Subject:	Town of Lincoln Corporate Climate Adaptation Plan
To:	General Business & Finance Committee
From:	Public Works Department

Report Number:	PW-22-19
Wards Affected:	All
Date to Committee:	Monday, July 8, 2019
Date to Council:	Monday, July 22, 2019

Recommendation:

Council receive and file report PW-22-19, Corporate Adaption Plan;

Council endorses the creation of a Corporate Climate Adaptation Plan**;**

Council supports the establishment of an Adaptation Steering Committee**;** and

Council supports the establishment of a Stakeholder Advisory Group.

Purpose:

The purpose of this report is to provide Council with an update on the development of the Climate Adaptation Plan for the Town of Lincoln, including the scientific background, local context, methodology, and proposed timeline.

Background:

Climate Change and Extreme Weather

In 2019, Environment and Climate Change Canada published Canada's Changing Climate Report which summarizes the evidence that the Earth has warmed during the Industrial Era and that the main cause of this warming is human influence. This evidence includes increases in near-surface and lower-atmosphere air temperature, sea surface temperature, and ocean heat content; widespread warming consistent with the observed increase in atmospheric water vapour and with declines in snow and ice cover; and global sea level rise from the expansion of ocean waters caused by warming and from the addition of water previously stored on land in glaciers and ice sheets.[i] These gradual shifts in average conditions (temperature, precipitation and sea level) will be accompanied by changes in the frequency and intensity of extreme weather events.

For example, extreme hot temperatures will become more frequent and more intense, leading to increased severity of heatwaves, droughts, and wildfire risks.[ii]

These observed climate changes cannot be explained by natural factors such as internal variations within the climate system, but rather, by human influences such as changes in atmospheric greenhouse gases (principally carbon dioxide) and aerosols, and changes to the land surface.[iii]

Climate and Extreme Weather Trends and Projections for Canada

The impacts of changing climate are already evident across the country. Environment and Climate Change Canada highlights Canada's changing climate, anticipated impacts, and projections for the future.

Key findings include:

- Canada's climate has warmed and will warm further in the future, driven by human influence. Both past and future warming in Canada is, on average, about double the magnitude of global warming. Northern Canada has warmed and will continue to warm at even more than double the global rate.
- Precipitation has increased in many parts of Canada, and there has been a shift toward less snowfall and more rainfall. Annual and winter precipitation is projected to increase everywhere in Canada over the 21st century. However, reductions in summer rainfall are projected for parts of southern Canada under a high emission scenario toward the late century.
- Temperature extremes have changed in Canada, consistent with the increase in mean temperature. Extreme warm temperatures have become hotter, while extreme cold temperatures have become less cold.
- Increased frequency and severity of extreme weather events (e.g. heat waves, floods, coastal storm surges and droughts), more smog episodes and disease outbreaks, thawing of permafrost, loss of northern sea ice, and rising sea levels.[iv]

Extreme weather events and their impacts also point to the vulnerability of Canadian communities and infrastructure to climate change. The costs resulting from extreme weather events in Canada over the past 15 years have been greater than all previous years combined. These costs include property damage and disruptions in the production and flow of goods and services associated with flooding, wind, hail and ice storms, hurricanes, tornados, and wild fires. With continued climate change, projected increases in the frequency and intensity of extreme weather will also affect the cost and availability of insurance and impact governments that serve as insurers of last resort.[v]

These impacts will continue to affect municipalities of all sizes and with positive and negative implications on infrastructure (e.g. transportation, water supply, sewage), social and economic systems (e.g. human health, recreation) and natural environments (e.g. biodiversity loss, habitat degradation, invasive species).[vi]

Local Climate and Extreme Weather Trends and Projections

To scale down climatic and extreme weather trends, a 2012 report[vii] published by Niagara Region outlined several changes in Niagara region's climate that have already been seen, including:

- An increase in annual average temperature of about 1.3 C in the last 40 years
- A trend towards more days with temperatures over 30˚C
- More heat waves of 3 or more consecutive hot days
- Longer growing season, with May and September significantly warmer
- An increase in average number of frost-free days with 10 more per year compared to 1970
- A small increase in annual precipitation, with most of the increase in winter
- More rain and less snow in winter
- More summer droughts and dry spells
- Increased numbers of freeze-thaw cycles
- An increase in heavy rain events.

Climate scientists project the following conditions for the Niagara region:

- An increase in average annual temperatures of 3-4˚C in by the 2050's
- Increase in freeze-free days by as much as 30 days in the 2050's and 50 days in the 2080's
- A 20% decrease in summer rainfall by the 2050's
- A continuing increase in freeze-thaw cycles for the next few decades
- Growth in the conditions that give rise to thunderstorms with a likely increase in heavy rains, lightning strikes, high winds, hailstorms and tornadoes

Anticipated areas of impact in Lincoln are summarized in Table 2:

Table 2: Anticipated Impacts of Climate Change on Lincoln[viii]

Affected Group	Impacts on Respective Group
Residents	• Basement flooding • More frequent storms • Strong winds damaging windows and roofs • Increase freeze-thaw cycles deteriorating roofs, driveways, and basement concrete • Increased storms can cause more frequent road accidents • Higher temperatures increase heat-related illnesses and deaths among vulnerable populations (e.g. children, elderly, homeless) • Increased smog resulting in worsening of respiratory illness (e.g. asthma) • Higher temperatures increase the populations of insects carrying diseases (e.g. West Nile, Lyme disease) • Frequent flooding causes runoff resulting in more waterborne diseases • Erosion of shorelines threatens land owners by reducing property boundaries
Businesses & Tourism	• Premature replacement of infrastructure due to more intense weathering

	• Power outages, floods, or other weather-related incidents may cause downtime for businesses • Increased emergency management costs • Weather related injury or illness may cause lower worker productivity • Increase in insurance rates and health care costs
Agriculture & Farmers	• Shorter ice-wine growing season • Increased energy consumption for greenhouses to sustain cooling regiment • Heat stress in farm animals • Increased water needed for irrigation • Increased water runoff and soil erosion • More frequent and intense storms can cause damage to infrastructure • Strong winds and damaging storms can destroy crop yields • Power outages may occur that can jeopardize agriculture product
Buildings & Infrastructure	• Increased freeze-thaw cycles can cause road damage • Higher temperatures and increased rainfall speed up chemical reactions causing corrosion damage to building materials • Pavement softening from hot weather • Damages to infrastructure induce more frequent road and bridge maintenance • Basement floods caused by prolonged rainfall
Water & Wildlife	• Increase in waterborne diseases • Higher temperatures increase disease-carrying insect populations • Temperature change is a threat to fish populations • Increased algae blooms can cause a decrease in water quality • Lower water levels reduce critical wetlands • Increased forest fires

Recent events in Lincoln, such as the spring 2017 and 2019 flood events, also point to the need to adapt and build resiliency to changing and extreme weather patterns. Lincoln experienced about $1 million in damages resulting from back-to-back spring storms in 2017 that caused extreme flooding from Lake Ontario. These events led to the Town's first-ever voluntary evacuation notice for residents living near the Lake Ontario shoreline and caused significant damage to Charles Daley Park and sewer systems in Jordan Station and Campden.[ix] In Spring 2019, significant rainfall and winds led to the Town's second voluntary evacuation as well as flooding, beach closures, and damage to boardwalks at Charles Daley Park.

Report:

Climate Adaptation Plan

Climate change adaptation refers to "actions that reduce the negative impact of climate change, while taking advantage of potential new opportunities [and] involves adjusting policies and actions because of observed or expected changes in climate"[x]. While adaptation can be reactive (in response to climate impacts) or anticipatory (before impacts are observed), anticipatory adaptations often result in lower long-term costs and can be more effective than reactive adaptations.[xi]

Local governments play a unique and important role in managing the risks of a changing climate. Given the local nature of many climate impacts, municipalities are

often the front line to manage risks, protect community safety, and promote economic sustainability. Through processes such as land use planning, community energy planning, and mechanisms like zoning or permit regulations, municipalities are effectively able to identify and implement adaptive measures.[xii]

The purpose of a Climate Adaptation Plan is to prepare the Town of Lincoln to adapt to anticipated climatic change and extreme weather, thereby minimizing the severity of the resulting impacts. This will be achieved through:

1. A vision for the Town of Lincoln's Corporate Climate Adaptation Plan;
2. Identification of the potential impacts related to climate change and extreme weather in Lincoln, and the risk they pose to the Town's infrastructure, assets, operations, services, and shoreline;
3. Prioritized adaptation actions to reduce risk and vulnerability associated with climate change and extreme weather impacts; and
4. A detailed implementation plan, including: estimated costs, funding sources, responsibilities, timelines, and a framework to monitor and evaluate progress.

The development of a Climate Adaptation Plan for the Town of Lincoln is driven and supported by the 2016 Asset Management Plan which states, "infrastructure is inextricably linked to the economic, social and environmental advancement of a community" and that "broader environmental and weather patterns have a direct impact on the reliability of critical infrastructure services". Accordingly, overarching principles of the Asset Management Plan include sustainability, delivering "optimal asset life cycles, ongoing systems performance, environmental and other long term consequences", and ensuring that Town services "preserve and protect the natural and heritage environment".[xiii] The Town of Lincoln has also affirmed its commitment to sustainability, "reviewing opportunities for reducing the impact of climate change,… meet[ing] the challenges of climate change and other environmental issues through integrated solutions,…[and] incorporat[ing] low impact design and other site design strategies to mitigate environmental impacts" in the Town's 2014 Official Plan.[xiv]

The development of a Climate Adaptation Plan for the Town of Lincoln is also driven and supported by the 2017 Growth Plan for the Greater Golden Horseshoe, of which a guiding principle is to "integrate climate change considerations into planning and managing growth such as planning for more resilient communities and infrastructure – that are adaptive to the impacts of a changing climate".[xv]

The development of a Climate Adaptation Plan fulfills the Phase 1 requirements of the Municipalities for Climate Innovation Program (MCIP) grant provided by the Federation of Canadian Municipalities (FCM).

Scope

The scope of the Climate Adaptation Plan is limited to the Corporation of the Town of Lincoln and will outline how the municipality as a corporation will adapt its assets, operations, and services to the impacts of extreme weather. A corporate climate adaptation plan increases the adaptive capacity and resiliency of Town-owned

infrastructure (road network, bridges and culverts, buildings, water network, wastewater network, land improvements, vehicles, and machinery and equipment), Town-run programs, and shoreline to future climate impacts, and to integrate extreme weather adaptation into day-to-day operations

Due to time constraints, a community climate adaptation plan, addressing broader community-wide initiatives outside of the Town's responsibility, will not be developed within this project. Due to the focus on adaptation, mitigation efforts are also out of scope. Nevertheless, through conducting baseline vulnerability and adaptive capacity assessments and engaging with corporate and community stakeholders, this project may identify the need to initiate a community and/or a mitigation plan. Additionally, implementation of the Corporate Climate Adaptation Plan is not within scope of this project; however, the plan will outline the implementation process including: prioritized actions, key performance indicators, and an implementation schedule.

The creation of a Corporate Climate Adaptation Plan and the activities of Niagara Adapts will occur in parallel with other initiatives within Lincoln including: the Shoreline Protection Study, the Town's Asset Management Plan Update, the Great Lakes and St. Lawrence Cities Initiative, and the Marine Environmental Observation Prediction and Response Network (MEOPAR) Great Lakes Coastal Resilience project which focuses on community vulnerability and adaptation.

Process/Methodology

The framework guiding the development process is will be developed by Niagara Adapts and finalized after Workshop 1. The project will follow the MCIP framework:

- Phase 1: Develop a Climate Adaptation Plan
- Phase 2: Operational or Institutional Changes
- Phase 3: Preparatory work leading to the implementation of climate adaptation initiatives

Following completion and endorsement of the Corporate Climate Adaptation Plan (Phase 1) in February 2021 the project will enter Phases 2 and 3.

Project Stakeholders and Organization

The role of the Climate Change Coordinator is to facilitate the development process. The plan will be primarily informed by the subject matter experts comprising the Adaptation Steering Committee. Input on the plan will be gathered from SMT, Council, the Stakeholder Advisory Group, and the Lincoln Community on an ongoing basis.

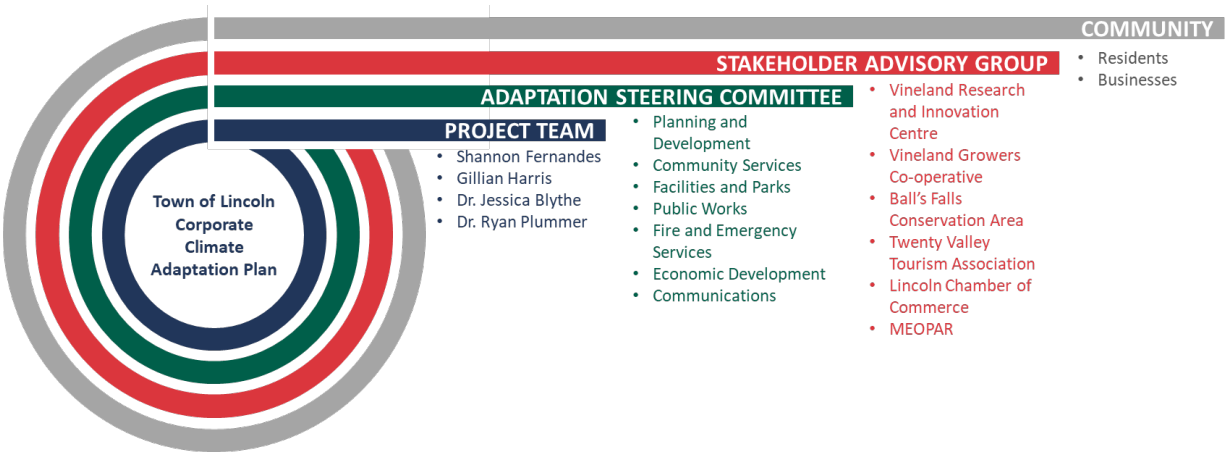


Figure 1: Project Stakeholders and Organization

Project Team

The Project Team consists of:

- Shannon Fernandes, Climate Change Coordinator, Town of Lincoln
- Gillian Harris, Manager, Environmental Services, Town of Lincoln
- Dr. Jessica Blythe, Assistant Professor, Environmental Sustainability Research Centre, Brock University
- Dr. Ryan Plummer, Director, Environmental Sustainability Research Centre, Brock University

Niagara Adapts

Niagara Adapts is a novel partnership between Brock University and municipalities in the Niagara Region. The partnership is designed to enhance effectiveness and realize efficiencies by leveraging resources and expertise to enable collaborative climate change adaptation assessments, planning and implementation, while at the same time acknowledging and supporting the uniqueness of each participating municipality.

Project Deliverables will include:

1. Adaptation Planning Workshops
2. Baseline assessment of vulnerability adaptive capacity for each municipality
3. Online learning network

Adaptation Steering Committee

To ensure the plan reflects staff expertise and corporate priorities, and can ultimately be integrated into departmental functions, most of the findings for each milestone will be derived from or refined through workshops with an Adaptation Steering Committee. The Steering Committee will be multi-departmental, comprised of mid-level management Town staff that have diverse expertise and experience with the Town's communities, infrastructure, assets, and services. Expected input would be 1 on 1 meetings and facilitated workshops to identify and evaluate risks and vulnerabilities and then to identify adaptation actions. Ownership for each department's adaptation plan will live with the department.

The Steering Committee include representatives from:

- Planning and Development
- Community Services
- Facilities and Parks
- Public Works
- Fire and Emergency Services
- Economic Development
- Communications

Stakeholder Advisory Group
To ensure the plan reflects local context and community priorities, a Stakeholder Advisory Group will be created by the Project Team and comprised of individuals and organizations with a variety of expertise and experience with Lincoln's communities, businesses, and services. Expected input would be 1 on 1 meetings and facilitated workshops to evaluate and consult on the adaptation planning process and draft plan.

The members of the group have yet to be determined, but may include:

- Vineland Research and Innovation Centre
- Vineland Growers Co-operative
- Ball's Falls Conservation Area
- Twenty Valley Tourism Association
- Lincoln Chamber of Commerce
- MEOPAR

Anticipated Touchpoints

Community
Ongoing citizen engagement will be an important part of the Corporate Climate Adaptation Planning process, through both the Stakeholder Advisory Group and Community Engagement. Anticipated touchpoints with community stakeholders, residents, and businesses may include: online surveys, information booths, engagement workshops.

Senior Management Team
Consultation with SMT will occur on a quarterly basis to provide updates, seek feedback, and ensure input is obtained from all management levels.

Community Services and Infrastructure Committee
The Committee will be updated on the progress on the Climate Adaptation Plan and related activities, through presentations twice a year and update reports as needed. A draft Climate Adaptation Plan will be presented to the committee for review and feedback before it is finalized in February 2021.

Timeline

A tentative timeline is presented below (Figure 2). As per the Municipalities for Climate Innovation Program (MCIP) grant, the Climate Adaptation Plan must be finalized by February 2021. The schedule for all other activities is tentative and will be updated after the initial Niagara Adapts workshop and Adaptation Steering Committee meeting. A detailed list of anticipated tasks and milestones can be found in Appendix A.

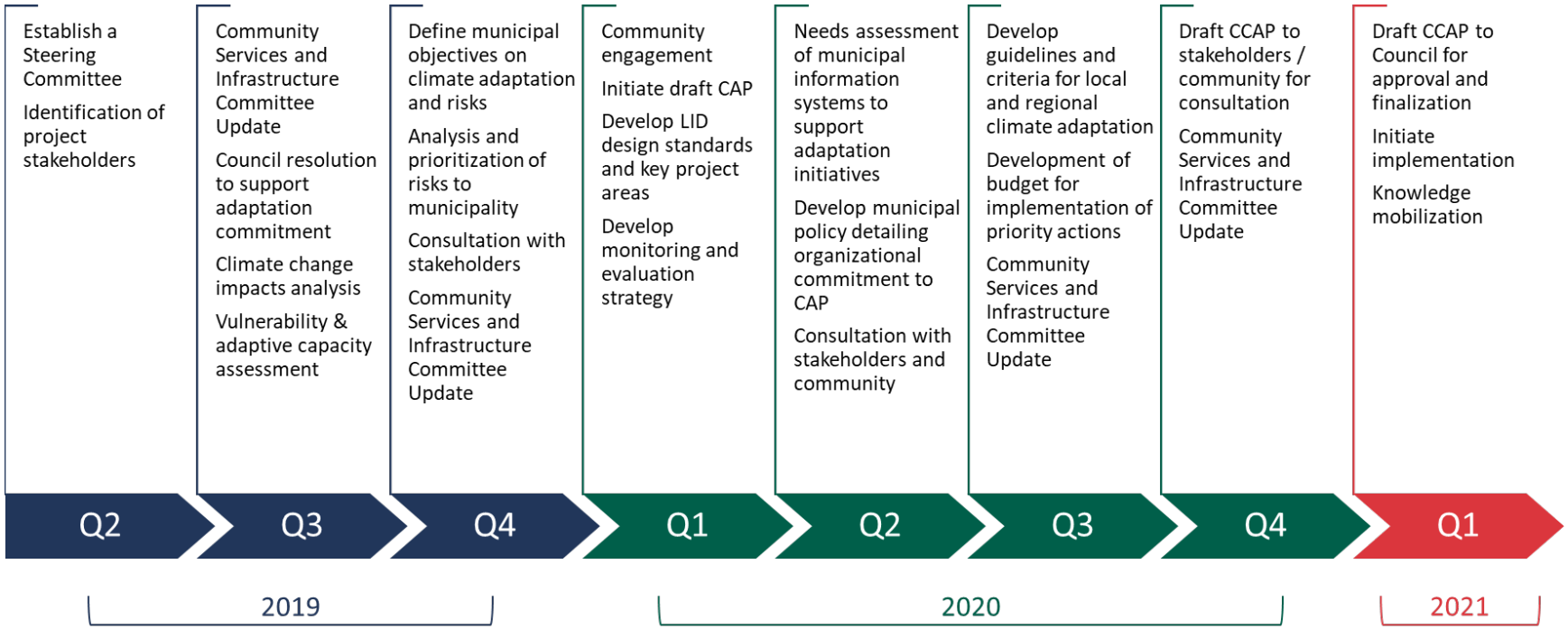


Figure 2: Tentative Corporate Climate Adaptation Plan Timeline

Financial, Legal, Staff Considerations:

Financial: N/A

Staffing:
The purpose of this project is to build corporate capacity for climate change and extreme weather adaptation with existing staff. No additional staff is required at this time.

It is anticipated that the Adaptation Steering Committee will be multi-departmental, comprised of Town staff that have diverse expertise and experience with the Town's communities, infrastructure, assets, and services. Expected input will be 1 on 1 meetings and facilitated workshops to identify and evaluate risks and vulnerabilities and then to identify adaptation next steps.

It is also anticipated that the Town's communication staff are utilized to prepare materials for public engagement/education initiatives and to assist with the notifications relating to the program.

Legal: N/A

Public Engagement Matters:

As noted above, ongoing community engagement with residents, stakeholders, and industry, will be an important part of the Corporate Climate Adaptation Plan. Anticipated community touchpoints may include online surveys, information booths, and engagement workshops.

Conclusion:

To allow for the Town of Lincoln to adapt to anticipated climatic change and extreme weather, thereby minimizing the severity of the resulting impacts, it is recommended that Council resolve to support the development of the Corporate Climate Adaptation Plan and the establishment of an Adaptation Steering Committee and a Stakeholder Advisory Group.

Respectfully submitted,

Shannon Fernandes
Climate Change Coordinator
905-563-2799 Ext.281

Appendices:

Appendix A - Corporate Climate Adaptation Plan Timeline

Appendix B - Niagara Adapts Climate Adaptation Planning Process and Tentative Schedule
Appendix C - Works Cited
Appendix D – Corporate Climate Adaption Plan Presentation

Report Approval:

Report has been reviewed and/or approved by the Director of Public Works. Final approval is by the Chief Administrative Officer.

Appendix A: Tentative Corporate Climate Adaptation Plan Timeline

Phase 1: Develop a Climate Adaptation Plan
Phase 2: Operational or Institutional Changes
Phase 3: Preparatory work leading to the implementation of climate adaptation initiatives
Project Management

	Milestone 1 - Year 1 - March 2019 - August 2019
1	Gantt Chart (Year 1 & Year 2)
2	Complete the preliminary FCM self-assessment using the Climate Action Maturity Scale
3	Confirmation of Community of Practice Activities
4	Develop a Lincoln Steering Committee & Prepare and coordinate monthly meetings to assist with development of CCAP
5	Niagara Adapts Meetings
6	Identification of project stakeholders (internal/external)
7	Conduct a review of climate change related events in Town
8	Review and enhance existing SOP for shoreline impacts
9	Research and develop list of current climate change impacts and affected municipal services
10	Gather baseline data on current state of the municipality
11	Analysis and prioritization of risks to municipality
12	Council Meeting Preparation and Presentation
13	Prepare and deliver education information for residents, town staff and council relating to CC issues and basic mitigating measures to consider
14	Coordinate with businesses and developers regarding CCA
15	Confirm/review KPIs for municipal infrastructure including (sanitary sewers, storm sewers, Konkle Creek, shoreline levels, etc.)
16	Preparation of reports to FCM
	Milestone 2 - Year 1 - September 2019 - February 2019
1	Niagara Adapts Meetings
2	Lincoln Steering Committee Meetings
3	Development of strategy for engaging external stakeholders
4	Community of Practice Activities
5	Consultation with stakeholders
6	Research on policy issues and constraints surrounding CCA in the region
7	Define municipal objectives on CCA and risk
8	Prepare and deliver education information for residents, town staff and council relating to climate change issues and basic mitigating measures to consider
9	Analysis and prioritization of risks to municipality
10	Develop a list of key adaptation project areas
11	Develop a study plan for project areas
12	Council Meeting Preparation and Presentation
13	Develop Council Resolution and Policies to support CCAP goals
14	Assemble cross-functional climate adaptation steering committee to oversee planning and deployment

15	Develop LID Design Standards and Key Project Areas
16	Develop a draft CCAP
17	Preparation of reports to FCM
18	Coordinate with businesses and developers regarding CCA
	Milestone 3 - Year 2 - March 2020 - August 2020
1	Lincoln Steering Committee Meetings
2	Community of Practice Activities
3	Consultation with stakeholders
4	Niagara Adapts Meetings
5	Define vision, objectives, and actions for CCA
6	Review of best practices in CCA
7	Creation of initial list of adaptation measures
8	Development of strategy to monitor and evaluate progress
9	Develop a draft CCAP
10	Needs assessment of municipal information systems to support CCA initiatives
11	Develop municipal policy detailing organizational commitment to CCA
12	Develop guidelines and criteria for local and regional CCA
13	Present CCAP to Council for approval of plan and proposed initiatives
14	Prepare and deliver education information for residents, town staff and council relating to climate change issues and basic mitigating measures to consider
15	Measurement, monitoring and review of data for KPIs
16	Prepare terms of reference for Shoreline Protection study
17	Work with departments for LID implementation in projects
18	Coordinate with businesses and developers regarding CCA
19	Complete Year 1 FCM self-assessment using the Climate Adaptation Maturity Scale
20	Preparation of reports to FCM
	Milestone 4 - Year 1 - September 2020 - February 2021
1	Lincoln Steering Committee Meetings
2	Community of Practice Activities
3	Consultation with stakeholders
4	Niagara Adapts Meetings
5	Assignment of "easy wins" to relevant municipal departments
6	Development of budget for implementation of priority actions
7	Project team provides support to municipal departments implementing identified actions
8	Council Meeting Prep and Presentation
9	Leveraging information from IS needs assessment to implement monitoring and evaluation
10	Coordinate with businesses and developers regarding CCA
11	Finalize Climate Adaption Plan
12	Revise Maturity Scale (with completed self-assessment)
13	Preparation of reports to FCM

Appendix B: Niagara Adapts Climate Adaptation Planning Process and Tentative Schedule

Niagara Adapts		
Workshop	**Modules**	
1. Introduction to Niagara Adapts (June 14, 2019)	This introductory workshop will orient participants to our collaborative partnership. Activities will include introductions, informal needs assessment, confirmation of draft schedule, etc.	Year 1
2. Climate change impacts analysis (~August 15, 2019)	In this workshop, we will review the available climate change data for each municipality, downscaling, climate projections, and scope potential impacts.	
3. Vulnerability & adaptive capacity assessment (~Sept 15, 2019)	In workshop 3, we will introduce vulnerability and adaptative capacity assessment tools, review data collection, risk prioritization and stakeholder engagement strategies.	
Niagara Adapts launch event (~October 15, 2019)		
4. Building adaptation plans (~Feb 20, 2020)	In this workshop, we will report-back on the baseline vulnerability data analysis, review adaptation planning principles, identify and prioritize adaptation options, etc.	
5. Monitoring & evaluation (~April 15, 2020)	In workshop 5, we will review monitoring and evaluation indicators, progress tracking, and the design and implementation of adaptive management	
Annual report to all partners in Niagara Adapts		
6. Stakeholder engagement for adaptation (~June 15, 2020)	In this workshop, we will review best practices for building public awareness and engagement, climate adaptation communication tools, etc.	Year 2
7. Building a community of practice (~Sept 15, 2020)	In workshop 7, we will review best practices for building best practices for the implementation of climate change adaptation plans.	
8. Share lessons & innovations (~Jan 15, 2021)	In this workshop, each municipality will present their adaptation plan to share lessons, innovations, and challenges. We will also review best practices for sharing 'easy wins' with municipal departments and beyond.	
9. Knowledge mobilization (~March 15, 2021)	In our final workshop, we will reflect on how to connect the knowledge generated throughout the planning and partnership process with practice within the broader community to support climate resilience in Niagara.	
Annual report to all partners in Niagara Adapts		

Appendix C: Works Cited

[i] Bush, E. and Lemmen, D.S., editors (2019). Canada's Changing Climate Report. Government of Canada. Ottawa, ON.
[ii] Richardson, G. R. A. (2010). Adapting to Climate Change: An Introduction for Canadian Municipalities. Natural Resources Canada. Ottawa, ON.
[iii] Bush, E. and Lemmen, D.S., editors (2019). Canada's Changing Climate Report. Government of Canada, Ottawa, ON.
[iv] Bush, E. and Lemmen, D.S., editors (2019). Canada's Changing Climate Report. Government of Canada, Ottawa, ON.
[v] Richardson, G. R. A. (2010). Adapting to Climate Change: An Introduction for Canadian Municipalities. Natural Resources Canada. Ottawa, ON.
[vi] Richardson, G. R. A. (2010). Adapting to Climate Change: An Introduction for Canadian Municipalities. Natural Resources Canada. Ottawa, ON.
[vii] Penney, J. (2012). Adapting to Climate Change: Challenges for Niagara. Climate Change Impacts and Adaptation Research and Policy. Retrieved from: https://www.niagararegion.ca/government/planning/pdf/climatechangerport.pdf
[viii] Penney, J. (2012). Adapting to Climate Change: Challenges for Niagara. Climate Change Impacts and Adaptation Research and Policy. Retrieved from: https://www.niagararegion.ca/government/planning/pdf/climatechangerport.pdf
[ix] Brock University. (2018). Communications, Media Relations and Public Affairs. May 3. https://brocku.ca/media-room/2018/05/03/brock-lincoln-living-lab-research-project-to-examine-lake-ontario-shoreline-flooding/
[x] Richardson, G. R. A. (2010). Adapting to Climate Change: An Introduction for Canadian Municipalities. Natural Resources Canada. Ottawa, ON.
[xi] Richardson, G. R. A. (2010). Adapting to Climate Change: An Introduction for Canadian Municipalities. Natural Resources Canada. Ottawa, ON.
[xii] Richardson, G. R. A. (2010). Adapting to Climate Change: An Introduction for Canadian Municipalities. Natural Resources Canada. Ottawa, ON.
[xiii] Town of Lincoln. (2016). Asset Management Plan.
[xiv] Town of Lincoln. (2014) Lincoln Official Plan. Retrieved from: https://lincoln.ca/sites/default/files/2018_centre_of_excellence_for_agriculture_op_final_2018_12_14small_final-s_894075.pdf
[xv] Government of Ontario. (2017). Growth Plan for the Greater Golden Horseshoe. Retrieved from: https://files.ontario.ca/appendix_-_growth_plan_2017_-_oc-10242017.pdf

Town of Lincoln

Corporate Climate Adaptation Plan

July 8, 2019

1

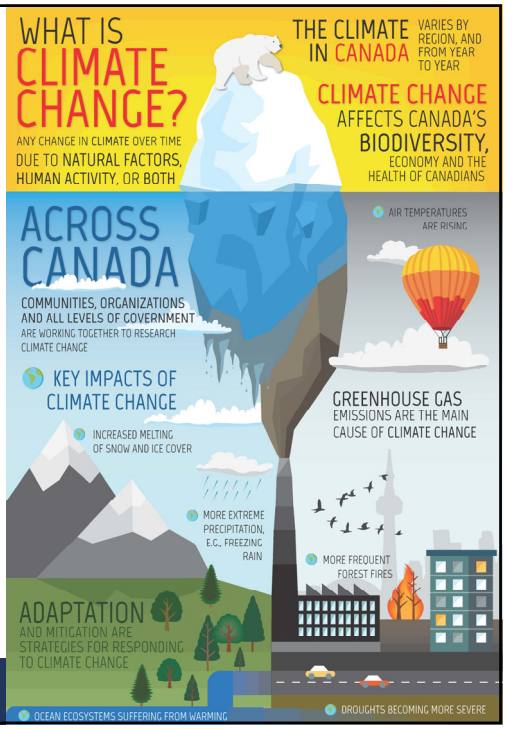
Climate Change and Extreme Weather

Climate Change

- Climate change is a long-term shift in weather conditions measured by changes in temperature, precipitation, wind, snow cover, and other indicators
- It can involve both changes in average conditions and changes in variability, including changes in extreme conditions

Extreme Weather

- Many of the most costly impacts of climate change--in terms of both life and property--will result from more frequent, longer-lasting, or more intense extreme weather events and associated natural disasters, such as heavy precipitation events, floods, heat waves, droughts, and wildfires



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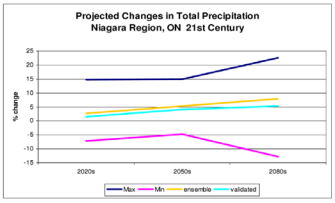
Local Conditions and Projections

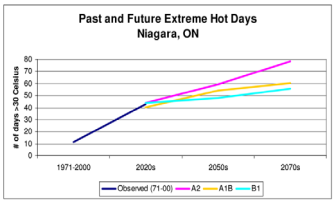
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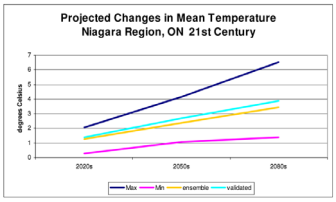
- An increase in annual average temperature of about 1.3˚C in the last 40 years
- A trend towards more days over 30˚C
- More heat waves of 3 or more consecutive hot days
- Longer growing season, with May and September significantly warmer
- An increase in average number of frost-free days with 10 more per year compared to 1970
- A small increase in annual precipitation, with most of the increase coming in winter
- More rain and less snow in winter
- More summer droughts and dry spells
- Increased numbers of freeze-thaw cycles
- An increase in heavy rain events

For the future, climate scientists project:

- An increase in average annual temperatures of 3-4˚C in the Niagara region by the 2050's
- Increase in freeze-free days by as much as 30 days in the 2050's and 50 days in the 2080's
- A 20% decrease in summer rainfall by the 2050's
- A continuing increase in freeze-thaw cycles for the next few decades
- Growth in the conditions that give rise to thunderstorms with a likely increase in heavy rains, lightning strikes, high winds, hailstorms and tornadoes







3

3

Impacts on Lincoln

Business and Tourism

- Weathering causes premature infrastructure repair
- Power outages and floods cause downtime for businesses
- ↑ emergency management costs
- Weather-related injury may cause lower worker productivity
- ↑ in insurance rates
- ↑ in healthcare costs

Residents

- ↑ frequency of damaging storms
- Basement flooding
- ↑ freeze thaw cycles
- ↑ heat-related illnesses due to higher temperatures
- ↑ smog resulting in respiratory illness
- Reduced property boundaries through shore erosion

Farmers and Agriculture

- ↓ in ice-wine growing season
- Storms and strong winds can damage infrastructure and crops
- ↑ energy consumption to sustain temperatures
- ↑ water needed for irrigation
- Heat stress in farm animals
- ↑ water runoff and soil erosion
- Power outages may jeopardize agriculture product

Buildings and Infrastructure

- ↑ freeze-thaw cycles = ↑road damage
- ↑ road maintenance costs
- ↑ temperatures and ↑ rainfall can speed up chemical reactions causing corrosion damage
- Pavement softening from hot weather
- More frequent road and bridge maintenance

Water and Wildlife

- ↑ waterborne diseases
- ↑ temperatures increase disease-carrying insect populations
- Temperature change is a threat to fish populations
- ↑ algae blooms can cause a decrease in water quality
- ↓ water levels reduce critical wetlands
- ↑ forest fires

4

4



Spring 2017 and 2019 Floods

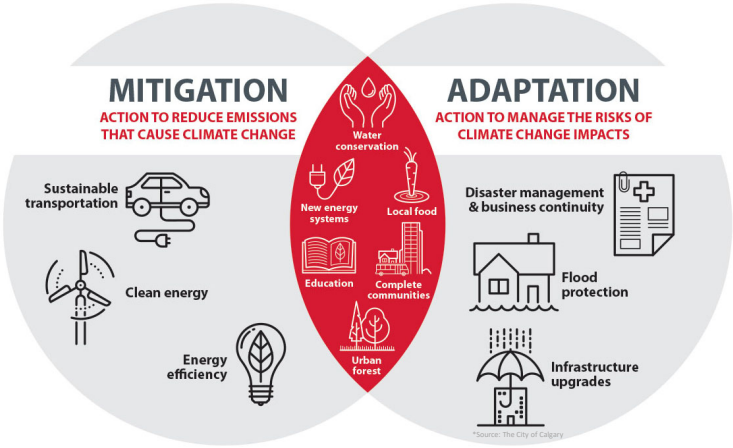
- Back-to-back spring storms in 2017 caused massive flooding from Lake Ontario, leading to:
  - ~ $1 million in damage
  - The Town's first-ever voluntary evacuation notice
  - Significant damage to Charles Daley Park and sewer systems in Jordan Station and Campden
- Significant rainfall and winds in 2019 caused:
  - The second voluntary evacuation notice
  - Shoreline damage, beach closings and damage to the boardwalk at Charles Daley Park

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Adaptation

- Climate adaptation actions:
  - Help communities and ecosystems cope with changing conditions and extreme weather
  - Reduce negative impacts
  - Take advantage of potential new opportunities



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Corporate Climate Adaptation Plan

Purpose

- To prepare the Town of Lincoln for anticipated climatic change and extreme weather by increasing adaptive capacity and resiliency of Town-owned infrastructure (i.e., sewers, watermains, storm systems, roads, buildings and facilities), Town-run programs, and shoreline

Outcome

1. A vision for the Town of Lincoln's Corporate Climate Adaptation Plan;
2. Identification of the potential impacts related to climate and extreme weather in Lincoln, and the risk they pose to the Town's infrastructure, assets, operations, services, and shoreline;
3. Prioritized adaptation actions to reduce risk and vulnerability associated with climate and extreme weather impacts; and
4. A detailed implementation plan, including: estimated costs, funding sources, responsibilities, timelines, and a framework to monitor and evaluate progress.

Scope

- Corporation of the Town of Lincoln and its assets, day-to-day operations, and services
- Out of scope: GHG mitigation, community adaptation, implementation

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Supporting Initiatives

2014 Official Plan

- Review opportunities for reducing the impact of climate change
- Meet the challenges of climate change and other environmental issues through integrated solutions and Incorporate low impact design to mitigate environmental impacts

2016 Asset Management Plan

- Broader environmental and weather patterns have a direct impact on the reliability of critical infrastructure services and infrastructure is inextricably linked to the economic, social, and environmental advancement of a community
- The Asset Management Plan update is occurring in parallel to the Corporate Climate Adaptation Plan

2017 Growth Plan for the Greater Golden Horseshoe

- Integrate climate change considerations into planning and managing growth such as planning for more resilient communities and infrastructure – that are adaptive to the impacts of a changing climate

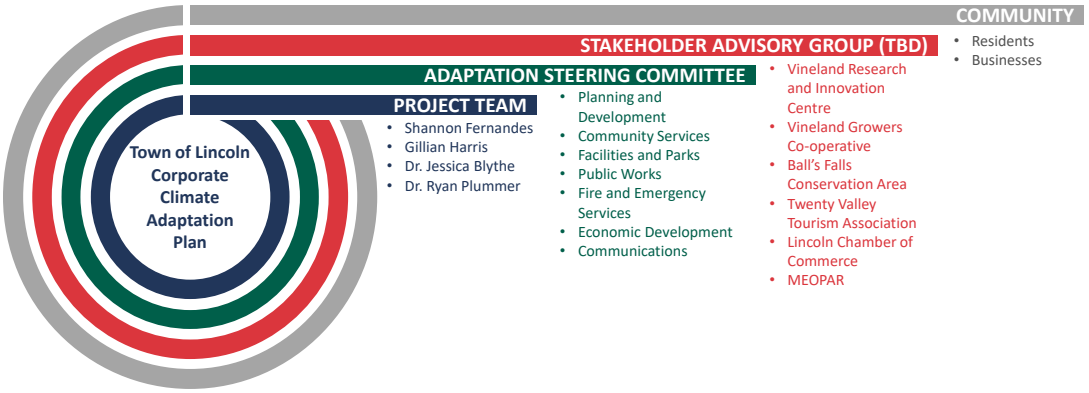
2019 Partners for a Healthy Ontario and Health Equity in All Policy

- Health Equity in All Policy (HEiAP) is an approach to public policies that systematically takes into account the health implications of decisions
- Adaptation actions such as disaster management, flood protection, education, and building complete communities help manage the impacts climate change and extreme weather have on public health

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Corporate Climate Adaptation Plan



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Niagara Adapts

- Partnership between Brock University and seven municipalities in the Niagara Region
- Project Deliverables will include:
  1. Adaptation Planning Workshops
  2. Baseline assessment of vulnerability adaptive capacity for each municipality
  3. Online learning network

Brock University

Town of Lincoln

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Touchpoints

Community

- Ongoing citizen engagement will ensure the plan reflects public interest, local context, and industry priorities
- May include: online surveys, information booths, workshops

Senior Management Team and Council

- Consultation with SMT and Council will occur on a quarterly basis to provide updates, get feedback, and ensure input is obtained from all management levels

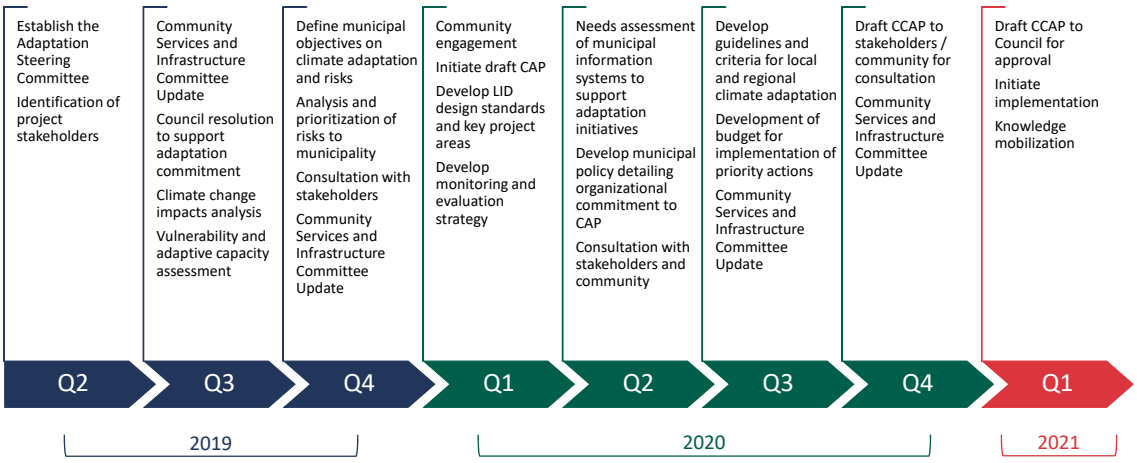
Community Services and Infrastructure Committee

- Committee will be updated twice a year on the progress on the Climate Change Adaptation Plan and related activities, with update reports as needed

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Projected Timeline



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Questions?

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