

# Adaptive Management in Climate Change Adaptation

In Ontario, the average annual temperature has increased by **1.4°C** over the last 60 years, and models suggest that by 2050 the average annual temperature in Ontario could increase by an additional **2.5°C to 3.7°C** (from baseline average 1961-1990)<sup>1</sup>. Research has shown that southern Ontario has been impacted by many heavy rainfall and flooding events that have exceeded existing historical estimates of infrastructure design rainfall intensity-duration-frequency (IDF) values<sup>2</sup>. Even though projections of total annual precipitation, into the 2050's, suggests little change in the southern parts of Ontario<sup>3</sup>, extreme rainfall events are expected to become more intense and occur more often<sup>4</sup>. Ontario has already experienced extreme weather events, prolonged heatwaves and wind storms<sup>1</sup>. These projected changes could have major implications for natural<sup>5, 6, 7</sup> and built systems<sup>7</sup> in Ontario. As the climate continues to change, decision-makers will need to adjust plans and operations to deal with these new conditions<sup>7</sup>.

**Adaptive Management** is a process where decision-makers take action in the face of uncertainty. Adaptive management seeks to improve scientific knowledge, and to develop management regimes that consider a range of possible futures outcomes and even take

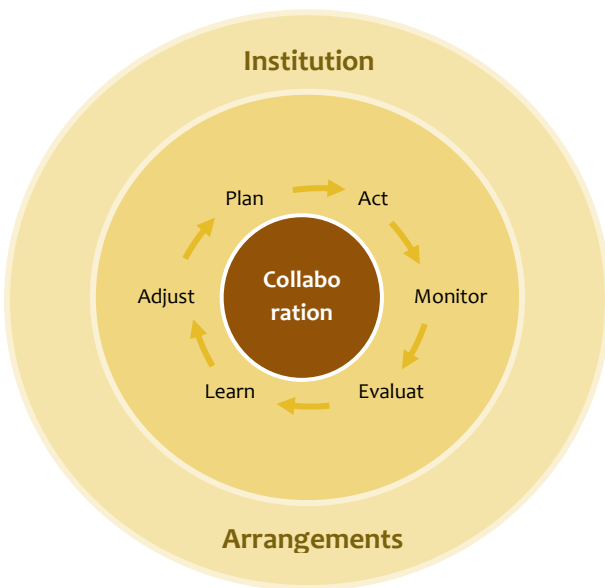
advantage of unanticipated events<sup>7</sup>. It is a structured, iterative approach for improving actions through long-term monitoring, modelling

and assessment, all essential to the success of the approach<sup>8</sup>. It increases the ability of decision-makers to form timely responses to new information<sup>7</sup>.

**Adaptive Management promotes flexible decision making that can be adjusted in the face of uncertainty as new outcomes from management actions and other events develop<sup>7</sup>.**

In the context of climate change, documentation and monitoring of each step and all outcomes advances the scientific understanding of climate change and informs adjustments in policy or operations as part of an iterative learning process<sup>7</sup>. It is not a 'trial by error' process but rather learning while doing<sup>7</sup>.

**Regardless of the uncertainty associated with climate models and projections, adaptation actions are needed to eliminate or reduce the vulnerability of systems to the impacts of climate change.**



Components of the adaptive management program used for the Lake Ontario – St. Lawrence River System study<sup>9</sup>



# Adaptive Management in Climate Change Adaptation

## International Upper Great Lakes Study (IUGLS) Adaptive Management

Climate change is affecting water levels in the Great Lakes, but the full impact is uncertain<sup>8</sup>. The Study Board for the IUGLS is concerned about both extreme high lake levels and extreme low lake levels (outside of the historical range)<sup>10</sup>. In the future, extreme level occurrences that are beyond what has already been experienced are plausible and even likely<sup>10</sup>. By developing an adaptive management strategy for the Upper Great Lakes, the Study Board is attempting to address these concerns and the uncertain future of lake levels. The International Upper Great Lakes Study Adaptive Management Group is proposing Adaptive Management to:

- Seek buy-in for a post study, long-term structured, iterative process for decision-making aimed at reducing uncertainty through monitoring and modelling and taking actions to minimize risk<sup>10</sup>.
- Assess key vulnerabilities to extreme water levels (both high and low)<sup>10</sup>
- Address climate uncertainty and extremes<sup>8</sup>
- Ensure new regulation plans have the intended results and can be adjusted if needed<sup>8</sup>
- Ensure decisions being made are based on the best available information (U.S. and Canada)<sup>8</sup>



## References

1. Ontario Ministry of the Environment. (2011). *Climate Ready: Ontario's Adaptation Strategy and Action Plan*. Accessed from: [http://www.ene.gov.on.ca/stdprodconsume/groups/lr/@ene/@resources/documents/resource/stdprod\\_085423.pdf](http://www.ene.gov.on.ca/stdprodconsume/groups/lr/@ene/@resources/documents/resource/stdprod_085423.pdf)
2. Paixao, E., Auld, H.M., Mirza, M.Q., Klaassen, J., Shephard. 2011. Regionalization of heavy rainfall to improve climatic design values for infrastructure: case study in Southern Ontario. *Hydrological Sciences Journal*. 56(7):1067-1089.
3. Report of the Expert Panel on Climate Change Adaptation. 2009. *Adapting to Climate Change in Ontario*. Accessed from [http://www.ene.gov.on.ca/stdprodconsume/groups/lr/@ene/@resources/documents/resource/std01\\_079212.pdf](http://www.ene.gov.on.ca/stdprodconsume/groups/lr/@ene/@resources/documents/resource/std01_079212.pdf)
4. Chiotti, Q., and Lavender, B. 2008. Ontario; in *From Impacts to "Adaptation: Canada in a Changing Climate 2007*. Edited by D. S. Lemmen, F.J. Warren, J. Lacroix, and E. Bush. Government of Canada, Ottawa, ON. p.227-274.
5. Public Infrastructure Engineering Vulnerability Committee. *National Engineering Assessment of the Vulnerability of Public Infrastructure to Climate Change*. Accessed from: <http://pievc.ca>
6. Varrin, Bowman, and Gray, 2007, as cited in Gleeson, J., Gray, P., Douglas, A., Lemieux, C.J., and Nielsen, G. 2011. *A Practitioner's Guide to Climate Change Adaptation in Ontario's Ecosystems*. Ontario Centre for Climate Impacts and Adaptation Resources, Sudbury, Ontario. 74 p. Accessed from: <http://www.climateontario.ca>
7. Panel on Adaptive Management for Resource Stewardship. 2004. *Adaptive Management for Water Resource Project planning*. National Research Council. Accessed from <http://www.nap.edu/catalog/10972.html>
8. Douglas, A. 2012. *International Upper Great Lakes Study: Adaptive Management*.
9. International Joint Commission. *Adaptive Management for the Lake Ontario-St. Lawrence River System*. Review of the Lake Ontario-St. Lawrence Order of Approval. Accessed from [http://www.ijc.org/LOSLdocuments/facts\\_adaptive\\_mgmt\\_e.php](http://www.ijc.org/LOSLdocuments/facts_adaptive_mgmt_e.php)
10. Leger, W. 2010. *Adaptive Management Approach in Response to Climate Change*. A.D. Latornell Conservation Symposium. Accessed from [http://www.latornell.ca/files/2010\\_sessions/2010\\_Latornell\\_F1A\\_Wendy\\_Leger.pdf](http://www.latornell.ca/files/2010_sessions/2010_Latornell_F1A_Wendy_Leger.pdf)

## Ontario Centre for Climate Impacts and Adaptation Resources

OCCIAR specializes in communication of climate impacts and supports adaptation planning to a wide range of stakeholders throughout the province of Ontario.

For more information please visit:

[www.climateontario.ca](http://www.climateontario.ca)

OCCIAR