

Ontario's Low Water Response Planning: Making Decisions for Areas Most Vulnerable to Drought and Low Water Conditions

Prepared for Conservation Ontario and Ontario Ministry of Agriculture and Food



**Water
Policy and
Governance
Group**

April 8, 2014

Preface

This document presents a description of Ontario’s low water response planning framework, the results of an analysis of low water and drought conditions in southern Ontario, and a scan of low water response planning frameworks both within Canada and internationally. The study was completed through a partnership between the Water Policy and Governance Group (WPGG) at the University of Waterloo, Conservation Ontario and the Ontario Ministry of Agriculture, Food and Rural Affairs.

The impetus for this report was a request from partners on our project *Evaluating Collaborative Approaches to Governance for Water Allocation in Canada: Lessons from Ontario*. Partners identified two specific knowledge needs:

1. How does Ontario’s experience with Low Water Response planning compare to other jurisdictions?
2. What areas in Ontario are most vulnerable to low water conditions based on existing data?

Lead Researchers and Authors

**Alyssa Roth, MES Candidate,
Water Policy and Governance Group**

**Dan Murray, PhD, Research Associate,
Water Policy and Governance Group**

Project Principal Investigator

Rob de Loë, PhD
University Research Chair in Water Policy and Governance
University of Waterloo
Waterloo, ON

We would like to thank all of the study participants who contributed their time and energy in support of this study. We would also like to thank, Charley Worte, Erin Harkins and Mathew Millar, our research partners at Conservation Ontario, and Deb Brooker and Tim Brook, our partners from Ontario Ministry of Agriculture and Food. This report was prepared by the WPGG and responsibility for any omissions or errors remains with the authors.

This report should be cited as

Roth, A. and Murray, D. 2014. *Ontario’s Low Water Response Planning: Making Decisions for Areas Most Vulnerable to Drought and Low Water Conditions*. Waterloo, Ontario: Water Policy and Governance Group.

This project was made possible through the financial support of the Social Sciences and Humanities Research Council (Water, Economics, Policy and Governance Network).



Social Sciences and Humanities
Research Council of Canada

Conseil de recherches en
sciences humaines du Canada

Canada

Water Policy and Governance Group: About Us

The Water Policy and Governance Group (WPGG) is a multi-university research collaborative. Our focus is water governance and water policy, primarily – but not exclusively – in Canada. Major themes in our research program include water security, source-water protection, water allocation, and adaptation to climate change. We conduct practical, policy-relevant research that contributes solutions to these problems.

Our success is grounded in our network of researchers and partners across Canada and around the world.

Graduate training is a central part of our mission. We accomplish our goals in large part because of the excellence of our graduate students, post-doctoral fellows, and research associates.

For more information about the WPGG, see www.wpgg.ca

Table of Contents

Preface	ii
Water Policy and Governance Group: About Us.....	iii
Table of Contents	iv
List of Tables.....	iv
List of Figures.....	iv
1. Introduction	1
2. Background.....	3
3. Identification of Problem Areas	6
4. Context Comparison	11
5. Conclusions	19
6. Appendix 1: Ontario Low Water Conditions 2001-2013 by Watershed.....	21
7. References Cited.....	50

List of Tables

Table 1: Trigger, Tools and Action for LWR Levels.....	4
Table 2: Comparison of Low Water Response Programs	12

List of Figures

Figure 1: Number of Level 1, 2, and 3 conditions observed within CA boundaries (2001-2013)	8
Figure 2: Number of weeks each CA has experience Level 1 Conditions by Duration (2001-2013)	9
Figure 3: Number of weeks each CA has experienced Level 2 Conditions by Duration (2001-2013) .	10
Figure 4: Forms of Public Participation in Decision-Making.....	18

1. Introduction

The impetus for this report was a request from partners on our project *Evaluating Collaborative Approaches to Governance for Water Allocation in Canada: Lessons from Ontario*. Partners identified two specific knowledge needs:

1. How does Ontario's experience with Low Water Response planning compare to other jurisdictions?
2. What areas in Ontario are most vulnerable to low water conditions based on existing data?

Planning for low water and drought conditions is becoming of increasing concern in Ontario. Historical instances of dry weather in Ontario indicate that low water conditions or drought have occurred approximately every ten to fifteen years^[5]. Pressure from increasing rates of water-use, combined with the anticipated impacts of climate change, are expected to make low water conditions more frequent and severe^[4]. Opportunities exist to address low water conditions, including conserving water through the implementation of improved technology, best management practices, and regulatory tools that can limit water taking in times of water stress. Low Water Response (LWR) is an important tool that combines various measures to better manage water takings and uses in times of low water conditions or drought.

Ontario's LWR Plan was born in the late 1990s when Ontario experienced extensive and prolonged low water conditions^[9]. In 2001, review of this low water episode led to the creation of the LWR Plan to ensure provincial support and preparedness during extended low water conditions^[5]. In 2007, extreme low water conditions affecting most of Ontario led to a re-examination of LWR and resulted in revisions to the LWR Plan, including changes to the structure and process of decision-making for Low Water Response.

With the goal of strengthening delivery of LWR, it is beneficial to assess geographic areas of high concern for low water conditions. Ensuring that areas of high concern are prioritized for ameliorating low water conditions is important for effective implementation^[1]. Conservation Ontario and the Ministry of Natural Resources have collected data over the duration of the LWR Plan to track when, where and for how long low water conditions have occurred. This makes it possible to identify areas that have experienced higher frequencies and longer periods of low water. Such information can identify areas in Ontario that face chronic low water conditions, permitting LWR Plans to deliver targeted strategic action for more effective and efficient outcomes.

In response to an information gap identified by our partners, this report also considers policies and plans from other jurisdictions to determine the structure and process of other low water response or drought programs in Canada and in similar political contexts around the world. Considering the experiences of other jurisdictions facing similar challenges can be prudent^[8]. This approach can reduce the time and cost associated with implementing new programs, and can help to take advantage of experiences where tried and true methods exist elsewhere. Comparing the efforts of Ontario against other jurisdictions and identifying practices in other regions that may be appropriate to improve LWR Plans in Ontario is a goal in this report.

We begin by outlining the role and composition of LWR Committees. We then review the process of LWR planning and implementation, detailing the triggers for each level of concern and corresponding actions. The report then highlights local areas of concern within Ontario that have experienced low water levels more frequently and for longer durations. Finally, low water response and drought planning approaches from selected other political jurisdictions are examined to foster an appreciation for the global landscape of low water planning.

2. Background

LWR reinforces longstanding legislation and relationships between provincial and local governments. It uses existing science, data collection networks and data analysis to complete its work. It is not designed to act as an emergency response plan, but rather attempts to mitigate below average water levels that could potentially become drought conditions^[5]. LWR is intended to coordinate a response between the Province, Conservation Authority (CA), and municipal, private and special interests involved in the use and management of water. It uses three levels to signify increasingly low water levels, which correspond to appropriate actions to alleviate the stress associated with low water conditions (Table 1).

Water Response Teams are developed within local CA boundaries to respond to current water situations. Long-term projections of water conditions remain the responsibility of designated agencies. Water Response Teams coordinate activities to address low water conditions by collecting information, interpreting policy, delivering programs and responding to emergencies^[5]. The key role of the Water Response Team is to promote conservation strategies, to declare Level 1 and Level 2 conditions in their watershed and to plan response options including conservation, restrictions and regulation. Level 3 conditions are determined by the Low Water Committee formed under the Ontario Water Directors committee. To accomplish their mandate, response team members communicate low water concerns and priorities within their sector, provide relevant data to the response team and implement management tools to alleviate drought effects. These management tools might include bylaws, irrigation scheduling, signage, and public awareness campaigns. Members are expected to attend meetings, communicate with their sector, share data and implement drought management tools^[5].

Water Response Teams are expected to have representative members from their watersheds, including local representatives, First Nations and recreational users. The Province is represented by multiple agencies including Ministry of Natural Resources (MNR), Ministry of the Environment (MOE), Ontario Ministry of Agriculture and Food (OMAF), Ontario Ministry of Municipal Affairs and Housing (OMMAH), and other departments depending on local contextual characteristics. CAs and municipalities are required members of the Water Response Team due to their respective responsibilities for water management in Ontario. The work undertaken for LWR is enabled through their mandates, legislative tools, communication abilities and access to data.

Table 1: Trigger, Tools and Action for LWR Levels

Level	Trigger	Tools	Actions
Level 1 <i>Potential water supply problems.</i>	<ul style="list-style-type: none"> Precipitation is less than 80% of the 3 month or 18 month monthly averages. Stream flow is less than 70% of the average spring or summer flow. 	<ul style="list-style-type: none"> Conservation: 10% reduction in water use among all sectors. 	<ul style="list-style-type: none"> WRT meeting convened within one week. WRT members promote conservation in their representative sectors. Prepare and disseminate informative documents, including media releases, etc.
Level 2 <i>Minor supply problems, potential for major supply problems.</i>	<ul style="list-style-type: none"> Precipitation is less than 60% of the 1 month, 3 month, or 18 month averages. More than 1 week with less than 7.6mm of precipitation. Stream flow is between 50-70% of the average spring or summer flow. 	<ul style="list-style-type: none"> Conservation: 20% reduction in water use. Restrictions: non-essential uses (enforced through municipal bylaw). Monitor and enforce compliance with existing permits (MOE). 	<ul style="list-style-type: none"> Low Water Committee activated to enhance cross-ministry program support. Low Water Committee Coordinator to notify Provincial Emergency Response Coordinator and commence regular briefings. Consider priorities for water restrictions at Level 3 (WRT). Publicize water use restrictions. Document conservation efforts and evidence of social, economic or environmental stress and that majority of water users have participated in conservation.
Level 3 <i>Supply fails to meet demand, social or economic impact.</i>	<ul style="list-style-type: none"> Precipitation is less than 40% of the 1 month, 3 month, or 18 month averages. Stream flow is less than 30% of the average of monthly flow. 	<ul style="list-style-type: none"> Conservation: continue 20% conservation. Restrictions: for small and large water users. Regulation: Reduce permit levels, set and institute water use priorities, and enforcement. 	<ul style="list-style-type: none"> WRT through the provincial representatives or chair make the recommendation for Level 3 conditions to Low Water Committee, including documentation of impacts, conservation compliance of users and recommendations for priorities for water use restrictions. Low Water Committee declares Level 3 or Level 2 continues.

Adapted from [5]

Each stakeholder has a role to play. The MNR is the lead authority for LWR and is responsible for funding. The MOE is responsible for administering the Permit to Take Water program, which can be used to impose conditions on large water takers to safeguard the supply of water. In terms of the decision-making process, provincial representatives on the committee are non-voting members, and play a purely advisory role in deliberation^[5]. Provincial representatives (or one of the co-chairs) of the Water Response Team also

communicate with the Low Water Committee¹. This committee is formed by the Ontario Water Directors committee – the overarching body responsible for coordinating provincial response.

The local CA is responsible for resource management at the watershed scale and coordinates communication networks. The CA will liaise with the MNR Surface Water Monitoring Centre to measure and observe water conditions in the watershed and to report conditions to the Water Response Team. A CA member usually acts as co-chair while the other chair is nominated from the membership representing municipal or local interests.

Municipalities represented on the Water Response Team can provide services that promote public wellbeing and enforce local bylaws to limit public takings on water, such as through alternative lawn watering day by-laws. Local representatives include agriculture, rural private industry, business, recreation, and resource management interests. Despite not being subject to provincial water allocation laws and regulations, First Nations are also represented on some teams. Members are responsible for communicating with their sector or community, and for providing sector-relevant data and opinions to the Water Response Team.

Water Response Teams have various priorities depending on the geographical location of the watershed they represent and the dominant sectors that take water. Geography plays a role in the prevalence and extremity of low water conditions. Some CAs will experience low water conditions more often or for longer durations. Furthermore, low water conditions can occur at a very local scale; sub-watersheds within CAs may experience low water conditions while the rest of the watershed has abundant or adequate water supplies. Understanding the general trends of low water conditions across Ontario will assist Conservation Ontario to target its effort to promote effective response to low water conditions. The next section discusses priority areas that experience low water conditions more often and longer than average.

¹ The Low Water Committee includes two representatives (the Policy Director and Field Director) from the MNR, MOE, OMAF, OMMAH. The committee becomes active once a watershed has entered Level 2 conditions. The purpose of the committee is to work with the watershed to provide advice and support. The Low Water Committee is responsible for reviewing the evidence of environmental, social and economic stress and deliberating on whether to declare a Level 3. A Level 3 has never been declared under the LWR plan.

3. Identification of Problem Areas

Responding to low water and drought conditions, is by necessity, a largely reactive activity. Actions to limit negative impacts often are initiated only when low water conditions are experienced. Nonetheless, strategic planning can play an important role in low water response. For example, identifying watersheds at risk of low water conditions is a strategic activity that can assist in resource allocation and policy development. Similarly, having a response plan in place before low water conditions are experienced can shorten response times and minimize potential conflict by providing agreed upon, transparent low water response measures.

With the goal of strengthening delivery of LWR, it is beneficial to assess geographic areas of high concern for low water conditions. Such action can encourage more effective implementation of mitigative measures by identifying areas of high concern. Data on low water conditions have been collected by CAs and MNR at both the watershed and sub-watershed scale. However, sub-watershed data are not available for all watersheds. For reporting consistency data have been aggregated to the watershed scale. Each watershed has complete data from 2001 to 2013 (January to the end of May). Consistent data collection and reporting standards across CAs would allow more accurate comparisons between the duration and frequency of low water events.

In identifying the watersheds of Ontario that are most vulnerable to drought and low water conditions there are three variables to consider:

- Severity, measured by the amount of water available for use (i.e., Level 3 conditions indicate greater severity than a Level 2, requiring increased reductions to water use);
- Frequency, measured by the number of times drought and low water conditions are experienced; and,
- Duration, the length of time drought and low water conditions are experienced.

To identify the severity and frequency of low water conditions, the cumulative number of Level 1, Level 2 and Level 3 conditions that each watershed has experienced was determined (see Figure 1). Figure 1 indicates that low water conditions are not experienced uniformly across watersheds in Ontario. The Nickel watershed experienced no low water conditions and the Credit Valley, Essex Region, Mattagami, Niagara Peninsula, North Bay, Raison Region, and Sault Saint Marie watersheds each only experienced one incidence of Level 1 low water conditions in the 2001-2013 time period.

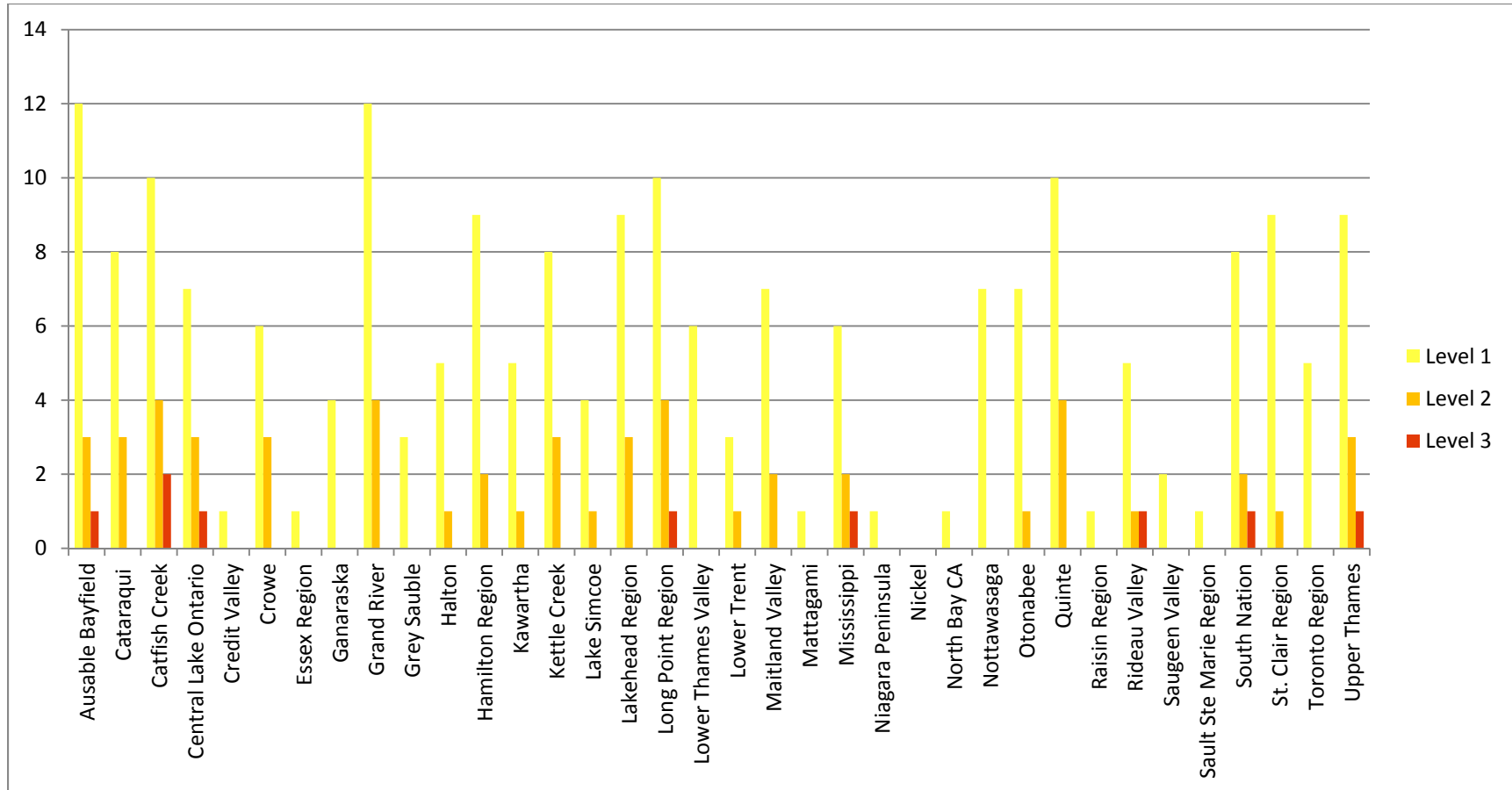
In comparison, Ausable Bayfield and Grand River watersheds experienced Level 1 conditions on twelve occasions and the Catfish Creek, Long Point, and Quinte watersheds experienced ten Level 1 conditions within the twelve year period. Each of these watersheds have experienced multiple incidences of Level 2 low water conditions and Level 3 low water conditions being experienced twice by the Catfish Creek watershed and once by the Ausable Bayfield, Central Lake, Long Point Region, Mississippi, Rideau Valley, South Nation and Upper Thames watersheds.

To examine the duration each watershed experienced low water conditions the cumulative number of weeks that each watershed spent in Level 1 (see Figure 2) and Level 2 (see Figure 3) was investigated. Figure 2

reveals that three watersheds experiences Level 1 conditions for over 150 weeks between 2001 and 2013 and two watershed experienced over 80 weeks at Level 2 conditions. The duration of Level 1 and 2 events varies greatly between watersheds. Rideau Valley and Saugeen Valley have experienced a similar number of weeks at Level 1, but Saugeen Valley has twice experienced Level 1 whereas Rideau Valley has had five shorter Level 1 periods. See Appendix 1 for complete data.

While the data in Figure 1, 2 and 3 identify the watersheds that are most vulnerable to low water conditions, they do not contain the additional information required to determine which watersheds require priority action. To identify priority watersheds it is also important to factor in the impact that low water conditions have on water users. Information required to make this assessment may include land use information, the number and types of water users extracting water from surface water bodies, the amount of water that is allocated for extraction within the watershed, and the vulnerability of water users to fluctuations in availability. The identification of priority watersheds will require the integration of such information.

Figure 1: Number of Level 1, 2, and 3 conditions observed within CA boundaries (2001-2013)²



² This graph is based on data supplied by Conservation Ontario. Discussions with CA staff suggests that Level 3 conditions were experienced in 2007, though this is not reflected in the data. The data may underrepresent the number of Level 3 conditions experienced.

Figure 2: Number of weeks each CA has experience Level 1 Conditions by Duration (2001-2013)

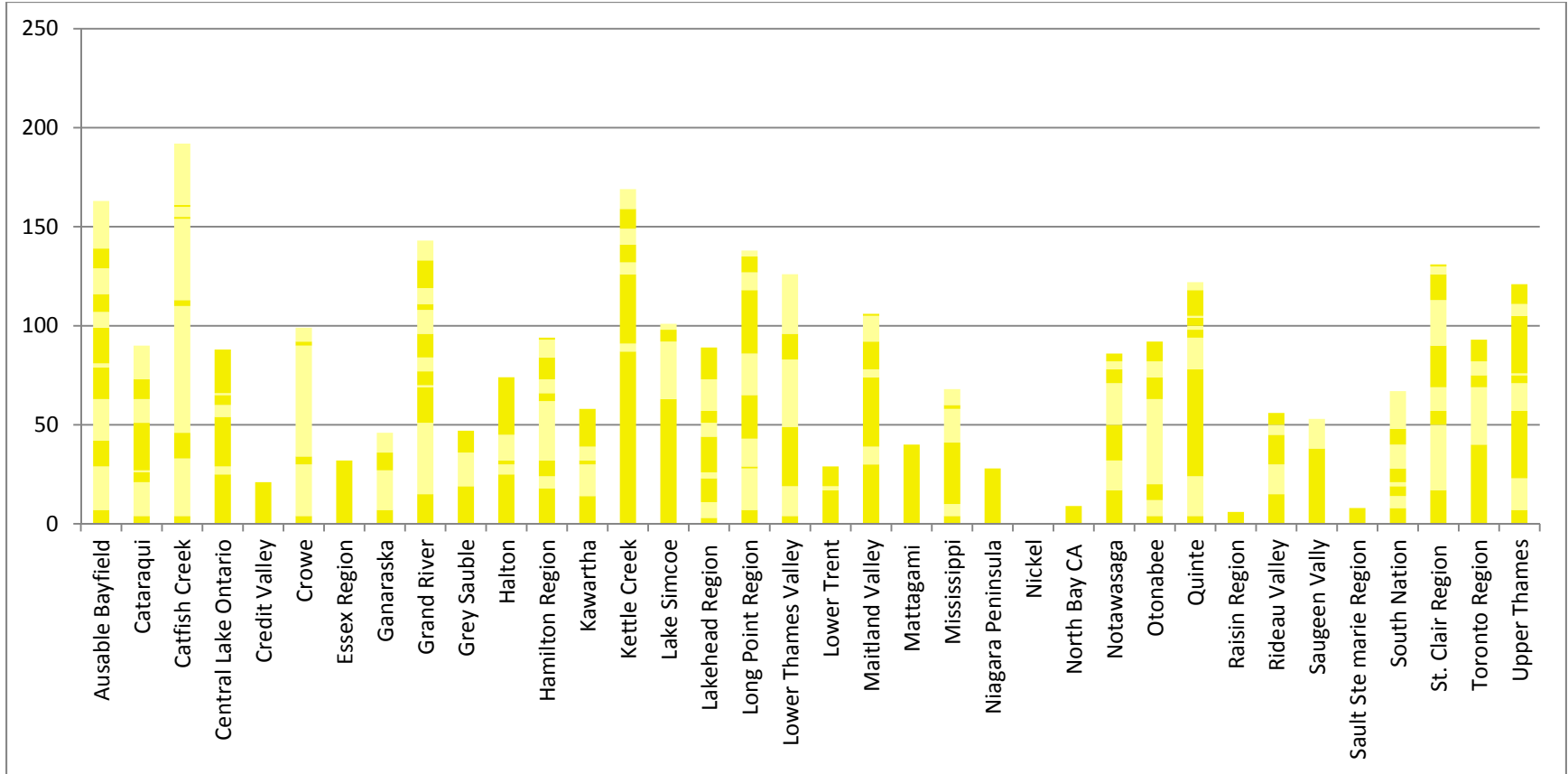
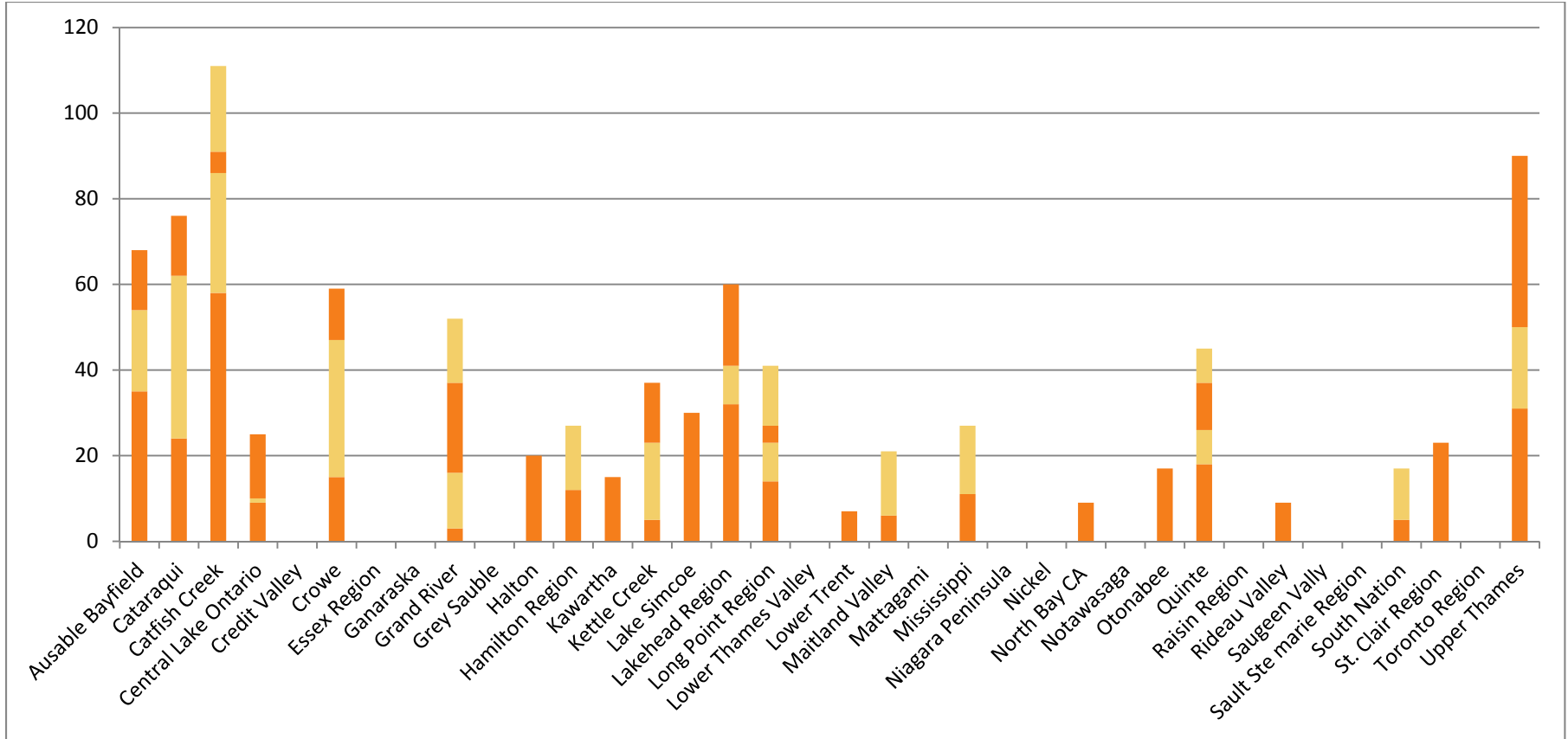


Figure 3: Number of weeks each CA has experienced Level 2 Conditions by Duration (2001-2013)



4. Context Comparison

Section 3 identified watersheds at risk of low water and drought conditions based on historical data. This section examines examples of low water and drought response from Canada and internationally to identify areas of similarity and difference with Ontario's LWR Plan (as described in Section 1). Examining experiences and programs from other areas may help to identify learning opportunities for continual improvement.

In identifying examples from other jurisdictions, it is important to consider their social, economic, environmental and political contextual considerations. Places that have very different hydrological conditions or legal systems may not provide as many relevant lessons that can be used in Ontario ^[7].

A scan of Canadian provinces and territories revealed that planning for low water or drought conditions varies across the country^[4]. At the time this report was prepared, only British Columbia and Ontario had established comprehensive approaches to addressing drought and low water conditions. The approach adopted by British Columbia is summarized in Table 3. Saskatchewan and Manitoba were in the process of developing such plans. Alberta had agriculture-specific drought risk management plans that attempted to minimize the effects of drought on agricultural producers, but did not have plans for general drought management.

Six international cases of low water or drought response were identified for further investigation based on broad similarities in their political, economic and social contexts. The cases are drawn from the United States, United Kingdom and Australia. Table 3 includes a program description that highlights the objective of the low water response or drought plans in each jurisdiction; triggers leading to the designation of low water conditions; tools and actions that are used to manage the impacts of low water conditions; and, the decision-making structure identifying how actions are carried out, the leaders of the response effort and whether there is a role for local stakeholders.

Table 2: Comparison of Low Water Response Programs³

Program	Program Description	Triggers	Tools	Decision-making Structure
British Columbia Drought Response Plan (Canada)	<ul style="list-style-type: none"> The Plan aims to improve communication and coordination of actions taken preceding, during and immediately after a drought and aims to reduce the impacts on people and aquatic ecosystems in times of water scarcity 	<ul style="list-style-type: none"> The plan has four levels of response (green, yellow, orange, and red) ranging from loss of supply to emergency response. Indicators to determine levels include snow level, seasonal runoff, precipitation and stream flow. Drought levels guide the decisions of water distributors, including farmers, water purveyors and local government. 	<ul style="list-style-type: none"> Each level sets objectives and targets for action, including communication, voluntary conservation, mandatory restrictions and regulation. 	<ul style="list-style-type: none"> The Inter-Agency Drought Working Group is responsible for implementing the Plan. The Group is led by the Ministry of Environment. Membership includes relevant Federal and Provincial department representatives. Advice is provided by a Technical Drought Working Group that liaises with regional cross-government drought teams. Local Drought Management Teams may be formed to coordinate a regional response (and a Local Drought Management Plan). Membership is adaptable to circumstance but can include representatives of local water users, local governments, First Nations, water suppliers, business and recreation, and staff from provincial and federal offices.

³ Information about the programs characterized in Table 3 was collected through a search of web sites and reports prepared by each jurisdiction. The search was completed in April, 2014.

Program	Program Description	Triggers	Tools	Decision-making Structure
United Kingdom Drought Plan	<ul style="list-style-type: none"> The aim is to ensure enough water is available for everyone without damaging the environment, both now and in the future. 	<ul style="list-style-type: none"> Drought levels can be normal, potential drought, drought and post drought. There are a number of triggers to initiate drought action including present and forecast conditions, considering how effective the action would be and consideration of the local setting. 	<ul style="list-style-type: none"> Enforce restrictions on water taking through license conditions on permits. 	<ul style="list-style-type: none"> Drought planning is led primarily from the national level. The Environment Agency is responsible for monitoring, reporting and acting to manage the impact of drought. Droughts are managed as part of the incidents and emergency planning procedures. There are seven regional drought plans under the national Drought Plan. Strategic management teams are convened during drought to provide strategic governance and direction.
Melbourne Drought Response Plan (Australia)	<ul style="list-style-type: none"> Ensure water users respond appropriately to expected or worsening conditions. Under the Plan, triggers for moving into stages are posted for specific watersheds and each license type (irrigation, domestic, etc.) has actions specified during low and high flow periods. 	<ul style="list-style-type: none"> Low, moderate and high risk levels are based on key catchment information including 7-day averages, rainfall and stream-flow conditions. 	<ul style="list-style-type: none"> Water taking restrictions are clearly articulated on licenses for low, medium and high risk levels. Licensed water users must comply with licensed conditions and allocations at each level. License holders are required to proactively seek and monitor information about drought status prior to taking any water. Failure to comply with restrictions or bans may lead to permanent license cancellation and/or fines and jail time under the Water Act. 	<ul style="list-style-type: none"> Regulatory based. The Plan is active at all times. Melbourne Water is the government agency in charge of implementing and overseeing the Plan. It is responsible for determining levels, restricting or banning water taking and lifting bans.

Program	Program Description	Triggers	Tools	Decision-making Structure
The Colorado Drought Mitigation and Response Plan (United States)	<ul style="list-style-type: none"> The Plan provides a blueprint for how the state will monitor, mitigate and respond to drought. The plan focuses on monitoring, assessment, mitigation and response. 	<ul style="list-style-type: none"> There are three phases of drought conditions that lead to actions normal (monitoring), moderate drought (activate impact task force as necessary) and severe drought (full plan activation). Drought conditions are determined through the Standardized Precipitation Index, Surface Water Supply Index and the Colorado Modified Palmer Drought Severity Index. 	<ul style="list-style-type: none"> Triggers initiate the formation of a number of committees and task forces comprised of stakeholders holding jurisdiction or responsibility for water. Action measures are identified for each stakeholder to implement on their own. Should conditions reach severe drought designation there may be a request for a Presidential Declaration to establish Colorado Division of Emergency Management Director as the State Coordinating Officer (SCO). 	<ul style="list-style-type: none"> The Division of Emergency Management is responsible for coordinating response actions. Drought planning is based on the Disaster Mitigation Act and the Federal Emergency Management Agency's guidance. The Plan intends to promote and coordinate mitigation planning and programming by local jurisdictions, though it is not a requirement. Local planning is supported by the state through funding and technical assistance. Drought can be declared in specific locations or in sectors, such as agriculture.
Minnesota Statewide Drought Plan (United States)	<ul style="list-style-type: none"> This plan provides a framework for preparing for and responding to droughts to minimize conflicts and negative impacts on Minnesota's Natural resources and economy. 	<ul style="list-style-type: none"> The US Drought Monitor reports the location and intensity of drought conditions using a blend of quantitative and qualitative indicators. These include such measures as the daily flow of the Mississippi River, whether water supply needs are not being met, or there are threatened or actual electricity shortages due to cooling water supply shortages. 	<ul style="list-style-type: none"> There are four levels of drought (watch, warning, restrictive, emergency). Each level necessitates actions from state, federal and water users or suppliers, including public awareness, voluntary measures to reduce water use, conservation measures, allocation restrictions, public water use reduction, mandatory water use reductions, and limit water use based on highest priorities. 	<ul style="list-style-type: none"> The State Drought Task Force is convened, during the warning Phase, to provide coordination and communication between agencies and institutions affected by drought. The Task Force is led by the Minnesota Department of Natural Resources Waters and includes federal and state government departments, University of Minnesota, Metropolitan Council, Association of Minnesota Counties and Hospitality Minnesota (a coalition of tourism and hospitality associations). For localized drought a Regional Drought Task Force can be created for the same purpose.

Program	Program Description	Triggers	Tools	Decision-making Structure
State of Ohio Emergency Operations Plan (United States)	<ul style="list-style-type: none"> This plan provides an effective and systematic means to assess and respond to drought. 	<ul style="list-style-type: none"> Precipitation, groundwater levels, stream flows, snowpack, and water quality are monitored to determine conditions. Also uses the Palmer Drought Severity Index and other indices (Crop Moisture Index, Standard Precipitation Index, etc.) to assess drought potential. 	<ul style="list-style-type: none"> There are four levels of drought (pre-drought conditions, increased monitoring, increased response actions and emergency actions. Each level requires action from federal, state and local government as well as the Public Utilities Commission. Actions include monitoring and communicating low water conditions, coordinating response and restricting water use. 	<ul style="list-style-type: none"> The primary planning agency is the Ohio Emergency Management Agency. The plan is based on current legislation and authorities, which do not provide for the mandatory allocation of water supplies by the State. There are six state level Drought Impact Task Forces (agriculture, wildfire, fish and wildlife, recreation and tourism, water supply, and economic) that oversee cooperation between involved agencies. Ohio is divided into ten climatological divisions based on administrative boundaries.
New York State Drought Plan (United States)	<ul style="list-style-type: none"> To minimize the adverse impacts of drought. 	<ul style="list-style-type: none"> Drought stage is determined within the regions from the two indices, which will be used in combination with other factors (economic, social, political, etc.) to determine stages. The two indices are Palmer Index and State Drought Index. 	<ul style="list-style-type: none"> Drought Alert: intensify monitoring, review contingency plans and local plans, and promote voluntary conservation. Drought warning: increase management efforts, continue monitoring, intensify voluntary reductions, improve leak control, make preparations for using emergency sources of supply, and public education. Drought Emergency: restrict water use in stages, use emergency equipment and tap emergency sources of water, recommend state funding and legislation if needed, penalty for water use violations. Drought Disaster: Further restrictions on water use, request State/Federal disaster declarations, enact emergency legislation and issue orders as required, request Federal disaster assistance. 	<ul style="list-style-type: none"> Eight drought regions. Local government and suppliers of water have the primary responsibility for insuring the availability of adequate quantities of good quality water. A Drought Management Task Force coordinates and manages all drought related actions through the activities of the member agencies prior to the declaration of drought emergency. The Disaster Preparedness Commission (DPC) directs emergency management efforts.

Examination of the low water and drought planning programs described in Table 3 reveals many similarities between Ontario's LWR and the drought management and planning approaches from the United Kingdom, United States, Australia and British Columbia related to triggers for declaring low water conditions, actions to address negative impacts of low water conditions, and decision-making structures to guide implementation.

Triggers for declaring low water conditions

Triggers for declaring low water conditions are generally consistent across all examples. Measurable indicators such as stream flow and precipitation are key indicators in each case. Context-specific indicators add additional measures in places such as British Columbia; these include snow level as an indicator, reflecting the key role that snow melt plays in stream base-flow. This high level of consistency indicates that there are few lessons to be learned from examining other examples for low water condition triggers.

Actions to address negative impacts of low water conditions

A number of the strategies to reduce water use in Ontario are also used in other jurisdictions. These include voluntary conservation, limiting public water use, limiting water use on highest priority and water restrictions. Water restrictions are implemented in various ways, depending on how permits/licenses to take water are regulated and controlled in each example. In Colorado, reduced extraction measures appear to be less regulatory and more voluntary in nature. In places such as Melbourne, water users are tightly regulated through water licenses.

One of the key differences among these examples is the way in which water restrictions are enforced. The Melbourne example shows stricter enforcement of bans than other cases. This may be due to the prolonged experiences of drought in Australia that has warranted stricter government control and enforcement to protect the environmental and social systems^[3]. The Melbourne plan places the responsibility on water license holders to ensure they are in compliance with the restrictions under their licenses and that water levels are adequate for withdrawing water. Failure to comply has serious repercussions, including jail time or permanent license cancellation.

These kinds of measures necessitate strong communication connections between regulators and water users, and require that water license holders have real-time accurate measurements of water levels and their own water extraction. It is expected that such measures would only work where water permits/licenses are tightly regulated and the social norms are accepting of strong enforcement measures. Context matters when considering examples from other jurisdictions. For example, in Ontario stricter implementation of bans on water taking may be met with resistance. Ontario has not experienced the prolonged and extensive drought conditions faced by Australians.

However, there are a number of different programs that offer interesting lessons for Ontario. For example a component of Melbourne's plan is strategic action in advance of expected low water conditions. This includes communication of the likelihood of a ban or restriction being called. Such action better prepares water users for the potential of not being able to access water. Melbourne also includes sector-specific actions to reduce water use at each level. These clearly define the roles and responsibilities of water users and ensure clarity and

transparency in the planning process. Melbourne’s approach relies on open communication channels between license holders and regulators. Such efforts to improve response times can minimize conflict when restrictions are required. Ohio’s plan uses state level Task Forces that inform decision-making on key topics during drought, such as agriculture or economy. This allows expert advice on important issues to be considered during decision-making. In the Colorado Plan drought can be declared in a sector. This allows targeted reductions and relief opportunities to be applied specifically.

Decision-making structures

Examination of the decision-making structures supporting each low water planning example highlights similarities and differences between Ontario and the other jurisdictions identified regarding the implementation scale of low water planning, level of coordination between government bodies, the participation of local stakeholders, and the degree to which low water response is linked to emergency management

Scale of low water planning

Studying other contexts for drought management illuminates that multiple scales are used to plan and manage droughts. Examples of different planning scales identified in this report include

- Cities (e.g., Melbourne);
- Watershed (e.g., Ontario);
- State/Provincial (e.g., United States and Canada);
- National (e.g., the United Kingdom).

The appropriate scale for low water planning is closely related to legislative and best management considerations. In Ontario, the Province is responsible for determining the overall structure of decision-making and declaring Level 3 – the most severe low water level – while multi-stakeholder planning occurs on a watershed based scale. This structure is similar to the one in British Columbia.

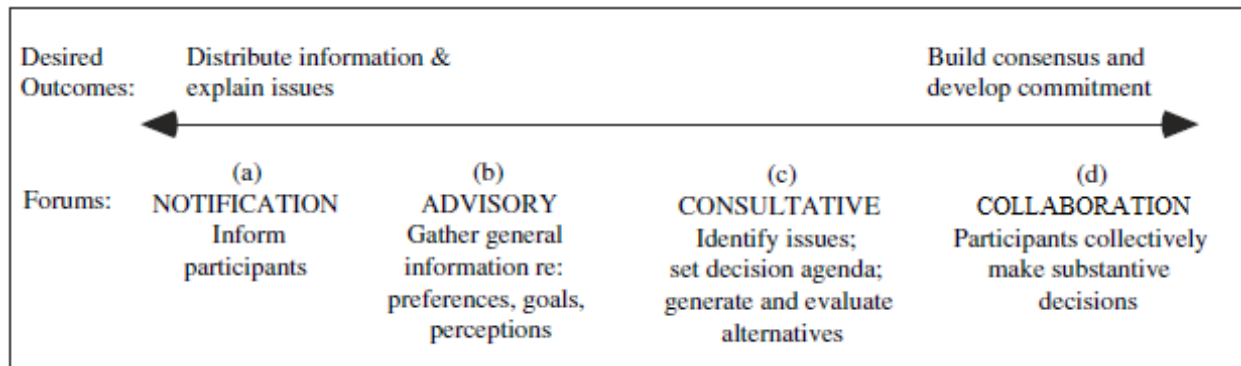
Level of coordination among government bodies

As is the case in Ontario, the frameworks in Minnesota and British Columbia cases advocate for coordination among multiple agencies to confront low water challenges. In contrast, Melbourne, Colorado and the United Kingdom have drought or low water planning under the mandate of one department.

Participation of local stakeholders

Internationally, public involvement in low water response decision-making occurs over a spectrum (Figure 4) varying from notification, as evident in Colorado, to collaboration, as in Minnesota and Ontario. Few jurisdictions have required local participation by water users to the extent evident under LWR in Ontario. In British Columbia, local response teams are not required, but rather encouraged. Under Minnesota’s Plan a wider range of actors participate in decision-making, including universities and tourism interests. However, under Minnesota’s Plan the multi-stakeholder approach takes place at the State scale, whereas in Ontario it is watershed-based and involves multi-stakeholder groups.

Figure 4: Forms of Public Participation in Decision-Making



Adapted from [2]

Degree to which low water response is linked to emergency management

The United Kingdom and Colorado link low water response with emergency management very closely. The United Kingdom uses emergency planning procedures to manage droughts. In Colorado the state works very closely with the Federal Emergency Management Agency to guide drought planning and response. The Division of Emergency Management in Colorado is responsible for coordinating response actions. In contrast, Ontario's Plan is not designed to act as an emergency response plan, but rather attempts to mitigate below average water levels that could potentially become drought conditions [5]. Should serious drought conditions be experienced in Ontario (for instance if Level 3 conditions were declared) it is unclear what emergency measures would be put in place. Developing and communicating clear protocols in such instances will provide more clarity over what may be expected under such conditions.

5. Conclusions

Planning for low water and drought conditions is becoming of increasing concern in Ontario. Increased incidences of dry, hot weather, such as occurred during 2007 and 2012, reinforce the potential for low water conditions in Ontario and the need for an effective response plan. The impetus for this report was a request from partners on our project *Evaluating Collaborative Approaches to Governance for Water Allocation in Canada: Lessons from Ontario*. Partners identified two specific knowledge needs:

1. How does Ontario's experience with Low Water Response planning compare to other jurisdictions?
2. What areas in Ontario are most vulnerable to low water conditions based on existing data?

Good planning benefits from experience garnered over time and knowledge of other options used in similar contexts. To support planning this report identified areas of high concern for low water conditions and offered suggestions for how Ontario LWR compares to other water management programs in similar contexts.

In order to better predict and manage low water events it is prudent to examine areas that have experienced low water conditions more often and for longer durations. Data on low water conditions were collected by CAs at both the watershed and sub-watershed scale. However, sub-watershed data were not available for all watersheds. For reporting consistency data were aggregated to the watershed scale. Each watershed has complete data from 2001 to 2013.

To assist in identifying the watersheds of Ontario that are most vulnerable to drought and low water conditions, data collected by CAs on low water conditions between 2001 and 2013 were examined in Section 3. Three variables were considered:

- Severity, measured by the amount of water available for use (i.e. Level 3 conditions indicate greater severity than a Level 2, requiring increased reductions to water use);
- Frequency, measured by the number of times drought and low water conditions are experienced; and,
- Duration, the length of time drought and low water conditions are experienced.

Results identified a number of watersheds that are most vulnerable to low water conditions. However, additional information is required before determining which watersheds require priority action, as this analysis does not account for how low water conditions impact water users. Information required to make this assessment may include land use information, the number and types of water users extracting water from surface water bodies, the amount of water that is allocated for extraction within the watershed, and the vulnerability of water users to fluctuations in availability. The identification of priority watersheds will require the integration of such information.

In comparing Ontario's LWR Plan with low water planning examples from British Columbia, Minnesota and Colorado in the United States, the United Kingdom and Melbourne in Australia it was determined that

Ontario's LWR Plan shares many attributes with other place's strategies for limiting harm from drought (Section 4). There were commonalities among the various systems examined here. Most jurisdictions have levels that are determined by low water conditions and correspond to actions that reduce the stress on water systems. The scale at which decision-making for drought management occurs varies largely by jurisdiction and depends on legislative and perceived best management practices. Coordination between government bodies, both at and between levels of government, is just as likely to occur as it is not to occur and it depends on the enabling legislation and mandate of the departments with management of water.

Some key differences were evident among the low water planning programs considered. Public participation in decision-making occurred in a few jurisdictions, but not to the same extent as in Ontario. This governance structure reinforces the fact that in Ontario, there is a preference for solutions to low water conditions that are developed locally.

Another important difference included the ways in which water restrictions are enforced. The enforcement that is enabled in some plans is more stringent than is the case in Ontario, though differing socio-political conditions mean that stronger enforcement provisions may be difficult to implement in Ontario's context. Finally, approaches differed in the connection between low water response and emergency management. In some approaches this connection is very clear. However, in the Ontario plan emergency planning is not clearly connected to the LWR. Developing and communicating clear protocols in such instances will provide more clarity over what may be expected under such conditions.

Understanding the unique context of Ontario and potential opportunities for low water planning is essential to building an effective Low Water Response program. The Source Water Protection program in Ontario has created vast information on water budgets and potential water quantity risks. Leveraging this data to inform local and provincial Low Water Response is a key opportunity that requires further study. The Low Water Response program is presently reactive, but having measures that could indicate early warning signs for low water and drought would increase planning time and improve mitigation and adaptation efforts. Effective early warning requires understanding groundwater and how it is linked to surface water. The initial work of understanding indicators for groundwater and regional practices in Canada and the United States has already begun^[6]. Finally, forming a closer relationship with the Canadian Drought Monitor that is part of the North American Drought Monitor could provide important co-benefits.

6. Appendix 1: Ontario Low Water Conditions 2001-2013 by Watershed

Raw data for this project were provided by Conservation Ontario. The data, organized by year, outlined confirmed Level 1, 2, and the presence of Level 3 low water conditions as recorded weekly at available monitoring stations. As part of the analysis the number of instances of recorded conditions (e.g. Number of Level 1, etc.) were compiled for each year and tallied in a summary sheet the contents of which are presented in this Appendix..

Watershed	2001				
	Number of Level 1	Number of Level 2	Number of Level 3	Weeks in Level 1	Weeks in Level 2
Ausable Bayfield					
Bayfield	no data	no data	no data	no data	no data
Lower Ausable	no data	no data	no data	no data	no data
Parkhill Creek	no data	no data	no data	no data	no data
Upper Ausable	no data	no data	no data	no data	no data
Alymer	no data	no data	no data	no data	no data
Bancroft					
Cataraqui	1	1		4	20
Catfish Creek					
Central Lake Ontario	1			25	
Chapleau					
Cochrane					
Credit Valley					
Crowe	2	1		9	15
Dryden					
Essex Region	1			28	
Fort Frances					
Ganaraska					
Grand River					
Eramosa R.					
Fairchild Creek					
Grand R./ Brantford					
Grand R./ Galt					
Grand River/ Doon					
Grand River/W. Montrose					
Horner Creek	no data	no data	no data	no data	no data
Kenny Creek	no data	no data	no data	no data	no data
Lower Conestoga					
Lower Grand R.					
Lower Speed R.					
McKenzie/ Mt.Pleasant Creek					
Mill Creek					
Nith R.					
Upper Conestoga					
Upper Grand					
Upper Speed R.					

Watershed	2001				
	Number of Level 1	Number of Level 2	Number of Level 3	Weeks in Level 1	Weeks in Level 2
Whiteman's Creek					
Grey Sauble					
Sauble River	no data	no data	no data	no data	no data
Halton					
Hamilton Region					
Spencer Creek	no data	no data	no data	no data	no data
Hearst					
Kawartha					
Kettle Creek					
Kirkland Lake					
Lake Simcoe					
Lakehead Region					
Long Point Region	1	1		7	14
Big Otter					
Big Creek					
East Basin					
Lower Thames Valley	1			4	
Lower Trent					
Maitland Valley					
Mattagami					
Midhurst					
Mississippi	2	1		10	11
Niagara Peninsula					
Nickel					
Nipigon					
North Bay district					
North Bay CA					
Nottawasaga	1			17	
Boyne	no data	no data	no data	no data	no data
Blue Mountain	no data	no data	no data	no data	no data
Innisfil Creek	no data	no data	no data	no data	no data
Mad	no data	no data	no data	no data	no data
Mid-Nottawasaga	no data	no data	no data	no data	no data
Pine	no data	no data	no data	no data	no data
Otonabee					
Parry Sound					
Pembroke					
Quinte	2	1		6	18
Raisin Region					
Red Lake					
Rideau Valley					
Saugeen Valley					
Sault Ste Marie District					
Sault Ste Marie Region					
Teesewater	no data	no data	no data	no data	no data
Sioux Lookout					
South Nation					

Watershed	2001				
	Number of Level 1	Number of Level 2	Number of Level 3	Weeks in Level 1	Weeks in Level 2
St. Clair Region	1			17	
Sudbury	no data	no data	no data	no data	no data
Thunder Bay					
Timmins	no data	no data	no data	no data	no data
Toronto Region					
Upper Thames					
Wawa					
Total	13	5	0	127	78

Watershed	2002				
	Number of Level 1	Number of Level 2	Number of Level 3	Weeks in Level 1	Weeks in Level 2
Ausable Bayfield	1	1	1	6	15
Bayfield	no data	no data	no data	no data	no data
Lower Ausable	no data	no data	no data	no data	no data
Parkhill Creek	no data	no data	no data	no data	no data
Upper Ausable	no data	no data	no data	no data	no data
Alymer	no data	no data	no data	no data	no data
Bancroft					
Cataraqui	2	2		22	18
Catfish Creek	1	1	1	4	17
Central Lake Ontario					
Chapleau					
Cochrane					
Credit Valley					
Crowe	2	1		25	10
Dryden	1			3	
Essex Region	1			4	
Fort Frances					
Ganaraska					
Grand River	1			15	
Eramosa R.	2	1		12	11
Fairchild Creek	2			7	
Grand R./ Brantford	2			7	
Grand R./ Galt	2			7	
Grand River/ Doon	2			7	
Grand River/W. Montrose	2			7	
Horner Creek	no data	no data	no data	no data	no data
Kenny Creek	no data	no data	no data	no data	no data
Lower Conestoga	2			7	
Lower Grand R.	2			7	
Lower Speed R.	2			7	
McKenzie/ Mt. Pleasant Creek	1	2		1	19
Mill Creek	1	1		11	11
Nith R.	2			18	
Upper Conestoga	2			7	

Watershed	2002				
	Number of Level 1	Number of Level 2	Number of Level 3	Weeks in Level 1	Weeks in Level 2
Upper Grand	2			7	
Upper Speed R.	2	1		12	11
Whiteman's Creek	2	2		13	8
Grey Sauble					
Sauble River	no data	no data	no data	no data	no data
Halton					
Hamilton Region	1			15	
Spencer Creek	no data	no data	no data	no data	no data
Hearst					
Kawartha					
Kenora					
Kettle Creek	1			17	
Lake Simcoe					
Lakehead Region	1			48	
Long Point Region	1	2		6	13
Big Otter	2	1		9	14
Big Creek	1			15	
East Basin	1			2	
Lower Thames Valley					
Lower Trent	1			16	
Maitland Valley	1			14	
Mattagami					
Midhurst	no data	no data	no data	no data	no data
Mississippi	1			11	
Niagara Peninsula					
Nickel					
Nipigon					
North Bay district					
North Bay CA					
Nottawasaga					
Boyne	no data	no data	no data	no data	no data
Blue Mountain	no data	no data	no data	no data	no data
Innisfil Creek	no data	no data	no data	no data	no data
Mad	no data	no data	no data	no data	no data
Mid-Nottawasaga	no data	no data	no data	no data	no data
Pine	no data	no data	no data	no data	no data
Otonabee					
Parry Sound					
Pembroke					
Quinte	2			25	
Raisin Region					
Red Lake					
Rideau Valley					
Saugeen Valley	1			10	
Sault Ste Marie District					
Sault Ste Marie Region					
Teeseewater	no data	no data	no data	no data	no data

Watershed	2002				
	Number of Level 1	Number of Level 2	Number of Level 3	Weeks in Level 1	Weeks in Level 2
Sioux Lookout					
South Nation	1			8	
St. Clair Region	1			15	
Sudbury					
Thunder Bay					
Timmins	no data	no data	no data	no data	no data
Toronto Region					
Upper Thames	1	1		7	15
Wawa					
Total	56	16	2	434	162

Watershed	2003				
	Number of Level 1	Number of Level 2	Number of Level 3	Weeks in Level 1	Weeks in Level 2
Ausable Bayfield	1	1	0	22	20
Bayfield	no data	no data	no data	no data	no data
Lower Ausable	no data	no data	no data	no data	no data
Parkhill Creek	no data	no data	no data	no data	no data
Upper Ausable	no data	no data	no data	no data	no data
Alymer	no data	no data	no data	no data	no data
Bancroft					
Catarauqui	1	1		1	24
Catfish Creek	1	1		7	41
Central Lake Ontario					
Chapleau					
Cochrane					
Credit Valley					
Crowe		1			22
Dryden	1			43	
Essex Region					
Fort Frances					
Ganaraska					
Grand River	1	1		24	3
Eramosa R.	1	1		28	1
Fairchild Creek	1			4	
Grand R./ Brantford	1			4	
Grand R./ Galt	1			4	
Grand River/ Doon	1			4	
Grand River/W. Montrose	1			4	
Horner Creek	no data	no data	no data	no data	no data
Kenny Creek	no data	no data	no data	no data	no data
Lower Conestoga	1			4	
Lower Grand R.	1			4	
Lower Speed R.	1			4	
McKenzie/ Mt. Pleasant Creek	1	1		18	10

Watershed	2003				
	Number of Level 1	Number of Level 2	Number of Level 3	Weeks in Level 1	Weeks in Level 2
Mill Creek	1	1		24	5
Nith R.	1	1		28	1
Upper Conestoga	1			4	
Upper Grand	1			4	
Upper Speed R.	1	1		31	1
Whiteman's Creek	1	1		13	1
Grey Sauble	1			4	
Sauble River	no data	no data	no data	no data	no data
Halton					
Hamilton Region	2			9	
Spencer Creek	no data	no data	no data	no data	no data
Hearst					
Kawartha	1			14	
Kenora	1			21	
Kettle Creek	1			48	
Lake Simcoe	1			17	
Lakehead Region					
Long Point Region	3			32	
Big Otter	2			18	
Big Creek	1			1	
East Basin	1			1	
Lower Thames Valley	1			15	
Lower Trent	2			5	
Maitland Valley	1			16	
Mattagami					
Midhurst					
Mississippi	1			20	
Niagara Peninsula					
Nickel					
Nipigon					
North Bay district					
North Bay CA					
Nottawasaga	1			15	
Boyne	no data	no data	no data	no data	no data
Blue Mountain	no data	no data	no data	no data	no data
Innisfil Creek	no data	no data	no data	no data	no data
Mad	no data	no data	no data	no data	no data
Mid-Nottawasaga	no data	no data	no data	no data	no data
Pine	no data	no data	no data	no data	no data
Otonabee	1			4	
Parry Sound					
Pembroke					
Quinte	1			47	
Raisin Region					
Red Lake					
Rideau Valley					
Saugeen Valley	1			28	

Watershed	2003				
	Number of Level 1	Number of Level 2	Number of Level 3	Weeks in Level 1	Weeks in Level 2
Sault Ste Marie District					
Sault Ste Marie Region					
Teeseewater	no data	no data	no data	no data	no data
Sioux Lookout					
South Nation					
St. Clair Region	2			25	
Sudbury					
Thunder Bay					
Timmins	no data	no data	no data	no data	no data
Toronto Region					
Upper Thames	1	1		10	16
Wawa					
Total	47	12	0	629	145

Watershed	2004				
	Number of Level 1	Number of Level 2	Number of Level 3	Weeks in Level 1	Weeks in Level 2
Ausable Bayfield	1			12	
Bayfield	no data	no data	no data	no data	no data
Lower Ausable	no data	no data	no data	no data	no data
Parkhill Creek	no data	no data	no data	no data	no data
Upper Ausable	no data	no data	no data	no data	no data
Alymer	no data	no data	no data	no data	no data
Bancroft					
Cataraqui					
Catfish Creek	2			34	
Central Lake Ontario					
Chapleau					
Cochrane					
Credit Valley					
Crowe					
Dryden	1			5	
Essex Region					
Fort Frances					
Ganaraska					
Grand River	2			25	
Eramosa R.					
Fairchild Creek					
Grand R./ Brantford	1			1	
Grand R./ Galt					
Grand River/ Doon					
Grand River/W. Montrose	1			1	
Horner Creek	no data	no data	no data	no data	no data
Kenny Creek	no data	no data	no data	no data	no data
Lower Conestoga					
Lower Grand R.	1			1	

Watershed	2004				
	Number of Level 1	Number of Level 2	Number of Level 3	Weeks in Level 1	Weeks in Level 2
Lower Speed R.	1			1	
McKenzie/ Mt. Pleasant Creek	1			1	
Mill Creek					
Nith R.	1			1	
Upper Conestoga					
Upper Grand	1			1	
Upper Speed R.	1			1	
Whiteman's Creek	1			1	
Grey Sauble					
Sauble River	no data	no data	no data	no data	no data
Halton					
Hamilton Region	1			8	
Spencer Creek	no data	no data	no data	no data	no data
Hearst					
Kawartha					
Kenora					
Kettle Creek	1			22	
Lake Simcoe					
Lakehead Region					
Long Point Region	1			12	
Big Otter					
Big Creek					
East Basin					
Lower Thames Valley					
Lower Trent					
Maitland Valley	1			6	
Mattagami					
Midhurst					
Mississippi					
Niagara Peninsula					
Nickel					
Nipigon					
North Bay district					
North Bay CA					
Nottawasaga					
Boyne	no data	no data	no data	no data	no data
Blue Mountain	no data	no data	no data	no data	no data
Innisfil Creek	no data	no data	no data	no data	no data
Mad	no data	no data	no data	no data	no data
Mid-Nottawasaga	no data	no data	no data	no data	no data
Pine	no data	no data	no data	no data	no data
Otonabee					
Parry Sound					
Pembroke					
Quinte					
Raisin Region					
Red Lake					

Watershed	2004				
	Number of Level 1	Number of Level 2	Number of Level 3	Weeks in Level 1	Weeks in Level 2
Rideau Valley					
Saugeen Valley					
Sault Ste Marie District					
Sault Ste Marie Region					
Teeseewater	no data	no data	no data	no data	no data
Sioux Lookout					
South Nation					
St. Clair Region	1			12	
Sudbury	no data	no data	no data	no data	no data
Thunder Bay					
Timmins	no data	no data	no data	no data	no data
Toronto Region					
Upper Thames					
Wawa					
Total	20	0	0	145	0

Watershed	2005				
	Number of Level 1	Number of Level 2	Number of Level 3	Weeks in Level 1	Weeks in Level 2
Ausable Bayfield	2			22	
Bayfield	1			9	
Lower Ausable	1			10	
Parkhill Creek	1			10	
Upper Ausable	1			10	
Alymer	no data	no data	no data	no data	no data
Bancroft					
Cataraqui	1			24	
Catfish Creek	2			27	
Central Lake Ontario	2	1	1	18	9
Chapleau					
Cochrane	1			15	
Credit Valley					
Crowe	1			15	
Dryden					
Essex Region					
Fort Frances					
Ganaraska	1			7	
Grand River	3	1		13	13
Eramosa R.	1	1		7	9
Fairchild Creek	1			6	
Grand R./ Brantford	1			6	
Grand R./ Galt	1			6	
Grand River/ Doon	1			6	
Grand River/W. Montrose	1			6	
Horner Creek	no data	no data	no data	no data	no data
Kenny Creek	no data	no data	no data	no data	no data

Watershed	2005				
	Number of Level 1	Number of Level 2	Number of Level 3	Weeks in Level 1	Weeks in Level 2
Lower Conestoga	1			6	
Lower Grand R.	1			6	
Lower Speed R.	1			6	
McKenzie/ Mt. Pleasant Creek	1			6	
Mill Creek	1			6	
Nith R.	1			6	
Upper Conestoga	1			6	
Upper Grand	1			6	
Upper Speed R.	1	1		7	9
Whiteman's Creek	1			6	
Grey Sauble	1			17	
Sauble River	no data	no data	no data	no data	no data
Halton	1			23	
Hamilton Region	1			23	
Spencer Creek	no data	no data	no data	no data	no data
Hearst	2	1		5	10
Kawartha	1			16	
Kenora					
Kettle Creek	2	1		22	5
Lake Simcoe	1			19	
Lakehead Region					
Long Point Region	3			31	
Big Otter	1			14	
Big Creek	1			14	
East Basin	1			14	
Lower Thames Valley	1			20	
Lower Trent					
Maitland Valley	2			26	
Mattagami					
Midhurst					
Mississippi	1			17	
Niagara Peninsula					
Nickel					
Nipigon					
North Bay district					
North Bay CA					
Nottawasaga	1			18	
Boyne	no data	no data	no data	no data	no data
Blue Mountain	no data	no data	no data	no data	no data
Innisfil Creek	no data	no data	no data	no data	no data
Mad	no data	no data	no data	no data	no data
Mid-Nottawasaga	no data	no data	no data	no data	no data
Pine	no data	no data	no data	no data	no data
Otonabee	1	1		8	17
Parry Sound					
Pembroke					
Quinte	1			16	

Watershed	2005				
	Number of Level 1	Number of Level 2	Number of Level 3	Weeks in Level 1	Weeks in Level 2
Raisin Region					
Red Lake					
Rideau Valley	1			15	
Saugeen Valley					
Sault Ste Marie District					
Sault Ste Marie Region					
Teeseewater	no data	no data	no data	no data	no data
Sioux Lookout					
South Nation					
St. Clair Region	2			23	
Sudbury	no data	no data	no data	no data	no data
Thunder Bay					
Timmins	no data	no data	no data	no data	no data
Toronto Region	1			23	
Upper Thames	1			24	
Wawa	1			19	
Total	61	7	1	685	72

Watershed	2006				
	Number of Level 1	Number of Level 2	Number of Level 3	Weeks in Level 1	Weeks in Level 2
Ausable Bayfield	1			16	
Bayfield					
Lower Ausable					
Parkhill Creek					
Upper Ausable					
Alymer	no data	no data	no data	no data	no data
Bancroft					
Cataraqui					
Catfish Creek	1			38	
Central Lake Ontario	1			11	
Chapleau					
Cochrane					
Credit Valley					
Crowe	1			41	
Dryden	1			17	
Essex Region					
Fort Frances	1			15	
Ganaraska					
Grand River	1			7	
Eramosa R.					
Fairchild Creek					
Grand R./ Brantford					
Grand R./ Galt					
Grand River/ Doon					
Grand River/W. Montrose					

Watershed	2006				
	Number of Level 1	Number of Level 2	Number of Level 3	Weeks in Level 1	Weeks in Level 2
Horner Creek	no data	no data	no data	no data	no data
Kenny Creek	no data	no data	no data	no data	no data
Lower Conestoga					
Lower Grand R.					
Lower Speed R.					
McKenzie/ Mt. Pleasant Creek					
Mill Creek					
Nith R.					
Upper Conestoga					
Upper Grand					
Upper Speed R.	1			6	
Whiteman's Creek	1			6	
Grey Sauble					
Sauble River	no data	no data	no data	no data	no data
Halton	1			6	
Hamilton Region	1			6	
Spencer Creek	no data	no data	no data	no data	no data
Hearst					
Kawartha					
Kenora					
Kettle Creek	1			17	
Lake Simcoe	1			10	
Lakehead Region	2	1		11	7
Long Point Region					
Big Otter					
Big Creek			1		
East Basin					
Lower Thames Valley	1			10	
Lower Trent					
Maitland Valley	1			12	
Mattagami					
Midhurst					
Mississippi					
Niagara Peninsula					
Nickel					
Nipigon					
North Bay district					
North Bay CA					
Nottawasaga					
Boyne	no data	no data	no data	no data	no data
Blue Mountain	no data	no data	no data	no data	no data
Innisfil Creek	no data	no data	no data	no data	no data
Mad	no data	no data	no data	no data	no data
Mid-Nottawasaga	no data	no data	no data	no data	no data
Pine	no data	no data	no data	no data	no data
Otonabee	1			8	
Parry Sound					

Watershed	2006				
	Number of Level 1	Number of Level 2	Number of Level 3	Weeks in Level 1	Weeks in Level 2
Pembroke					
Quinte					
Raisin Region					
Red Lake					
Rideau Valley					
Saugeen Valley					
Sault Ste Marie District					
Sault Ste Marie Region					
Teesewater	no data	no data	no data	no data	no data
Sioux Lookout					
South Nation	1			6	
St. Clair Region					
Sudbury	no data	no data	no data	no data	no data
Thunder Bay					
Timmins	no data	no data	no data	no data	no data
Toronto Region	1			17	
Upper Thames	2			24	
Wawa	1			14	
Total	23	1	1	298	7

Watershed	2007				
	Number of Level 1	Number of Level 2	Number of Level 3	Weeks in Level 1	Weeks in Level 2
Ausable Bayfield	2	1		4	19
Bayfield	1	1		5	16
Lower Ausable	1	1		2	19
Parkhill Creek	1	1		2	19
Upper Ausable					
Alymer	no data	no data	no data	no data	no data
Bancroft					
Cataraqui	1			12	
Catfish Creek	1	1		3	21
Central Lake Ontario	2	2		11	12
Chapleau					
Cochrane					
Credit Valley					
Crowe					
Dryden	1			23	
Essex Region					
Fort Frances	1			44	
Ganaraska	1			18	
Grand River	1	1		12	13
Eramosa R.	1	1		4	13
Fairchild Creek	1	1		4	13

Watershed	2007				
	Number of Level 1	Number of Level 2	Number of Level 3	Weeks in Level 1	Weeks in Level 2
Grand R./ Brantford	1	1		4	13
Grand R./ Galt	1	1		4	13
Grand River/ Doon	1	1		4	13
Grand River/W. Montrose	1	1		4	13
Horner Creek	1	1		12	13
Kenny Creek	1	1		4	21
Lower Conestoga	1	1		4	13
Lower Grand R.	1	1		12	13
Lower Speed R.	1	1		4	13
McKenzie/ Mt. Pleasant Creek	1	1		4	21
Mill Creek	1	1		4	13
Nith R.	1	1		4	13
Upper Conestoga	1	1		4	13
Upper Grand	1	1		4	13
Upper Speed R.	1	1		1	24
Whiteman's Creek	1	1		4	21
Grey Sauble	1			11	
Sauble River	1	1		2	9
Halton	1	1		5	18
Hamilton Region	2	1		9	12
Spencer Creek	1	1		4	17
Hearst					
Kawartha	2	1		3	15
Kenora					
Kettle Creek	1	1		6	16
Lake Simcoe	1	1		6	19
Lakehead Region	1	1		12	25
Long Point Region	1			27	
Big Otter	2	1		9	18
Big Creek	1			27	
East Basin	2	1		6	21
Lower Thames Valley	1			23	
Lower Trent					
Maitland Valley					
Mattagami					
Midhurst					
Mississippi					
Niagara Peninsula	1			25	
Nickel					
Nipigon					
North Bay district					
North Bay CA					
Nottawasaga	1			21	
Boyne	2	1		11	7
Blue Mountain	no data	no data	no data	no data	no data
Innisfil Creek	2	1		7	11
Mad	2	1		14	7

Watershed	2007				
	Number of Level 1	Number of Level 2	Number of Level 3	Weeks in Level 1	Weeks in Level 2
Mid-Nottawasaga	2	1		11	7
Pine	2	1		11	7
Otonabee	1			18	
Parry Sound					
Pembroke					
Quinte	2	1		6	8
Raisin Region					
Red Lake					
Rideau Valley					
Saugeen Valley	1			15	
Sault Ste Marie District					
Sault Ste Marie Region					
Teeseewater	1			15	
Sioux Lookout					
South Nation	2	1		7	5
St. Clair Region	1			23	
Sudbury	no data	no data	no data	no data	no data
Thunder Bay	1			9	
Timmins	no data	no data	no data	no data	no data
Toronto Region	1			23	
Upper Thames	1	1		4	19
Wawa	1			38	
Total	73	44	0	629	629

Watershed	2008				
	Number of Level 1	Number of Level 2	Number of Level 3	Weeks in Level 1	Weeks in Level 2
Ausable Bayfield	1			16	
Bayfield	1			10	
Lower Ausable	1			10	
Parkhill Creek	1			10	
Upper Ausable	1			10	
Alymer	no data	no data	no data	no data	no data
Bancroft					
Cataraqui					
Catfish Creek		1			7
Central Lake Ontario	1	1		1	4
Chapleau					
Cochrane					
Credit Valley					
Crowe					
Dryden					
Essex Region					
Fort Frances					

Watershed	2008				
	Number of Level 1	Number of Level 2	Number of Level 3	Weeks in Level 1	Weeks in Level 2
Ganaraska	1			2	
Grand River	1	1		12	8
Eramosa R.	1	1		3	8
Fairchild Creek	1	1		3	8
Grand R./ Brantford	1	1		3	8
Grand R./ Galt	1	1		3	8
Grand River/ Doon	1	1		3	8
Grand River/W. Montrose	1	1		3	8
Horner Creek	1	1		3	8
Kenny Creek	1	1		3	8
Lower Conestoga	1	1		3	8
Lower Grand R.	1	1		3	8
Lower Speed R.	1	1		3	8
McKenzie/ Mt. Pleasant Creek	1	1		3	8
Mill Creek	1	1		3	8
Nith R.	1	1		3	8
Upper Conestoga	1	1		3	8
Upper Grand	1	1		3	8
Upper Speed R.	1	1		3	8
Whiteman's Creek	1	1		3	8
Grey Sauble					
Sauble River					
Halton	1	1		2	2
Hamilton Region	1			2	
Spencer Creek		1			2
Hearst					
Kawartha	1			6	
Kenora					
Kettle Creek	1	1		9	2
Lake Simcoe		1			11
Lakehead Region					
Long Point Region	1			5	
Big Otter	1			5	
Big Creek					
East Basin	1			5	
Lower Thames Valley	1			11	
Lower Trent					
Maitland Valley					
Mattagami					
Midhurst					
Mississippi					
Niagara Peninsula	1			3	
Nickel					
Nipigon					
North Bay district					
North Bay CA					
Nottawasaga					

Watershed	2008				
	Number of Level 1	Number of Level 2	Number of Level 3	Weeks in Level 1	Weeks in Level 2
Boyne					
Blue Mountain	no data	no data	no data	no data	no data
Innisfil Creek					
Mad					
Mid-Nottawasaga					
Pine					
Otonabee	1			25	
Parry Sound					
Pembroke					
Quinte	1			2	
Raisin Region					
Red Lake					
Rideau Valley					
Saugeen Valley					
Sault Ste Marie District					
Sault Ste Marie Region					
Teesewater					
Sioux Lookout					
South Nation					
St. Clair Region	1			1	
Sudbury	no data	no data	no data	no data	no data
Thunder Bay					
Timmins	no data	no data	no data	no data	no data
Toronto Region	1			10	
Upper Thames	1	1		3	2
Wawa					
Total	40	26	0	214	182

Watershed	2009				
	Number of Level 1	Number of Level 2	Number of Level 3	Weeks in Level 1	Weeks in Level 2
Ausable Bayfield	1			8	
Bayfield					
Lower Ausable					
Parkhill Creek					
Upper Ausable					
Alymer	no data	no data	no data	no data	no data
Bancroft					
Cataraqui					
Catfish Creek					
Central Lake Ontario					
Chapleau					
Cochrane					
Credit Valley					

Watershed	2009				
	Number of Level 1	Number of Level 2	Number of Level 3	Weeks in Level 1	Weeks in Level 2
Crowe					
Dryden					
Essex Region					
Fort Frances					
Ganaraska					
Grand River	1			3	
Eramosa R.	1			4	
Fairchild Creek					
Grand R./ Brantford					
Grand R./ Galt					
Grand River/ Doon					
Grand River/W. Montrose					
Horner Creek					
Kenny Creek					
Lower Conestoga					
Lower Grand R.					
Lower Speed R.					
McKenzie/ Mt. Pleasant Creek					
Mill Creek					
Nith R.					
Upper Conestoga					
Upper Grand					
Upper Speed R.					
Whiteman's Creek					
Grey Sauble					
Sauble River					
Halton					
Hamilton Region					
Spencer Creek	no data	no data	no data	no data	no data
Hearst					
Kawartha					
Kenora					
Kettle Creek					
Lake Simcoe					
Lakehead Region					
Long Point Region					
Big Otter					
Big Creek					
East Basin					
Lower Thames Valley					
Lower Trent					
Maitland Valley	1	1		4	6
Mattagami					
Midhurst					
Mississippi					
Niagara Peninsula					
Nickel					

Watershed	2009				
	Number of Level 1	Number of Level 2	Number of Level 3	Weeks in Level 1	Weeks in Level 2
Nipigon					
North Bay district					
North Bay CA					
Nottawasaga					
Boyne					
Blue Mountain	no data	no data	no data	no data	no data
Innisfil Creek					
Mad					
Mid-Nottawasaga					
Pine					
Otonabee					
Parry Sound					
Pembroke					
Quinte					
Raisin Region					
Red Lake					
Rideau Valley					
Saugeen Valley					
Sault Ste Marie District					
Sault Ste Marie Region					
Teeseewater					
Sioux Lookout					
South Nation					
St. Clair Region					
Sudbury					
Thunder Bay					
Timmins	no data	no data	no data	no data	no data
Toronto Region					
Upper Thames	1			4	
Wawa					
Total	5	1	0	23	6

Watershed	2010				
	Number of Level 1	Number of Level 2	Number of Level 3	Weeks in Level 1	Weeks in Level 2
Ausable Bayfield	1			9	
Bayfield					
Lower Ausable					
Parkhill Creek					
Upper Ausable					
Alymer	no data	no data	no data	no data	no data
Bancroft					
Cataraqui					
Catfish Creek	1			28	

Watershed	2010				
	Number of Level 1	Number of Level 2	Number of Level 3	Weeks in Level 1	Weeks in Level 2
Central Lake Ontario					
Chapleau					
Cochrane	1			21	
Credit Valley					
Crowe					
Dryden					
Essex Region					
Fort Frances					
Ganaraska	1			9	
Grand River	1			8	
Eramosa R.					
Fairchild Creek					
Grand R./ Brantford					
Grand R./ Galt					
Grand River/ Doon					
Grand River/W. Montrose					
Horner Creek					
Kenny Creek					
Lower Conestoga					
Lower Grand R.					
Lower Speed R.					
McKenzie/ Mt. Pleasant Creek					
Mill Creek					
Nith R.	1			8	
Upper Conestoga					
Upper Grand					
Upper Speed R.					
Whiteman's Creek					
Grey Sauble					
Sauble River					
Halton					
Hamilton Region					
Spencer Creek	no data	no data	no data	no data	no data
Hearst					
Kawartha					
Kenora					
Kettle Creek	1			8	
Lake Simcoe					
Lakehead Region	2	1		21	9
Long Point Region					
Big Otter					
Big Creek					
East Basin					
Lower Thames Valley	1			13	
Lower Trent					
Maitland Valley					
Mattagami	1			28	

Watershed	2010				
	Number of Level 1	Number of Level 2	Number of Level 3	Weeks in Level 1	Weeks in Level 2
Midhurst					
Mississippi					
Niagara Peninsula					
Nickel					
Nipigon	1			28	
North Bay district					
North Bay CA					
Nottawasaga					
Boyne					
Blue Mountain	no data	no data	no data	no data	no data
Innisfil Creek					
Mad					
Mid-Nottawasaga					
Pine					
Otonabee	1			11	
Parry Sound					
Pembroke					
Quinte					
Raisin Region					
Red Lake					
Rideau Valley					
Saugeen Valley					
Sault Ste Marie District					
Sault Ste Marie Region	1			8	
Teeseewater					
Sioux Lookout					
South Nation	1			7	
St. Clair Region	1			13	
Sudbury	1			19	
Thunder Bay	1			34	
Timmins	1			30	
Toronto Region	1			6	
Upper Thames	1			25	
Wawa	1			28	
Total	22	1	0	362	9

Watershed	2011				
	Number of Level 1	Number of Level 2	Number of Level 3	Weeks in Level 1	Weeks in Level 2
Ausable Bayfield	1			13	
Bayfield					
Lower Ausable					
Parkhill Creek					
Upper Ausable					

Watershed	2011				
	Number of Level 1	Number of Level 2	Number of Level 3	Weeks in Level 1	Weeks in Level 2
Alymer	no data	no data	no data	no data	no data
Bancroft					
Cataraqui					
Catfish Creek	3	1	1	19	5
Central Lake Ontario					
Chapleau					
Cochrane					
Credit Valley					
Crowe					
Dryden					
Essex Region					
Fort Frances					
Ganaraska					
Grand River	1			14	
Eramosa R.					
Fairchild Creek					
Grand R./ Brantford					
Grand R./ Galt					
Grand River/ Doon					
Grand River/W. Montrose					
Horner Creek					
Kenny Creek					
Lower Conestoga					
Lower Grand R.					
Lower Speed R.					
McKenzie/ Mt. Pleasant Creek					
Mill Creek					
Nith R.					
Upper Conestoga					
Upper Grand					
Upper Speed R.					
Whiteman's Creek	1			2	
Grey Sauble					
Sauble River					
Halton	1			13	
Hamilton Region	1			11	
Spencer Creek	no data	no data	no data	no data	no data
Hearst					
Kawartha					
Kenora					
Kettle Creek	1			10	
Lake Simcoe					
Lakehead Region	1	1		7	4
Long Point Region	1		1	9	
Big Otter					
Big Creek					
East Basin					

Watershed	2011				
	Number of Level 1	Number of Level 2	Number of Level 3	Weeks in Level 1	Weeks in Level 2
Lower Thames Valley					
Lower Trent					
Maitland Valley	1			14	
Mattagami	1			12	
Midhurst					
Mississippi			1		
Niagara Peninsula					
Nickel					
Nipigon	1			20	
North Bay district					
North Bay CA					
Nottawasaga	1			7	
Boyne	1			2	
Blue Mountain	1			2	
Innisfil Creek	1			2	
Mad	1				
Mid-Nottawasaga					
Pine					
Otonabee					
Parry Sound					
Pembroke					
Quinte	2	1		5	11
Raisin Region					
Red Lake					
Rideau Valley	1		1	13	
Saugeen Valley					
Sault Ste Marie District					
Sault Ste Marie Region					
Teeseewater					
Sioux Lookout					
South Nation	1		1	12	
St. Clair Region					
Sudbury	1			12	
Thunder Bay	2			7	
Timmins	1			18	
Toronto Region					
Upper Thames			1		
Wawa	1			12	
Total	28	3	6	236	20

Watershed	2012				
	Number of Level 1	Number of Level 2	Number of Level 3	Weeks in Level 1	Weeks in Level 2
Ausable Bayfield	2	1		16	14
Bayfield					
Lower Ausable					
Parkhill Creek					
Upper Ausable					
Alymer					
Bancroft					
Cataraqui	2	1		17	14
Catfish Creek	2	1		11	20
Central Lake Ontario	1			22	
Chapleau					
Cochrane	1			11	
Credit Valley	1			21	
Crowe	2	1		9	12
Dryden					
Essex Region					
Fort Frances					
Ganaraska	1			10	
Grand River	1	1		10	15
Eramosa R.	1	1		2	7
Fairchild Creek	1	1		2	7
Grand R./ Brantford	1	1		2	7
Grand R./ Galt	1	1		2	7
Grand River/ Doon	1	1		2	7
Grand River/W. Montrose	1	1		2	7
Horner Creek	1	1		2	7
Kenny Creek	1	1		2	7
Lower Conestoga	1	1		2	7
Lower Grand R.	1	1		2	7
Lower Speed R.	1	1		2	7
McKenzie/ Mt. Pleasant Creek	1	1		2	7
Mill Creek	1	1		2	7
Nith R.	1	1		2	7
Upper Conestoga	1	1		2	7
Upper Grand	1	1		2	7
Upper Speed R.	1	1		2	7
Whiteman's Creek	1	1		2	7
Grey Sauble					
Sauble River					
Halton	1			29	
Hamilton Region	2	1		10	15
Spencer Creek	no data	no data	no data	no data	no data
Hearst					
Kawartha	1			19	
Kenora					
Kettle Creek	1	1		10	14
Lake Simcoe	1			3	

Watershed	2012				
	Number of Level 1	Number of Level 2	Number of Level 3	Weeks in Level 1	Weeks in Level 2
Lakehead Region	1	1		6	15
Long Point Region	2	1		11	14
Big Otter	1	1		4	6
Big Creek	1	1		4	6
East Basin	1	1		4	6
Lower Thames Valley	1			30	
Lower Trent	1	1		10	7
Maitland Valley	2	1		14	15
Mattagami					
Midhurst					
Mississippi	2	1		8	16
Niagara Peninsula					
Nickel					
Nipigon					
North Bay district					
North Bay CA	1			9	
Nottawasaga	2			8	
Boyne	1			11	
Blue Mountain	1			11	
Innisfil Creek	1			11	
Mad	1			11	
Mid-Nottawasaga	1			11	
Pine	1			11	
Otonabee	2			18	
Parry Sound					
Pembroke	2	1		7	16
Quinte	2	1		17	8
Raisin Region	1			6	
Red Lake					
Rideau Valley	3	1		22	9
Saugeen Valley					
Sault Ste Marie District					
Sault Ste Marie Region					
Teesewater					
Sioux Lookout					
South Nation	2	1		18	12
St. Clair Region	2	1		5	23
Sudbury					
Thunder Bay	2			33	
Timmins					
Toronto Region	2			18	
Upper Thames	1	1		6	31
Wawa					
Total	77	39	0	558	414

Watershed	2013 - to June				
	Number of Level 1	Number of Level 2	Number of Level 3	Weeks in Level 1	Weeks in Level 2
Ausable Bayfield	1			18	
Bayfield					
Lower Ausable					
Parkhill Creek					
Upper Ausable					
Alymer					
Bancroft					
Cataraqui	1			10	
Catfish Creek	1			21	
Central Lake Ontario					
Chapleau					
Cochrane	1			16	
Credit Valley					
Crowe					
Dryden					
Essex Region					
Fort Frances					
Ganaraska					
Grand River					
Eramosa R.					
Fairchild Creek					
Grand R./ Brantford					
Grand R./ Galt					
Grand River/ Doon					
Grand River/W. Montrose					
Horner Creek					
Kenny Creek					
Lower Conestoga					
Lower Grand R.					
Lower Speed R.					
McKenzie/ Mt. Pleasant Creek					
Mill Creek					
Nith R.					
Upper Conestoga					
Upper Grand					
Upper Speed R.					
Whiteman's Creek					
Grey Sauble					
Sauble River					
Halton					
Hamilton Region					
Spencer Creek	no data	no data	no data	no data	no data
Hearst					
Kawartha					
Kenora					
Kettle Creek					
Lake Simcoe					

Watershed	2013 - to June				
	Number of Level 1	Number of Level 2	Number of Level 3	Weeks in Level 1	Weeks in Level 2
Lakehead Region	1			16	
Long Point Region					
Big Otter					
Big Creek					
East Basin					
Lower Thames Valley					
Lower Trent					
Maitland Valley					
Mattagami					
Midhurst					
Mississippi	1			2	
Niagara Peninsula					
Nickel					
Nipigon					
North Bay district					
North Bay CA					
Nottawasaga					
Boyne					
Blue Mountain					
Innisfil Creek					
Mad					
Mid-Nottawasaga					
Pine					
Otonabee					
Parry Sound					
Pembroke	1			4	
Quinte					
Raisin Region					
Red Lake					
Rideau Valley	1			6	
Saugeen Valley					
Sault Ste Marie District					
Sault Ste Marie Region					
Teesewater					
Sioux Lookout					
South Nation	1			9	
St. Clair Region					
Sudbury					
Thunder Bay	1			16	
Timmins					
Toronto Region					
Upper Thames	1			10	
Wawa					
Total	11	0	0	128	0

Watershed	Total (2001 – 2013)				
	Number of Level 1	Number of Level 2	Number of Level 3	Weeks in Level 1	Weeks in Level 2
Ausable Bayfield	12	3	1	162	68
Bayfield	2	1	0	24	16
Lower Ausable	2	1	0	22	19
Parkhill Creek	2	1	0	22	19
Upper Ausable	2	0	0	20	0
Alymer	0	0	0	0	0
Bancroft	0	0	0	0	0
Cataraqui	8	5	0	90	76
Catfish Creek	10	4	2	192	111
Central Lake Ontario	7	3	1	88	25
Chapleau	0	0	0	0	0
Cochrane	4	0	0	63	0
Credit Valley	1	0	0	21	0
Crowe	6	3	0	99	59
Dryden	3	0	0	91	0
Essex Region	1	0	0	32	0
Fort Frances	1	0	0	59	0
Ganaraska	4	0	0	46	0
Grand River	12	4	0	143	52
Eramosa R.	7	5	0	60	49
Fairchild Creek	7	2	0	26	28
Grand R./ Brantford	8	2	0	27	28
Grand R./ Galt	7	2	0	26	28
Grand River/ Doon	7	2	0	26	28
Grand River/W. Montrose	8	2	0	27	28
Horner Creek	3	2	0	17	28
Kenny Creek	3	2	0	9	36
Lower Conestoga	7	2	0	26	28
Lower Grand R.	8	2	0	35	28
Lower Speed R.	8	2	0	27	28
McKenzie/ Mt. Pleasant Creek	7	4	0	35	65
Mill Creek	5	5	0	50	44
Nith R.	8	3	0	70	29
Upper Conestoga	7	2	0	26	28
Upper Grand	8	2	0	27	28
Upper Speed R.	8	5	0	63	60
Whiteman's Creek	10	6	0	50	45
Grey Sauble	3	0	0	32	0
Sauble River	1	1	0	2	9
Halton	5	1	0	78	20
Hamilton Region	10	3	0	93	27
Spencer Creek	1	1	0	4	19
Hearst	2	1	0	5	10
Kawartha	5	1	0	58	15
Kenora	1	0	0	21	0

Watershed	Total (2001 – 2013)				
	Number of Level 1	Number of Level 2	Number of Level 3	Weeks in Level 1	Weeks in Level 2
Kirkland Lake	0	0	0	0	0
Lake Simcoe	4	1	0	55	30
Lakehead Region	8	3	0	121	60
Long Point Region	10	4	1	140	41
Big Otter	7	3	0	59	38
Big Creek	5	1	1	61	6
East Basin	6	2	0	32	27
Lower Thames Valley	6	0	0	126	0
Lower Trent	3	1	0	31	7
Maitland Valley	7	2	0	106	21
Mattagami	1	0	0	40	0
Midhurst	0	0	0	0	0
Mississippi	6	2	1	68	27
Niagara Peninsula	1	0	0	28	0
Nickel	0	0	0	0	0
Nipigon	1	0	0	48	0
North Bay district	0	0	0	0	0
North Bay CA	1	0	0	9	0
Nottawasaga	7	0	0	86	0
Boyne	4	1	0	24	7
Blue Mountain	2	0	0	13	0
Innisfil Creek	4	1	0	20	11
Mad	3	1	0	25	7
Mid-Nottawasaga	3	1	0	22	7
Pine	3	1	0	22	7
Otonabee	7	1	0	92	17
Parry Sound	0	0	0	0	0
Pembroke	2	1	0	11	16
Quinte	10	4	0	124	45
Raisin Region	1	0	0	6	0
Red Lake	0	0	0	0	0
Rideau Valley	5	1	1	56	9
Saugeen Valley	2	0	0	53	0
Sault Ste Marie District	0	0	0	0	0
Sault Ste Marie Region	1	0	0	8	0
Teesewater	1	0	0	15	0
Sioux Lookout	0	0	0	0	0
South Nation	8	2	1	67	17
St. Clair Region	9	1	0	134	23
Sudbury	2	0	0	31	0
Thunder Bay	5	0	0	99	0
Timmins	1	0	0	48	0
Toronto Region	5	0	0	97	0
Upper Thames	9	3	1	117	83
Wawa	3	0	0	111	0

7. References Cited

- 1 Biermann, F., Chan, M., Mert, A., and Pattberg, P. 2007. Multi-stakeholder partnerships for sustainable development: does the promise hold? In *Partnerships, Governance and Sustainable Development: Reflections of Theory and Practice*, eds. P. Glasbergen, F. Biermann, and A. P. J. Mol, 239-260. Northampton: Edward Elgar Publishing Ltd.
- 2 Cowie, G. M. and Borrett, S. R. 2005. Institutional perspectives on participation and information in water management. *Environmental Modelling and Software*, 20, 469-483.
- 3 de Loë, R., Varghese, J., Ferreyra, C., and Kreuzwiser, R. 2007. *Water Allocation and Water Security in Canada: Initiating a Policy Dialogue for the 21st Century* Guelph: Guelph Water Management Group, University of Guelph.
- 4 Durley, J. L. and de Loë, R. 2005. Empowering communities to carry out drought contingency planning. *Water Policy*, 7 (6), 551-567.
- 5 Ontario Ministry of Natural Resources, Ontario Ministry of the Environment, Ontario Ministry of Agriculture and Food, Ontario Ministry of Municipal Affairs and Housing, Ontario Ministry of Enterprise, Opportunity and Innovation, Association of Municipalities of Ontario, and Conservation Ontario. 2010. *Ontario Low Water Response* Toronto, ON: Queen's Printer for Ontario.
- 6 Post, R. 2013. *Percentile Groundwater Indicator Literature Review* Utopia: Nottawasaga Valley Conservation Authority.
- 7 Swainson, R. and de Loë, R. 2010. *Exploring the Role of Policy Transfer in Water Governance: A Discussion Paper* Waterloo: Water Policy and Governance Group.
- 8 Swainson, R. and de Loë, R. 2011. The Importance of context in relation to policy transfer: a case study of environmental water allocation in Australia. *Environmental Policy and Governance*, 21, 58-69.
- 9 Valiante, M. 2004. The future of common law water rights in Ontario. *Journal of Environmental Law and Practice*, 14, 293-313.