**The effect of Rainstorms In Muskoka**

With many areas in Canada experiencing floods right now, here are some flood facts:

* According to Environment Canada, floods are the costliest natural disaster in Canada in terms of property damage. They are also the most common Canadian natural disaster, with about 40 per cent of floods occurring in April and May.
* Coastal storms, ice jams, snowmelt runoff and rainstorms are all causes of floods in Canada. Even tsunamis cause flooding of our country’s waters. In 1929, [an earthquake off Newfoundland's Burin Peninsula](http://www.heritage.nf.ca/law/tsunami29.html) caused a tsunami, resulting in 28 deaths.
* A hurricane caused the [worst flood in Ontario’s history](http://www.ec.gc.ca/eau-water/default.asp?lang=En&n=B85B942F-1). Hazel hit Toronto on Oct. 14, 1954, taking 81 lives and causing an estimated $146.9 million (1998 dollars) in damages.
* On May 30, 1961, 254 millimetres of rain fell in one hour in Buffalo Gap, Sask. According to Environment Canada data, this is the briefest, most intense flash flood we know of in Canadian history.
* Manitoba’s Red River is infamous for its spring floods. Its worst flood on record was in 1826, during which, the estimated flow rate was 6,371 cubic metres per second. But don’t worry — a flood of that magnitude occurs only about once every 667 years.
* What was Canada’s first billion dollar natural disaster? [The 1996 floods](http://www.collectionscanada.gc.ca/sos/002028-1300-e.html) in Quebec’s Saguenay region win that dubious honour, costing about $1.5 billion.
* The costliest natural disaster in Canada goes to [last year’s Alberta floods](http://alberta.ca/Flood-recovery-update.cfm), which caused an estimated $5 billion dollars in damages.

**It is recommended that everyone read** **Climate Change and Adaption in Muskoka**[**https://www.muskokawatershed.org/wp-content/uploads/2011/12/ClimateChangeMuskoka\_April201011.pdf**](https://www.muskokawatershed.org/wp-content/uploads/2011/12/ClimateChangeMuskoka_April201011.pdf)

**More moisture in a warmer atmosphere is expected to cause an increase in extreme weather events – rain, snow, drought, heat waves, wind, and ice storms. There are indications that this trend has already begun. Weather is also likely to be more variable and less predictable**

**Water quantity may be the most important integrator of response to climate change and should be monitored. Methods to hold back spring freshet and storm waters and release it slowly, sustaining streams during periods of drought and increasing recharge to groundwater, should be explored. Approaches to active lake management should also be explored with the province.**

**water treatment and distribution systems, energy generation and transmission, as well as transportation and residential damage – are likely**

**Conclusions and Recommendations**

**1. Implement the following actions: a. Encourage the District Municipality of Muskoka and Area Municipalities to develop a regional natural heritage strategy that will provide buffer zones and refuges and protection of connected wildlife corridors across the watershed, including areas of farmland and forests. b. Work with other watershed interests to develop monitoring programs, waste management programs, and sound land use policies that reduce human impact on the watershed. c. Protect wetlands as they are a link between terrestrial and aquatic habitats. d. Protect natural areas that can hold back spring freshet and stormwater. e. Prevent topsoil removal. f. Require appropriate studies in order to understand the impact of land use change on the hydrologic cycle.**

**2. Develop partnerships with a wide variety of organizations that value an ecologically sound watershed to identify climate change issues and develop adaptation strategies. This may include forestry, agriculture, and provincial and municipal interests and organizations, as well as private landowners and naturalists.**

 **3. Support local resources-based industries including forestry and agriculture.**

 **4. Increase awareness and training of young resource sector workers such as young farmers, loggers and mineral aggregate workers on issues such as water harvesting, endangered species and habitat, and the need to maintain connected natural areas.**

 **5. Encourage active acquisition of land that fits landscape conservation targets.**

**6. Continue to advocate provincially, nationally, and internationally to reduce carbon dioxide emissions and support local adaptation strategies.**

**7. Exploration of new technologies: a. Periodic assessments of the risk in light of climate projections b. Review of design standards.**

**8. Advocate for strong provincial and municipal regulatory framework to address both climate change mitigation and adaptation. It is recommended that the Muskoka Watershed Council establish a steering committee to design a process engaging all affected parties to assess vulnerability of Muskoka’s watersheds to changing climatic conditions and to identify specific watershed-based**

**Of note in it are the following excerpts**

**Extreme Weather**

* Th**e frequency and intensity of extreme weather and climatic event**s, such as thunderstorms and windstorms, hailstorms, ice storms, intense precipitation events, drought, heat waves, and abnormally warm winters, **are likely to increase** and this may be apparent by 2030 according to MNR.9 The effect of ice storms on maple forests was studied by OMNR following the 1998 eastern Ontario event and was shown to have the effect of reducing syrup output for a number of years after.
The windstorm that occurred across southern Ontario in the early summer of 2009 was reported for its human impact. The forest impact was also massive, and cleanup will be continuing for a number of years. Renewal activities, where they are possible, are expensive and not budgeted for by any level of government. More frequent storm events will have significant financial implications.
* **Climate change will affect how much precipitation falls as rain as opposed to snow**, and this in turn will affect the flow regimes of lakes and rivers, and the moisture content of wetlands. Warmer springs and summers can be expected to bring more extreme weather events, such as severe thunderstorms and tornadoes, and therefore have the potential to increase the frequency and severity of natural disturbances such as wind and fire. Upland forests in particular are expected to experience prolonged periods of drought, and will be more susceptible to fire. Where fires are set by humans, for example to burn off cover on agricultural land or open ground, drier conditions may encourage the spread of fire to neighbouring forests.

**Extreme weather: Why the impact will be felt more widely**

<https://pursuit.unimelb.edu.au/articles/extreme-weather-why-the-impact-will-be-felt-more-widely>

* **Extreme is the** [**new normal**](https://www.theguardian.com/environment/2017/mar/27/climate-change-human-fingerprint-found-on-global-extreme-weather%E2%88%9A) when it comes to weather, with devastation caused by floods, fires and cyclones filling our news feeds all too frequently.
* Thanks to the relatively recent development of [event attribution](https://pursuit.unimelb.edu.au/articles/how-we-can-link-some-extreme-weather-to-climate-change.amp) in climate science, researchers can now confidently attribute **the increase in extreme weather events to human-forced climate change.**
* For Australians, climate change means more heatwaves, more droughts, more intense [cyclones](https://pursuit.unimelb.edu.au/articles/cyclones-the-science-behind-these-beautiful-monsters) (although less of them) and more flooding. The impact of such weather is already a reality for many who have lost homes and, tragically, loved ones, in events like the recent Queensland and northern New South Wales [floods](http://www.abc.net.au/news/2017-04-05/cyclone-debbie-smashes-march-rainfall-records-in-dozens-of-area/8415506).
* **But the impact of extreme weather will be felt more widely.** How will it affect our health? Are our buildings changing to adapt? Will our insurance policies change?

**CLIMATE CHANGE IN MUSKOKA: A WORKSHOP ON EXTREME WEATHER AND WATERFRONT PROPERTY**AUGUST 8, 2017 WATERLOO SUMMIT CENTRE FOR THE ENVIRONMENT 87 FORBES HILL DR, HUNTSVILLE,

**Extreme Weather and Emergency Preparedness Presented by: Geoff Coulson (Warning Preparedness Meteorologist, Environment and Climate Change Canada)**[**http://www.climateontario.ca/doc/workshop/CCinMuskoka\_WP/AttendeeHandout.pdf**](http://www.climateontario.ca/doc/workshop/CCinMuskoka_WP/AttendeeHandout.pdf)

On Friday August 4, 2017 there were two tornadoes in the Muskoka region – one southwest of Huntsville and one to the northeast of Huntsville. It is clear that extreme weather is something we have to deal with now, but trends will be are changing as we go into the coming decade.

Large-scale storm systems can bring significant rainfall over a number of hours/days and can combine with snowmelt to exacerbate spring-time flooding. Flash floods are floods that rise and fall rapidly with little or no advance warning, usually as the result of intense rainfall over a relatively small area. Currently, there is no flash flood warning in Canada per se, but ECCC issues severe thunderstorm warnings that may mention the possibility of flash flooding. It is then up to the provincial district offices to send out messages to their districts. Some small scale storms can develop and move quickly, making it difficult to give lead time on those types of short-fuse events (often only minutes). Thus, it is important for people to pay attention to special weather statements and weather watches.

**Flood Risk Mitigation – Properties & Property Presented by: Dan Sandink (Director of Research, Institute for Catastrophic Loss Reduction**

Sewer backup and sump pump/plumbing failure are both widely insured, coverage for infiltration flooding is variable, and coverage for overland flooding (pluvial) is variable but increasing. River flooding is difficult to insure for the following reasons:  Adverse selection  Lack of randomness  Size of the insured community  High concentration (time and space)  Inconsistent hazard assessment in Canada

Public disaster relief programs can help fill this insurance void. Ontario’s disaster relief program compares well to all other provincial programs and covers 90% of eligible coverage up to $250,000 with a $500 deductible. However, this only covers primary residences and excludes secondary residences/cottages. Since the Alberta floods in 2013, the public has become more aware that overland flooding is not covered by most insurance companies. Most insurers will not offer overland flooding coverage to high risk properties, and of the very few that do cover overland flooding, they include variable deductibles, high premiums, and can use caps (no full coverage). Since coverage is so variable**, it is important to think of what you can do on your property in order to reduce the risk of flooding.**

From an adaptation point of view, **there are a number of things property owners can do to minimize damage to property: do not pu**t your boat in the water unless you are regularly using it or have a dependable neighbor to keep an eye on it; understand how high the water could potential get on your shoreline and adjust/build docks and breakwalls to suit the highest likely water levels; manage risk of debris in water (i.e. move items on your property above expected high water levels); and understand your water damage coverage (i.e. greater willingness to purchase overland flood coverage for homes, rather than secondary residences).

**Climate Change in Cottage Country: Get Ready Presented by: Terry Rees (Executive Director, Federation of Ontario Cottagers’ Associations)**

FOCA deals with many initiatives related to biodiversity and knows that there are three things that are **threatening our waterfronts: loss of habitat, the impact of invasive species and climate change (which acts as a multiplier).**

**What can you do as a cottage owner? First, keep your shoreline natural and do what you can to protect and enhance natural biodiversity on your property. Second, use appropriate building materials and consider climate-smart site planning. Third, stay informed about severe weather and long term climate changes. Fourth, report changes in your local community and become a citizen scientist. And fifth, have an emergency plan and be prepared**.

**What’s a small town to do?**<https://www.muskokaregion.com/news-story/7922889-climate-change-extreme-weather-and-what-a-small-town-can-do-about-it/>

 “You have to think about what your planning for in the future. You need to plan for your infrastructure to handle significant rainfall,” said McGarvey.

One strategy some communities in the south are experimenting with is requiring developers **to build to a more flood resistant standard**. According to McGarvey, that has run into some opposition as developers have taken municipalities to the OMB over the more flood-resistant standard.

Smaller communities, like the ones in Almaguin, have different sets of issues and ways to respond. They typically have entirely private wastewater systems but extensive culvert systems.

Sam Dunnett, the mayor of Magnetawan, said the last year was wet but nothing that required an emergency response. It has mandated a change in the way drainage infrastructure is created.

“We now find ourselves **replacing culverts**, when required, with larger size culverts because of the wetter past summers that we have experienced,” said Dunnett.

Some municipalities have even begun treating storms the way they have long responded to extreme winter weather.

Seguin Township wasn’t officially hit with a tornado according to Environment Canada. But it was struck with a severe July storm that did extensive damage throughout.

Bruce Gibbon, mayor of [Seguin Township, said the changing weather](https://www.parrysound.com/news-story/7575974-seguin-considers-increasing-storm-reserves/) has led to them establishing a new reserve just in case.

“We’ve long had what we call a winter control reserve that we used to handle severe winters,” said Gibbon. “Now, we are in the process of setting up what we will probably **call a severe weather reserve**. We seem to be experiencing severe weather more and more often so as part of our planning we feel we need to make an increased allowance for dealing with these storms.”

**So what can we do about it?**

[**https://www.muskokawatershed.org/wp-content/uploads/2011/12/ClimateChangeMuskoka\_April201011.pdf**](https://www.muskokawatershed.org/wp-content/uploads/2011/12/ClimateChangeMuskoka_April201011.pdf)

Changes in Muskoka’s climate must be reflected in changes to how we manage our lakes. Presently our local management efforts are focused on those actions that we can control locally – we run good monitoring programs, minimize our nutrient inputs through excellent sewage treatment, develop wise policies for land use and lake management, and support the great research in lake ecology that has come out of the Ministry of the Environment’s (MOE) research labs in Dorset. Locally, the District government may need to expand its excellent lake water quality program and work with MNR/MOE to expand and fine tune means of monitoring water quantity – lake levels, stream flows and periods of drought. Water quantity may be the most important integrator of response to climate change. Some responses to this could be simple. A recent study by University of Alberta scientists showed that allowing beaver populations to increase in the landscape produced many small but leaky dams**. These held back spring freshet and stormwaters and released it slowly, sustaining streams during periods of drought and increasing recharge to groundwater.**

The acid rain focus of the 1980s showed us that local influence could change policies throughout North America to reduce acid emissions. We must now put the same effort into worldwide efforts to reduce carbon dioxide emissions. We could start by recognizing that our recreational economy in Muskoka is supported by per-capita carbon dioxide emissions that are among the highest in the world. How can we build a more sustainable economy? But locally, and in the meantime, **we must now manage lakes to adapt to changes in the climate –** we can’t solve the carbon dioxide problem

**Climate Change and Adaptation in Muskoka**

Active lake management will require a change in attitudes, both locally and among our provincial and federal regulators. It is possible to manage changes in thermal structure and oxygen status of lakes to prevent their worst consequences, should society’s values accept this form of adaptation. It has been done safely in the USA for decades through active lake management techniques such as aerating or mixing lakes and by adding chemicals to the water to lock up nutrients in the bottom sediments. The technology and methods are well established and some have been tried experimentally in Ontario. We will, of course, need to find the regulatory structures to ensure that techniques are used safely and wisely.

**Comparative Costs of Low Impact Development Approaches as Compared to Traditional Approaches Of House Construction**

 <https://muskoka.civicweb.net/document/6682>

The United States Environmental Protection Agency issued a report in December 2007, entitled Reducing Stormwater Costs through Low Impact Development (LID) Strategies and Practices. The report summarized 17 case studies of development throughout the United States and Canada that included Low Impact Development. Table 1.2 provides a summary of the locations of the projects together with a comparison of Conventional Development Costs as compared to Low Impact Development Costs. The case studies included a variety of different land uses and dealt with both Greenfield and redevelopment scenarios.

 Some of the key findings from this study are provided below:

 • Total capital cost savings ranged from 15 to 80 percent when LID methods were used, with a few exceptions in which LID project costs were higher than conventional stormwater management costs.

 • The study focused on the cost savings and cost reductions that are achievable through the use of LID practices. It should also be noted that communities and/or developers can experience many amenities and associated economic benefits that go beyond cost savings. These include enhanced property values, faster home sales, improved habitat, aesthetic amenities and improved quality of life. This study did not monetize and consider these values in performing the cost calculations, but these economic, social and environmental benefits are real and significant.

 • More **research is needed to monetize the cost reductions that can be achieved through environmental performance,** reductions in long-term operation and maintenance costs, and/or reductions in the life cycle costs of replacing or rehabilitating infrastructure.

**Climate Change and Effects on Lakes**

[**https://muskoka.civicweb.net/document/27580**](https://muskoka.civicweb.net/document/27580)

**Peter F Sale Muskoka Watershed Council**

**Modeling of Harp Lake revealed**

• Increased evapotranspiration & the shift of precipitation to winter months will combine: • There will be 3X more water available to flow or flood in 4 winter months • And half as much water to nourish wetlands, rivers and lakes the other 8 months of the year

 Summer conditions will be more favorable for algal growth Changed hydrology may enhance internal loading of nutrients We currently lack data that might help predict where and when blooms most likely Nor are there easy remedies We need better understanding of how algae in our lakes will behave

Impacts of new pests and pathogens • Increased fire risk • Trees migrating north to follow climate

We must adapt our built infrastructure to the new climatic conditions - greater volumes of run-off - greater snowpack in some years - more freeze-thaw cycles - more severe winter storms We should modify our lifestyles to reduce our carbon footprint

15 Recommenataions

**• Enhance monitoring of lakes & waterways
• Research into algal blooms, calcium decline in forests, environmental effects of road salt
• Review techniques for retaining wetlands in dryer landscape
• Plan & implement policies and infrastructure to control water flow, keeping water upstream to maintain summer/fall flows
• Inform communities re enhanced flooding risks, delineate flood plains • Inform community on methods to manage forested land as climate change
• Individuals should become informed and strive to reduce own carbon footprint
• DMM (District Municipality of Muskoka) should establish position of Director of Climate Adaptation for Muskoka
• DMM should convene Climate Adaptation Steering Committee to bring all affected parties together, twice a year, to ensure an adaptation program is on track**

It may be impossible to predict the outcome of a devastating storm  when it hits but he said, "It is highly predictable that they will occur."

"So you're far better off to prepare and get ahead of the curve than just keep waiting for these things to happen."

**How is Canada preparing for climate change impact?
Worth listening to:**<http://www.cbc.ca/radio/thecurrent/the-current-for-september-05-2017-1.4274756/september-5-2017-full-episode-transcript-1.4276455#segment1>.

 [A new study](https://www.intactcentreclimateadaptation.ca/wp-content/uploads/2018/06/After-The-Flood.pdf) shows that Canadians who experience flooding are having a hard time coping, long after they've cleaned up the mess left behind.

"Even if we reduce carbon dramatically now the temperatures are still going to climb ... so adaptation is as crucial as mitigation."

**Solutions
1. Understanding the science and making sure the science is available to decision m2.
2. Highlighting potential vulnerabilities in terms of infrastructure
3. Focusing on the more vulnerable communities in the country relative to extreme weather
4. How to address health implications of extreme weather
5. Updating floodplain maps**

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