based initiatives to improve community members' resilience to extreme weather events

- Action 3.1: Continue to update existing municipal and regional emergency preparedness and response plans with increased emphasis on protecting, communicating with and helping vulnerable populations during weather-related emergencies
- Action 3.2: Establish buddy systems/help-your-neighbour programs to implement during extreme weather events

Objective 4:

Monitor and plan for the potential introduction of new vectors and vector-borne illnesses to the community

- Action 4.1: Develop and promote educational tools and resources concerning disease vector recognition and prevention



Built environment

Objective 5:

Incorporate climate change into future land use, development and construction, and improve the resilience of existing buildings to climate-related risks

- Action 5.1: Collaborate with local partners on available mapping tools, and share best practices for creating, interpreting and utilizing localized heat- and flood-risk maps to guide adaptation policies and programs
- Action 5.2: Explore opportunities for increased climate resiliency of new buildings through local adoption of upcoming national or provincial building standards
- Action 5.3: Seek opportunities to incorporate shade features in new development and on existing properties to reduce the urban heat island (UHI) effect
- Action 5.4: Seek opportunities to reduce flood risks by considering Low Impact Development (LID) features, green infrastructure, and building upgrades
- Action 5.5: Encourage homeowners and landlords to improve the climate resilience of residential buildings through upgrades and/or retrofits
- Action 5.6: Encourage local businesses and managers of commercial properties to proactively improve the climate resilience of their buildings

Objective 6:

Improve the longevity and resilience of infrastructure to extreme weather and temperatures

- Action 6.1: Periodically review materials, design options, and best practices for new climate-resilient infrastructure, and share best practices between municipalities and other key stakeholders across Waterloo Region
- Action 6.2: Encourage property owners and managers to keep storm drains clear of leaves and other debris to reduce the risk of flooding

Objective 7:

Reduce transportation disruptions due to extreme weather events and improve safety of travel on roads, sidewalks and trails

- Action 7.1: Promote safer travel practices, choices and alternatives throughout the region
- Action 7.2: Explore how traffic flows and communications across municipal boundaries can be enhanced to better facilitate emergency response and business continuity in severe weather events
- Action 7.3: Improve winter travel conditions for pedestrians



Natural environment and water

Objective 8:

Expand the use of natural features and green infrastructure to better manage storm water runoff and decrease flood risk

- Action 8.1: Continue seeking opportunities to protect riparian zones, wetlands and other natural areas to help manage storm water and flood risk
- Action 8.2: Continue seeking opportunities to acquire or dedicate land and natural areas for conservation, and to enhance the management and restoration of existing natural areas

Objective 9:

Conserve and protect surface water and groundwater resources from urban runoff pollution

- Action 9.1: Explore opportunities to improve snow- and ice-clearing response methods to reflect changing weather patterns, and aim to effectively clear roads, parking lots and walking surfaces with less salt
- Action 9.2: Enable residents and landowners to adopt landscaping practices that improve water infiltration or reduce the need for watering

Objective 10:

Monitor, coordinate, plan for and mitigate the spread of invasive species in the natural environment

- Action 10.1: Encourage and support broad community participation in the detection and management of invasive species

Objective 11:

Monitor, maintain and improve the diversity and resiliency of urban trees and forests

- Action 11.1: Work with local partners to explore opportunities for tree planting, tree maintenance, and other strategies to improve tree coverage in urban areas

Objective 12:

Maximize effective nutrient management and retention to reduce runoff from agricultural practices

- Action 12.1: Continue to support and explore opportunities to enhance or improve the Rural Water Quality Program
- Action 12.2: Explore opportunities to better understand and share best practices to address agricultural water quality issues and risks



Energy and economy

Objective 13:

Improve the resilience of energy infrastructure to weather-related disruptions

- Action 13.1: Explore opportunities and feasibility of decentralized energy generation, storage, and distribution in Waterloo Region
- Action 13.2: Increase the resilience of electricity distribution infrastructure to extreme weather events through strategic planning and retrofits

Objective 14:

Enable local organizations, businesses and community members to be more resilient to power interruptions

- Action 14.1: Encourage critical and important services in the community to have adequate, working backup power

Objective 15:

Encourage local businesses and other organizations to identify and plan for climate-related risks and opportunities that may affect their business activities and/or quality of service

- Action 15.1: Encourage community organizations and businesses to develop their own climate adaptation plans and to include climate adaptation in emergency response plans
- Action 15.2: Increase the availability and accessibility of climate-related datasets to assist developers, local businesses and other organizations



3.3 How objectives and actions were identified and prioritized

This section outlines the role the Community Climate Adaptation Plan plays in local climate change efforts, and the details of the plan development process.

Key features of the Plan development process

Three key features are foundational to the development process for this draft Plan: the ICLEI BARC Framework, the community-wide focus, and the Community Partners and community stakeholders.

ICLEI BARC Framework

To complete the climate adaptation planning process, the Region retained ICLEI – Local Governments for Sustainability (ICLEI Canada) in June 2017 for facilitation and technical support under their Building Adaptive and Resilient Communities program or BARC, a framework developed specifically for municipalities to undertake climate adaptation planning.

The Region has completed the first two milestones of the ICLEI BARC framework, and the completion of the Community Climate Adaptation Plan will fulfill Milestone 3.

Table 1: ICLEI BARC adaptation framework milestones

ICLEI BARC milestone	Overview of tasks
1) Initiate	Identify stakeholders, build core team, inventory existing actions, gain initial Council support
2) Research	Prepare climate projections, identify impacts, conduct vulnerability and risk assessments
3) Plan	Identify options and Actions, develop and launch Action Plan
4) Implement	Solidify support from Community Partners and Council, implement Action Plan
5) Monitor and review	Assess new information, review and revise Action Plan

Community-wide focus

Local municipalities, including the Region of Waterloo, are working toward adapting their own operations to address the impacts of climate change. The Community Climate Adaptation Plan aligns with and builds on these efforts, to focus on impacts and risks that affect people and organizations across Waterloo Region and

that must be addressed with participation from across the community. The Region has played a foundational role in facilitating the development of the draft Plan, working to ensure that the perspectives and adaptation Actions contained in it are community-wide in scope. Participation and leadership from diverse actors across the community informed both the process used to develop the Plan and the Actions that it identifies.

Community Partners and community stakeholders

Due to the community-wide scope of the plan, the Community Partners group served as a guiding force through the key steps involved in assessing the potential problems climate change will create for our community and identifying solutions. Their contributions and expertise were central to the inputs and outputs of all stages of the process. The Community Partners group includes individuals from key public sector, academic, and community organizations.

In addition to the focused and continuing work of the formal Community Partners, consultation of and engagement with a broader range of community stakeholders and members of the public has contributed a breadth of perspectives to the process and fostered awareness of diverse priorities.

Assessing the problem – Potential climate impacts

The climate adaptation planning process began with an assessment of the possible impacts of climate change on Waterloo Region, followed by

assessments of how vulnerable we are, how likely it is to happen, and what consequences it could have.

The Community Partners provided their expertise and guidance, and a broader group of community stakeholders and municipal staff were engaged to provide their perspectives, contributing to a multifaceted understanding of vulnerability and risk across Waterloo Region's diverse communities.

Impact statements

A selection of 40 impact statements were identified based on local climate projections developed at the University of Waterloo. These impact statements were identified by the Region and representatives from the GRCA and Cities of Cambridge, Kitchener and Waterloo, with guidance from ICLEI Canada and validation/revisions by the Community Partners in future planning stages. Impact statements describe how the climate projections for Waterloo Region might affect the community; for example, "Increased extreme precipitation events can lead to road washouts, bridge closures, and disruptions to transportation services."

"We have lots of damage to our shelter and housing programs (and to our administration offices, too) caused by water, typically from leaking roofs and windows, and have had to deal with mould on more than a couple of occasions."

- community service provider



Vulnerability assessment

In the vulnerability assessment, each impact statement was assessed to indicate how much the community would be affected by each impact (our “sensitivity”), as well as the ability of the community to address such an impact (our “adaptive capacity”). Taken together, these two factors indicate how vulnerable the community would be to the impact. Each impact was scored on sensitivity and adaptive capacity, producing a vulnerability score ranging from V1 to V5.

Of the 40 impacts, 36 were selected to continue into the risk assessment, based on higher vulnerability scores and the assessment of local experts.

Risk assessment

For the risk assessment, the 36 impact statements were assessed based on the perceived likelihood and consequences of their occurrence. Likelihood was assessed on a scale of 1 (Rare: unlikely in the next 25 years) to 5 (Almost Certain: could occur several times per year). Consequences were assessed across twelve (12) factors, with ratings from 1 (Negligible consequences) to 5 (Catastrophic consequences). These 12 criteria fall under 3 categories as presented in Table 2.

Table 2: Consequence categories

Social factors	Economic factors	Environmental factors
Public health & safety	Property damage	Air
Displacement	Local economy & growth	Soil & vegetation
Loss of livelihood	Community livability	Water
Cultural aspects	Public administration	Ecosystem function

The risk score for each impact was calculated by adding the consequences scores together, and then multiplying by the likelihood score.

Each impact received three risk scores – one for each consequence category – on a scale out of 100,

and a cumulative risk score was assigned for each impact out of 300. The category-specific scores helped to ensure that impacts with high risks in one category but low risks in others would still be captured, even if the overall risk score was lower.



Prioritizing impacts

Impacts were identified as priority impacts if they received an overall risk score of Medium or higher. This identified 14 priority impacts.

Additional impacts were included if they received a single category score of Medium or higher, and if they were also identified by subject-matter experts or community members as being of considerable concern. This process identified six additional impacts for consideration in the action planning stage, and two of these were consolidated into one. As a result, a total of 19 impacts were prioritized for the action planning stage.

Identifying solutions – Adaptation actions

To guide the identification of adaptation Actions that help our community avoid or reduce the 19 priority impacts, the Region and Community Partners group developed Guiding Principles, Goals and Objectives for the Community Climate Adaptation Plan.

Guiding Principles





Four Guiding Principles were identified by the Community Partners and the Region of Waterloo. Guiding Principles are overarching intentions to inform brainstorming, planning and implementing for all of the Actions in the CCA Plan:

1. Identify adaptation Actions that are equitable and responsive to the most vulnerable in our community
2. Maximize long-term sustainability and co-benefits of adaptation Actions for local economic, social and environmental priorities
3. Build awareness, understanding and ownership of adaptation Actions throughout the community
4. Enable a collaborative and innovative environment for the community to learn by doing and adopt a continuous improvement approach

Goals

Based on the identified priority impacts, the Community Partners identified one Goal for each of the four impact areas to serve as a high-level intention for the community to strive for, and to provide a framework for the eventual structure of the Plan:

Table 3: Goals for the CCA Plan

Impact area	Goal
 Health and community	Improve community members' resilience to the risks of extreme weather impacts and changing climate conditions
 Built environment	Improve the climate resiliency of the built environment in terms of its long-term durability and functionality
 Natural environment and water	Preserve, restore and enhance local biodiversity and the resilience of the natural environment and water resources throughout the region
 Energy and economy	Increase the resilience of local energy systems and businesses in a changing climate to enable a thriving regional economy

Identifying and refining objectives and actions

Following the selection of the Goals, the Community Partners identified three to five Objectives per goal. The Objectives identify the general ways in which our community intends to overcome the priority impacts. There were 15 Objectives identified by the Community Partners.

Following the selection of Objectives, several meetings were held with diverse stakeholder groups and community members to brainstorm and refine possible actions. In addition to several workshops with the Community Partners, events included a community forum and a business breakfast. To reach people using other formats, consultations were conducted online using EngageWR, and questions on climate change adaptation were included in a telephone and

online survey of members of the public. Meetings were also conducted with municipal staff at the Region of Waterloo and Area Municipalities whose work is connected to the Objectives and Actions.

To address the first Guiding Principle regarding equity, the Sustainable Societies Consulting Group was retained to explore the needs of marginalized community members with respect to climate change adaptation. They conducted outreach to social service providers, community/neighbourhood groups, people with lived experiences of marginalization, and Indigenous people living in the community.

The collaborative process to refine and target the Objectives and Actions has been ongoing, and has been informed by the desire to ensure that they are locally feasible and effective.

“Long power outages from storms are a concern because it puts vulnerable people (seniors, those in precarious housing/homeless, those with medical and health conditions, etc.) at higher risk. If the power is out, agencies, health care, businesses, etc. are not able to function at the same level (or at all) which means that services to support people in crisis may not be available.”

- community service provider



Next steps and implementation

As outlined in the ICLEI BARC framework, finalization of this plan will be followed by work toward Milestone 4 (Implement) and Milestone 5 (Monitor and Review).

The next steps involved in implementing each Action take one or more of the following four main forms:

1. Researching and collecting data
2. Communicating and educating
3. Collaborating and building partnerships
4. Changing policies and practices

The community has played a central role in the development of this Plan, and will continue to play a central a role in its implementation. This focus on community involvement is due both to the vision of the Plan and to the complex challenges and threats of a changing climate.

As a result, the Community Partners group that provided crucial guidance during plan development will continue to provide guidance through the life of the Plan during ongoing implementation and monitoring cycles.

The Region of Waterloo will also play a central role in these phases, serving as the institutional home for the community-wide Plan. The primary roles filled by the Region will be general staff support, convening the Community Partners, Action monitoring, and mid-term and five-year reporting. The Region will encourage participation and collaboration on the adaptation Actions in this Plan.

Organizations will participate in implementation by taking on specific Actions based on their indications of interest throughout the planning process.

The Region and/or leads for adaptation Actions will seek resources and opportunities to support ongoing work and new projects as identified under the Actions in the CCA Plan. This may include funding/financing, guidance from experts, and new partnerships.

Timelines and schedules

As detailed in the Actions section of the Plan, the ultimate success of the CCA Plan will rely on the continuing work of potential partners identified for each Action. Due to the community focus of this plan and the need for the adaptation Actions to be completed by diverse actors across the region, this plan does not prioritize certain actions over others for order of implementation. Timelines and schedules for implementation will be unique to each individual Action, and will be determined collaboratively with potential partners considering their current and future plans and capacity.

Work to implement the Actions identified in the plan will be assessed on a 5-year monitoring cycle. Every 5 years, the plan will be revised to reflect the work completed to date and the climate change adaptation challenges that remain for our community. Through this ongoing implementation and periodic monitoring, the Plan will fulfill its mandate to continually improve Waterloo Region's resilience to extreme weather and climate change impacts through increased local adaptive capacity and collaboration among community stakeholders.



4 Project team, Community Partners and key contributors

This Plan was developed using a collaborative community-wide approach, facilitated by the Region of Waterloo, and has been made possible through diverse contributions by individual members of the public as well as people from across municipal, community, and expert organizations, namely:

Project team – staff and partners who worked directly on coordinating and managing one or more substantial aspects of Plan development. The Project Team included:

- ◆ Kate Hagerman and Nicholas Cloet, Region of Waterloo
- ◆ Ewa Jackson and Hana Lapp, ICLEI – Local Governments for Sustainability (ICLEI Canada)
- ◆ Sarah Brown and Jackson Smith, Sustainable Societies Consulting Group
- ◆ With assistance from David Roewade and Kate Daley, former and current Environmental Sustainability Specialists at the Region of Waterloo

Community Partners – a group of individuals from key public sector, academic, and community organizations, whose contributions and expertise were central to the inputs and outputs of all stages of the planning process. The Community Partners included:

- ◆ Climate change researchers and organizations based out of the University of Waterloo
- ◆ Community Emergency Management Coordinators and climate change adaptation leads with the Cities of Cambridge, Kitchener, Waterloo, and the Townships of Woolwich, Wellesley, Wilmot and North Dumfries
- ◆ Grand River Conservation Authority (GRCA)
- ◆ Waterloo North Hydro, Kitchener-Wilmot

Hydro, Kitchener Utilities and Enbridge (Union Gas)

- ◆ Sustainability managers from Conestoga College, University of Waterloo and Wilfrid Laurier University
- ◆ Ontario Federation of Agriculture (OFA), Waterloo Federation of Agriculture (WFA)
- ◆ Waterloo Catholic District School Board (WCDSB) and Waterloo Region District School Board (WRDSB)
- ◆ Sustainable Societies Consulting Group
- ◆ Kitchener Waterloo Multicultural Centre
- ◆ Reep Green Solutions
- ◆ Homelessness and Housing Umbrella Group
- ◆ Region of Waterloo staff across several departments, including the Emergency Management Office, Public Health, Water Services and Asset Management
- ◆ Members of the Region of Waterloo's Ecological and Environmental Advisory Committee (EEAC)

Additional stakeholders were important contributors to plan development and/or made various community consultations possible:

- ◆ Corporate Climate Adaptation leads from the Cities of Cambridge, Kitchener and Waterloo
- ◆ Woolwich Community Health Centre
- ◆ Interdisciplinary Centre for Climate Change (IC3), University of Waterloo
- ◆ Intact Centre on Climate Adaptation
- ◆ Partners for Action
- ◆ Transition KW, People's Climate Foundation, Divest Waterloo, Faith and the Common Good
- ◆ Supporting staff from ICLEI Canada

5 Introduction

Despite local and international efforts to reduce greenhouse gas emissions, human activities have already caused roughly 1.0°C of global warming and are likely on track to cause 1.5°C between 2030 and 2052, compared to pre-industrial levels.¹ The Paris Agreement, signed in 2016 as part of the United Nations Framework Convention on Climate Change, established a goal of keeping average global warming between 1.5°C and 2°C. This collective agreement can reduce, but not eliminate, the impacts of climate change.² The inevitable climate change related impacts are not felt evenly around the world. Some regions will experience more warming (such as northern Canada, which is warming at more than double the global average rate).³ Various economic, social and environmental factors will also influence the types and severity of impacts that communities may experience; for example, small and isolated communities may be more impacted by flooded roads and infrastructure damage than larger, well-connected communities.

According to a localized climate change projections study by the University of Waterloo,⁴

Waterloo Region can expect to experience a variety of climate-related impacts, including increased annual average temperatures, changes in precipitation (rain, ice and snow), and more extreme temperature and weather events. In recent history, our community has experienced many of the types of extreme weather events that we expect to become stronger and/or more common over the coming decades, including:

- ◆ In May 2018, wind gusts of up to 122 km/h damaged trees and street lights, and caused thousands of power outages across Waterloo Region
- ◆ In April 2018, heavy ice and winds caused more than \$85 million in insured damages across Ontario and Quebec
- ◆ In February 2018, a combination of unusually warm weather, snowmelt and an extended rain event caused significant local flooding
- ◆ In June 2017, record-breaking rainfall of around 100mm fell in only 2 hours, overwhelming reservoirs and causing significant flooding in areas of Waterloo Region



In the summers of 2016, 2017, and 2018, Waterloo Region experienced several heat waves and humidex values reaching up to the mid-40s. Extreme weather events in other parts of Ontario, neighbouring Quebec and the northeastern United States also highlight how extreme summer heat, spring flooding, ice storms and other impacts could affect our own community in the future. The need for a Community Climate Adaptation Plan is therefore a key priority for the Region of Waterloo.

The Community Climate Adaptation (CCA) Plan aims to support and improve the climate resilience of the broader community of Waterloo Region. The Purpose of the CCA Plan is to continually improve Waterloo Region's resilience to extreme weather and climate change impacts through increased local adaptive capacity and collaboration among community stakeholders.

The CCA Plan is an opportunity for Waterloo Region to proactively manage climate-related risks while continuing to make our community a healthy, sustainable and prosperous place to live and work over the long-term. This Plan is supported by a wide range of community stakeholders, including regional and area municipal partners and regional Councillors, the Grand River Conservation Authority, residents, businesses, not-for-profit organizations and other community-based organizations.

The CCA Plan is written in two parts. [Part I: Plan development](#) focuses on the step-by-step components of the plan development process, such as identifying local problems caused by climate change, and setting the Plan's priorities and scope. [Part II: Objectives and actions](#) outlines the Objectives that identify the general ways in which our community intends to overcome the priority impacts of climate change, and the Actions that identify specific steps to take.

Purpose: to continually improve Waterloo Region's resilience to extreme weather and climate change impacts through increased local adaptive capacity and collaboration among community stakeholders.



5.1 Mitigation and adaptation

Organizations and individuals within Waterloo Region are also taking action to reduce our community's contributions to greenhouse gas (GHG) emissions and global climate change. Actions to reduce GHG emissions – also known as climate change mitigation – can include energy efficiency improvements and renewable energy, tree planting and environmental stewardship, sustainable agricultural practices, and more. GHG mitigation is an important part of reducing future climate-related risks locally and around the globe. Unfortunately, the world is essentially “locked-in” to experience a certain amount of global warming over the course of this century, even if GHG mitigation efforts increase significantly.⁵

Since we are already affected by climate change, and with the expected impacts of climate change projected to worsen, a local dedicated plan to address climate change adaptation is needed. Adaptation involves identifying the risks that climate change may pose to the community, and taking actions to avoid or minimize those risks. The CCA Plan focuses on climate change adaptation for Waterloo Region, while local GHG mitigation is

addressed in several existing policies (described in the next section).

Of course, there can be overlap between mitigation and adaptation actions; for example, planting trees and restoring natural areas can absorb carbon dioxide (one of the most common GHG emissions) while increasing local resilience to the risks of erosion, flooding, and heat-related illnesses. The CCA Plan includes adaptation actions with likely co-benefits for other local priorities, including GHG mitigation, but the Plan focuses primarily on adaptation.

5.2 The Region of Waterloo's climate change commitments

The Region of Waterloo's Strategic Plan for 2015 – 2018 included several strategic objectives and actions that will help to address climate change locally, including investments in public transit and improved traffic management, increasing waste diversion from landfill, and preserving green spaces and agricultural lands. To address climate change mitigation and adaptation directly, the Region of Waterloo committed to the strategic actions outlined in Table 4.

Table 4: Region of Waterloo strategic actions to address climate change, 2015 - 2018

Strategic actions (2015 – 2018)	
3.3.1:	Reduce emissions of greenhouse gases (GHGs) from Regional operations, activities and facilities.
3.3.2:	Work with local stakeholders to continue to reduce emissions of greenhouse gases (GHGs) at a community-scale and consider establishing a long-term GHG reduction target.
3.3.3:	Work with local stakeholders to facilitate the development of a Community Energy Investment Strategy.
3.4.1:	Develop an adaptation strategy to deal with the impact of climate change/severe weather events on the Region's infrastructure, programs and services.
3.4.2:	Collaborate with stakeholders to develop a Community Climate Adaptation Plan.

5.3 Community-wide adaptation

Many municipal climate change adaptation plans focus on improving the resilience of corporate assets (such as roads, buildings, storm water infrastructure, parks, etc.) and municipal services (such as snow clearing, etc.). The Cities of Cambridge, Kitchener and Waterloo have developed climate change adaptation plans for their corporate assets and services, which are important components of community-level resilience. The Region of Waterloo is also beginning to undertake similar corporate-scope adaptation planning.

In contrast to corporate-scope adaptation planning, the community-wide focus of the CCA Plan aims to address impacts and risks affecting people and organizations across Waterloo Region, as mandated by Strategic Action 3.4.2 in the Region of Waterloo's Strategic Plan for 2015-2018. Many climate-related impacts cross municipal borders or have the potential to affect all area municipalities, and many important local services rely on partnerships

and participation across the community to be effective. These types of impacts make it important to collaborate with diverse local stakeholders on adaptation actions that can be taken to improve resilience across Waterloo Region.

A community-wide Community Partners group including individuals from key public sector, academic, and community organizations was organized to support the local climate adaptation planning process. The Community Partners group served as a guiding force through the key steps involved in assessing the problems climate change will create for our community and identifying solutions. Their contributions and expertise were central to the inputs and outputs of all stages of the process. In addition to the focused and continuing work of the formal Community Partners, consultation of and engagement with a broader range of community stakeholders and members of the public has enabled breadth of perspective and responsiveness to diverse priorities.



“My husband is a full time farmer, very weather dependent. Decreased water supply will effect everyone, we need a safe and good supply of water. We have our own well so the runoff effects our water quality.”

- survey respondent

Part I: Plan development

Part I identifies the problems related to climate change for Waterloo Region, outlines the priorities of the CCA Plan, and describes the details of the plan development process.

6 The problem of climate change

6.1 Climate change projections

The Intergovernmental Panel on Climate Change (IPCC) has stated that “warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia. Human influence on the climate system is clear, and recent anthropogenic emissions of greenhouse gases (GHGs) are the highest in history.”⁶ In 2018, the IPCC published a report that stated with high confidence that global warming is likely to reach 1.5°C between 2030 and 2052 if GHG emissions continue to increase at the current rate.⁷ GHGs can include a long list of gasses, including carbon dioxide (the most common), methane, and nitrous oxide.⁸

6.1.1 Climate vs. weather

“Weather” and “climate” are sometimes used interchangeably, but actually have different meanings. Weather describes local conditions in the atmosphere over a short period of time – from minutes to days or weeks, and even seasons. Weather conditions typically include a combination of temperature, precipitation (rain, ice or snowfall), humidity, wind, cloudiness and visibility.

Climate, in contrast, describes the average weather conditions of a place over a period of at least 30 years.⁹ As such, short-term changes in weather – such as an unusually warm summer, an intense rainstorm event, or an extremely cold day – are not proof or disproof of climate change. To understand how the climate is changing, we must compare observations of past climate periods

“warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia.”

- Intergovernmental Panel on Climate Change

and long-term trends with the results of climate modelling for future climate periods.

6.1.2 The climate modelling process

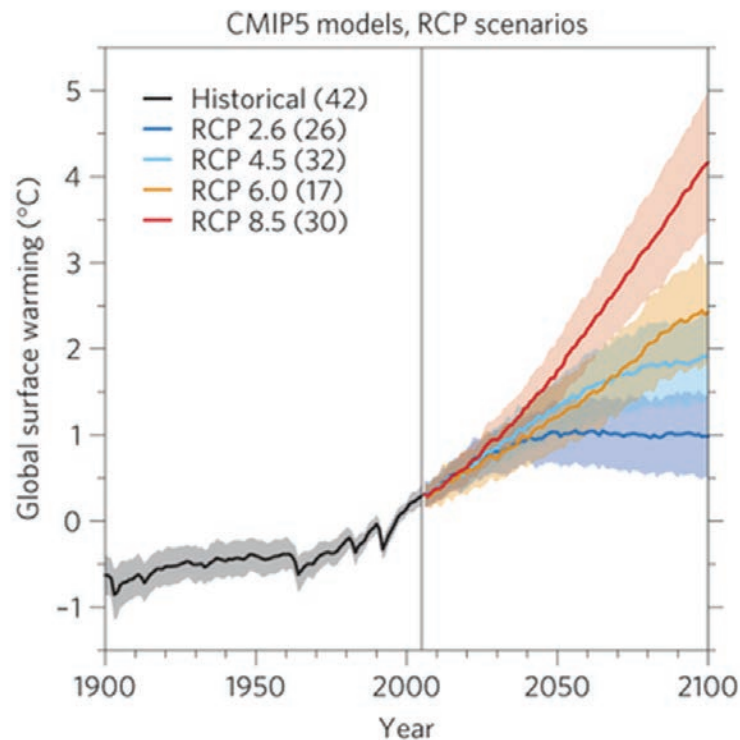
Climate modelling creates a simulation of the components of the world’s climate system, including the atmosphere, oceans and water bodies, ice caps, land surface, and biosphere (trees and ecosystems). Climate models are usually tested by comparing actual historic data to model-generated results about the past,¹⁰ before using them to create climate change projections for the future.

Projections are also informed by the use of GHG emission scenarios – possible versions of the future based on differing human population levels, economic activity and land use, and other social and economic factors – and how changes to these factors may influence GHG emissions and therefore the climate. In order to account for multiple possible future emissions scenarios, the IPCC developed four Representative Concentration Pathways (RCPs). RCP8.5, the highest emissions scenario, represents a future where regular economic growth continues and GHG emissions continue to increase. RCP2.6, the lowest emissions scenario, assumes immediate, rapid reductions in GHG-emitting activities after global emissions peak in 2020.¹¹ Between these extreme scenarios, RCP4.5 and RCP6.0 assume that GHG emissions will increase slowly until roughly 2050 or 2080 (respectively) before declining as a result of GHG emissions reductions.¹² Figure 1 illustrates the projected global warming associated with the four scenarios.

“We need to encourage the city and region to plant more trees and foliage. People might need to go away from green lawns that require a huge amount of water.”

- survey respondent



Figure 1: RCP greenhouse gas emissions scenarios¹³

Uncertainty is an integral component in the study of climate change. Uncertainty is 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. Climate change cannot be predicted with absolute certainty in any given case, and all data must be considered with this in mind; however, climate change scenarios help create plausible representations of future climate conditions which should be considered as part of long-term planning efforts. Even accounting for upper and lower ranges of uncertainty (as visualized in Figure 1), global models predict that temperatures will continue to rise across all emissions scenarios (except RCP2.6), further highlighting the need to address climate change.

"I mostly worry about our capacity as a community to handle these impacts. I can control how ready me and my family are, but if our [r]egion isn't prepared to handle them, then I have less confidence that my family will get the help it needs in times like these."

- survey respondent

6.1.3 Climate change in Canada

The response of the climate system to increasing atmospheric concentrations of GHGs varies from one region to another. As a result, the rates of warming around the world are not the same. Canada's rate of warming is about twice the global rate, meaning a global average temperature increase of 2°C is expected to bring a 3 to 4°C increase for Canada.¹⁴ The effects of this widespread warming are evident in many parts of Canada and are projected to intensify in the future. These effects include more extreme heat events, longer growing seasons, shorter snow and ice cover seasons, fewer extreme cold events, earlier spring peak stream flow, thinning glaciers, thawing permafrost and rising sea levels.¹⁵

6.1.4 Climate change in Waterloo Region

Many of the effects of climate change across Canada are comparable to local climate projections for Waterloo Region. The

Interdisciplinary Centre on Climate Change (IC3) at the University of Waterloo developed a report, entitled Localized Climate Change Projections for Waterloo Region.¹⁶ This report was developed in response to the need expressed by staff at the Region of Waterloo and Cities of Cambridge, Kitchener and Waterloo to gain a greater understanding of climate-related risks that are relevant to the region as a means to inform municipal strategic and collaborative planning.

The report outlines changes to temperature and precipitation patterns, as well as some information on extreme weather, such as freezing rain and wind events. The projections are based on historical weather data from the region, as well as an ensemble of 22 climate models considering three GHG emissions scenarios: RCP2.6, RCP4.5 and RCP8.5. Table 5 summarizes how projected climatic changes for Waterloo Region may be "Warmer, Wetter and Wilder" in the RCP8.5 scenario.

The report includes detailed information on the methodology, limitations and results of this study.



Table 5: Summary of projected climatic changes in Waterloo Region

Temperature “warmer”	<ul style="list-style-type: none"> ◆ Annual mean temperature is projected to increase by about 2-3°C by the 2050s. ◆ Increases in monthly temperatures are projected to be the most marked throughout the winter and into early summer. ◆ Extreme heat days (daily maximum temperature exceeding 30°C) are expected to increase from 10 days per year to 32 days per year by 2050. ◆ Extreme cold days (daily minimum temperature lower than -15°C) are expected to decrease from 22 days per year to 6 days by the 2080s.
Precipitation “wetter”	<ul style="list-style-type: none"> ◆ Total annual precipitation is projected to increase by approximately 8-12% in the 2050s. ◆ Seasonally, the largest precipitation increases are expected in winter, spring, and summer. ◆ Rainfall intensities are projected to increase, with large magnitude rainfall events expected to occur more frequently than in the historical record.
Extreme Weather “wilder”	<ul style="list-style-type: none"> ◆ In Southern Ontario, the months of December, January, and February are expected to experience 40% more freezing rain events by the 2050s, and 45% more freezing rain events by the 2080s. ◆ More wind gust events are expected in Southern Ontario by the end of the century, as both large-scale frontal storms and local convective windstorms are projected to occur more frequently.

6.2 Climate change impacts and issues

In our modern economy, almost every human activity is linked to the use of fossil fuels or other sources of climate-altering GHGs. Every time we turn on a light, cook a meal, or travel to work, we are impacting climate change. Similarly, almost everything that sustains and enriches our lives is affected, either directly or indirectly, by the changing climate. The extent and magnitude of climate change effects will vary over time and with the ability of different societal and environmental systems to mitigate or adapt to change. Even if we were to stop emitting all GHGs tomorrow, temperatures would continue to rise as already-released carbon dioxide will remain in the

atmosphere for thousands of years. That is why adaptation is essential to reduce the damages from climate change that cannot be avoided. The impacts of climate change on Waterloo Region fall into four main categories: impacts to human health and safety; impacts to the built environment; impacts to water and the natural environment; and impacts to the economy.

6.2.1 Impacts to human health and safety

Climate change will impact the health and wellbeing of residents and workers in Waterloo Region. These impacts are both direct and indirect, and are as diverse as the health impacts of extreme heat, long-term mould-related issues from increased flooding, and increased hazardous

walking conditions due to increased freezing rain. People across our community can experience the effects of climate change differently. Some people have characteristics that may make them more vulnerable to health and safety impacts, and changing climate conditions may place a greater burden on social services that are currently in place to help people find shelter or relief from extreme weather and temperatures.

"I've already had to pay thousands due to really extreme wind storms in the past 5 years... People's shingles are also being ripped off the roof, and traffic lights destroyed, by these wind storms even in brand new homes. Building standards for roof materials and other building standards clearly may need to be increased."

- survey respondent



6.2.2 Impacts to the built environment

The impacts of climate change will affect Waterloo Region's built environment, including buildings (e.g. homes, community centres) and infrastructure (e.g. roads, bridges, storm water management). Increased heavy precipitation events can cause increased overland and riverine flooding, resulting in road washouts, flooded basements, and damage to building exteriors and structures. More frequent and extreme weather events will also increase maintenance requirements, replacement costs and asset loss for community organizations and businesses.

6.2.3 Impacts to water and the natural environment

There are many ways climate change can damage water and the natural environment. Some of the most visible examples already being observed across Canada include severe disturbances to trees and natural areas, such as fires, pest outbreaks, drought, windstorms and ice storms.¹⁷ These risks may affect Waterloo Region, along with more subtle changes, such as changes in the diversity of trees and other native species as average temperatures rise over time. Increased rain and snowmelt can also threaten water quality through increased runoff of salt, agricultural nutrients, and other pollution, and increased risk of stream bank erosion.

6.2.4 Impacts to the economy

In Waterloo Region, threats to the local economy from climate change could occur in the form of structural damage to local businesses, such as storefronts, mechanical equipment, or inventory. Climate change can also threaten business continuity in the event of power outages, or if local transportation networks are disrupted by extreme weather. Worker safety can also be affected by extreme heat and weather events, especially for employees who work outdoors or travel. Various industries, such as landscaping and farming, may need to adjust their practices to adapt to changing climate conditions.

7 Priorities

The purpose of the CCA Plan is to continually improve Waterloo Region's resilience to extreme weather and climate change impacts through increased local adaptive capacity and collaboration among community stakeholders.

The CCA Plan is built on four Guiding Principles and four Goals. These were identified in collaboration with the Community Partners.

7.1 Guiding principles

Guiding Principles are overarching intentions to inform brainstorming, planning and implementing for all of the Actions in the CCA Plan, and are as follows:





- ◆ Identify adaptation Actions that are equitable and responsive to the most vulnerable in our community

- ◆ Maximize long-term sustainability and co-benefits of adaptation Actions with local economic, social and environmental priorities
- ◆ Build awareness, understanding and ownership of adaptation Actions throughout the community
- ◆ Enable a collaborative and innovative environment for the community to learn by doing and adopt a continuous improvement approach

7.2 Goals

The Community Partners identified four Goals, which are high-level intentions for the community to strive toward (see Table 6), and which focus on one of four climate-related impact areas.

Table 6: Goals for the CCA Plan

Impact area	Goal
 Health and community	Improve community members' resilience to the risks of extreme weather impacts and changing climate conditions
 Built environment	Improve the climate resiliency of the built environment in terms of its long-term durability and functionality
 Natural environment and water	Preserve, restore and enhance local biodiversity and the resilience of the natural environment and water resources throughout the region
 Energy and economy	Increase the resilience of local energy systems and businesses in a changing climate to enable a thriving regional economy

7.3 Scope

7.3.1 Local and effective

Two other principles must underpin the actions in the CCA Plan. First, actions must be local. The adaptation actions must be able to be implemented within Waterloo Region by one or more local organizations.

Second, the implementation actions must be effective. Adaptation actions must be able to address the priority impacts of climate change and extreme weather, while meeting the identified Guiding Principles and Goals.

7.3.2 Local concern for global impacts

The distinctly local nature of the CCA Plan may appear to be at odds with the global nature of climate change, which crosses jurisdictional and geographic boundaries; however, the goal of the CCA Plan is to build local capacity to respond to these impacts and how they may affect our quality of life here at home.

During the development of this Plan, there were impacts of concern to our community participants that unfortunately could not be included in the focus of this plan. Two particularly noteworthy examples are food security and climate change migration.

Food security is influenced not only by local food production (which this Plan considers) but also by global economic and trade conditions, consumption habits, water scarcity and a wide variety of other national and global factors. Similarly, potential changes in migration to Waterloo Region will be influenced by Canada's national policies on migration and a variety of geopolitical factors (e.g. conflict, resource scarcity, the ability of home countries to resettle their own displaced citizens, etc.). As most of the information needed to understand these impacts relies on external factors and decisions, and as the CCA Plan relies primarily on localized climate projections for Waterloo Region, these important issues could not be addressed by this CCA Plan.

The Plan development process has shown that community members in Waterloo Region are passionate about climate change concerns beyond the local scale. The Region recognizes that important work to support food security, settlement and other social, environmental and economic priorities contribute to the overall wellbeing of our community and will continue to support these actions as appropriate.

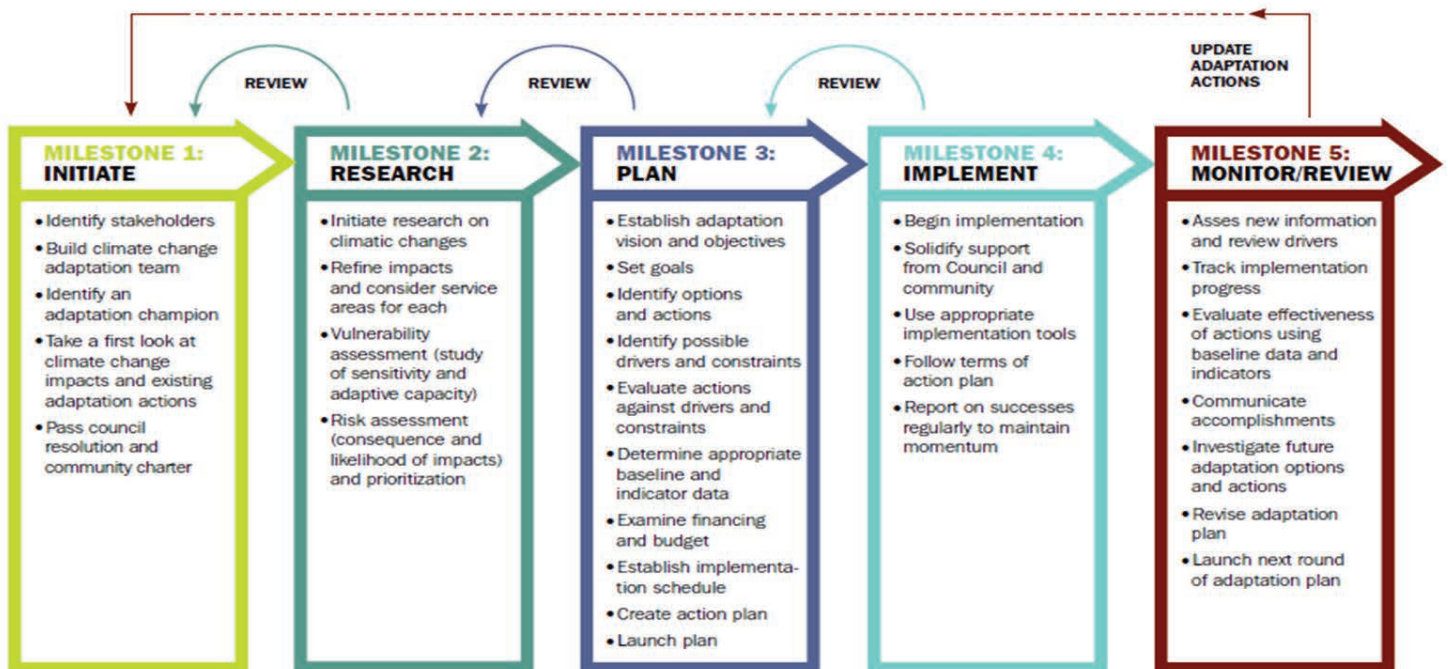


8 Plan development process

Waterloo Region's Community Climate Adaptation Plan is guided by ICLEI's Building Adaptive and Resilient Communities (BARC) Program. The BARC Program provides a framework and protocol guiding municipalities through a comprehensive planning methodology that includes research and climate impact assessment methods, plan development,

action-setting processes, implementation planning, and monitoring and review strategies. It has been utilized by municipalities throughout Canada, including: Vancouver, Thunder Bay, Calgary, Edmonton, Fredericton, Windsor, Oakville, and more. A model of BARC's five-Milestone process is shown in Figure 2.

Figure 2: BARC five-milestone framework¹⁸



"I worry more about the vulnerable people ...older people, ill people, people with poor health...and the impact the heat will have on them"

- survey respondent

The tasks required for each of the five BARC Milestones from Figure 2 are also summarized in Table 7, below, along with the Region's current completion status for each Milestone.

Table 7: Summary of ICLEI BARC's five-milestone climate adaptation framework

ICLEI BARC milestone	Overview of tasks
1) Initiate	Identify stakeholders, build core team, inventory existing actions, gain initial Council support
2) Research	Prepare climate projections, identify impacts, conduct vulnerability and risk assessments
3) Plan	Identify options and Actions, develop and launch Action Plan
4) Implement	Solidify support from Community Partners and Council, implement Action Plan
5) Monitor and review	Assess new information, review and revise Action Plan

8.1 Milestone 1: Initiate

The Region of Waterloo joined the BARC program in May 2017, following the completion of ICLEI Canada's Great Lakes Climate Change Adaptation Project, which helped the Region get started on Milestones 1 and 2 of the BARC Framework.

Fulfilling the criteria of Milestone 1, the Region identified a core group of stakeholders to participate in the adaptation planning process as part of a "Community Partners" group. As this Plan takes a community-wide look at climate change adaptation, Community Partners were identified as either having one or more areas of expertise regarding climate change impacts, or as being the appropriate representatives of local organizations that may play a key role in local resilience. These stakeholders included Region of Waterloo Public Health, the Grand River Conservation Authority

(GRCA), Community Emergency Management Coordinators (CEMCs) for the Cities and Townships, academic institutions, community service organizations, and more. Invitees to the Community Partners group participated in meetings and workshops to develop the CCA Plan and/or were kept informed of progress and were encouraged to provide feedback throughout the development of the CCA Plan. The full list of Community Partners can be found in Section 3 Project Team, Community Partners and Key Contributors.

The Region also looked at current conditions within the community and identified existing actions, plans, and policies that currently address climate change and extreme weather, though they may not necessarily be labelled as adaptation. These were used later on in the CCA Plan to identify current initiatives and areas for mainstreaming additional adaptation actions.

The Region of Waterloo formally achieved Milestone 1 of ICLEI BARC on August 31, 2017.

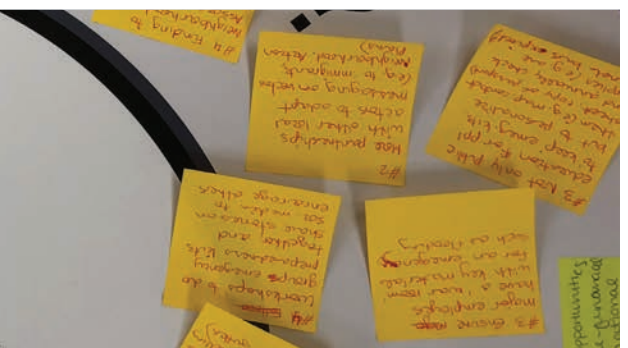
8.2 Milestone 2: Research

Milestone 2 was the research phase of the Region's adaptation planning efforts. It focused on obtaining information about how climate change will affect the community, and involved community stakeholders in deciding what these changes will mean for the community.

One of the earliest accomplishments in this Milestone was the Localized Climate Projections for Waterloo Region report developed by the University of Waterloo's Interdisciplinary Centre on Climate Change. Based on this report, a selection of 40 impact statements were identified by the Region and representatives from the GRCA and Cities of Cambridge, Kitchener and Waterloo, with guidance from ICLEI Canada. Validation and

revisions of these impact statements was provided by Community Partners in future planning stages (namely the vulnerability and risk assessments). Impact statements described how the climate projections for Waterloo Region might affect the community; for example, "Increased extreme precipitation events can lead to road washouts, bridge closures, and disruptions to transportation services." Effort was taken to ensure the impacts addressed the social, physical, economic, and ecological implications of climate change and extreme weather on the community as a whole.

Impact statements are the foundation of vulnerability and risk assessments. The following sections describe how these assessments helped to prioritize the list of 40 impact statements across a range of factors. These impact statements can also be found in Appendix A: Vulnerability and Risk Assessment Results.



8.2.1 Vulnerability assessment

The vulnerability assessment evaluated the perceived vulnerability of different types of stakeholders in the community to the 40 impact statements. Vulnerability is a combination of sensitivity and adaptive capacity, where sensitivity measures the degree to which the community will

be affected when exposed to a climate-related impact, and adaptive capacity determines whether the community can adjust to the climate impact with minimal cost or disruption.

The sensitivity and adaptive capacity scores were plotted on a vulnerability matrix to determine a final vulnerability score for each impact statement. The vulnerability matrix is shown below in Figure 3.

Figure 3: Vulnerability matrix

		Sensitivity: Low to High				
		S1	S2	S3	S4	S5
Adaptive Capacity: Low to High	AC1	V2	V2	V4	V5	V5
	AC2	V2	V2	V3	V4	V5
	AC3	V2	V2	V3	V4	V4
	AC4	V1	V2	V2	V3	V3
	AC5	V1	V1	V2	V3	V3

As shown in Figure 3, impacts with a high sensitivity (S5) and a low adaptive capacity (AC1) would receive a high vulnerability score (V5). Alternatively, an impact with low sensitivity (S1) and high adaptive capacity (AC5) would receive a low vulnerability score (V1). Those impacts that ranked between V3 and V5 were selected to continue into the risk assessment, whereas those impacts that ranked a V1 or V2 – generally seen as less of a concern to the community - were not.

The final vulnerability scores for each impact were informed by the results of a Vulnerability Assessment workshop, three “Workshop-in-a-Box” activities that local organizations went through with their staff and/or students, and several other meetings and interviews with key stakeholder groups.

The distribution of vulnerability assessment results is displayed in Table 8.

Table 8: Number of impacts for each final vulnerability score

Final vulnerability score	Number of impacts
V1	0
V2	5
V3	23
V4	12
V5	0

In addition to impacts ranked V3 to V5, one V2 impact also moved forward into the risk assessment based on feedback from Community Partners and other local experts. As a result, thirty-six (36) impact statements were considered in the Risk Assessment. Appendix A: Vulnerability and Risk Assessment Results includes the individual vulnerability scores received by each of the 40 impact statements.

While the vulnerability assessment determined an approximate, general level of vulnerability for each impact statement, it was also recognized that some community members may be more vulnerable than others, depending on features of the built and natural environment (e.g. level of exposure to temperature or rain), and on individuals' personal and social characteristics (e.g. income, social status, education, literacy, gender, culture, age, and social support networks). In Waterloo Region, people who are vulnerable to climate change impacts can include seniors, children and infants, socially and economically disadvantaged people, those with chronic illnesses, and residents living in isolated areas. These characteristics can cause vulnerable people to experience disproportionate physical, mental, financial, and social stress due to extreme weather and temperature events. As such, it was important

for the local climate adaptation planning process to consider how individual vulnerabilities might affect the Risk Assessment results (below), as well as the identification and prioritization of adaptation actions in Milestone 3.

8.2.2 Risk assessment

The purpose of the risk assessment was to prioritize impacts that pose a moderate-to-significant threat to Waterloo Region as a community. Risk is the product of likelihood and consequence (i.e. risk = likelihood x consequence), where 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 to the community.

The first step of the risk assessment was to determine the likelihood of each potential impact occurring in Waterloo Region. Likelihood was measured on a scale from 1 to 5, where 1 indicates a 'Rare' occurrence, and 5 indicates an 'Almost Certain' occurrence. As most of the impacts were classified as "recurrent" (meaning the impact may occur multiple times) rather than as single events, approximate time scales were included to help participants assign appropriate Likelihood scores. Table 9, below, includes the likelihood ratings and approximate timescales.

Table 9: Likelihood matrix for recurrent impacts

Likelihood rating	Recurrent impact
Almost certain (5)	Could occur several times per year
Likely (4)	May arise about once per year
Possible (3)	May arise once in 10 years
Unlikely (2)	May arise once in 10 years to 25 years
Rare (1)	Unlikely during the next 25 years

Participants in the Community Partners group determined Likelihood scores for each of the 36 impact statements based on localized climate projections as well as anecdotal knowledge of current conditions within the community.

The second part of the risk assessment looked at the expected consequences of each impact. Participants were asked to assign a consequence rating - ranging from Negligible (1) to

Catastrophic (5) for each of twelve consequence criteria, organized into Social, Economic, and Environmental categories. In addition to these numeric scores, participants were asked to provide justification for the ratings they assigned to provide transparency for future reference. The detailed consequence tables can be found in the Waterloo Region's [Risk Assessment Report](#) on the Region of Waterloo website.

Table 10: Consequence categories

Social factors	Economic factors	Environmental factors
Public health & safety	Property damage	Air
Displacement	Local economy & growth	Soil & vegetation
Loss of livelihood	Community livability	Water
Cultural aspects	Public administration	Ecosystem function

The evaluation of likelihood and consequence scores resulted in risk scores for each consequence category as well as one overall risk ranking. The level of risk per consequence category was calculated by adding up the four

consequence scores for the category, and then multiplying the sum by the impact's likelihoods core. The total risk number was then assigned a risk ranking using the information in Table 11.

Table 11: Risk rankings and numeric risk scores for consequence categories and for total risk

Risk ranking	Numeric risk score for consequence categories (social, environmental or economic risk)	Total numeric risk score (sum of all three consequence categories)
Very low	5 to 16	15 to 50
Low	17 to 28	51 to 86
Medium-low	29 to 40	87 to 122
Medium	41 to 52	123 to 158
Medium-high	53 to 64	159 to 194
High	65 to 76	195 to 230
Very high	77 to 88	231 to 266
Extreme	89 to 100	267 to 300

Three category-specific risk scores and one overall risk score were assigned to each impact. The category-specific scores helped to ensure that impacts with imbalanced category-specific risks (e.g. high social risks due to health concerns, but low economic and environmental risks) would still be captured, even if the overall risk score was low.

It is important to note that the risk assessment process is not an exact science; rather, it is a qualitative exercise that evaluates participants' perceptions of the risks posed by climate-

related impacts. Outreach methods for the risk assessment included various community experts, interviews with social service organizations, and an online survey through EngageWR to collect public feedback on perceived risk. While it is not possible to capture every stakeholder perspective in the community, to ensure marginalized voices and needs were included, the Region also retained Sustainable Societies Consulting Group (SSCG) to engage four main groups or populations: (1) social service providers/organizations; (2) people with

lived experience living on low or fixed income, in precarious housing and/or experiencing homelessness; (3) neighbourhoods; and (4) Indigenous peoples and organizations.

As described above, the risk assessment prioritized impacts that present moderate-to-significant risks to the community. Impacts were included in the action planning stage if they met one or more of the following conditions:

- ◆ The impact achieved a Medium or higher overall risk score, or,

- ◆ The impact achieved less than a Medium overall risk score, where:
 - ◆ At least one of the consequence categories received a Medium or higher risk score; or,
 - ◆ Input from subject-matter experts or the level of concern expressed by community members provided significant reason to include the impact for action planning.

The distribution of the risk assessment results is displayed in Table 12.

Table 12: Number of impacts by risk ranking

Overall risk ranking	Number of impacts	Number of impacts prioritized for action planning
Medium-high	6	6
Medium	8	8
Medium-low	13	6
Low	9	0
Total	36	20

Two of the Medium-Low impacts prioritized for action planning were consolidated into a single impact statement, resulting in a final total of 19 impact statements considered in the action planning stage.

More details regarding the Risk Assessment process – including the results and more detailed descriptions of stakeholder engagement activities – are available in the [Risk Assessment Report](#). The Risk scores for each impact statement are also provided in Appendix A: Vulnerability and Risk Assessment Results. With the completion of the

Risk Assessment Report, the Region of Waterloo formally achieved Milestone 2 of ICLEI BARC in September of 2018.

8.3 Milestone 3: Plan

Following an evaluation and understanding of the region's climate risks in Milestone 2, Milestone 3 involved identifying Guiding Principles, Goals, and Objectives, and developing adaptation actions that Waterloo Region community stakeholders can take to address the goals and objectives.

8.3.1 Goals and objectives

A Goals and Objectives workshop was held in September of 2018, with the Community Partners. Workshop participants reviewed the prioritized medium- and high-risk impacts from the risk assessment and contributed ideas for the Guiding Principles, Goals, and Objectives of the CCA Plan. The outputs of this workshop helped the Region and its Community Partners to brainstorm and edit actions to better address community priorities.

See **Section 6 Priorities** for the Guiding Principles and Goals of the CCA Plan. The Objectives – which identify the general ways in which our community intends to overcome the priority impacts of climate change – are included as headings for the adaptation Actions in **Section 9 Adaptation actions**.

8.3.2 Action brainstorming & editing

Adaptation action brainstorming and editing was undertaken from October 2018 to May 2019. Adaptation Actions identify how the community will overcome the impacts of climate change and work towards the identified guiding principles, goals and objectives of the CCA Plan. These were collected from a series of engagement activities, including a Community Partners workshop, a Public Forum, an online idea-sharing tool on the EngageWR online engagement platform, and in-person meetings with specific organizations and groups. A long list of adaptation action ideas – more than 250 individual ideas – was compiled from the results of these meetings and tools. Ideas contributed in this stage were not edited or filtered until they had been collected and consolidated.

The Region and ICLEI Canada consolidated the long list of adaptation action ideas by combining similar action ideas together, and by ensuring the ideas met the following criteria:

- ◆ Be local - adaptation actions can be implemented within Waterloo Region by one or more local organizations



- ◆ Be effective – adaptation actions will help to address the identified guiding principles, goals and objectives of the priority impacts of climate change and extreme weather

To gather adaptation action ideas and perspectives from as wide a variety of community members as possible, the Region facilitated action brainstorming and editing activities through several avenues. These included:

- ◆ **Community Partners workshops** – Several workshops were held in the winter of 2018 and spring of 2019 with the Community Partners group in order to brainstorm and edit adaptation actions. Participants were given the chance to review best practices and suggest new actions that the community could take in order to achieve the identified guiding principles, goals and objectives. These workshops were also an opportunity for Community Partners to learn from existing plans and programs from other communities that could either complement or help mainstream various adaptation actions. Community Partners attending these workshops helped to identify the

potential drivers and constraints of different adaptation actions, addressed some of the finer written details, and were invited to provide further feedback on the draft adaptation Actions.

- ◆ **Public forum** – A Public Forum was held in November 2018 to involve community members in brainstorming potential adaptation actions that would improve the resilience of the community to extreme weather events and changing climate conditions. Group discussions focused on five themed areas: Strong Winds and Storms, Freezing Rain and Cold Weather, Hot and Dry Weather, Flooding and Long-Term Impacts. Participants shared their ideas in personal response sheets and in guided discussions between group members.
- ◆ **EngageWR** - The Region invited members of the public to suggest adaptation action ideas through the EngageWR online stakeholder engagement platform. These results focused mainly on the levels of concern that respondents have for various climate-related impacts, and learning from community members' past experiences with an extreme weather or temperature event.
- ◆ **Business breakfast** – A business breakfast was held in November 2018 with a collection of local businesses and employers to discuss business continuity, insurance, legal risks, and opportunities in the context of changing climate conditions. Representatives of local businesses provided their perspectives on how to address the risks to business operations from extreme weather, and how to develop a more sustainable and climate-resilient economy and community.
- ◆ **Sustainable Societies Consulting Group** – The Region retained Sustainable Societies Consulting Group (SSCG) to continue to engage specific community segments in the adaptation planning process (as a continuation from the risk assessment process). The purpose of this engagement was to better understand how some community members may be disproportionately affected by climate change impacts, and what actions they or other organizations in the community could take in order to improve their resilience. SSCG's outreach focused on social service providers, community or neighbourhood groups, people with lived experiences, and Indigenous people living in the community.
- ◆ **Survey** – The Region included questions on local climate adaptation in the Waterloo Region Matters Survey (WRMS), an omnibus survey conducted by researchers at the University of Waterloo. The WRMS reached 500 adult residents across Waterloo Region with five questions on climate change adaptation, and the results are weighted according to municipality and age so as to be representative of the entire community. Data collection began in January 2019 and ended in March 2019.



Questions in the WRMS survey asked participants about climate-related impacts – which one concerns them the most, how would they like to respond or adapt to the selected impact, and what challenges would they face in adapting to the impact. The final (fifth) question asked respondents to identify how local organizations

could improve the ability of respondents to help themselves and/or others in the community adapt to the climate-related impact that most concerns them. Respondents provided open-ended answers, which were coded to identify common themes. The results of this question are provided in Table 13, below.

Table 13: Suggested ways that local organizations could support community-level climate adaptation

Coded responses	Frequency	Weighted percent
Education programs/Share information on actions to reduce risk	272	55.1%
Provide incentives for home improvement initiatives/ neighbourhood initiatives	214	42.3%
Provide resources to protect against extreme conditions/Offer emergency kits	164	33.6%
Encourage community level action/Form or lead community action groups	158	31.9%
Provide temporary shelter from extreme weather/ temperatures	143	28.8%
Provide funding for community programs/services	139	26.8%
Provide direct assistance or coaching	117	22.6%
Other	35	7.1%
Don't know	3	0.6%
Refused	1	0.2%

The most commonly identified form of support was improved information and education, suggested by 55.1% of respondents. 42.3% of respondents would like to see incentives to improve the resilience of their homes and neighbourhoods, while 33.6% and 31.9% of respondents would like to receive resources or would like to see community-level actions, respectively. Other types of assistance (i.e.

temporary shelter, funding for community services/ programs, direct assistance) were also identified by a significant number of community members. A common theme found in the “Other” responses is the need for local governments and organizations such as the GRCA and utilities to take a leadership role on climate change adaptation.



8.4 Milestone 4: Implement and Milestone 5: Monitor and review

As outlined in the ICLEI BARC framework, finalization of this plan will be followed by work toward Milestone 4 (Implement) and Milestone 5 (Monitor and Review).

The next steps involved in implementing each Action take one or more of the following four main forms:

1. Researching and collecting data
2. Communicating and educating
3. Collaborating and building partnerships
4. Changing policies and practices

The community has played a central role in the development of this Plan, and will continue to play a central a role in its implementation. This focus on community involvement is due to both the vision of the Plan and the complex challenges and threats

“For those walking and busing, especially the disabled, getting around on icy sidewalks/roads [is] very difficult.”

- community service provider

of a changing climate. As a result, the Community Partners group who provided crucial guidance during plan development will continue to provide guidance through the life of the plan during ongoing implementation and monitoring cycles.

The Region of Waterloo will also play a central role in these phases, serving as the institutional home for the community-wide Plan. The primary roles filled by the Region will be general staff support, convening the Community Partners, Action monitoring, and mid-term and five-year reporting. The Region will encourage participation and collaboration on the adaptation Actions in this Plan. Organizations will participate in implementation by taking on specific Actions based on their indications of interest throughout the planning process.

The Region and/or leads for adaptation Actions will seek resources and opportunities to support ongoing work and new projects as identified under the Actions in the CCA Plan. This may include funding/financing, guidance from experts, and new partnerships.

As detailed in the Actions section of the Plan, the ultimate success of the CCA Plan will rely on the continuing work of potential partners identified for each Action. The Region has a key role to play in identifying and engaging potential partners, but will

also look to the Community Partners for advice on which potential partners to involve for each Action, whether to organize sub-groups or Action-specific working groups, and other ways to engage key stakeholders in implementing the adaptation Actions.

8.4.1 Timelines and schedules

Due to the community focus of this Plan and the need for the adaptation Actions to be completed by diverse actors across the region, this Plan does not prioritize certain actions over others for order of implementation. Timelines and schedules for implementation will be unique to each individual Action, and will be determined collaboratively with potential partners considering their current and future plans and capacity.

The Actions identified in the Plan will be assessed on a 5-year monitoring cycle. Every 5 years, the Plan will be revised to reflect any updates to the climate change projections, work completed to date, and the climate change adaptation challenges that remain for our community. As an important part of these five-year monitoring and review cycles, the Region will engage four main stakeholder groups on an ongoing basis as detailed in Table 14.



Table 14: Ongoing stakeholder engagement

Stakeholder group	Type of engagement
Community Partners	Meetings with the Community Partners will include Action-specific progress updates when available, enabling this group to give meaningful guidance and advice. The Community Partners, who bring expertise in their respective fields, can advise of new research or innovative solutions to consider in implementation. The frequency of these meetings will be determined with the input of the Community Partners, but may occur twice per year for the overall group, and more often as needed/practical for Action-specific sub-groups.
Action-specific partners	For each Action, there may be additional partners that need to be brought to the table. Action-specific working groups and other ways to engage key stakeholders in implementing specific adaptation Actions will be determined by the potential partners listed for each Action and supported by Regional staff.
Regional Council	Progress updates to Council will occur at the approximate halfway point of each 5-year monitoring cycle. These updates will include the status of progress indicators, any notable trends or comparisons to previous updates, lessons learned, minor adjustments made to the Plan, and next steps. The 5-year monitoring cycle will also include a progress update as part of more substantial revisions to the CCA Plan.
Broader public	Information from progress updates to Council will be shared with the public. The 5-year monitoring cycle will include more focused opportunities for community stakeholders to provide input on potential revisions to the CCA Plan. Several adaptation Actions will also rely on deliberate engagement of, further consultation with, and/or participation of community members to be successful.

Through this ongoing implementation and periodic monitoring, the Plan will fulfill its mandate to continually improve Waterloo Region's resilience to extreme weather and

climate change impacts through increased local adaptive capacity and collaboration among community stakeholders.

"Weather is constantly changing and we are seeing more and more extremes. I feel like we should all have emergency evacuation plans in place, as well as a go bag with water, food, essentials, etc."

- survey respondent

Part II: Objectives and Actions

9 How to read the adaptation Actions

The Actions in this Plan are organized by Objective, and are presented in standardized tables. This page explains how the sections of each Action table can be interpreted. A few adaptation Actions do not follow this format, and are presented as text only.

Action X.Y: Action title

Context for the Action and main considerations (e.g. impacts addressed).

Suggestions from the community	<ul style="list-style-type: none"> ◆ Ideas received from community stakeholders, either in consultation with the Community Partners – a group of key local experts and stakeholders – or with other organizations and members of the broader public. These ideas are included to illustrate what some community members hope to see happen and may inspire implementing partners, but may not be implemented unless they are included in the Next Steps
Current practice	<ul style="list-style-type: none"> ◆ Some of the related or supporting actions already underway with local partners that help to improve our climate resilience
Potential partners	<ul style="list-style-type: none"> ◆ Organizations that may help implement the adaptation actions. This list illustrates who might be involved, but is not exhaustive and does not direct potential partners to participate. Partners including (*lead) or (*potential lead) may take a leadership role
Next steps	<p>How the action will be addressed within the first five-year period of the CCA Plan. These Next Steps often refer to one or more of the following groups:</p> <ul style="list-style-type: none"> ◆ Region of Waterloo – often staff in Community Planning, but may refer to other departments (e.g. Public Health, Water Services, etc.) ◆ Community Partners – this group fulfills advisory and implementation roles, as determined by its participants, and will have a prominent role to play in many Actions ◆ Potential partners – several actions refer to “potential partners”; meaning the stakeholders included in the “Potential Partners” section in each table may have a role to play <p>Specific groups other than the Region of Waterloo (e.g. GRCA, Waterloo Region CEMCs) are listed as initiating next steps if they have suggested during the consultation process that they will take certain actions. Approval of this Plan does not bind them to doing so.</p>
Outcomes	<ul style="list-style-type: none"> ◆ A description of what this action will ideally do for the community
Measurement considerations	<ul style="list-style-type: none"> ◆ This section sometimes includes ideas for how progress might be measured, but in many cases the implementation details (including measurement) still need to be determined in collaboration with Community Partners or potential partners.

10 Adaptation Actions

Goal 1: Health and community

Improve community members' resilience to the risks of extreme weather impacts and changing climate conditions

Objective 1:

Help vulnerable populations avoid or reduce the health-related risks of extreme weather and temperatures

53

Action 1.1: Raise awareness of policies and practices to protect workers from extreme temperatures and weather conditions 53

Action 1.2: Explore opportunities to expand current Cooling and Warming Centre programming 54

Action 1.3: Explore opportunities to offer improved access to cooling and hydration in public spaces and at public events during hot summer months 55

Action 1.4: Continue ongoing work to provide supportive and affordable housing as a means of reducing climate related impacts 56

Action 1.5: Coordinate local efforts to address excessive indoor temperatures in rental housing 57

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Action 1.7: Explore options to establish one or more vulnerable persons' registries to guide emergency responders and/or other assistance programs to reduce health impacts in extreme weather events 59

Objective 2:

Improve the personal preparedness of community members to respond to emergencies ... 61

Action 2.1: Coordinate public outreach and education on the personal risks and best practices for responding to climate change and extreme weather impacts 61

Action 2.2: Increase the uptake of household emergency kits 62

Objective 3:

Encourage community-based initiatives to improve community members' resilience to extreme weather events

63

- Action 3.1: Continue to update existing municipal and regional emergency preparedness and response plans with increased emphasis on protecting, communicating with and helping vulnerable populations during weather-related emergencies 63
- Action 3.2: Establish buddy systems/help-your-neighbour programs to implement during extreme weather events 64

Objective 4:

- Monitor and plan for the potential introduction of new vectors and vector-borne illnesses to the community** 66
- Action 4.1: Develop and promote educational tools and resources concerning disease vector recognition and prevention 66



"I am a person with Multiple Sclerosis. When the weather gets over 28 degrees Celsius, I develop difficult symptoms. Over the years, with more extreme heat days, I am less and less able to go outside."

- survey respondent



Goal 2: Built environment

Improve the climate resiliency of the built environment in terms of its long-term durability and functionality

Objective 5:

Incorporate climate change into future land use, development and construction, and improve the resilience of existing buildings to climate-related risks 67

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- Action 5.2: Explore opportunities for increased climate resiliency of new buildings through local adoption of upcoming national or provincial building standards 68
- Action 5.3: Seek opportunities to incorporate shade features in new development and on existing properties to reduce the urban heat island (UHI) effect 69
- Action 5.4: Seek opportunities to reduce flood risks by considering Low Impact Development (LID) features, green infrastructure, and building upgrades 70
- Action 5.5: Encourage homeowners and landlords to improve the climate resilience of residential buildings through upgrades and/or retrofit 71
- Action 5.6: Encourage local businesses and managers of commercial properties to proactively improve the climate resilience of their buildings 73

Objective 6:

Improve the longevity and resilience of infrastructure to extreme weather and temperatures 75

- Action 6.1: Periodically review materials, design options, and best practices for new climate-resilient infrastructure, and share best practices between municipalities and other key stakeholders across Waterloo Region 75
- Action 6.2: Encourage property owners and managers to keep storm drains clear of leaves and other debris to reduce the risk of flooding 75

Objective 7:

Reduce transportation disruptions due to extreme weather events and improve safety of travel on roads, sidewalks and trails 77

Action 7.1:	Promote safer travel practices, choices and alternatives throughout the region	77
Action 7.2:	Explore how traffic flows and communications across municipal boundaries can be enhanced to better facilitate emergency response and business continuity in severe weather events	78
Action 7.3:	Improve winter travel conditions for pedestrians	79



“Our residence is super-insulated, but the majority of our neighbourhood is in the low insulation construction period post-WWII. So the combination of over-heated houses and the load from constant air conditioning are both issues I am concerned about in the warming of the climate.”

- survey respondent





Goal 3: Natural environment and water

Preserve, restore and enhance local biodiversity and the resilience of the natural environment and water resources throughout the region

Objective 8:

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Action 8.1: Continue seeking opportunities to protect riparian zones, wetlands and other natural areas to help manage storm water and flood risk 80

Action 8.2: Continue seeking opportunities to acquire or dedicate land and natural areas for conservation, and to enhance the management and restoration of existing natural areas 81

Objective 9:

Conserve and protect surface water and groundwater resources from urban runoff pollution 83

Action 9.1: Explore opportunities to improve snow- and ice-clearing response methods to reflect changing weather patterns, and aim to effectively clear roads, parking lots and walking surfaces with less salt 83

Action 9.2: Enable residents and landowners to adopt landscaping practices that improve water infiltration or reduce the need for watering 84

Objective 10:

Monitor, coordinate, plan for and mitigate the spread of invasive species in the natural environment 86

Action 10.1: Encourage and support broad community participation in the detection and management of invasive species 86

Objective 11:

Monitor, maintain and improve the diversity and resiliency of urban trees and forests 88

Action 11.1: Work with local partners to explore opportunities for tree planting, tree maintenance, and other strategies to improve tree coverage in urban areas .. 88

Objective 12:**Maximize effective nutrient management and retention to reduce runoff from agricultural practices****90**

Action 12.1: Continue to support and explore opportunities to enhance or improve the Rural Water Quality Program

90

Action 12.2: Explore opportunities to better understand and share best practices to address agricultural water quality issues and risks

91

"Falling trees are a major hazard, especially trees on private property not maintained by regional or city departments."

- survey respondent





Goal 4: Energy and economy

Increase the resilience of local energy systems and businesses in a changing climate to enable a thriving regional economy

Objective 13:

Improve the resilience of energy infrastructure to weather-related disruptions 93

Action 13.1: Explore opportunities and feasibility of decentralized energy generation, storage, and distribution in Waterloo Region 93

Action 13.2: Increase the resilience of electricity distribution infrastructure to extreme weather events through strategic planning and retrofits 93

Objective 14:

Enable local organizations, businesses and community members to be more resilient to power interruptions 95

Action 14.1: Encourage critical and important services in the community to have adequate, working backup power 95

Objective 15:

Encourage local businesses and other organizations to identify and plan for climate-related risks and opportunities that may affect their business activities and/or quality of service 97

Action 15.1: Encourage community organizations and businesses to develop their own climate adaptation plans and to include climate adaptation in emergency response plans 97

Action 15.2: Increase the availability and accessibility of climate-related datasets to assist developers, local businesses and other organizations 98

"As we develop and pave over more of our land, it increases the likelihood of flood damage due to overground surface runoff during heavy rainfall or sudden melt offs."

- survey respondent



Goal 1: Health and community

Objective 1: Help vulnerable populations avoid or reduce the health-related risks of extreme weather and temperatures

Action 1.1: Raise awareness of policies and practices to protect workers from extreme temperatures and weather conditions

Extreme temperatures can affect the health and safety of workers, especially outdoor workers, unless precautions are taken. Worker safety best practices are already developed and disseminated to employers and employees by Provincial and Federal government agencies, but there may be a role for local businesses and/or Community Partners to promote these best practices locally.

Suggestions from the community	<ul style="list-style-type: none"> ◆ Share existing information and best practices to keep local workers (particularly outdoor workers) safe in extreme temperatures and weather ◆ Share corporate health and safety policies for outdoor workers with local organizations to provide examples/templates of how best practices can be applied ◆ Consider indoor workers who may be affected by extreme outdoor temperatures
Current practice	<ul style="list-style-type: none"> ◆ Various provincial agencies uphold minimum worker health and safety standards (OHSA) and disseminate health and safety information and training to Ontario employers and workers (e.g. WHSC, IHSA), including temperature and extreme weather best practices ◆ National programs (e.g. sunsafetyatwork.ca) also provide health and safety information, as well as best practices to employees and employers across the country ◆ The Region of Waterloo has heat- and weather-related policies for its own workers and contractors ◆ Region of Waterloo Public Health shares definitions of extreme heat and cold, and links to relevant information on the Environmental Health section of the Region of Waterloo website and via social media (@ROWPublicHealth)
Potential partners	<ul style="list-style-type: none"> ◆ Local business and human resources associations (e.g. HRPV Grand Valley Chapter, Chambers of Commerce) ◆ Local organizations connected with outdoor and vulnerable workers (e.g. legal clinics, local work placement and employment assistance programs) ◆ Provincial and Federal worker safety programs ◆ Region of Waterloo
Next steps	<ul style="list-style-type: none"> ◆ Community Partners will engage with local organizations and networks that can potentially complement provincial/federal information sharing on extreme weather-related health and safety best practices with local employers and employees, focusing on those with outdoor workers [possibly as part of Action 15.1 and/or in conjunction with other worker safety information, such as vector-borne diseases (see Action 4.1) and/or safe travel practices and alternatives (see Action 7.1)]

Outcomes	<ul style="list-style-type: none"> ◆ Increased awareness of relevant health risks and best practices that local workers and employers can take to reduce risks posed by extreme weather and temperatures in their places of work, particularly outdoor workers
Measurement considerations	<ul style="list-style-type: none"> ◆ Number of communications to businesses that include temperature and extreme weather preparedness for outdoor workers

Action 1.2: Explore opportunities to expand current cooling and warming centre programming

Members of our community may lack air conditioning in their home, may be precariously sheltered or have no shelter at all, or may have certain medical or physiological needs that make them more vulnerable to extreme temperature events. Region of Waterloo Public Health coordinates a community response to heat or cold warnings issued by Environment and Climate Change Canada for Waterloo Region. Cooling and warming centres in Waterloo Region help provide a space for people to find relief from extreme temperatures and are one way to help prevent potentially serious health impacts.

Suggestions from the community	<ul style="list-style-type: none"> ◆ Work with existing centres to see if hours can be extended, including in evenings and outside of extreme weather events ◆ Explore opportunities for new centres with new Community Partners (e.g. businesses) and current partners ◆ Increase access to shelters for people experiencing homelessness, extend hours wherever possible (e.g. full days during extreme temperature events), and identify opportunities for air conditioning in shelters ◆ Identify opportunities for pets (e.g. separate areas, more locations) in cooling/warming centres ◆ Inform homeless or other vulnerable people of cooling/warming centres and overnight shelters (e.g. with info cards, or verbally) ◆ Disseminate information/education regarding warming/cooling centres (why they exist, where to find them) to multicultural centres, including information in multiple languages ◆ Consider how to help people stay safe when travelling to and from cooling and warming centres (e.g. Action 7.3, 11.1)
Current practice	<ul style="list-style-type: none"> ◆ The Waterloo Region Extreme Heat and Cold Partnership, led by Region of Waterloo Public Health, is a collection of local partners that work together to improve the resilience of the public to negative health effects of extreme heat and cold, and focuses on priority populations who are most at risk for heat-related illness and cold injuries. This network includes representatives from 67 Warming/Cooling Centres in our three cities and four townships. Warming/Cooling Centres are open to all residents to seek relief from extreme temperatures during notification periods (as triggered by Environment and Climate Change Canada). The centres consist of public buildings such as municipal buildings, libraries, recreation centres, and the Ken Seiling Waterloo Region Museum. This multi-sector network also brings together stakeholders who have front-line contact with priority populations such as isolated seniors and individuals experiencing homelessness

Potential partners	<ul style="list-style-type: none"> ◆ Region of Waterloo Public Health (*lead) ◆ Waterloo Region Extreme Heat and Cold Partnership (current Lead: Region of Waterloo Public Health), which includes many organizations including: Waterloo Region Community Emergency Management Coordinators (CEMCs), Community service organizations (e.g. shelter providers, municipal buildings, community centres, multicultural centres, outreach workers, first responders (including EMS, Fire, Police), municipal departments, and more)
Next steps	<ul style="list-style-type: none"> ◆ Region of Waterloo Public Health and its partners will continue to explore opportunities to improve Cooling/Warming Centres. Information on cooling and warming centres can also be included in other health and safety related communications to the public (e.g. Action 2.1)
Outcomes	<ul style="list-style-type: none"> ◆ More cooling/warming centre availability to serve larger and broader community needs, particularly those who are more vulnerable or exposed to extreme temperatures. Greater awareness of available cooling/warming centre options among the public
Measurement considerations	<ul style="list-style-type: none"> ◆ Region of Waterloo Public Health will consider whether local targets and measurable goals could be set for the number and/or distribution of cooling and warming centres

Action 1.3: Explore opportunities to offer improved access to cooling and hydration in public spaces and at public events during hot summer months

Easy access to drinking water and/or cooling is an important part of providing safe and enjoyable public spaces and events, especially during hot summer months when dehydration and heat-related illnesses are a greater risk.

Suggestions from the community	<ul style="list-style-type: none"> ◆ Increase offerings of free swim times, public pools and splash pads ◆ Install water-based outdoor cooling stations such as misting stations ◆ Improve public access to hydration (e.g. fountains, hydration stations, water bottle refill) and information to help people find hydration options, with special consideration for vulnerable populations ◆ Consider feasibility of providing low-cost reusable water bottles to people experiencing homelessness
Current practice	<ul style="list-style-type: none"> ◆ BlueW program has been in place since approximately 2010, allowing people to fill their water bottles for free at participating businesses, public buildings and other establishments across Waterloo Region ◆ The Region's Water Wagon program is being replaced by a similar service through the Ontario Clean Water Agency as one option to provide hydration at public events ◆ Area municipal parks, community centres and other public spaces sometimes have splash pads for children or offer swimming

Potential partners	<ul style="list-style-type: none"> ◆ Community centres/groups and neighbourhood associations ◆ Community organizations (e.g. event organizers) ◆ Municipalities ◆ Salvation Army via the Waterloo Region Extreme Heat and Cold Partnership
Next steps	<ul style="list-style-type: none"> ◆ Potential partners are encouraged to continue exploring opportunities to provide access to hydration and cooling, and to share best practices/lessons learned to help public events provide hydration and/or cooling options ◆ The Region of Waterloo will continue promoting the BlueW program as a central resource to find or share water access locations
Outcomes	<ul style="list-style-type: none"> ◆ Extreme heat and hot summer temperatures are less of a barrier to health and physical activity in Waterloo Region, with improved awareness and availability of hydration and cooling options
Measurement considerations	<ul style="list-style-type: none"> ◆ The Region of Waterloo will consider goals and targets for evaluating improved awareness, participation and impact of the BlueW program

Action 1.4: Continue ongoing work to provide supportive and affordable housing as a means of reducing climate related impacts

The Region is responsible for approximately 9,000 units of Community Housing and has a waiting list of 4,647 households (end of 2018). Access to stable housing can reduce the exposure of people and families to extreme temperatures and weather.

Suggestions from the community	<ul style="list-style-type: none"> ◆ Local initiatives and partners should continue to provide and maintain supportive and affordable housing ◆ Work to improve the climate resiliency of new and existing affordable and supportive housing – Objective 5
Current practice	<ul style="list-style-type: none"> ◆ Region of Waterloo offers incentives for new affordable housing development ◆ The Region of Waterloo works with property managers and landlords for many affordable homes and also manages many affordable housing units itself ◆ HHUG's All In 2020 initiative to end chronic homelessness by 2020
Potential partners	<ul style="list-style-type: none"> ◆ Region of Waterloo Housing Services (*lead) ◆ Community service organizations (e.g. Homelessness and Housing Umbrella Group (HHUG), Working Centre, and more) ◆ Municipalities
Next steps	<ul style="list-style-type: none"> ◆ Current work to encourage and provide affordable housing will continue, and potential partners are encouraged to explore new partnerships and opportunities to increase shelter and affordable housing availability

Next steps (continued)	<ul style="list-style-type: none"> ◆ The Region of Waterloo will investigate and recognize ways in which environmental sustainability and climate change adaptation priorities can support ongoing affordable housing initiatives (i.e. breadth of communication, linking sectors, co-supporting initiatives) in Waterloo Region
Outcomes	<ul style="list-style-type: none"> ◆ More affordable and supportive housing will help keep vulnerable people sheltered and therefore more resilient to extreme temperatures and weather events
Measurement considerations	<ul style="list-style-type: none"> ◆ Number of new affordable rental units or existing units rehabilitated according to resiliency considerations or standards

Action 1.5: Coordinate local efforts to address excessive indoor temperatures in rental housing

Excessive indoor temperatures can cause significant health issues to building occupants, especially older adults and other vulnerable populations. Community stakeholders have identified rental housing as a key opportunity to improve summer indoor temperatures, especially for older rental housing where air conditioning is less likely, and in rental housing where residents may have one or more vulnerable characteristics.

Suggestions from the community	<ul style="list-style-type: none"> ◆ Review research into temperature-related health issues and coping strategies, and distribute information to appropriate tenant audiences ◆ Explore best practices for landlords/building managers to protect tenants from excessive heat (e.g. program to install heat and humidity sensors in apartments, which can communicate with landlords and/or Community Emergency Management Coordinators; "A/C collectives" or dedicated air-conditioned shared spaces in multi-residential buildings; follow a communication strategy identifying who to notify, how and when; etc.) ◆ Expand collaboration between CEMCs and landlords/building managers to include check-ins with vulnerable groups during periods of extreme temperature (may link to Action 3.2)
Current practice	<ul style="list-style-type: none"> ◆ Health Canada has not identified nor provided guidance around setting/enforcing maximum indoor temperatures
Potential partners	<ul style="list-style-type: none"> ◆ Community groups, neighbourhood associations, etc. ◆ Community service providers (e.g. Community Support Connections: Meals on Wheels and More) ◆ Legal Clinics (e.g. Waterloo Region Community Legal Services) ◆ Local Health Integration Network (or Ontario Health Teams) ◆ Local home care agencies ◆ Local landlords and tenant associations (e.g. Waterloo Region Apartment Managers Association) ◆ Region of Waterloo Public Health, Housing Services and/or Community Services ◆ Renters Educating and Networking Together (RENT)

Potential partners (continued)	<ul style="list-style-type: none"> ◆ Researchers and Health Professionals (e.g. children's hospitals) ◆ Waterloo Region CEMCs ◆ Waterloo Region Extreme Heat and Cold Partnership
Next steps	<ul style="list-style-type: none"> ◆ The Region of Waterloo will host a meeting with potential partners to determine who would like to work together to address the issue, and who will take the lead. Participants can help identify strategies and partnerships used successfully in other jurisdictions to encourage landlord participation in tenant health/safety during extreme weather and temperature events
Outcomes	<ul style="list-style-type: none"> ◆ Landlords and/or building managers become a resource to help vulnerable residents (such as seniors, low-income and precariously-housed residents) find relief from excessive indoor temperatures
Measurement considerations	<ul style="list-style-type: none"> ◆ Measurement details will be determined as implementation progresses

Action 1.6: Include mental health considerations as part of emergency preparation and recovery-related information, and in overall climate adaptation messaging

The impacts of climate change and extreme weather can affect mental health and wellness in several ways, including:

- ◆ Immediate needs for mental health support during emergency response and recovery
- ◆ Additional stress during recovery (or recurring events)
- ◆ Ongoing anxiety about the future

Suggestions from the community	<ul style="list-style-type: none"> ◆ Incorporate mental health considerations into climate change adaptation outreach and education programming ◆ Frame messaging around climate change risks and adaptation as opportunities – policy development, link to quality of life/wellness work, to inspire hope and action ◆ Administer long-term (3+ years) follow up with communities affected by extreme weather events to better monitor mental health impacts and identify potential needs or interventions (particularly communities that have experienced multiple recent events) ◆ Design a framework for climate adaptation-related messaging that will inspire positive actions and outcomes (e.g. balance, being prepared, offering support, etc.) and make available to stakeholder groups ◆ Liaise with local research institutions (e.g. Intact Centre on Climate Adaptation) for ongoing guidance and research on best practices
Current practice	<ul style="list-style-type: none"> ◆ The Region's Emergency Management Office (EMO) provides an Emergency Social Services (ESS) program for people displaced by an emergency (including food, clothing, lodging, other supports) in partnership with local partners ◆ Regional/community efforts through Wellbeing WR may help to address some underlying factors to improve mental health and wellbeing across Waterloo Region

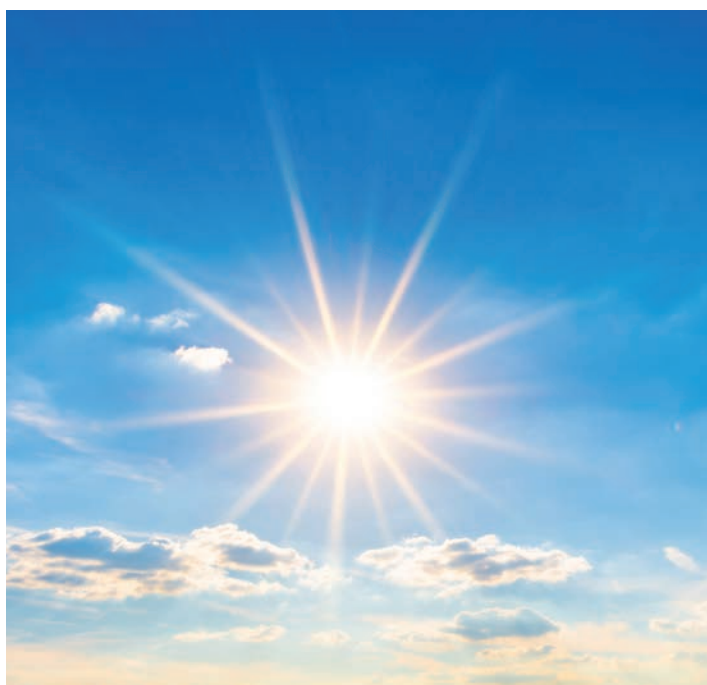
Potential partners	<ul style="list-style-type: none"> ◆ Community service organizations (e.g. CAMH) ◆ Homewood (or similar Employee & Family Assistance Programs) ◆ Intact Centre on Climate Adaptation ◆ Post-secondary institutions ◆ Region of Waterloo Emergency Social Services ◆ Region of Waterloo Public Health ◆ School Boards ◆ Waterloo Region Community Emergency Management Coordinators (CEMCs) ◆ Waterloo Region Victim Services
Next steps	<ul style="list-style-type: none"> ◆ The potential partners are encouraged to consider if and where there may be opportunities to include mental health information and/or partnerships in other actions in the CCA Plan ◆ Region of Waterloo Public Health will stay abreast of further studies/research in the area of mental health impacts regarding weather-related events
Outcomes	<ul style="list-style-type: none"> ◆ Individuals and communities that experience flooding and other weather-related emergencies are connected to available and appropriate mental health resources
Measurement considerations	<ul style="list-style-type: none"> ◆ Number of climate change-related communications that incorporate mental health considerations/messaging

Action 1.7: Explore options to establish one or more vulnerable persons' registries to guide emergency responders and/or other assistance programs to reduce health impacts in extreme weather events

One or more vulnerable persons' registries could make it easier for emergency services to help people who have heightened health and safety concerns in the context of an extreme weather or temperature event. Ideally, people will be able to self-identify and choose to receive check-ins or communications from Community Emergency Management Coordinators (CEMCs) and/or other trusted community groups/assistance programs.

Suggestions from the community	<ul style="list-style-type: none"> ◆ Collaborate with local partners to identify viable options for one or more formal vulnerable persons registries ◆ Outreach with local community groups, neighbourhood associations, faith communities, multicultural associations, etc. to promote registration to the registry (if/when this becomes an option) throughout Waterloo Region
Current practice	<ul style="list-style-type: none"> ◆ Region of Waterloo EMO has an internal vulnerability mapping tool identifying numbers of people requiring special consideration from emergency services at the street level ◆ Community services organizations may already identify clients with vulnerabilities and/or check on them in extreme weather events (e.g. CSC Meals on Wheels, homecare organizations, homelessness groups, mental health groups, newcomers, etc.)

Potential partners	<ul style="list-style-type: none"> ◆ Waterloo Region CEMCs and Region of Waterloo Emergency Management Office (EMO) (*potential leads) ◆ Community service organizations (e.g. Community Support Connections, homecare organizations) ◆ Community groups, neighbourhood associations, faith communities, etc. ◆ EMS and WRPS ◆ LHIN/Ontario Health ◆ Multicultural Associations
Next steps	<ul style="list-style-type: none"> ◆ The Region of Waterloo EMO will continue to improve upon the internal vulnerability mapping tool to potentially a) increase resolution to the level of individual buildings, and/or b) allow community members to self-identify for the registry ◆ Waterloo Region CEMCs are encouraged to consult with community services organizations, community groups and other partners to better connect other lists of vulnerable persons with emergency services
Outcomes	<ul style="list-style-type: none"> ◆ Vulnerable community members, possibly including those who have self-identified as having specific vulnerabilities (e.g. older adults, ill, isolated, etc.), will receive some form of health and safety check-in (such as a call, visit, or notification) during an extreme temperature or weather event, helping to prevent medical emergencies and/or direct emergency responders more efficiently to people in need
Measurement considerations	<ul style="list-style-type: none"> ◆ When it is possible for people to register for one or more vulnerability registries, registration numbers can be monitored



"Heat is a concern as I find it harder to breathe in excess heat. My place also has no air conditioning and there is no legal rules for keeping apartments below a certain temperature in the summer months."

- survey respondent



Goal 1: Health and community

Objective 2: Improve the personal preparedness of community members to respond to emergencies

Action 2.1: Coordinate public outreach and education on the personal risks and best practices for responding to climate change and extreme weather impacts

More extreme weather and temperature events may present increased health and safety challenges for community members. Efforts to continue to raise public awareness of the risks and best practices for personal health and safety can build on current practices and partnerships.

Suggestions from the community	<ul style="list-style-type: none"> ◆ Consider who needs information (prioritize audiences, e.g. vulnerable populations); who can help share information (trusted communication partners and platforms, e.g. AlertWR); and who has the information (e.g. reliable sources of new research) ◆ Link information on the health and safety risks with related social/economic impacts to make more of an impact ◆ Consider the health and safety risks of adaptation actions (e.g. how to avoid carbon monoxide/fire as risks of backup power) ◆ Ensure information on risks includes information on local programs/services to help, and/or best practices to address the risks, where applicable (e.g. Actions 1.2, 1.3, 1.6, 1.7, 2.2)
Current practice	<ul style="list-style-type: none"> ◆ Aspects of weather-related health and safety are included in the public school curriculum ◆ Simple messages/best practices are already shared with the broader public
Potential partners	<ul style="list-style-type: none"> ◆ Region of Waterloo (*potential leads Public Health and Waterloo Region Community Emergency Management Coordinators) ◆ Community groups, neighbourhood associations, faith communities, etc. ◆ Community service organizations ◆ Post-secondary institutions ◆ Schools and Youth
Next steps	<ul style="list-style-type: none"> ◆ The Community Partners will help assess current communication and education efforts, identify areas for improvement, and coordinate with potential partners to fill any gaps
Outcomes	<ul style="list-style-type: none"> ◆ Community members across Waterloo Region are more aware and better prepared for the potential health and safety impacts of climate change and extreme weather
Measurement considerations	<ul style="list-style-type: none"> ◆ Measurement details will be determined as implementation progresses

Action 2.2: Increase the uptake of household emergency kits

In a weather-related emergency, people may be without basic services (e.g. electricity, water) for an extended period of time. The best practice recommended by emergency management professionals is to keep certain items ready to ensure households can be self-sufficient for at least 72 hours.

Suggestions from the community	<ul style="list-style-type: none"> ◆ Training to encourage people to assemble their own emergency kits as part of emergency preparedness events, summer camps for students, and other opportunities ◆ Showcase examples of local champions/leaders with their emergency kits through social media ◆ Distribute 72-hour preparedness checklists in magnetic form for households in different languages ◆ Provide free or subsidized emergency kits for vulnerable populations ◆ Distribution of 'starter' emergency kits ◆ Couple with information on household emergency planning, education around backup power, etc. ◆ Share information on vehicle emergency kits
Current practice	<ul style="list-style-type: none"> ◆ Emergency kit information is provided to local stakeholders via the AlertWR.ca website (referencing Federal government information which is also publicly available) and through other partners (e.g. Red Cross)
Potential partners	<ul style="list-style-type: none"> ◆ Waterloo Region Community Emergency Management Coordinators (CEMCs) (*potential lead) ◆ Canadian Red Cross ◆ Community groups, neighbourhood associations, faith communities, etc. ◆ Intact Centre on Climate Adaptation ◆ Multicultural Associations ◆ Partners for Action
Next steps	<ul style="list-style-type: none"> ◆ Waterloo Region CEMCs are encouraged to review options to improve current outreach and education practices
Outcomes	<ul style="list-style-type: none"> ◆ Residents of Waterloo Region are aware of the components and importance of a 72-hour emergency kit, and are more likely to have and maintain such a kit in their homes
Measurement considerations	<ul style="list-style-type: none"> ◆ Emergency kit uptake including number of kits, and qualitative information (e.g. are kits maintained, how did people learn about emergency kits, where are they stored, etc.) to help guide continual improvement over time



Goal 1: Health and community

Objective 3: Encourage community-based initiatives to improve community members' resilience to extreme weather events

Action 3.1: Continue to update existing municipal and regional emergency preparedness and response plans with increased emphasis on protecting, communicating with and helping vulnerable populations during weather-related emergencies

Any community can be vulnerable to a variety of weather-related hazards and emergencies, including fires, flooding, and ice storms. Municipal emergency preparedness and response plans and tools coordinate and mobilize local emergency services, sometimes in collaboration across Area Municipalities, to mitigate impacts and restore the community during and after an emergency. Some people may be more vulnerable to weather-related emergencies than others and could need prioritized or specialized emergency services as a result.

Suggestions from the community	<ul style="list-style-type: none"> ◆ Promote Alert Waterloo Region (AlertWR) - a public safety messaging service that allows people to receive important public safety messages in the event of a large scale emergency such as a flood, severe weather, or other emergency situations - by disseminating self-registration information and encouraging participation through various channels to reach a larger audience ◆ Consider climate change projections as part of reviewing the Hazard Identification and Risk Assessment (HIRA) which helps Community Emergency Management Coordinators (CEMCs) prioritize emergency management programs ◆ Ensure key organizations (e.g. retirement homes and others serving vulnerable populations) have evacuation plans ◆ Deliver free training programs for community members on emergency preparedness
Current practice	<ul style="list-style-type: none"> ◆ Region and Area Municipalities all have emergency response plans and work together on planning and response ◆ AlertWR is a collaborative project of the Region of Waterloo, Area Municipalities and the Waterloo Regional Police Service ◆ Area Municipalities have open burn bans, limits and/or permits to reduce the risks and impacts of outdoor fires ◆ GRCA is responsible for issuing flood messages (including watches and warnings) for Waterloo Region and operates upstream reservoirs to manage water during a flood ◆ GRCA works with Waterloo Region CEMCs to develop mapping products for use in emergency planning
Potential partners	<ul style="list-style-type: none"> ◆ Region of Waterloo Emergency Management Office (EMO) and Area Municipal CEMCs (*leads) ◆ Community groups, neighbourhood associations, faith communities, etc. ◆ Grand River Conservation Authority (GRCA) ◆ Long-term care facilities

Potential partners (continued)	<ul style="list-style-type: none"> ◆ Region of Waterloo Public Health ◆ School boards ◆ Waterloo Region Multicultural Centre and other community service providers ◆ Waterloo Regional Police Service
Next steps	<ul style="list-style-type: none"> ◆ The Region of Waterloo EMO, Area Municipal CEMCs and Waterloo Regional Police Service will continue to collaborate on the promotion of the AlertWR platform ◆ Waterloo Region CEMCs are encouraged to identify key existing groups/organizations in the community to work with and determine how to plan/work with local organizations to better reach vulnerable populations
Outcomes	<ul style="list-style-type: none"> ◆ Increased AlertWR registrations across all cities and townships in Waterloo Region ◆ Aligned messaging across municipalities and with other groups and improved emergency management coordination with vulnerable groups (see Action 1.7)
Measurement considerations	<ul style="list-style-type: none"> ◆ Measurement details will be determined as implementation progresses ◆ Region of Waterloo EMO will consider an appropriate registration target for the AlertWR service

Action 3.2: Establish buddy systems/help-your-neighbour programs to implement during extreme weather events

Extreme temperatures and other extreme weather events will affect some community members more than others. When family, friends and neighbours check-in on each other (and especially those who are most vulnerable), the risk of illness or injury can be reduced.

Suggestions from the community	<ul style="list-style-type: none"> ◆ Connect municipal neighbourhood strategies, tenants' associations, neighbourhood associations and other community-building groups to learn from each other on how to establish and maintain informal buddy systems in buildings or neighbourhoods ◆ Consider how to encourage informal actions – such as neighbourly check-ins – in areas without neighbourhood or community associations ◆ Explore possibility of a program to link student populations with community members in need, particularly for new Canadians and providing language support ◆ Encourage existing neighbourhood-level programs to continue (e.g. snow shovelling assistance programs, Snow Angels, etc.) and expand where possible (e.g. heat check-in network) ◆ Look into feasibility of regular wellbeing checks by staff across Regional housing and regionally-funded supportive housing ◆ Waterloo Region Community Emergency Management Coordinators (CEMCs) can share information about these networks (i.e. promote local buddy programs with AlertWR) and ensure participants are aware of emergency resources
Current practice	<ul style="list-style-type: none"> ◆ Local programs to increase neighbourhood cohesion (e.g. Kitchener's Love My Hood initiative, Waterloo Neighbourhood Strategy, community centres and neighbourhood associations in Cambridge, Wilmot Healthy Communities)

Current practice (continued)	<ul style="list-style-type: none"> ◆ Wellbeing WR is working to build social inclusion seeking equity, preventing isolation and strengthening belonging
Potential partners	<ul style="list-style-type: none"> ◆ Community groups, neighbourhood associations, faith communities, etc. ◆ Community service organizations (e.g. community health centres, Community Support Connections, others) ◆ Local landlord and tenant associations (e.g. condo boards) ◆ Municipal community-building programs ◆ Post-secondary institutions ◆ Region of Waterloo (Public Health, Community Planning) ◆ Waterloo Region CEMCs ◆ Waterloo Region Police Services Auxiliary Unit
Next steps	<ul style="list-style-type: none"> ◆ The Region of Waterloo will conduct research into tools/strategies used in other communities to support informal buddy systems ◆ The Community Partners will help identify key stakeholders and can discuss potential tools/strategies to help local groups foster informal buddy systems and/or resiliency networks that are appropriate to their community's particular needs
Outcomes	<ul style="list-style-type: none"> ◆ One or more replicable models or approaches to informal resilience can be identified and promoted to local community groups
Measurement considerations	<ul style="list-style-type: none"> ◆ This working group should consider whether a local target and measurable goals could be set, and how progress will be measured (e.g. number of local organizations participating in check-on your neighbour programming)

"I am especially concerned about my older friends in their 80's & 90's who will not leave their homes in extreme weather conditions. This can lead to more loneliness & isolation plus health issues that are not attended to in a timely way."

- survey respondent



Goal 1: Health and community

Objective 4: Monitor and plan for the potential introduction of new vectors and vector-borne illnesses to the community

Action 4.1: Develop and promote educational tools and resources concerning disease vector recognition and prevention

Some diseases can be transmitted to humans from other living creatures. These carrier species are known as disease vectors, and in Ontario commonly include mosquitoes (carriers of West Nile Virus) and black-legged ticks (carriers of Lyme disease). Changing climate conditions may contribute to the expanding range of disease vectors (such as black-legged ticks in Waterloo Region, or Asian tiger mosquitoes (which can transmit Zika virus and other diseases) from the northeastern United States into southern Ontario).

Suggestions from the community	<ul style="list-style-type: none"> ◆ Promote existing information from Public Health and any tools or mechanisms that already exist to report sightings of certain vectors ◆ Increase partnerships and awareness of prevention with newcomers/travellers ◆ Continue to monitor disease vector sightings and incidences of vector-borne illnesses in the community ◆ Increase partnerships with other local organizations to adapt messaging for community members with different communication needs and preferences
Current practice	<ul style="list-style-type: none"> ◆ Region of Waterloo Public Health monitoring and information activities are ongoing for West Nile and Lyme disease, and are in place to detect and respond to other vector-borne illnesses ◆ Region of Waterloo Public Health provides information and tools (e.g. tick ID and response cards) to help people protect themselves from vector-borne illnesses ◆ Public Health Ontario annually updates the Ontario Lyme Disease Map of Estimated Risk Areas
Potential partners	<ul style="list-style-type: none"> ◆ Region of Waterloo Public Health (*lead) ◆ ENGOs (e.g. outdoor-focused) ◆ Local health and veterinary clinics
Next steps	<ul style="list-style-type: none"> ◆ Region of Waterloo Public Health will consider how to communicate current monitoring practices for vector-borne illnesses with the public, and can also review how information on personal practices to prevent vector-borne illnesses is shared with the public
Outcomes	<ul style="list-style-type: none"> ◆ Public health is in a position to respond to increases or changes in vector-borne diseases
Measurement considerations	<ul style="list-style-type: none"> ◆ Number of reported vector-borne illnesses in Waterloo Region each year



Goal 2: Built environment

Objective 5: Incorporate climate change into future land use, development and construction, and improve the resilience of existing buildings to climate-related risks

Action 5.1: Collaborate with local partners on available mapping tools, and share best practices for creating, interpreting and utilizing localized heat- and flood-risk maps to guide adaptation policies and programs

Some parts of Waterloo Region are more vulnerable to flooding or extreme heat than others, often as a result of past land-use decisions and/or geographic features. Localized studies (e.g. mapping, inventories and risk assessments) can help decision-makers target adaptation information or programs towards more vulnerable neighbourhoods. As municipalities in Waterloo Region conduct mapping exercises to identify areas of concern, there is the potential for local collaboration on best practices to conduct and interpret such maps, and/or on appropriate ways to use this information to address climate-related risks across Waterloo Region.

Suggestions from the community	<ul style="list-style-type: none"> ◆ Inventory and assess current status of urban flood risk and heat mapping ◆ Identification of neighbourhoods with higher incidences and/or risk of flooding (possibly using complaints/anecdotes as part of the mapping process) ◆ Identify vulnerable road infrastructure and target areas for storm water management ◆ Utilities can use flood risk maps to better manage/mitigate the potential risks to critical infrastructure (e.g. gas/water valves) ◆ Use heat- and flood-risk maps to help identify priority areas for green space, tree planting, cool roofs, flood risk reduction information/incentives, information on insurance options, etc. ◆ Consider how to encourage flood resilience measures in targeted areas (e.g. for buildings in designated flood plains or at a higher risk of urban flooding - including upstream measures to reduce flood risk downstream)
Current practice	<ul style="list-style-type: none"> ◆ The Grand River Conservation Authority (GRCA) regulates hazard lands including riverine flooding hazards and riverine erosion hazards throughout Waterloo Region, and identifies them through engineering studies based on established provincial standards and criteria (development in these areas may be limited or in some cases, prohibited, to minimize risks of flooding and erosion; the GRCA generally does not consider urban flood risk caused by runoff) ◆ Flood plain mapping is included in municipal Official Plans, which establish detailed policy frameworks for development within the regulatory flood plain ◆ Area Municipalities are considering heat and/or flood risk mapping as part of their corporate climate adaptation plans
Potential partners	<ul style="list-style-type: none"> ◆ Grand River Conservation Authority (GRCA) (riverine flooding) ◆ Insurance companies ◆ Region of Waterloo and Area Municipalities (urban flood risk, heat vulnerability) ◆ Region of Waterloo Public Health (heat vulnerability)

Next steps	<ul style="list-style-type: none"> ◆ Potential partners are encouraged to share and assess current mapping activities and information, and identify opportunities to collaborate ◆ GRCA will update flood damage assessments over time, reporting on flood damages and estimating average annual damages to assess feasibility and financial benefit of flood mitigation projects
Outcomes	<ul style="list-style-type: none"> ◆ Local flood risk mitigation programs/policies can be based on flood risk information to help prioritize certain areas for greater efficiency and effectiveness
Measurement considerations	<ul style="list-style-type: none"> ◆ Additional measurement details will be determined as implementation progresses

Action 5.2: Explore opportunities for increased climate resiliency of new buildings through local adoption of upcoming national or provincial building standards

Building standards ensure a minimum level of quality is met for new construction. A building standard for resiliency would ensure new homes are more resistant to temperature and weather extremes, improving occupant safety and reducing the risk of property damage. Updates to the provincial building code would be mandatory for new buildings and could also affect existing buildings undergoing significant renovations; however, voluntary resilience measures might be an option to help local builders adjust to anticipated changes.

Suggestions from the community	<p>Community stakeholders suggested various resilient building practices/ standards, including:</p> <ul style="list-style-type: none"> ◆ Features to protect roofs from wind damage (e.g. hurricane straps) and ice storms ◆ Built-in flood risk mitigation ◆ Use flood-resilient materials on lower levels (e.g. tiles) to minimize the potential for flood damage ◆ Passive forms of heating/cooling or other resilient features and building designs ◆ Backup generators and backup sump-pumps ◆ Secure rooftop piping and gas meters
Current practice	<ul style="list-style-type: none"> ◆ Existing building code standards (Ontario Building Code) and voluntary standards (e.g. LEED) ◆ National Research Council of Canada and Infrastructure Canada are developing national model construction codes to support more resilient development of buildings and infrastructure, which may be adopted by Ontario ◆ Intact Centre for Climate Adaptation has developed flood resilient building standards for residential communities, which the Canadian Standards Association is currently turning into a standard for flood resilient neighbourhood development ◆ The Community Energy Investment Strategy (CEIS) for Waterloo Region involves the Area Municipalities in coordinating efforts to investigate, evaluate and recommend tools to increase the energy performance and self-sufficiency of new developments

Potential partners	<ul style="list-style-type: none"> ◆ Developers, builders, architects, etc. ◆ Municipalities ◆ Region of Waterloo (Community Planning, Housing Services)
Next steps	<ul style="list-style-type: none"> ◆ The potential partners are encouraged to explore voluntary local adoption of climate resilient building standards in anticipation of upcoming changes to the provincial building code. ◆ The Region will explore the feasibility of adding climate-resilient building considerations to RFPs for new affordable housing, and will share this RFP language with Community Partners
Outcomes	<ul style="list-style-type: none"> ◆ New buildings (and their occupants) are less vulnerable to floods, storms/ winds and extreme temperatures for their decades-long lifespans ◆ Developers, builders, architects, etc. in Waterloo Region will be prepared to design and build climate-resilient structures to meet updated building standards for resiliency
Measurement considerations	<ul style="list-style-type: none"> ◆ This stakeholder group should consider whether a local target and measurable goals could be set, and how progress will be measured ◆ The Region can track the amount of affordable housing built according to resiliency considerations or standards.

Action 5.3: Seek opportunities to incorporate shade and cooling features in new development and on existing properties to reduce the urban heat island (UHI) effect

The urban heat island (UHI) effect typically affects built-up urban areas, which are more effective at trapping and amplifying heat than neighbouring rural areas. Tightly-positioned buildings, paved surfaces, conventional roofs and human activities contribute to higher ambient temperatures, whereas rural areas typically have more natural, shaded and open areas. UHIs can result in an increase in air conditioning needs (and resulting energy costs), and can make homes and outdoor spaces more difficult to live in.

Suggestions from the community	<ul style="list-style-type: none"> ◆ Heat vulnerability mapping (see Action 5.1) to identify priority areas for green space, tree planting, cool roofs and other actions to reduce the UHI effect ◆ Encourage or require new tree planting, and discourage the removal of existing trees in new developments ◆ Incentives for developers or property owners to incorporate features to reduce the UHI effect (e.g. tree islands and shade structures in parking lots, green/cool roofs, cool pavement, etc.) into new construction or existing properties ◆ Development of a green/cool roof bylaw to require and govern the construction of such roofs in new developments – which may be possible if/ when a revised Ontario Building Code includes a set standard ◆ Shade design standards - develop and include in city Urban Design Manuals, Requests for Proposals (RFPs), project charters, etc. to encourage optimal shading of new developments
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Current practice	<ul style="list-style-type: none"> ◆ Existing bylaws/policies on tree planting and preservation in site development ◆ Municipal urban forest strategies (e.g. City of Cambridge Urban Forest Plan, City of Kitchener Sustainable Urban Forest Strategy)
Potential partners	<ul style="list-style-type: none"> ◆ Academics/Researchers ◆ Area Municipalities ◆ Developers, builders, landscape architects, architects, etc. ◆ Reep Green Solutions ◆ Region of Waterloo Public Health ◆ Utilities
Next steps	<ul style="list-style-type: none"> ◆ Potential partners are encouraged to collaborate on a best practice review to learn about strategies used in other communities to encourage shade features as part of new developments/redevelopments ◆ The Community Partners will help to identify research needed (e.g. heat mapping, tree inventories, shade audits, etc.), and explore policies or programs to help reduce the UHI effect across Waterloo Region
Outcomes	<ul style="list-style-type: none"> ◆ More opportunities for people to reduce their heat and UVR exposure in the context of increasingly warm summers
Measurement considerations	<ul style="list-style-type: none"> ◆ This stakeholder group should consider whether a local target and measurable goals could be set, and how progress will be measured. Metrics could include the number of shade/reflective/green features added to new developments

Action 5.4: Seek opportunities to reduce flood risks by considering Low Impact Development (LID) features, green infrastructure, and building upgrades

Urban surfaces contribute to runoff which causes flooding. Low Impact Development (LID) and green infrastructure include a range of strategies to increase the infiltration of rainwater into the ground, thereby reducing the risk of overland flooding. Examples of LID and green infrastructure include rain gardens, permeable pavers, blue roof systems, and more. These features are typically used to increase infiltration of clean water runoff (e.g. roof drainage, runoff from green areas), as increased infiltration of contaminated water (e.g. from salted roads) is not desirable. Building upgrades to prevent flooding through basement windows, sewer backups or leaks are also critical to reducing urban flood risks.

Suggestions from the community	<ul style="list-style-type: none"> ◆ Train and/or educate contractors, developers and landscape designers on LID and green infrastructure ◆ Consider incentives and standards to encourage adoption of flood resilient features by developers ◆ Target LID for wellhead protection areas on private land where there is clean water runoff ◆ Review the results of LID and green infrastructure pilot projects, including their longer-term costs and benefits
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Suggestions from the community (continued)	<ul style="list-style-type: none"> ◆ Communicate information on best management practices for storm water, options for LID and the preservation of natural features with developers ◆ Parking lot designs can include green infrastructure to handle water runoff, but should also consider how winter snow/ice can be cleared as part of reducing salt use ◆ Build community engagement around LID to ensure public buy-in and understanding of these features and their functions ◆ Advocate for provincial guidance – specifically to complete and implement the Low Impact Development Stormwater Management guidance manual and runoff volume control standard ◆ Engage local utilities as LID and green infrastructure may impact site servicing
Current practice	<ul style="list-style-type: none"> ◆ Cities of Kitchener and Waterloo both have storm-water management (SWM) utilities that offer credit programs for implementation of LID on private lands ◆ City of Kitchener’s SWM master plan establishes a volume control target that will drive LID uptake in that City ◆ Reep Green Solutions’ RAIN storm water education and action program linked to municipal storm water credit programs Updated Storm Water Management Plans for some Area Municipalities have identified areas at risk of urban flooding and/or where storm sewers are undersized, which can at least partially be addressed by LID
Potential partners	<ul style="list-style-type: none"> ◆ Developers, builders ◆ ENGOS (e.g. Reep Green Solutions, Sustainable Waterloo Region) ◆ Grand River Conservation Authority (GRCA) ◆ Property owners ◆ Region of Waterloo and Area Municipalities ◆ Utilities
Next steps	<ul style="list-style-type: none"> ◆ Potential partners are encouraged to identify any research needed (e.g. urban flood risk mapping). This group may support stakeholder consultations to explore options that may be possible for communities across Waterloo Region
Outcomes	<ul style="list-style-type: none"> ◆ New developments and redevelopment projects in Waterloo Region will consider LID, allowing for greater infiltration of storm water, reducing the risks of erosion, runoff and possibly the risk of overland flooding
Measurement considerations	<ul style="list-style-type: none"> ◆ This stakeholder group should consider whether a local target and measurable goals could be set, and how progress will be measured. The number of LID projects implemented in new developments and redevelopments can also be monitored

Action 5.5: Encourage homeowners and landlords to improve the climate resilience of residential buildings through upgrades and/or retrofits

The creation of information, incentives or other programs to improve the resilience of community members can help reach and encourage community members to reduce climate-related risks to their buildings. Partnering with a broad selection of community organizations will help to target more specific areas or community segments for improved uptake of information, programs and incentives among homes and neighbourhoods throughout Waterloo Region.

Suggestions from the community	<ul style="list-style-type: none"> ◆ Consider both ‘one-to-one’ interventions (e.g. home visits and assessments of flood risk) and ‘one-to-many’ interventions (e.g. demonstration events, training programs) ◆ Include information on: available local, provincial and/or national incentives and cost assistance programs, insurance options, real-time flood risk information, etc. where possible and appropriate. ◆ Work with local partners to reach the broader community in effective and engaging ways (e.g. partner on events, provide information in multiple languages, targeted communications to at-risk neighbourhoods, work with retailers to provide print information or workshops, etc.) ◆ Incentives or financing for home retrofits to improve climate resilience (e.g. providing subsidies for sump pumps and backwater valves to vulnerable and low-income residents to reduce basement flooding) ◆ Education on how to maintain climate resilience retrofits ◆ Downspout disconnection, sump pump disconnection from sanitary/sewer line, cross-connection detection and enforcement ◆ Encourage engagement with, and consideration of, tenants ◆ Explore ways to improve detection and enforcement of building standards, particularly to reduce prolonged mould exposure for residents ◆ Promote the co-benefits of adaptation-related incentives or programs (e.g. climate-resilience, cost/GHG savings, etc.) ◆ Encourage or require shades, awnings, or other shade solutions on windows ◆ Encourage and support shade trees on private property (see Action 11.1) ◆ Develop green demonstration homes/infrastructure to help educate residents on resiliency upgrades
Current practice	<ul style="list-style-type: none"> ◆ Flood risk reduction information already exists with Community Partners (e.g. GRCA ‘Preparing for Floods’ website, local flood preparation guides for Ayr and New Hamburg) and broader provincial or national programs (e.g. CMHC ‘After the Flood’) ◆ Intact Centre on Climate Adaptation provides research-supported flood protection information on its website – including an April 2019 guide to reducing flood risks for residential properties ◆ A number of assistance programs and incentives exist to help people save energy and assist with bills ◆ Reep Green Solutions’ RAIN program (home/business consultations), demonstration home, and other programs ◆ City of Kitchener and City of Waterloo storm water credits for actions that reduce runoff and flood risk ◆ The Region’s Repair Assistance program helps homeowners on tight budgets fix leaks, remove mould and make other repairs
Potential partners	<ul style="list-style-type: none"> ◆ Community centres/groups and neighbourhood associations ◆ Community service organizations (e.g. multicultural centres) ◆ Grand River Conservation Authority (GRCA) ◆ Insurance companies ◆ Intact Centre on Climate Adaptation ◆ Municipalities ◆ Partners for Action

Potential partners (continued)	<ul style="list-style-type: none"> ◆ Provincial and Federal Agencies and Ministries ◆ Real Estate Agencies ◆ Reep Green Solutions and other ENGOs ◆ Region of Waterloo ◆ Waterloo Region CEMCs
Next steps	<ul style="list-style-type: none"> ◆ Potential partners are encouraged to collaborate on the promotion and delivery of new information, programs and incentives to reduce climate-related risks ◆ Potential partners are encouraged to continue sharing any existing climate-risk reduction information, program materials, research and best practices with each other to improve information, programs and incentives
Outcomes	<ul style="list-style-type: none"> ◆ Homeowners and landlords are more aware of the potential climate-related risks (e.g. flooding) and ways to become more resilient on their property ◆ Increased uptake of climate-risk mitigation programs in local residential properties and neighbourhoods
Measurement considerations	<ul style="list-style-type: none"> ◆ Measurement details will be determined as implementation progresses

Action 5.6: Encourage local businesses and managers of commercial properties to proactively improve the climate resilience of their buildings

Businesses, property managers and other larger facilities may be vulnerable to climate-related impacts and damages. Reaching these community members with climate-resilience information (such as best practices and case studies) and any incentives or other programs that may be available, will likely require a different approach as compared to household- and neighbourhood-oriented outreach (see **Action 5.5**).

Suggestions from the community	<ul style="list-style-type: none"> ◆ Demonstrate viability of certain retrofits for climate risk mitigation (e.g. through case studies) and share results with local businesses ◆ Target information/communications/incentives to flood-prone districts (e.g. businesses located in floodplains) ◆ Encourage and support shade trees on private property (see Action 11.1) ◆ Consider land use planning tools to help business districts implement actions to reduce their flood risk, improve shade/green space, etc. ◆ Conduct a best practice review of measures that businesses and institutions can take to improve the climate resiliency of their buildings/operations and share with local businesses ◆ Continue implementation of Community Energy Investment Strategy (CEIS)
Current practice	<ul style="list-style-type: none"> ◆ Enbridge (Union Gas) Savings by Design program helps builders design and construct buildings and houses with higher energy performance ◆ The CEIS may help commercial and institutional buildings to find energy solutions that improve their resilience to power disruptions (see Action 13.1)

Potential partners	<ul style="list-style-type: none"> ◆ ENGOs (e.g. Sustainable Waterloo Region) ◆ Grand River Energy and local utility companies ◆ Region of Waterloo and Area Municipalities ◆ BIAs and Chambers of Commerce
Next steps	<ul style="list-style-type: none"> ◆ Potential partners are encouraged to disseminate information on programs and best practices for resilient non-residential buildings. This may be done in the course of providing information on organizational risk assessments and climate change adaptation (see Action 15.1). ◆ The Region of Waterloo and partners will continue to implement the CEIS ◆ The Region of Waterloo will consider opportunities to demonstrate retrofits that would be applicable to commercial and institutional buildings during corporate-scope climate adaptation planning
Outcomes	<ul style="list-style-type: none"> ◆ Local businesses and property managers can identify the potential for risk reduction and co-benefits of resilient building retrofits, and are motivated to undertake retrofits that improve the climate resilience of their buildings
Measurement considerations	<ul style="list-style-type: none"> ◆ Additional measurement details will be determined as implementation progresses



"I worry that our infrastructure was not built with these weather extremes in mind, and that costs and dangers will increase with the extremes of the weather."

- survey respondent



Goal 2: Built environment

Objective 6: Improve the longevity and resilience of infrastructure to extreme weather and temperatures

Action 6.1: Periodically review materials, design options, and best practices for new climate-resilient infrastructure, and share best practices between municipalities and other key stakeholders across Waterloo Region

Buildings and infrastructure are designed and constructed according to design standards and accepted practice adopted by engineering professions. One important aspect of these design standards is underlying assumptions of how environmental factors will affect the behavior of the overall structure itself as well as the individual material components of the design. Over the longer term, changing climate conditions may create new risks with regard to the design of civil structures; as such, it will be important for Regional and area municipal staff to share best practices and investigate potential options for climate-resilient infrastructure materials and design on a periodic basis.

The Region of Waterloo and Area Municipalities in Waterloo Region participate in a Joint Design Standards group, which meets periodically to discuss infrastructure design standards. In addition, the Regional Public Works Commissioners of Ontario (RPWCO) has a Climate Change Sub-Committee which is looking into best practices/processes around climate change and infrastructure. The RPWCO will likely make recommendations to improve the climate resilience of infrastructure across Ontario, and Regional staff will continue to connect with and/or participate in this group.

These current practices will continue to help local municipal partners make infrastructure design choices that take climate change into account.

Action 6.2: Encourage property owners and managers to keep storm drains clear of leaves and other debris to reduce the risk of flooding

Catch basin and storm drain clearing is an efficient and cost-effective means of preventing costly maintenance from storm drain blockages and also in preventing pollutants from reaching provincial water bodies. Storm drains can become clogged with leaves, snow/ice or other debris, preventing water drainage into the storm water system and increasing the risk of localized flooding. As such, initiatives to keep storm drains clear of debris are important to reduce improper drainage and flood risk.

Suggestions from the community

- ◆ Encourage residents to use in-place mulching and yard waste bags
- ◆ Develop public education/messaging on clearing catch basins
- ◆ Support Reep Green Solutions' storm drain adoption program, possibly with a GIS program to help identify neighbourhoods where citizen storm drain adoption would be helpful and not dangerous
- ◆ Consider flood risks as part of evaluating curbside leaf collection and street cleaning
- ◆ Explore possibility of storm drain markers to help identify storm drains and keep them clear in the winter

Current practice	<ul style="list-style-type: none"> ◆ Reep Green Solutions is supported by Green Communities Canada, Partners for Action and the City of Kitchener to encourage the “Adopt a Storm Drain” program, which includes information and an interactive mapping tool ◆ Region of Waterloo and City websites already encourage the use of yard waste bags, onsite mulching and backyard composting
Potential partners	<ul style="list-style-type: none"> ◆ Community centres/groups and neighbourhood associations ◆ ENGOs ◆ Reep Green Solutions ◆ Region of Waterloo and Area Municipalities
Next steps	<ul style="list-style-type: none"> ◆ As part of reporting on the results of the current Adopt a Storm Drain program, Reep Green Solutions is encouraged to recommend how the program might continue and improve with continued support, if appropriate ◆ Potential partners are encouraged to include information on keeping storm drains clear with existing communications (e.g. the use of yard waste bags, benefits of on-site mulching and composting to manage fallen leaves, etc.) if/where appropriate
Outcomes	<ul style="list-style-type: none"> ◆ Increase in community behaviours that help to keep catch basins/storm drains clear of leaves, snow/ice and other debris, especially in the fall and winter
Measurement considerations	<ul style="list-style-type: none"> ◆ The number of adopted storm drains across Waterloo Region can indicate progress on this action, and a study of participant experiences may also help identify areas for improvement





Goal 2: Built environment

Objective 7: Reduce transportation disruptions due to extreme weather events and improve safety of travel on roads, sidewalks and trails

Action 7.1: Promote safer travel practices, choices and alternatives throughout the region

Extreme weather can make it dangerous to travel, as icy roads, debris from storm damage, flooding, and extreme heat can be dangerous hazards. Safer travel practices might include defensive driving, using snow tires or studded bicycle tires; safer choices and alternatives might include changing your mode of travel, or avoiding travel altogether during an extreme weather event.

Suggestions from the community	<ul style="list-style-type: none"> ◆ Promote safe travel practices and training opportunities with travelers across all modes ◆ Promote use of public transit as a safer way to travel in unsafe conditions ◆ Encourage local organizations to develop safe travel and/or telecommuting policies for employees
Current practice	<ul style="list-style-type: none"> ◆ ClimateActionWR transportation sub-group explores/proposes new actions to help reduce local transportation-related GHG emissions ◆ Travelwise provides a membership program on behalf of the Region of Waterloo to encourage carpooling and alternative transportation ◆ The Region of Waterloo aims to increase the use of alternative transportation with the approved Transportation Master Plan (2018) and Active Transportation Master Plan (2014) ◆ The Region of Waterloo and WRPS are collaborating on Safe Roads Waterloo Region, an education campaign to promote safe driving practices
Potential partners	<ul style="list-style-type: none"> ◆ ENGOs and community programs (e.g. ClimateActionWR, Sustainable Waterloo Region, and Travelwise) ◆ Region of Waterloo (Transportation and Environmental Services, communications staff) ◆ Waterloo Region Police Services (WRPS)
Next steps	<ul style="list-style-type: none"> ◆ Potential partners will explore opportunities to encourage safer travel practices, choices and alternatives with community members in the context of extreme weather events
Outcomes	<ul style="list-style-type: none"> ◆ Travellers in Waterloo Region are better prepared for extreme weather conditions and feel empowered to make safer travel choices
Measurement considerations	<ul style="list-style-type: none"> ◆ Implementing partners should consider whether a target and measurable goals could be set, and how progress will be measured

Action 7.2: Explore how traffic flows and communications across municipal boundaries can be enhanced to better facilitate emergency response and business continuity in severe weather events

Roads closures are disruptive to transportation in the community. In addition to regular road maintenance and scheduled upgrades, these closures may be caused by damages to roads and bridges caused by freeze/thaw cycles, erosion and/or flooding, which may be influenced by changing climate conditions. Emergency services, local businesses and daily commuters rely on knowledge of road conditions to travel efficiently. Negative impacts of road closures to these stakeholders (e.g. safety, economic) may be reduced with enhanced traffic management and information sharing across Waterloo Region.

Suggestions from the community	<ul style="list-style-type: none"> ◆ Revise the existing Road Closure Protocol (established 2018) to frame it as a supporting plan ◆ Develop a Communications/Media Emergency supporting plan to raise public awareness of road closures due to emergencies (e.g. flooding or washout, etc.) ◆ Provide information on snow/ice clearing status to public, businesses ◆ Develop Emergency Detour Routes (EDRs) to improve emergency preparedness plans in areas that may be affected by flooding
Current practice	<ul style="list-style-type: none"> ◆ Pingstreet app and online map tools allow members of the public to access construction-related road closure information for Regional roads as well as for Cambridge, Kitchener and Waterloo ◆ Road closures due to planned construction are coordinated between Area Municipalities, but spot repairs may not be ◆ GRCA is collaborating with Waterloo Region CEMCs to share flood risk and road/bridge closure information with emergency services
Potential partners	<ul style="list-style-type: none"> ◆ Grand River Conservation Authority (GRCA) ◆ Region of Waterloo and Area Municipalities ◆ Waterloo Region Community Emergency Management Coordinators (CEMCs)
Next steps	<ul style="list-style-type: none"> ◆ The Region of Waterloo will convene a meeting with key local partners to examine if and how traffic coordination between the Area Municipalities can improve ◆ The Region of Waterloo and Community Partners will consider how to consult with affected groups and consider if traffic information on weather-related road closures can be improved and shared more effectively with community stakeholders
Outcomes	<ul style="list-style-type: none"> ◆ Impacts to roads causing damage and the need for repairs will have less of an impact on emergency services and other local traffic ◆ Businesses and other organizations may be better able to plan business travel and shipment routes, reducing the impacts of extreme weather on the local economy
Measurement considerations	<ul style="list-style-type: none"> ◆ Measurement details will be determined as implementation progresses

Action 7.3: Improve winter travel conditions for pedestrians

Snowy and icy conditions make winter travel difficult for everyone, but pedestrians and other sidewalk and trails users can be more heavily impacted. With a projected 40% increase in freezing rain events by the 2050s, and with several difficult seasons for snow and ice accumulation in recent history, community members want improved winter mobility and safety, which may help to reduce injuries from falls and improve social connectedness in the wintertime.

Suggestions from the community	<ul style="list-style-type: none"> ◆ Incorporate reporting of icy sidewalks into Pingstreet ◆ Identify priority needs for snow/ice clearing of sidewalks and trails (e.g. between shelters and social services, linking communities to GRT stops, grocery stores, near seniors' homes, or to support AODA accessibility regulations) and implement a system of clear responsibility to ensure timely clearing of those areas ◆ Encourage local neighbourhood snow clearing programs (e.g. Snow Buddies) ◆ Explore possibility of expanded municipal sidewalk clearing ◆ Promote fall/injury prevention information ◆ Conduct targeted improvements to infrastructure and areas of concern (e.g. addressing drainage-related concerns that cause icy walking surfaces) ◆ Expand use of protective/anti-slip footwear ◆ Expand Reep Green Solutions' RAIN program to include winter precipitation recommendations (i.e. ice build-up, freeze-thaw)
Current practice	<ul style="list-style-type: none"> ◆ Existing de-icing policies and strategies with Area Municipalities and Region for sidewalk clearing ◆ Municipal winter maintenance operations, such as GRT stops and platforms (Region), municipal properties, certain sidewalks (e.g. where there are no homes or businesses), roads and crosswalks, etc. ◆ Existing community-level snow clearing programs (e.g. Kitchener Snow Blower sharing program and Snow Angels program) and programs from different providers connect snow shovelers with people in need of shoveling (e.g. Community Support Connections, Waterloo Home Support Services)
Potential partners	<ul style="list-style-type: none"> ◆ Community centres/groups and neighbourhood associations ◆ Community Support Connections ◆ Municipalities (e.g. operations staff, parks/rec/culture staff) ◆ Reep Rain Program ◆ Region of Waterloo (Smart About Salt/Salting Shift); Public Health (falls prevention); operations staff; contractor for wastewater facilities, etc.
Next steps	<ul style="list-style-type: none"> ◆ Potential partners are encouraged to identify any gaps in current programs/strategies and to find opportunities for improvement that may be jointly-supported to improve winter walking conditions
Outcomes	<ul style="list-style-type: none"> ◆ Sidewalks across Waterloo Region become more accessible and safer for pedestrians in the wintertime, making it easier for people to visit friends/family (or be visited) and improving access to important services
Measurement considerations	<ul style="list-style-type: none"> ◆ This inter-municipal working group should consider whether a local target and measurable goals could be set, and how progress will be measured



Goal 3: Natural environment and water

Objective 8: Expand the use of natural features and green infrastructure to better manage storm water runoff and decrease flood risk

Action 8.1: Continue seeking opportunities to protect riparian zones, wetlands and other natural areas to help manage storm water and flood risk

Riparian zones are areas that surround water bodies (e.g. streams, rivers and ponds) and typically act as important transitions between other environments and surface water resources. Wetlands are areas of land where the soil is covered by water and can take many forms (e.g. swamps, lakes, and bogs). Riparian zones and wetlands help protect watercourses from erosion and runoff (improving water quality), reduce water temperatures and can reduce the risk of flooding. These naturalized areas can also create important habitat for local wildlife and pollinators.

Suggestions from the community	<ul style="list-style-type: none"> ◆ Increased stewardship funding for the naturalization, maintenance and/or enhancement of natural areas, focusing on aquatic ecosystems, riparian areas and wetlands ◆ Continued maintenance of river banks, dikes, etc. to remove debris, prevent erosion, and protect buildings. ◆ Increased education to landowners living near natural areas (including watercourses, wetlands) concerning stream/creek naturalization and reducing encroachment ◆ Restoring buried rivers and creeks throughout the Region (i.e. daylighting) to reduce strain on storm sewer systems
Current practice	<ul style="list-style-type: none"> ◆ Municipal Subwatershed Plans, Storm Water Management Plans and/or Official Plans typically promote conservation of natural features ◆ Grand River Conservation Authority (GRCA) Water Management Plan ◆ The Region completed a case study in 2016 to look at how best to balance transportation needs and environmental considerations in the Laurel Creek Headwaters Environmentally Sensitive Lands (ESL) ◆ City of Waterloo Silver Lake and Laurel Creek rehabilitation project ◆ The Rural Water Quality Program (RWQP) helps reduce rural runoff and flooding (see Action 13.1)
Potential partners	<ul style="list-style-type: none"> ◆ ENGOS ◆ Grand River Conservation Authority ◆ Property owners ◆ Region of Waterloo and Area Municipalities ◆ Region of Waterloo Ecological and Environmental Advisory Committee (focus on Environmentally Sensitive Policy Areas) ◆ Waterloo Federation of Agriculture and other agricultural/rural stakeholders

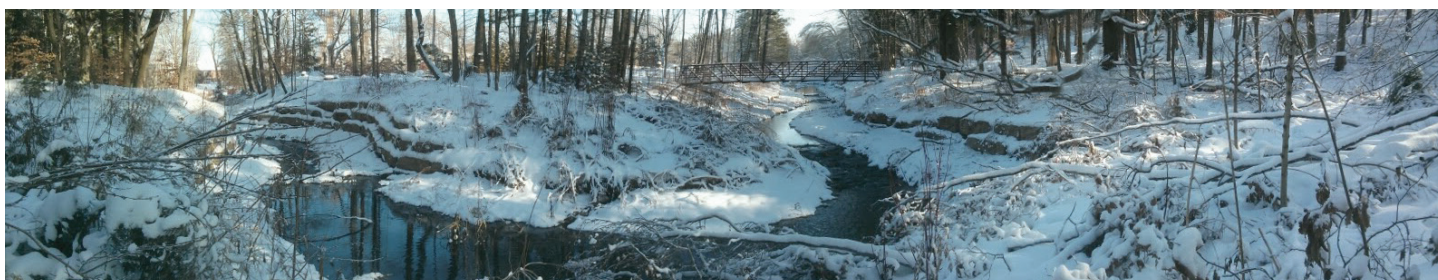
Next steps	<ul style="list-style-type: none"> ◆ Community Partners will help identify opportunities (e.g. programs, plans, partnerships) to improve riparian zones and natural features to reduce runoff, erosion and flood risk
Outcomes	<ul style="list-style-type: none"> ◆ Improved control and management of storm water through naturalized processes
Measurement considerations	<ul style="list-style-type: none"> ◆ This stakeholder group should consider whether a local target and measurable goals could be set, and how progress will be measured

Action 8.2: Continue seeking opportunities to acquire or dedicate land and natural areas for conservation, and to enhance the management and restoration of existing natural areas

In comparison to conventional landscaping, natural landscapes can have many ecological, environmental, educational, recreational and economic benefits. Protected and restored natural areas can help address climate change by conserving biodiversity, protecting ecosystem services (such as water infiltration and flood control), and capturing and storing carbon. While natural landscapes may be low maintenance and self-renewing, they do still require ongoing maintenance to control invasive species and keep valuable ecological functions intact.

Suggestions from the community	<ul style="list-style-type: none"> ◆ Develop stewardship programs for public lands (e.g. roadside lands, public parks, agricultural lands, Regional forests, etc.) ◆ Increase the Region's Community Environment Fund to increase stewardship for private landowners ◆ Explore potential for long-term partnerships with local partners and increased funding for long-term retention of natural and protected lands ◆ Utilize developer dedications to expand conservation and restoration of natural areas ◆ Research the long-term, cumulative growth impacts on natural areas and agricultural lands in Waterloo Region ◆ Research and map the Region's current "climate corridors" – lands that provide connected routes for species to move between areas due to climate change – and prioritize areas for conservation/protection. ◆ Continue to educate the community about the unique value of ecosystems within Waterloo Region, and what they can do to protect them ◆ Share guidance/resources with private landowners or provide incentives to encourage naturalizing, conservation and protection of private lands that still conform to local bylaws – may related to water efficient landscapes in Action 10.2
Current practice	<ul style="list-style-type: none"> ◆ The Region, through the Regional Official Plan (ROP) has designated approximately 8500 acres of land as Environmentally Sensitive Landscapes. ◆ The ROP also encourages Area Municipalities to secure ownership of elements of the Greenlands Network and to prepare management plans for these lands, to maintain, enhance or, wherever feasible, restore their ecological functions (Policy 7.I.10).

Current practice (continued)	<ul style="list-style-type: none"> ◆ Region of Waterloo Council approval of the Regional Forest Management Plan in 2006. Among the properties owned and managed by the Region are sixteen woodlands totalling approximately 435 hectares (1075 acres) which are covered by the Regional Forest Management Plan. ◆ Since 1976, the Region has designated over 90 Environmentally Sensitive Policy Areas (ESPAs). ◆ The GRCA owns about 19,400 hectares (48,000 acres) of land in 430 parcels, representing about 2.8 per cent of the land in the Grand River watershed. The GRCA's Property Department handles the acquisition, sale, and management of much of the property. ◆ City Official Plans contain policies guiding the acquisition of environmental lands and policies for restoration areas (e.g. Kitchener Ecological Restoration Areas) ◆ Land trusts in Waterloo Region, including Branchton Land Trust and raresites Land Trust, and guidance from the Nature Conservancy of Canada and/or Ontario Land Trust Alliance ◆ Ongoing conservation and restoration initiatives from local ENGOs, such as Waterloo Region Nature and rare Charitable Research Reserve
Potential partners	<ul style="list-style-type: none"> ◆ Region of Waterloo (*lead) ◆ ENGOs (e.g. raresites Land Trust) ◆ Grand River Conservation Authority (GRCA) ◆ Municipalities ◆ Property Owners ◆ Provincial ministries and agencies
Next steps	<ul style="list-style-type: none"> ◆ Community Partners will consider how to engage potential partners and options to take stock of land conservation strategies currently underway in Waterloo Region, including who owns the land and is responsible for maintenance, etc. ◆ The Region of Waterloo and Community Partners will collaborate on a community forum to discuss community-based approaches to conserving natural heritage properties in Waterloo Region. As part of this discussion, the group should consider whether a local target and measurable goals could be set
Outcomes	<ul style="list-style-type: none"> ◆ An increase in the amount of protected land within Waterloo Region, and improvement in the health and resilience of natural landscapes
Measurement considerations	<ul style="list-style-type: none"> ◆ Area of conserved/protected land in Waterloo Region can be tracked over time. Priority for certain key areas may lead to specific goals that will only be achieved when the targeted land is protected





Goal 3: Natural environment and water

Objective 9: Conserve and protect surface water and groundwater resources from urban runoff pollution

Action 9.1: Explore opportunities to improve snow- and ice-clearing response methods to reflect changing weather patterns, and aim to effectively clear roads, parking lots and walking surfaces with less salt

Previous studies have found that road salt contaminates both groundwater and surface water and washes into creeks, rivers, lakes, and ultimately into drinking water. With an increase in icy conditions requiring the use of de-icing strategies, the proper management of salt handling, storage and application of road salt should be coupled with an exploration of alternative snow and ice-clearing strategies (e.g. non-salt de-icers, snow brushes, etc.) to reduce salt use, thereby reducing the impacts of salt runoff on water resources.

Suggestions from the community	<ul style="list-style-type: none"> ◆ Conducting research on alternative treatments (such as brine, beet juice or other options) and best practices for winter management – to reduce salt use while still maintaining adequate levels of service ◆ Facilitating coordinated discussions on best practices, joint efforts, and standards for clearing between Area Municipalities ◆ Improve communications to local residents and businesses on their role in the maintenance of sidewalks and parking lots, appropriate salt application rates, and best management practices during freezing rain or snow events
Current practice	<ul style="list-style-type: none"> ◆ The Region of Waterloo's Transportation and Operations currently follow a comprehensive salt management plan. ◆ The Region of Waterloo only hires Smart About Salt certified contractors with salt management training and Region of Waterloo winter maintenance staff receive Smart About Salt Training ◆ Source Protection Plan requires certain properties in Wellhead Protection Areas to follow Risk Management Plans for their winter maintenance ◆ Region of Waterloo promotes responsible salt usage through education programs including a Salt Management website, the Salting Shift program, and the Waterloo Wellington Children's Groundwater Festival ◆ Region of Waterloo is currently working with local businesses to encourage responsible salt use and best practices
Potential partners	<ul style="list-style-type: none"> ◆ Grand River Conservation Authority (GRCA) ◆ Elementary and secondary schools ◆ Municipalities (service staff) ◆ Post-secondary institutions ◆ Property owners with parking lots and/or walkways ◆ Region of Waterloo (Water Services)

Next steps	<ul style="list-style-type: none"> ◆ The Region of Waterloo will continue collaborating with potential partners on salt management best practices and potential alternatives ◆ The Region of Waterloo will continue to deliver programs to encourage responsible salt use throughout the community, such as Salting Shift and Smart About Salt
Outcomes	<ul style="list-style-type: none"> ◆ A reduction of salt runoff from paved and hard surfaces, reducing the accumulation of sodium and chloride in the local water system
Measurement considerations	<ul style="list-style-type: none"> ◆ GRCA's measurements of sodium and chloride concentrations in source water wells across Waterloo Region will be a key indicator

Action 9.2: Enable residents and landowners to adopt landscaping practices that improve water infiltration or reduce the need for watering

Water-efficient landscaping practices can reduce or eliminate the need for watering. Native species offer many advantages, such as better adaptation and providing food for native pollinators. The practice of xeriscaping uses creative landscaping techniques, such as grouping of drought-resistant vegetation, and creates an aesthetically interesting natural environment. Rain gardens use species that can handle both drought and heavy moisture, and can help retain and infiltrate runoff and reduce the risk of flooding.

Suggestions from the community	<ul style="list-style-type: none"> ◆ Increase education to residents on water efficient landscaping practices, including plantings of native species and opportunities to increase local biodiversity ◆ Support the development of demonstration gardens (e.g. xeriscaping, native species/naturalization, rain gardens, pollinator gardens, etc.) with partners to educate regional homeowners and property owners about alternatives to traditional landscaping while promoting practices that conserve water and protect the environment ◆ Encourage community landscaping design and maintenance workshops for residents in collaboration with Community Partners
Current practice	<ul style="list-style-type: none"> ◆ The Region of Waterloo Water Efficiency Master Plan encourages water efficiency within homes, businesses and other organizations ◆ The Region of Waterloo and the GRCA actively monitor surface and ground water quality and quantity ◆ The Region of Waterloo's Water Conservation Bylaw is in effect every year from May 31 to September 30 and drives adaptation in local landscaping ◆ Weather stations throughout the Region that monitor precipitation amounts ◆ Reep Green Solutions' RAIN program ◆ Ongoing rain barrel distribution to residents ◆ Several institutions, businesses and other organizations across Waterloo Region already use environmentally-friendly landscaping design and maintenance practices
Potential partners	<ul style="list-style-type: none"> ◆ Community centres/groups and neighbourhood associations ◆ Grand River Conservation Authority (GRCA)

Potential partners (continued)	<ul style="list-style-type: none"> ◆ Local ENGOs (e.g. horticultural societies, Reep Green Solutions, Waterloo Region Nature, others) ◆ Municipalities ◆ Post-secondary institutions ◆ Region of Waterloo (Water Services)
Next steps	<ul style="list-style-type: none"> ◆ The Region of Waterloo can consider including water-efficient landscaping information in the Region's Water Efficient Technology (WET) Program ◆ The Region of Waterloo will continue to include xeriscaping, rain gardens, and/or other water-efficient and environmentally-friendly landscaping practices as part of the Region's Naturescaping Series of seminars, as appropriate ◆ Potential partners are encouraged to consider opportunities to promote water-efficient landscaping practices with new audiences across the community
Outcomes	<ul style="list-style-type: none"> ◆ A reduction in the amount of water used for local landscaping and lawn maintenance purposes
Measurement considerations	<ul style="list-style-type: none"> ◆ Measurement details will be determined as implementation progresses





Goal 3: Natural environment and water

Objective 10: Monitor, coordinate, plan for and mitigate the spread of invasive species in the natural environment

Action 10.1: Encourage and support broad community participation in the detection and management of invasive species

Invasive species represent the second most significant cause of species extinction worldwide, after habitat loss. Invasive species can also interfere with agricultural and horticultural industries, affect natural forest regeneration and damage the urban tree canopy, and in some cases can have health and safety, economic and aesthetic impacts. In addition to human activities (such as trade), climate change may make it easier for some invasive species to establish themselves and thrive in Waterloo Region.

Suggestions from the community	<ul style="list-style-type: none"> ◆ Identify and report on the status and types of invasive species present in Waterloo Region ◆ Encourage use of EDDMapS (Early Detection & Distribution Mapping System) among community stakeholders to document the presence of invasive species in Waterloo Region ◆ Partner with neighbouring jurisdictions and other levels of government (e.g. Ontario Invasive Plants Council, Ontario Invasive Species Centre, CFIA) to stay up to date on best management practices and plan for new invasive species threats ◆ Determine potential roles for Regional and area municipal staff, local organizations and landowners to identify and/or assist in the removal of invasive species ◆ Explore possibility of a more formal invasive species response strategy, which could also include funding and guidance materials for private landowners
Current practice	<ul style="list-style-type: none"> ◆ The GRCA has a program for managing invasive species, such as emerald ash borer and giant hogweed ◆ Ontario Weed Control Act places a legal obligation on farmers and landowners (agricultural/horticultural land use) to manage noxious weed species on their property, and OMAFRA maintains a list of noxious weeds in Ontario which must be controlled ◆ Rare Charitable Research Reserve manages invasive species on its own properties and undertakes research on the management of some of these invasive species
Potential partners	<ul style="list-style-type: none"> ◆ ENGOs (e.g. horticultural societies, Waterloo Region Nature, rare Charitable Research Reserve, others) ◆ Grand River Conservation Authority (GRCA) ◆ Nurseries, landscaping industry and the agricultural sector ◆ Post-secondary institutions ◆ Provincial ministries and agencies ◆ The Region of Waterloo and Area Municipalities

Next steps	<ul style="list-style-type: none"> ◆ The Region of Waterloo will continue to review best practices of neighbouring municipalities to learn how they are planning for and addressing invasive species ◆ Community Partners will help to identify key local stakeholders (e.g. large private land owners, Area Municipalities, ENGOs, etc.) to consult in the development of a more formal invasive species response strategy, and can help identify external funding opportunities to support strategy development and/or other invasive species management practices
Outcomes	<ul style="list-style-type: none"> ◆ More community members become involved in the detection and management of invasive species
Measurement considerations	<ul style="list-style-type: none"> ◆ Local targets, measurable goals and measurement criteria can be identified as part of developing this strategy with stakeholders





Goal 3: Natural environment and water

Objective 11: Monitor, maintain and improve the diversity and resiliency of urban trees and forests

Action 11.1: Work with local partners to explore opportunities for tree planting, tree maintenance, and other strategies to improve tree coverage in urban areas

Urban forested areas (e.g. backyard trees, parks, etc.) and street trees offer many community benefits – they can help reduce the urban heat island effect, help manage storm water runoff, and provide intangible benefits to communities, such as improved psychological and social wellbeing. Protecting the health of our trees requires long-term planning, ongoing maintenance and short-term crisis management.

Suggestions from the community	<ul style="list-style-type: none"> ◆ Encourage increased tree maintenance and proactive pruning (i.e. with incentives or information) to maintain healthy urban forests on private lands across all Area Municipalities ◆ Ensure optimal tree planting by developing and sharing guidance materials on root growth, soil requirements, species selection, etc. with residents and other property owners ◆ Explore challenges facing municipal street tree planting (e.g. appropriate budgeting, utility conflicts, ongoing maintenance costs, liability, soil volume, etc.) ◆ Monitor areas of increased urban heat island and urban flooding to determine strategic areas for planting ◆ When planting street trees, use best practices (e.g. age diversity, species diversity, native species, pollinators, etc.) ◆ Develop a funding mechanism/program to subsidize tree planting costs for residents, especially for native trees and plant species. ◆ Explore ways to support or require replacing of removed trees on private property ◆ Consider developing a Citizen Pruners program (volunteers training by a professional arborist) to help maintain urban trees ◆ Explore opportunities to naturalize public spaces (see Actions 8.1, 8.2)
Current practice	<ul style="list-style-type: none"> ◆ Many of the Area Municipalities have their own urban forestry plans, including: Kitchener Sustainable Urban Forestry Plan; Cambridge Urban Forest Plan; Waterloo Urban Forest Policy; Town of Elmira's tree inventory ◆ City of Kitchener's Love My Hood program supports tree planting and other neighbourhood greening projects ◆ Woolwich Healthy Communities, Waterloo Region Environment Network, and other ENGOS often encourage or support tree planting and/or maintenance
Potential partners	<ul style="list-style-type: none"> ◆ Grand River Conservation Authority (GRCA) ◆ Nurseries, tree service companies, landscaping industry ◆ Post-secondary institutions ◆ Rare Charitable Research Reserve

Potential partners (continued)	<ul style="list-style-type: none"> ◆ Reep Green Solutions and other ENGOS ◆ Region of Waterloo and Area Municipalities (e.g. public works, parks, forestry)
Next steps	<ul style="list-style-type: none"> ◆ Potential partners are encouraged to discuss urban forestry plans, share information/research, address challenges facing municipal street tree planting/maintenance, and potential to include climate change considerations
Outcomes	<ul style="list-style-type: none"> ◆ Improvements to the size and diversity of the urban tree canopy, and improved shading and storm water management for the community, including residents
Measurement considerations	<ul style="list-style-type: none"> ◆ Measurement criteria from existing municipal Urban Forestry Plans/Policies can be used (e.g. the number of trees in a designated urban area)





Goal 3: Natural environment and water

Objective 12: Maximize effective nutrient management and retention to reduce runoff from agricultural practices

Action 12.1: Continue to support and explore opportunities to enhance or improve the Rural Water Quality Program

As the majority of land in the Region of Waterloo and the Grand River watershed is privately owned, landowners have an important role to play in protecting and improving the health of the watershed. The Rural Water Quality Program (RWQP) provides grants to farmers undertaking projects to protect water quality on their land. The program offers grants ranging from 50 per cent to 100 per cent of the cost of selected best management practices (BMPs). Money is available for projects including stream fencing, tree planting, manure storage, well decommissioning and more.

Suggestions from the community	<ul style="list-style-type: none"> ◆ Expanding the types of projects that can be captured under the program (e.g. relating to flood risk reduction, climate change adaptation) ◆ Support for ongoing maintenance costs of some BMP projects ◆ Increase involvement and engagement with Rural Land Owners with regards to RWQP ◆ Increase monitoring of BMPs under severe weather events ◆ Expand guidance on BMP implementation and maintenance ◆ Explore complementary programs (e.g. ALUS Canada) to the RWQP to improve rural/agricultural landowner stewardship and conservation ◆ Explore opportunities to expand BMPs with regenerative agriculture or other farming practices to achieve the watershed management goals of the RWQP, while also achieving ecological and/or climate change mitigation co-benefits
Current practice	<ul style="list-style-type: none"> ◆ The Rural Water Quality Program was created by farmers, who also continue to oversee the program. Local committees, with representation from agricultural organizations, prioritize BMP applications and decide how to most-appropriately direct the available funding. The Grand River Conservation Authority administers the program, which is funded by the Region of Waterloo. The RWQP and eligible projects are reviewed and updated as part of a 5-year renewal cycle – the program evolves over time
Potential partners	<ul style="list-style-type: none"> ◆ Grand River Conservation Authority (GRCA) (*lead) ◆ Agricultural community ◆ Region of Waterloo
Next steps	<ul style="list-style-type: none"> ◆ RWQP partners will continue to conduct periodic reviews of the RWQP program to determine areas of possible improvement; the GRCA's Lower Conestoga Review report will help to inform next steps for the RWQP ◆ RWQP partners are encouraged to explore opportunities for enhanced funding in priority areas and additional action types (e.g. targeting certain locations that are contributing more to nutrient runoff, 4R nutrient stewardship programs, etc.)

Outcomes	<ul style="list-style-type: none"> ◆ Reduced nutrient levels and overall improvements in surface water quality, as well as improvements to soil erosion and sedimentation issues in local watercourses
Measurement considerations	<ul style="list-style-type: none"> ◆ GRCA can continue to track program uptake and investment resulting from the RWQP

Action 12.2: Explore opportunities to better understand and share best practices to address agricultural water quality issues and risks

Agricultural runoff is water escaping from farm fields due to rain, melted snow, infiltration, or tile drainage. This runoff water can contain fertilizers, pesticides, animal waste and/or soil particles which can contaminate surface water and ground water. These potential impacts may increase in severe weather and changing climate conditions, but can be minimized by using management practices that are adapted to local conditions.

Suggestions from the community	<ul style="list-style-type: none"> ◆ Partnering with local Universities on water quality studies and research, and/or translating current and ongoing research into best practices to share with agricultural stakeholders ◆ Seek opportunities to conduct additional agricultural non-point runoff impact assessments, potentially including tile drainage and water escaping from fields ◆ Identify and monitor temporary/transient river systems ◆ Monitor whether changes made to reduce agricultural runoff and flood risk are kept in place and in good condition
Current practice	<ul style="list-style-type: none"> ◆ The Ontario Farmland Trust's Farmland Protection Program is the foundation of the organization's work, permanently protecting farmland by working directly with farmers and other rural landowners to ensure their land remains available for agricultural and conservation uses in the long-term ◆ The Rural Water Quality Program managed by the GRCA and the Region of Waterloo currently supports Farmers who wish to implement BMPs to manage water quality issues on their farms. ◆ GRCA has conducted GIS modelling exercises to identify areas of high erosion on farm fields and certain areas of the watershed ◆ Region of Waterloo Public Health provides private well water testing for bacteria, nitrates and fluoride
Potential partners	<ul style="list-style-type: none"> ◆ Academic researchers ◆ Agricultural community ◆ Grand River Conservation Authority (GRCA) ◆ Region of Waterloo (Water Services - Source Water Protection)
Next steps	<ul style="list-style-type: none"> ◆ Potential partners are encouraged to suggest relevant new research and best practices, and how to communicate this information with the local agricultural community in partnership with other climate adaptation communications included in this Plan

Next steps (continued)	◆ Potential partners are encouraged to consider if and how additional agricultural non-point runoff assessments or other water course/quality monitoring can be funded and undertaken around agricultural lands
Outcomes	◆ Better understanding of risks to local water quality, and potential improvement in runoff from agricultural lands
Measurement considerations	◆ Measurement details will be determined as implementation progresses

“Water quality is essential to the well-being of every person in our community. Run-off from farmers fields and erosion due to increased flooding is a big concern.”

- survey respondent





Goal 4: Energy and economy

Objective 13: Improve the resilience of energy infrastructure to weather-related disruptions

Action 13.1: Explore opportunities and feasibility of decentralized energy generation, storage, and distribution in Waterloo Region

Decentralized energy can simultaneously improve energy security, reduce carbon pollution and help the community adapt to vulnerabilities (e.g. the risk of power outages to business continuity) arising from a changing climate. An important step in improving energy security will be to determine local energy generation, storage and distribution opportunities as supported by the Region of Waterloo's Community Energy Investment Strategy (CEIS), and take steps to increase the local uptake of these technologies. These may include:

- ◆ Biomass- or biogas-fuelled district energy systems
- ◆ Ground mounted Solar PV community energy generation
- ◆ Combined heat and power or energy storage for some ICI customers and multi-residential buildings, such as condominiums and apartment buildings
- ◆ Micro-grids in industrial or business parks

Community stakeholders suggested several of these local energy technologies as potential solutions to the risk of power outages caused by extreme weather. These ideas align directly with the priorities of the CEIS, which has the support and direct participation of Area Municipalities and energy utility companies in Waterloo Region. The CEIS was adopted in February, 2018 to "improve and sustain Waterloo Region's economic competitiveness and quality of life through the coordination of targeted energy investments" including decentralized energy generation which may improve the reliability of energy access of some customers. The Region will continue to work with its local partners to implement the CEIS for a range of community benefits, including (but not limited to) improved energy reliability.

Action 13.2: Increase the resilience of electricity distribution infrastructure to extreme weather events through strategic planning and retrofits

Extreme weather events (ice storms, strong winds/storms, etc.) may cause power outages. Local distribution companies (LDCs) are responsible for managing electricity distribution infrastructure, which may be more vulnerable due to changing climate conditions. LDCs already work to restore power as quickly as possible when an outage occurs, and also plan for and invest in long term reliability of the local system. LDCs may consider how climate change could influence these practices when planning for the future.

Suggestions from the community	<ul style="list-style-type: none"> ◆ Perform a localized vulnerability assessment of local distribution infrastructure to identify key opportunities for improvement ◆ Partner with utility companies on urban forest programs to ensure safety and protection of energy infrastructure ◆ Investigate feasibility of burying power lines to prevent power outages caused by extreme weather ◆ Include long-term tracking of direct and indirect costs associated with power outages/damages for full-cost accounting, which may help justify upgrades/system hardening
Current practice	<ul style="list-style-type: none"> ◆ Ontario's 2017 Long-Term Energy Plan (LTEP) included a requirement for the Ontario Energy Board (OEB) and Independent Electricity System Operator (IESO) to provide utility companies with guidance on climate change adaptation. The OEB's Implementation Plan for the 2017 LTEP confirmed that OEB will provide a vulnerability assessment to Ontario energy distributors to help utilities consider and address the impacts of climate change
Potential partners	<ul style="list-style-type: none"> ◆ Municipalities (e.g. planning, forestry, parks departments) ◆ Utilities (LDCs)
Next steps	<ul style="list-style-type: none"> ◆ The Region of Waterloo will continue to meet with local LDCs to exchange information on climate projections and potential impacts, learn about current system resilience/hardening considerations being made, and discuss the potential implications of upcoming OEB guidance around vulnerability assessments
Outcomes	<ul style="list-style-type: none"> ◆ Improved energy security and service continuity during and after extreme weather events in Waterloo Region
Measurement considerations	<ul style="list-style-type: none"> ◆ LDCs report on the number, duration and types of power outages to the OEB, including weather-related outages





Goal 4: Energy and economy

Objective 14: Enable local organizations, businesses and community members to be more resilient to power interruptions

Action 14.1: Encourage critical and important services in the community to have adequate, working backup power

Climate change poses a major threat to energy and electricity infrastructure, including damage to power generation, distribution and storage. Critical and important services are still needed by community members, and may even be more important, during or following an extreme weather event. It is important that critical and important services in the community have access to back-up power in case of power outages.

Suggestions from the community	<ul style="list-style-type: none"> ◆ Determine what organizations, businesses, etc. may not be required by legislation to maintain backup power, but nevertheless are very important to the functioning of the community in a power outage (e.g. shelters, long-term care homes, community support organizations, schools, etc.) ◆ Ensure back-up power for essential and important services is not vulnerable to climate extremes (e.g. generators are not in basement where vulnerable to flooding, etc.) and that they have adequate fuel for extended power outages ◆ Encourage identified ‘important’ services and agencies to develop Business Continuity Plans that include considerations for backup power, such as: proper installation/maintenance, cross-training of staff, alternative fuel/energy suppliers, storing vital information off-site, necessary communication protocols, etc. ◆ Educate community organizations and businesses on back up power planning and purchasing options, and explore possibility of providing grants to specific organizations/groups ◆ Information on backup power may be included in information to area businesses and other organization as part of Action 15.1
Current practice	<ul style="list-style-type: none"> ◆ The majority of Area Municipalities’ and Region’s critical infrastructure has portable or permanent back-up generators powered by diesel or natural gas (e.g. storm water pumps, water supply areas, wastewater treatment) ◆ Grand River Conservation Authority (GRCA) has backup power on critical infrastructure. Backup communications and power equipment are being added to monitoring stations as monitoring equipment is upgraded ◆ Many new large-scale developments and retrofits include emergency generators
Potential partners	<ul style="list-style-type: none"> ◆ Community service organizations (e.g. hospitals, nursing homes/palliative care facilities, homeless shelters, correctional facilities, etc.) ◆ Local utility companies ◆ Municipalities ◆ Region of Waterloo (Corporate Services) ◆ Waterloo Region Community Emergency Management Coordinators (CEMCs)

Next steps	<ul style="list-style-type: none">◆ Potential partners will discuss options to conduct an inventory of important and critical services within the Region, which would identify those with or without back-up power systems◆ Community Partners can advise on the sharing of available flood and heat mapping information to help prioritize installation of back-up power systems
Outcomes	<ul style="list-style-type: none">◆ Organizations and businesses delivering critical and important services to the community have back-up power plans in place in case of short- or medium-term power outages
Measurement considerations	<ul style="list-style-type: none">◆ Beginning with an inventory of facilities that should have backup power, the number and/or proportion of these with functional backup power can be monitored





Goal 4: Energy and economy

Objective 15: Encourage local businesses and other organizations to identify and plan for climate-related risks and opportunities that may affect their business activities and/or quality of service

Action 15.1: Encourage community organizations and businesses to develop their own climate adaptation plans and to include climate adaptation in emergency response plans

Climate change poses risks to businesses, both in terms of business continuity, as well as human health risks for workers and clients. This is also true for institutions and community service organizations, such as hospitals or nursing homes. Some organizations, such as food banks, grocery stores and community services, are important to broader community resilience. Ensuring that these organizations are well equipped to handle climate-related risks specific to their company, assets, and services will improve their long-term resilience.

Suggestions from the community	<ul style="list-style-type: none"> ◆ Support local businesses and other organizations in developing communication protocols regarding extreme weather days/events ◆ Support local businesses and other organizations in conducting internal climate change risk assessments and developing organizational adaptation plans ◆ Region of Waterloo to pursue one or more corporate-scope adaptation plans covering Regional assets and services ◆ Develop and promote an emergency preparedness guide or toolkit for organizations (e.g. businesses) within the community ◆ Develop networking opportunities for local businesses to connect and engage with climate change industry experts to explore specific adaptation interventions ◆ Consider the resilience of communications technologies as part of risk assessments and adaptation plans
Current practice	<ul style="list-style-type: none"> ◆ Business continuity planning and climate change adaptation plans currently occur on an ad hoc basis, and may not be very common. ◆ Businesses sometimes reach out to CEMCs for guidance on emergency response/business continuity plans, which is provided as requested
Potential partners	<ul style="list-style-type: none"> ◆ Region of Waterloo (*lead) ◆ Agricultural community ◆ Community service organizations ◆ Community groups, neighbourhood associations, faith communities, etc. ◆ Local BIAs/Chambers of Commerce ◆ Local ENGOs ◆ School boards ◆ Waterloo Region Community Emergency Management Coordinators (CEMCs)

Next steps	<ul style="list-style-type: none"> ◆ The Region of Waterloo will identify and consult with Potential Partners on specific needs for undertaking organizational climate change risk assessments and planning ◆ The Region of Waterloo and Community Partners will review available information and/or templates that could be shared with local organizations to encourage long-term planning and consideration of climate-related risks and opportunities
Outcomes	<ul style="list-style-type: none"> ◆ Local businesses and community service organizations have plans in place to cope with the potential impacts of climate change and extreme weather to their operations
Measurement considerations	<ul style="list-style-type: none"> ◆ The number of new emergency/adaptation plans might be tracked. Users of this information can be encouraged to provide qualitative indicators of progress

Action 15.2: Increase the availability and accessibility of climate-related datasets to assist developers, local businesses and other organizations

Planning for climate change impacts requires a certain degree of understanding and research on how the climate is projected to change over the long-term, and what areas or assets in a community may be particularly vulnerable to extreme weather. Many organizations and institutions have developed or undertaken climate change-related research, however the data is either not publicly available, or organizations are not aware that it exists. Facilitating better access to climate data and tools could motivate local actors to pursue adaptation or mitigation-related work.

Suggestions from the community	<ul style="list-style-type: none"> ◆ Improved communication surrounding the availability of studies and datasets, and/or relevant findings from these studies for key local audiences, including: <ul style="list-style-type: none"> ◆ Historical localized weather station data ◆ Current climate projections for Waterloo Region, including links to publicly available datasets and resources ◆ Flood risk mapping/data ◆ Heat vulnerability mapping studies ◆ Agricultural vulnerability mapping, etc. ◆ Create a central repository for climate-related data, risk information and communications ◆ Consider opportunities and partners to increase monitoring of precipitation in urban areas for improved data quality
Current practice	<ul style="list-style-type: none"> ◆ Several different publicly available datasets concerning climate change projections are available, including but not limited to: Canadian Centre for Climate Services, Ontario Climate Data Portal, Canadian Climate Data and Scenarios, Great Lakes Observing System, Climate Wizard, IPCC - Global and Regional Climate Change Projections, etc. ◆ GRCA's online property mapping tool identifies whether properties are within a floodplain or regulated area

Current practice (continued)	<ul style="list-style-type: none"> ◆ GRCA reports monthly on current watershed conditions, maintains a monitoring network and shares real-time monitoring data and rainfall information (i.e. tabular rainfall summary) ◆ GRCA conducts post-event evaluations of major weather events
Potential partners	<ul style="list-style-type: none"> ◆ Grand River Conservation Authority (GRCA) ◆ Municipalities ◆ Post-secondary institutions ◆ Provincial and Federal agencies and ministries ◆ Region of Waterloo
Next steps	<ul style="list-style-type: none"> ◆ The Region of Waterloo and Community Partners will take stock of current climate-related datasets and information, and will ensure localized climate change projections and other local climate risk-related data are kept current and/or made publicly available, as appropriate ◆ The Region of Waterloo will work with Community Partners to develop information, communications/graphics, etc. and share with community members in a digestible, understandable way ◆ GRCA will continue in its role of monitoring and evaluating watershed conditions and flooding events, and sharing this information, and will explore areas for improvement (e.g. mapping rainfall depth and extent over periods of time) ◆ Potential partners are encouraged to consider opportunities to improve monitoring (e.g. urban precipitation) and/or quality of other key data sources across Waterloo Region
Outcomes	<ul style="list-style-type: none"> ◆ Local organizations (such as developers and building managers, businesses, environmental NGOs, and more) are better-informed of projected future climate conditions and local risks, and how their organizations and stakeholders might be affected
Measurement considerations	<ul style="list-style-type: none"> ◆ Measurement details will be determined as implementation progresses



Appendix A: Vulnerability and risk assessment results

On the following pages there is a summary of results from the Waterloo Region vulnerability and risk assessment processes, which took place from September 2017 – August 2018.

Each impact statement received a vulnerability score ranging from V1 – V5. The vulnerability scores were informed by several stakeholder engagement activities, including a Community Workshop, and three Workshop-in-a-Box (WIB) activities. Of 40 original impact statements, 36 moved forward into the risk assessment, while four impacts did not.

For the risk assessment, each impact statement received a risk score for each consequence category (i.e. social, environmental, and economic) as well as one overall risk score. The social, economic, and environmental risk scores are out of a total 100 points, while the overall risk score is out of a total 300 points. The overall risk rankings are assigned and coloured based on the risk spectrum presented in **Section 7.2.2** of the CCA Plan.

These scores were calculated using the assigned consequence and likelihood scores that were assigned in Community Partner Meetings. In some cases, scores were altered slightly based on follow-up with Community Partners.

All impacts with risk scores of Medium or higher were automatically brought forward into action planning. In addition to these impacts, a select number of impacts that ranked Medium-Low were also brought forward, following feedback from community experts and members of the public who contributed to the Region's Engage Surveys. The risk assessment prioritized 20 of the original 40 impact statements for action planning, and combined two of these (#29 and #37) for a final total of 19 priority impact statements.

More information concerning the detailed breakdown of risk scoring, as well as outreach methods, can be found in the Region's [Risk Assessment Report](#) or in **Section 7.2** of the CCA Plan.

"My neighbours aid us in clearing our sidewalks since my husband and I are unable to do so ourselves."

- survey respondent



Impact ID	Climate event category	Impact statement	Final average vulnerability score	Social risk score (/100)	Economic risk score (/100)	Environmental risk score (/100)	Overall risk score (/300)	Brought forward to action planning?
7	Increased rain events	Increased extreme precipitation events can lead to more accidents and emergencies.	V3	High: 75	High: 70	Medium-low: 45	Medium-high: 190	Yes
13	Increased freezing rain	Increased freezing rain and winter storm events may increase hazardous road and walking conditions.	V3	High: 65	High: 75	Medium-low: 40	Medium-high: 180	Yes
8	Increased rain events	Increased incidences of flooding may lead to displacement and/or evacuation of residents from flooded homes.	V3	Medium-high: 64	Medium-high: 64	Medium: 48	Medium-high: 176	Yes
27	Changes in temperature	Temperatures increasing earlier in the spring/winter period can lead to faster/earlier thawing and snowmelt causing flooding, washouts, and property damage.	V2	Medium-high: 60	High: 70	Medium: 45	Medium-high: 175	Yes
1	Increased rain events	Increase in quantity of rain and number of heavy rainfall events may increase overland riverine flooding from local watercourses.	V3	Medium-high: 60	Medium-high: 60	Medium: 45	Medium-high: 165	Yes
3	Increased rain events	More extreme rainfall events may lead to erosion of riverbanks and hill sides causing bank destabilization and loss of habitat.	V3	Medium: 50	Medium: 50	Medium-high: 60	Medium-high: 160	Yes
34	Changes in temperature	Changes in freeze-thaw cycle can cause frost movements which may damage infrastructure (roads, water, sewer).	V4	Medium-low: 40	High: 65	Medium-low: 35	Medium: 140	Yes

Impact ID	Climate event category	Impact statement	Final average vulnerability score	Social risk score (/100)	Economic risk score (/100)	Environmental risk score (/100)	Overall risk score (/300)	Brought forward to action planning?
22	Decreased precipitation rain	Increased periods of hot & dry weather may increase the risk of fire to the natural and built environment.	V3	Medium: 48	Medium: 52	Medium-low: 40	Medium: 140	Yes
24	Increased wind and storms	Increase in wind speeds and storm events (including lightning and tornadoes) may lead to damages to the built environment and infrastructure.	V3	Medium: 45	High: 65	Low: 20	Medium: 130	Yes
32	Changes in temperature	Increase in seasonal temperature may lead to migration of new disease vectors and illnesses into the community.	V3	Medium-high: 55	Medium-low: 40	Medium-low: 35	Medium: 130	Yes
9	Increased rain events	Increased incidences of flooding may lead to exposure to illness and pathogens (water-borne, molds, etc.).	V3	Medium: 44	Medium: 44	Medium-low: 40	Medium: 128	Yes
18	Decreased precipitation rain	A decrease in precipitation may affect groundwater reserves and may lead to potable water shortages and or restrictions on water use.	V4	Medium-low: 36	Medium: 44	Medium: 48	Medium: 128	Yes
16	Increased freezing rain	Increased freezing rain events can increase the use of road salt which may impact water resources.	V4	Low: 25	Medium-low: 40	Medium-high: 60	Medium: 125	Yes
2	Increased rain events	Increased extreme precipitation events can lead to road washouts, bridge closures, and disruptions to transportation services.	V4	Medium: 45	Medium: 45	Medium-low: 35	Medium: 125	Yes

Impact ID	Climate event category	Impact statement	Final average vulnerability score	Social risk score (/100)	Economic risk score (/100)	Environmental risk score (/100)	Overall risk score (/300)	Brought forward to action planning?
29	Changes in temperature	Increase in summer temperatures can lead to risk of medical issues for vulnerable populations and outdoor workers.	V3	Medium-high: 55	Medium-low: 40	Low: 20	Medium-low: 115	Yes
21	Decreased precipitation rain	Decreased precipitation in the summer may increase irrigation and lawn watering which leads to lower water table and competitive uses.	V3	Medium-low: 32	Medium: 44	Medium-low: 36	Medium-low: 112	Yes
31	Changes in temperature	Changes in seasonal temperatures may lead to shifting eco regions for flora and fauna communities and can lead to increase spread of invasive species and changes in native species.	V4	Medium-low: 36	Low: 24	Medium: 52	Medium-low: 112	No
39	Changes in temperature	More extreme cold days can lead to increased incidences of burst pipes and water mains.	V4	Low: 28	Medium: 52	Low: 28	Medium-low: 108	No
23	Increased wind and storms	Increase in wind speeds and storm events can lead to damage to urban trees, parks, trails.	V3	Medium-low: 40	Medium-low: 40	Low: 28	Medium-low: 108	No
15	Increased freezing rain	Increased freezing rain events may result in damage to the urban tree canopy.	V3	Medium-low: 36	Medium-low: 40	Low: 28	Medium-low: 104	No
14	Increased freezing rain	Increased freezing rain and winter storm events may increase damage to power lines resulting in prolonged power interruptions.	V4	Medium-low: 32	Medium: 52	Very low: 16	Medium-low: 100	Yes

Impact ID	Climate event category	Impact statement	Final average vulnerability score	Social risk score (/100)	Economic risk score (/100)	Environmental risk score (/100)	Overall risk score (/300)	Brought forward to action planning?
25	Increased wind and storms	Increase in wind speeds and storm events may damage power infrastructure, leading to more frequent and prolonged power interruptions.	V3	Medium-low: 32	Medium: 52	Very low: 16	Medium-low: 100	Yes
6	Increased rain events	Heavier rainfall over a shorter time can increase stress on built infrastructure (e.g. buildings and sidewalks).	V3	Low: 28	Medium: 44	Low: 24	Medium-low: 96	No
37	Changes in temperature	More frequent extreme heat days over 30 degrees Celsius which will adversely impact air quality.	V4	Medium-Low: 30	Medium-Low: 36	Medium-Low: 30	Medium-low: 96	Yes
20	Decreased precipitation rain	Decreased precipitation in the spring and summer may cause lower water levels in local watercourses and other surface water (ponds), negatively affecting ecosystems and biodiversity.	V3	Low: 24	Low: 28	Medium-low: 40	Medium-low: 92	No
35	Changes in temperature	More days over 30 degrees Celsius may increase water temperature, which will lower the assimilative capacity of local watercourses.	V3	Low: 20	Low: 25	Medium-low: 45	Medium-low: 90	No
5	Increased rain events	Increased precipitation in the summer may increase risk of water pollution from runoff (from farmlands and overland runoff), increasing the risk of algae blooms.	V3	Medium-low: 32	Low: 24	Medium-low: 32	Medium-low: 88	Yes

Impact ID	Climate event category	Impact statement	Final average vulnerability score	Social risk score (/100)	Economic risk score (/100)	Environmental risk score (/100)	Overall risk score (/300)	Brought forward to action planning?
26	Increased wind and storms	Increase in wind speeds and storm events may increase transportation disruption such as transit, emergency services, and airports	V3	Medium-low: 36	Medium-low: 32	Very low: 16	Low: 84	No
40	Changes in temperature	More extreme cold days can lead to isolation of vulnerable or rural populations.	V3	Medium-low: 40	Low: 24	Low: 20	Low: 84	No
33	Changes in temperature	Increased winter temperatures can lead to decline of winter recreation and tourist opportunities in Waterloo Region.	V3	Medium-low: 32	Low: 24	Low: 20	Low: 76	No
30	Changes in temperature	Increased temperatures in the summer can increase demand on electricity grid for air conditioning, increasing potential for power interruption.	V4	Medium-low: 30	Medium-low: 33	Very low: 12	Low: 75	No
17	Decreased precipitation rain	Decreased summer precipitation and higher temperatures may increase the probability of summer drought, affecting urban forest cover.	V3	Low: 20	Low: 24	Low: 28	Low: 72	No
11	Increased rain events	Increased quantity of rain may cause flooding of electrical infrastructure leading to blackouts.	V3	Low: 18	Medium-low: 39	Very low: 12	Low: 69	No
19	Decreased precipitation rain	Decreased summer precipitation and higher temperatures may put stress on local food supply and local agricultural industry.	V4	Low: 28	Low: 24	Very low: 16	Low: 68	No

Impact ID	Climate event category	Impact statement	Final average vulnerability score	Social risk score (/100)	Economic risk score (/100)	Environmental risk score (/100)	Overall risk score (/300)	Brought forward to action planning?
28	Changes in temperature	Changes in seasonal temperature may lead to shifting eco regions for flora and fauna communities causing decreased yields of current crops and the need to change agricultural crops.	V4	Low: 28	Low: 24	Very low: 16	Low: 68	No
4	Increased rain events	More severe rainfall incidents can lead to waste water treatment plant bypass discharges to local watercourses.	V3	Very low: 15	Very low: 15	Low: 18	Very low: 48	No
10	Increased rain events	Increased risk of vector-borne diseases (e.g. West Nile) due to increased stagnant water sources from increase precipitation and flooding events.	V2	N/A	N/A	N/A	N/A	No
12	Increased rain events	Increase in precipitation leading to oversaturated soil in parks, sports fields, and outside event spaces.	V2	N/A	N/A	N/A	N/A	No
36	Changes in temperature	More extreme heat days lead to reduced water quality at beaches and natural outdoor swimming areas.	V2	N/A	N/A	N/A	N/A	No
38	Changes in temperature	Extended warm summers may increase demand on water for recreational use.	V2	N/A	N/A	N/A	N/A	No

Appendix B: Glossary

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 damages, to take advantage of opportunities, or to cope with the consequences.

Area Municipality: Cities and Townships of Waterloo Region, including the Cities of Cambridge, Kitchener and Waterloo, and the Townships of North Dumfries, Wellesley, Wilmot and Woolwich.

Baseline: A reference period, typically three decades (or 30 years), that is used to compare fluctuations of climate between one period and another. Baselines can also be called references or reference periods.

Climate change: Changes in long-term weather patterns caused by natural phenomena and human activities that alter the chemical composition of the atmosphere through the build-up of greenhouse gases which trap heat and reflect it back to the earth's surface.

Climate change projections: Simulated responses 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.

Community Partners: A group of individuals from key public sector, academic, and community organizations, the Community Partners have been central contributors to the adaptation planning process. The Community Partners will be key partners for the ongoing implementation of the CCA Plan.

ENGO: Environmental non-governmental organization, which can include groups, associations or organizations that promote environmental protections in various ways without being affiliated with local, provincial or federal governments.

Extreme weather event: A meteorological event that is rare at a place and time of year, such as an intense storm, tornado, hail storm, flood or heat wave, and is beyond the normal range of activity. An extreme weather event would normally occur very rarely or fall into the tenth percentile of probability.

Goals: High-level intentions for the community to strive toward, focusing on one of four climate-related impact areas: Health and Community; Built Environment; Natural Environment and Water; Energy and Economy.

Guiding principles: Overarching intentions to inform the brainstorming, planning and implementing any of the Actions in the CCA Plan.

Green infrastructure: The natural vegetative systems and green technologies that collectively provide society with a multitude of economic, environmental and social benefits.

Greenhouse Gas (GHG) emissions: 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.

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.

Objectives: Statements which identify the general ways in which our community intends to overcome the priority impacts of climate change.

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.

Representative Concentration Pathways

(RCPs): Four greenhouse gas concentration (not emissions) trajectories adopted by the IPCC for its fifth Assessment Report (AR5) in 2014. It supersedes Special Report on Emissions Scenarios (SRES) projections published in 2000.

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

"We keep track of our most vulnerable clients in our database. If there was a serious emergency in the area (e.g., where power is out for days), we would have staff check on these vulnerable clients to ensure that they have food, water and adequate shelter. We are not an emergency service, but we do our best to help vulnerable people in our community."

- community service provider

"I work as a first responder, so any time there is an extreme weather event (flooding, icy roads contributing to collisions, evacuations), I am directly affected in my work load and working hours."

- survey respondent

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