City Council
ADDENDUM TO AGENDA

*For the **Regular Meeting** of City Council*
*To be held on **Tuesday, June 13, 2023** At **6:00 P.M.***
*In the **Council Chamber or Via Electronic Participation***
Tom Davies Square

Addendum

(Two-thirds Majority Required to Deal with the Addendum)

Declarations of Pecuniary Interest and the General Nature Thereof

ADD- 1 Presentations

Greater Sudbury Community Climate Change Adaptation Plan (CCCAP)

This report and presentation provides a summary and recommendation regarding the Greater Sudbury Community Climate Change Adaptation Plan (CCCAP) which outlines the climate-related changes expected to increasingly affect Greater Sudbury and includes actions aimed at building resilience in local social, economic, built, and natural systems.

Greater Sudbury Community Climate Change Adaptation Plan (CCCAP)

Presented To:	City Council
Meeting Date:	June 13, 2023
Type:	Presentations
Prepared by:	Stephen Monet Planning Services
Recommended by:	General Manager of Growth and Infrastructure

Report Summary

This report and presentation provides a summary and recommendation regarding the Greater Sudbury Community Climate Change Adaptation Plan (CCCAP) which outlines the climate-related changes expected to increasingly affect Greater Sudbury and includes actions aimed at building resilience in local social, economic, built, and natural systems.

Resolution

THAT the City of Greater Sudbury approves the Greater Sudbury Community Climate Change Adaptation Plan (CCCAP) and directs staff to proceed with its implementation, as outlined in the report entitled “Greater Sudbury Community Climate Change Adaptation Plan (CCCAP)”, from the General Manager of Growth and Infrastructure, presented at the City Council meeting on June 13, 2023;

AND THAT the City of Greater Sudbury create a Climate Resilience contract position to lead the implementation of the Community Energy & Emissions Plan (CEEP) and the Community Climate Change Adaptation Plan (CCCAP).

Relationship to the Strategic Plan, Health Impact Assessment and Community Energy & Emissions Plan (CEEP)

This report directly meets Objective 3.2 (Develop and Strengthen Strategies and Policies to Mitigate Impact of Climate Change) under the “Climate Change” strategic priority by identifying ways to improve climate resilience of Greater Sudbury’s social, economic, built and natural systems. By providing guidance for climate change adaptation and community resilience, the CCCAP meets several of the City’s priorities listed under Asset Management and Service Excellence, Economic Capacity and Investment Readiness and Create a Healthier Community. Becoming more resilient to extreme weather events, for example, will require improving infrastructure and enhancing communication between many sectors, especially vulnerable populations.

Together, the CCCAP and the CEEP provide climate action guidance for the Greater Sudbury community.

Financial Implications

The recommended Climate Resilience contract position will be funded from existing, approved funds in 2023, with a sustainable financing plan for the role presented in the 2024 Budget.

Specific projects associated with the CCCAP will be funded through the assignment of operating funds or, where appropriate, consideration as business cases in future budget deliberations.

Background

On May 28, 2019, City of Greater Sudbury Council passed resolution 2019-151 declaring "…a climate emergency to name and deepen our commitment to protecting our economy, our ecosystems, and our community from climate change." In addition, the resolution "…reaffirms action on climate change as a strategic priority." Finally, the resolution directs "…staff to bring a report to City Council for its consideration before the end of 2019 that describes an approach for creating a Climate Change Adaptation & Mitigation Plan …" Two climate-related planning actions had been initiated by the City prior to the climate emergency declaration:

1. In terms of climate mitigation, the Community Energy and Emissions Plan (CEEP) process started in the fall of 2017.
2. In terms of climate adaptation, the City conducted a risk and vulnerability assessment in 2017 to identify and prioritize local climate change impacts. This assessment was done as part of ICLEI Canada's Train-the-Trainer Initiative of the Great Lakes Climate Change Adaptation Project.

Development of the CEEP progressed through 2018 and 2019 and was approved by the City in September 2020. During the CEEP's first year of implementation in 2021, the City was chosen to participate in the ICLEI Advancing Adaptation project funded through the Ministry of Environment, Conservation and Parks as well as Environment and Climate Change Canada. Through this program, advice, guidance, and support on the development of the adaptation plan was delivered by ICLEI Canada. The CCCAP that resulted from this effort is presented in Appendix 1.

CCCAP Key Findings

The CCCAP is aimed at building climate resilience in Greater Sudbury's social, economic, built, and natural systems. The following six overarching theme areas were identified through engagement with several City divisions and community stakeholders:

1. Built Environment (e.g., municipal infrastructure, roads, bridges, pump stations, buildings, power lines)
2. Natural Environment (e.g., natural resources, ecosystems, wetlands, trails, wildlife)
3. Local Economy (e.g., local businesses, tourism, agriculture)
4. Cultural and Social Cohesion (e.g., building community resilience through schools, community centres, faith and cultural centres, volunteerism)
5. Community Health and Well-Being (e.g., disaster and emergency management, health and medical care, food access, evacuation, and public communications)
6. Enabling Actions (e.g., inform and empower community, research and new technologies, integration of climate change adaptation)

The CCCAP recommends 17 objectives that are tied to the strategy themes along with numerous actions and sub-actions aimed at adapting to change climate and increasing resilience to extreme climate events. Actions include those that are principally under the municipality's control, such as replacing and enhancing stormwater infrastructure (Action 2.1), developing an Urban Forest Master Plan (Action 5.2) and maintaining current cooling and warming centres and emergency evacuation centres (Action 11.4).

The CCCAP also includes actions over which the municipality has far less control, such as:

- creating resilient, all-season uses and opportunities for schools, faith centres, community centres, cultural venues and traditional gathering places (Action 9.2); and,
- encouraging employers to identify and address potential climate impacts on their workers and protecting them from increased exposure to extreme heat, wildfire smoke, and vector-borne diseases as recommended by Health Canada and the Ontario Ministry of Labour, Immigration, Training and Skills Development (Action 11.5).

CCCAP Implementation

As was done for the CEEP's implementation, staff will develop a five-year implementation plan for the CCCAP that outlines the climate adaptation actions to be achieved over that time frame by the various municipal divisions involved. Achieving all the CCCAP objectives will rely on coordinated efforts among public and private collaborators, upper-level government incentives, innovation, education and awareness moving forward. Thus far, four climate working groups have been established through the City's Climate Change Coordinator to help facilitate climate actions in Greater Sudbury. These working groups include the following: 1) Electric Vehicle Working Group; 2) Efficient Buildings Working Group; 3) Climate Actions Communications Working Group, and 4) Industrial Efficiency Working Group. Various community stakeholders participate on these working groups.

To enhance municipal coordination on climate action, a Climate Action Resource Team (CART) comprised of CGS staff across multiple divisions was established in December 2022. The CART recommends measures, strategies and tools to the City's Executive Leadership Team (ELT) for integrating climate actions into bylaws, policies, plans, programs, business processes, business plans and annual budgets. The Climate Change Coordinator provides the necessary support for the CART. In addition, the Climate Change Coordinator has the ongoing role of keeping track of climate-related federal and provincial funding opportunities and forwarding these to the appropriate municipal service units. The CART's priorities for the first two years include the following actions:

- ONGOING: prepare a Climate Action Annual Report for Council and the community that identifies progress in meeting the CEEP and CCCAP objections and, ultimately, the net-zero by 2050 target;
- YEAR 1: update and expand the Climate Emergency Lens;
- YEAR 1: enhance the capital project prioritization tool to include climate mitigation and adaptation criteria;
- YEAR 2: develop a sustainable or 'green' procurement policy.

To oversee and coordinate the implementation of both the CEEP and the CCCAP at CGS and to liaise with upper levels of government and private industry, senior staff recommend the creation of a Climate Resilience contract position reporting to ELT. The mandate of this position would be to lead the municipal actions in meeting emissions reduction targets and foster strategies for environmental resilience and climate adaptation. This Climate Resilience leadership position would lead the CART and have the authority to provide direction and guidance across all City departments, ensuring staff have the knowledge and resources to implement actions identified in the CEEP and CCCAP in a timely fashion. From improving natural infrastructure assets that manage stormwater, to proposing social procurement policies, to supporting local food systems, this new leadership position will take a holistic approach to climate and community resilience.

Conclusion

The CCCAP is aimed at building climate resilience in Greater Sudbury's social, economic, built, and natural systems. Together, the CCCAP and the CEEP provide climate action guidance for the Greater Sudbury community. It is recommended that a Climate Resilience contract position be created to oversee implementation of the CEEP and CCCAP at the City.

Resources Cited

Greater Sudbury CEEP - https://www.greatersudbury.ca/live/environment-and-sustainability1/net-zero-2050/community-energy-and-emissions-plan-ceep-march-2021-pdf/

Greater Sudbury

Community Climate Change Adaptation Plan

Greater | Grand Sudbury

EarthCare Terre à coeur SUDBURY

CEEP

ICLEI Local Governments for Sustainability

Table of Contents

1 Executive Summary

Data show a clear indication that climate change is affecting Greater Sudbury through rising annual temperatures, increases/decreases in precipitation, and extreme weather events. By 2050, climate models suggest that Greater Sudbury will be over 2°C warmer on average and experience double the current number of days hotter than 30°C.

The impacts from these unpredictable events include flooding, drought, decreased snow fall or wet heavy snow, rain, ice storms, extreme heat events, spread of invasive species and changes in natural phenomenon such blue-green algae blooms. These changes can have tremendous effects on our local natural environment, infrastructure, economy and community. The community must prepare for both positive and negative financial, health and environmental consequences of these impacts.

The Greater Sudbury Community Climate Change Adaptation Plan (CCCAP) aims to provide guidance and recommendations for the City, homeowners, property owners, businesses, and the entire community. It is a comprehensive, long-term plan to improve resiliency and growth in the community. By planning for climate change, Greater Sudbury can better adapt and bounce back after a crisis or disaster. Together we must work towards preventing prolonged service disruptions, helping vulnerable populations navigate through crises, and mobilizing the community in the recovery process.

To develop the CCCAP, City staff, Atikameksheng Anishnawbek, Wahnapitae First Nation and community stakeholders were engaged to collectively identify key vulnerabilities for our region related to climate change impacts. Eleven impact statements were developed that helped identify vulnerabilities such as an increase in public health concerns due to increasing summer temperatures and wildfire, as well as an increase in damaged powerlines due to increased wind, flooding and freezing events.

The impacts from climate change will disproportionately affect our community's vulnerable populations. Thus, recommended adaptation actions consider specific needs of the community.

Despite the numerous negative impacts we may experience, climate change may also provide opportunities for growth and partnerships through longer growing seasons, collaborative tourism or business strategies.

The changing climate presents us with an uncertain future, but by developing this CCCAP, Greater Sudbury will be better prepared and resilient to changes that may come.

The following six overarching theme areas were identified through stakeholder engagement for the climate adaptation actions in this plan.

1. Built Environment (e.g., municipal infrastructure, roads, bridges, pump stations, buildings, power lines)
2. Natural Environment (e.g., natural resources, ecosystems, wetlands, trails, wildlife)
3. Local Economy (e.g., local businesses, tourism, agriculture)
4. Cultural and Social Cohesion (e.g., building community resilience through schools, community centres, faith and cultural centres, volunteerism)
5. Community Health and Well-Being (e.g., disaster and emergency management, health and medical care, food access, evacuation, and public communications)
6. Enabling Actions (e.g., inform and empower community, research and new technologies, integration of climate change adaptation)

Under these themes, the CCCAP provides recommendations to help the community prepare for future changes in our local climate. Some example actions are:

2.1 Replace and enhance stormwater and wastewater infrastructure to protect people, property and the environment.

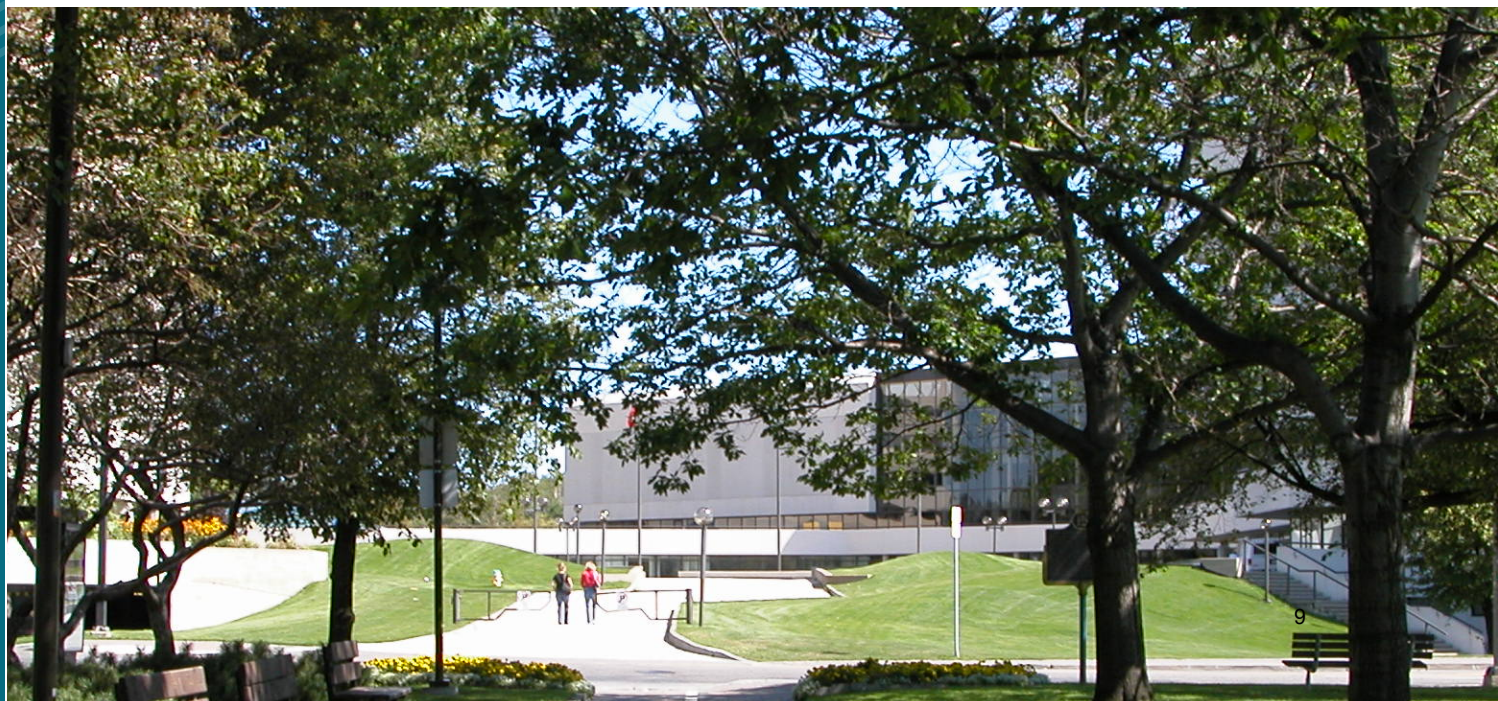
9.2 Create resilient, all-season uses and opportunities for schools, faith centres, community centres, cultural venues, and traditional gathering places.

11.1 Increase efforts to communicate with and aid vulnerable residents, including those with inadequate housing or those with medical and social support needs.

This plan is the second of two complementary municipal plans on climate change action.

The Community Energy and Emissions Plan (CEEP), a climate change mitigation plan, was approved in 2020 and contains strategies for the community and the municipality to reach net-zero greenhouse gas emissions by 2050.

This CCCAP addresses the impacts of the already changing climate and identifies opportunities to build climate resilience in its social, economic, built, and natural systems. Climate change adaptation and mitigation are both equally important and the City of Greater Sudbury continues to show its commitment to climate action by developing and implementing these two plans.



2 Acknowledgements

Land Acknowledgement

The City of Greater Sudbury recognizes that it stands within the boundaries of the Robinson-Huron Treaty of 1850. We respectfully acknowledge the Atikameksheng Anishnawbek on whose original territory the City is situated and Wahnapitae First Nation and the Métis People, who also make this their homeland. We thank and honour the people, families, and elders of these communities, who make this their homeland and whose enduring presence is felt to this day.

Stakeholder Involvement and Plan Development

The City of Greater Sudbury would like to thank all those who contributed to the development of the CCCAP and acknowledge the following stakeholders, who attended meetings and contributed their valuable knowledge and expertise:

Project Staff

- **Jennifer Babin-Fenske**, Climate Change Coordinator
- **Stephen Monet**, Manager of Strategic and Environmental Planning
- **Paul Javor**, Drainage Engineer
- **Taylor Menard**, Lake Water Quality Program Coordinator
- **Cheryl Beam**, Program Lead, Water/Wastewater Task Force
- **ICLEI Canada**

Participating Nations and Stakeholders

- Atikameksheng Anishnawbek
- Blair Flynn, community resident
- Cambrian College
- Charles Ramcharan, community resident
- Climate Risk Institute
- Coalition for a Liveable Sudbury
- Conservation Sudbury
- Enbridge Inc.
- Franco Mariotti, community resident
- Greater Sudbury Climate Change Consortium
- Greater Sudbury Food Policy Council
- Greater Sudbury Hydro Inc.
- Greater Sudbury Public Library
- Hydro One
- Laurentian University
- Le Centre de santé communautaire du Grand Sudbury
- Paula Worton, community resident
- Peter Beckett, community resident
- Public Health Sudbury & Districts
- reThink Green
- Science North
- Wahnapitae First Nation
- Ward 8 Community Action Network

Advice, guidance, and support on the development of the adaptation plan was delivered by ICLEI Canada through the 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

Goal, Intention and Community Scope of the Plan

The goals of this CCCAP are to:

- Build on existing actions within the City of Greater Sudbury that address climate change impacts.
- Identify opportunities for action that advance the community further towards climate resilience of its social, economic, built and natural systems.
- Help organizations, institutions, businesses, vulnerable populations, and individuals of all ages adapt to current and future climate-related risks and opportunities.

Although developed by the municipality, this plan relied heavily on community input. Climate actions presented in this plan were co-developed using the knowledge and experience of multiple municipal staff, residents, community groups, First Nations and organizations. Numerous climate-related risks extend beyond municipal jurisdiction, requiring City staff to collaborate with community service providers, local partnerships and other levels of government.

4 Climate Change in our Community

Climate change refers to both the long-term shift in global weather patterns and the regional influences, such as increased temperatures, extreme weather events, and the spread of invasive species. Although the City of Greater Sudbury has been working with the community on climate change action since the 1990s, many residents did not recognize the extent of the potential local impacts until an intense rain event flooded many homes in 2009.

This event helped residents become more aware of climate change and heightened the need for climate change mitigation and adaptation. The Greater Sudbury Climate Change Consortium was then developed through Conservation Sudbury to be a network of organizations united to act on climate change and was a strong voice and supporter for climate action from the City.

Climate action includes joining ICLEI's Partners for Climate Protection Program (PCP) in 1997 and creating action plans, infrastructure upgrades and policies that can support and encourage more sustainable behaviours that in turn can help the community reduce its ecological footprint and become more resilient (Figure 1).

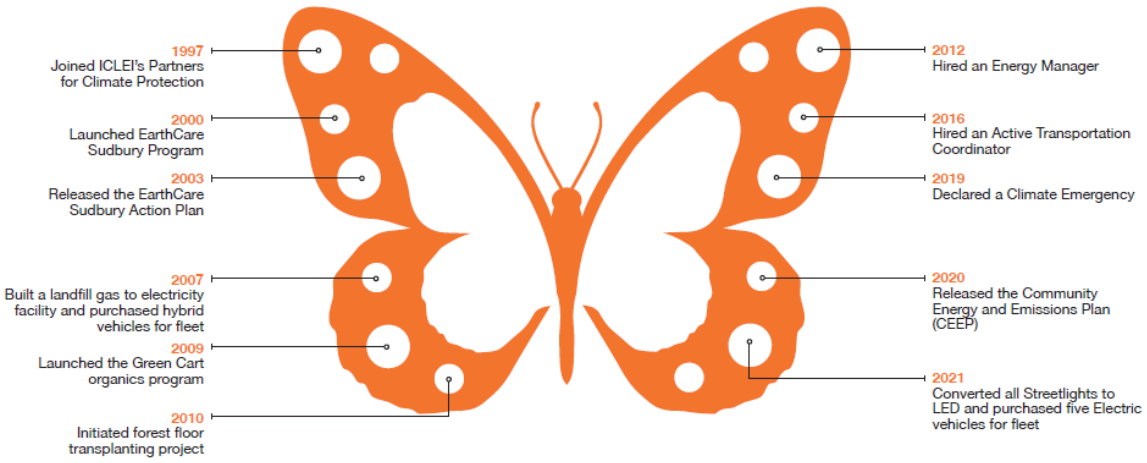


Figure 1: Greater Sudbury Climate Action Timeline

The impacts of climate change continue to be felt in the community. Increased extreme precipitation events, such as heavy rain and snowfall, have led to floods, ice storms, and early snow melts causing damage to residential homes and cancelled tourism events such as the annual pond hockey tournament in 2016. Extreme heat and drought have generated concern for the City's vulnerable populations, while changes in seasonal temperatures and precipitation are resulting in observed shifts in growing seasons and irrigation needs for local farmers. Climate change also influences the presence of invasive species both on land and in our lakes, as well as natural phenomena such as blue-green algae, which has an impact on recreational activities such as swimming and fishing.

These observed local changes are supported by global patterns and climate models as detailed in local (i) and national reports (ii) and through the Climate Risk Institute. In particular, ICLEI's 2016 Climate Science Report for Greater Sudbury reported climate change projections specific to the region for several climate events, such as hot days, changes in water quality and extreme precipitation. The data from this report was used to inform this plan's impact statements, and ultimately, the objectives and actions to be taken. When the process for updating this iterative plan begins, a new snapshot in time will be taken of climate data to direct the subsequent series of actions. As of April 2022, select climate variables under the RCP8.5 scenario are represented in Table 1.

Table 1: Summary of Climactic Changes for Greater Sudbury under RCP8.5
Source: Climate Atlas of Canada www.climateatlas.ca

RCP 8.5			
Climate Indices	**Baseline (1976-2005)**	**2021-2050**	**2051-2080**
Mean Annual Temperature	4.3°C	6.5°C	8.8°C
Days Warmer than 30°C	6 days/year	18 days/year	39 days/year
Date of Last Spring Frost	May 13	May 1	April 21
Mean Annual Precipitation	848 mm	904 mm	938 mm

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 (iii), the IPCC declared with certainty the widespread impact of human-caused climatic changes. The most urgent report to date, AR6 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.

When the City joined hundreds of local governments around the world to declare a Climate Emergency in 2019, the community came together to take action. A phone survey undertaken in 2019 revealed that 82 percent of respondents identified climate change as a concern and 73 percent claimed that they must play a role in reducing GHG emissions and the effects of climate change.

The City continues to integrate climate action into its strategic plans and capital projects. For example, the Official Plan includes a section on climate change and City Council has established a climate lens to integrate climate change into decision-making. The Stormwater Master Plan, including several sub-watershed studies, also demonstrates how climate change affects the future planning of the community.

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 (Figure 2). These include anti-idling by-laws, building retrofits to conserve energy, and transitioning to low-carbon energy sources. The City of Greater Sudbury developed a climate change mitigation plan that was approved by Council in 2020. The Greater Sudbury CEEP sets a goal to be a net-zero community by 2050 and includes actions such as retrofitting the existing building stock for 50% increased energy efficiency by 2040, electrifying 100% of transit and City fleet by 2035, having 100% of new vehicle sales being electric by 2030 and establishing a renewable energy cooperative to advance solar energy systems. Together, the Community Energy and Emissions Plan (CEEP) and Community Climate Change Adaptation Plan (CCCAP) will be the guiding documents of climate action for the City of Greater Sudbury.

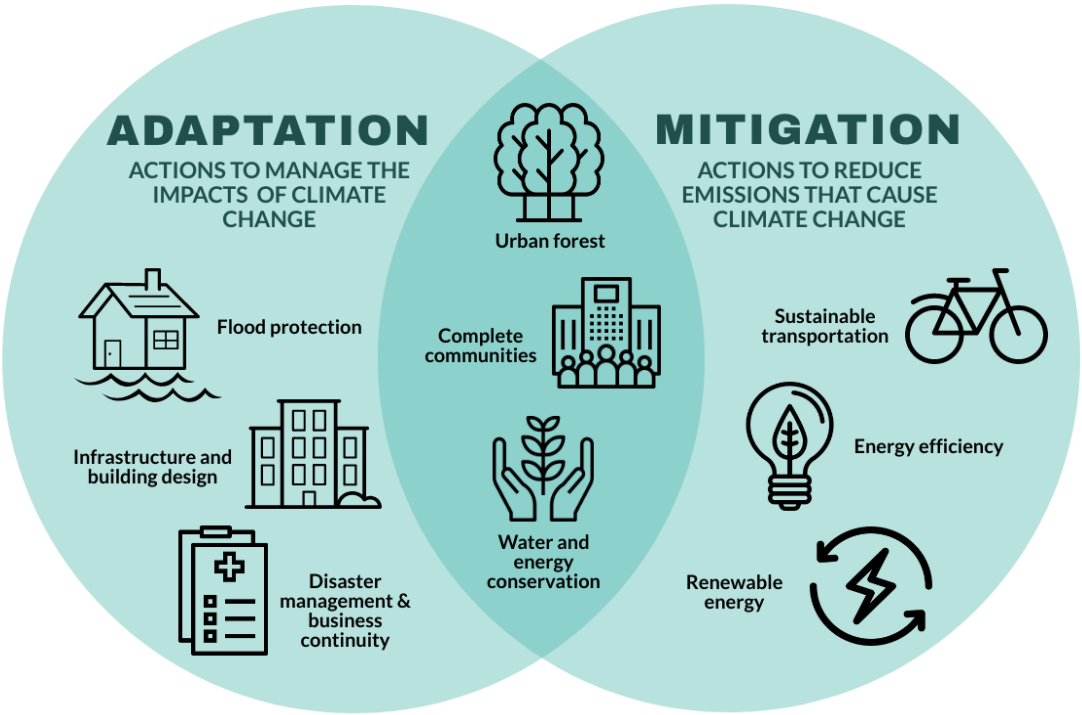


Figure 2: Adaptation, Mitigation, and Low-carbon Resilient Actions. Source: ICLEI Canada, 2019

ADAPTATION = managing the unavoidable
MITIGATION = avoiding the unmanageable

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[iv].

BARC Methodology

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

Development of the plan 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, climate impact assessment methods, plan development, action-setting processes, implementation planning, and monitoring and review strategies (see Figure 3).

As part of ICLEI's Advancing Adaptation Project, the City of Greater Sudbury worked through and completed Milestone 3 of the framework, as well as a review and reassessment of Milestones 1 and 2, and which culminated in the creation of this Community Climate Change Adaptation Plan.

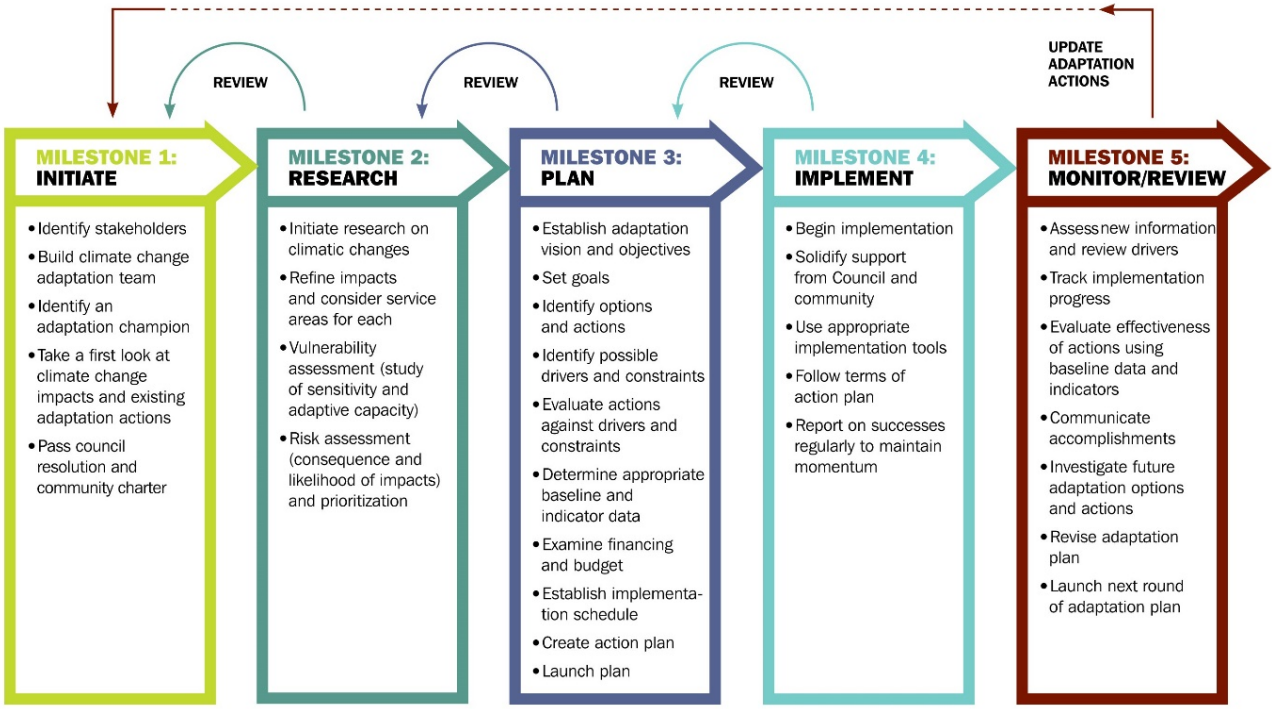


Figure 3: ICLEI Canada's Building Adaptive and Resilient Communities Framework

MILESTONE ONE - INITIATE

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. 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 opportunities for various actions. From there, the community will draft a Local Adaptation Strategy. Baseline data are 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 plan.

MILESTONE FOUR - IMPLEMENT

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

MILESTONE FIVE – MONITOR & REVIEW

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

Plan Development Process

The development of this plan was facilitated by the municipality's participation in the ICLEI Canada-led 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. Centered 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 four municipalities between June 2021 and March 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.

Guided by BARC Milestone 3, the adaptation planning process was community-focused, and each participating municipality convened a wide range of community stakeholders at two municipality-led workshops, allowing for a collaborative co-development of the adaptation plan. The planning process involved multiple steps, including conducting a current status assessment; performing a gap analysis and identifying additional work needed; 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.

Vulnerability and Risk Assessment

The City of Greater Sudbury participated in ICLEI Canada's Train-the-Trainer Initiative of the Great Lakes Climate Change Adaptation Project and performed a risk and vulnerability assessment in 2017 to determine and prioritize impacts. City staff developed a long list of impact statements, which are concise sentences that outline locally relevant climatic changes expected to occur, and how they will affect the municipality. This initial list of over 80 impact statements was presented to several municipal departments, as well as staff at Conservation Sudbury and Public Health Sudbury & District. Based on responses, City staff reduced the list to under 40 impact statements presented for a public risk and vulnerability assessment workshop, with the intention to prioritize climate change adaptation efforts (Appendix A Risk and Vulnerability Assessment).

To support the City's planning process, ICLEI Canada conducted a gap analysis of the climate impacts and results of risk and vulnerability assessments. An equity, diversity and inclusion (EDI) lens was used to ensure alignment with the BARC process and account for vulnerable populations that may be at greater risk to the effects of climate impacts. These groups include seniors, Indigenous peoples, low-income residents, persons with low literacy levels, transient populations, persons with a disability, medically dependent persons, children and youth, women, new immigrants, and racial or cultural minorities, among other populations. Through public consultation at the public risk and vulnerability assessment workshop, the 40 impact statements were reviewed by multiple stakeholders. The 40 impact statements were further refined to nine; however, through the ICLEI Canada gap analysis, two were subdivided, resulting in eleven impact statements as found in the table below (Table 2).

1.	Heavier rainfall over a shorter time will increase stress on built infrastructure.
2.	Increasing summer temperatures will lead to more frequent extreme heat events, resulting in heat-related illness and reduction of services.
3.	More days over 30°C may increase evaporation, which will lower the assimilative capacity of the lakes/rivers (the ability to naturally absorb pollutants without adverse effects).
4.	More frequent periods of drought will lead to increased wildfire activity in the region, causing poor air quality and increased public health concerns locally.
5.	More frequent periods of drought will lead to increased wildfire activity in the region, impacting historically compromised biodiversity, soil and ecosystem services.
6.	Increased rain events in the summer may lead to urban flooding especially in basements in low-lying areas.
7.	Variability in temperature resulting in warmer year-round temperatures will impact air quality and cause increased local public health concerns.
8.	Variability in temperature resulting in warmer year-round temperatures will impact current tourism opportunities (e.g., winter recreation activities).
9.	Increased freezing rain events may increase the instances of damaged power lines from fallen tree limbs
10.	Increased extreme weather events and variability in temperature may lead to increased freezing rain events, causing hazardous road conditions and affecting emergency services.
11.	Changes in seasonal temperature will lead to shifting eco-regions for flora and fauna communities, leading to increased spread of invasive species.

The above impact statements, prioritized through the risk assessment workshop will be the main drivers of the adaptation plan. The remaining impacts not found in the above list can be found in Appendix A. The additional impacts have not been identified as community priorities but remain relevant and will continue to be monitored by the appropriate City departments and local stakeholders.

The implementation of these actions will require continued relationships and collaborations with a variety of organizations, First Nations and government agencies. A full list of the objectives and actions in this Plan can be found in Community and Climate Change Action Table in Appendix B.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5 CENTS

6 The Path to a Climate Resilient Greater Sudbury: Themes Objectives, and Actions

Vision

Greater Sudbury will proactively adapt to changing climate conditions and embrace new opportunities to remain an engaged, healthy, safe, resilient and sustainable community.

Theme #1 – Built Environment

Objectives of this theme seek to increase the resilience of the built environment, including municipal infrastructure, roads, bridges, pump stations, buildings and powerlines. Damage of built infrastructure may include physical breakage, chemical corrosion (i.e., from rust or increased salt use), biological mold, and thermal damage (heat or cold damage). The built environment may also fail due to insufficient size or capacity, such as the wastewater system during heavy rain or flood events. The work to mitigate these risks has already begun within the City through projects to improve performance and resilience of local infrastructure under extreme weather conditions. The City has taken climate change into consideration for ongoing upgrades to culverts, lift stations and bridges, for example.

Other climate change adaptation projects include various stormwater management projects, watermain lining, corrosion control program, proactive leak detection, and installation of District Metered Areas (DMA) and Pressure Management Areas (PMA) to help measure, manage or reduce stress on our system that can lead to premature failures.

While increased precipitation seems to be a major concern for the built environment, there are many other climate change scenarios that should be accounted for such as extreme wind and heat. Snow depth is another concern for Greater Sudbury. A thick snow covering helps insulate pipes from the cold weather, reducing the risk of watermain breaks and loss of water service. This speaks to the importance of ongoing risk assessment and preventative maintenance programs as snow depths change and may decrease, leaving more exposed infrastructure in the winter.

As the CCCAP is a community plan, it also includes recommendations for non-governmental organizations, businesses and private property owners. For the built environment, adapting private dwellings will be essential in our overall community resilience. Some of the actions in this theme and others will deal with increased education and incentives for retrofitting buildings and properties with climate change adaptation components, such as disconnecting roof leaders, weeping tiles and sump pumps from the sanitary sewer system. Documents, such as the watershed and subwatershed studies, help explain the importance of water staying on the property where it falls to reduce the engineered requirement to carry water away in infrastructure and encouraging the right kind of landscaping to accommodate this drainage.

Objective #1 Infrastructure and buildings are more resilient to future climate conditions and extreme events

- Action 1.1 Perform vulnerability and risk assessment using the Public Infrastructure Engineering Vulnerability Committee (PIEVC) protocol for City-owned and leased buildings, utilities, critical infrastructure and essential service delivery.
- Action 1.2 Improve the resilience of roofs to heavy snow and extreme weather.
- Action 1.3 Update drinking water source capacity models and source protection actions with current climate impact predictions.
- Action 1.4 Improve performance and resilience of roads, culverts and bridges under extreme weather conditions that may cause impacts such as washouts and buckling.

Objective #2 Urban flooding and wastewater system bypass events are less severe and less frequent

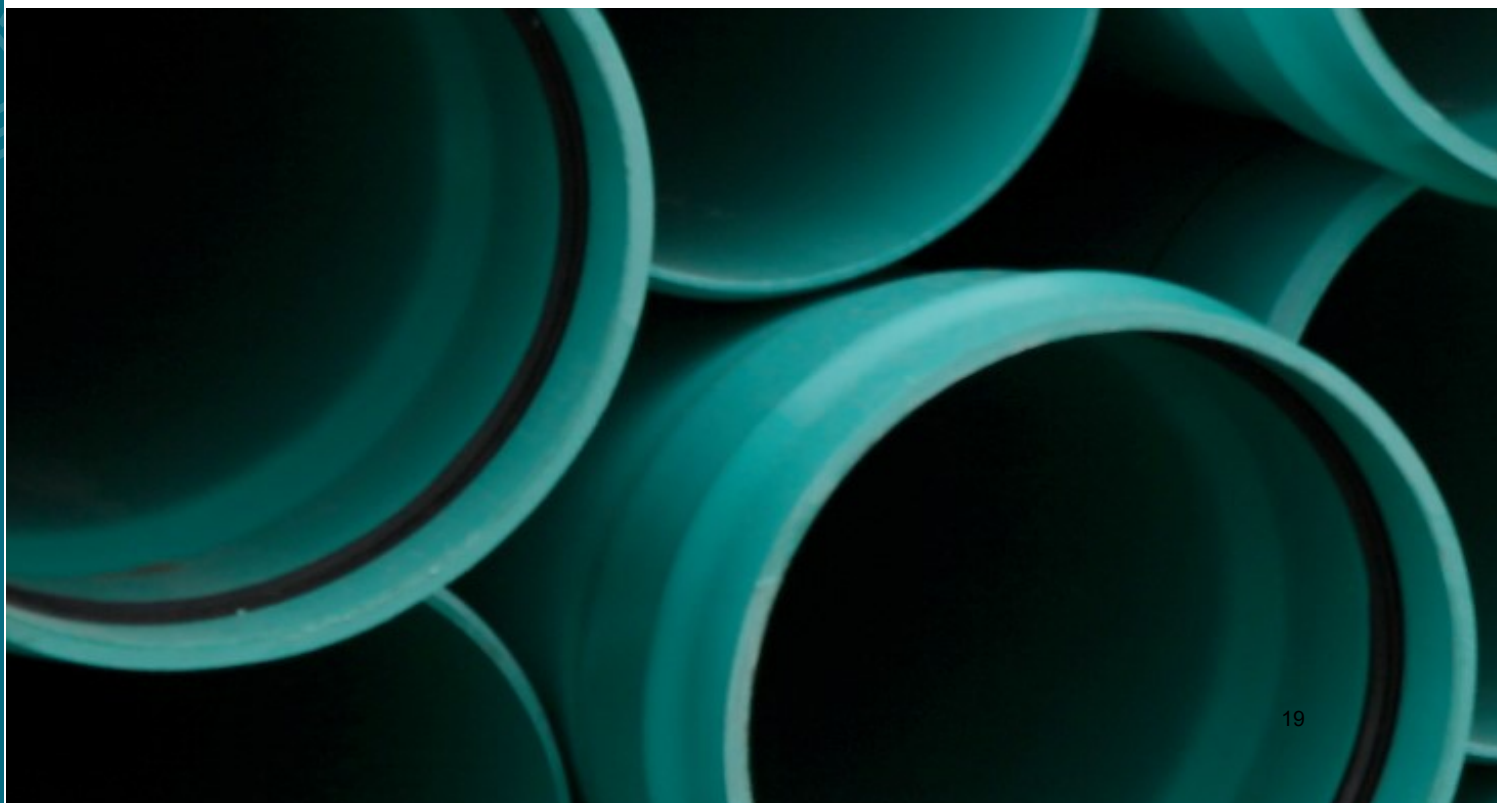
- Action 2.1 Replace and enhance stormwater and wastewater infrastructure to protect people, property, and the environment.
- Action 2.2 Reduce the amount of stormwater reaching the urban system and guide stormwater to follow natural systems.
- Action 2.3 Include natural assets in the City of Greater Sudbury Corporate Asset Management Plan.
- Action 2.4 Continue to update floodplain mapping to include new data and weather monitors to better understand flood risks.
- Action 2.5 Review and amend development standards to include updated floodplain mapping and stormwater management best practices.

Objective #3 Power and communication systems are more resilient to future climate conditions and extreme events

- Action 3.1 Increase distributed energy resources (DER) to reduce risk of power disruption.
- Action 3.2 Continue to install and maintain backup power at essential service buildings such as water and wastewater treatment plants and pumping stations.
- Action 3.3 Decrease the risk of power outage because of weather events through enhanced monitoring and mapping.

Objective #4 Homes are more resilient to future climate conditions and extreme events

- Action 4.1 Develop a web-based tool for self-assessment of household climate adaptation and resilience.
- Action 4.2 Develop programs and policies to help homeowners become more successful at reducing their inflow and infiltration (I&I) contribution.



Theme #2 – Natural Environment

Objectives of this theme will seek to increase the resilience of the natural environment, including natural resources, ecosystems, wetlands, trails, and wildlife.

Climate change affects natural resources and ecosystems in many complex ways. Greater Sudbury has a unique history, which has greatly impacted the natural landscape because of extensive logging and mining activities in the late 1800s and early to mid-1900s which may have unexpected implications as a result of a changing climate. For example, the deposition of heavy metals on the landscape from mining activities, hotter and drier summers along with more frequent periods of drought can lead to lower water levels exposing and re-oxidizing heavy metals and toxins previously dormant within submerged sediment.

The City's Regreening Program will play an important role in enhancing ecosystem services, protecting the regional watersheds, and creating healthy soil. The program supervised the planting of over 100,000 trees and shrubs each year, including edible plants for foraging. Trees play an important role in our community for shade, stormwater management, erosion control and carbon sequestration.

Greater Sudbury is just beyond the most northern distribution of many species. This position means that only minor changes in growing seasons and winter temperatures will result in the migration of both native and invasive species. New species can have severe impacts on local ecosystems and their functions. Recent sightings of invasive species migrating to the north include spiny waterflea (Bythotrephes cederstroemi), phragmites (Phragmites australis ssp. australis), giant hogweed (Heracleum mantegazzianum), garlic mustard (Alliaria petiolata) among others. The increased presence of these species requires the development of an invasive species management plan. Such a plan would provide the City of Greater Sudbury with an opportunity to develop a framework and implement strategies to control current populations of invasive species, mitigate the spread of these species into and within the community, and limit their impact on the local landscape.

An increase in seasonal temperatures may also lead to increased instability in lake ice resulting in increased reliance on Water/Ice Rescue teams. There may also be more ice-free days on lakes, higher surface temperatures, more days over 30°C, more rainfall and potentially increased nutrient levels. With warmer water and higher nutrient levels, there is a risk of more occurrences of blue-green algae impacting fishing, swimming, boating and drinking water.

The natural environment will also be affected by flooding, erosions, drought and fire. Both private and public properties must be ready for these events and can better prepare by including green infrastructure such as trees, rain gardens, wetlands and parks. Junction Creek is an example of a natural asset that not only provides social and environmental benefits through recreation and habitat but also provides financial benefits to the community through its stormwater management capacity (such as flood control, erosion prevention and filtration). Many municipalities are beginning to integrate natural assets such as Junction Creek into their asset management plans.

Objective #5 Natural landscapes have enhanced adaptive capacity

- Action 5.1 Protect and regulate the use of existing natural spaces and vulnerable ecosystems.
- Action 5.2 Develop an Urban Forest Master Plan that will complement other documents such as the Subwatershed Studies and tree planting guidelines from local utilities.
- Action 5.3 Support holistic regreening efforts and policies that aid in erosion mitigation, healthy soil formation, biodiversity, and assisted migration.
- Action 5.4 Implement the Sudbury Forest Management Plan (FMP).

Objective #6 Watersheds and shorelines are healthy and have increased canopy cover, root systems, water retention, and recharge capacity

- Action 6.1 Implement Water Efficiency Strategy and Subwatershed Studies.
- Action 6.2 Continue education and outreach to support healthy lakes, shorelines and soils.
- Action 6.3 Protect and enhance existing wetlands through policy and innovation while examining options for artificial, functional wetlands.
- Action 6.4 Continue to implement the Source Water Protection Plan policies on salt, septic systems, dense nonaqueous phase liquids (DNAPLS) and organic solvents.

Objective #7 Risk of invasive species spread is reduced

- Action 7.1 Develop an Invasive Species Management Plan.
- Action 7.2 Work with local nurseries to replace the sale of invasive species with native species.

Theme #3 – Local Economy

Objectives of this theme will seek to increase the resilience of the local economy through private sector businesses and related not-for-profit sector organizations. The actions for this theme will support climate adaptation in businesses and key stakeholders in economic development and tourism. It will aid the availability and awareness of public sector resources, including funding incentives, networks, partnerships and services.

Tourism and commercial sectors are not immune to the changing climate, because impacts may lead to changes in travel and spending behaviours. Climate-ready marketing strategies could include diversification of local products, services and enhanced public spaces. There is already an increased awareness around reducing emissions and fluctuating market prices of key business inputs, such as shipping, food availability, and fuel costs.

Real estate and insurance sectors will also be impacted and may result in property owners being required to implement resilience measures to secure insurance. The business and tourism community will need to consider climate change risks with impacts such as extreme heat, wildfire smoke, reduced snow and ice cover, as well as blue-green algae.

The actions for this theme will require collaborative work with industry stakeholders and partner networks to identify gaps in climate change resilience and provide awareness and access to support services and programs. Municipal economic development programs and strategies will be reviewed to align with the CCCAP and ensure climate change resiliency is prioritized, incentivized and accessible.

Objective #8 Local industry and businesses are resilient, diversified, attractive and sustainable

- Action 8.1 Create and support neighbourhood-level programs and strategies to increase climate resilience, accessibility and attraction.
- Action 8.2 Create an economic action plan that includes climate change risks and opportunities, and drives an equitable and green economy for Greater Sudbury.
- Action 8.3 Review existing and future municipal economic development programs to ensure climate change resiliency is prioritized, incentivized and accessible.

Theme #4 – Cultural and Social Cohesion

Objectives of this theme will seek to increase the resilience of culture and social cohesion through schools, community centres, faith and cultural centres, organizations and volunteerism.

Climate change impacts the culture and social cohesion of Greater Sudbury. This includes reduced access to cultural events, volunteer opportunities, spiritual gathering places and educational institutions. By building the resilience of culturally important locations such as churches, schools, spiritual gathering places and community centres, residents can together build a more adaptive community.

Because climate change affects freshwater and forest foods, spiritual gathering places, and culturally significant locations, substantial negative impacts on the local Indigenous community will be felt. Through stakeholder engagement and one-on-one meetings with Indigenous residents and members of both Atikameksheng Anishnawbek and Wahnapitae First Nation, City staff have heard that Indigenous peoples would like their vulnerable community members supported and their ideas for natural resource protection, through Traditional Ecological Knowledge (TEK), to be heard and implemented. There will also be continued sharing of resources, such as educational material.

Many of the most vulnerable populations will experience a disproportionate increase in physical, mental, social, and cultural impacts due to climate change. There may be reduced or removed opportunities to meet with friends, continue education, or have medical needs met. During the COVID-19 pandemic, online work, education, and connections were accepted and widely practiced. Options for connecting virtually provide an adaptive opportunity that can be continued during extreme weather events.

The City of Greater Sudbury will continue to consider and include all populations in our collective efforts become a more resilient community for all residents.

Objective #9 Cultural and social centres are resilient to future climate conditions and extreme events

- Action 9.1 Support local Indigenous communities in protecting and strengthening Indigenous culture centres and provide support for developing adaptation plans for their communities.
- Action 9.2 Create resilient, all-season uses and opportunities for schools, faith centres, community centres, cultural venues and traditional gathering places.
- Action 9.3 Build on current volunteer opportunities for youth to engage in climate change adaptation through community gardening and other programs.
- Action 9.4 Adapt cultural and social centres to provide safe havens for vulnerable populations, including youth, who may be seeking refuge during climate emergencies and extreme weather events.
- Action 9.5 Utilize resource hubs, such as libraries and schools to increase awareness and education.

Theme #5 – Community Health and Well-Being

Objectives of this theme will seek to increase the resilience of the community's health and well-being in the face of hazards, increasing with climate change. Climate change exacerbates existing health inequities, such as extreme weather, water- and food-borne illnesses, vector-borne disease, wildfire, changes to water quality and quantity, as well as risk to local food systems.

Direct health impacts of climate change include heat stroke, aggravation of respiratory and cardiovascular conditions, serious injury, illness, anxiety and trauma, and others. Climate change can have indirect impacts on health, such as the interruption of medical and social services, loss of housing or belongings to floods or other crises and lost employment hours and wages.
Adaptations for the benefit of health and well-being can occur at various levels. Individuals can adapt to climate

change through practising health-protective behaviours. Communities can implement programming and policies to better support people disproportionately affected by climate change, such as those living on a low income and experiencing systemic barriers.

Employers can assess the vulnerability of their workers and include climate change hazards in health and safety messages and policies. Health systems can adapt by ensuring they remain operational when threatened by hazards and sustainable over the longer term.

In planning and implementing adaptations, vulnerability to health risks can be assessed by exploring sensitivity, exposure and adaptive capacity. Greater Sudbury strategies, such as the Food Strategy and the Hazard Identification and Risk Assessment, benefit the community and prepare us for severe events. Emergency managers will continue to play a critical role in our community's preparation and the delivery of services during climate-related emergencies.

Objective #10 Service interruptions during extreme weather events are reduced

- Action 10.1 Identify gaps in knowledge, equipment and personnel during extreme weather events.
- Action 10.2 Continue annual reviews of the Greater Sudbury Hazard Identification and Risk Assessment (HIRA) for identified hazards and patterns within the community.
- Action 10.3 Assess hospital capacity and identify secondary treatment locations for patients with conditions that are exacerbated by extreme weather events, including enhanced support for mental health and addiction.

Objective #11 Health risks are reduced and safety is increased for populations impacted by extreme weather events

- Action 11.1 Increase efforts to communicate with and aid vulnerable residents, including those with inadequate housing or those with medical and social support needs.
- Action 11.2 Develop and deliver customized education programs on adapting to climate change for targeted audiences.
- Action 11.3 Increase available shade in the community.
- Action 11.4 Maintain current cooling or warming centres and emergency evacuation centres.
- Action 11.5 Encourage employers to identify and address potential climate impacts on their workers and protect them from increased exposure to extreme heat, wildfire smoke and vector-borne diseases as recommended by Health Canada and the Ontario Ministry of Labour, Immigration, Training and Skills Development.
- Action 11.6 Implement the Active Transportation Plan and Transportation Master Plan.

Objective #12 Risks of water-borne, vector-borne and food-borne illnesses are reduced

- Action 12.1 Evaluate impacts and risks of increased disease vectors in design of stormwater infrastructure (e.g. avoiding ponding/standing water).
- Action 12.2 Monitor and report disease trends.

Objective #13 Risks of wildfire occurrence and impacts are reduced

- Action 13.1 Increase wildfire education and awareness, including air quality concerns, for the whole community as well as for settings that serve vulnerable populations (e.g., daycares, schools, long-term care settings/retirement homes).
- Action 13.2 Continue to update wildland urban interface hazard inventory and risk assessment.
- Action 13.3 Prepare a water-use strategy for combating wildfires.

Objective #14 Local food systems and drinking water supply are resilient to future climate conditions and extreme events

- Action 14.1 Review and reprioritize the actions of the Greater Sudbury Food Strategy to build an equitable, vibrant and sustainable food system that is resilient to the impacts of climate change.
- Action 14.2 Monitor drinking water sources for changes in quality and quantity from climate change to ensure proper treatment.


CANADA
NICKEL
1951
CENTS
PARAMEDIC
CP02
CP03
COMMUNITY
PARAMEDIC
GREATER GRAND SUDBURY
rEVolution
electric 100% électrique

Theme #6 – Enabling Actions

Objectives of this theme affect several City divisions and community sectors and seek to integrate climate change adaptation into a variety of policies and initiatives and facilitate diverse collaborations and partnerships. Enabling actions also address increased needs for resources, support and education to help our community better understand and prepare for climate change risks and recover more quickly from crisis. Through financial support, partnerships and resource-sharing, non-profit, grassroots, and cultural organizations can build capacity and support their initiatives and programs that build awareness and actions around climate change.

Objective #15 Climate change adaptation is integrated into operational procedures and community decision-making

- Action 15.1 Continue to encourage sustainable procurement policies throughout the community.
- Action 15.2 Develop a climate change adaptation lens for decision-making.
- Action 15.3 Include climate change action in utility and communication providers' asset management plans.

Objective #16 The community is informed and empowered

- Action 16.1 Find and share climate change adaptation-related funding opportunities.
- Action 16.2 Promote policies that raise people out of poverty, for example, living wages or guaranteed basic income.
- Action 16.3 Increase public awareness of climate change risks and meaningfully include the community in implementing the plan.
- Action 16.4 Engage with insurance and real estate sectors on measuring private property risk and communicating best practices.

Objective #17 New technology and best practices in design and construction are incorporated

- Action 17.1 Incorporate innovative technology and building techniques in residential projects through collaborations with the City, educational institutions, businesses, real estate, and the construction community.
- Action 17.2 Develop incentives for the creation and adoption of innovative technology and building techniques.
- Action 17.3 Work with partners to lobby provincial and federal governments to support increased funding to improve infrastructure resiliency.

Opportunities

While the negative impacts of climate change often take precedence for our community to prepare for, there are also opportunities that climate change can provide.

Potential opportunities include:

1. Warmer winter temperatures allowing for:

- Easier year-round active transportation.
- Longer beach season.
- Longer golf season.
- Diversification of local agricultural crops and products.
- Increased agricultural yields.
- Alternative snow trail-use options.

2. Embrace community as a hub for climate change research and actions.

3. Advancements in environmentally-related architectural and construction improvements.

4. Advancements in supporting the health and well-being of community members.

5. Encourage and stimulate long-lasting partnerships.

7 Implementation, Monitoring and Governance

The Community Climate Change Action Plan (CCCAP) is intended to guide the City of Greater Sudbury, residents and community partners to prepare for the impacts of climate change. A strong focus on implementation, governance, and monitoring is essential to the plan's success. Changes to federal and provincial legislation and regulations, as well as technological advances are anticipated over the plan's duration. These advances will affect the long-range strategies, underscoring the importance of periodic review and adjustments to the CCCAP. Clear governance and oversight of this strategy is essential for effective implementation and regular updates.

For climate change adaptation to be successful, the CCCAP will be guided by the municipality and implemented by the entire community. This model enables the City to take a leadership role, while also sharing the responsibility and costs of implementation with partners. A community-wide approach also allows for the leveraging of additional capital for those actions that are beyond municipal responsibility.

The City's Strategic and Environmental Planning Section, particularly through the Climate Change Coordinator, will be responsible for coordinating the implementation of this strategy along with the Community Energy and Emissions Plan (CEEP). Together, the CEEP and the CCCAP are the City of Greater Sudbury's Climate Action Plans that cover both mitigation and adaptation. City staff will identify and work with action leads to refine the actions and implementation tables, encouraging them to integrate the actions into workplans and timelines in a productive way. Having one team oversee the strategy helps centralize data and keep track of the planning processes across departments, existing and future City projects, and community opportunities where actions in the strategy can be leveraged.

The oversight role also includes collaborating with the Climate Risk Institute for monitoring climate change projections for the City and identifying when additional corporate and community vulnerability and risk assessments are required to ensure that the City of Greater Sudbury is aware of possible impacts from a changing climate. The CCCAP will be examined for review and revision approximately every five years.

There will be a reporting schedule for providing updates on climate change initiatives to Council. Any external partners that undertake actions will provide updates to the City as part of this reporting cycle.

Working groups will be established to collaborate on the implementation of actions and continue fostering supportive relationships amongst the City, Indigenous peoples, community groups, residents, and other stakeholders (Figure 4).

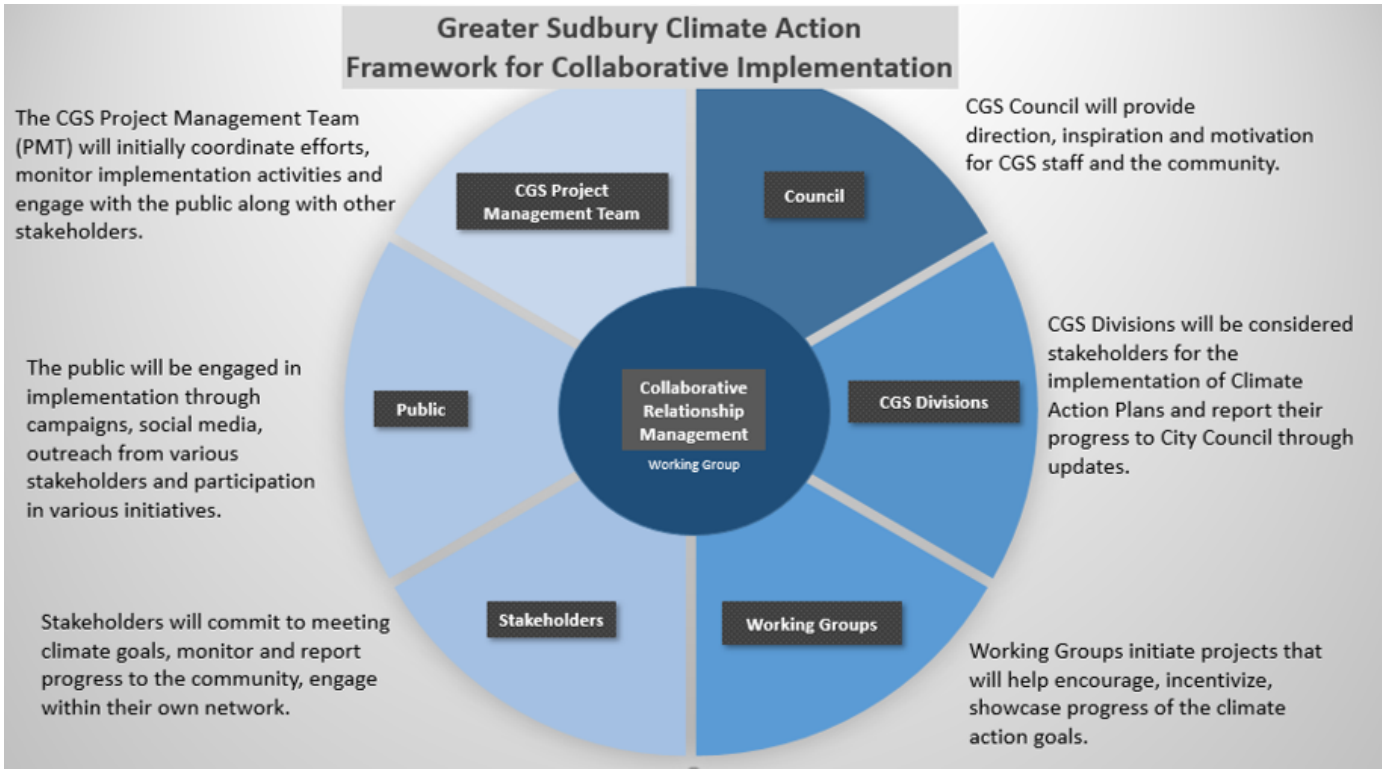


Figure 4: Greater Sudbury Climate Action Framework for Collaborative Implementation

8 Next Steps

The City of Greater Sudbury will begin working with City departments, stakeholders, First Nations, and working groups to develop more concrete implementation schedules for the actions in this plan.

The current climate lens for City staff that was developed for climate change mitigation will be adapted to include climate change adaptation to make it a more holistic approach to the decision-making process within City operations.

This lens will be adapted and shared externally to help community businesses, organizations, and groups adopt a similar approach for future growth to improve resiliency and reduce the ecological footprint of the community.

9 Appendices

A: Vulnerability and Risk Assessment Outcomes.

Vulnerability (V) and risk (R) scores from the 2017 risk and vulnerability assessment.
Darker colours represent higher scores, to help visualize impacts that are of greater concern.

Vulnerability Assessment

RECALL:

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

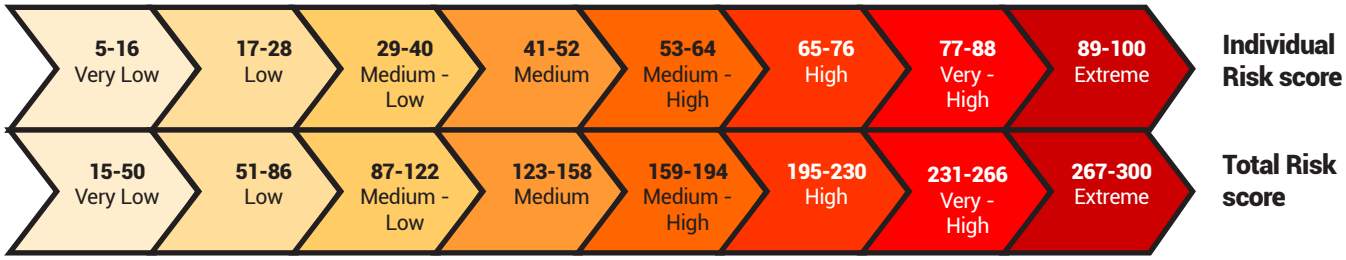
It is a function of:

- A system's sensitivity to climate change impacts, and
- Its capacity to adapt, or cope, with those impacts.

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

Risk Spectrum

- Extreme – risks demand urgent attention in the most senior level and cannot be simply accepted as a part of routine operations without executive sanction;
- High – risks are the most severe that can be accepted as part of routine operations without executive sanction but they will be the responsibility of the most senior operational management and reported upon at the executive level;
- Medium – risks can be expected to form part of routine operations but they will be explicitly assigned to relevant managers for actions, maintained under review and reported upon at senior management levels;
- Low – risks will be maintained under review but it is expected that existing controls will be sufficient and no further actions will be required to treat them unless they become more severe.



Impact Statement	V Score	R Score
Decreased summer precipitation will increase the probability of summer drought, affecting urban forest cover.	1	57
Increased ice storms can lead to damage to trees and forests.	4	58.5
Increased intensity of snowfall may impact snow removal and planning for these services.	4	72
Increased intensity of rainfall in the summer may wash out roads, which will cut off access for residents, emergency services, etc.	3	76.5
More precipitation will create heavier and faster runoff, which will cause erosion of the shoreline and decrease bank stabilization.	4	77
Increased freezing rain events may increase the use of road salt which may impact water resources.	4	80
Increased incidence of summer storms leading to wind damage to trees and public property.	3	82.25
Temperatures increasing earlier in the spring and later in the fall will lead to faster/earlier thawing and can cause heavy runoff.	2	84
High wind speeds may increase falling tree limbs.	4	84
Increased quantity of rain may cause flooding of electrical infrastructure leading to blackouts.	3	86
Temperatures increasing earlier in the spring and later in the fall may cause impacts on water/ sewers due to frost movements on roads.	3	88
Increased winter precipitation leads to ice storms that cause power failures.	4	94.5
Increase in summer temperatures leads to risk of medical issues for vulnerable populations.	3	95
Colder winter temperatures will increase freezing rain events and road ice.	2	100
Increase in wind speeds and storm events may increase property damage.	3	104
More heavy rainfall can lead to more combined sewer overflows.	2	105
Increase in winter snowfall may increase the need for road operations (plowing, salt availability, sidewalks).	2	105
More hot days over 30 degrees Celsius will increase heat-related illnesses.	3	105
More storms, lightning and tornadoes may impact electricity line and power outages.	3	107.5
More extreme weather events (i.e. high winds) will lead to damages to the built environment and infrastructure.	4	108
Change in winter snowfall patterns, leading to increasingly hazardous road conditions.	3	110
More frequent and severe rainfall, leading to stormwater management facility failures.	4	110
More storms, lightning and tornadoes may increase property damage.	4	110
Decreased summer precipitation may decrease water levels in surface water (ponds) lakes rivers.	2	115
Increased incidences of flooding leading to displacement of residents.	3	120
Increased incidences of ice storms can limit mobility on city streets.	4	125
Increased frequency and intensity of rainfall may flood roads in low-lying areas.	4	125
Heavier rainfall over a shorter time will increase stress on built infrastructure.	5	130
Increased summer temperatures will increase the number of extreme heat days.	4	140
More days over 30 degrees Celsius may increase evaporation, which will lower the assimilative capacity of the lakes/rivers.	3	145
Increased periods with little or no rainfall will increase forest fire risks.	5	148
Increased rain events in the summer may lead to urban flooding, especially in basements in low-lying areas.	3	160
Increasing number of warm days and decreasing number of cold days will adversely impact air quality.	4	160
Increased freezing rain events may increase damaged power lines from fallen tree limbs.	5	164
Increased freezing rain events may increase hazardous road accidents.	3	165
Changes in seasonal temperature will lead to shifting eco-regions for flora and fauna communities and can lead to increased spread of invasive species.	5	165

B: Community Climate Change Actions

Climate Change Impacts
1. Heavier rainfall over a shorter time will increase stress on built infrastructure.
2. Increasing summer temperatures will lead to more frequent extreme heat events, resulting in heat-related illness and reduction of services.
3. More days over 30°C may increase evaporation, which will lower the assimilative capacity of the lakes/rivers (the ability to naturally absorb pollutants without adverse effects).
4. More frequent periods of drought will lead to increased wildfire activity in the region, causing poor air quality and increased public health concerns locally.
5. More frequent periods of drought will lead to increased wildfire activity in the region, impacting historically compromised biodiversity, soil and ecosystem services.
6. Increased rain events in the summer may lead to urban flooding especially in basements in low-lying areas.
7. Variability in temperature resulting in warmer year-round temperatures will impact air quality and cause increased local public health concerns.
8. Variability in temperature resulting in warmer year-round temperatures will impact current tourism opportunities (e.g., winter recreation activities).
9. Increased freezing rain events may increase the instances of damaged power lines from fallen tree limbs.
10. Increased extreme weather events and variability in temperature may lead to increased freezing rain events, causing hazardous road conditions and affecting emergency services.
11. Changes in seasonal temperature will lead to shifting eco-regions for flora and fauna communities, leading to increased spread of invasive species.

Community Climate Change Action Table

Built Environment (e.g. municipal infrastructure, roads, bridges, pump stations, buildings, power lines)			
Objectives	**Impact this goal addresses**	**Action**	**Sub-actions**
1. Infrastructure and buildings are more resilient to future climate conditions and extreme events.	1,3,10	**1.1** Perform vulnerability and risk assessment using the Public Infrastructure Engineering Vulnerability Committee (PIEVC) protocol for City-owned and leased buildings, utilities, critical infrastructure, and essential service delivery.	Complete a Climate Resilience Roadmap through Regional Public Works Commissioners of Ontario (RPWCO). Incorporate climate adaptation and mitigation into the City's asset management planning.
		1.2 Improve the resilience of roofs to heavy snow and extreme weather.	Conduct a feasibility study on resilient roof technology, such as green or white roofs. Develop standards to improve roof resilience. Create an incentive program to encourage homeowners to upgrade and replace roofs.

		1.3 Update drinking water source capacity models and source protection actions with current climate impact predictions.	Complete the City's Valley Wells study. Use a climate change adaptation lens in the next revision of the Water/Wastewater Master Plan. Continue to implement the Source Protection Plan and update when required.
		1.4 Improve performance and resilience of roads, culverts and bridges under extreme weather conditions that may cause impacts such as washouts and buckling.	Maintain and improve the inventory and biennial inspections of bridges and culverts. Explore resilient pavement material and technology such as cool pavement. Update priority route mapping and maintenance as required.
2. Urban flooding and wastewater system bypass events are less severe and less frequent.	1,6	**2.1** Replace and enhance stormwater and wastewater infrastructure to protect people, property, and the environment.	Implement the City's Stormwater Asset Management Plan. Follow recommendations of the Subwatershed Studies and Stormwater Master Plans. Pursue a sustainable funding model for the City's stormwater systems. Review current policies, plans, and strategies to align with stormwater management and adaptation.
		2.2 Reduce the amount of stormwater reaching the urban system and guide stormwater to follow natural systems.	Develop and implement an educational campaign on methods to manage drainage on properties. Explore innovative Low Impact Development methods and site-specific solutions.
		2.3 Include natural assets in the City of Greater Sudbury Corporate Asset Management Plan.	Conduct feasibility study on Natural Asset Management.

		2.4 Continue to update floodplain mapping to include new data and weather monitors to better understand flood risks.	Increase number of permanent weather stations and breadth of stream gauges to collect more data and improve accuracy of flood forecasting tools.
		2.5 Review and amend development standards to include updated floodplain mapping and stormwater management best practices.	
3. Power and communication systems are more resilient to future climate conditions and extreme events.	1,4,9	**3.1** Increase distributed energy resources (DER) to reduce risk of power disruption.	Explore more opportunities to utilize systems, such as cogeneration and local renewable energy systems. Set up a renewable energy co-op (as recommended in the CEEP) and increase local energy security.
		3.2 Continue to install and maintain backup power at essential service buildings such as water and wastewater treatment plants and pumping stations.	
		3.3 Decrease the risk of power outage because of weather events through enhanced monitoring and mapping.	Overlay existing inventory of underground and surface electrical equipment with area maps to assess vulnerability to flooding, wildfire, and extreme storm events. Include climate mitigation & adaptation in asset management by utilities/ communication providers. Ensure that Greater Sudbury Hydro tree planting and pruning guidelines are followed around power lines and other essential electrical infrastructure (e.g. transformers, stations, etc.).
4. Homes are more resilient to future climate conditions and extreme events.	1,6	**4.1** Develop a web-based tool for self assessment of household climate adaptation and resilience.	
		4.2 Develop programs and policies to help homeowners become more successful at reducing their inflow and infiltration (I&I) contribution.	Evaluate and revise construction standards that affect I&I. Develop an education and incentive program to decrease I&I and promote lot-level stormwater controls.

Natural Environment (e.g. natural resources, ecosystems, wetlands, trails, wildlife)			
Objectives	**Impact this goal addresses**	**Action**	**Sub-actions**
5. Natural landscapes have enhanced adaptive capacity.	3,4,5,8	**5.1** Protect and regulate the use of existing natural spaces and vulnerable ecosystems.	Conduct natural heritage threat mapping. Identify priority areas that are at greatest risk to climate change. Review by-laws that restrict naturalization on private property.
		5.2 Develop an Urban Forest Master Plan that will complement other documents such as the Subwatershed Studies and tree planting guidelines from local utilities.	Conduct an urban heat island analysis. Develop inventories and maps for climate refugia, canopy cover, connectivity and erosion. Create schedules for preventative maintenance and inspection of trees on public property (e.g. tree pruning, removal of diseased/ hazardous trees, proactive planting) to reduce the damage caused by extreme weather events to the urban forest. Expand public park landscaping waste composting.
		5.3 Support holistic regreening efforts and policies that aid in erosion mitigation, healthy soil formation, biodiversity and assisted migration.	Continue ecological restoration research and collaborations with increased volunteer involvement and public education. Implement CEEP Goal 18: Increase the reforestation efforts of the Regreening Program. Consult with Indigenous communities to integrate traditional ways of water and forest protection.
		5.4 Implement the Sudbury Forest Management Plan (FMP).	

6. Watersheds and shorelines are healthy and have increased canopy cover, root systems, water retention and recharge capacity.	1,2,3,5	**6.1** Implement Water Efficiency Strategy and Subwatershed Studies.	Finalize the remaining few subwatershed studies of the original 17 proposed.
		6.2 Continue education and outreach to support healthy lakes, shorelines and soils.	Raise awareness of shoreline buffer regulations. Update and increase shoreline demonstration sites. Continue to monitor and study phosphorous and cyanobacteria (blue-green algae) levels in lake.
		6.3 Protect and enhance existing wetlands through policy and innovation while examining options for artificial, functional wetlands.	
		6.4 Continue to implement the Source Water Protection Plan policies on salt, septic systems, dense nonaqueous phase liquids (DNAPLS) and organic solvents.	Support the Smart About Salt program and other methods to properly manage salt use on commercial and residential properties.
7. Risk of invasive species spread is reduced.	11	**7.1** Develop an Invasive Species Management Plan.	Expand Citizen Science Programs for invasive species. Increase education, identification, mapping and removal of invasive species.
		7.2 Work with local nurseries to replace the sale of invasive species with native species.	

Local Economy (e.g. local businesses, tourism, agriculture, private enterprise)			
Objectives	**Impact this goal addresses**	**Action**	**Sub-actions**
8. Local industry and businesses are resilient, diversified, attractive, and sustainable.	1,2,6,8	**8.1** Create and support neighbourhood-level programs and strategies to increase climate resilience, accessibility, and attraction.	Establish a local business best practice network. Provide more education and incentives for businesses to develop climate-resilient strategies for topics such as stormwater management.

		8.2 Create an economic action plan that includes climate change risks and opportunities, and drives an equitable and green economy for Greater Sudbury.	Conduct community assessment on current and new tourism opportunities and innovation. Encourage and establish flexible work schedules and work locations to help employees avoid extreme weather events (extreme heat, wildfire, snow), reduce commute emissions and reduce occupancy of air-conditioned workplaces. Develop emergency plans for wildfire and power outages for key tourism locations, such as hotels and campgrounds.
		8.3 Review existing and future municipal economic development programs to ensure climate change resiliency is prioritized, incentivized and accessible.	

Cultural and Social Cohesion (e.g. building community resilience through schools, community centres, faith and cultural centres, volunteerism)			
Objectives	**Impact this goal addresses**	**Action**	**Sub-actions**
9. Cultural and social centres are resilient to future climate conditions and extreme events.	1,2,4,6,7,10	**9.1** Support local Indigenous communities in protecting and strengthening Indigenous culture centres and provide support for developing adaptation plans for their communities.	Create a working group for Indigenous involvement.
		9.2 Create resilient, all-season uses and opportunities for schools, faith centres, community centres, cultural venues and traditional gathering places.	Develop an inventory of locations and contacts.
		9.3 Build upon current volunteer opportunities for youth to engage in climate change adaptation through community gardening and other programs.	Develop an inventory of groups and initiatives.
		9.4 Adapt cultural and social centres to provide safe havens for vulnerable populations, including youth, who may be seeking refuge during climate emergencies and extreme weather events.	
		9.5 Utilize resource hubs, such as libraries and schools to increase awareness and education.	

10. Service interruptions/delays due to changing climate conditions and extreme climate events are reduced.	2,4,10	**10.1** Identify gaps in knowledge, equipment, and personnel during extreme weather events.	Require all essential service vehicles to have winter tires and four-wheel drive. Review and update emergency and economic routes that require early attention during community emergencies. Provide more training on essential route preparation and clearing of hazards or snow.
		10.2 Continue annual reviews of the Greater Sudbury Hazard Identification and Risk Assessment (HIRA) for identified hazards and patterns within the community.	Create or update emergency hazard-specific plans (examples: extreme heat, cold, freezing rain, flooding and wildfire events).
		10.3 Assess hospital capacity and identify secondary treatment locations for patients with conditions that are exacerbated by extreme weather events, including enhanced support for mental health and addiction.	

Community Health and Well-Being (e.g. disaster and emergency management, health and medical care, food access, evacuation and public communications)			
Objectives	**Impact this goal addresses**	**Action**	**Sub-actions**
11. Health Risks are reduced and safety is increased for populations impacted by extreme weather events.	2,4,10	**11.1** Increase efforts to communicate with and aid vulnerable residents, including those with inadequate housing or those with medical and social support needs.	Continue updating the City's vulnerable citizens response procedures. Develop programs to engage vulnerable residents. Enhance communications relaying the importance of personal preparedness (including 72-hour survival kits).
		11.2 Develop and deliver customized education programs on adapting to climate change for targeted audiences.	

		11.3 Increase available shade in the community.	Conduct a shade audit for public facilities and spaces, such as playgrounds, parks, sports fields, and community gathering spaces. Identify priority areas for shade improvements. Increase shade installations, prioritizing use of trees and areas with greatest need.
		11.4 Maintain current cooling or warming centres and emergency evacuation centres.	Update inventory of municipal recreation centres, libraries, and other facilities, which could be used as cooling/warming centres and emergency evacuation centres, taking into consideration the current and future availability of back-up power.
		11.5 Encourage employers to identify and address potential climate impacts on their workers and protect them from increased exposure to extreme heat, wildfire smoke, and vector-borne diseases as recommended by Health Canada and the Ontario Ministry of Labour, Immigration, Training and Skills Development.	Create regional committee to review current workplace health and safety policies and guidelines to determine if potential climate impacts on workers are identified and addressed.
		11.6 Implement the Active Transportation Plan and Transportation Master Plan.	Develop an inventory of active transportation routes with future climate conditions considered, such as snow removal, ice management, shade, and public drinking water locations. Increase maintenance (and adjust service levels/practices as needed) and inspection of road and sidewalks during snow or extreme weather events.
12 Risks of waterborne, vector-borne and food-borne illnesses are reduced.	2,6,11	**12.1** Evaluate impacts and risks of increased disease vectors in design of stormwater infrastructure (e.g. avoiding ponding/standing water).	
		12.2 Monitor and report disease trends.	

13 Risks of wildfire occurrence and impacts are reduced.	4,5	**13.1** Increase wildfire education and awareness, including air quality concerns, for the whole community as well as for settings that serve vulnerable populations (e.g., daycares, schools, long-term care settings/retirement homes).	Assess the feasibility for a Community Wildfire Protection Plan. Improve the broadcasting and warning system for air quality issues during wildfire events. Create Wildfire Safety Information kits for vulnerable populations in collaboration with Aviation Forest Fire and the Ministry of Natural Resources and Forestry (NDMNRF).
		13.2 Continue to update wildland urban interface hazard inventory and risk assessment.	Engage with Indigenous communities and peoples to integrate traditional practises of wildfire management.
		13.3 Prepare a water use strategy for combating wildfires.	Assess water accessibility for wildfire needs in partnership with Greater Sudbury Water/Wastewater and Fire Services and Ministry of Northern Development, Mines, Natural Resources.
14 Local food systems and drinking water supply are resilient to future climate conditions and extreme events.	2,5,8,11	**14.1** Review and reprioritize the actions of the Greater Sudbury Food Strategy to build an equitable, vibrant, and sustainable food system that is resilient to the impacts of climate change.	Develop programs to address climate change adaptation in the commercial agriculture and food supply sectors. Establish and fund a Food Strategy Coordinator position that would be charged with facilitating the implementation of the Greater Sudbury Food Strategy. Create policies to ensure that urban agriculture, including community gardens, food forests, gardens for schools, and other institutions are supported and encouraged by any new developments.
		14.2 Monitor drinking water sources for changes in quality and quantity from climate change to ensure proper treatment.	

15 Climate change adaptation is integrated into operational procedures and community decisionmaking.	1-11	**15.1** Continue to encourage sustainable procurement policies throughout the community.	Develop a sustainable procurement policy with a climate change lens for the City.
		15.2 Develop a climate change adaptation lens for decision-making.	Revise City's current climate lens to include climate adaptation and share it as a resource for community organizations.
		15.3 Include climate change action in utility and communication.	
16 The community is informed and empowered.	1-11	**16.1** Find and share climate change adaptation-related funding opportunities.	
		16.2 Promote policies that raise people out of poverty, for example, living wages or guaranteed basic income.	
		16.3 Increase public awareness of climate change risks and meaningfully include the community in implementing the plan.	Increase efforts to share advanced weather warnings with precautions and advice for the public. Work collaboratively with the Ministry of Northern Development, Mines, Natural Resources and Forestry to help with prevention and mitigation during local events. Continue public announcements through television, radio, social media and landline for alerts that provide guidance for appropriate actions to take during extreme weather events. Increase subscriptions to Sudbury Alerts.
		16.4 Engage with insurance and real estate sectors on measuring private property risk and communicating best practices.	
17 New technology and best practices in design and construction are incorporated.	1-11	**17.1** Incorporate innovative technology and building techniques in residential projects through collaborations with the City, educational institutions, businesses, real estate and the construction community.	

		17.2 Develop incentives for the creation and adoption of innovative technology and building techniques.	Introduce programs for education, training of builders and tradespeople. Consider pilot projects to test various innovative technology, environmental monitoring, and building techniques in partnerships with utilities, innovation hubs, industry and post-secondary institutions.
		17.3 Work with partners to lobby provincial and federal governments to support increased funding to improve infrastructure resiliency.	

C: 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: Both the long-term shift in global weather patterns and the regional influences, such as increased temperatures, extreme weather events, and the spread of invasive species 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: An interactive tool that combines climate science, mapping, and storytelling to depict expected climatic changes across Canada until 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 Scenario: The difference between a future climate situation 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.

Climate Change Data and Scenarios Tool: A tool on The Canadian Climate Data and Scenarios (CCDS) site that 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: A collaboration that offers local climate data and 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 Impact: The effect of existing or forecast changes in climate on built, natural and human systems. There are 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).

Climate Projections: Projections 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.

Ensemble Approach: Using 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: 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.

Impact Statement: Concise statement that outlines 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 several 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 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 (RCPs): 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 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): Five different storylines of alternate socioeconomic 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.

Traditional Ecological Knowledge (TEK): A collaborative concept where a rich fabric of knowledge and wisdom is accumulated across generations and renewed by each new generation through years of interacting with the land, the water and the air (the natural environment). "Indigenous knowledge presents a rich fabric of knowledge and wisdom that relates directly to environmental stewardship, preservation and the enhancement of biological diversity by the First Peoples of Turtle Island (North America)" v.

Vulnerability: 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.

D: Acronyms

BARC – Building Adaptive and Resilient Communities

CCAP – Community 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

E: References

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