DISTRICT MUNICIPALITY OF MUSKOKA

REGIONAL CLIMATE CHANGE ADAPTATION PLAN

2023

Photo by: Rebecca Willison

ICLEI Local Governments for Sustainability CANADA

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Land Acknowledgement

This land acknowledgement is an expression of gratitude and appreciation to those on whose territory we gather, and as a way of honoring the Indigenous Peoples who have been living and working on this land for centuries. We honor all Indigenous Peoples – First Nations, Métis and Inuit – for their cultures, their languages, their wise teachings, and ways of being that have shaped this country since time began.

In Muskoka, we are on the traditional territory of the Anishnaabeg, which includes the Ojibwe, Odawa, and Potawatomi Nations, collectively known as the Three Fires Confederacy. The Huron-Wendat and the Haudenosaunee Nations have also walked on this territory over time. Southern portions of Muskoka were the traditional territory of the Wendat when they resided in Simcoe County between AD 1300 and 1650 and they travelled regularly through Muskoka during those centuries.

Today Muskoka is home to three sovereign nations: Wahta Mohawks First Nations, Moose Deer Point First Nation and the Moon River Métis. These lands are covered by the Williams Treaty (of 1923), the Robinson Huron Treaty of 1850 and the J. Collins land purchase (of 1785) and we must respect these treaties.

Indigenous Peoples have cared for this territory for the benefit of future generations and their stewardship throughout the ages is recognized.

G’chi miigwech.
Thank you very much.

Photo by: John McQuarrie

Regional Climate Change Adaptation Plan

1. Executive Summary

This adaptation plan outlines the actions that each Area Municipality (AM) within the District Municipality of Muskoka (the District or DMM) plans to take to address the most urgent and threatening impacts of climate change. The effects of climate change are already visible in Muskoka, and we know that these effects will continue to increase. To protect our families, our economies, and the environment in which we live from the impacts of climate change, we must adapt by altering our behaviours, our systems and – in some cases – our ways of life. We can undertake actions and activities specifically designed to reduce, minimize, or eliminate the adverse effects of a changing climate.

The District Municipality of Muskoka is an upper-tier municipality comprised of six lower-tier municipalities, five of which are participating in this Regional Climate Change Adaptation Plan ("ReCAP"). Participating Area Municipalities are the Towns of Huntsville, Bracebridge, and Gravenhurst, as well as the Townships of Muskoka Lakes and Lake of Bays. Each of the AMs are committed to advancing climate change adaptation planning across their municipal departments and throughout their communities. This report outlines the process that the AMs, in partnership with the DMM undertook with the support of ICLEI Canada to create the unique adaptation plans. Section 6 outlines the five unique chapters of the adaptation plan, one for each AM. The differences are based on the individual municipality's identification of its most prevalent climatic threats, its particular natural environment, its current infrastructure, the steps that the municipality has already taken to face climate change adaptation, as well as the capacity and resources of each municipality.

This plan was developed with support and guidance from ICLEI Canada through a collaborative process involving District Municipal staff, Area Municipality staff, and community stakeholders. Becoming a climate resilient and sustainable community is a collaborative effort, and community engagement and partnerships across the community will help implement this plan. The purpose of this Regional Climate Change Adaptation Plan is to provide each of the five Area Municipalities and their community with clear goals and actions to reduce the effects of climate change and improve resilience. 32 total priority action areas have been identified, with a varying number of the identified actions being applicable to each AM. The actions have been divided into five themes based on the area of work required of the action: Development and Infrastructure, Communication and Outreach, Adaptation Programs, Emergency Response Measures and Policy Change. The goal is for the chapters of the plan to be actionable and provide direction for each of the AMs in the path towards Muskoka's climate resiliency.

2. Acknowledgements

Project Team

The coordination of this project was done with representatives from each of the participating Area Municipalities and the Watershed & Environment team at the District Municipality of Muskoka. We would like to acknowledge the support and guidance of ICLEI Canada through the development of this plan:

- Hiba Kariem, Climate Change Project Coordinator, ICLEI Canada
- Robert Wilson, Climate Change Planner, ICLEI Canada

Committed collaboration and communication were crucial to developing and delivering this project. The participating Area Municipalities were supported by diverse staff teams led by their ReCAP representative:

- Arla Freitas Nissenthall, Planning Technician, Township of Lake of Bays
- Melissa Halford, Director of Development Services, Town of Gravenhurst
- Kirstin Maxwell, Director of Development Services, Town of Huntsville
- Corey Moore, Economic Development Officer, Township of Muskoka Lakes
- Stephen Rettie, Chief Administration Officer, Town of Bracebridge

The project was coordinated through the support of various staff from the District Municipality of Muskoka's Watershed & Environment Team, including Kevin Boyle, Christy Doyle, Cassie Emms, Jacquie Evans, and Lauren Valliere. Many District staff from other departments also contributed to advancing this project, including those from the Office of the CAO; Finance & Corporate Services; Community Services & Planning; and Engineering & Public Works.

Stakeholders involved in plan development

A community working group was established using many of the members that supported the District Municipality of Muskoka's New Leaf Climate Action Plan, plus some additional community stakeholders to ensure as many community voices as possible were heard. The following list reflects the groups and organizations that had members involved in the working group which is referred to as the New Leaf Community Working group (NLCWG).

Table 1 - Organizations in the New Leaf Community Working Group

- Muskoka Conservancy
- Lakeland Power
- Climate Action Muskoka
- Moose Deer Point First Nation
- Chamber of Commerce Representative from Gravenhurst
- Muskoka Watershed Council
- Friends of the Muskoka Watershed
- Muskoka Tourism and Marketing Association (MTMA)
- Westwind Forest Stewardship
- IDEA (Inclusion, Diversity, Equity, Anti-racism) Advisory group
- Muskoka Discovery Centre and Steamships

- Teams from the following AMs:
  - Town of Huntsville
  - Town of Bracebridge
  - Town of Gravenhurst
  - Township of Muskoka Lakes
  - Township of Lake of Bays
- Muskoka Paramedic Services and Emergency Management
- Simcoe Muskoka District Health Unit
- Gravenhurst Environmental Advisory Committee (GEAC)
- Trillium Lakelands District School Board
- Federation of Ontario Cottagers' Associations (FOCA)

Project funding statement

Advice, guidance, and support on the development of the adaptation plan was delivered by ICLEI Canada through the Vulnerability and Risk Assessment and Planning cohort of the Advancing Adaptation: Train the Trainer project, funded through the Ministry of Environment, Conservation and Parks alongside support from Environment and Climate Change Canada.

3. Introduction

Muskoka's climate is changing and as a result, the Muskoka of tomorrow will be drastically different than the Muskoka of the past. Climate change will bring significant changes to Muskoka's weather patterns, ecosystems, and infrastructure. It is necessary taking action to increase the resiliency of Muskoka against these climatic changes. In December of 2020, Muskoka District Council officially declared a Climate Emergency, a declaration that deepens the District's commitment to protecting Muskoka's economy, community, and ecosystems from the impacts of our changing climate. At that point, Muskoka District Council also approved "A New Leaf: Muskoka's Climate Strategy" to address climate change at both corporate and community levels. The New Leaf Climate Action Plan outlines actions that the District has committed to undertake to support climate action and resiliency, one of those actions is to support each of the Area Municipalities in the generation of their own regional climate adaptation plans, which is contained within this report.

The development of this plan was facilitated through the ICLEI Canada Advancing Adaptation project. Funded through a grant from the Ministry of the Environment, Conservation and Parks (MECP) under the Canada-Ontario Agreement (COA), Advancing Adaptation was a two-year initiative that engaged Ontario municipalities to build local capacity for climate change resilience and to advance efforts on adaptation. Centred around the creation and drafting of an implementation-ready local climate change adaptation plan, the train-the-trainer Adaptation Planning project, brought together a cohort of 11 local governments between June 2021 and December 2022, to participate in multiple training workshops to network, learn, and share experiences about adaptation planning. ICLEI Canada provided expert advice, one-on-one training and consultation throughout the entire planning process, planning resources, training on stakeholder engagement, and support in the drafting and review of the final adaptation plan.

This project was supported by the District Municipality of Muskoka's Watershed & Environment Team to coordinate the creation of a Regional Climate Adaptation Plan (ReCAP) for each of the five participating lower-tier Area Municipalities (AMs). Participating AMs include the Towns of Huntsville, Bracebridge, and Gravenhurst, and the Townships of Lake of Bays and Muskoka Lakes. This approach of promoted communication, collaboration, and exchange of resources among the participants.

Drawing on the contributions from internal and external stakeholders and their priority values for a Regional Climate Change Adaptation Plan, the following Vision Statement was developed to guide the overall intention and goal that is to be achieved with the plan:

"Muskoka will be a progressive and resilient leader in the increasingly urgent need to adapt to changing climate conditions, ensuring the protection of the natural environment and prosperous communities."

Intention of the Plan and Community Scope

The goal of the ReCAP is to build upon the existing actions taken by each of the AMs, which are listed in Section 6 in the individual chapters, which address climate change and allow the municipalities to identify opportunities for action that advance the community further towards the climate resilience of its social, economic, built, and natural systems. The development of the ReCAP took a broad approach and involved the community as well as municipal administration. The ReCAP intends to support organizations, institutions, businesses, vulnerable populations, and individuals of all ages in a proactive manner to prepare for current and future climate-related risks and changes. Although the AM staff may be the lead actors for many actions outlined in the plan, numerous climate-related risks extend beyond municipal jurisdiction, requiring the collaboration of important community service providers, local partnerships, and other levels of government. As such, the climate actions presented in this plan were co-developed using the knowledge and experience of many DMM and AM staff members, community groups and organizations.

This report first outlines the general actions that were taken by the AMs, DMM and the New Leaf Community Working Group with the assistance of ICLEI Canada to create the adaptation plan, and then secondly outlines the actionable portion of the plans which is divided into a chapter for each AM. Although climate change affects everyone and everywhere, the direct impacts vary significantly. Since each of the AMs are unique with varying populations, geographical size, financial capacity, staff capacity, built infrastructure, natural considerations and many more factors, it made the most sense to divide the action plan by AM. Although climate change impacts all AMs, since the path to climate resiliency is unique, each AM was able to tailor their plans and customize their intentions.

Adaptation vs. Mitigation

Climate change adaptation refers to any initiative or action that seeks to reduce the vulnerability of social, economic, built, and natural systems to a changing climate. Adaptation efforts may focus on changing individual behaviours, updating municipal by-laws and policies, enhancing the capacity of physical infrastructure, and improving ecological services. A community-based adaptation approach can further support local governments in building resilience while reducing vulnerability via meaningful engagement of communities and residents throughout the entire process of adaptation. A wide range of community stakeholders and actors should be involved allowing for a collaborative co-development of an adaptation plan that addresses climate risks across multiple sectors and systems. This process also recognizes and aims to shift the power dynamics between decision-makers and other actors within the participatory process. Traditional and local knowledge and assets of community members are incorporated and inform local adaptation planning and implementation.

Climate change mitigation refers to the implementation of policy, regulatory and project-based measures that contribute to the stabilization or reduction of greenhouse gas concentrations in the atmosphere. These include anti-idling by-laws, building retrofits to conserve energy, and transitioning to low-carbon energy sources.

The effects of climate change are wide-ranging and will require a diversity of responses. While mitigation efforts work to contain the long-term impacts of global warming, adaptation measures are needed to address the climate change impacts now and into the future. Adaptation is not meant to replace or undermine mitigation efforts, rather adaptation complements local government efforts to protect and improve their long-term sustainability. Where possible and appropriate, local governments can apply a low carbon resilience (LCR) lens which integrates mitigation and adaptation through municipal planning and decision-making approaches that reduce greenhouse gas (GHG) emissions and vulnerabilities to the impacts of climate change and realizes co-benefits of their activities[i].

Adaptation = Managing the unavoidable

Mitigation = Avoiding the unmanageable

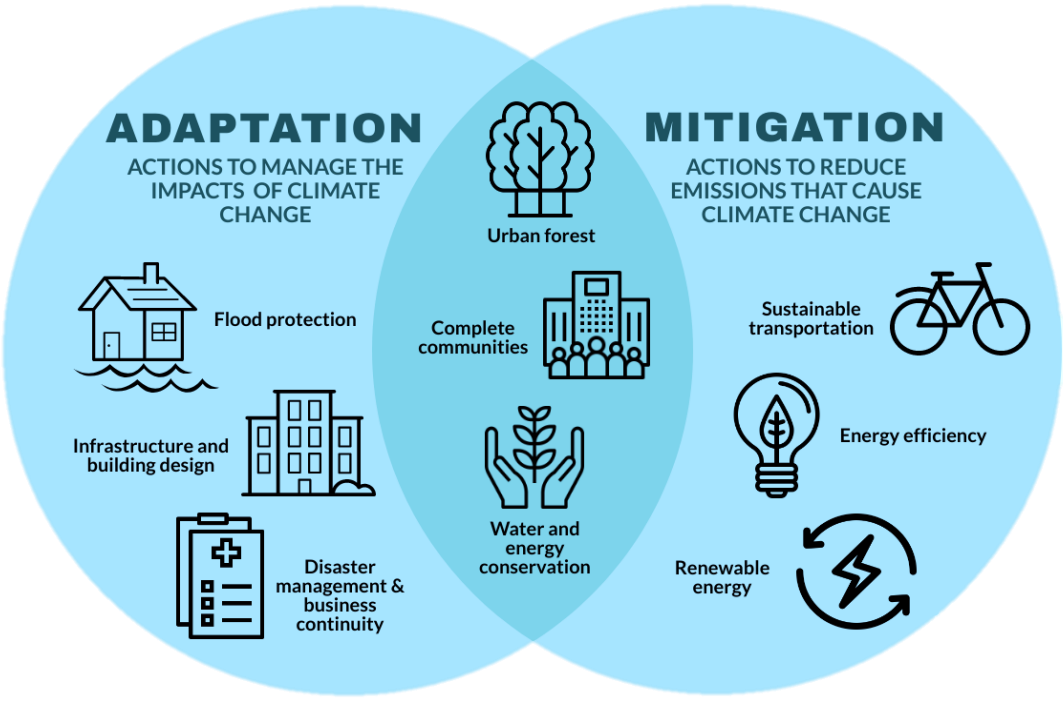


Figure 1: Overlap and Differences Between Adaptation and Mitigation (ICLEI Canada, 2019).

4. Climate Change in Muskoka

Climate Change Science:

Global and National Climate Change

Since the late 1800s, the Earth's temperature has risen by 1°C largely due to human activities[ii]. As fossil fuel extraction and consumption continue around the world, warming is accelerating at a faster rate. Earth's average surface temperature in 2020 tied 2016 for the hottest years since record-keeping began in the 1880s[iii]. The seven warmest years have taken place consecutively since 2015, and the 20 warmest years on record have occurred over the past 22 years[iv]. July 2019 was the second hottest month ever recorded, shrinking Arctic and Antarctic sea ice to historic lows 19.8% below average[v].

Similar to global trends, Canada has been warming over the last six decades, with annual average surface air temperatures over land warming by 1.7ºC since 1948, and even greater increases observed in the North, the Prairies, and northern British Columbia[vi]. This rate of warming is almost double the global average reported over the same period, meaning an increase of 2°C globally could result in a 3-4°C change in Canada. The record-setting 2021 summer heatwave in British Columbia saw temperatures reach 49.6°C and resulting in over 500 heat-related deaths.

Canada has also generally become wetter over the past several decades, with average annual precipitation across the country increasing by approximately 16% between 1950-2010. This increase is dominated by large changes in British Columbia and Atlantic Canada. Extreme precipitation events are also likely to become more intense and more frequent – recent studies show that 1-in-20-year storm events are likely to become 1-in-10-year storm events by the 2050s.

IPCC Direction

The United Nations Intergovernmental Panel on Climate Change (IPCC) is the UN institution tasked with assessing the scientific basis of climate change, its impacts and potential future risks, and potential response options. In its Sixth Assessment report (AR6), released in 2022, the IPCC declared with certainty the widespread impact of human-caused climatic changes. The report stated:

> "Human-induced climate change, including more frequent and intense extreme events, has caused widespread adverse impacts and related losses and damages to nature and people, beyond natural climate variability. The rise in weather and climate extremes has led to some irreversible impacts as natural and human systems are pushed beyond their ability to adapt"[vii].

The most urgent report to date, the AR6 report states that even with major reductions of GHG emissions in the short term (RCP2.5 scenario) there is greater than a 50% likelihood that global warming will reach or exceed 1.5°C in the near term. According to the report, "Global warming, reaching 1.5°C in the near-term, would cause unavoidable increases in multiple climate hazards and present multiple risks to ecosystems and humans. The level of risk will depend on concurrent

near-term trends in vulnerability, exposure, level of socioeconomic development, and adaptation"[viii]. Now more than ever, it is crucial that cities implement comprehensive, effective, and innovative responses between adaptation and mitigation efforts to advance sustainable development and to capitalize on the co-benefits these strategies can provide[ix].

Federal Policy Direction on Climate Adaptation

Canada was one of 195 countries to sign the Paris Agreement in December 2015. The Agreement aims to keep the global temperature to well below 2°C, and to drive efforts to limit the temperature increase even further to 1.5°C above pre-industrial levels. In terms of adaptation, the Agreement has a goal to enhance adaptive capacity, strengthen resilience and reduce vulnerability to global climate change, in line with the temperature goal.

In addition to signing onto the Paris Climate Agreement, the Government of Canada has also produced several policy documents that inform and guide decision-makers on climate change adaptation. In 2016, the Government of Canada released its Pan Canadian Framework on Clean Growth and Climate Change, which includes adaptation considerations and actions to improve climate resiliency. In November of 2022 the Government of Canada released Canada's National Adaptation Strategy with provincial, territorial, and municipal governments, Indigenous Peoples, and other key partners. The Strategy focuses on improving resiliency across five key systems including:

- Disaster resilience
- Health and wellbeing
- Nature and biodiversity
- Infrastructure
- Economy and workers

The framework recognizes the important role that municipalities will play in implementing climate solutions locally. While federal and provincial governments provide strategic focus, standards, and potential funding streams for adaptation, it will be up to local governments to tailor climate change adaptation strategies to their local circumstances and the unique set of climate change impacts they are already experiencing or expect to face.

Other resources developed by the Government of Canada include the National Issues Report *Health of Canadians in a Changing Climate* to provide a national perspective on how climate is impacting Canadian communities, the environment, and its economies. The *Map of Adaptation Actions* is a repository of case studies from across Canada that explores how communities and sectors are adapting to a changing climate.

Provincial Policy Direction on Climate Adaptation

The Government of Ontario's *A Made-in-Ontario Environment Plan* issued in 2018 addresses climate change through both mitigation and adaptation strategies. These strategies include emissions performance standards and regulations to reduce emissions from the transportation sector, programs to enhance and expand public transit networks, funding for extreme-weather resistant infrastructure, a province-wide multi-sector provincial climate change impact assessment,

and the *Protecting People and Property: Ontario's Flooding Strategy* to reduce flood risk. Additionally, the Provincial Policy Statement has been updated to include direction for planning authorities to prepare for the impacts of a changing climate, including climate change decision-making in land-use and development policy, and enhanced stormwater management policies to enhance climate resilience. During the 2019 flooding events, the damage was so significant across Ontario and specifically Muskoka, that the province appointed a Special Advisor on Flooding who created an independent review and consultation of the flooding events. After the DMM and three AMs declared a state of emergency, Muskoka was one of three areas provincially that was studied during the investigation for the report. The recommendations from this report are extremely relevant to Muskoka and have supported many of the projects around Integrated Watershed Management.

Climate Change Projections for the Muskoka

Climate change is an increasingly critical issue at the global, national, provincial, and local level. Recent events in Canada including flooding, ice storms, wildfires, heat domes, and other occurrences of extreme weather over the past several decades have highlighted the need to be prepared for ongoing challenges. The most prevalent issues facing the Muskoka region related to climate change have historically been flooding, increased temperatures, extreme wind events and intense rainfall. The data in the table below comes from the Climate Science Report completed by ICLEI Canada and the Planning for Climate Change in Muskoka report completed by the Muskoka Watershed Council. The Climate Atlas of Canada tool was used to collect downscaled climate projections, using a baseline of 1976-2005. Within the tool, the Region of Huntsville data point was selected to collect this information, as it was the best available area with long-range observed historical data and future climate projections for the District. For the projections indicated in the table, RCP8.5, the business-as-usual scenario was used.

Photo by: Rebecca Willison

Summary of Projected Climate Change in Muskoka

Tempertature 	• Annual increase in mean temperature of approximately 2.2°C by 2050 and 4.4°C by 2080 from the baseline mean • The number of hot days (>30°C) is currently averaging 4.6 days, which is expected to increase to an average of 27.2 days by 2050 (491% increase), and to an average of 38.1 days by 2080 (728% increase) • Heatwaves are expected to increase in length, frequency, and intensity. Muskoka can expect approximately 5 heatwave events annually by 2080 • Increased surface temperature in lakes, rivers, and streams which can impact wetlands, habitats, biodiversity, bacteria, algae, and aquatic species • The mean winter temperature will increase from -9.6°C to -7.2°C by 2050 and to -4.4°C by 2080
Precipitation 	• Annual increase in precipitation of 64 mm by 2050 and 97mm by 2080 • Spring precipitation is expected to increase by nearly 10% by 2050 and by nearly 17% by 2080 which is expected to impact flooding conditions • Decrease in summer precipitation which is expected to lead to drought conditions
Extreme Weather Events 	• Heavy precipitation days are expected to increase by approximately 11% for 10 mm days and by 21% for 20 mm days by 2050 • Extreme precipitation events are expected to increase in intensity, duration, and frequency

Local Climate Change Significance in Muskoka

Fire

- In 2018, the Parry Sound "33" fire consumed over 11,362 hectares and burned from mid-July to the end of October, News article can be found here.
- Fighting forest fires in Ontario cost $212 million in 2018, significantly surpassing the base budget of $70 million.

Invasive Species

- Muskoka's lakes have seen an increase in confirmed blue-green algal blooms, as discussed in the article attached here.
- Many invasive species including Japanese knotweed, phragmites or giant hogweed are species that have migrated to Muskoka due to human movements, but the warming climate allows them to become more easily established and invade which has a significant impact on the native species and ecological movements.
- Ticks have become increasingly prevalent in Muskoka due to increased temperatures and warmer weather patterns and are a serious threat to human health. The instances of Black Legged Ticks carrying Lyme disease is also on the rise with rising temperatures which can be linked to climate change.

Photo by: Brandon Scott

Tornado

- Muskoka has been severely affected by tornados and there were three tornado storm events on June 10th, 2020.
- During this storm a Tornado touched down in Baysville and had a 5.6 km long path, up to 140 m. wide, with winds up to 145 km/hr. Bracebridge was hit by a tornado with winds reaching 150 km/hr. and the most destructive event was around Mary Lake where a tornado with winds reaching 190 km/hr. and a path of 24.6 kms destroyed trees in its path. News articles found here and here.
- Another tornado incident occurred on July 14th/15th 2021 with winds reaching 190 km/hr. in Dwight as explained here and here.
- These events have left thousands of residents without power, damaged many houses and buildings and blocked roads due to down trees. News articles found here.

Photo by: Lyndsie McGregor

Flooding

- Over the past decade, there have been three major flood events in Muskoka (2013, 2016, 2019).
- In 2019, flooding levels were the highest in Muskoka's recorded history at three of the four major water flow stations. The 2019 flood was labelled as the second '100 – year flood' in just 6 years, following the 2013 flood. News article about this flood can be found here. Road washouts left several routes and neighborhoods without access.
- The 2019 floods caused the District, the Towns of Huntsville and Bracebridge and the Township of Muskoka Lakes to declare a state of emergency. Support from the Canadian Armed Forces was required to support flood prevention efforts.
- The 2019 flood caused significant damage at the Muskoka Wharf (Gravenhurst), news articles can be found here, and here. Many properties, both private and public, across Muskoka were also impacted.
- Much of Muskoka's existing municipal infrastructure, such as roads, bridges, buildings, drinking water/wastewater systems, and stormwater management systems, were not constructed to withstand the climate that Muskoka is expected have by mid-century.

Photo by: Lyndsie McGregor

5. Plan Development

ICLEI Canada's Building Adaptive and Resilient Communities (BARC) Framework

Development of the ReCAP was guided by ICLEI Canada's Building Adaptive and Resilient Communities (BARC program). BARC is a five-milestone Planning framework for local governments aimed at preparing communities for the impacts of climate change. BARC is a comprehensive planning methodology that guides municipalities through areas of research and climate impact assessment methods, plan development, action-setting processes, implementation planning, and monitoring and review strategies (see Figure 2). As part of the Advancing Adaptation project, the Area Municipalities with the support of the District of Muskoka worked through and completed Milestone One, Two, and Three of the BARC Framework, culminating in the creation of the ReCAP.

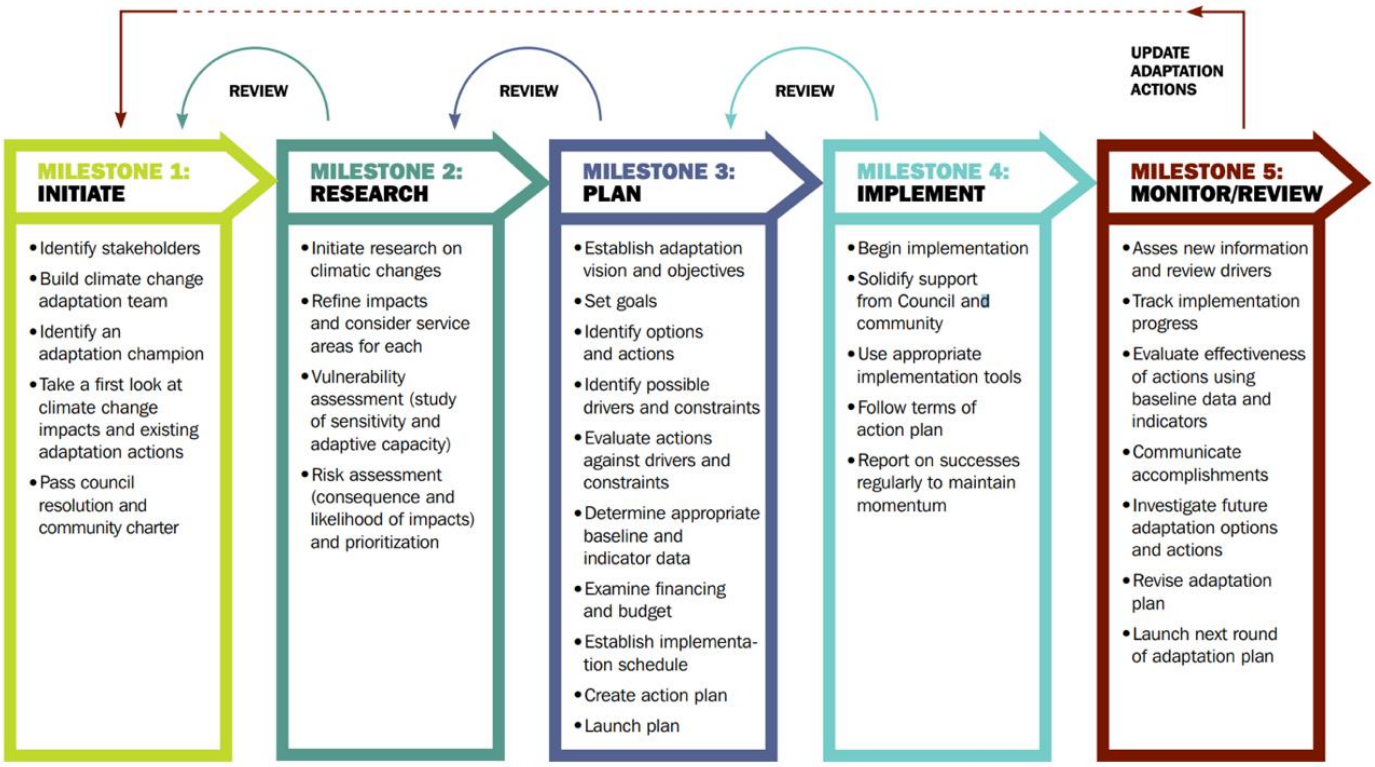


Figure 2: ICLEI Canada's Building Adaptive and Resilient Communities Framework

Milestones

Milestone One – Initiate

Within this milestone, communities identify stakeholders to review and understand existing knowledge on how the regional climate is changing, followed by a brainstorming exercise to identify potential climate change impacts.

Milestone Two – Research

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

Milestone Three – Plan

The third milestone provides guidance on how to establish a vision, set adaptation goals and objectives, identify adaptation options, and examine possible constraints and drivers to various actions. From there, a community will draft a Local Adaptation Strategy. Baseline data is collected and recorded, financing and budget issues are addressed, an implementation schedule is drafted, implementation responsibilities are determined, and progress and effectiveness indicators are identified in the ReCAP.

Milestone Four – Implement

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

Milestone Five – Monitor & Review

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

Plan Structure

As the area municipalities worked through each milestone, the local distinctions between the AMs became increasingly obvious in the Planning Milestone (Milestone three) as the implementation actions were discussed. Since this stage involved reflecting on current practices and assigning more specific actions to their owners (lead or supporting organizations) it was important to note the full range of various input from all participating municipalities. For this reason, the chapters in the Action Plans for a Climate Resilient Muskoka section are unique to the Area Municipalities.

Milestone One: Initiate

Fulfilling the criteria of Milestone One, the District identified and invited a core group of community stakeholders to participate in the adaptation planning process as part of a climate change adaptation working group. These group members were part of the original community group who supported the generation of the District's New Leaf Climate Action plan and are referred to as the New Leaf Community Working Group (NLCWG).

Climate change is expected to impact a wide range of areas in Muskoka, from tourism, infrastructure, land use, human health, and wellbeing, and more. As such, community stakeholders were identified to participate in the adaptation planning process, representing a range of organizations that can play a key role in local resilience and service delivery (see Table 1 on Page 6/7). The project team provided subject matter knowledge and expertise, while ensuring that the ReCAP is aligned with community needs.

The NLCWG was crucial in providing specific knowledge, input, and ensuring that the plan aligned with community needs. By building upon the expertise of these individuals, the ReCAP is reflective of a wide range of perspectives and identifies needs and priorities for each of the AMs. Invitees to the working group participated in meetings and workshops to develop the ReCAP and/or were kept informed of progress and were encouraged to provide feedback throughout the development of the plan.

To commence the Advancing Adaptation program, the District held a kickoff meeting. The purpose of this workshop was to scope the Advancing Adaptation program, outline the findings of the Climate Science Report and potential climate impacts the community would face, and begin the impact identification phase of Milestone Two.

Milestone Two: Research

Milestone two focused on developing a community's understanding of climate change impacts and the major service areas which are likely to be most affected. Within this milestone, the NLCWG scoped the climate change impacts and conduct both a vulnerability and risk assessment.

Impact Identification

Climate-related impact statements are the foundation of the vulnerability and risk assessment processes and must be tailored to each municipality's context. These are concise statements that outline locally relevant projected threats and how these changes are expected to affect the built, natural, social, and economic systems across Muskoka. They bring together knowledge of climate change and projected changes into the medium and long-term as well as knowledge of the local conditions in the jurisdiction that is being studied.

Nearly 50 potential impacts were identified but through revisions and discussions this was reduced to 37. These impacts cover a range of affected areas including infrastructure, the natural environment, public health and safety, tourism, and more. Impact statements have been further organized by climate event to help the NLCWG better understand the focus and scope of each

impact. Climate event categories include changes in temperature, changes in precipitation, changes in water temperatures and levels, and extreme weather events.

Vulnerability Assessment

A vulnerability assessment was conducted for each impact statement to identify how vulnerable the community is to various impacts, and to prioritize areas of focus. Vulnerability is a function of two criteria – the sensitivity of the community to a given climate change impact, and its adaptive capacity, or ability to cope, with given climate change impacts.

Sensitivity is determined by assessing how the functionality of the community would be affected should the impact occur today is considered. This includes considering how the impact would affect the community's ability to deliver and access services, maintain regular functionality, etc. In contrast, adaptive capacity refers to the ability of systems, institutions, individuals, and other assets to adjust to potential damage, to take advantage of opportunities, or to respond to consequences. To determine adaptive capacity, participants considered the time and resources required to restore the community or assets to its previous functionality should the impact occur today, as well as consider any plans, policies, and actions already in place to address this issue.

The vulnerability assessment was carried out using an online survey and was completed by the NLCWG. The results provided a first look at prioritization of impacts before doing a more in-depth consideration of future risk. Vulnerability rankings that are "high" indicate the impacts to which the District is *sensitive* or has low *adaptive capacity*. 28 Medium and High scoring impacts were brought forward to the risk assessment process.

Risk Assessment

The risk assessment process is used to further analyze and prioritize which risks are most pertinent in a climate-adjusted future. Risk is the combination of the probability of an event occurring and its negative consequences. It can be expressed as a function of *likelihood* x *consequence*. In this case, *likelihood* refers to the probability of a projected impact occurring, and *consequence* refers to the known or estimated outcomes of a particular climate change impact.

When determining likelihood, both recurring (flooding, extreme weather) and slow-onset events (biodiversity loss, shifting eco regions) were considered and rated on a scale of 1 – 5, with 1 being 'rare', and 5 being 'almost certain'. These ratings were informed both by the localized climate change projections, as well as local knowledge and expertise of current conditions.

Consequences referred to the known or estimated consequences of a particular impact. To determine consequences, the working group assessed the 28 impacts across twelve different consequence criteria. Consequence criteria were divided into three categories – economic, social, and environmental. Each of the twelve criteria receive a score from 1 – 5, ranking from 'negligible' to 'catastrophic'. As such, each impact receives a risk score for each category, as well as one overall risk score.

Based on the results of the risk assessment, the NLCWG identified 12 impacts to move forward into planning. Impacts were prioritized if they had an overall risk score of medium or higher, or if

they had an overall risk score of medium-low but at least one category-specific risk score that was medium or higher. This was done to ensure that impacts that posed a significant risk to a specific category were not left out of the process.

Photo by: Lyndsie McGregor

Priority Climate Change Impacts

Through the vulnerability and risk assessment process and results (the full results of which are shown in Appendix B), we arrived at a list of 12 *priority climate change impact statements*, described in Table 2 below. Some impacts are inherently more or less negative or consequential than others and can vary widely for different demographic groups.

Table 2: Priority Climate Change Impact Statements

Priority Climate Change Impact Statements
Increased frequency and intensity of precipitation events resulting in more flooding, leading to increased municipal infrastructure damage (i.e., buildings, roads, bridges, trees, streetlights, signs, etc.), associated costs, and staff-impacts.
Increase in hot days over 30°C, increase in water temperatures, increase in heatwaves and the frequency of violent summer storms/precipitation events, and changes in wind patterns (longer periods of calm) leading to an increased frequency of algal blooms (and elevated lake bacteria levels) resulting to a decline in drinking water quality and loss of recreational and tourism opportunities (beach closures, outdoor events, etc.).
Increase in annual average temperatures & increased frequency and intensity of precipitation events leading to shifting eco regions for flora and fauna, resulting in an increase in human health and safety implications (i.e., change in infectious disease patterns: food-borne, water-borne, vector-borne, etc.) for the community (i.e., residents, businesses, etc.).
Increase in average winter temperatures leading to decreased ice safety on lakes and wetlands and less snow resulting in decreased winter recreation & tourism (i.e., shortened snowmobiling season, ice fishing, use of outdoor rinks, etc.).
Increase in the frequency/intensity of extreme weather events (e.g., ice storms, windstorms, tornadoes, snowstorms, etc.) / Increase in severe freezing rain events (especially in January) leading to increased likelihood for damage to electrical infrastructure resulting in more power outages (brownouts, blackouts, extreme cold) & service disruptions (business, flow of goods/services, etc.).
Increased average annual temperatures leading to less snow coverage and changes to habitat resulting in impacts to traditional land uses, and harvest practises of Indigenous communities (i.e., loss of habitat for traditional FN food sources, horseshoe hare & stouts changing colour in winter no longer match surroundings, many species shift north, plants and animals used to make medicines shift north, etc.)
Increase in hot days over 30°C, extended heatwaves leading to unsafe outdoor working conditions and loss of productivity for construction, maintenance, landscaping, etc.
Increase in hot days over 30°C leading to increased waterfront and park use and deterioration of infrastructure (i.e., roads, bridges, etc.), requiring more maintenance & repair of assets, crowding, transportation systems, AM assets (parking area, trails, public beaches), etc.

Increased average temperatures leading to shifting eco-regions for flora and fauna and longer growing seasons resulting in increased survival & spread of invasive species (e.g., gypsy moths, emerald ash borer, etc.), wetlands drying up, more tree mortality, and decreased forest health (i.e., hemlock woolly algid, sugar maple shift north, beech bark disease spread to reduce food availability for wildlife).
Increase in precipitation leading to higher water flows resulting in increased erosion which impacts both natural and built systems (road, bridges, aquatic health, riparian zones etc.).
Increase in hot days over 30°C leading to heatwaves resulting in health impacts to vulnerable populations and outdoor workers.
Increase in the frequency/intensity of extreme weather events (e.g. ice storms, wind storms, tornadoes, snowstorms, etc.) and increased frequency/intensity of precipitation events leading to unsafe/hazardous road and travel conditions and flooding of roads and bridges resulting in disruptions to all transportation (active and vehicular, school buses), emergency services, public transit systems, and other essential services (i.e. food systems, medical care/hospitals, fire, police, paramedic, airports, etc.).
Increased water temperatures leading to disrupted/damaged aquatic species habitat and ecosystems, resulting in increased fish mortality, increased algal blooms, and changing breeding patterns (i.e., subsequent food web impacts).

Milestone Three: Plan

Guided by BARC Milestone Three, the adaptation planning process was community-focused, convening a wide range of community stakeholders at multiple municipality-led workshops, allowing for a collaborative co-development of the adaptation plan. The planning process involved multiple steps, including performing a gap analysis and identifying additional follow-ups and engagement with NLCWG members, establishing a final list of prioritized risks, establishing a long-term adaptation vision, goals, and objectives, identifying and prioritizing adaptation action options with considerations for implementation (including the development of implementation schedules), and developing a monitoring and review process.

Action Identification and Prioritization

An action brainstorming workshop was held with the working group where a total of 73 potential actions and supporting actions were identified. All actions were reviewed by the Project Team to edit and refine the actions and the result was a prioritization of each action as urgent, high, medium, or low. 32 total priority action areas were identified, with a varying number of the identified actions being applicable to each AM, the process was continued with the 32 priority actions list.

Implementation

An implementation workshop was held with the NLCWG, and subsequent focus group discussions were had with the senior leadership teams within each AM to identify implementation

considerations for each action. This was completed for the urgent, high, and medium-priority actions, and where applicable, some actions were combined or condensed. The implementation schedules are intended to be a living document and will be further refined as implementation progresses.

The individual Area Municipal Action Plans in Section 6 indicate the actions that will be undertaken by each AM as well as the individual supporting actions and immediate next steps they will need to complete. A more fulsome description of these items is as follows:

- **Action Name**: the name of the identified action.
- **Immediate Next Steps:** immediate next steps that need to be taken.
- **Supporting Actions**: actions to help support the implementation of the action, or steps that need to be taken before the action itself can be considered.

Further to this, there are implementation schedules for each AM in Appendixes C to G that detail other implementation considerations required to complete the priority actions. Each Implementation Schedule includes:

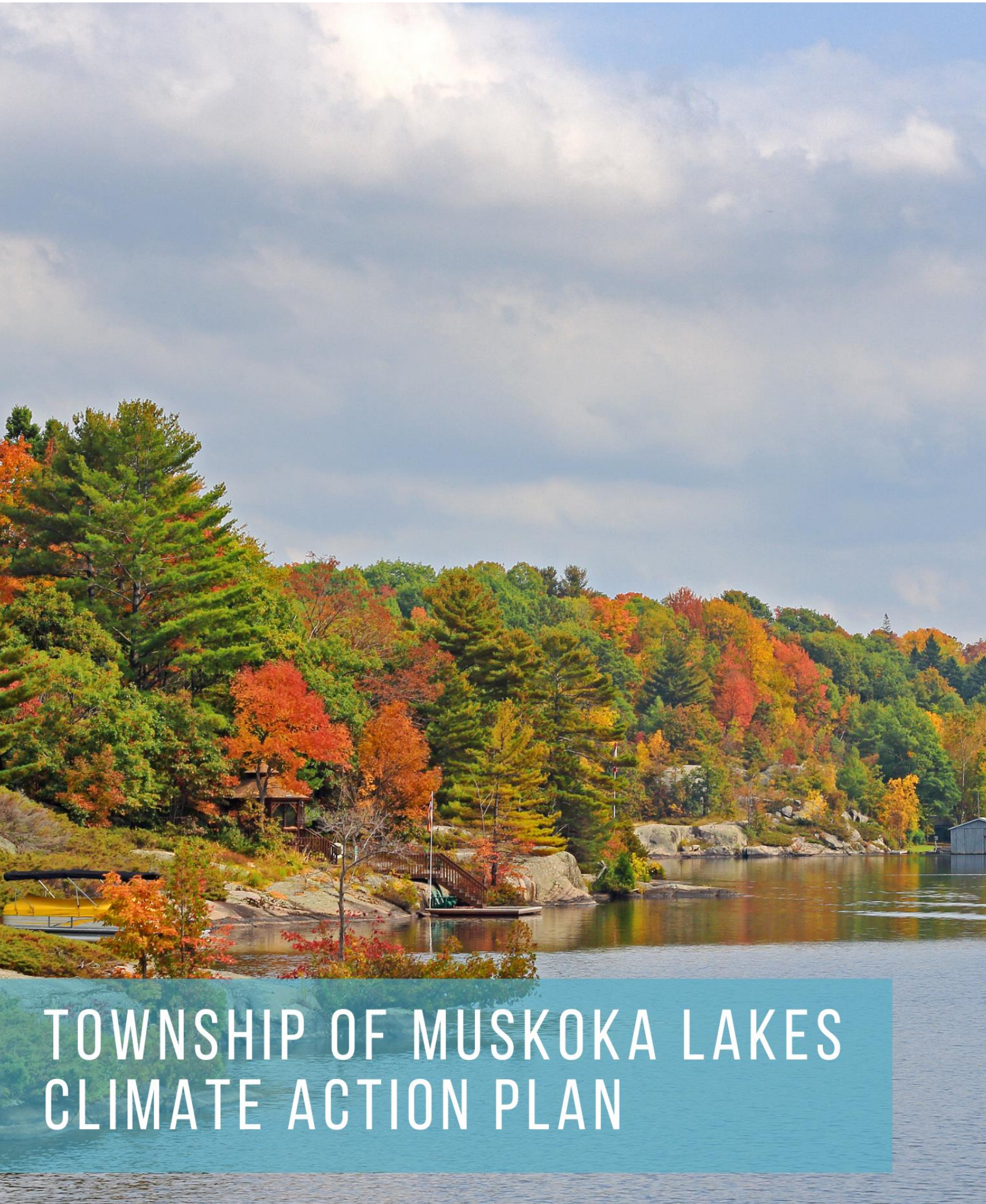
- **Action Name**: the name of the identified action.
- **Action Details**: description of the intent of the action, what it hopes to achieve, and its relative scope.
- **Lead Organization(s)**: department(s)/organization(s) that will lead implementation.
- **Potential Supporting Organization(s):** the department(s)/organization(s) that will support implementation of the action.
- **Current Practice:** related programs, initiatives, or policies that are already underway or happening that speak to or are in alignment with the action.
- **Anticipated timing:** How long implementation of action would take: short-term (<2 years), medium-term (2-5 years), long-term (5+ years).
- **Monitoring Metric:** indicator(s) to monitor the action and evaluate progress on achieving the identified objectives.

6. Action Plans for a Climate Resilient Muskoka

Each of the following five chapters outline some background information and details of each AM, as well as the specific actions that each AM will be undertaking to move towards the climate resiliency vision. There are many commonalities between the AMs since many of the actions require support from all the communities, but there are differences in the specific actions for each AM based on their unique capacity, needs and priorities. These subsections break down the action items based on the area of work required to implement.

The actions in each plan are divided based on action area and include the following areas:

- Development and Infrastructure.
- Communication and Educational Awareness.
- Adaptation Programs.
- Emergency Response Measures.
- Policy Change.



TOWNSHIP OF MUSKOKA LAKES CLIMATE ACTION PLAN

Township of Muskoka Lakes Adaptation Plan

The Township of Muskoka Lakes' Municipal vision statement is:
"Where generations live and gather in a breathtaking natural environment, enjoying recreation, history, and small-town character. These will be protected and enhanced for future generations, while encouraging thriving communities."

The Municipality has a permanent population of 7,400 and a seasonal population of 25,000. The Township encompasses a large geographic area around Lakes Muskoka, Rosseau and Joseph, including many rural communities. The communities of Bala and Port Carling are the largest urban centres.

The proximity of the Township of Muskoka Lakes to the urban populations of Ontario and the northern United States has contributed to its historic and contemporary role as an iconic cottage, recreation and tourism destination. The Township's small communities, waterfront and rural areas provide an attractive lifestyle to its residents. In the face of global change, the Township understands the need to take a leadership role in protecting the features that make our community unique so that future generations can also enjoy the Muskoka experience.

The Township of Muskoka Lakes wishes to protect its economy, community, and ecosystems from the impacts of our changing climate. A main priority is adding a climate action perspective on all decision-making, large and small, and working to achieve community wellbeing, resiliency, and equity. Below is a list of some of the current actions that the Township of Muskoka Lakes is undertaking:

- On August 11, 2021, the Township of Muskoka Lakes declared a Climate Emergency and committed to the development of the ReCAP.
- Continue to assess changes to Updated Septic Inspection Program.
- Continue to assess changes to Updated Tree Conservation by-law.
- Promote Friends of the Muskoka Watershed residential wood ash recycling program to increase forest resilience to drought and insect damage.
- Continue to review of municipal processes to find ways to better optimize salt use to balance ecosystem health and community safety.
- Ensure municipal policies encourage use of municipal lands for community food, water retention and pollination gardens.
- Review Municipal Emergency Response Plan.
- Replaced all streetlamps with LED light bulbs.
- Dark Sky by-law under review. This by-law will aim to enforce light pollution mitigation methods within the Township.
- Adopted the updated Official Plan to protect the environment and water quality.
- Adopted the Official Plan amendment to protect the environment and character of Minett.

As the Township of Muskoka Lakes continues to prioritize climate change adaptation, the following actions are the priority areas for the community.

Theme #1 – Development & Infrastructure

Action 1: Assess impact of new Official Plan policies that encourage Low Impact Development (LID) features and green infrastructure in development projects.	
Immediate Action 1.1	Review best practices from other municipalities.
Supporting Action 1. a	Consider creating Green Development Standards (GDS) with resiliency measures.
Supporting Action 1. b	Encourage homeowners and landlords to meet green development standards when undertaking development.
Supporting Action 1. c	Investigate legal hurdles to require this through the site plan approval process.
Supporting Action 1. d	Advocate for changes to the Ontario Building Code.

Action 2: Assess the resilience of existing Municipal infrastructure (i.e., buildings, roads, water/wastewater infrastructure, etc.) to climate-related risks.	
Immediate Action 2.1	Research best practices on how to incorporate climate resilience into asset management.
Supporting Action 2. a	Explore mobile infrastructure – shared services to reduce duplication

Action 3: Continue to assess changes to Updated Tree Conservation by-law.	
Immediate Action 3.1	Continue to monitor effectiveness of recent By-law update, and consider expanding its application within Urban centres/Communities.
Immediate Action 3.2	Create a communication plan to ensure community awareness.
Supporting Action 3. a	Research and implement best practices to conserve and increase vegetation retention including urban tree canopies.
Supporting Action 3. b	Continue to ensure vegetation retention for all development and follow Official Plan greenspace/parkland requirements for new development.
Supporting Action 3. c	Review reporting and enforcement mechanisms to ensure trees are protected & site alteration minimized.

Theme #2 – Communication & Educational Awareness

Action 4: Compare best practices with communicating watershed advisory statements and improve process where required.	
Immediate Action 4.1	Explore and implement best practices from other AMs.
Supporting Action 4. a	Review current Municipal communication strategy for communicating this information.
Supporting Action 4. b	Investigate the use of Voyent Alert.

Action 5: Increase knowledge of climate change impacts in the community and improve personal preparedness of community members.	
Immediate Action 5.1	Review best practices from other AMs and DMM.
Supporting Action 5.2	Explore opportunities to increase climate change awareness and education.
Supporting Action 5. a	Encourage community members to check on family, friends, and neighbours during of extreme weather events.
Supporting Action 5. b	Partner with external organizations to understand communication best practices.

Action 6: Work with Simcoe Muskoka District Health Unit to improve communication regarding beach/lake closures with respect to blue-green algae or other health related closures.	
Immediate Action 6.1	Schedule a meeting with Simcoe Muskoka District Health Unit, Area Municipal and District staff to discuss collaboration on this subject.
Supporting Action 6. a	Review the Simcoe Muskoka District Health Unit (SMDHU) communication process.

Action 7: Work with Muskoka municipal partners to create educational material (i.e., rack card) for residents and commercial businesses to better understand climate change risks, adaptation, and mitigation.	
Immediate Action 7.1	Review best practices from other AMs.
Supporting Action 7. a	Partner with Chamber of Commerce to identify opportunities to extend summer season without damage to ecosystems.
Supporting Action 7. b	Look for opportunities to incentivise businesses for best in practice climate resiliency measures.
Supporting Action 7. c	Work with local business on continuity plans, including funding/insurance to ensure seamless operation during climatic events.

Theme #3 – Adaptation Programs

Action 8: Explore grant opportunities for home efficiency and resiliency.	
Immediate Action 8.1	Implement Community Improvement Plan Incentive Programs.
Supporting Action 8. a	Encourage homeowners and landlords to improve the resilience of residential buildings to climate-related risks through upgrades and/or retrofits.
Supporting Action 8. b	Explore grant programs for potential opportunities to increase resiliency through Community Improvement Plan.
Supporting Action 8. c	Advocate for changes to the Ontario Building Code.

Action 9: Conduct a review of Municipal processes to find ways to better optimize salt use to balance ecosystem health and community safety.	
Immediate Action 9.3	Review best practices from other AMs.
Immediate Action 9.4	Review application and volume of municipal salt use.
Supporting Action 9. a	Create educational material for residents on proper salt application.

Action 10: Explore a rain barrel program for residents.	
Immediate Action 10.1	Review lessons learned from the District program.
Supporting Action 10. a	Communications/education on this type of program.
Supporting Action 10. b	Investigate subsidies or partnerships with companies that make rain barrels.
Supporting action 10. c	Create education program on how to make your own rain barrel at home.
Supporting action 10. d	Review implementation for parks or community gardens (including schools, libraries)/recreational programs.

Action 11: Promote Friends of the Muskoka Watershed residential wood ash recycling program to increase forest resilience to drought and insect damage.	
Immediate action 11.1	Investigate potential support for program.
Supporting Action 11. a	Continue to promote communications.
Supporting Action 11. b	Investigate partnership opportunities for application of Ash on Municipal parks and property to increase tree strength and resiliency to invasive species, drought, blow down, etc.

Action 12: Ensure the installation of educational signage to reduce the spread of invasive species at boat launches and trailheads.	
Immediate Action 12.1	Communicate with the Federation of Ontario Cottagers' Associations (FOCA) on existing signage best practices.
Supporting Action 12. a	Continue to develop and deliver educational program on reporting/identifying invasive species.
Supporting Action 12. b	Explore grant opportunities.

Action 13: Continue partnership with Muskoka Conservancy to protect significant conservation lands.	
Supporting Action 13. a	Provide link to Muskoka Conservancy website and promotional materials when land being divided.

Theme #4 – Emergency Response Measures

Action 14: Work with municipal partners to improve and coordinate municipal efforts respecting warming and cooling interventions employed during extreme weather events.	
Immediate Action 14.1	Review current guidelines and thresholds established for cooling/warming interventions.
Supporting Action 14. a	Assess the current communications strategy, communicate best practices with other AMs.
Supporting Action 14. b	Establish updated guidelines of when to enact these facilities.
Supporting Action 14. c	Review buildings to determine which have adequate generator capacity. (i.e., warming centre with no backup power).

Action 15: Ensuring increased response and support for vulnerable populations during extreme weather events/flooding.	
Immediate action 15.1	Conduct review of current practices around communications.
Immediate action 15.2	Share current practices with other AMs.
Supporting Action 15. a	Partner with external organizations to determine how and what additional support can be provided to vulnerable populations during /after extreme weather events.
Supporting Action 15. b	Increase communications to improve awareness of the resources that exist to support vulnerable populations using different methods.
Supporting Action 15. c	Partner with SMDHU to conduct a needs assessment to identify the various vulnerable populations that exist, what the specific populations need, what they have access to and what improvements need to be made. .

Theme #5 – Policy Change

Action 16: Ensure municipal policies encourage community food, water retention (rain garden, bioswales, etc.) and pollination gardens.	
Immediate Action 16.1	Investigate partnership opportunities.
Supporting Action 16. a	Research and implement best practices to increase community involvement in developing community food, water retention and pollination gardens.
Supporting Action 16. b	Continue to promote communications and awareness of opportunities through the Municipality.

Action 17: Implement flood hazard policy in Official Plans through provisions in the Comprehensive Zoning by-law.	
Immediate Action 18.1	Research best practices and tailor to Muskoka.
Supporting Action 18. a	Review results of second phase of the floodplain mapping project to identify more at-risk parts of the community.
Supporting Action 18. b	Incorporate updated mapping into Comprehensive Zoning by-law.

Action 18: Development clear internal/external policies and communication plans to ensure notification of extreme weather events, road closures, power outages, etc.	
Immediate Action 19.1	Reviewing current practices within Voyent Alert.
Immediate Action 19.2	Share and adopt best practices from other AMs.

Involves themes 2 and 4 also

7. Implementation, Monitoring and Governance

Adaptation Plan Implementation and Governance

Each Area Municipality will lead the charge for the actions outlined in their regional climate adaptation plan. This will require coordination, support and engagement from many key departments and leaders within each organization, as well as community stakeholders. The Area Municipalities have decided the specific next steps for their action plans based on capacity, resources, and immediate threats to their community, which are outlined above in the action plans. The implementation of this plan involves several key steps including but not limited to the following actions:

- Establish internal ownership for actions (where necessary) and prioritize the action list
- Collaboration and communication between AMs and DMM
- Increase awareness and interest around issues and projects within the community
- Establish stakeholder groups if needed (project and AM specific)
- Develop communications strategies
- Develop reporting structure

The implementation of these action plans must be considered a priority within each AM. These plans must remain flexible as they need to adapt to continually changing needs and circumstances within each community to ensure the long-term resiliency.

Monitoring and evaluation

This adaptation plan is intended to be a living document that will be reviewed and updated by each AM as needed. The status of the action plan will be monitored as progress occurs for each of the AMs. Moving forward, a formal review and update will occur if there are significant changes required to the plan, otherwise, the plans will be formally updated every five years.

Funding

The actions outlined in the plan vary in terms of cost, timeline, and level of priority. Many of the actions require little to no funding and can be completed within existing budgets. Many of the actions are also already being addressed by community groups and stakeholders. For these projects, those groups will be leveraged as a great resource to further the community's resiliency to climate changes. Developing partnerships and gaining support from community groups and stakeholders will be a key step in furthering the implementation of the outlined initiatives.

Funding sources are constantly sought after to further advance climate action throughout Muskoka. Many grants and funding programs will be investigated as outlined in the action plans and if applicable grants are available the AMs and DMM should prioritize acquiring that funding to further climate resiliency. Moving forward, the goal is to incorporate the budget for many of the climate actions into each annual municipal budget.

Communication, Education and Outreach

Each Area Municipality, along with the District Municipality will continue to initiate, support, and engage in outreach and educational programs that support climate adaptation and mitigation education and efforts. Since education and outreach are such a key part of raising awareness on the issues of climate change, these areas will be a focal point in each of the AMs moving forward. Although each AM will take a different approach to the specifics of how the community will be educated and informed, overall, this will be a priority action throughout Muskoka. Once the ReCAP has been approved by each council, the AM will be required to provide access to this plan on their municipal website.

As outlined in the action plan, one of the main takeaways from this entire project is the benefit of strong inter-district communication amongst the Area Municipalities and the District Municipality. Many of the immediate and supporting actions involve communicating current practices and best practices amongst the AMs and DMM which will require strong and open streams of communication. During the process of creating this plan, many inter-district relationships were strengthened, which will ultimately support the continuation of communication between parallel departments between AMs.

Photo by: John McQuarrie

8. Call to Action

For members of the public including individuals, families, businesses, educators, or anyone seeking to take action around climate change there are many ways to help on a local level. There are many volunteer groups, individual actions, community outreach programs and involvement opportunities to support both climate change mitigation and adaptation actions, some of which are outlined below.

- Stay informed and provide input where applicable to the Area Municipalities and District Municipality through the respective environment and engagement pages. Get involved in community outreach events about climate change. Educate yourself and be an advocate for climate change education and action within your community.
    - District Municipality of Muskoka EnviroHub and Engage Page.
    - Town of Huntsville Environment Page and Engage Page.
    - Town of Bracebridge Environment Page and Engage Page.
    - Town of Gravenhurst Engage Page.
    - Township of Muskoka Lakes Environment Page and Engage Page.
    - Township of Lake of Bays Community Plan and Engage Page.
- Anyone interested in Volunteering throughout Muskoka is encouraged to checkout one of the many Muskoka-region Organizations for volunteer opportunities: Muskoka Volunteer Opportunities
- Always be prepared for emergencies with these three steps: know the risks, make a plan, and prepare an emergency kit. This will help support emergency preparedness in the case of a climate emergency or any other emergency. Learn more here.
- Plant native plants and native pollinator gardens to support biodiversity. Information from Muskoka Watershed Council about Healthy Lawns and Gardens, Naturally is available online.
- Check in on your neighbours, family and friends during extreme weather events and climate emergencies to ensure everyone is safe and has adequate supplies.
- Be flood ready, especially if your home / property is on a known flood plain. This resource from the Government of Canada details how to prepare your property for a flood, and why you shouldn't wait for the water.
- If your property is a woodlot, follow the steps outlined in this resource from Muskoka Watershed Council on how woodlot owners can take action towards climate change.
- Sign up for Voyent Alert. By downloading the Voyent Alert! app and registering, residents and visitors can select to receive notifications from a wide variety of communication channels including mobile apps, text/SMS alerting, email or voice calling.
- Create a rain garden at your home or business to help reduce the effects of increased precipitation in Muskoka. Rain gardens increase water retention which reduces local effects of flooding during extreme rain events, and they can also increase pollutant filtration so that urban stormwater systems are less effected by lawn fertilizers, pesticides,

oils, and other chemicals from man-made infrastructure. Resources about creating a rain garden can be found here.

- Keep your wood ash and donate to the Friends of the Muskoka Watershed Wood Ash program- ASHMuskoka. Wood ash recovered from residential wood stoves can be scattered in forests to replenish calcium levels in soil and water, which increases forest health and resiliency.
- Learn about and participate in Algae Monitoring Program. Muskoka Watershed Council developed the Algae Monitoring Program to collect information on the distribution, abundance, and seasonal cycles algae across Muskoka area lakes so that, over time, it may be possible to identify conditions favoring algae, detect trends in phytoplankton abundance, and provide management advice.
- Ensure your property has a natural edge. Muskoka Watershed Council offers Watersheds Canada's popular The Natural Edge program in the Muskoka area. Shorelines are one of the richest environments on earth, but they are also among the most threatened. Habitat loss and degradation, water quality impairments, and increasing pressures from shoreline development can deteriorate our lakes and rivers, making them a priority for environmental stewardship and restoration. Protecting your shoreline can help support ecosystems and lake health which has countless environment, social and financial benefits.
- Support natural stormwater management techniques such as rain barrels or porous pavement at your home or business. Resources and information can be found here.
- Clean Muskoka Together is a year-round Muskoka-wide community litter clean-up program in partnership with the DMM and Area Municipality partners. This program provides all the tools you need to help keep Muskoka beautiful, including gloves, recycling bags and specially marked garbage bags.

Photo by: John McQuarrie

9. Conclusion

As previously stated, the vision of this project is: *Muskoka will be a progressive and resilient leader in the urgent need to adapt to changing climate conditions, ensuring the protection of the natural environment and prosperous communities.* Throughout the development of the ReCAP, this vision has remained top of mind. This plan will support Muskoka's municipalities drive forward their resiliency against the significant and high-risk impacts of climate change.

Everyone has a part to play in our goal of adapting to climate change. Environmental, financial, and social responsibilities are key pillars of a resilient community. The actions outlined in this plan are not only actionable by the Area Municipalities and the District of Muskoka, but also by the individual, as each of us can make an impact in transitioning Muskoka into a more climate change-aware and resilient community.

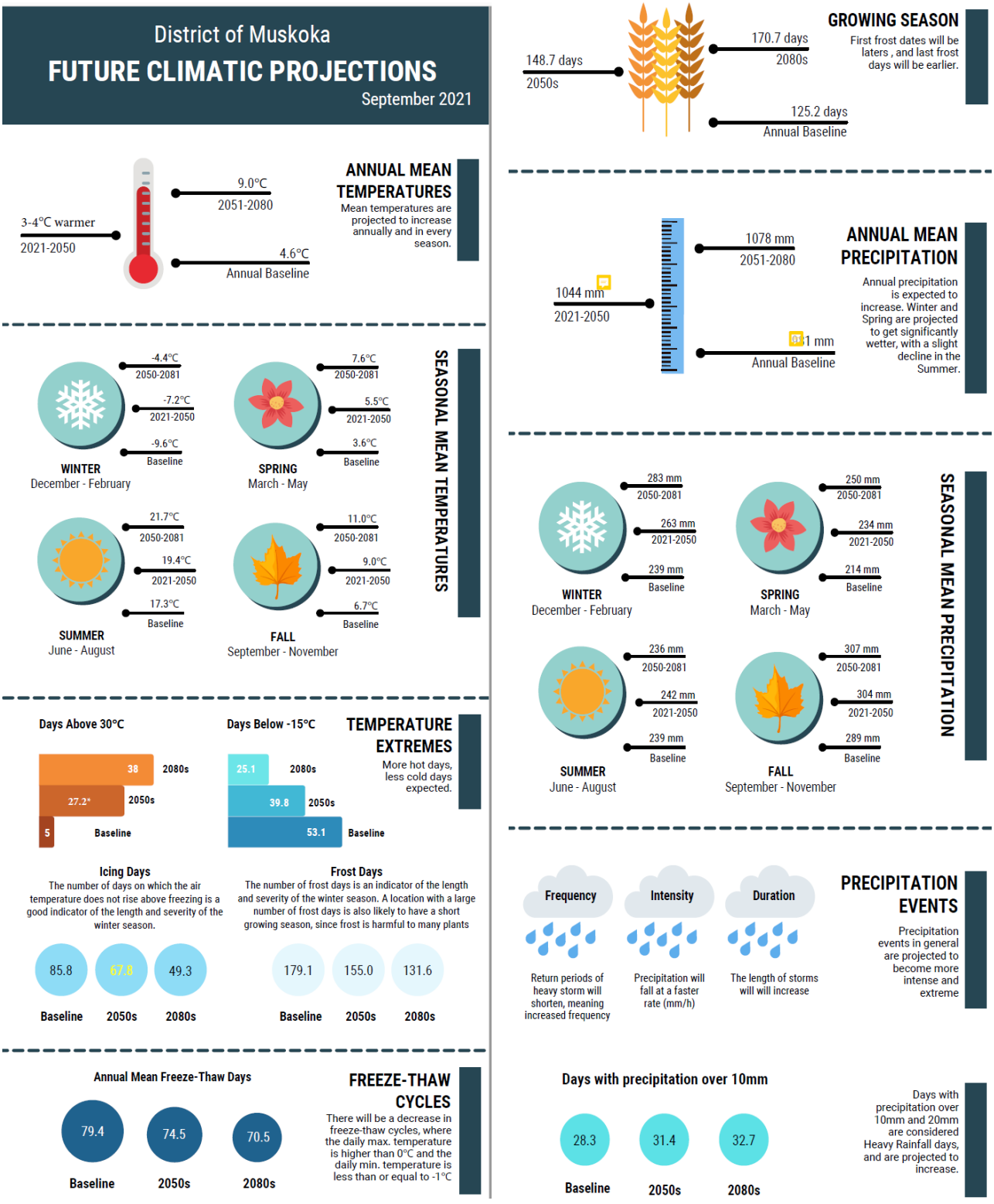
This process and report were completed with an overarching view of Muskoka as a whole, as well as with a specific lens for each Area Municipality. In doing so, communication, collaboration, and resource-sharing have happened throughout the District of Muskoka. As the action plans are specific to each Area Municipality, the next steps are tailored to their local circumstances and as such, are very actionable.

The key to success for many of these actions is communication, and in doing this adaptation planning process with a District wide lens, the lines of communication have been opened. This report will be a living document that will be utilized as an action plan and when needed it will be reviewed and modified so as to continue being a useful action plan.

Adaptation is an extremely important aspect of climate change since it can have the highest local impact on how Muskoka is affected by climate change. With many climate science projections showing a higher likelihood of more extreme weather events, heat waves, precipitation, and flooding events locally, Muskoka needs to be prepared for these events to reduce the financial, social, and environmental impacts of those events when they occur.

10. Appendices

Appendix A: Climate Science Infographic



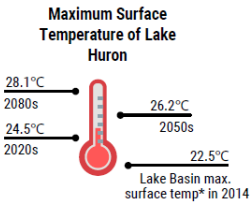
Severe freezing rain events (>6 h per day) are projected to increase up to 30% by 2100

FREEZING RAIN EVENTS

Freezing rain events are expected to increase slightly during January, slightly change in December, and decrease in November, March, and April

TREE COVERAGE AND DISTRIBUTION

Tree coverage for the primary forest species of Eastern White Pine, Sugar Maple, and White Spruce is expected to decrease and shift northward as seasonal and annual temperature increases



20%

Loss of coldwater (<19°C) stream habitat

WATER TEMPERATURES

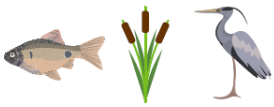
Lake basin temperatures will increase. This can negatively impact wetlands, habitats, and biodiversity.

*This includes all wetlands and tributaries

WATER LEVELS

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

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



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

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

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

Sources:

Canadian Climate Data and Scenarios Network

Climate Atlas of Canada Tool.

Planning for Climate Change in Muskoka, Muskoka Watershed Council.

Appendix B: Vulnerability and Risk Assessment Outcomes

Impact ID	Impact Statement	Vulnerability Ranking	Likelihood (/5)	Social Risk Score (/100)	Economic Risk Score (/100)	Environmental Risk Score (/100)	Total Risk Score (/300)	Overall Risk Ranking
1	Increase in summer temperatures and changing summer precipitation patterns leading to the death of ground vegetation resulting in decreased wildlife food sources	Medium	2	12	12	12	36	**Very Low**
2	Increased average temperatures leading to shifting eco-regions for flora and fauna and longer growing seasons resulting in increased survival & spread of invasive species (e.g., gypsy moths, emerald ash borer, etc.), wetlands drying up, more tree mortality, and decreased forest health (i.e., hemlock woolly algid, sugar maple shift north, beech bark disease spread to reduce food availability for wildlife)	High	3	27	33	33	93	**Medium-low**
3	Increased average annual temperatures leading to less snow coverage and changes to habitat resulting in impacts to traditional land uses, and harvest practises of Indigenous communities (i.e., loss of habitat for traditional FN food sources, horseshoe hare & stouts changing colour in winter no longer match surroundings, many species shift north, plants and animals used to make medicines shift north, etc.)	Medium	3	45	36	21	102	**Medium-low**
4	Increase in hot days over 30°C, increase in water temperatures, increase in heatwaves and the frequency of violent summer storms/precipitation events, and changes in wind patterns (longer periods of calm) leading to an increased frequency of algal blooms (and elevated lake bacteria levels) resulting to a decline in drinking water quality and loss of recreational and tourism opportunities (beach closures, outdoor events, etc.)	High	4	56	40	24	120	**Medium-low**

5	Increase in annual average temperatures & increased frequency and intensity of precipitation events leading to shifting eco regions for flora and fauna, resulting in an increase in human health and safety implications (i.e., change in infectious disease patterns: food-borne, water-borne, vector-borne, etc.) for the community (i.e., residents, businesses, etc.)	Medium	3	39	30	36	105	**Medium-low**
6	Increased water temperatures leading to disrupted/damaged aquatic species habitat and ecosystems, resulting in increased fish mortality, increased algal blooms, and changing breeding patterns (i.e., subsequent food web impacts)	High	3	30	27	24	81	**Low**
7	Increase in summer temperatures resulting in increased likelihood of wildfires, leading to damaged/disrupted ecosystems and subsequent loss of ecosystem functions (i.e., loss of carbon sequestration capacity, decreased ability of forests to hold water contributing to increased risk of flooding, etc.) and damage/loss of corporate assets (e.g., infrastructure, buildings, etc.) and personal property (e.g., homes, assets, etc.)	High	2	28	26	24	78	**Low**
8	Increased rain and warmer temperatures in winter leading to reduced lake ice resulting in damaged/disrupted ecosystems (i.e., warmer water temperatures affecting habitats, low water levels, etc.)	High	2	20	14	10	44	**Very Low**
9	Decreased summer precipitation and increased summer temperatures resulting in more demand for irrigation for agriculture, potable water, and golf courses resulting in increased stress on water availability.	Medium	3	27	33	18	78	**Low**
10	Decreased summer precipitation and increased summer temperatures resulting in lower water levels in lakes, rivers, and wetlands resulting in impacts on animal migration and feeding areas	Medium	2	14	8	12	34	**Very Low**
11	Increase in precipitation leading to higher water flows resulting in increased erosion which impacts both natural and built systems (road, bridges, aquatic health, riparian zones etc.)	High	4	32	32	28	92	**Medium-low**
12	Increase in the frequency/intensity of extreme weather events and flooding leading to damage natural features resulting in tree falls, loss of ecosystem goods and services, water contamination (i.e., reduced shading from extreme heat, landscape more vulnerable to	High	2	16	20	18	54	**Low**

	flooding, depleted aquifer recharge abilities, reduced air quality from tree decline, water contamination from septic or sewer overflow, etc.)							
13	Increase in hot days over 30°C leading to heatwaves resulting in health impacts to vulnerable populations and outdoor workers	High/Medium	4	36	32	24	92	**Medium-low**
14	Increase in average annual temperatures leading to more dry days, lower water levels and increased likelihood of wildfires resulting in impacts on human health and safety (i.e., increased physical health impacts from lower air quality, mental health impacts on those that are displaced, physical safety concerns, boat safety)	Medium	2	20	20	20	60	**Low**
15	Increased average annual temperatures and increased frequency/intensity of extreme weather events in southern Ontario resulting in an influx of forced migration due to climate change into the area (e.g., from Toronto - too hot in the city)	High	1	7	8	8	23	**Very Low**
16	Increase in average winter temperatures leading to decreased ice safety on lakes and wetlands and less snow resulting in decreased winter recreation & tourism (i.e., shortened snowmobiling season, ice fishing, use of outdoor rinks, etc.)	High	4	48	32	24	104	**Medium-low**
17	Increase in average annual temperatures leading to more pressure on the power grid, resulting in increased power outages (i.e., blackouts, brownouts) and reduced power production	High	1	9	8	5	22	**Very Low**
18	Increase in hot days over 30°C, extended heatwaves leading to unsafe outdoor working conditions and loss of productivity for construction, maintenance, landscaping, etc.	High	4	24	32	40	96	**Medium-low**
19	Warmer winters resulting in icy road conditions, leading to increased salt use resulting in increased run-off into the natural environment, and declines in water quality, and increased maintenance costs	High	3	24	15	33	72	**Low**
20	Increased frequency and intensity of precipitation events leading to increased flooding resulting in damage to private assets and infrastructure (i.e., homes, businesses, property, products/inventory, etc.)	High	3	27	30	15	72	**Low**
21	Increased frequency/intensity of extreme weather and precipitation events resulting in power outages, flooding of homes, businesses, and institutions causing more displacement or evacuation of residents, and physical and mental health	Medium	3	24	24	15	63	**Low**

	implications (i.e., from hazardous conditions, mold, unsafe food handling, food insecurity)							
22	Increased frequency and intensity of precipitation events resulting in more flooding, leading to increased municipal infrastructure damage (i.e., buildings, roads, bridges, trees, streetlights, signs, etc.) & associated costs and staff-impacts	High	4	36	64	40	140	**Medium**
23	Increase in the frequency/intensity of extreme weather events (e.g. ice storms, wind storms, tornadoes, snowstorms, etc.) and increased frequency/intensity of precipitation events leading to unsafe/hazardous road and travel conditions and flooding of roads and bridges resulting in disruptions to all transportation (active and vehicular, school buses), emergency services, public transit systems, and other essential services (i.e. food systems, medical care/hospitals, fire, police, paramedic, airports, etc.).	High	3	33	39	18	90	**Medium-low**
24	Increase in the frequency/intensity of extreme weather events (e.g., ice storms, windstorms, tornadoes, snowstorms, etc.) / Increase in severe freezing rain events (especially in January) leading to increased likelihood for damage to electrical infrastructure resulting in more power outages (brownouts, blackouts, extreme cold) & service disruptions (business, flow of goods/services, etc.)	High	4	44	40	20	104	**Medium-low**
25	Increase in hot days over 30°C leading to increased demand for outdoor shaded recreation/indoor cooling facilities resulting in increased need for cooling centres to operate outside of business hours (i.e., more maintenance to operate) and increased costs to municipalities	Medium	4	24	28	20	72	**Low**
26	Increase in hot days over 30°C leading to increased waterfront and park use and deterioration of infrastructure (i.e., roads, bridges, etc.), requiring more maintenance & repair of assets, crowding, transportation systems, AM assets (parking area, trails, public beaches), etc.	High	4	24	44	28	96	**Medium-low**
27	Increase in average annual temperature resulting in an increased pressure on water and wastewater facilities	Medium	3	24	30	24	78	**Low**
28	Increase in the frequency/intensity of extreme weather events increases probability of damage to buried infrastructure (i.e., water, utilities, telecommunications, power, etc.)	Medium	3	21	36	18	75	**Low**

Appendix F: Implementation Schedule for the Township of Muskoka Lakes

Action ID	Action	Description	Anticipated Timing	Lead Organization(s) / Department(s)	Supporting Organization(s)/Department(s)	Current Practices	Monitoring Metric(s)
1	Assess impact of new Official Plan policies that encourage Low Impact Development (LID) features and green infrastructure in development projects	Green development standards can be used to build resilience in future builds.	Long-term (5+ years)	• Township of Muskoka Lakes Planning and Development Services	• District of Muskoka Planning Department • Province of Ontario	• Building codes and Official Plans (established framework)	• Number of site plan approvals that incorporate LID • Number of major development approvals that incorporate LID (subdivision/condo)
2	Assess the resilience of existing Municipal infrastructure (i.e., buildings, roads, water/wastewater infrastructure, etc.) to climate-related risks	Ensure municipal infrastructure is protected from climate related risks	Medium-term (2-5 years)	• Township of Muskoka Lakes Operations department	• Local Utilities	• Municipal asset management practices	• Amount ofinfrastructure damage from extreme weather (i.e., less road floods) • Budget expenditures
3	Continue to assess changes to Updated Tree Conservation by-law	Trees have many positive impacts on mitigating floods. A consistent policy approach is needed.	Short-term (< 2 years)	• Township of Muskoka Lakes Planning and by-law Enforcement	• District of Muskoka Planning department • Muskoka Watershed Council • Friends of the Muskoka Watershed • Garden Centres	• Tree Conservation By-law • by-law updated in 2022 - increased area of coverage from 200 feet along the waterfront and 25 feet in urban centres/communities to 300 feet and 200 feet, respectively. • Enhanced by-law enforcement resources • Planning Act permits maximum acquisition of 2-5% parkland	• Tree canopy aerial data year by year
4	Compare best practices in communicating watershed advisory statements and improve process where required	Ensure the community is aware of advisories and message is distributed efficiently	Short-term (< 2 years)	• Township of Muskoka Lakes Communications and Emergency Services	• Ministry of Northern Development, Mines, Natural Resource and Forestry • District of Muskoka	• Share via Municipal website and social media channels	• Effectiveness and timeliness of Watershed advisory statements • Percentage of community members who are aware of the advisory statements
5	Increase knowledge of climate change impacts in the community and improve personal preparedness of community members	Improved awareness and preparedness reduces potential negative impacts of climate change. 43% of Canadians failed a general Climate Change knowledge test	Medium-term (2-5 years)	• Township of Muskoka Lakes Emergency Services and Communications	• Libraries • Schools • Climate Action Muskoka • District of Muskoka Climate Initiatives Coordinator • Simcoe Muskoka District Health Unit (SMDHU) • Muskoka Watershed Council	• SMDHU – climate/health specific messaging exists, messaging around climate health risks (i.e., heat, cold, VBDs, extreme weather) around increasing adaptive capacity, and some messaging around links between climate change and health	• Number of communications around climate change risks • Number of individuals targeted with messaging

Action ID	Action	Description	Anticipated Timing	Lead Organization(s) / Department(s)	Supporting Organization(s)/Department(s)	Current Practices	Monitoring Metric(s)
						• CAPE, Ontario Clean Air Alliance (for research purposes – what is already being done, information exists)	
6	Work with Simcoe Muskoka District Health Unit to improve communication regarding beach/lake closures with respect to health-related closures	Ensure community is aware of closures/health concerns	Short-term (< 2 years)	• Township of Muskoka Lakes Communications	• District of Muskoka communications department • Muskoka Watershed Council • Simcoe Muskoka District Health Unit • Township of Muskoka Lakes Public Works	• SMDHU Safe Water team – conducts water inspections after which team puts out warnings, area municipalities are alerted, etc.	• Time between confirmed bloom and issued communication is decreased • Percentage awareness of community members of closures/health concerns
7	Work with Muskoka municipal partners to create educational material (i.e., rack card) for residents and commercial businesses to better understand climate change risks, adaptation, and mitigation	• Encourage businesses to have a role in climate adaptation • Businesses can continue their operation as the climate changes • Businesses can create strategies to adapt and mitigate to climate change	Medium-term (2-5 years)	• Township of Muskoka Lakes Communications and Economic Development	• RTO12 • Muskoka Tourism • Chambers of Commerce	• RTO12 is looking at sustainable tourism initiatives	• Survey local businesses to gauge how prepared they feel about climatic changes/how climate change would affect their business
8	Explore grant opportunities for home efficiency and resiliency	Explore providing grant opportunities for older buildings to provide AC room, requirements for shading, resilient asphalts, no sub-grade windows, window awning minimums, hurricane ties, etc.	Long-term (5+ years)	• Township of Muskoka Lakes Economic Development and Development Services	• Federation of Canadian Municipalities • Province of Ontario • HydroOne/Lakeland Power • District of Muskoka	• Community improvement plan includes grants for building improvements and landscaping	• Number of Approved grants
9	Continue to review of municipal processes to find ways to better optimize salt use to balance ecosystem health and community safety	Salt reduction is beneficial both financially and environmentally.	Medium-term (2-5 years)	• Township of Muskoka Lakes Operations	• Muskoka Watershed Council • Friends of Muskoka Watershed • Ministry of Transportation	• Automatic spreaders and trackers on fleet	• Chloride levels in lakes/soil adjacent to roads are minimized
10	Explore a rain barrel program for residents	• To decrease water quantity entering the system • To prepare for extreme drought (on-site water storage) • Save $ on water bills • Save $ on water treatment • Increase community involvement/awareness with	Medium-term (2-5 years)	• Township of Muskoka Lakes Operations	• District of Muskoka Climate Initiatives Coordinator • Muskoka Watershed Council	• There is no rain barrel program in place for Muskoka Lakes	• A rain barrel program is in place and the community partakes • Number of barrels used in the community and where (urban vs rural) • Which organizations (schools/libraries/community orgs) are implementing

Action ID	Action	Description	Anticipated Timing	Lead Organization(s) / Department(s)	Supporting Organization(s)/Department(s)	Current Practices	Monitoring Metric(s)
		environmental stewardship programs					
11	Promote Friends of Muskoka Watershed residential wood ash recycling program to increase forest resilience to drought and insect damage	• To supplement forest soil with calcium as it helps tree growth rates • Increase of carbon sequestration of 20-40% • Increase water retention • Increase evapotranspiration • Increase trees resiliency to drought, invasive species, blow down etc. • Increase community involvement/awareness with environmental stewardship programs	Short-term (< 2 years)	• Township of Muskoka Lakes Economic Development and Communications	• District of Muskoka Climate Initiatives Coordinator • Friends of Muskoka Watershed	• District is supporting this program by offering space at Rosewarne Landfill. Additional support could be provided through communications, project funds, etc. • FOCA current promotes communications	• Percentage awareness by community members of project • Number of community members that volunteer to participate
12	Ensure the installation of educational signage to reduce the spread of invasive species at boat launches and trailheads	• Help decrease the spread of invasive species • Increase community involvement/awareness	Short-term (< 2 years)	• Township of Muskoka Lakes Communications	• Muskoka Watershed Council • District of Muskoka Climate Initiatives Coordinator • Ontario Federation of Anglers and Hunters • Federation of Ontario Cottagers Association (FOCA) • Township of Muskoka Lakes Public Works	• The Muskoka Watershed Council hires a seasonal employee to attend events to raise awareness of invasive species. • FOCA has signs created already – signs available: Clean Drain Dry – it's the law now.	• Signage installed • Increased awareness of invasive species and their impacts • Percentage/Amount of of invasive species being reported
13	Continue partnership with Muskoka Conservancy to protect significant conservation lands	Continue to advise landowners about benefits of donating conservation lands during development process	Short-term (< 2 years)	• Township of Muskoka Lakes Planning Department	• District of Muskoka Climate Initiatives Coordinator • Muskoka Conservancy	• Financial support through community grant program	• Monitor amount of conservation lands protected
14	Work with municipal partners to improve and coordinate municipal efforts respecting warming and cooling interventions employed during extreme weather events	Muskoka is warming at twice the global average. It is essential to establish interventions to prepare for these situations.	Short-term (< 2 years)	• Township of Muskoka Lakes Emergency Services	• District of Muskoka EPW • Simcoe Muskoka District Health Unit • Township of Muskoka Lakes Public Works	• #AlertMuskoka - Voyent Alert. • Emergency Plan, existing communications plan • SMDHU – Recommendations to Municipalities in Response to Heat Warning	• Number of visits to heating/cooling facilities

Action ID	Action	Description	Anticipated Timing	Lead Organization(s) / Department(s)	Supporting Organization(s)/Department(s)	Current Practices	Monitoring Metric(s)
15	Ensuring increased response and support for vulnerable populations during extreme weather events/flooding	Climate change disproportionately impacts vulnerable populations	Medium-term (2-5 years)	• Township of Muskoka Lakes Emergency Services	• Salvation Army • Habitat for Humanity • District Homelessness staff • Local Non-profits (GAP) • Township of Muskoka Lakes Public Works	• Vulnerability assessment by SMDHU exists – who are the vulnerable populations. • Building is open during hours of operation for warming/cooling during extreme temperatures	• Number of injuries, hospital visits per climatic event
16	Ensure municipal policies encourage use of municipal lands for community food, water retention and pollination gardens	• Access to fresh vegetables • Support pollinators • Gardens retain more water than a lawn	Medium-term (2-5 years)	• Township of Muskoka Lakes Operations	• Muskoka Heritage Foundation (native plant sales) • Muskoka Watershed Council • Horticultural Societies • Communities in Bloom	• Community garden in Milford Bay	• Number of community gardens • Number of pollinator habitats created/protected
17	Implement flood hazard policy in Official Plans through provisions in the Comprehensive Zoning By law	Significant flooding events have occurred in 2008, 2013, 2016, and the worst in 2019 which resulted in declaring a state of emergency at the Township of Muskoka Lakes Preventing development within flood prone areas reduces risk to health and safety and costs	Medium-term (2-5 years)	• Township of Muskoka Lakes Planning Department	• MNRF • District of Muskoka Planning department • Muskoka Emergency Response Committee (MERC)	• Staff currently use flood line elevations as articulated in the Zoning By-law and use the updated DMM mapping as a best practice	• Harmonized FPM
18	Development of clear internal/external policies and communication plans to ensure notification of extreme weather events, road closures, power outages, etc.	It is essential to establish clear guidelines and regulations around extreme weather events.	Short-term (< 2 years)	• Township of Muskoka Lakes Communications	• Environment Canada (does existing notifications) – municipality can sign up • Electrical companies (Ontario Hydro) – to communicate info re: power outages, downed cables, towers, etc.	• District of Muskoka Alert System (Voyent Alert)	• Number of reads • Number of web page views
19	Continue to assess changes to Updated Septic Inspection Program	Ensure private septic systems are properly functioning and protect water quality	Long-term (5+ years)	• Township of Muskoka Lakes Development Services	• District of Muskoka planning department • Engineering firms, septic contractors	• Operate Septic Re-inspection program since 2000. Evaluate septic systems to provide the owner with information regarding performance, operation and maintenance of the septic system (educational talk and material handouts).	• Percent of septic systems Phase I and II inspections completed

Appendix H: Glossary of Terms

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

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

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

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

Climate Change Atlas of Canada: The Climate Atlas of Canada is an interactive tool that combines climate science, mapping, and storytelling to depict expected climatic changes across Canada to the end of the century. The 250-layer map is based on data from 12 global climate models. Users are shown a baseline period of warming trends by region that spans from 1950 to 2005 and can toggle between two future projection periods, 2021 to 2050 and 2051 to 2080.

Climate Change Data and Scenarios Tool: The Canadian Climate Data and Scenarios (CCDS) site was originally launched in February 2005 with support from Environment and Climate Change Canada, the Climate Change Adaptation Fund (CCAF) and the University of Regina. The CCDS supports climate change impact and adaptation research in Canada through the provision of climate model and observational data.

Climate Data Canada: Offers local climate data and advanced customization options to allow for a better understanding of changes likely to be experienced by Canadian communities. Climate Data Canada is a collaboration between Environment and Climate Change Canada, the Computer Research Institute of Montréal, Ouranos, the Pacific Climate Impacts Consortium, the Prairie Climate Centre, and HabitatSeven.

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

Climate Change Scenario: A climate change scenario is the difference between a future climate scenario and the current climate. It is a simplified representation of future climate based on comprehensive scientific analyses of the potential consequences of anthropogenic climate change. It is meant to be a plausible representation of the future emission amounts based on a coherent and consistent set of assumptions about driving forces (such as demographic and socioeconomic development, technological change) and their key relationships.

Ensemble Approach: An ensemble approach uses the average of all global climate models (GCMs) for temperature and precipitation. Research has shown that running many models provides the most realistic projection of annual and seasonal temperature and precipitation than using a single model.

Extreme Weather Event: A meteorological event that is rare at a place and time of year, such as an intense storm, tornado, hailstorm, 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.

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

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

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

Low Carbon Resilience (LCR): an approach to climate action that encourages coordination and co-evaluation of mitigation and adaptation measures to reduce greenhouse gas emissions while also building resilience. Applying a LCR lens bridges the gap between mitigation and adaptation silos by finding alignment in planning, policies, and programs. LCR brings with it a number of operational benefits and climate action synergies including cost savings and resource efficiencies, reduced reliance on grey infrastructure, improved flood and heat management, improved carbon sequestration, as well as a number of co-benefits for health, air quality, infrastructure, equity, preserving ecosystem health and biodiversity.

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.

Representative Concentration Pathways: Representative Concentration Pathways (RCPs) are four greenhouse gas concentration (not emissions) trajectories adopted by the IPCC for its fifth Assessment Report (AR5) in 2014. It supersedes the Special Report on Emissions Scenarios (SRES) projections published in 2000. For information on the Shared Socio-economic Pathways (SSPs) in the 6th Assessment Report (AR6) see below.

Resilience: The capacity of a system, community or society exposed to hazards to adapt, by resisting or changing in order to reach and maintain an acceptable level of functioning and structure.

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

Shared Socio-economic Pathways (SSP): The SSPs describe five different storylines of alternate socio-economic developments, including: sustainable development, regional rivalry, inequality, fossil-fueled development, and middle-of-the-road development**.** While the Representative Concentration Pathways (RCPs) focus on mitigation targets to address the physical climate, the SSPs focus on the storylines and associated socio-economic ramifications of different scenarios including different challenges for climate adaptation and mitigation. The SSPs are featured in the IPCC's Sixth Assessment Report (AR6) that was launched in 2021.

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

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

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

Acronyms

BARC – Building Adaptive and Resilient Communities
ReCAP – Regional Climate Adaptation Plan
IPCC – Intergovernmental Panel on Climate Change
LCR – Low Carbon Resilience
LID – Low Impact Development
NBS – Nature-based Solutions
RCP – Representative Concentration Pathways
SSP - Shared Socio-economic Pathways
AM – Area Municipality
DMM – District Municipality of Muskoka
SMDHU - Simcoe Muskoka District Health Unit
BIA - Business Improvement Area
IWM – Integrated Watershed Management
FPM – Flood Plain Mapping
LOB – Lake of Bays
TML – Township of Muskoka Lakes
FOCA – Federation of Ontario Cottagers' Associations
CSC - Canada Summit Centre

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