



COUNTY OF HALIBURTON

CORPORATE CLIMATE CHANGE ADAPTATION PLAN

2022-2030



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Executive Summary

Although climate change is occurring globally, the impacts are felt at the local level. The County of Haliburton is experiencing more extreme weather, prolonged heatwaves, flooding events, and milder winters, among other impacts.

The County of Haliburton and its four local municipalities – the Township of Algonquin Highlands, the Municipality of Dysart et al, the Municipality of Highlands East and the Township of Minden Hills – recognize the threat that climate change poses to the operations and services of local governments. The Corporate Climate Change Adaptation Plan aims to minimize this threat by identifying the impacts of a changing climate on our municipal assets, infrastructure and operations, and outlining potential actions that the County and its local municipalities can take to minimize risk and build resilience.

Research was conducted on local climate projections to see how the local climate might change in the future. The impact these changes present for municipal operations were identified. Vulnerability and risk assessments were conducted to prioritize the impacts to be included in this plan. The plan builds on years of action from our local governments addressing severe rainfalls, extreme heat and intense storms. Actions in this plan serve as a guide to continue this work.

A preliminary implementation schedule is included with the intention to be flexible as changes in data, resources, and funding occur. The Corporate Climate Change Adaptation Plan is a living document that should be monitored, reviewed and updated to ensure it remains effective.

Glossary

Definitions are adapted from the Intergovernmental Panel on Climate Change (IPCC).

Adaptation: The process of adjustment to actual or expected climate and its effects, in order to moderate harm or exploit beneficial opportunities.

Adaptive capacity: The ability of systems, institutions, humans and other organisms to adjust to potential damage, to take advantage of opportunities, or to respond to consequences.

Business as usual (BAU): Scenarios that are based on the assumption that no mitigation policies or measures will be implemented beyond those that are already in place or are planned to be adopted.

Exposure: The presence of people; livelihoods; species or ecosystems; environmental functions, services, and resources; infrastructure; or economic, social, or cultural assets in places and settings that could be adversely affected.

Flood: The overflowing of the normal confines of a stream or other body of water, or the accumulation of water over areas that are not normally submerged.

Green infrastructure: The interconnected set of natural and constructed ecological systems, green spaces and other landscape features. It includes planted and indigenous trees, wetlands, parks, green open spaces and original grassland and woodlands, as well as possible building and street-level design interventions that incorporate vegetation. Green infrastructure provides services and functions in the same way as conventional infrastructure.

Greenhouse gas (GHG): Gaseous constituents of the atmosphere that absorb and emit radiation. Water vapour (H₂O), carbon dioxide (CO₂), nitrous oxide (N₂O), methane (CH₄) and ozone (O₃) are the primary GHGs in the Earth's atmosphere.

Heatwave: A period of abnormally hot weather.

ICLEI: Local Governments for Sustainability.

Impacts: The consequences of realized risks on natural and human systems, where risks result from the interactions of climate-related hazards (including extreme weather and climate events), exposure, and vulnerability. Impacts generally refer to effects on lives; livelihoods; health and well-being; ecosystems and species; economic, social and cultural assets; services (including ecosystem services); and infrastructure.

Glossary

Definitions are adapted from the Intergovernmental Panel on Climate Change (IPCC).

Representative Concentration Pathways (RCPs): Scenarios that include time series of emissions and concentrations of the full suite of greenhouse gases (GHGs) and aerosols and chemically active gases, as well as land use/land cover. The word representative signifies that each RCP provides only one of many possible scenarios that would lead to the specific radiative forcing characteristics. The term pathway emphasizes the fact that not only the long-term concentration levels but also the trajectory taken over time to reach that outcome are of interest.

Resilience: The capacity of social, economic and environmental systems to cope with a hazardous event or trend or disturbance, responding or reorganizing in ways that maintain their essential function, identity and structure while also maintaining the capacity for adaptation, learning and transformation.

Risk: The potential for adverse consequences where something of value is at stake and where the occurrence and degree of an outcome is uncertain. In the context of the assessment of climate impacts, the term risk is often used to refer to the potential for adverse consequences of a climate-related hazard, or of adaptation or mitigation responses to such a hazard, on lives, livelihoods, health and well-being, ecosystems and species, economic, social and cultural assets, services (including ecosystem services), and infrastructure. Risk results from the interaction of vulnerability (of the affected system), its exposure over time (to the hazard), as well as the (climate-related) hazard and the likelihood of its occurrence.

Sensitivity: The degree to which a system is affected by climate-related stimuli.

Vulnerability: The propensity or predisposition to be adversely affected. Vulnerability encompasses a variety of concepts and elements including sensitivity or susceptibility to harm and lack of capacity to cope and adapt.

Introduction

GLOBAL CLIMATE CHANGE

Climate change refers to changes in long-term weather patterns. Human influence on the climate has increased significantly since the Industrial Revolution through emitting greenhouse gases, such as carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O). The main source of greenhouse gas emissions is the combustion of fossil fuels such as coal, oil and gas. Other activities such as the conversion of forests into agricultural land and the decomposition of organic waste also produce greenhouse gas emissions. Greenhouse gases trap heat in the atmosphere, changing the temperature of air and water and upsetting the balance of the climate system. The global average temperature has increased by 1°C, causing more frequent and intense heat waves, droughts and wildfires, less snow and ice, changing rain patterns, more extreme storms, thawing permafrost, and rising sea levels across the globe. Canada is warming at about double the global rate. The average annual temperature in Canada has increased by 1.7°C since 1948 and could increase up to 6.3°C if efforts are not made to reduce greenhouse gas emissions.[1] The United Nations Intergovernmental Panel on Climate Change (IPCC) states that a warming world poses significant risks for human health, ecosystems and the economy.

Continued emission of greenhouse gases will cause further warming and irreversible impacts.[2] To minimize future risks, we need to reduce greenhouse gas emissions significantly on the global scale. This is referred to as climate change mitigation and includes activities such as improving energy efficiency in buildings, transitioning to electric vehicles, and reducing waste. Since the climate is already changing and will continue to change into the future, adapting to climate change is also essential. Climate change adaptation involves responding to the actual or expected impacts of climate change. Adaptation can involve designing infrastructure to withstand more extreme weather or creating a disaster management plan. Actions can address both mitigation and adaptation through low carbon resilience, such as planting trees which store carbon (mitigation) while regulating water and providing shade (adaptation).

LOCAL CLIMATE ACTION

The County of Haliburton and its local municipalities are committed to taking action on climate change. The County is taking a three phased approach to climate change planning: corporate mitigation, corporate adaptation, and community mitigation and adaptation. In 2019, the County joined the Partners for Climate Protection program and in 2020, the County and local municipalities developed a Corporate Climate Change Mitigation Plan. The Corporate Climate Change Mitigation Plan focuses on actions to reduce greenhouse gas emissions from municipal operations and services, while this plan focuses on protecting municipal operations and services from a changing climate.

Local governments are well positioned to address climate change adaptation since they are on the front lines of responding to extreme weather events which has impacts on service levels and budgets. They are also the closest level of government to the community and can target adaptation efforts to unique local circumstances to protect the local community, environment and economy. Local governments have a variety of mechanisms under their control to influence climate change adaptation, including education and outreach, policy and program development, and capital investments.[3] Adaptation strategies are cost effective methods to reduce the economic impacts of climate change, since the costs of not taking action are significantly higher. The National Roundtable on the Environment and the Economy found that the economic impact of climate change in Canada could reach between \$21 and \$43 billion per year by 2050.[4] For every dollar invested in risk mitigation measures, approximately \$6 is saved in future damages.[5]

The Corporate Climate Change Adaptation Plan identifies how the County of Haliburton and its local municipalities can adapt their infrastructure, assets and operations to the impacts of a changing climate. This includes roads, bridges, water and wastewater infrastructure, corporate buildings, and natural areas such as parks. This plan is a first step for understanding the climate-related risks that impact municipal operations and services, and provides steps to embed resiliency across daily and long-term municipal operations. The Community Climate Action Plan, to be developed over the course of 2022-2023 with a variety of stakeholders from the community, will be broader in scope to address the impacts and vulnerabilities for the community, including impacts on private property.

FIVE MILESTONES FOR CLIMATE ADAPTATION

This plan was developed using the Changing Climate, Changing Communities Guide and Workbook for Municipal Climate Adaptation developed by ICLEI. The guide outlines five milestones for climate adaptation that involve identifying local climate change projections, determining impacts on municipal operations and services, conducting a vulnerability and risk assessment, and identifying actions to build adaptive capacity and increase resilience.



Milestone 1
INITIATE



Milestone 2
RESEARCH



Milestone 3
PLAN



Milestone 4
IMPLEMENT



Milestone 5
MONITOR/REVIEW

Adaptation Governance

GLOBAL

In 2015, nearly 200 nations signed on to the Paris Agreement, an ambitious global plan to take action on climate change. The agreement aims to keep global temperature rise this century well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5°C. Countries outline actions they will take to build resilience to adapt to the impacts of rising temperatures through Nationally Determined Contributions.

NATIONAL

A Healthy Environment and Healthy Economy is Canada's strengthened climate plan that builds on the Pan-Canadian Framework on Clean Growth and Climate Change. The plan commits to developing Canada's first National Adaptation Strategy. The Canadian Centre for Climate Services' climate data portal is a resource that provides local climate data for decision makers to plan and adapt for climate change. The federal government offers the National Disaster Mitigation and Adaptation Fund which helps communities mitigate impacts such as flooding and wildfires.

PROVINCIAL

The Ontario government is conducting the first multi-sector climate change impact assessment, a component on the Made in Ontario Environment Plan. This study will seek to understand where and how climate change is likely to impact communities, critical infrastructure, economies and the natural environment to strengthen the province's resilience to climate change. In 2020, the Ontario government released Ontario's Flooding Strategy, with the announcement made in Minden. The strategy includes priorities of understanding flood risks; strengthening the governance of flood risks; enhancing flood preparedness; enhancing flood response and recovery; and investing in flood risk reduction.

The Changing Climate in Haliburton County

CLIMATE PROJECTIONS

Climate models are run on powerful computers and take thousands of factors into account (solar radiation, greenhouse gas emissions, ocean currents, cloud formation, etc.) to model the entire climate system.[6] Future climate projection data comes from Environment and Climate Change Canada, the Prairie Climate Centre and the Institute for Catastrophic Loss Reduction based on data from an ensemble of global climate models. Climate projections are based on a business-as-usual scenario (RCP 8.5), a scenario where greenhouse gas emissions continue to rise. Climate models provide the best available scientific information of future climate conditions, however there are limitations for using a computer to model the complex interactions between humans and the Earth. While there is some level of uncertainty regarding future climate conditions, we can plan for overall trends.

IDENTIFYING IMPACTS

Climate impacts and actions to prepare for the impacts were identified with the knowledge and experience of county and municipal staff, including public works, parks and recreation, water and wastewater, and emergency services departments. A survey was completed to identify the impacts that warmer, wetter and wilder weather presents to each department and subsequently assess the vulnerability and risk of the identified impacts. A second survey was completed to receive feedback on best practice actions that the municipality can take to build adaptive capacity, based on climate impacts that were identified as having a medium-high vulnerability and present substantial risk.

ASSESSING VULNERABILITY AND RISK

Vulnerability is the degree to which a system is susceptible to, or unable to cope with, the adverse effects of climate change, including variability and extremes. Vulnerability is a function of sensitivity (the degree to which a system is affected by climate-related stimuli) and adaptive capacity (the ability of a system to adjust to climate variability and extremes). The climate impacts that were determined to have a high sensitivity (adversely affected by climate variability and extremes) and a low adaptive capacity (low ability to adjust to climate variability and extremes and reduce potential damages with minimal cost and disruption) are those that have a high vulnerability and are important to plan for. Vulnerability was assigned using the sensitivity and adaptive capacity ratings for each service area (see Appendix 1). Impacts that are assessed to have medium-high vulnerability move forward to the risk assessment process. Risk is a function of the consequence of an impact and how likely it is to happen (see Appendix 2).

SENSITIVITY

Sensitivity assessments were conducted through looking at each identified impact and assessing if changing climate conditions would significantly impact the functionality of the given service area. This included assessing the extent to which the service area was under existing stress and whether the impact will exacerbate that stress. A value from 1-5 was assigned to represent the sensitivity of the service area.

ADAPTIVE CAPACITY

Adaptive capacity assessments were completed through determining how well the service area could adjust to the projected impact with minimal cost and disruption. A value of 1-5 was used to represent the adaptive capacity of the service area.

TEMPERATURE PROJECTIONS

2011-2020 was the warmest decade on record, following a long-term warming trend since pre-industrial levels.

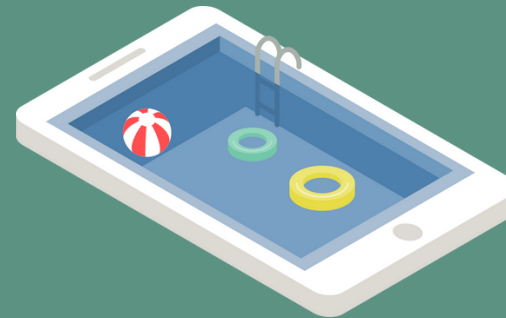


4.4°C
INCREASE IN MEAN
TEMPERATURE

Haliburton can expect to see a 2.2°C rise in the mean temperature in the immediate future (2021-2050) and 4.4°C rise in the near future (2051-2080).

WARMER WINTERS

In the near future (2051-2080) there may not be any days below -30°C, compared to 6 days as the baseline (1976-2005).



38

HOT DAYS (+30°C)

Haliburton can expect to see 17 very hot days in the immediate future (2021-2050) and 38 very hot days in the near future (2051-2080), compared to 5 as the baseline (1976-2005).

IMPACTS OF INCREASED TEMPERATURES

- More frequent freeze/thaw cycles are expected to cause an increase in stress on municipal infrastructure. This may result in damage to buildings, roads, trails, bridges, sidewalks, culverts and outdoor recreation facilities.
- Higher average temperatures are expected to lead to an increase in summer tourism, causing an increased demand for beaches, parks, trails, pools, etc.
- More frequent and intense heat waves will increase health risks for staff working outdoors, including dehydration, exhaustion, heat stroke and exposure to vector borne diseases. This may lead to shortened windows for working outdoors.
- More mild winters may lead to winter melts causing disruption to outdoor events and programming for winter-based recreation.
- Higher average temperatures may lead to increased survival rates for pests and invasive species, resulting in damage or loss of vegetation.

PRECIPITATION PROJECTIONS

A warmer climate stimulates the evaporation of water and allows the atmosphere to hold more moisture. This results in a more intense hydrological cycle, with rainfall concentrated in more extreme events with longer dry spells in between.[7]



9.9%
INCREASE IN ANNUAL
PRECIPITATION

Haliburton can expect to see 1044mm of rain in the immediate future (2021-2050) and 1078mm in the near future (2051-2080), compared to a baseline of 981mm.

DRY SPELLS

While Haliburton will see an increase in overall rainfall, there will be longer periods without any rainfall.



34

DAYS WITH OVER 10MM

Haliburton can expect to see 33 days with over 10mm of precipitation in the immediate future (2021-2050) and 34 days in the near future (2051-2080), compared to 30 days as the baseline (1976-2005).

IMPACTS OF CHANGING PRECIPITATION

- An increase in intense rainfall events combined with more rapid snowmelt is expected to cause an increase in surface water levels, particularly while the ground is still frozen, leading to overland flooding. This may lead to the closure of roads and bridges, causing disruption to transportation, including emergency services. This may also lead to flooding of municipal buildings and facilities.
- More frequent and intense rainfall and rapid snowmelts can lead to an overburdening of wastewater infrastructure, resulting in potential backups or bypassing of treatment units.
- An increase in extreme rainfall is expected to cause erosion, washouts, flooding and/or oversaturation of parks, trails, and boat launches. This will result in increased closure and repairs.
- More intense rainfall leading to nutrient runoff combined with prolonged warm weather may lead to increased water quality concerns such as blue-green algae blooms causing closure of public beaches.
- More frequent and intense heat waves combined with increased dry periods are expected to result in increased fire bans.
- An increase in dry spells combined with earlier snowmelt is expected to result in lower lake levels, causing hazards at public boat launches.

EXTREME AND VARIABLE WEATHER

Variable weather conditions and extreme weather events are a result of increased energy in the atmosphere from increased temperatures.



16%
INCREASE IN RAINFALL
INTENSITY FOR A 1 IN 100
YEAR STORM

STORMS

Haliburton can expect to see increased ice storms, snow storms and thunderstorms.

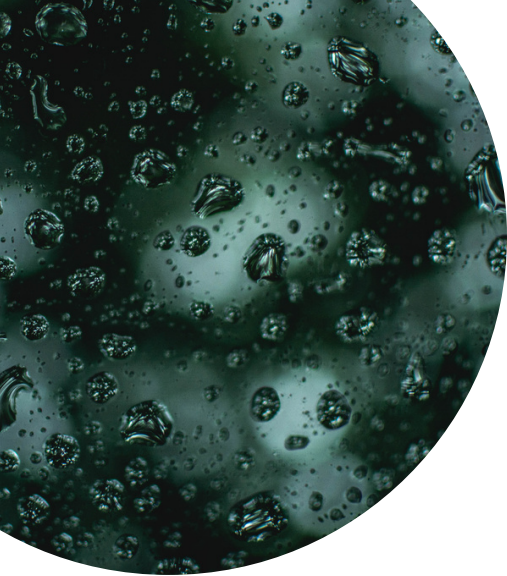


VARIABLE LAKE LEVELS

Warmer weather increases evaporation and reduced ice cover extends the amount of time in the year that evaporation occurs. More extreme precipitation events will increase water levels. Droughts may occur with longer dry spells in between extreme rain events. Overall we can expect to see higher highs and lower lows.

IMPACTS OF EXTREME WEATHER

- An increase in intense rain and ice storms is expected to cause damage to municipally owned assets and infrastructure. This may increase maintenance and repairs required for streetlights, signs, buildings and trees.
- An increase in freezing rain and ice storms is expected to cause hazardous conditions on roads, parking lots and sidewalks. This may lead to an increased demand on road maintenance and safety concerns.
- More extreme weather can cause tree branches and other debris to block drainage infrastructure (sewers, culverts, etc.) or roads resulting in increased road washouts and disruptions to transportation.
- An increase in extreme weather is expected to cause damage to or increased demand on power utilities, leading to increased power outages and service disruptions.
- More extreme weather is expected to cause increased risks for the public, particularly vulnerable populations. This may cause an increased demand for municipal buildings as cooling and warming centres and emergency evacuation centres.



Flooding

Significant flooding events were experienced locally in 2013, 2017 and 2019 due to high levels of precipitation and rapid snowmelt resulting in rising water levels in the Gull River and Burnt River watersheds. The 2013 flood caused over \$365,000 in damages to public property. Access routes were blocked to residences, causing disruptions to emergency response.

The County is working on a four-year project to produce flood hazard mapping along central waterways and key lake areas within the Gull and Burnt River watersheds in partnership with Parks Canada: Trent Severn Waterway; Kawartha Conservation Authority; Ganaraska Conservation Authority; the Upper Trent Water Management Partnership and the Coalition for Equitable Waterflow. The County received National Disaster Mitigation Program (NDMP) funding to assist with the acquisition of Light Detection and Ranging (LiDAR) data, the associated analysis of that information to be used in the development of flood mapping and flood mitigation planning tools. The County of Haliburton received additional NDMP funding to acquire bathymetric data to be used for future hydraulic models to assist in the determination of the regulatory flood line of the Gull River and Burnt River systems. The bathymetric field work was completed in fall 2021 and data is currently being processed for delivery to the County in the near future. This information will be used to update building regulations and inform emergency response actions and infrastructure design in association with asset management plans. The planning will be integral at the County and local municipal level and will support climate change adaptation through mapping hazards and understanding risks.

VISION

The County of Haliburton and its local municipalities take a forward-thinking, coordinated and collaborative approach for proactive actions to strengthen climate resilience.

GOALS

1

Ensure current and future infrastructure is adapted to withstand the impacts of a changing climate

2

Protect municipal natural assets and enhance nature-based solutions

3

Minimize health risks to outdoor staff and provide resources to the community to improve their capacity to adapt

4

Integrate climate adaptation into municipal plans and processes



Infrastructure and Assets

Public infrastructure is an important foundation for a community, including transportation systems that move people and goods and buildings such as arenas and recreation centres that contribute to healthy and vibrant communities. Many municipal assets were built decades ago and designed for historic climate conditions. In a future climate, our infrastructure will experience more frequent and extreme weather events, increased variability and changing average conditions. Canada's Infrastructure Report Card finds that the state of our infrastructure is at risk and will require significant maintenance, rehabilitation or replacement in the coming decades.[8] These investments must be designed for future climate conditions. Currently, data relating to climate change impacts is not integrated or poorly integrated into local infrastructure decision-making in Canada.[9]

Natural assets are abundant in Haliburton County. These natural resources can also be referred to as green infrastructure due to their natural functions that provide services similar to grey infrastructure (such as stormwater management). Natural assets can also be engineered, for example through the construction of a green roof.

Infrastructure and Assets

Strategy 1: Reduce the risk of infrastructure becoming overburdened in a future climate of increased precipitation and more intense rainfall events.

- **Action 1.1** – Ensure new or replacement infrastructure is designed to reflect future climate conditions, including increasing culverts and bridges in size and height to reflect increased precipitation and increasing the capacity of water and wastewater infrastructure.
- **Action 1.2** – Develop an education and incentive program to promote lot level storm water controls (e.g. rain barrels).
- **Action 1.3** – Incorporate green infrastructure and low impact development including permeable pavement, green roofs, rain gardens, and native plants on municipal properties to improve stormwater management.

Strategy 2: Continue to invest in preventative and routine maintenance of municipal infrastructure.

- **Action 2.1** – Expand preventative maintenance and repair program for buildings, roads, bridges, sidewalks, culverts, trees and trails to mitigate damage due to more extreme weather where necessary.
- **Action 2.2** – Continue to conduct maintenance and inspection of sewer infrastructure to minimize the risks of extreme weather.

Strategy 3: Ensure municipal buildings are more resilient to extreme weather.

- **Action 3.1** – Prioritize flood protection retrofits and upgrades for municipal properties that are located within current and anticipated floodplains.
- **Action 3.2** – Incorporate low carbon resiliency measures into municipal buildings (new builds and retrofits) such as passive forms of heating and cooling and renewable backup power.



Recreation and Natural Environment

Each township and municipality within the County provides a variety of recreation programs and services (community centres, parks, trails, beaches, etc.) for local residents and visitors. The benefits of parks and community spaces extend beyond environmental benefits to benefits for physical and mental health. The COVID-19 pandemic has brought on a renewed appreciation and demand for these spaces. Local municipalities are already noticing the impacts of climate change on their parks and recreation operations, such as washouts on trails and boat launches, difficulty maintaining outdoor rinks, and erosion of shorelines. Addressing these impacts proactively can save money and staff time down the road.

Recreation and Natural Environment

Strategy 4: Ensure community parks and recreation spaces are more resilient to a changing climate.

- **Action 4.1** – Identify public spaces that are at risk of flooding, washouts or oversaturation and prioritize additional drainage measures. Ensure there is sufficient drainage systems in the creation of new public spaces.
- **Action 4.2** – Enhance shoreline protection at public waterfronts.
- **Action 4.3** – Monitor and control invasive species in parks and public areas.

Strategy 5: Continue to maintain and expand outdoor recreation spaces that provide a reprieve from the heat.

- **Action 5.1** – Implement natural (e.g. tree canopy) and constructed shaded spaces in public areas. Increase the quantity of water refill stations outside public buildings that are adjacent to beaches, parks, and trails.
- **Action 5.2** – Maintain and expand trail networks and public parks and beaches to provide increased accessible public spaces. Consider expanding cooling outdoor recreation opportunities such as the construction of splash pads and pools.

Strategy 6: Ensure flexibility and adaptability of recreation opportunities in a changing climate and that changes are well communicated.

- **Action 6.1** – Continue to communicate beach closures or swimming advisories to the public.
- **Action 6.2** – Continue to communicate weather dependency when planning for events that depend on snowpack. Consider developing alternative programming for low snowpack conditions.



Health and Safety

More extreme weather presents health and safety risks for municipal staff and community members, including injury, illness and death. A changing climate will present unexpected and unprecedented conditions. This presents risks if the tools and knowledge needed to adapt are not available. Planning ahead is critical for minimizing or preventing negative impacts.

Climate change does not impact all people the same. Risks are greater for outdoor workers and vulnerable populations such as people with pre-existing health conditions, the elderly, and those with improper housing. It is important to develop and implement strategies to lower vulnerabilities to extreme weather.

Health and Safety

Strategy 7: Enhance the health and safety of staff during extreme weather events.

- **Action 7.1** – Continue to provide education, resources and training to outdoor staff to reduce heat stress and maintain productivity.
- **Action 7.2** – Update health and safety policies to incorporate climate change considerations.
- **Action 7.3** – Develop alternative work arrangements that reduce commuting during extreme weather events and hazardous road conditions.

Strategy 8: Utilize municipal assets to enhance the health and safety of the community during extreme weather events.

- **Action 8.1** – Continue to use municipal facilities to provide support during extreme weather events. Consider expanding the number of buildings and hours of operation for cooling and warming centres, or emergency sites during overland flooding and power outages.
- **Action 8.2** – Continue to provide sandbags to the public as required during instances of flooding.
- **Action 8.3** – Initiate joint education and awareness campaigns to encourage personal preparedness during extreme weather and being safe during heat waves.
- **Action 8.4** – Improve communications to the public regarding road conditions (including the plowing/sanding/salting status of roads) and safety during extreme weather events.



Strategic Planning

The County and local municipalities have been adapting to more extreme and variable weather for years through various projects and policies. The purpose of strategic planning is to create a coordinated approach to identify leverage points to accelerate existing adaptation actions. Rather than creating separate climate policies, it is often more effective and efficient to integrate climate change considerations across existing plans and policies.

Strategic Planning

Strategy 9: Leverage external resources to build adaptive capacity.

- **Action 9.1** – Continue partnerships and collaboration on updated flood mapping and communicate the results.
- **Action 9.2** – Continue to leverage provincial and federal funding to build resilience.

Strategy 10: Mainstream climate change considerations into municipal decision making.

- **Action 10.1** – Integrate climate adaptation considerations in staff reports to council.
- **Action 10.2** – Incorporate climate change considerations into the asset management plan, including risk assessments and deterioration rates. Consider including green infrastructure in a future update of the asset management plan.
- **Action 10.3** – Integrate climate change considerations into the emergency response plan.

Strategy 11: Build internal capacity to respond to a changing climate.

- **Action 11.1** – Provide resources and training to staff to support climate adaptation efforts.
- **Action 11.2** – Develop a process for conducting post-disaster event analysis to identify lessons learned from extreme weather events.

Implementation

The Corporate Climate Adaptation Plan is intended to guide the County and local municipalities to prepare for and respond to the impacts of climate change on municipal assets, operations and services. A preliminary implementation schedule has been developed to ensure that implementation is immediate and effective. The implementation schedule is designed to be flexible rather than provide prescriptive guidance. It is intended to be a living document that is updated based on changes in available information, data, funding, staffing resources and unexpected events. This plan is only the start of a process that will require action across all departments and embedding adaptation into operational culture. Priority will first be given to actions that integrate with existing work plans and involve modest operational changes. A comprehensive implementation plan for projects involving more resources and staff time, spanning corporate climate change mitigation, corporate climate change adaptation, and community climate change mitigation and adaptation, is recommended to be developed on completion of phase three of climate change planning at the County level.

Timescale: Short (2022-2024) | Medium (2025-2027) | Long (2028-2030)

Cost: \$ = \$0-\$25,000 | \$\$ = \$25,000-\$75,000 | \$\$\$ = \$100,000+

Goal 1: Ensure current and future infrastructure is adapted to withstand the impacts of a changing climate

| ACTION | IMPLEMENTATION NOTES | CURRENT PRACTICES | ANTICIPATED TIMING, INITIAL COSTS AND LEAD DEPARTMENTS | MONITORING METRICS |
|--------|----------------------|-------------------|--|--------------------|
|--------|----------------------|-------------------|--|--------------------|

| | | | | |
|---|---|---|---|--|
| <p>1.1 Ensure new or replacement infrastructure is designed to reflect future climate conditions, including increasing culverts and bridges in size and height and increasing the capacity of water and wastewater infrastructure to reflect increased precipitation.</p> | <ul style="list-style-type: none"> - Identify critical infrastructure improvement and upgrade opportunities based on updated floodplain mapping to improve performance during flooding events - The design of drainage infrastructure such as culverts, bridges, sewers and roadside ditches requires Intensity, Duration and Frequency (IDF) curves that incorporate future climate projections (rather than those based on historical data) | <ul style="list-style-type: none"> - We have been using local knowledge and experience and historical events to increase culvert sizes and raise the road grade to facilitate drainage. This needs to be more formally incorporated into future designs. - Wastewater infrastructure is not set up to easily handle the increased flow from precipitation and snow melt in the spring. Highlands East is installing additional pumps to help handle the flows when needed to avoid backups and overflows. | <p>Ongoing</p> <p>\$\$\$</p> <p>County and Municipal Public Works, Municipal Water and Wastewater</p> | <ul style="list-style-type: none"> - Number of infrastructure (culverts, bridges and roads) projects where climate projections are integrated into the design, maintenance, or assessment |
| <p>1.2 Develop an education and incentive program to promote lot level storm water controls (e.g. rain barrels, downspout disconnection programs, etc.)</p> | <ul style="list-style-type: none"> - Add water conservation section on municipal websites - Explore possible education and incentive program development - Partner with other municipalities and community organizations | <p>- N/A</p> | <p>Medium</p> <p>\$\$\$</p> <p>County Planning and Municipal Water and Wastewater</p> | <ul style="list-style-type: none"> - Number of materials distributed or social media hits on education pieces - Number of incentives/subsidies used |

| | | | | |
|---|--|---|--|---|
| | and seek out funding opportunities | | | |
| 1.3 Incorporate green infrastructure and low impact development including green roofs, rain gardens, and native plants on municipal properties to improve stormwater management. | <ul style="list-style-type: none"> - Remove unnecessary pavement to improve infiltration - Identify key areas based on updated floodplain mapping | - N/A | <p>Medium</p> <p>\$\$\$</p> <p>County and Municipal Public Works and Municipal Parks</p> | - Number of converted spaces |
| 2.1 Expand preventative maintenance and repair program for buildings, roads, bridges, sidewalks, culverts, trees and trails to mitigate damage due to more extreme weather where necessary. | <ul style="list-style-type: none"> - Conduct more in-depth infrastructure assessments with updated climate projections to identify infrastructure vulnerabilities and risks (see action 10.2) - Continue to prioritize high-risk assets for maintenance and upgrades - Consider integrating buildings into asset management plans | <ul style="list-style-type: none"> - O. Reg. 104/97 requires that structural bridges and culverts be inspected every two years. This usually creates an immediate action plan. - County's maintenance program incorporates climate considerations (intensity and duration of rain and snow events) by removing berms along roadways to direct water into the ditches, ditching improvements, erosion control measures, and culvert replacements. Improved traditional pothole repairs by using a thin lift of compacted asphalt that is more durable to freeze/thaw cycles. - Municipal Asset Management Program provides funding to | <p>Ongoing</p> <p>\$\$</p> <p>County and Municipal Public Works and Municipal Parks</p> | - Number of asset maintenance projects (prior and after to integrating climate considerations) |

| | | | | |
|--|--|---|---|---|
| | | enhance asset management practices. | | |
| 2.2 Continue to conduct maintenance and inspection of sewer infrastructure to minimize the risks of extreme weather. | | <ul style="list-style-type: none"> - Routine maintenance, such as replacing rubber gaskets on manhole covers, is performed on an as-needed basis to manage infiltration. - Routine checks and tests are completed as required. It is a priority to regularly maintain and test items such as backup power & pumping systems. - CCTV of underground infrastructure is conducted occasionally. | <p>Ongoing</p> <p>\$</p> <p>Municipal Water and Wastewater</p> | <ul style="list-style-type: none"> - Number of inspections - Number of maintenance activities |
| 3.1 Prioritize flood protection retrofits and upgrades for municipal properties that are located within current and anticipated floodplains. | | <ul style="list-style-type: none"> - Combine with mitigation planning including energy efficiency retrofits. | <p>Medium</p> <p>\$\$\$</p> <p>County Public Works, Municipal Public Works, Municipal Parks, and Municipal Water and Wastewater</p> | <ul style="list-style-type: none"> - Number of building retrofits that include flood protection |
| 3.2 Incorporate low carbon resiliency measures into municipal buildings (new builds and | | <ul style="list-style-type: none"> - Combine with mitigation planning including the green new building policy and energy efficiency retrofits. | <p>Medium</p> <p>\$\$\$</p> | <ul style="list-style-type: none"> - Number of backup generators; number of renewable |

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| retrofits) such as passive forms of heating and cooling and renewable backup power. | | | County Public Works, Municipal Public Works and Parks | backup generators |
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Goal 2: Protect municipal natural assets and enhance nature-based solutions

| ACTION | IMPLEMENTATION NOTES | CURRENT PRACTICES | ANTICIPATED TIMING, COSTS AND LEAD DEPARTMENTS | MONITORING METRICS |
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| 4.1 Identify public spaces that are at risk of flooding, washouts or oversaturation and prioritize additional drainage measures. Ensure there is sufficient drainage systems in the creation of new public spaces. | - Identify key areas based on updated floodplain mapping | - Washouts on trails and boat launches are already being seen and increasing over the last five years. Also low lying parks may flood more often. - Increased extreme rainfalls may have a significant impact on our public boat launches and how they are maintained/managed. - Dysart is already working on upgrading drainage and infrastructure in Head Lake Park. - Much of the current infrastructure in our parks, trail systems and sports fields is old. If we experience many extreme rainfalls, there is a likely chance that closures and | Medium \$ Municipal Parks | - Number of public spaces washed out - Number of drainage systems implemented |

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| | | repairs will be needed. Currently, most of our repairs and upgrades are completed in house, with parks staff. | | |
| 4.2 Enhance shoreline protection at public waterfronts. | <ul style="list-style-type: none"> - Begin by identifying priority areas - Utilize projects as public education opportunities | <ul style="list-style-type: none"> - Dysart started with the memorial tree program as well as the Drag River erosion stabilization. - Dysart partnered with the Coalition of Haliburton Property Owners' Association to undertake a shoreline revitalization demonstration project at Sam Slick Park at Head Lake. - Dysart naturalized the shorelines around Head Lake in an effort to control the effects of geese on the lake and water quality. | <p>Short \$\$</p> <p>Municipal Parks and County Planning</p> | - Number of restoration projects |
| 4.3 Monitor and control invasive species in parks and public areas. | <ul style="list-style-type: none"> - Track the occurrence of invasive species on municipal property - Consider partnering with local organizations for education and removal of invasive species on municipal property - Increase public awareness of invasive species through municipal | <ul style="list-style-type: none"> - Submit reports through Early Detection and Distribution Mapping System (EDDMapS) Ontario. - Dysart worked with the Coalition of Haliburton Property Owners' Association to have invasive species signage placed at public water access points. | <p>Ongoing \$\$</p> <p>Municipal Parks and County Planning</p> | - Number of invasive species removed |

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| | social media channels and signage at parks | | | |
| 5.1 Implement natural (e.g. tree canopy) and constructed shaded spaces in public areas. Increase the quantity of water refill stations outside public buildings that are adjacent to beaches, parks, and trails. | | <ul style="list-style-type: none"> - Dysart received funding through an Ontario Trillium Foundation grant to install drinking water refill stations in areas where people participate in physical activity. - Dysart undertook a Head Lake Park tree study with U-Links with the goal of creating shade and stabilizing shorelines along the river banks as many of the older species are dying off and erosion is getting worse. They budget annually to add more trees to support this plan. | <p>Medium</p> <p>\$\$\$</p> <p>Municipal Parks</p> | <ul style="list-style-type: none"> - Number of refill stations installed - Number of trees planted - Number of shade structures installed |
| 5.2 Maintain and expand trail networks and public parks and beaches to provide increased accessible public spaces. Consider expanding cooling outdoor recreation opportunities such as the construction of splash pads and pools. | <ul style="list-style-type: none"> - Splash pads and pools can be large energy consumers and water users. Energy and water efficiency should be considered in the design. | <ul style="list-style-type: none"> - We are fortunate to have access to public beaches; however, there is limited space at each of these beaches. The community may request splash pads or other water or shade-based infrastructure, resulting in more capital costs and maintenance costs. - The Head Lake Park Master Plan includes a provision for space for a splash pad on the Rotary Park Side. | <p>Long</p> <p>\$\$\$</p> <p>Municipal Parks</p> | <ul style="list-style-type: none"> - Number of cooling outdoor spaces constructed |
| 6.1 Continue to communicate beach closures or swimming | <ul style="list-style-type: none"> - Increase public education on the effects | <ul style="list-style-type: none"> - Beach water quality monitoring from the Haliburton, Kawartha, Pine Ridge District Health Unit. | <p>Ongoing</p> <p>\$</p> | <ul style="list-style-type: none"> - Number of social media |

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| advisories to the public. | of climate change on water quality - Utilize social media, websites, signage | - We often get failed water tests at beaches after an influx of storm water stirring everything up and introducing contaminants. - Seeing increases in reports of toxic algae blooms into late fall due to milder weather; becoming a more frequent occurrence when we don't freeze up early enough. | Municipal Parks | posts or signage created |
| 6.2 Continue to communicate weather dependency when planning for events that depend on snowpack. Consider developing alternative programming for low snowpack conditions. | - Utilize social media, websites, signage | - Municipalities have had to alter plans for significant winter events (-40°C one year, +16°C the following). Many of the outdoor winter programs/events include the phrase 'weather dependent'. With increased temperatures and less of a snow base, we will have to become creative with other types of programming. | Ongoing \$\$ County Tourism and Municipal Parks | - Number of alternative programs developed |

Goal 3: Minimize health risks to outdoor staff and provide resources to the community to improve their capacity to adapt

| ACTION | IMPLEMENTATION NOTES | CURRENT PRACTICES | ANTICIPATED TIMING, COSTS AND LEAD DEPARTMENTS | MONITORING METRICS |
|---------------|-----------------------------|--------------------------|---|---------------------------|
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| <p>7.1 Continue to provide education, resources and training to outdoor staff to reduce heat stress and maintain productivity.</p> | | <p>- Sunscreen, bug spray and ice water and provided to outdoor staff.</p> | <p>Ongoing \$ County Public Works, Municipal Public Works and Parks</p> | <p>- Number of training sessions - Number of resources provided to staff</p> |
| <p>7.2 Review and update health and safety policies to incorporate climate change considerations.</p> | <p>- Establish/review maximum outdoor working temperatures for staff - Enable staff to complete outdoor work during the cooler times of the day</p> | <p>- Consider split shifts for cleaning and garbage removal at our public parks. Public perception would have to change, as during the middle of the day, garbage cans may be full and requiring attention. - Supervisors monitor the weather and adjust operations accordingly.</p> | <p>Short \$ All Departments</p> | <p>- Number of policies reviewed/updated</p> |
| <p>7.3 Develop alternative work arrangements that reduce commuting during extreme weather events and hazardous road conditions.</p> | <p>- Explore stay-at-home days and remote work options for staff during periods of extreme weather and hazardous conditions - Define extreme weather events and identify staff that are eligible based on duties</p> | <p>- The COVID-19 pandemic has led to more remote and flexible work arrangements.</p> | <p>Short \$ County and Municipal Administration</p> | <p>- Number of policies implemented</p> |
| <p>8.1 Continue to use municipal facilities to provide support during</p> | <p>- Identify current and additional facilities that can serve as cooling,</p> | <p>- To provide a proper cooling centre, our recreational facilities would have to be upgraded to include air</p> | <p>Medium \$-\$\$\$</p> | <p>- Number of facilities identified</p> |

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| extreme weather events. Consider expanding the number of buildings and hours of operation for cooling and warming centres, or emergency sites during overland flooding and power outages. | warming or emergency centres - Identify considerations for adequate backup power, HVAC systems, and accessibility - Conduct public education campaigns to increase awareness on the location and availability of these centres | conditioning units and ensure facilities are fully accessible. | County Public Works, Municipal Parks and Public Works | - Number of residents using each facility |
| 8.2 Continue to provide sandbags to the public as required during instances of flooding. | | - The Township of Minden Hills filled approximately 33,000 sandbags during the 2013 flood and 47,000 sandbags during the 2017 flood, and purchased a sandbagging machine. | Ongoing \$\$ Municipal Public Works and Emergency Services | - Number of sandbags distributed |
| 8.3 Initiate joint education and awareness campaigns to encourage personal preparedness during extreme weather and being safe during heat waves. | - Consider implementing joint municipal education campaign on Emergency Preparedness Week | - All municipal websites promote personal emergency preparedness. - Municipalities have developed information materials for the public focused on flood preparedness. | Short \$ County Planning and Municipal Administration | - Number of social media posts - New information developed on websites |

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| <p>8.4 Improve communications to the public regarding road conditions (including the plowing/sanding/salting status of roads) and safety during extreme weather events.</p> | <ul style="list-style-type: none"> - Leverage existing technologies to improve the dissemination of information (municipal 511; where's my plow; social media) - Continue to post serve weather alerts on the municipal website and communicate actions the community should take to stay safe | <ul style="list-style-type: none"> - Emergency updates as pop-ups on websites. - Encouraging residents to subscribe to website updates and follow social media pages. | <p>Short</p> <p>\$</p> <p>County and Municipal Public Works</p> | <ul style="list-style-type: none"> - Number of submissions to municipal 511 - Number of posts on social media |
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Goal 4: Integrate climate adaptation into municipal plans and processes

| ACTION | IMPLEMENTATION NOTES | CURRENT PRACTICES | ANTICIPATED TIMING, COSTS AND LEAD DEPARTMENTS | MONITORING METRICS |
|--|--|--|---|--|
| <p>9.1 Continue partnerships and collaboration on updated flood mapping and communicate the results.</p> | <ul style="list-style-type: none"> - Enhance knowledge of location of flood areas - Allow more effective assessment of planning, building, public works - Emergency response planning will be enhanced by identification of | <ul style="list-style-type: none"> - Currently processing data from bathymetric field work. | <p>Ongoing</p> <p>\$\$\$</p> <p>County Planning</p> | <ul style="list-style-type: none"> - Updated flood maps |

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| | potential flood roads access and emergency routes | | | |
| 9.2 Continue to leverage provincial and federal funding to build resilience. | - Funding programs include Disaster Mitigation and Adaptation Fund, Investing in Canada Infrastructure Program, Green Municipal Fund | - The Township of Minden Hills received National Disaster Mitigation Program funding to complete a drainage study for high-risk flood zones. - The County of Haliburton received National Disaster Mitigation Program funding to acquire Airborne Light Detection and Ranging (LiDAR) and bathymetry data for the Gull and Burnt River watersheds. | Ongoing \$-\$\$\$ All Departments | - Number of grants and loans applied for and received |
| 10.1 Integrate climate adaptation considerations in staff reports to council. | - Integrate training for staff for utilization of the Clean Air Partnership Tool | - The County has implemented climate change considerations in staff reports to Council through the Clean Air Partnership Municipal Climate Lens Tool. | Short \$ County and Municipal Administration | - Number of council reports with climate adaptation considerations |
| 10.2 Integrate future climate considerations to the asset management plan. Consider including green infrastructure in a future update of the | - Upon renewal of plans - Quantify the value of natural assets (e.g. forests and wetlands) | - Natural assets support municipal services such as flood attenuation and water quality. | Medium \$ County and Municipal Public Works | - Number of climate considerations added to the asset management plan |

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| asset management plan. | | | | |
| 10.3 Integrate climate change considerations into the emergency response plan. | <ul style="list-style-type: none"> - Procedures to guide Emergency Control Group through an emergency - Identify vulnerable roads and areas prone to overland flooding and have appropriate plans in place to address them - Identify staff resources and available services to support citizens during an extreme weather event (floods, wildfires, extreme heat/cold, ice storms etc.) | <ul style="list-style-type: none"> - There are now regular spring freshet conference calls with the Ministry of Natural Resources, Trent-Severn Waterway, County elected officials and staff from emergency services, administration and public works, to disseminate information regarding flooding. - The Township of Minden Hills updated their Emergency Plan to include an Incident Management System (IMS) as the response system/process. | <p>Medium</p> <p>\$</p> <p>County and Municipal Emergency Response</p> | <ul style="list-style-type: none"> - Review of Emergency Response Plan with a climate lens |
| 11.1 Provide resources and training to staff to support climate adaptation efforts. | | <ul style="list-style-type: none"> - There is a need to stay current regarding best practices and solicit and implement innovative solutions from staff and professional organizations. | <p>Short</p> <p>\$</p> <p>County Planning</p> | <ul style="list-style-type: none"> - Number of resources created and distributed |
| 11.2 Develop a process for conducting post-disaster event analysis to identify lessons learned from extreme weather events. | <ul style="list-style-type: none"> - Record the outcomes of extreme weather events (such as number of roads closed, infrastructure that is damaged) and associated costs and staff | <ul style="list-style-type: none"> - Climate change and spring weather events need to be a priority throughout the year. - Changes and ideas that came up during the event should be acted upon to help for the next time. | <p>Short</p> <p>\$</p> <p>All Departments</p> | <ul style="list-style-type: none"> - Occurrence of post-disaster event analysis - Number of reports generated |

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| | <p>time to assist in evaluation</p> <ul style="list-style-type: none"> - Identify lessons learned and action items and ensure they become implemented in a reasonable timeframe - Consider adjusting operating budgets and reserves to account for contingencies associated with extreme weather events - Assess staffing requirements in critical service areas (such as emergency management services and public works) to accommodate increased demands due to climate change | <ul style="list-style-type: none"> - Documentation needs to be improved. There is currently no database to record damages from extreme weather events. The memory of senior staff can be relied upon for past events and issues. | | |
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Monitoring

The plan is intended to be regularly monitored and updated through a flexible, dynamic and continuous process as new information and resources become available. As climate data and projections are updated, local extreme

weather events occur, and federal and provincial funding becomes available, climate adaptation priorities may shift. A review of this plan is to take place in 2025 and a new plan should be developed in 2030.

Indicators to measure progress have been included with each action item. The Climate Change Coordinator is responsible for tracking actions that are completed and presenting progress to council on an annual basis. These updates will be integrated with greenhouse gas inventory updates for monitoring of the Corporate Climate Change Mitigation Plan.

References

- [1] Bush, E. and Lemmen, D.S., 2019. Canada's Changing Climate Report; Government of Canada.
- [2] Intergovernmental Panel on Climate Change, 2014. Climate Change Synthesis Report Summary for Policymakers.
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- [6] Prairie Climate Centre, 2022. Climate Change Projections: Climate Atlas of Canada.
- [7] Bush, E. and Lemmen, D.S. (2019). Canada's Changing Climate Report; Government of Canada.
- [8] Canada's Infrastructure Report Card, 2019, available at <http://canadianinfrastructure.ca/downloads/canadian-infrastructure-report-card-2019.pdf>
- [9] Federation of Canadian Municipalities, 2019, Using Better Data to Identify Climate Change-Related Infrastructure Vulnerabilities in Canadian Communities.

Appendix 1: Vulnerability Assessment Criteria

Sensitivity Assessment

S1: If the impact occurs, the functionality of the service area will stay the same.

S2: If the impact occurs, the functionality will likely stay the same.

S3: If the impact occurs, the functionality is likely to get worse.

S4: If the impact occurs, the functionality will get worse.

S5: If the impact occurs, the functionality will become unmanageable.

Adaptive Capacity Assessment

AC1: Adjusting to the projected impact will require substantial costs and staff intervention.

AC2: Adjusting to the projected impact will require significant costs and staff intervention.

AC3: Adjusting to the projected impact will require some costs and staff interventions.

AC4: Adjusting to the projected impact will require some slight costs and staff intervention.

AC5: Adjusting to the projected impact will require little to no costs and staff intervention.

Sensitivity and Adaptive Capacity Matrix

| | S1 | S2 | S3 | S4 | S5 |
|-----|----|----|----|----|----|
| 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 |

V1 = low vulnerability | V2 = medium-low vulnerability | V3 = medium vulnerability | V4 = medium-high vulnerability | V5 = high vulnerability

Appendix 2: Risk Assessment Criteria

Risk = Likelihood x Consequence

Likelihood Rating

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

Consequence Criteria

| Consequence Rating | Criteria |
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| Catastrophic (5) | Service area would fall into decay and cease to be effective |
| Major (4) | Service area would struggle to remain effective and would be seen to be in danger of failing completely |

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| Moderate (3) | Service area would be under severe pressure on several fronts |
| Minor (2) | Isolated instances of service area being under severe pressure |
| Negligible (1) | There would be minor instances of the service area being under more than usual stress but it could be managed |