ASSESSMENT OF WATER RESOURCES TO SUPPORT A REVIEW OF ONTARIO'S

WATER QUANTITY MANAGEMENT FRAMEWORK: WATER MANAGERS WORKSHOPS REPORT

Submitted to:

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Project Number: 180107-03
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1. INTRODUCTION

As part of the Ministry of the Environment, Conservation and Parks (MECP) Ontario's Water Quantity Management Review Project, three separate workshops with Water Managers were held in Guelph, Kingston and Toronto. The objectives of the workshops were to:

- Introduce the water quantity science and jurisdictional best practices reviews (Task 1 & 2) completed by BluMetric under contract to MECP.
- Share findings related to:
    - Assessment of cumulative effects (CE) (in consideration of climate change, population growth and environmental flow needs (EFN)) including the assessment of EFN; and
    - Management of CE, including EFN (in consideration of scale, governance and adaptive management).
- Provide an opportunity for Water Managers to offer feedback on the applicability of approaches and tools found in the science and jurisdictional reviews to Ontario.

Prior to the Workshops, a survey questionnaire was developed and sent out to the Water Managers to gain some prior insight into the concerns and challenges of Water Managers on items to be addressed during the workshop and to further inform the project.

1.1 REPORT OBJECTIVE

The overall purpose of this report is to provide a synopsis of the workshops and to summarize the feedback provided by the Water Managers. The goals of this report are to: (a) discuss the survey process and findings; (b) provide an overview of the workshops and describe the methodology undertaken for the workshops; and (c) summarize the feedback provided by the Water Managers during the workshops noting key topics of interest and/or concerns as well as identifying similarities and uniqueness between the three (3) regional workshops.

2. DISCUSSION OF SURVEY PROCESS AND FINDINGS

An invitation to complete the survey questionnaire was sent out to 196 Water Managers. The questionnaire was uploaded to an online survey platform (Survey Gizmo) to facilitate easy completion and submission of the survey as well as expedite the data analysis and reporting process. The survey was open online for approximately eight (8) days for the Water Managers to complete and was closed on April 20, 2018. The survey questionnaire and detailed survey results are provided in **Appendix A** and **Appendix B** respectively. A summary of the survey findings is presented below.

2.1 SUMMARY OF SURVEY FINDINGS

Fifty-three (53) Water Managers (27%) completed the survey and the following is a detailed summary based on their responses. A summary of key points is provided in Section 2.6 below.

2.1.1 General Information Questions

The first series of questions requested general information from the Water Manager and the area they were representing. The following is a summary of the responses. Further details are provided in **Appendix B:** Questions 1 through 6.

- The vast majority of responses were from Water Managers located in Southern Ontario.
- There were responses from individuals representing Conservation Authorities (~43%), Municipalities (~25%) and Source Water Protection (SWP) Authorities (~15%). There was limited response from Indigenous Community representatives (~2%) and private well supply representatives (0%). The remaining 15% of respondents selected the 'Other Category' and wrote in who they were representing. Example responses included Consultant/Association of Professional Geoscientists of Ontario (APGO) and a combination of the options (e.g. representing both Conservation Authority and SWP Authority). Please refer to Question 3 in **Appendix B** for additional detail.
- There was a good distribution of respondents representing various drinking water supply sources.
- The majority of respondents indicated that Water Budgets (Tier 1, 2 and/or 3) had been completed for their area.

- Respondents had various water quantity management concerns (**Appendix B**: Question 6) with the greatest number of respondents (72%) indicating that concerns regarding the impacts of current or potential challenges or conflict related to growth pressures was applicable to their area. Additional concerns that were not listed in the survey were also provided.

2.2 Necessary Data and Tools

A series of questions was asked regarding whether the respondent had the necessary data and tools for assessing water quantity resources to sustainably manage the water resources in their area. Based on the results (Table 1 and **Appendix B:** Questions 7 to 13), the majority of respondents indicated that more data and/or tools are needed for all listed water quantity resources and management topics.

Table 1: Percent of respondents who DO NOT have the necessary data and/or tools to adequately assess the following water quantity resource and management topics*

Approximate % of Respondents**	Water Quantity Resource and Management Issue
80%	Sustainability assessment
80%	Effects of climate change on water resources from a quantity perspective
75%	Environmental flow needs
70%	Cumulative effects of multiple water takings on water resources
70%	Water security assessment
70%	Effects of population growth and changing land uses on water resources from a quantity perspective
65%	Water resources from a quantity perspective

*For more details please refer to **Appendix B:** Questions 7 to 13

% Respondent calculated by adding the respondents who selected one of the following choices: neither necessary tools nor data are available; necessary tools are available but data is insufficient; and necessary data is available but tools are not available or are inadequate. For other categories please refer to Questions 7 to 13 in **Appendix B.

2.3 VALUE OF DATA

A series of questions was asked regarding how valuable to the respondent's work sources of data were or could be if made more accessible. The vast majority of respondents indicated that all of the listed data sources are valuable or could be if made more available. Table 2 summarizes the results with more specific details provided in **Appendix B:** Questions 14 to 25. Water Managers also listed a number of additional valuable data sources. In particular the Ontario Geology Survey (OGS) data, soil moisture data and land use data was mentioned by a number of respondents. A detailed list of the other valuable data sources listed by respondents is provided in **Appendix B: Survey Report:** Question 26.

Table 2: Percent respondents who consider the following sources of data very valuable or somewhat valuable to their work or could be if made more available.*

Approximate % of Respondents	Data Source
98%	Climate data - meteorological
95%	Stream flow monitoring
95%	Population growth projections
90%	Your organization / community's own data sets
90%	Cold water fisheries mapping
90%	Climate data - current climate change projections
90%	Permit to Take Water (PTTW)
85%	Base flow data
85%	Actual daily water taking volumes in the WTRS
85%	Groundwater level monitoring data in the Provincial Ground Monitoring Network (PGMN)
85%	HYDAT stream flow gauge low-flow statistics
85%	Well Records (Water Well Information System (WWIS))

*For more details refer **to Appendix B**: Questions 14 to 25

2.4 ONTARIO'S WATER QUANTITY MANAGEMENT FRAMEWORK QUESTIONS

A series of questions (**Appendix B:** Questions 27 to 30) was asked regarding specific statements related to how adequately water taking is currently managed in Ontario. For all statements, 55% to 60% of respondents indicated that water takings are inadequately managed. **Table 3** summarizes the results with more specific details provided in **Appendix B**. The majority of respondents (~75%) also indicated that apart from PTTW decisions, there are other water and land use planning decisions that strongly influence water quantity in their geographic region (**Appendix B:** Question 31).

Table 3: With regards to their region, percent respondents who Disagree with the Specific Water Taking Statement.*

Approximate % of Respondents who Disagree**	Specific Water Taking Statement
~55%	Ontario's regulatory and policy framework for managing water takings is adequate to respond to current or potential future water scarcity in my geographic region caused by human factors such as population growth and permitted & unpermitted water takings.
~60%	Ontario's regulatory and policy framework for managing water takings is adequate to respond to current or potential future water scarcity in my geographic region caused by drought, seasonal and long term climate variability & climate change.
~60%	Ontario's existing provincial & local data, science, and management tools that are available to support water taking decisions are adequate to respond to current or potential future water scarcity in my geographic region caused by human factors such as growth and permitted & unpermitted water takings.
~60%	Ontario's existing data, science, and management tools that are available to support water taking decisions are adequate to respond to current or potential future water scarcity in my region caused by drought, seasonal and long term climate variability & climate change.

*For more details refer to **Appendix B:** Questions 27 to 30

**% Respondent calculated by adding the respondents who selected one of the following choices: strongly disagree and disagree.

2.5 CONSIDERATIONS FOR SUSTAINABLY MANAGING WATER RESOURCES IN ONTARIO

The last series of questions asked Water Manages to indicate from their perspective the level of importance of a number of topics for the MECP to consider in enhancing its framework for managing water use in Ontario. Water Managers ranked most topics as high or moderate in importance for the MECP to consider in enhancing the framework for managing water use. Assessing and managing the CE of multiple water takings within an area was ranked as high by the most Water Managers (91%). **Table 4** summarizes the results with more specific details provided in **Appendix B:** Questions 32 to 45. A number of additional topics were also provided by the Water Managers for the MECP to consider in enhancing its framework for managing water use in Ontario (**Appendix B**: Question 46). Topics included items such as funding, data management and availability; collaboration between government and local water users etc.

Table 4: Percent respondents who ranked topics as HIGH in importance.*

Percent of Respondents	Topics for the MECP to consider in enhancing its framework for managing water use in Ontario
91%	Assessing and managing the cumulative effects of multiple water takings within an area
81%	Planning and preparing to manage water takings during drought.
81%	Assessing the long term sustainability of water resources
77%	Protecting environmental flows
74%	Setting priorities of water use to guide water taking decisions during critical times of water shortage
73%	Monitoring & reporting on water resources (groundwater, surface water, climate)
70%	Monitoring and reporting water use
68%	Considering ground and surface water interaction in water taking decisions
64%	Collaboration among Ontario Government agencies, Indigenous communities, municipal governments and Conservation Authorities and other non-government stakeholders (e.g. water users) in making water taking decisions
57%	Assessing the impact of climate change on future water resources
45%	Enhancing water conservation requirements for permitted water takings
30%	Conflict Resolution among water uses (priority of uses)
26%	Enhancing public/stakeholder involvement in making water taking decisions
21%	Additional requirements related to water taking for the purpose of water bottling

*For more details refer to **Appendix B**: Questions 32 to 45

2.6 SURVEY KEY FINDINGS

The vast majority of responses were from Water Managers located in Southern Ontario. Limited feedback was received from Indigenous Community representatives, private well supply representatives and those located in Northern Ontario. Additional consultation is required to gather input from individuals representing these communities, locations and water supplies where limited feedback was obtained.

The top three water quantity management concerns applicable to the Water Manager's area (from the list provided in the survey) were: (1) concerns regarding the impacts of current or potential challenges or conflict related to growth pressures; (2) concerns relating to the quality of the available water supply; and (3) water quantity concerns/complaints related to private wells.

The majority of Water Managers indicated that water takings are inadequately managed under Ontario's regulatory and policy framework. Modifications to the framework should ensure that Ontario's regulatory and policy framework for managing water takings is adequate to respond to current or potential future water scarcity and that provincial and local data, science, and management tools are available to support water taking decisions to adequately respond to current or potential future water scarcity. Two of the top three topics, identified by the Water Managers, for the MECP to consider in enhancing its framework also included water takings. The top three responses (from the list provided in the survey) were: (1) Assessing and managing the cumulative effects of multiple water takings within an area; (2) Planning and preparing to manage water takings during drought; and (3) Assessing the long term sustainability of water resources. A number of additional topics were also provided by the Water Managers for the MECP to consider in enhancing its framework for managing water use in Ontario.

All listed data sources were considered valuable by the majority (85% - 98%) of Water Managers with climate data (meteorological data), stream flow monitoring data and population growth projections being identified as valuable by the most number of Water Managers. The respondents indicated a number of additional (not listed) data sources and data as being valuable such as the OGS data, soil moisture data and land use data. It was also identified that more data and/or tools are needed for all listed water quantity resources and management topics. The top two areas in which the Water Managers identified more available data and/or tools are needed include: (1) to adequately assess sustainability (ability to meet current needs,

without compromising the ability of future generations to meet their own needs (environment, economic and societal values based assessment) and (2) to assess the effects of climate change on water resources from a quantity perspective.

3. METHODOLOGY AND OVERVIEW OF MEETINGS

Three (3) three-hour Water Manager Workshops were held in Guelph, Kingston and Toronto on April 24th, 25th and 27th in 2018 respectively.

3.1 ATTENDANCE & REPRESENTATION

One hundred and eighty-five (185) invitations to the workshops were sent out to Water Managers from or representing Municipalities, Conservation Authorities, Indigenous Communities, Professional Associations (e.g. Professional Engineers of Ontario) and Consultants. In total, sixty-five (65) Water Managers and representatives attended the workshops with thirty (30), eighteen (18) and seventeen (17) Water Managers attending the Guelph, Kingston and Toronto workshops respectively. **Table 5** details the number of Water Managers in attendance and which types of organizations were represented. The vast majority of attendees represented areas located in Southern Ontario; only one attendee represented Northern Ontario. Also, there were only three individuals associated with or representing Indigenous Communities in attendance. An attendance list is provided in **Appendix C**.

Table 5: Number of Water Managers (WM) who were invited and who attended

Type of Agency	# of WM Invited	# of WM in Attendance	Percent Attendance Based on # of WM Invited from Type of Agency	Percent Attendance Based on Total # of Attendees
Professional Associations & Consultants	7	6	86%	9%
Municipalities	70	24	34%	37%
Conservation Authorities	69	31	46%	49%
Indigenous Communities / Representative	39	3	8%	5%
Total	**185**	**65**		**35%**

3.2 METHODOLOGY

The workshops consisted of a plenary session with presentations followed by breakout discussion groups to solicit feedback and gather information from the Water Managers. The workshop agenda and the plenary session presentation slides are provided in **Appendix D**.

There were four facilitated breakout discussion groups planned (two groups per topic) on the following:

- Topic 1: Assessing and managing cumulative effects and environmental flows on an area basis (watershed, aquifer, municipal, other); and
- Topic 2: Drought planning and priority of use as a conflict resolution tool

In the Toronto workshop only three breakout discussion groups were held due to the number of participants. With two groups discussing Topic 1 and one group discussing Topic 2.

Facilitators and note takers were allocated for each breakout session to capture the discussion and input provided by the Water Managers. Two facilitators were from BluMetric and two were from the MECP. Task 1 and Task 2 subject matter experts from BluMetric were available to go between breakout groups to provide detailed topic specific support as required. A workshop worksheet with discussion questions was prepared to assist the Facilitator by providing key questions that could be asked related to the respective topic and help guide the conversation. This worksheet was available during the discussion groups for participants to review. The facilitator used a flip chart to assist in facilitating the discussion as well as capturing some comments, while the note takers captured detailed comments of the discussion. A copy of the facilitator worksheet is provided in **Appendix D**.

4. SUMMARY AND EVALUATION OF WORKSHOP DISCUSSIONS

After the workshops, Discussion Summaries for each breakout session / group discussion were prepared from key points and comments raised. The Summaries are based on a compilation of comments captured as part of several different recordings of the discussion including the summary comments noted on a flip chart during the discussion, digital notes taken during the discussion as well as clarification provided during and after the workshop as obtained through telephone conversations, email and formal written submissions. The Summaries of each

discussion group are provided in **Appendix E**. Based on the key topics to be discussed, a number of related subjects arose during the discussions. From the broader subject matter discussed, categories were created in order to better capture, summarize and compare the feedback received on the topics between the different groups. The overall workshop summary and evaluation of the feedback is provided below.

4.1 WORKSHOP SUMMARY

The workshop summary below presents:

1. Feedback received on the Science and Jurisdictional Reviews presented during the plenary sessions.
2. A summary of the breakout group discussions for Topic 1: Assessing and Managing Sustainable Water Resources.
3. A summary of the breakout group discussions for Topic 2: Managing Water Resources When Water is Scarce.
4. A summary of key takeaways from the above discussions

Of note, the feedback received on the Science and Jurisdictional Reviews was limited and is discussed below in Section 4.1.1. Greater feedback was received on other approaches, models and tools such as SWP models and water budgets which the Water Managers were familiar with. This feedback is presented below under the Topic 1 and Topic 2 specific discussion summaries. It was noted that the discussions at the different workshops were influenced by lived experience in their region. For example, the drought of 2016 in Eastern Ontario was reflected in comments at the Kingston workshop. There were some common themes / categories that were discussed throughout the workshops in the Topic specific discussions; these included: scale, data needs, triggers, funding, integration of policies and programs, roles and responsibilities, enforcement, local knowledge, development and specific programs (OLWR, SWP and PGMN).

4.1.1 Science and Jurisdictional Review Feedback

One of the objectives of the workshop discussions was to: provide an opportunity for Water Managers to give feedback on the applicability of the approaches and tools found in the science and jurisdictional reviews to Ontario. Information regarding the different approaches and tools

was presented to the Water Managers during the plenary session of the workshops. The slide decks of the presentations were also provided to the Water Managers on April 23rd, the day before the Guelph workshop. For information and details on the presented approaches / tools please refer to the slide decks provided in **Appendix D**.

Limited feedback was received on the approaches/tools presented. The reason for this is attributed to time constraints to present, review and discuss the technical merits of each in detail. However, two noteworthy discussions of the approaches/tools presented were the Michigan Tool and the California Model.

Water Withdrawal Assessment Tool (WWAT) (Michigan, US)

During a discussion on CE (Topic 1), participants from a Guelph discussion group were concerned that the Michigan tool was too simplistic for use across Ontario and that it was potentially unreliable for assessing CE. The tool could potentially work at a regional (i.e. municipal) scale but not on a provincial scale. While it covers a broader area and range of environmental / water resources conditions it cannot accommodate all the environmental complexities needed for Ontario as a whole.

California Drought Contingency Plan

During a discussion on drought planning (Topic 2), participants from a Guelph discussion group identified that the California model is an example of planning for resilience in the water supply system. This model could be looked at in terms of how it addresses all water sources (the entire water cycle).

4.1.2 Topic 1: Assessing and Managing Sustainable Water Resources

Topic 1: Assessing and Managing Sustainable Water Resources was discussed by six (6) groups: two (2) in Guelph; two (2) in Kingston and two (2) in Toronto. There were two main sub topics: Assessment of CE including Environmental Flow Needs, and Managing CE. The two sub-topics were often discussed together throughout the workshops, as such, both assessment and management are presented together under identified main categories that arose during the discussions.

General Statement(s)

CE and EFN assessments are considered useful and needed tools for current and future water quantity management in consideration of climate change, population growth and EFN. The Water Managers indicated that an integrated water management approach is needed where both surface water and groundwater are assessed together as a whole system.

Most discussions with the Water Managers around the sub topic of Management of CE suggested that the Ministry should consider the SWP process and the Tier 3 water budget models implemented for municipal drinking water systems could / should (recommendation varies) be used for managing water quantity beyond municipal supplies. One group in Guelph also identified that there should be a suitable timeline to revisit Tier 2 water budgets to incorporate new data (as original Tier 2 budgets were completed in 2008) and prepare for impacts of climate change and population growth. This implies that new data may necessitate the need to develop a Tier 3 water budget model at some point in the not too distant future. It was also commonly indicated that current programs and tools used in Ontario such as the PTTW and OLWR should be harmonized, integrated and expanded upon. For example, in the Guelph discussion, Whitemans Creek was used as an example of this where different triggers, OLWR triggers as well as interference on a municipal well from a cluster of PTTW led to revisiting the original Tier 2 water budget assessment and examining the assessment in more detail. This assessment determined that all the PTTW sources were clustered in the same area within the zone of influence of the municipal well. As a result, MECP and Ministry of Natural Resources and Forestry (MNRF) funded a pilot study to complete a more detailed assessment including modelling.

When discussing EFN assessments Water Managers agreed that any approach taken needs to be stream specific, ecology dependent and incorporate local knowledge. They also indicated that assessments will require Provincial support as monitoring EFN is resource intensive. Funding is needed for additional staff to collect the necessary stream flow data / install gauges to complete an EFN assessment. In the Kingston discussion, some issues and thoughts with current EFN approaches were discussed. For example, the frequency analysis of 7Q20 for Environmental Activity and Sector Registry (EASRs) was discussed as not really being possible or reliable. It was also mentioned that the Geological Survey of Canada (GSC) has their own guidelines where they use base flow assessments using HYDAT data (both the federal method and MNRF's Ontario Flow Assessment Tool (OFAT)). It was noted that all these methods need to incorporate other factors such as surface water / groundwater interaction and geological

setting for example the Ontario Stream Assessment Program (OSAP) which includes a module on identifying groundwater upwelling in streams. In the Kingston discussion it was noted that Quinte Conservation has data (benthic data, flows, water quality) but needs support combining and analyzing this data in order to be able to complete an EFN Assessment.

Roles and Responsibilities

The discussion of roles and responsibilities was discussed in general throughout the workshops with the Kingston workshop specifically indicating that clarification of the roles and responsibilities of municipalities, Conservation Authorities and provincial level government are needed during drought conditions with respect to the assessment of CE.

Capacity (Funding / Resource)

The need for additional capacity for those responsible for managing and assessing water quantity including assessing and managing CE was discussed at all workshops. Municipalities, Conservation Authorities and other regional groups indicated that more funding is/will be needed for the following: model maintenance; data collection (especially for base flow data which is key for CE and EFN assessments); staff resources and local experts; and independent water monitoring by First Nations.

In addition to comments received at the workshops, feedback was provided by letter from a participant whose jurisdiction does not include a Conservation Authority (CA) or larger municipal tax base. The written submission indicates that while they support a watershed based scale approach, the Province needs to consider a funding model that provides long-term, ongoing financial support for Water Managers and their organizations where a CA or larger municipality, and the associated level of technical expertise, is absent. In these areas, organizations and smaller municipalities are struggling to meet current implementation requirements in executing their various planning responsibilities.

Scale

The need for provincial direction and guidelines (for example within a policy framework) with local implementation and flexibility for assessing CE and EFN was specified at most workshops. This was elaborated upon by various discussion groups which indicated that the province should/could provide a selection of acceptable approaches/tools/models for local regions to use in assessing CE and EFN within a framework. It was also identified that assessments cannot be completed province-wide and should be completed at a local sub-watershed scale. For

example, from the Kingston workshop it was noted that EFN assessments need to be water body specific and are dependent on the specific ecology of that water body. There needs to be flexibility within the guidelines/framework to incorporate local conditions and requirements (e.g. Whitemans Creek Case Study was mentioned in Guelph and briefly described above – details provided in Case Study Section below).

Three additional specific comments to highlight are:

1. The North in general has water quantity concerns (e.g. the Albany River only had a few feet of water over the drinking water intake). Currently there are no/few Conservation Authorities or SWP areas (e.g., Mattawa area) in the North. There needs to be an agency or consortium to be responsible for the assessment and management of water quantity in the North.
2. In the Guelph workshop, it was noted that Provincial source protection funding is risk based, for example if risk/problems are identified, assessment proceeds to the next tier and funding is provided. Funding is also needed for other items. For example, it was also mentioned that some areas have funding for data collection but funding is also required for management such as data acquisition, infrastructure, retaining staff and monitoring.
3. The Province is encouraged to consider how to implement the policy framework outside of the Conservation Authority model. The concept of implementing on a watershed scale is supported but using non Conservation Authority organizations and potentially other ministries (in areas of the province where there would be a gap) must be an option to consider and must include a delivery framework.

Data Needs/Management

Data requirements and data management were discussed extensively in all of the workshops and it was noted that varying degrees of data needs exist. For example, in the Toronto workshop it was noted that data exists (e.g. precipitation models, PGMN) but often Water Managers are not aware of or cannot find the available data. All the workshops discussed the need for increased sharing of data including the integration of data sets between CAs, the province, municipalities and consultants. One challenge noted with respect to data sharing is privacy and the intellectual property rights associated with consultant data.

A database platform was also mentioned in Toronto as a possible consideration for sharing data; however, it was recognized that this is not always practical or possible. The Oak Ridges Moraine Program was specified as an example program where lots of data is provided to a common source and available to all for a user fee.

Specific data needs, gaps and enhancements were discussed in all the workshops and included the following main comments:

- Private sector water taking data and data on takings under 50,000 L/day (below permitted threshold) is needed to fully understand the impacts of water taking on an aquifer for CE assessment (Guelph discussion).
- In order to properly assess CE, data is needed on actual takings under a PTTW versus the maximum permitted (Toronto, Kingston and Guelph discussions).
- Baseline data is needed for assessing CE now and into the future (Guelph Discussion)
- Increased temporal data is key for assessing CE and sustainable management of water resources as conditions are often dynamic (Toronto Discussion).
- Enhancements to the PGMN are needed to provide better spatial data (Kingston and Guelph Workshop). This includes the need for a greater density of PGMN groundwater monitoring wells and increased shallow aquifer wells in priority areas.
- Increased geographic coverage is also required within the HYDAT monitoring station network (Guelph discussion).
- Increased surface water data is needed for assessing EFN (Guelph and Kingston) especially for priority cold water creeks (Guelph).

Three specific comments to highlight include:

- In Guelph, participants noted that Provincial guidance on data requirements would be beneficial in justifying the need for additional data.
- Significant data exists within source protection regions where there has been a tier 1, 2 and 3 study completed. It would be beneficial to have the same type of data for priority areas outside of source protection regions across the province.

- It was recognized, in the Guelph discussions, that it would be helpful if certain key permit holders were required to collect certain types of data / level of information similar to that required by major water bottling companies as part of the permit renewal process beyond actual takings and water levels. For example, it would be beneficial for areas where the density of quarry operations is significant or above average, to report daily takings in real-time similar to major water bottling companies. This would support the assessment of CE and EFN for assessments beyond the site scale.

Details on modelling information and models in general is provided below following the sections on Local Knowledge/Capacity and Triggers/Indicators.

Local Knowledge/Capacity

Local knowledge and capacity was discussed at all workshops. It was recognized that local knowledge is often necessary when assessing CE and EFN as well as the overall assessment of water resources. Due to the 2016 drought, in Kingston it was noted that local capacity is being built and local knowledge was necessary to respond to drought. For example, based on the 2016 drought there is now an understanding that fish are at risk in some parts of the watershed. During the drought, a local mitigation approach was implemented based on the knowledge of local biologists. This plan included moving fish from ponded areas by hand. This emphasizes the fact that local knowledge can be used to identify at risk areas as well as to assess and monitor those areas. The Whiteman's Creek example above also demonstrates the need for local knowledge.

The need for consistent sustainable funding to support local staffing is needed to resource and manage data, assessment and Tier 3 models, including local experts to run the models.

Triggers/Indicators

Triggers identified from the various workshops which could prompt the need for more detailed studies on CE or EFN include: multiple or significant takings; irrigation; historical issues; municipal supply; population growth; and cold water fisheries. It was identified at all workshops that stressed/at risk areas should be a priority for enhanced science and management such as for CE and EFN assessments and it was noted in Guelph that EFN should not solely be focused on assessing the impact on fish but the approach should be flexible enough to be able to incorporate other environmental priorities if local knowledge indicates the need. The Kingston and Toronto workshops both discussed the need for a groundwater trigger in the OLWR

Program as currently the OLWR is mainly triggered by surface water levels impacted by the lack of precipitation. This is especially relevant in Prince Edward County where shallow wells run dry during drought conditions.

Drought indicators were also discussed in the Kingston and Toronto workshops. Indicators need to be based / assessed on a local scale and could include soil moisture and wetland functions/levels. It was also mentioned that remote sensing provides rapid/continuous measurement versus gauges and could be considered for assessing drought conditions.

Models

Models to assess CE and EFN need to integrate both surface water and groundwater. Models are also needed for different scales; a local approach to take into account local conditions and takings is needed. When modelling CE the modeller and model users need to be cognizant of the limitations of the model. Example case studies / models given during the discussions are discussed below under Specific Case Study/Model. Tier 3 models is discussed under the SWP section immediately below.

Programs

Source Water Protection

All workshops mentioned that the SWP process could be expanded to other aspects of water quantity assessment and management outside of municipal water supply. For example it was mentioned in Kingston that the SWP water budget Tier 3 models and tiered risk based approach is appreciated and this approach could be used for CE assessments as well. Toronto workshop attendees mentioned that this program could cover other areas with water quantity needs such as EFN. The comment was also raised that there is a need for water quantity management tools to assess the impacts of water takings in areas outside of SWP areas as wells as those not covered by Conservation Authorities. This is especially true for Northern Ontario. Northern areas would like to be included in the SWP framework and/or have more CAs. Similar conversations were had regarding the SWP program under Topic 2. For more details please refer to page 24 below.

Ontario Low Water Response Plan

As mentioned previously in triggers/indicators, there is a need for there to be a groundwater trigger incorporated into the OLWR Plan as currently the OLWR is mainly triggered by surface water levels impacted by the lack of precipitation. In addition to the above noted comments,

the OLWR needs to be focused on the source of water in the area (needs to be on a local scale). One additional relevant comment was that baseflow data was not available in one region for certain creeks and as a result Level 3 drought conditions could not be declared under the OLWR program when it needed to be. Enhancements to the program to be able to declare droughts are required for data poor regions. Similar conversations were had regarding the OLWR program under Topic 2. For more details please refer to page 25 below.

Permit to Take Water

The PTTW program was discussed in the Toronto workshop as a key tool needing some policy program enhancements for CE and EFN. Water use reduction conditions linked to the OLWR Plan could be included in PTTWs. However, there needs to be flexibility based on significance of takings and local conditions. For example, for rural municipalities reducing PTTW volumes upstream of the municipal drinking water system may not necessarily be a significant amount therefore may not change aquifer or stream levels (Kingston discussion). It was also mentioned that Provincial guidance documents need to be updated to incorporate examples of CE and EFN assessments for the purpose of the PTTW application process (Guelph discussion).

Integration of Policy/Programs

Integration of policies and programs was discussed at the various workshops. It was generally recognized that one integrated provincial approach is needed for managing CE and water quantity in general. Currently there is conflicting advice between government agencies (e.g. MECP, Ministry of Natural Resources and Forestry (MNRF), Ministry of Municipal Affairs and Housing (MMAH)). For example there are conflicting mandates between growth and drought planning/conservation. Integration of programs could include the linking of the PTTW program with OLWR Plan; permits could specify conditions for reducing water withdrawals during Level 1/2/3 drought. Integration of programs could also include coordination between the PTTW program and the SWP program; private well developments for subdivisions should need a PTTW.

Enforcement

The following two points were said during a Kingston discussion with respect to enforcement:

- Current plans/policies have limitations with respect to enforcement. For example, PTTWs are individually managed with voluntary reporting process.

- A resource planning working group of all relevant bodies (municipalities/Conservation Authorities/ Province and key private stakeholders) could be formed to ensure a coordinated approach. It needs to be formalized to ensure attendance.

Voluntary/mandatory reductions and enforcement was discussed in greater detail during the discussions on Topic 2 (refer to pages 26 and 27 below).

Development Planning

The Kingston and Toronto workshops discussed the need for water quantity supply needs to be better integrated and assessed in development planning. One Toronto discussion mentioned that some jurisdictions "require" a "net zero" approach to maintaining post-development recharge in residential areas in municipal systems with a risk of water quantity stress. It was suggested that this approach could be considered more broadly.

The approach could require that a water balance of a proposed new water supply system should be maintained through mitigation of infiltration deficits including technical solutions and mandatory mitigation in significant groundwater recharge areas, creation of policies which maintain the water balance of a system and consider the carrying capacity of the system. It was noted that typically there are conflicting priorities between EFN and population growth/human needs.

Communication/Education

Different aspects of communication were discussed at all the workshops. For example, it was identified in Toronto that there is a need to establish (re-establish) community networks to identify local needs, stresses, and priorities. OLWR committees should be keeping communication channels open and meeting more often even when there is plenty of water and this is a challenge due to time commitment and competing short term and longer term priorities.

In Kingston communication was discussed with regards to coordinating messaging around the fact that different actions are sometimes needed depending on the source of water (groundwater versus surface water) and reduction needs/requirements. An example included the conflicting messages between the message being communicated by South Nation Conservation Authority and the City of Ottawa during OLWR Level 2 conditions in the watershed in 2017. The City of Ottawa residents who relied upon the City of Ottawa's central

drinking water system did not need to conserve water as their water is sourced from the Ottawa River and deep aquifers which were not significantly impacted; however, residents who relied on private well systems and those drawing from open surface water sources needed to practice conservation for different technical reasons. One participant indicated that the City of Ottawa encouraged people to water grass so it would not catch on fire if a cigarette fell on it.

In Guelph the discussion focused on the need for better communication and coordination between municipalities located in the same watershed and subject to the same Source Protection Plan. Also, better communication, education and outreach to private water takers is needed on water quantity management (CE and EFN). Private takers need to collect and report their own data but it would be helpful to be able to share and compile this data with public water taking data in order to better assess CE and EFN in an area of interest.

Specific Case Studies/Models

Whitemans Creek

In the Guelph discussions, Whitemans Creek was provided as an example of an assessment of CE and EFN which incorporated local conditions and data as well as stress to fish within the model. Data and individuals with local knowledge were needed to complete the assessment. The CA completed a Climate Change Assessment using the MNRF climate change guidance for water budgets. CA did not use MNRF OLWR definition to identify the three levels of low water conditions. Instead they used a definition that included stress to fish and substituted this site specific Level 2 definition and included this ecological response (when fish cannot move between pools and become stressed) in the assessment. This CA found the assessment useful as a first step in climate change assessments; however the CA is moving away from a climate scenario modeling approach and instead moving more towards a risk assessment approach for climate change planning.

Oak Ridges Moraine Program & Ecologically Significant Groundwater Recharge Areas

The Oak Ridges Moraine database was mentioned in Guelph as a model platform that could be applied province wide. It was also mentioned in Toronto that there is a need to integrate groundwater and surface water into models to assess for EFN. SWP models can be used and supplemented by base models, such as models used in the Oak Ridges Moraine (ORM) and ecologically significant groundwater recharge models, to assess impacts of takings and impacts on specific features.

A follow-up email provided additional information regarding the model used for EFN. An initial hydrological numerical model at Central Lake Conservation Authority (CLOCA) was developed under the SWP Program. Using this SWP numerical model as a base, CLOCA was able to develop more numerical models including, the Oak Ridges Moraine Conservation Plan (ORMCP) Model and the Ecologically Significant Groundwater Recharge Areas (ESGRA) Model. CLOCA Staff identified areas of ecological importance, such as wetlands, stream channels and natural features and provided the information to their consultants, in order for the consultant to use the existing ESGRA model to delineate groundwater recharge areas that feed the identified ecological features. Details of the study and full report can be downloaded from CLOCA website: http://cloca.ca/spp/index.php.

Other Models

Another example model/approach which the MECP could look at is the one used in the United Kingdom (mentioned in the Guelph discussions). The approach integrates surface water and groundwater information and is therefore an approach which avoids conflicting results and inconsistencies.

Another example mentioned in Kingston that could be used by other municipalities is the groundwater studies completed in the South Nation watershed. These studies were completed on a municipal scale where the CA, OGS and municipalities worked together to create a data management tool so that data could be shared. In this example, the data tool is used to support evaluation of development permits in areas with poor water quality. The studies reduced the sample spacing based on OGS methodology to develop the plots and identify areas where development permits were unlikely to be granted due to poor water quality.

4.1.3 Topic 2: Managing Water Resources When Water is Scarce

Topic 2: Managing Water Resources When Water is Scarce was discussed by 5 groups: two (2) in Guelph; two (2) in Kingston and one (1) in Toronto. Due to limited workshop attendees in Toronto only one group on this topic was established. There were two subtopics: Drought Planning and Priority of Use. Key topics and salient points are presented below.

4.1.3.1 Drought Planning

The discussions from all workshops indicated that a proactive approach to drought planning is needed. Proactive drought planning could include conservation and efficiency in new infrastructure (buildings); establishment of drought plans, contingency plans and priorities of use developed prior to drought conditions. In addition, both discussion groups in Guelph specified that drought planning and preparedness is especially needed when watersheds cross jurisdictional/municipal boundaries. The theme of focusing on the resiliency of the water supply system within the drought planning process also arose during discussions in two different workshops (Kingston and Guelph).

Roles & Responsibilities

Discussions from both the Toronto and Kingston workshops included comments regarding the need for the roles and responsibilities, of all stakeholders, with respect to drought planning, preparedness and management to be clearly defined and communicated. This includes who has authority over the various elements of drought planning.

Capacity (Funding /Resources)

It was identified at all workshops that increased funding and staff resources is required for Conservation Authorities, Ontario Low Water Response (OLWR) teams and municipalities to successfully develop and implement proactive drought plans. This includes funding to enforce any required water reductions.

Scale

The discussions from all three workshops specified that drought planning should have provincial guidance with local program development and implementation. This was elaborated upon by various groups which indicated that standard tools could be developed for local regions, Conservation Authorities and/or municipalities to select from. Local flexibility within the drought planning policy framework is needed as conditions (e.g. physical, socioeconomic values and local agency capacity) as well as available data are very different between areas and regions of the province. One group from Guelph also indicated that implementation should be on a municipal level/subwatershed scale and that this process has been started through the Tier 3 water budgets completed under the SWP Program.

Data Needs / Management

Data needs including data management were discussed extensively in all of the workshops and it was noted that varying degrees of data needs exist.

From the Toronto workshop it emerged that there is a lot of data collected by various groups within the area; however, better data management, sharing of data and communication regarding the existence of data is required to support drought planning.

The need for additional groundwater data was discussed in both the Kingston and Guelph workshops. This additional data is needed to support/defend decisions (e.g. land use planning and reductions/conservation decisions), quantify voluntary/required reductions, model on a PTTW scale, as well as for conflict resolution. Specific data needs mentioned included:

- accessible real time groundwater data;
- actual volume of water taking data under the PTTW; and
- water taking data for takers below the permitted threshold (50,000L/day) and agriculture and/or exempted uses.

Enhancement of the PGMN data was also discussed. Toronto participants indicated that there is a need for increased analysis of the data; and Kingston participants indicated that an assessment of the data is needed to determine its accuracy and representativeness.

One Guelph discussion raised data and the use within models. It was emphasized that data needs to be shared on what water is actually being taken under a PTTW in order to model on a PTTW scale. Also discussed, was the disconnect between models and how the PTTW data is considered. Most models look at water availability over 'average' days. This contrasts with PTTWs that are set at permitted water taking rates which are usually more than actual water takings. Also there are times (days, weeks, months or years) when water is not taken under a permit and therefore the effects of the PTTW on the water system are not considered in a representative way in a model looking at daily averages. The difference between actual water taking and permitted rates in the PTTW, however, adds a buffer to the area of interest being managed. A fire (or other emergency) could drastically increase short term needs for a municipality for example. The PTTW cannot be easily reduced to only reflect actual water taking.

Database

The creation of a database platform was discussed in both Kingston and Guelph, with the former indicating the need for MECP data to be more available and that this could be accomplished through the creation of a database platform, and the latter indicating the need for an accessible database with a process for the Ministry and others (e.g. municipalities and Conservation Authorities) to provide feedback and update information.

Triggers

The topic of drought triggers was discussed at all workshops.

Kingston workshop discussions mentioned that ecological assessments and triggers are needed for drought planning. In the Toronto workshop it was suggested that to support the development of ecological drought triggers historical PGMN data that was gathered during drought conditions and is available could be analyzed and compared with data collected from a biologist/ecologist during the same drought period. Drought triggers could be developed based on what the biologist/ecologist were observing at the various stages of drought.

Also, in Kingston, both groups indicated that soil moisture data could be used as a drought trigger. This data would need to be collected and analyzed. Soil moisture data can also be an indicator of the near-future irrigation needs of farmers and golf courses.

Programs

Source Water Protection Program

The SWP program was discussed at all workshops. Two workshops (Kingston and Toronto) mentioned that the MECP should consider expanding the SWP program beyond municipal areas. Toronto participants indicated that this program is already well understood by Water Managers and others. Guelph discussions identified that municipalities with Tier 3 water budgets are looking at how they can use them more broadly in the management of water quantity resources. Guelph discussions also indicated some small municipalities have wanted to take SWP Tiered Water Budget process to the next level but did not meet the risk factors set out by the SWP program.

OLWR Program

Discussed, in both Kingston and Guelph, was the need for groundwater triggers in the OLWR Program. Currently the OLWR is based on triggers related to surface water and related parameters. The Kingston discussions noted that private groundwater wells had previously gone dry in some regions while surface water levels were adequate.

In addition to adding groundwater triggers to the OLWR program, other possible program enhancement and support was discussed at both the Kingston and Guelph workshops. It was noted that Provincial guidance is needed on what data/information is required in order to declare and define a Level 3 low water condition. Also, guidance is needed on how to build and maintain an OLWR team that is adequate in size and keeps all stakeholders informed. Currently, building and maintaining OLWR teams can be a challenge as it is not legislated for teams to meet. It was also noted that drought conditions can be declared too late under the program. For example, in Guelph the surface water intake is not useable because of low water levels well before an OLWR declaration. It should be noted, however, that the OLWR is supported in particular by smaller municipalities as it provides a definitive time when water reductions should be made, despite the specified needed improvements to the program.

Integration of Policies and Programs

At both the Kingston and Guelph workshops it was noted that there is a need for more integrated policies and plans between agencies including the MNRF and the MECP. Also there should be less compartmentalization of programs such as: the OLWR Program, Watershed Planning, and the SWP Program.

Tools/Maps/Assessments

All three workshops included discussions on assessments and tools that could be considered and/or used to support drought planning by focusing on the higher risk regions or the cause of the drought.

In the Guelph workshop discussions, it was specified that drought planning should be based on a broad drought assessment, which would evaluate the potential risk areas that could be impacted by drought (i.e. based on history and potential climate change impacts), and the actions to mitigate the drought impacts could be focussed on high risk areas. The assessments need to be at the correct scale.

In Kingston, a group specified that an assessment of climate-driven drought versus low water as a result of water takers needs to be considered in drought planning. It was noted that water taking reductions may not have an impact on aquifer levels during a climate driven drought. To prepare for climate-driven drought, tools which can be considered include: education on water conditions and contingency actions; having back-up water supplies; planned sharing of resources between municipalities and overall proactive planning.

Toronto participants indicated that a provincial hydrogeological / hydrological properties map and mapping the availability and vulnerability of water resource zones across the province is needed/could be developed to support drought planning to understand where the largest water takings / withdrawals are. The map could be developed based on risk (e.g. map growth areas first). Also, map out high risk areas and of low, medium and high vulnerability (example, resiliency of groundwater resources; provincially significant wetlands etc.). The map could be developed on a tiered process based on the level of sensitivity of various environmental features.

Voluntary/Mandatory Reductions & Enforcement

There was feedback at the workshops around voluntary and mandatory reductions as well as enforcement of water reductions. The following were key items which came out of the discussions.

The Guelph discussions mentioned the need to proactively try to regulate water conservation before mandatory reductions are required. For example, require water auditing for industries or large takers.

It was also noted by both the Kingston and Guelph workshops that in order to enforce water reductions a tool/method is needed to be able to quantify the required reductions needed. There is a need to quantify the water level and flows needed to sustain both EFN and business needs before requests are made to meet the required reductions. Also, information is needed about actual volume of water takings as permit holders should be asked to reduce based on actual takings (as opposed to maximum permitted). Finally, quantifying the impact of voluntary and/or mandatory reductions is needed after reductions have occurred to discuss/assess the effectiveness of reductions and the resulting impact of reductions.

When voluntary conservation does not work, mandatory implementation of conservation measures with an ability to enforce the required reductions is needed. Currently, with the exception of municipal by-laws, only education and outreach are available as tools for implementing reductions.

Enforcement was a topic that was mentioned or discussed at all workshops. Key points made include: legislation / regulations are needed to enforce mandatory water reductions when voluntary conservation is not working (Toronto); municipalities need to have the willingness to implement and enforce water restrictions (this is a potential conflict as a reduction in water use can lead to a reduction in revenue); sector specific conservation measures could be required in PTTWs; during OLWR it is the Province's responsibility to enforce PTTW conditions. It was mentioned in Guelph that mandatory reductions during drought conditions could be included in a PTTW but there needs to be flexibility based on sensitivity of source and use.

In Kingston, it was noted that standardized water conservation measures/practices for local industries would be beneficial, which include contingency planning, and continual reassessment during drought. However, flexibility is needed as individual users should develop what works for their industry to reduce. There needs to be flexibility in approaches to accommodate for different sectors of water users and ways to conserve and be efficient with the available water. Water conservation in agriculture is an example of this where more efficient irrigation methods and diversification of crops can be considered as options.

Development Application Needs

Development and planning issues were discussed. It was noted that guidance is needed on how to assess the impact of private takers (e.g. subdivision or industrial operation) and that developments require greater assessment from a water quantity / drought planning perspective prior to being approved. Currently there is the potential to approve developments that perhaps would not be approved if assessed appropriately with respect to CE. It was also mentioned in Toronto that there are conflicting priorities between drought plans and growth plans. The Toronto discussion group provided a number of thoughts for consideration on development including the following points:

- An entity is needed to better regulate developments based on water availability;
- A PTTW where CE are considered should be required for a large development;

- Assessments need to occur during the planning phase – PTTW assessments come too late in the process;
- Municipalities need to be involved in the development planning if the development can affect its water supply regardless of whether it is within the municipality;
- The environment needs to be considered in the water use planning process;
- Functional servicing studies was suggested as a tool that could be considered to address / incorporate permitting at the planning stage, before the development. Water needs should be looked at before the land is broken into individual service lots.
- To obtain a building permit there needs to be a requirement to demonstrate enough water supply in areas of water scarcity.

An additional discussion point that arose in the Kingston workshop was that the MECP could update D-5-5 Private Wells: Water Supply Assessment for subdivision/development projects to include drought considerations.

Communication/Education

The need for increased communication and/or education and outreach was discussed in both the Kingston and Guelph workshops. The discussions indicated that increased communication with and education of the public and other stakeholders is needed regarding a number of items including drought planning and water consumption reductions. One group from Kingston indicated that better communication to the public of what uses are considered non-essential uses (under the OLWR program), as well as specifying which reductions will have an impact on overall water levels would be good. There is also a role for broader education to change use behaviour in all sectors (e.g. water reuse and low impact developments). A group in Guelph also discussed the requirement for improved communication and messaging (e.g. voluntary reductions) to all stakeholders (including public, private takers and agricultural water takers) using different communication methods. Examples of communication methods were provided such as phone calls, signage, and visibly displaying current water levels. Also noted in Guelph and Kingston was that sometimes different communication messages with respect to different sources is needed. For example the City of Ottawa sources water from the river and did not need to conserve surface water but groundwater users did need to conserve. These differing messages can be confusing to the general population if the context is not communicated.

4.1.3.2 Priority of Use

Priority of use was discussed with respect to drought planning. There were varying opinions on the need for priority of use and which sectors should get priority. Some participants felt prioritization is needed; some felt prioritization is needed in times of water scarcity only. Some Water Managers indicated that proactively developing priorities within drought plans could avoid conflicts. A common point is that, similar to Source Water Protection, Provincial guidance should be provided with potential tools (provide a tool kit) for local implementation and decision-making if required. Guidance from the province is needed with local flexibility during implementation.

One Guelph discussion also indicated that existing rules and regulations should be implemented and enforced before developing any new requirements. For example, provision to provide water supply already assigns priority in O. Reg. 170. Some developments beyond a certain size have mandatory requirement for a regulated small water system which mitigates installation of multiple wells and septic systems as the area grows until a large costly system is needed. However, this still happens regardless of existing planning rules.

One of the Kingston discussions also mentioned that a vulnerability assessment should be completed in order to prioritize water supplies as certain areas will have a higher priority over others.

5. OVERALL SUMMARY – KEY WORKSHOP TAKAWAYS

The Water Managers Workshops gathered input from Water Managers through three regional workshops. Through a pre-workshop survey as well as during the individual regional workshops the Water Managers provided input based on their practical experiences and knowledge gained through the challenges they experienced during the execution of their duties as Water Managers.

The Water Managers were presented with the key findings from the Science and Jurisdictional Reviews. Very little opportunity was available for them to incorporate the results of these studies into their thinking and input during the regional workshops due to limited time available to familiarize themselves with the findings in advance of the workshops. The studies concluded that the many aspects of water management are very interrelated and an integrated approach is required. Leading up to the workshops, the Science and Jurisdictional Reviews indicated that many of the areas that need to be addressed to effectively manage water in Ontario are likely already addressed through existing policies and programs. Two areas possibly requiring additional development are Cumulative Effects (CE) and Environmental Flow Needs (EFN).

A cohesive and integrated framework that addresses all aspects of water management including policy, approaches, tools and science would assist to provide a clearer understanding and vision for all to adopt throughout Ontario. This would reduce or eliminate any conflict in mandated objectives implemented by departments with potentially conflicting expectations and outcomes. Particularly relevant are conservation requirements at odds with the requirements for development in growth areas. Integration of objectives and mandates of various departments and agencies would ensure consistency and common outcomes but with the flexibility to be applied at a level that can take regional and local conditions into account during implementation.

A Provincial framework developed and implemented by the Provincial authorities would need to be supported by local knowledge and data. Data collection and management at the scale to provide relevant inputs to the management tools including predictive models are required to ensure relevance of the model as a useful tool for regional and local water management. Extensive amounts of data have been identified but are often scattered in several places and not easily available to those who would need to use them in effectively completing their responsibilities as Water Managers. The increased access to data is limited by a lack of integration of datasets where they exist, by confidentiality constraints and by a lack of a requirement to share the data imposed on the keepers of the data. More ready access to data would enable Water Managers to complete a more comprehensive assessment of water conditions on a local and regional scale. Ideally there would be a broad sharing of data collected through current programs augmented with additional data sourced through requirements imposed by Permits and annual reporting. Existing programs are good but in many cases limited to specific circumstances. Additional data collection is also required in areas where there are limited data available. The expansion of existing programs including source water protection

beyond Municipal Tier 3 water budget models or similar and a platform similar to the Oak Ridges Moraines data portal for data collection and management with adaption to local requirements would be beneficial in priority areas. The continued collection of data over time augmented with new data collections in areas where there is a lack of data will allow for a temporal trend analysis in areas where water quantity management is an emerging issue. A review of the trends and clear thresholds and action levels would enable an adaptive management approach for dealing with low water conditions, conservation, cumulative effects and water security.

A proactive approach to drought planning would be beneficial especially in priority and high risk areas and should have provincial guidance with local program development and implementation. Local flexibility within the drought planning policy framework is needed as conditions (e.g. physical, socioeconomic values and local agency capacity) as well as available data are very different between areas and regions of the province. Although varying opinions were received on both the need for priority of use and which sectors should receive priority, priority of use should be addressed through provincial guidance with potential tools for local implementation and decision making as/if required. Provincial Guidance should allow for flexibility of implementation at the local level depending on the local overarching priorities based on primary industries, human and environmental health needs and related socio-economic factors.

The following are key takeaways from the synthesis of the workshop discussion groups:

- A consistent provincial approach to water quantity management which enables local decision making is needed.
    - Clear definitions of the roles and responsibilities of the various agencies are needed.
    - A common set of scientific assessment requirements and management tools across ministries (MECP, MMHA, MNRF), legislation and programs dealing with water quantity (e.g. planning, resourcing, permitting, quarry approvals and drought plans) are needed to avoid the impact of conflicting mandates, evaluation and assessment outcomes. An example of conflicting mandates would include growth pressures versus water conservation.

  - Provincial oversight and direction on acceptable assessment and management tools with built in flexibility to allow for local / regional government assessments, triggers and management needs is encouraged.
  - Stronger ties are needed between MECP PTTW and MNRF OLWR programs. Support for enforceable tools, similar to OLWR declarations was expressed. This would assist in enforcing the reduction of permitted water use during times of scarcity. Some Water Managers indicated that enforcement should be on a provincial level.

- Some Water Managers suggested that local / regional governance should focus on municipalities, Conservation Authorities and / or source protection committees (not a new level of governance); others requested some kind of entity that was not any of these, for example areas where there is no Conservation Authority or source protection committee established.
- SWP water budget models (Tier 3) implemented for municipal drinking water systems could / should (recommendation varies) be used for managing water quantity beyond municipal supplies in priority areas.
  - Many consider a screening tool or line of evidence such as a Tier 2 water budget, not a definitive or adequate decision making tool for high risk or priority areas.
  - Some Water Managers suggested similar models be developed to address water quantity issues beyond municipal water supply aquifers.
  - Guelph area Water Managers are looking for funding and a mandate to use, maintain and manage their new source protection models for managing water quantity more broadly.
  - Concern regarding use of models beyond the purpose for which they were developed. For example, limiting conditions, such as model boundary conditions, infiltration settings, used in developing a model to protect a municipal supply aquifer, may not be appropriate for use in predicting impacts from a quarry, water bottler or other takings without considerable changes to the model.
- In priority areas or areas where stress has been observed, area based approaches should be considered.
  - It was identified by Water Managers that stressed / at risk areas should be a priority for enhanced science and management such as for CE and EFN assessments. For example, an at risk area could be an area where there are multiple or significant water takings.

- Some Water Managers suggested that drought planning should be based on a broad drought assessment, which would evaluate the potential risk areas that could be impacted by drought (e.g. based on history and potential climate change impacts), and the actions to mitigate the drought impacts could be focused on high risk areas. The assessments need to be at the correct scale.
- Assessments of climate-driven drought versus low water as a result of multiple water takers should also be considered in drought planning.
- It was suggested that water quantity supply needs to be better integrated and assessed in development planning where water shortages have been experienced in the recent past. Regional water needs should be looked at before the land is approved to be broken into individual service lots.
- A suggestion by a Water Manager in the Toronto workshop indicated that mapping the availability and vulnerability of water resource zones across the province to support drought planning could be beneficial. The map could be developed based on risk and sensitivity of various environmental features.

- Mixed feedback was received on the need for priority of use. Some Water Managers indicated that proactive prioritization is needed; some others indicated prioritization may be needed in times of water scarcity only. The province should provide a decision making process (guidance) with the flexibility for Water Managers to make decisions based on local priorities at the time of drought and priorities may differ depending on the resource and month. Local rather than province wide decision making should occur.
  - A suggestion at the Guelph workshop indicated that priority of use should be used and tied to the Provincial growth plan and Places to Grow requirements (i.e. protection of future municipal supply and prioritization in times of scarcity).
  - Some Water Managers in Eastern Ontario are looking for the Province to provide tools to manage developments on private wells and quarries during times of drought.
- There is a shortage of adequate groundwater data, agency capacity and funding to use and analyze data. This is seen as a significant barrier to evaluating current water quantity needs.
  - This affects how accurate modelling can be in predicting changes in water quantity.
  - The Water Managers indicated that Cumulative Effects is notoriously difficult to quantify, and the lack of data further contributes to this problem.

  - Lack of funding to support data collection, management and assessment is a hindrance to the management of water quantity in many local areas.
  - First Nations representatives that attended the workshops stated the importance of enabling First Nations to do their own groundwater monitoring. More funding would be required for this.
  - Actual water taking data and data on takings under 50,000 L/day (below permitted threshold) would be beneficial for drought planning (including assessing and implementing voluntary/mandatory reductions) and to fully understand the impacts of water taking on an aquifer for the purpose of CE assessments.
- Better / increased communication / education is needed between all stakeholders to proactively plan for periods of drought and during drought conditions. For example:
  - There is a role for broader education to change use behaviour in all sectors (e.g. water reuse and low impact developments).
  - Increased communication regarding which water uses are considered non-essential (under the OLWR program), as well as specifying which reductions will have an impact on overall water levels (surface water) would be beneficial.

Respectfully submitted,
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APPENDIX A

Survey Questionnaire

Ministry Of Environment and Climate Change (MOECC) Water Managers Workshop Survey

General Information

Survey Purpose:

- **Gather preliminary information on Ontario's water quantity management framework from the perspective of Ontario's Water Managers**
- **Supplement the input that will be received at the Water Managers Workshops**

Ontario's water quantity management framework: The policies, programs and science used by the Ministry of the Environment and Climate Change (MOECC) in the management of water use.

1) Please provide your name.*

_____

2) Please provide the name of your organization or community.*

_____

3) Please identify the capacity or role in which you are providing your responses (if you wish to provide your responses in more than one context you will need to complete separate surveys for each context you wish to address. Please contact Kendra Leek at kleek@blumetric.ca to obtain additional unique survey links):*

( ) Municipal supply

( ) Indigenous community water supply

( ) Source water protection authority

( ) Conservation authority

( ) Communal and private water supply

( ) Other - Write In (Required): _____*

4) Where does your drinking water supply come from (pick all that are appropriate)?*

[ ] Surface water – river or creek

[ ] Surface water – inland waters

[ ] Surface water – Great Lakes

[ ] Groundwater – overburden

[ ] Groundwater – bedrock

[ ] Groundwater – surface water interaction (linked system)

5) What level of water quantity assessment water budgeting has been completed for your area?*

[ ] Tier 1 Water Budget through Source Water Protection Program

[ ] Tier 2 Water Budget through Source Water Protection Program

[ ] Tier 3 Water Budget through Source Water Protection Program

[ ] None

[ ] Other - Write In (Required): _____*

6) What are the water <u>quantity</u> management concerns in your area (pick all that are appropriate)?*

[ ] Concerns regarding the ability to provide sufficient water now and in the future

[ ] Concerns related to the quality of the available water supply

[ ] Water quantity concerns / complaints related to private wells

[ ] Water quantity concerns / complaints between permitted takers

[ ] Concerns regarding impacts of current or potential challenges or conflict, related to growth pressures

[ ] Concerns regarding impacts of current or potential challenges or conflict, related to water resource sustainability

[ ] Known or potential impacts of taking on surface water baseflow or aquatic ecological systems identified

[ ] Ministry of Natural Resources and Forestry (MNRF) Low Water Response Program - low water declarations often triggered in drier years

[ ] Low natural resiliency to drought

[ ] Insufficient data or knowledge available to adequately assess the sustainability of water resources in your area

[ ] Inadequate legislative or regulatory tools to enable you to address the water quantity concerns in your area

[ ] Other - Write In (Required): _____*

Approaches and Tools

Approaches and Tools for Assessing Water Quantity Resources to Sustainably Manage the Water Resources in Your Area

For this series of questions, please identify with respect to your area if you have the data and tools needed to adequately assess the following:

7) Water resources from a quantity perspective*

( ) Necessary data and assessment tools (methodology, approach, model, criteria or other) are available and are adequate

( ) Necessary data is available but tools are not available or are inadequate

( ) Necessary tools are available but data is insufficient

( ) Neither necessary tools nor data are available

( ) Not necessary / relevant to my area

8) Environmental Flow Needs - the quantity, quality and timing of water flows (the hydrological regime) required to sustain freshwater ecosystems*

( ) Necessary data and assessment tools (methodology, approach, model, criteria or other) are available and are adequate

( ) Necessary data is available but tools are not available or are inadequate

( ) Necessary tools are available but data is insufficient

( ) Neither necessary tools nor data are available

( ) Not necessary / relevant to my area

9) Effects of climate change on water resources from a quantity perspective*

( ) Necessary data and assessment tools (methodology, approach, model, criteria or other) are available and are adequate

( ) Necessary data is available but tools are not available or are inadequate

( ) Necessary tools are available but data is insufficient

( ) Neither necessary tools nor data are available

( ) Not necessary / relevant to my area

10) Effects of population growth and changing land uses on water resources from a quantity perspective*

( ) Necessary data and assessment tools (methodology, approach, model, criteria or other) are available and are adequate

( ) Necessary data is available but tools are not available or are inadequate

( ) Necessary tools are available but data is insufficient

( ) Neither necessary tools nor data are available

( ) Not necessary / relevant to my area

11) Cumulative effects of multiple water takings on water resources*

( ) Necessary data and assessment tools (methodology, approach, model, criteria or other) are available and are adequate

( ) Necessary data is available but tools are not available or are inadequate

( ) Necessary tools are available but data is insufficient

( ) Neither necessary tools nor data are available

( ) Not necessary / relevant to my area

12) Water security assessment – the ability to safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human well-being, and socio-economic development, and for preserving ecosystems (needs based assessment)*

( ) Necessary data and assessment tools (methodology, approach, model, criteria or other) are available and are adequate

( ) Necessary data is available but tools are not available or are inadequate

( ) Necessary tools are available but data is insufficient

( ) Neither necessary tools nor data are available

( ) Not necessary / relevant to my area

13) Sustainability assessment – ability to meet current needs, without compromising the ability of future generations to meet their own needs (environment, economic and societal values based assessment)*

( ) Necessary data and assessment tools (methodology, approach, model, criteria or other) are available and are adequate

( ) Necessary data is available but tools are not available or are inadequate

( ) Necessary tools are available but data is insufficient

( ) Neither necessary tools nor data are available

( ) Not necessary / relevant to my area

Availability of Data

Availability of Data

In this series of questions, please indicate how valuable to your work the following sources of data are or could be if made more accessible.

14) Permits to Take Water (PTTW) including such information as the number of permits, the purpose of taking and the maximum permitted volumes*

( ) Not valuable

( ) Somewhat not valuable

( ) Neutral

( ) Somewhat valuable

( ) Very valuable

( ) Unsure

15) Actual daily water taking volumes in the Water Taking and Reporting System (WTRS)*

( ) Not valuable

( ) Somewhat not valuable

( ) Neutral

( ) Somewhat valuable

( ) Very valuable

( ) Unsure

16) Groundwater level monitoring data in the Provincial Groundwater Monitoring Network (PGMN)*

( ) Not valuable

( ) Somewhat not valuable

( ) Neutral

( ) Somewhat valuable

( ) Very valuable

( ) Unsure

17) Stream flow monitoring*

( ) Not valuable

( ) Somewhat not valuable

( ) Neutral

( ) Somewhat valuable

( ) Very valuable

( ) Unsure

18) HYDAT stream flow gauge low-flow statistics*

( ) Not valuable

( ) Somewhat not valuable

( ) Neutral

( ) Somewhat valuable

( ) Very valuable

( ) Unsure

19) Climate data - meteorological*

( ) Not valuable

( ) Somewhat not valuable

( ) Neutral

( ) Somewhat valuable

( ) Very valuable

( ) Unsure

20) Climate data - current climate change projections*

( ) Not valuable

( ) Somewhat not valuable

( ) Neutral

( ) Somewhat valuable

( ) Very valuable

( ) Unsure

21) Population growth projections*

( ) Not valuable

( ) Somewhat not valuable

( ) Neutral

( ) Somewhat valuable

( ) Very valuable

( ) Unsure

22) Well Records (WWIS)*

( ) Not valuable

( ) Somewhat not valuable

( ) Neutral

( ) Somewhat valuable

( ) Very valuable

( ) Unsure

23) Base flow data*

( ) Not valuable

( ) Somewhat not valuable

( ) Neutral

( ) Somewhat valuable

( ) Very valuable

( ) Unsure

24) Cold water fisheries mapping*

( ) Not valuable

( ) Somewhat not valuable

( ) Neutral

( ) Somewhat valuable

( ) Very valuable

( ) Unsure

25) Your organization / community's own data sets*

( ) Not valuable

( ) Somewhat not valuable

( ) Neutral

( ) Somewhat valuable

( ) Very valuable

( ) Unsure

26) Please indicate any relevant data that you rely on that may have been missed in the previous set of questions and indicate the value it has to your organization.

_____

_____

_____

_____

Ontario's Water Quantity Management Framework

Ontario's water quantity management framework (policy, program and science)

From your regional perspective, please indicate your level of agreement with the following statements related to how water taking is currently managed in Ontario.

27) Ontario's regulatory and policy framework for managing water takings is adequate to respond to current or potential future water scarcity in my geographic region caused by human factors such as population growth and permitted and unpermitted water takings.*

( ) Strongly disagree

( ) Disagree

( ) Neutral

( ) Agree

( ) Strongly agree

( ) Unsure

28) Ontario's regulatory and policy framework for managing water takings is adequate to respond to current or potential future water scarcity in my geographic region caused by drought, seasonal and long term climate variability and climate change.*

( ) Strongly disagree

( ) Disagree

( ) Neutral

( ) Agree

( ) Strongly agree

( ) Unsure

29) Ontario's existing provincial and local data, science, and management tools that are available to support water taking decisions are adequate to respond to current or potential future water scarcity in my geographic region caused by human factors such as growth and permitted and unpermitted water takings.*

( ) Strongly disagree

( ) Disagree

( ) Neutral

( ) Agree

( ) Strongly agree

( ) Unsure

30) Ontario's existing data, science, and management tools that are available to support water taking decisions are adequate to respond to current or potential future water scarcity in my geographic region caused by drought, seasonal and long term climate variability and climate change.*

( ) Strongly disagree

( ) Disagree

( ) Neutral

( ) Agree

( ) Strongly agree

( ) Unsure

31) Apart from permit to take water decisions, there are other water and land use planning decisions that strongly influence water quantity in my geographic region.*

( ) Strongly disagree

( ) Disagree

( ) Neutral

( ) Agree

( ) Strongly agree

( ) Unsure

Considerations for Sustainably Managing Water Resources in Ontario

Considerations for sustainably managing water resources in Ontario

For each topic listed below please indicate from your perspective the level of importance of each for the Ministry of the Environment and Climate Change (MOECC) to consider in enhancing its framework for managing water use in Ontario.

32) Conflict resolution among water users (priority of uses).*

( ) Not relevant

( ) Unsure

( ) Low

( ) Moderate

( ) High

33) Collaboration among Ontario Government agencies, Indigenous communities, municipal governments, and Conservation Authorities, and other non-government stakeholders (e.g., water users) in making water taking decisions.*

( ) Not relevant

( ) Unsure

( ) Low

( ) Moderate

( ) High

34) Enhancing public/stakeholder involvement in making water taking decisions.*

( ) Not relevant

( ) Unsure

( ) Low

( ) Moderate

( ) High

35) Considering ground and surface water interaction in water taking decisions.*

( ) Not relevant

( ) Unsure

( ) Low

( ) Moderate

( ) High

36) Assessing and managing the cumulative effects of multiple water takings within an area.*

( ) Not relevant

( ) Unsure

( ) Low

( ) Moderate

( ) High

37) Protecting environmental flows.*

( ) Not relevant

( ) Unsure

( ) Low

( ) Moderate

( ) High

38) Planning and preparing to manage water takings during drought.*

( ) Not relevant

( ) Unsure

( ) Low

( ) Moderate

( ) High

39) Setting priorities of water use to guide water taking decisions during critical times of water shortage.*

( ) Not relevant

( ) Unsure

( ) Low

( ) Moderate

( ) High

40) Enhancing water conservation requirements for permitted water takings.*

( ) Not relevant

( ) Unsure

( ) Low

( ) Moderate

( ) High

41) Assessing the impact of climate change on future water resources.*

( ) Not relevant

( ) Unsure

( ) Low

( ) Moderate

( ) High

42) Assessing the long term sustainability of water resources.*

( ) Not relevant

( ) Unsure

( ) Low

( ) Moderate

( ) High

43) Monitoring and reporting water use.*

( ) Not relevant

( ) Unsure

( ) Low

( ) Moderate

( ) High

44) Monitoring and reporting on water resources (groundwater, surface water, climate).*

( ) Not relevant

( ) Unsure

( ) Low

( ) Moderate

( ) High

45) Additional requirements related to water taking for the purpose of water bottling.*

( ) Not relevant

( ) Unsure

( ) Low

( ) Moderate

( ) High

46) If a topic was missed in the preceding questions that you feel would be important for the MOECC to consider in enhancing its framework for managing water use in Ontario please provide details below.

_____

_____

_____

_____

Thank You!

Thank you for taking our survey. Your responses are very important to us.

APPENDIX B

Survey Results

Report for Ministry Of Environment and Climate Change (MOECC) Water Managers Workshop Survey

Ministry Of Environment and Climate Change (MOECC) Water Managers Workshop Survey

1. Please provide your name

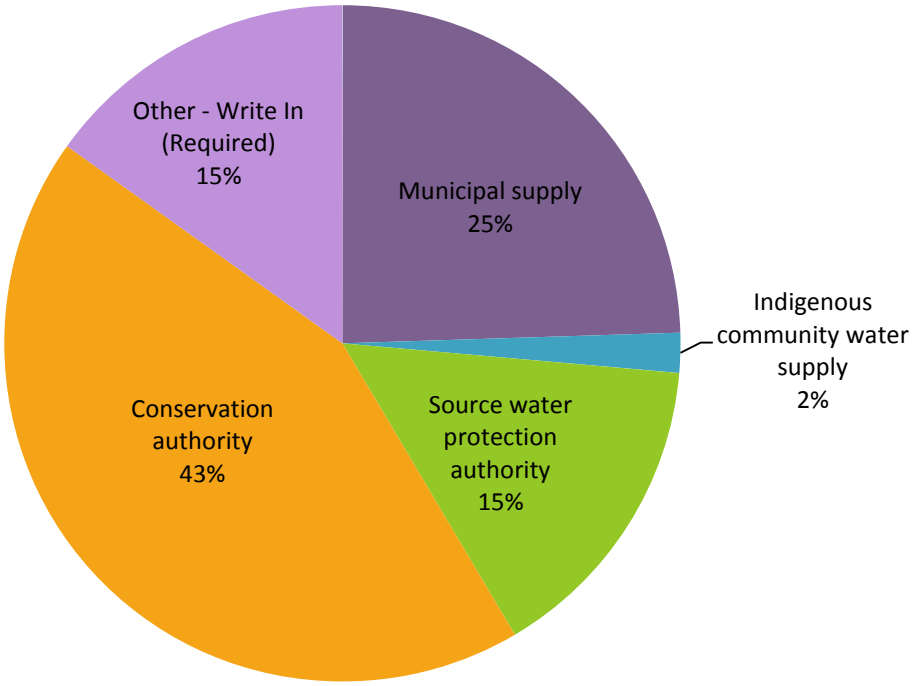
Names have been omitted from this overall report.

2. Please provide the name of your organization or community.

Count	Response
3	Quinte Conservation
2	Central Lake Ontario Conservation Authority
2	City of Guelph
2	Conservation Ontario
2	Grand River Conservation Authority
2	Long Point Region Conservation Authority
2	Ontario First Nations Technical Services Corporation
1	Ausable Bayfield Conservation Authority
1	CRCA
1	Cataraqui Region Conservation Authority
1	City of Guelph Water Services
1	City of Ottawa
1	Conservation Halton
1	County of Brant
1	Credit Valley Conservation Authority
1	Dragunas
1	GRCA
1	Ganaraska Region Conservation Authority
1	Grey Sauble CA
1	Kawartha Conservation
1	Kettle Creek Conservation Authority

Count	Response
1	LSRCA
1	Lake Simcoe Region Conservation Authority
1	Lakehead Region Conservation Authority
1	Municipality of North Perth
1	Municipality of South Huron
1	NVCA
1	Niagara Peninsula Conservation Authority
1	Norfolk County
1	Oak Ridges Moraine Groundwater Program
1	Oxford County
1	Raisin Region Conservation Authority
1	Region of Peel
1	Rideau Valley Conservation Authority
1	Severn Sound Environmental Association
1	South Nation Conservation
1	Stantec Consulting Ltd.
1	TRCA
1	Town of Niagara on the Lake
1	Township of Centre Wellington
1	Wellington Source Water Protection
1	Wood
1	Wood/APGO (Hamilton)
1	York Region
1	MVCA

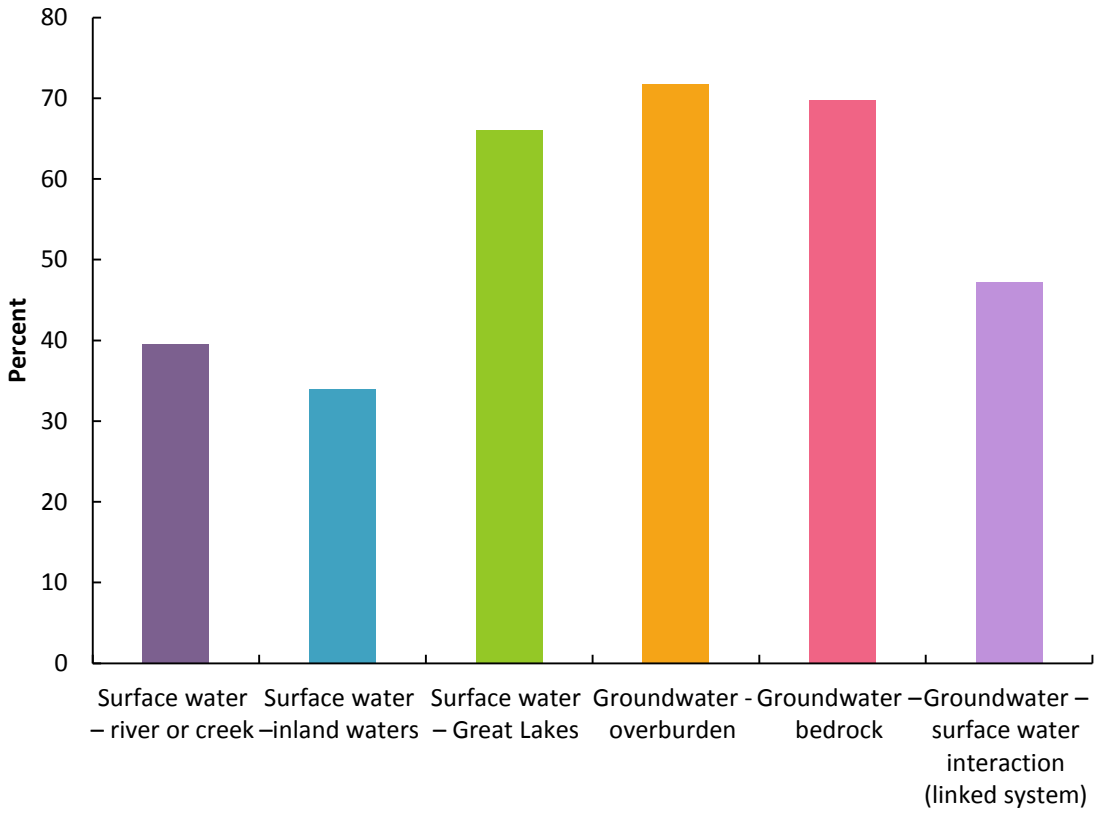
3. **Please identify the capacity or role in which you are providing your responses (if you wish to provide your responses in more than one context you will need to complete separate surveys for each context you wish to address. Please contact Kendra Leek at kleek@blumetric.ca to obtain additional unique survey links):**



Value	Percent	Count
Municipal supply	24.5%	13
Indigenous community water supply	1.9%	1
Source water protection authority	15.1%	8
Conservation authority	43.4%	23
Other - Write In (Required)	15.1%	8
	Totals	53

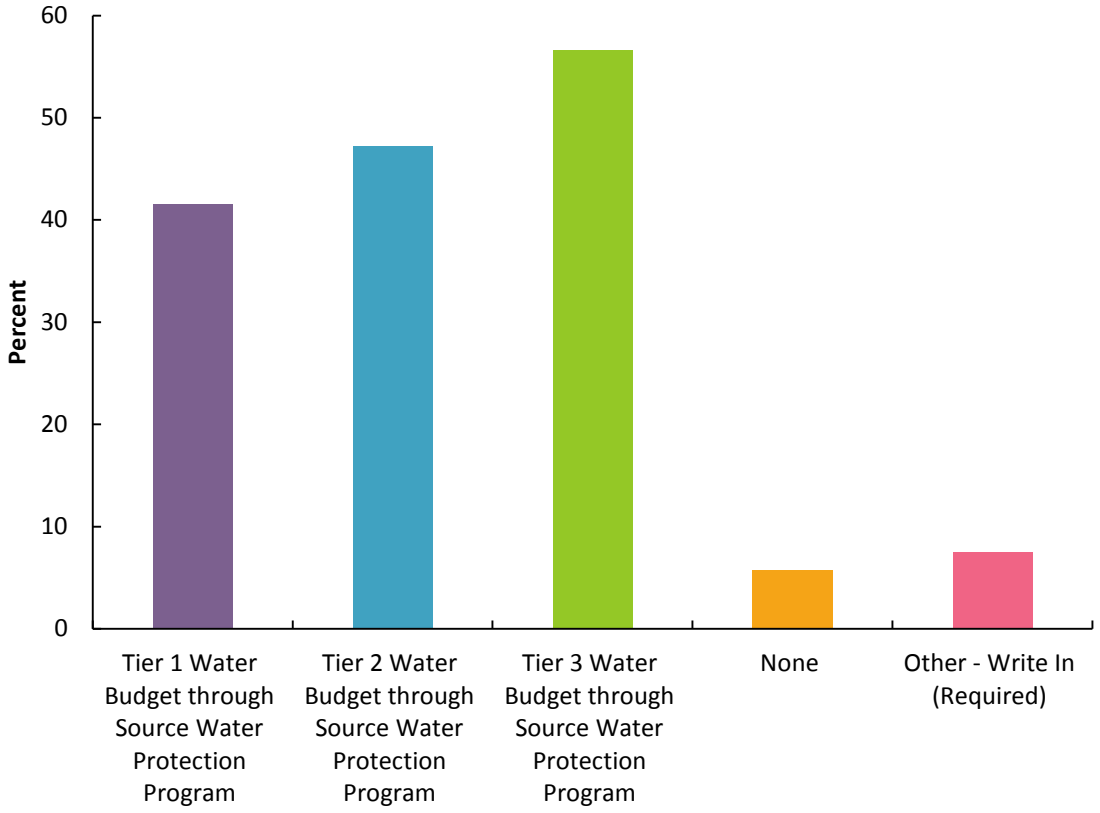
Other – Write In (Required)	Count
Conservation Authority and Source Protection Authority	1
Consultant/APGO	1
Indigenous - Advisory Services	1
LPRCA watersheds	1
Municipal Planning	1
Support all Source protection authorities	1
Water Management Expert with international experience	1
Choices 1, 3 and 4.	1
Totals	8

4. Where does your drinking water supply come from (pick all that are appropriate)?



Value	Percent	Count
Surface water – river or creek	39.6%	21
Surface water – inland waters	34.0%	18
Surface water – Great Lakes	66.0%	35
Groundwater – overburden	71.7%	38
Groundwater – bedrock	69.8%	37
Groundwater – surface water interaction (linked system)	47.2%	25

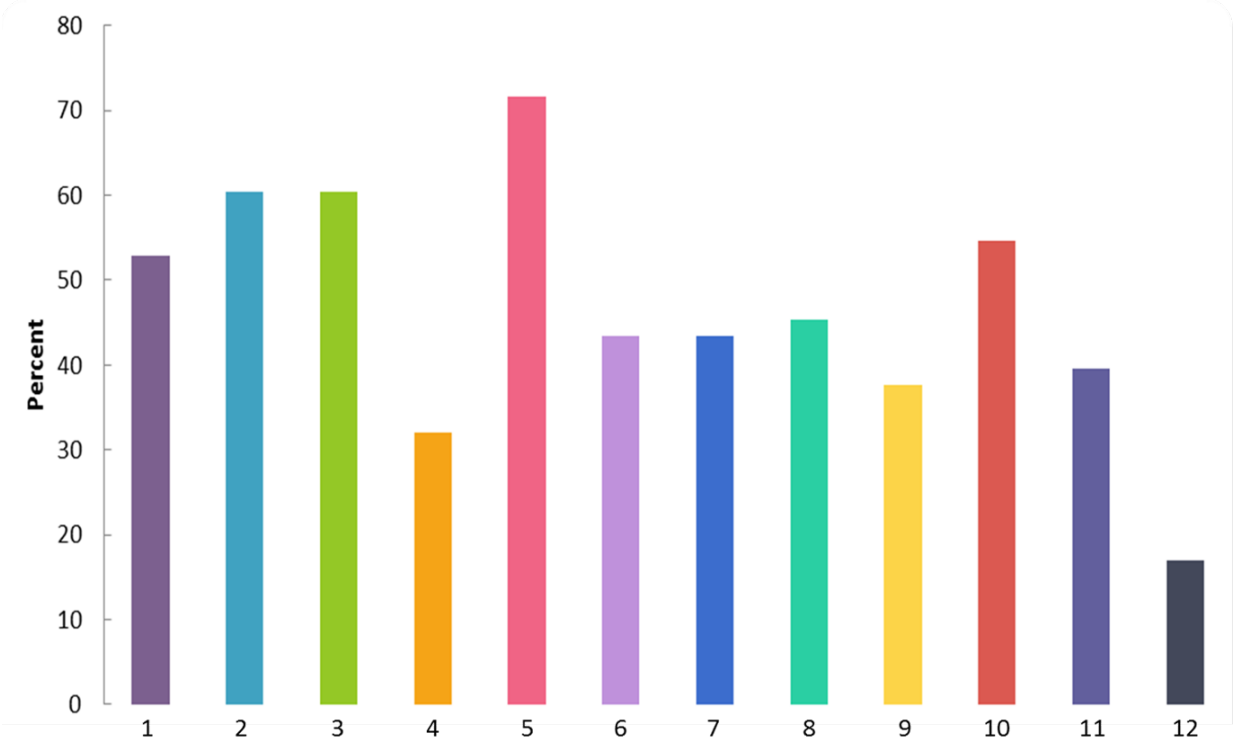
5. What level of water quantity assessment water budgeting has been completed for your area?



Value	Percent	Count
Tier 1 Water Budget through Source Water Protection Program	41.5%	22
Tier 2 Water Budget through Source Water Protection Program	47.2%	25
Tier 3 Water Budget through Source Water Protection Program	56.6%	30
None	5.7%	3
Other - Write In (Required)	7.5%	4

Other – Write In (Required)	Count
Do not follow status of SWP where I live	1
I support all source protection authorities	1
Varies in region	1
Work Province Wide	1
Totals	4

6. **What are the water quantity management concerns in your area (pick all that are appropriate)?**



Value	Percent	Count
(1) Concerns regarding the ability to provide sufficient water now and in the future	52.8%	28
(2) Concerns related to the quality of the available water supply	60.4%	32
(3) Water quantity concerns/complaints related to private wells	60.4%	32
(4) Water quantity concerns / complaints between permitted takers	32.1%	17
(5) Concerns regarding impacts of current or potential challenges or conflict, related to growth pressures	71.7%	38
(6) Concerns regarding impacts of current or potential challenges or conflict, related to water resource sustainability	43.4%	23
(7) Known or potential impacts of taking on surface water baseflow or aquatic ecological systems identified	43.4%	23
(8) Ministry of Natural Resources and Forestry (MNRF) Low Water Response Program - low water declarations often triggered in drier years	45.3%	24

Value	Percent	Count
(9) Low natural resiliency to drought	37.7%	20
(10) Insufficient data or knowledge available to adequately assess the sustainability of water resources in your area	54.7%	29
(11) Inadequate legislative or regulatory tools to enable you to address the water quantity concerns in your area	39.6%	21
(12) Other - Write In (Required)	17.0%	9

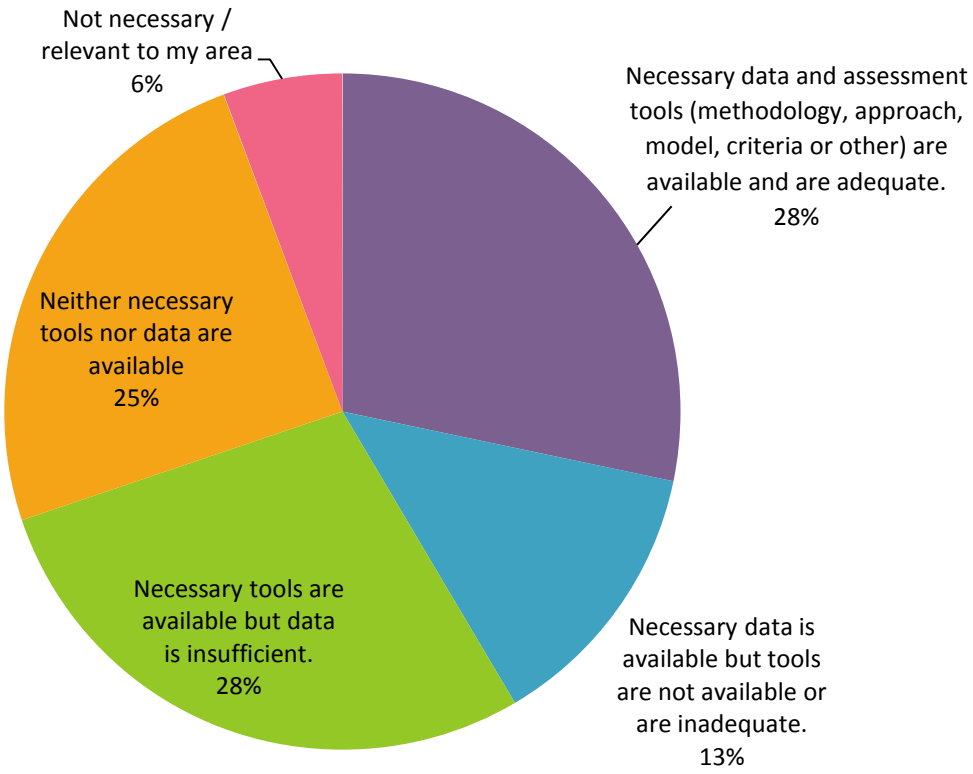
Other – Write In (Required)	Count
Concerns related to the ability, cost and timeliness of approvals to develop needed water supplies. Lack of water conservation efforts fairly among users. Insufficient knowledge available to understand and consider natural resiliency to drought. The fact that none of these concerns are represented in the list above.	1
Cumulative impacts from abstraction and discharge very difficult to assess/evaluate due to lack of data sharing/reporting and lack of industrial data sharing etc.	1
NA	1
No concerns	1
Public concern regarding large PTTW users (water bottling, quarries and large manufacturing)	1
Single-tier municipality and lack of cross jurisdictional responsibilities	1
Work Province Wide	1
impacts of climate change on quantity	1
unknown impacts from climate change	1
Totals	9

Approaches and Tools

Approaches and Tools for Assessing Water Quantity Resources to Sustainably Manage the Water Resources in Your Area

For this series of questions, please identify with respect to your area if you have the data and tools needed to adequately assess the following:

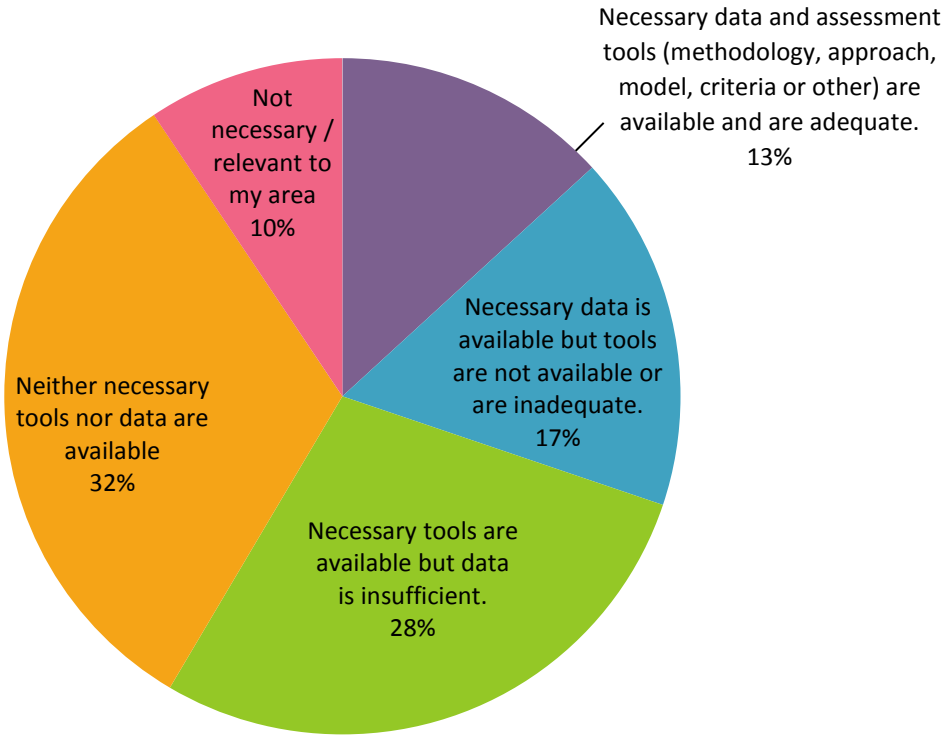
7. Water resources from a quantity perspective



Value	Percent	Count
Necessary data and assessment tools (methodology, approach, model, criteria or other) are available and are adequate.	28.3%	15
Necessary data is available but tools are not available or are inadequate.	13.2%	7

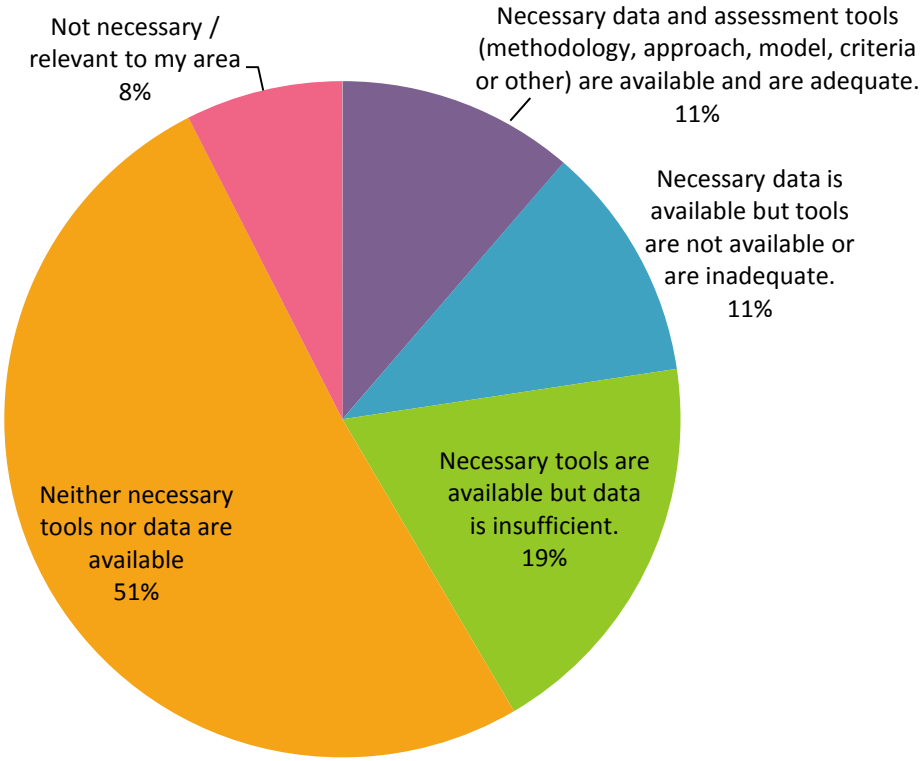
Value	Percent	Count
Necessary tools are available but data is insufficient.	28.3%	15
Neither necessary tools nor data are available	24.5%	13
Not necessary / relevant to my area	5.7%	3
	Totals	53

8. Environmental Flow Needs - the quantity, quality and timing of water flows (the hydrological regime) required to sustain freshwater ecosystems



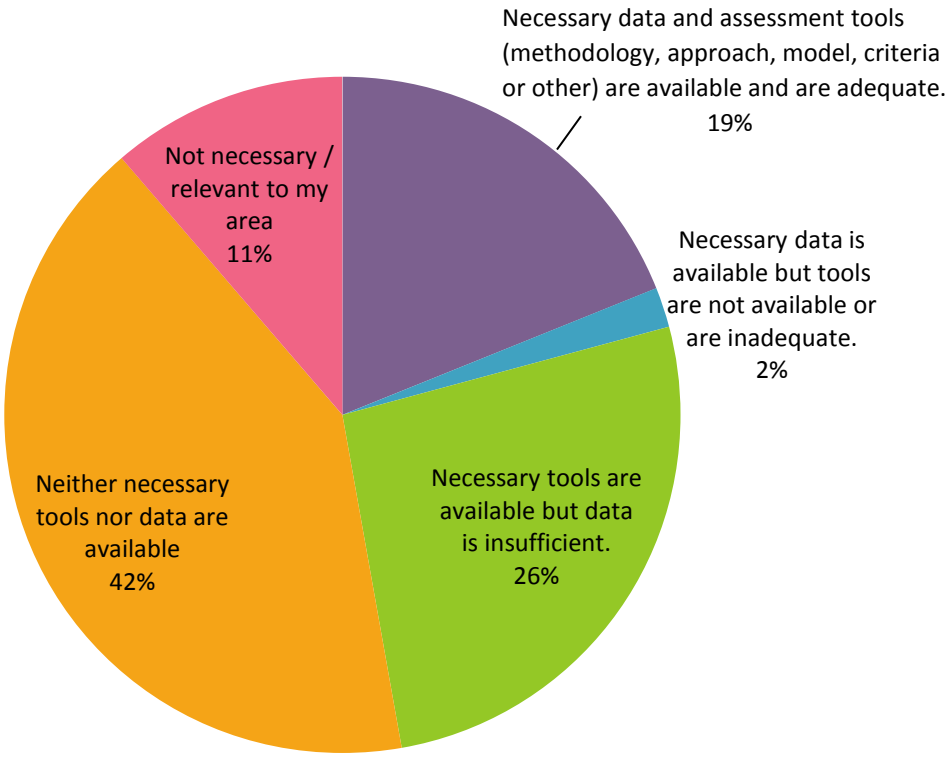
Value	Percent	Count
Necessary data and assessment tools (methodology, approach, model, criteria or other) are available and are adequate.	13.2%	7
Necessary data is available but tools are not available or are inadequate.	17.0%	9
Necessary tools are available but data is insufficient.	28.3%	15
Neither necessary tools nor data are available	32.1%	17
Not necessary / relevant to my area	9.4%	5
	Totals	53

9. Effects of climate change on water resources from a quantity perspective



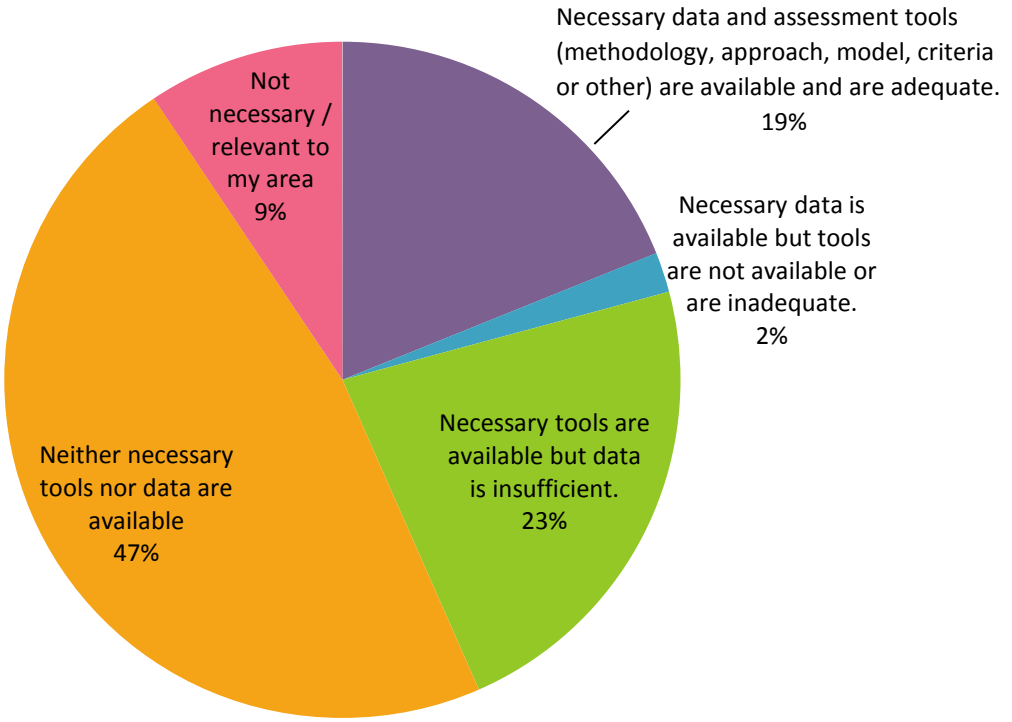
Value	Percent	Count
Necessary data and assessment tools (methodology, approach, model, criteria or other) are available and are adequate.	11.3%	6
Necessary data is available but tools are not available or are inadequate.	11.3%	6
Necessary tools are available but data is insufficient.	18.9%	10
Neither necessary tools nor data are available	50.9%	27
Not necessary / relevant to my area	7.5%	4
	Totals	53

10. Effects of population growth and changing land uses on water resources from a quantity perspective



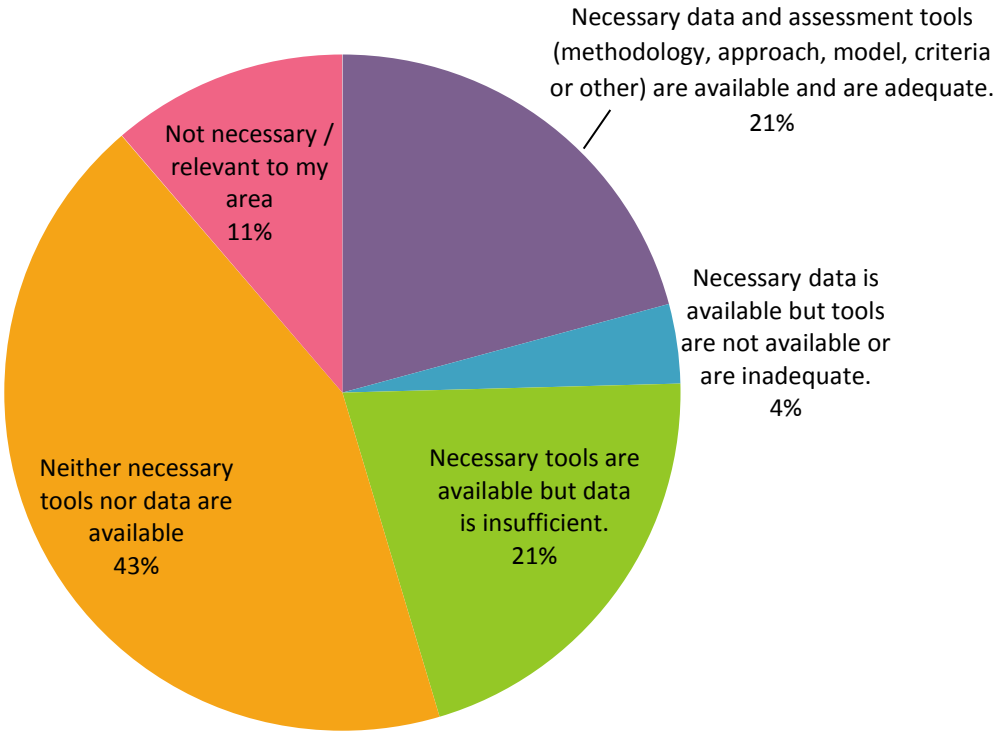
Value	Percent	Count
Necessary data and assessment tools (methodology, approach, model, criteria or other) are available and are adequate.	18.9%	10
Necessary data is available but tools are not available or are inadequate.	1.9%	1
Necessary tools are available but data is insufficient.	26.4%	14
Neither necessary tools nor data are available	41.5%	22
Not necessary / relevant to my area	11.3%	6
	Totals	53

11. Cumulative effects of multiple water takings on water resources



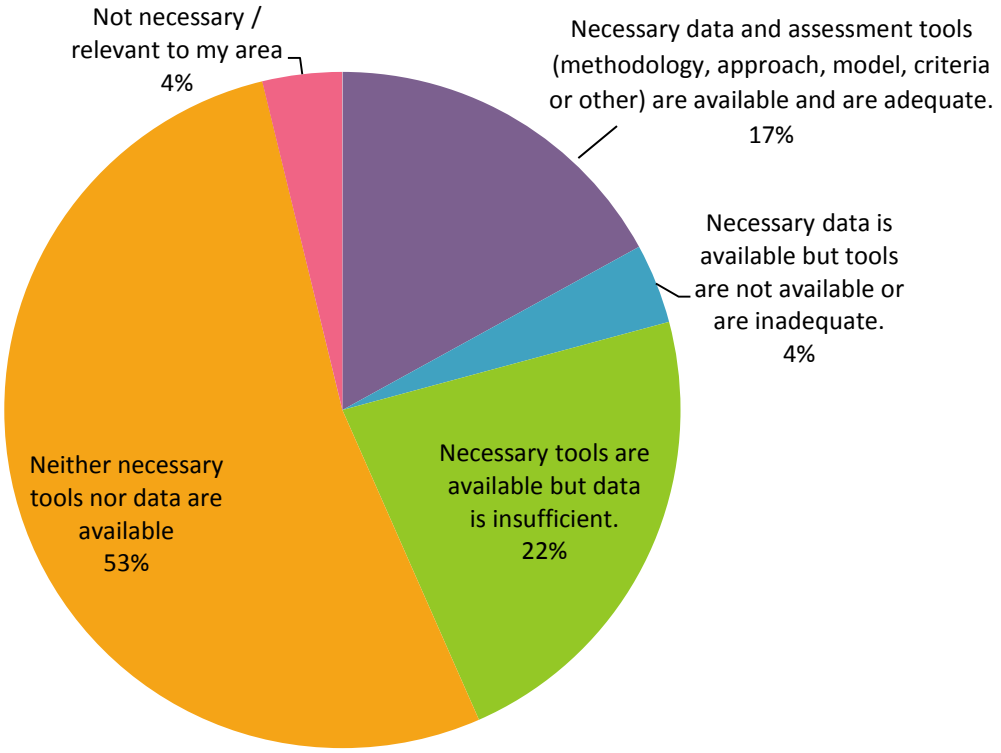
Value	Percent	Count
Necessary data and assessment tools (methodology, approach, model, criteria or other) are available and are adequate.	18.9%	10
Necessary data is available but tools are not available or are inadequate.	1.9%	1
Necessary tools are available but data is insufficient.	22.6%	12
Neither necessary tools nor data are available	47.2%	25
Not necessary / relevant to my area	9.4%	5
	Totals	53

12. Water security assessment – the ability to safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human well-being, and socio-economic development, and for preserving ecosystems (needs based assessment)



Value	Percent	Count
Necessary data and assessment tools (methodology, approach, model, criteria or other) are available and are adequate.	20.8%	11
Necessary data is available but tools are not available or are inadequate.	3.8%	2
Necessary tools are available but data is insufficient.	20.8%	11
Neither necessary tools nor data are available	43.4%	23
Not necessary / relevant to my area	11.3%	6
	Totals	53

13. Sustainability assessment – ability to meet current needs, without compromising the ability of future generations to meet their own needs (environment, economic and societal values based assessment)



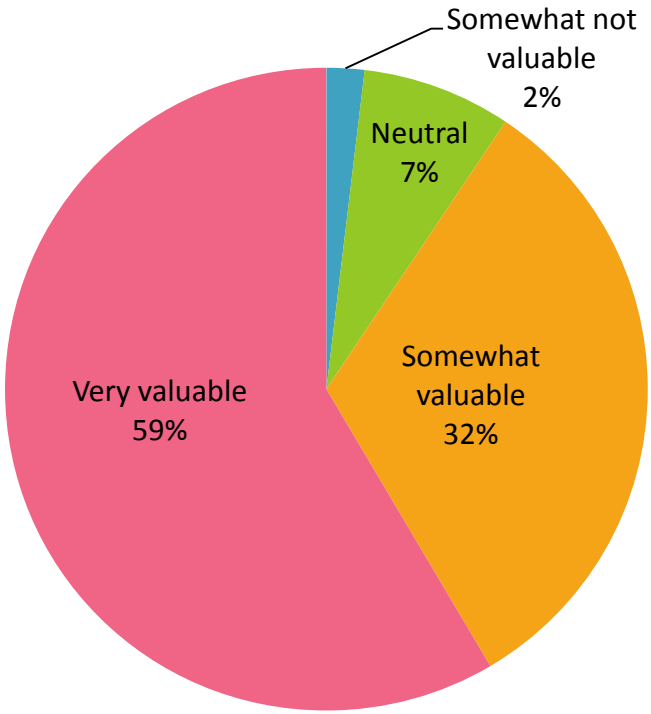
Value	Percent	Count
Necessary data and assessment tools (methodology, approach, model, criteria or other) are available and are adequate.	17.0%	9
Necessary data is available but tools are not available or are inadequate.	3.8%	2
Necessary tools are available but data is insufficient.	22.6%	12
Neither necessary tools nor data are available	52.8%	28
Not necessary / relevant to my area	3.8%	2
	Totals	53

Availability of Data

Availability of Data

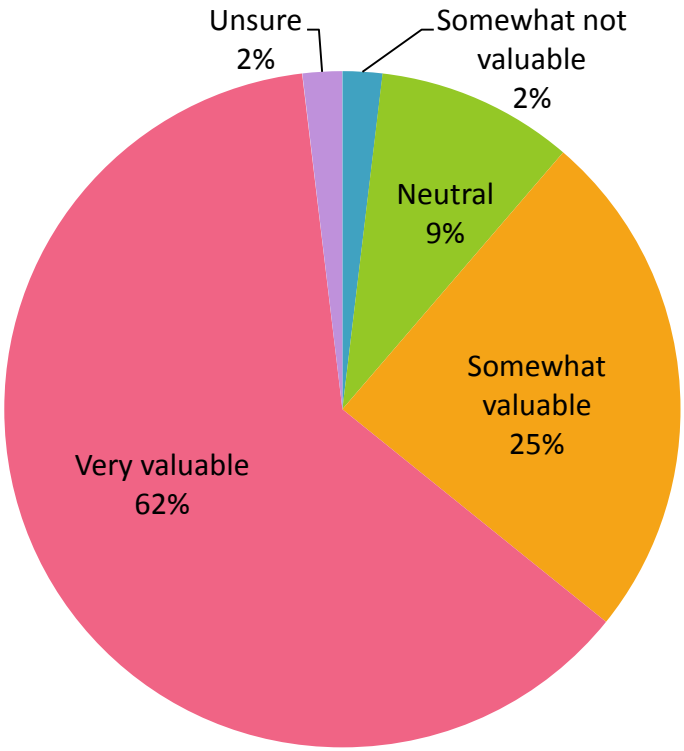
In this series of questions, please indicate how valuable to your work the following sources of data are or could be if made more accessible.

14. Permits to Take Water (PTTW) including such information as the number of permits, the purpose of taking and the maximum permitted volumes



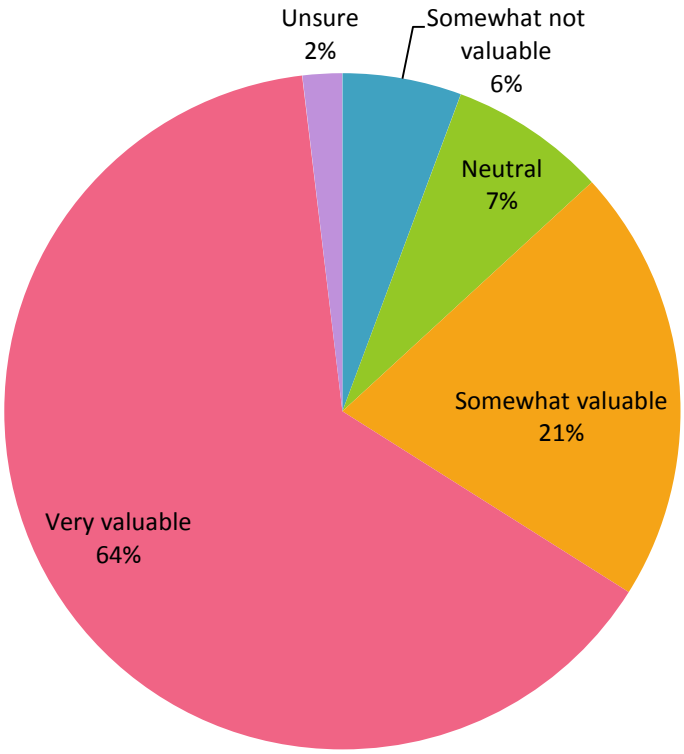
Value	Percent	Count
Somewhat not valuable	1.9%	1
Neutral	7.5%	4
Somewhat valuable	32.1%	17
Very valuable	58.5%	31
	Totals	53

15. Actual daily water taking volumes in the Water Taking and Reporting System (WTRS)



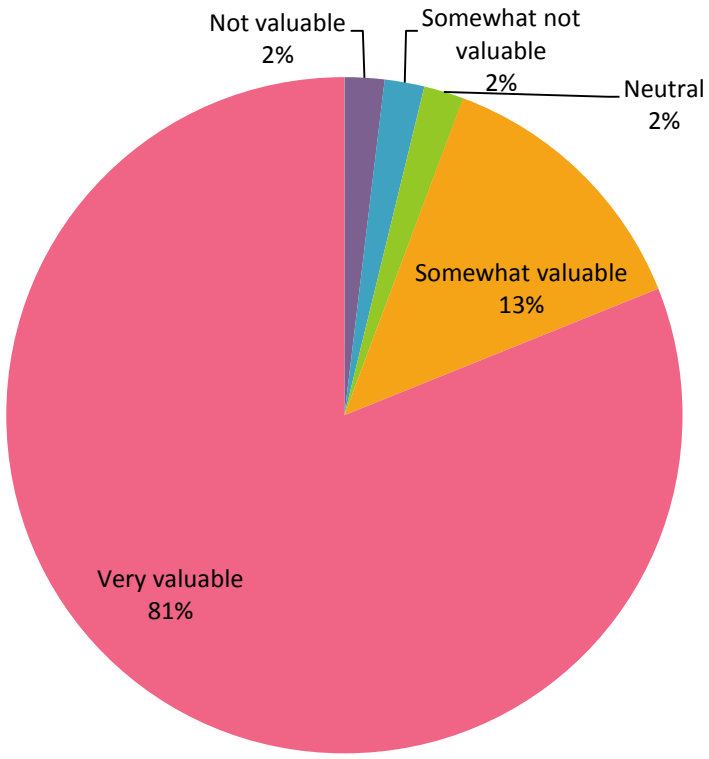
Value	Percent	Count
Somewhat not valuable	1.9%	1
Neutral	9.4%	5
Somewhat valuable	24.5%	13
Very valuable	62.3%	33
Unsure	1.9%	1
	Totals	53

16. Groundwater level monitoring data in the Provincial Groundwater Monitoring Network (PGMN)



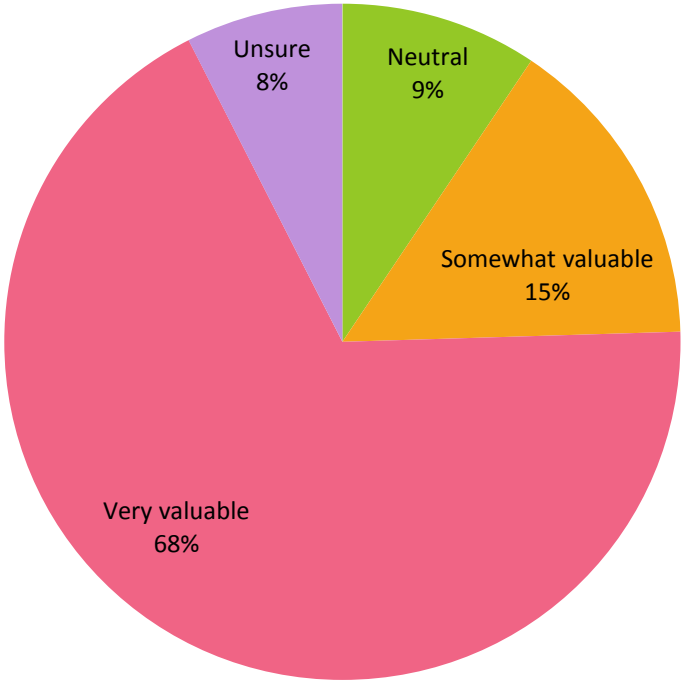
Value	Percent	Count
Somewhat not valuable	5.7%	3
Neutral	7.5%	4
Somewhat valuable	20.8%	11
Very valuable	64.2%	34
Unsure	1.9%	1
	Totals	53

17. Stream flow monitoring



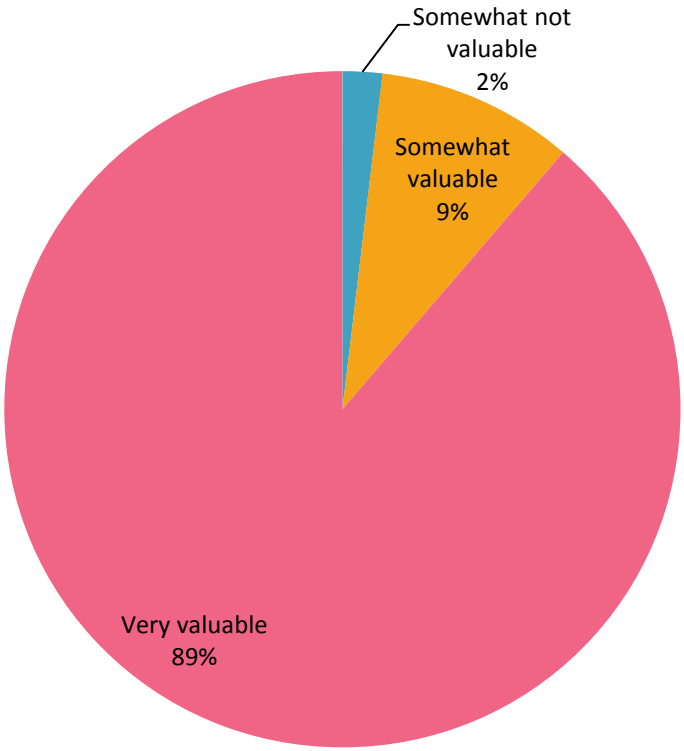
Value	Percent	Count
Not valuable	1.9%	1
Somewhat not valuable	1.9%	1
Neutral	1.9%	1
Somewhat valuable	13.2%	7
Very valuable	81.1%	43
	Totals	53

18. HYDAT stream flow gauge low-flow statistics



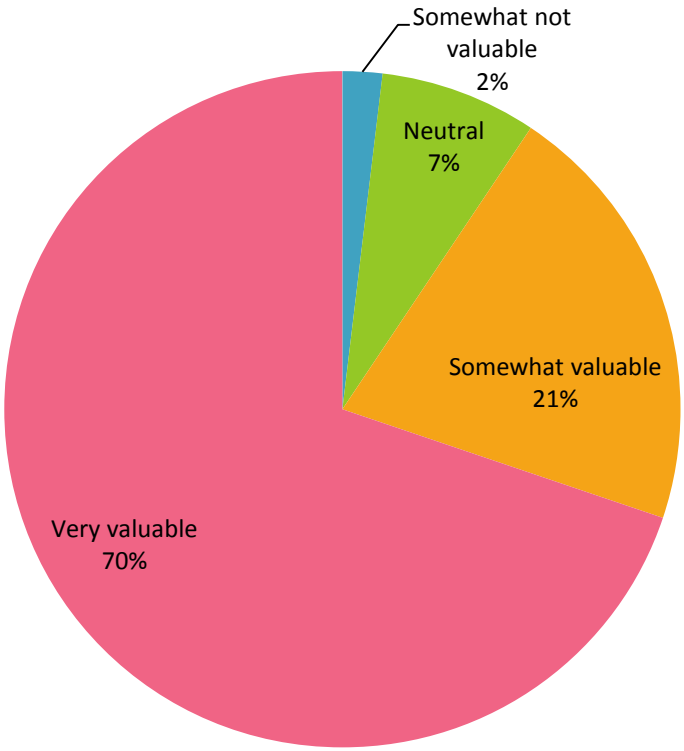
Value	Percent	Count
Neutral	9.4%	5
Somewhat valuable	15.1%	8
Very valuable	67.9%	36
Unsure	7.5%	4
	Totals	53

19. Climate data - meteorological



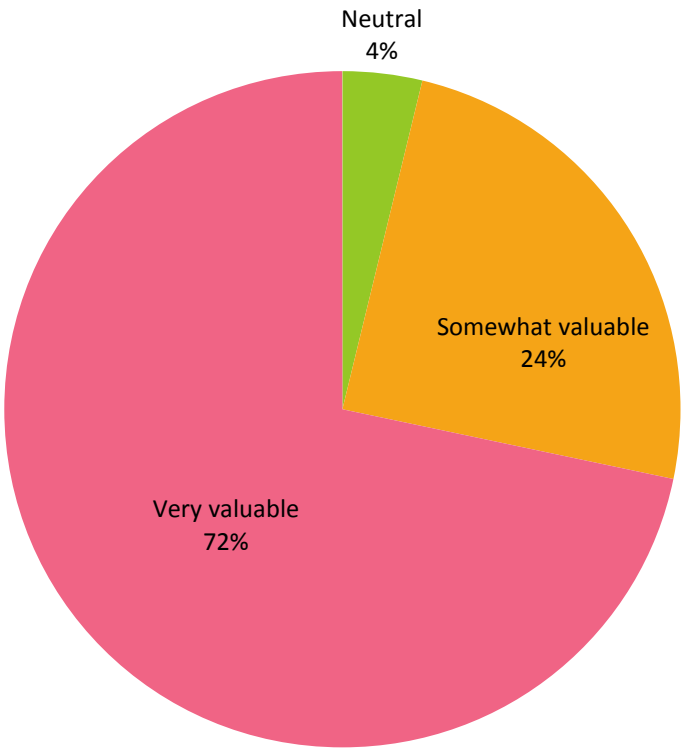
Value	Percent	Count
Somewhat not valuable	1.9%	1
Somewhat valuable	9.4%	5
Very valuable	88.7%	47
	Totals	53

20. Climate data - current climate change projections



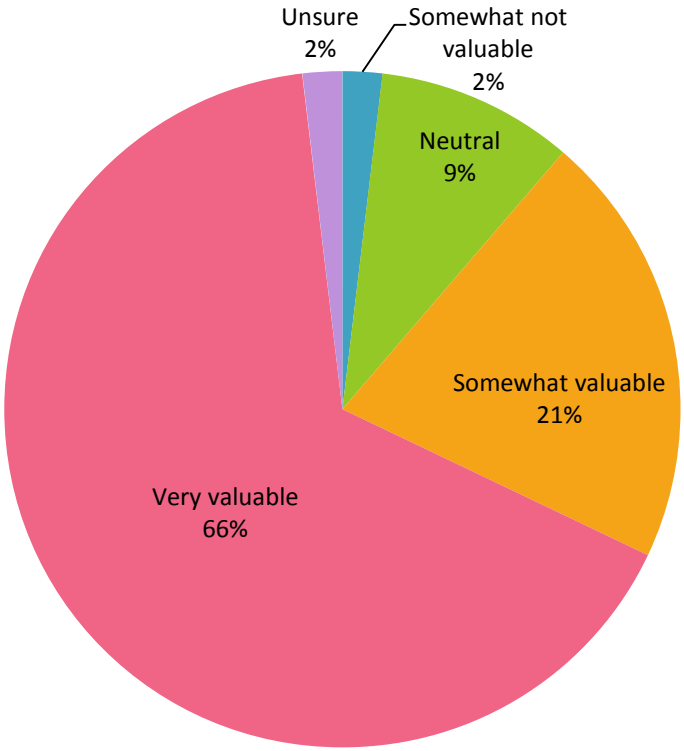
Value	Percent	Count
Somewhat not valuable	1.9%	1
Neutral	7.5%	4
Somewhat valuable	20.8%	11
Very valuable	69.8%	37
	Totals	53

21. Population growth projections



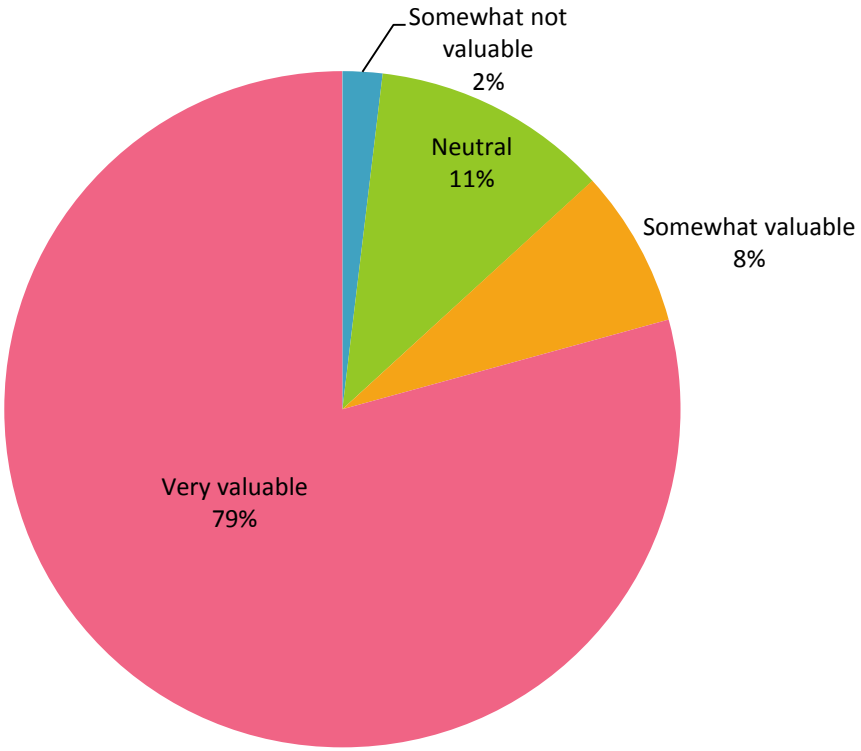
Value	Percent	Count
Neutral	3.8%	2
Somewhat valuable	24.5%	13
Very valuable	71.7%	38
	Totals	53

22. Well Records (WWIS)



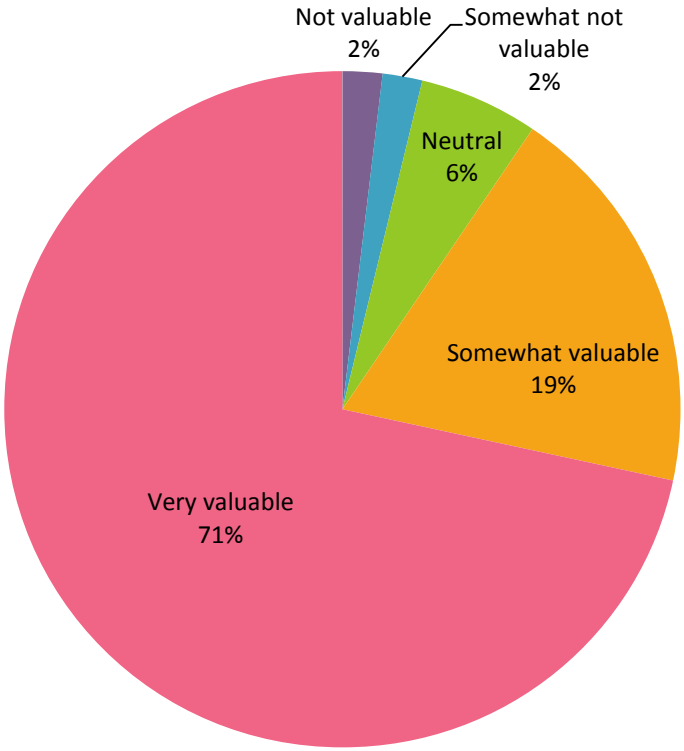
Value	Percent	Count
Somewhat not valuable	1.9%	1
Neutral	9.4%	5
Somewhat valuable	20.8%	11
Very valuable	66.0%	35
Unsure	1.9%	1
	Totals	53

23. Base flow data



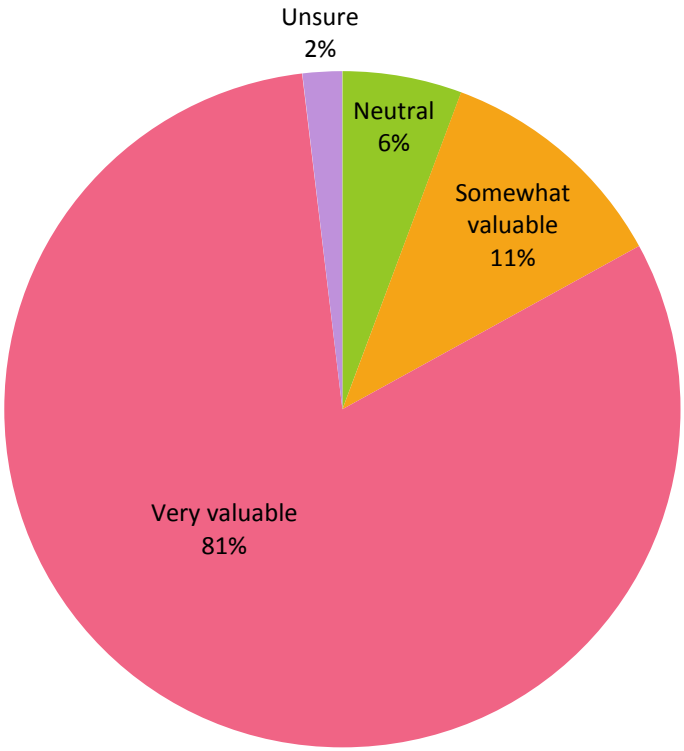
Value	Percent	Count
Somewhat not valuable	1.9%	1
Neutral	11.3%	6
Somewhat valuable	7.5%	4
Very valuable	79.2%	42
	Totals	53

24. Cold water fisheries mapping



Value	Percent	Count
Not valuable	1.9%	1
Somewhat not valuable	1.9%	1
Neutral	5.7%	3
Somewhat valuable	18.9%	10
Very valuable	71.7%	38
	Totals	53

25. Your organization / community's own data sets



Value	Percent	Count
Neutral	5.7%	3
Somewhat valuable	11.3%	6
Very valuable	81.1%	43
Unsure	1.9%	1
	Totals	53

26. Please indicate any relevant data that you rely on that may have been missed in the previous set of questions and indicate the value it has to your organization.

Response
Aquifer mapping groundwater - surface connections
Geological Survey data - extremely valuable Wetland hydrology data - extremely valuable hazard data (especially sensitive soils) - extremely valuable Groundwater discharge area mapping - extremely valuable
GSC and OGS data on geology and geochemistry. remote sensing data, LIDAR, Road networks, impervious cover, consistent land use, ELC, coldwater streams.
Hydrogeologic characterization datasets, aquifer layers, properties, numerical flow models
Data which is relied on regarding low water is not readily available in real time due to inaccessibility to the hydrometric stations not working properly
PWQMN surface water quality data from MOECC - very valuable Updated wetland evaluation data from MNRF - very valuable
soil moisture, landuse data, well testing results, well interference studies, septic maintenance records, nutrient management strategies/plans, raw water sampling at municipal systems
soil moisture land use agricultural water takings private well testing results well interference studies septic maintenance records nutrient management strategies and plans
Water quality of headwaters - very valuable
Agricultural water use data needs to be included
EOHU bacterial water test results
monitoring data associated with municipal water taking - very valuable monitoring data from non-municipal water takings - very valuable
Estimates of agricultural, non-permitted water use. OGS data once published (geological, water levels and chemistry) Private contaminated sites data (GW levels and chemistry) Private company water level and chemistry data (ie water bottlers, manufacturing etc) University research data (G360) Estimates of road watering withdrawals from water bodies
All these data are very valuable and absolutely necessary if the data collected, managed and available are modified to meet the needs for this program.
Evapotranspiration Land use

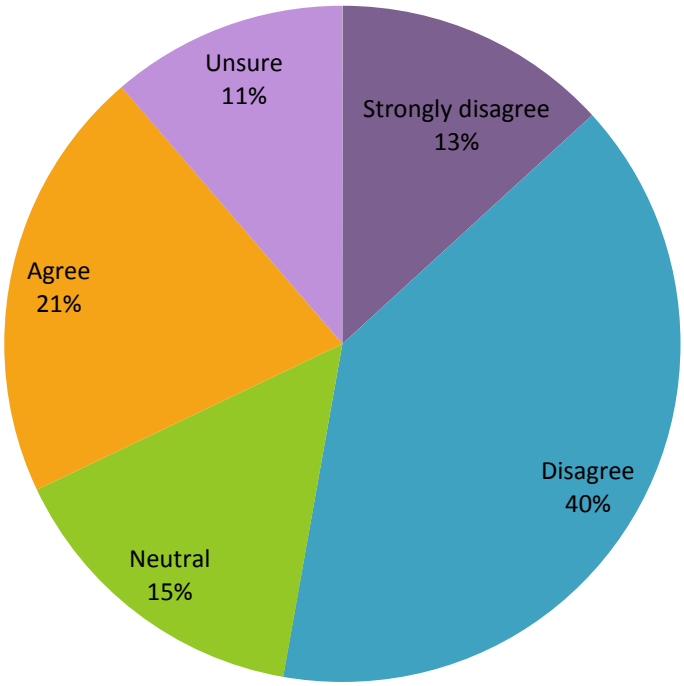
Response
The following are very valuable - solar radiation, evaporation, stratigraphy updated to OGS studies, golden spikes, proper identification in PTTW of groundwater and surface water takings (i.e. dugout pond is groundwater, not surface water), LIDAR, current and historical aerial photos
-Great Lakes water levels (federal) - very valuable -OGS mapping products - very valuable - MNRF GIS data/imagery - very valuable
Detailed subsurface geologic information. Highest value.
I work at Conservation Ontario supporting a wide variety of conservation authorities and their programs.
Condition site data and updates

Ontario's Water Quantity Management Framework

Ontario's water quantity management framework (policy, program and science)

From your regional perspective, please indicate your level of agreement with the following statements related to how water taking is currently managed in Ontario.

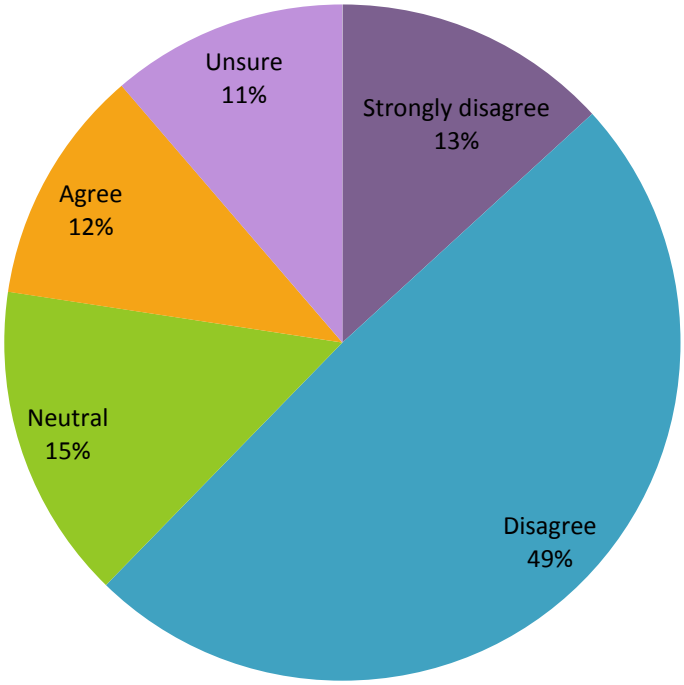
27. Ontario's regulatory and policy framework for managing water takings is adequate to respond to current or potential future water scarcity in my geographic region caused by human factors such as population growth and permitted and unpermitted water takings.



Value	Percent	Count
Strongly disagree	13.2%	7
Disagree	39.6%	21

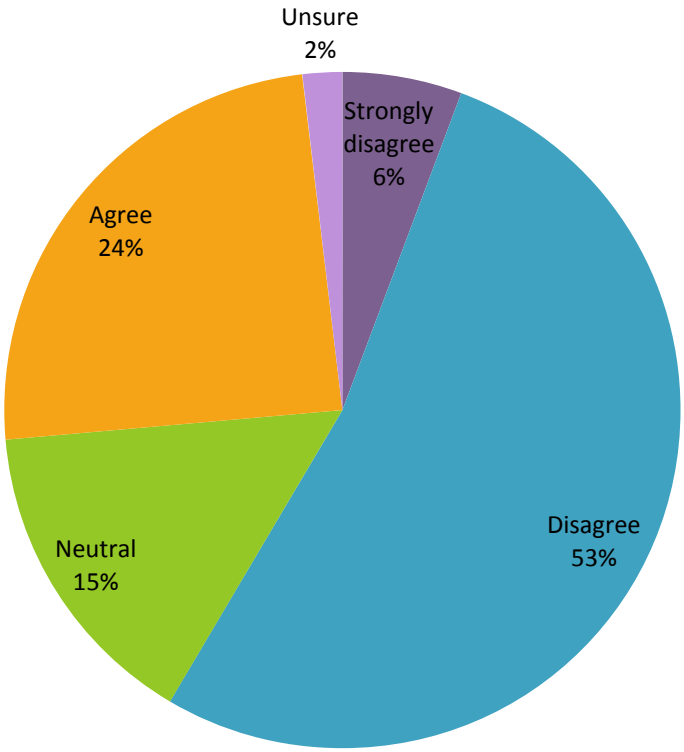
Value	Percent	Count
Neutral	15.1%	8
Agree	20.8%	11
Unsure	11.3%	6
	Totals	53

28. Ontario's regulatory and policy framework for managing water takings is adequate to respond to current or potential future water scarcity in my geographic region caused by drought, seasonal and long term climate variability and climate change.



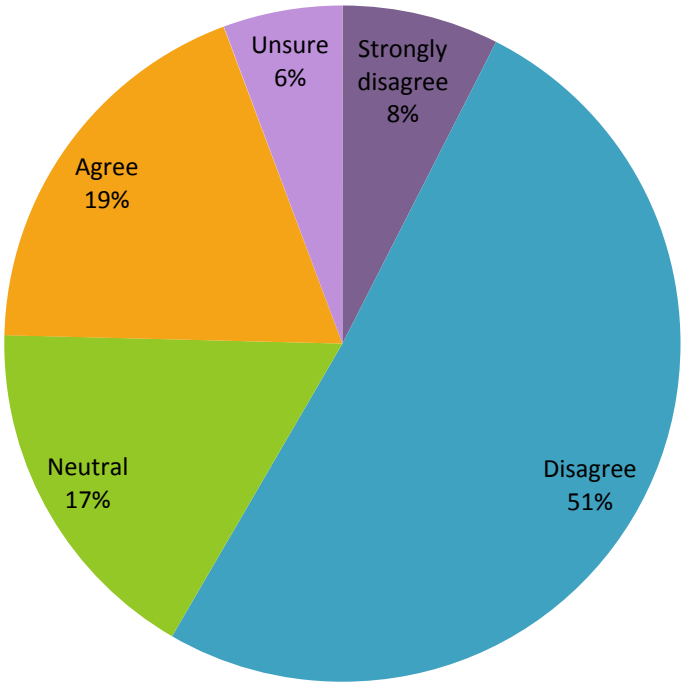
Value	Percent	Count
Strongly disagree	13.2%	7
Disagree	49.1%	26
Neutral	15.1%	8
Agree	11.3%	6
Unsure	11.3%	6
	Totals	53

29. Ontario's existing provincial and local data, science, and management tools that are available to support water taking decisions are adequate to respond to current or potential future water scarcity in my geographic region caused by human factors such as growth and permitted and unpermitted water takings.



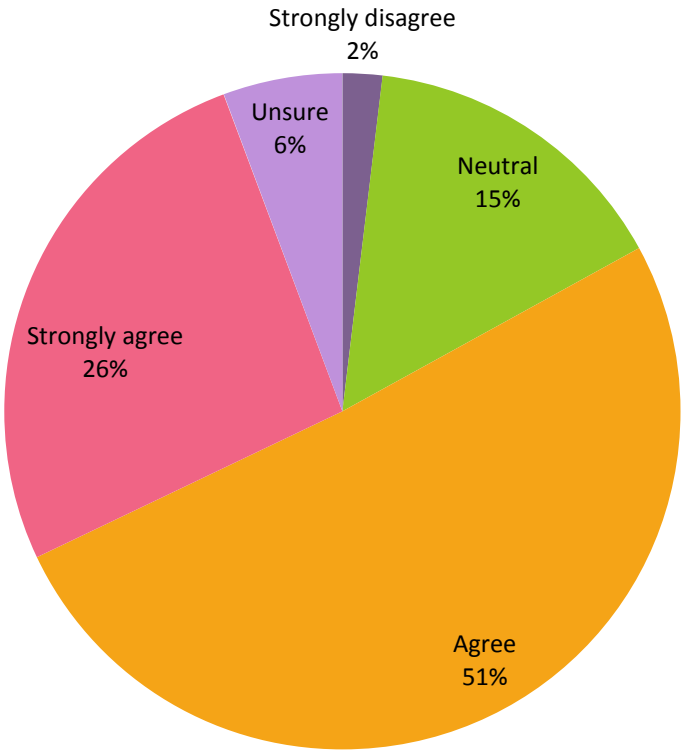
Value	Percent	Count
Strongly disagree	5.7%	3
Disagree	52.8%	28
Neutral	15.1%	8
Agree	24.5%	13
Unsure	1.9%	1
	Totals	53

30. Ontario's existing data , science, and management tools that are available to support water taking decisions are adequate to respond to current or potential future water scarcity in my geographic region caused by drought, seasonal and long term climate variability and climate change.



Value	Percent	Count
Strongly disagree	7.5%	4
Disagree	50.9%	27
Neutral	17.0%	9
Agree	18.9%	10
Unsure	5.7%	3
	Totals	53

31. Apart from permit to take water decisions, there are other water and land use planning decisions that strongly influence water quantity in my geographic region.



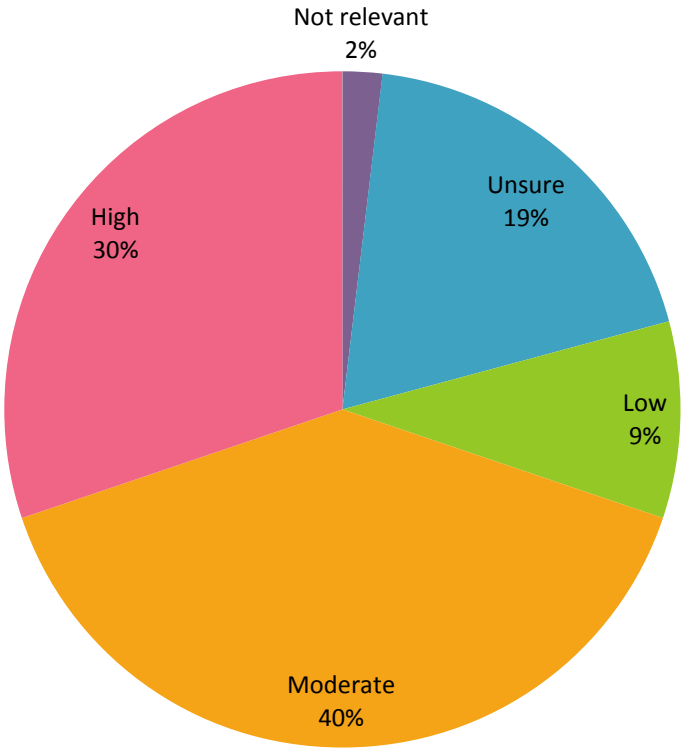
Value	Percent	Count
Strongly disagree	1.9%	1
Neutral	15.1%	8
Agree	50.9%	27
Strongly agree	26.4%	14
Unsure	5.7%	3
	Totals	53

Considerations for Sustainably Managing Water Resources in Ontario

Considerations for sustainably managing water resources in Ontario

For each topic listed below please indicate from your perspective the level of importance of each for the Ministry of the Environment and Climate Change (MOECC) to consider in enhancing its framework for managing water use in Ontario.

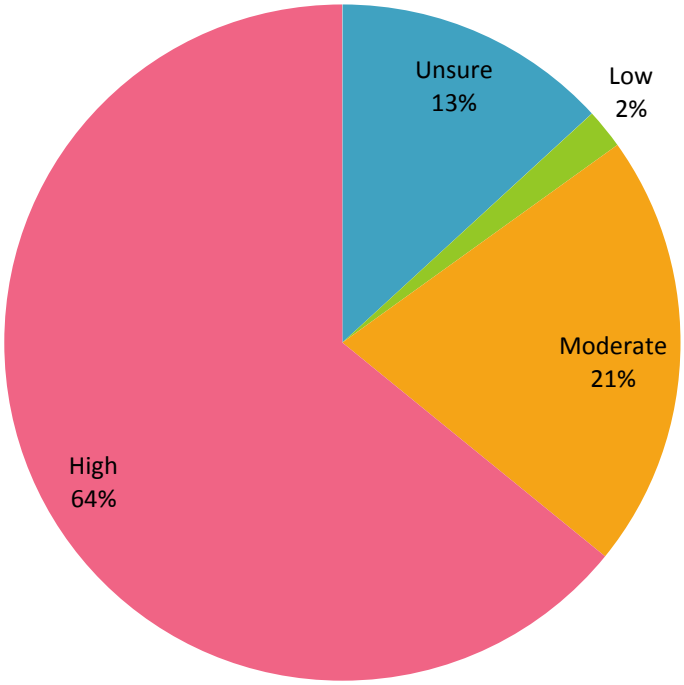
32. Conflict resolution among water users (priority of uses).



Value	Percent	Count
Not relevant	1.9%	1
Unsure	18.9%	10

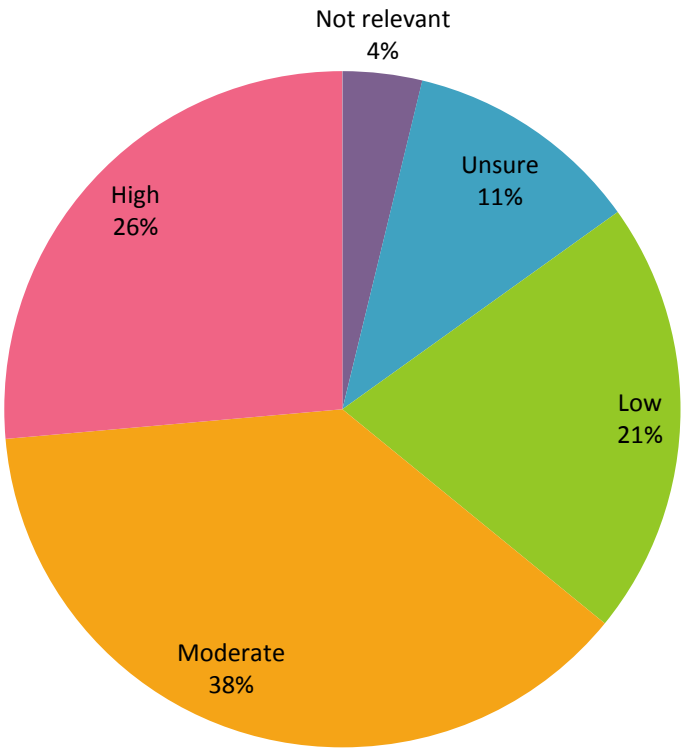
Value	Percent	Count
Low	9.4%	5
Moderate	39.6%	21
High	30.2%	16
	Totals	53

33. Collaboration among Ontario Government agencies, Indigenous communities, municipal governments, and Conservation Authorities, and other non-government stakeholders (e.g., water users) in making water taking decisions.



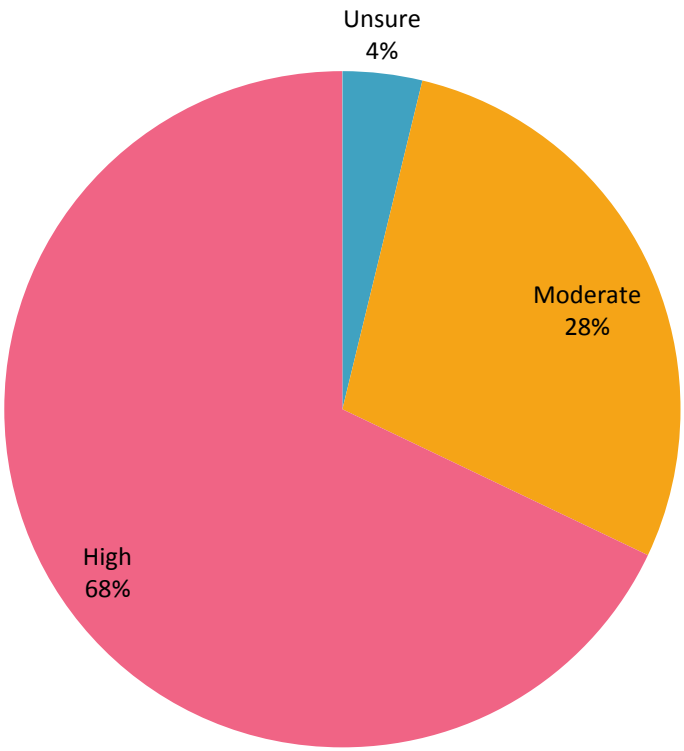
Value	Percent	Count
Unsure	13.2%	7
Low	1.9%	1
Moderate	20.8%	11
High	64.2%	34
	Totals	53

34. Enhancing public/stakeholder involvement in making water taking decisions.



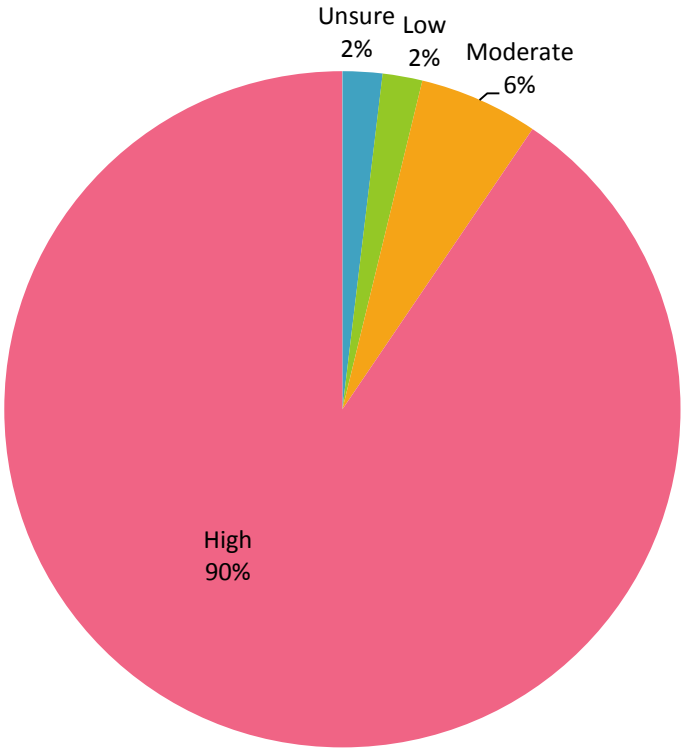
Value	Percent	Count
Not relevant	3.8%	2
Unsure	11.3%	6
Low	20.8%	11
Moderate	37.7%	20
High	26.4%	14
	Totals	53

35. Considering ground and surface water interaction in water taking decisions.



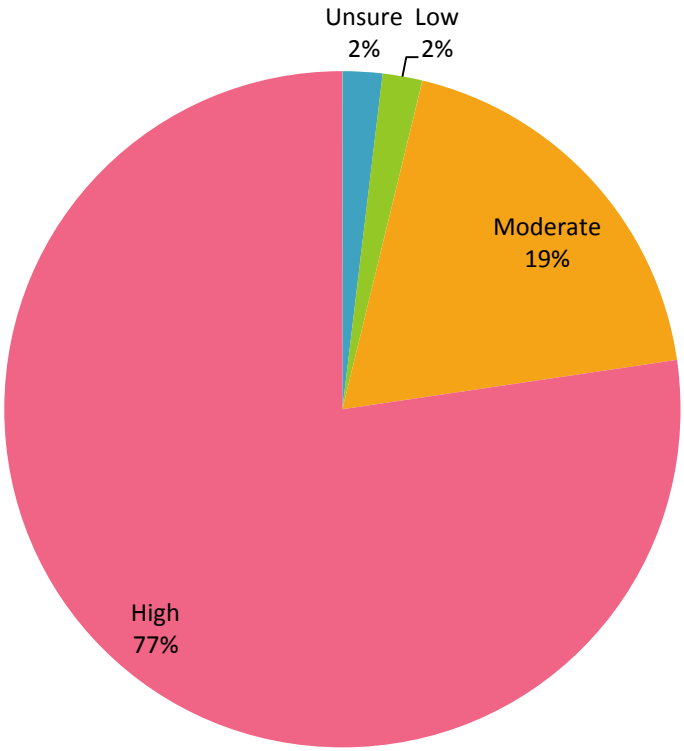
Value	Percent	Count
Unsure	3.8%	2
Moderate	28.3%	15
High	67.9%	36
	Totals	53

36. Assessing and managing the cumulative effects of multiple water takings within an area.



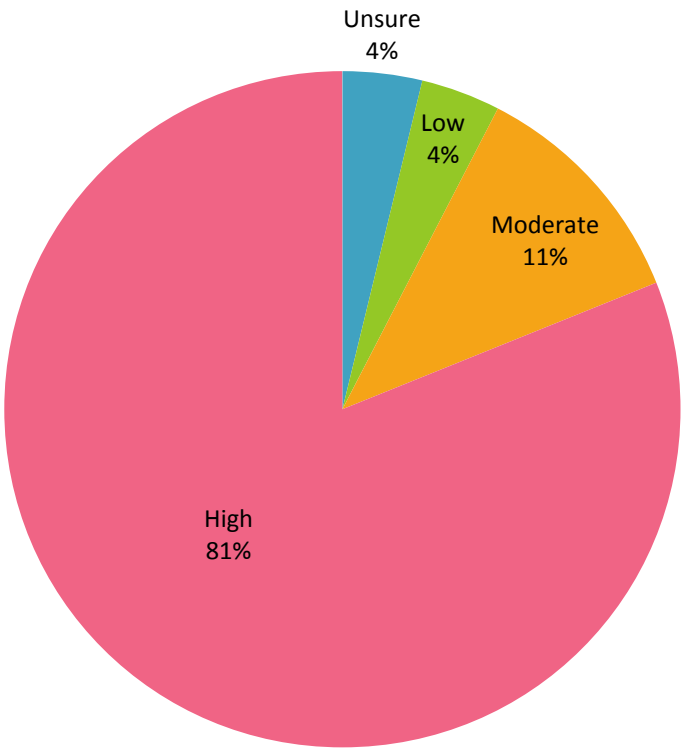
Value	Percent	Count
Unsure	1.9%	1
Low	1.9%	1
Moderate	5.7%	3
High	90.6%	48
	Totals	53

37. Protecting environmental flows.



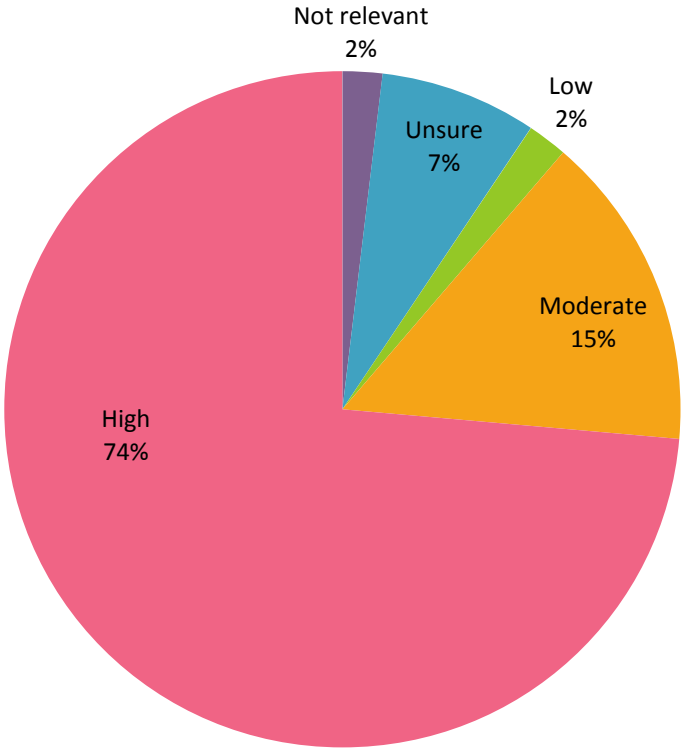
Value	Percent	Count
Unsure	1.9%	1
Low	1.9%	1
Moderate	18.9%	10
High	77.4%	41
	Totals	53

38. Planning and preparing to manage water takings during drought.



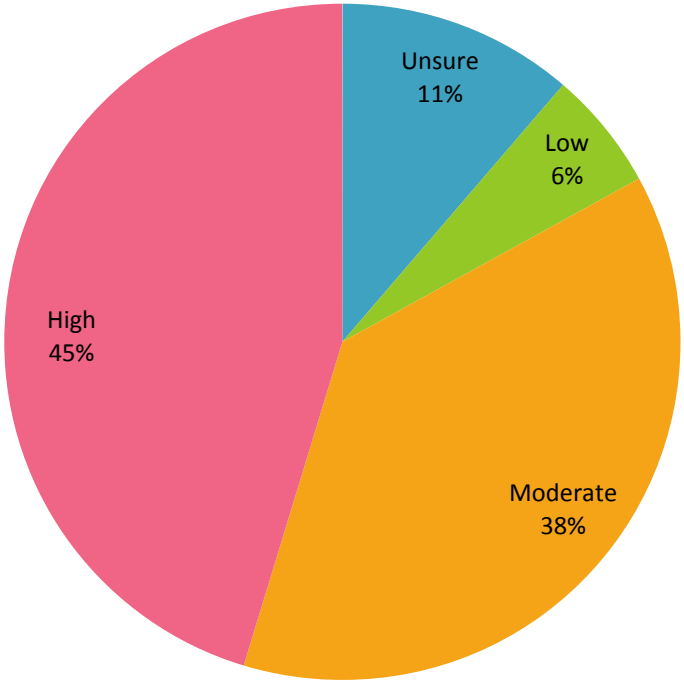
Value	Percent	Count
Unsure	3.8%	2
Low	3.8%	2
Moderate	11.3%	6
High	81.1%	43
	Totals	53

39. Setting priorities of water use to guide water taking decisions during critical times of water shortage.



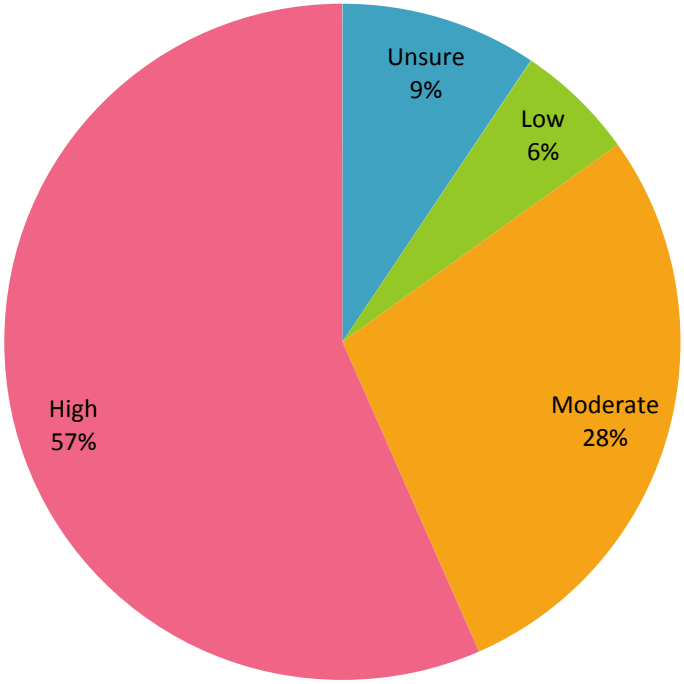
Value	Percent	Count
Not relevant	1.9%	1
Unsure	7.5%	4
Low	1.9%	1
Moderate	15.1%	8
High	73.6%	39
	Totals	53

40. Enhancing water conservation requirements for permitted water takings.



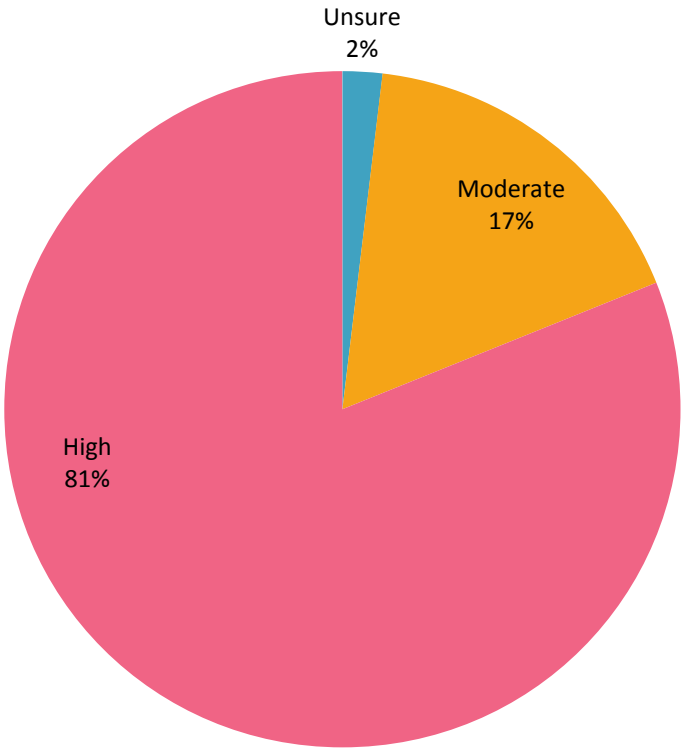
Value	Percent	Count
Unsure	11.3%	6
Low	5.7%	3
Moderate	37.7%	20
High	45.3%	24
	Totals	53

41. Assessing the impact of climate change on future water resources.



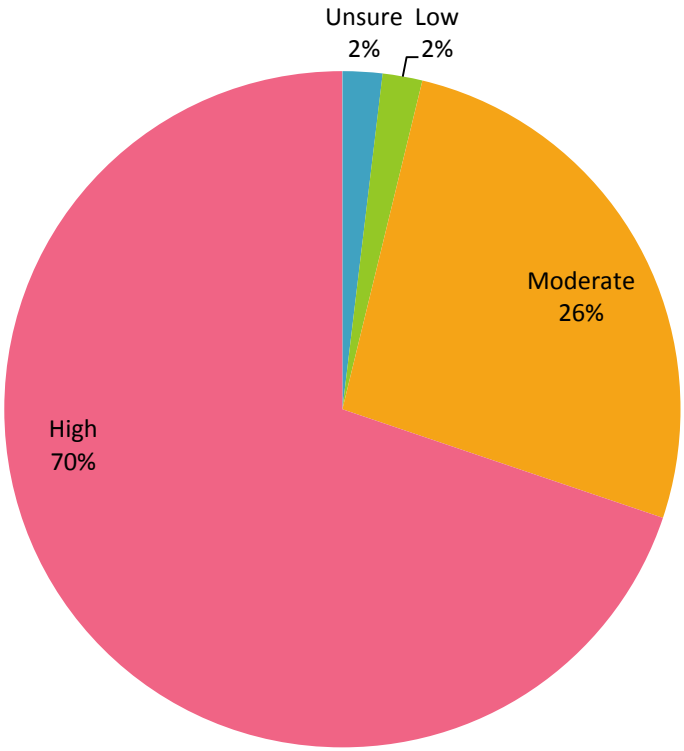
Value	Percent	Count
Unsure	9.4%	5
Low	5.7%	3
Moderate	28.3%	15
High	56.6%	30
	Totals	53

42. Assessing the long term sustainability of water resources.



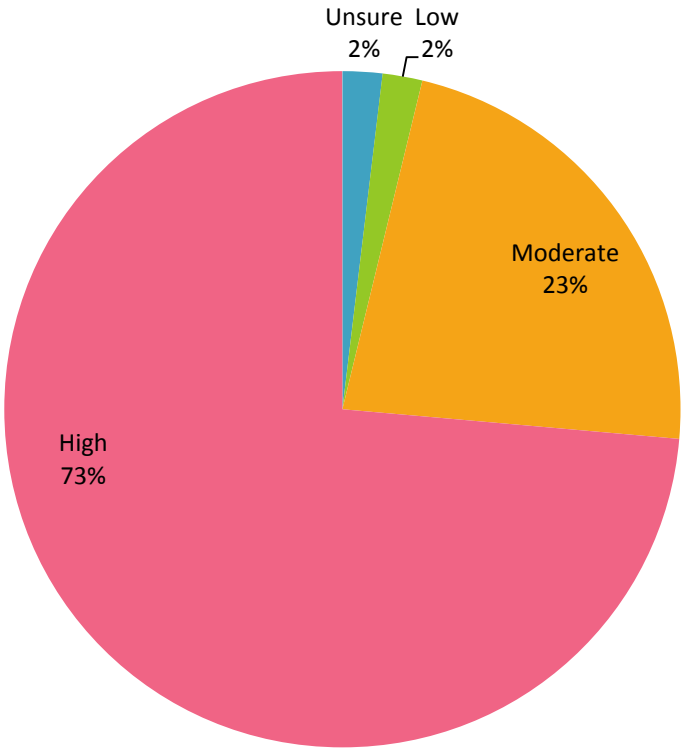
Value	Percent	Count
Unsure	1.9%	1
Moderate	17.0%	9
High	81.1%	43
	Totals	53

43. Monitoring and reporting water use.



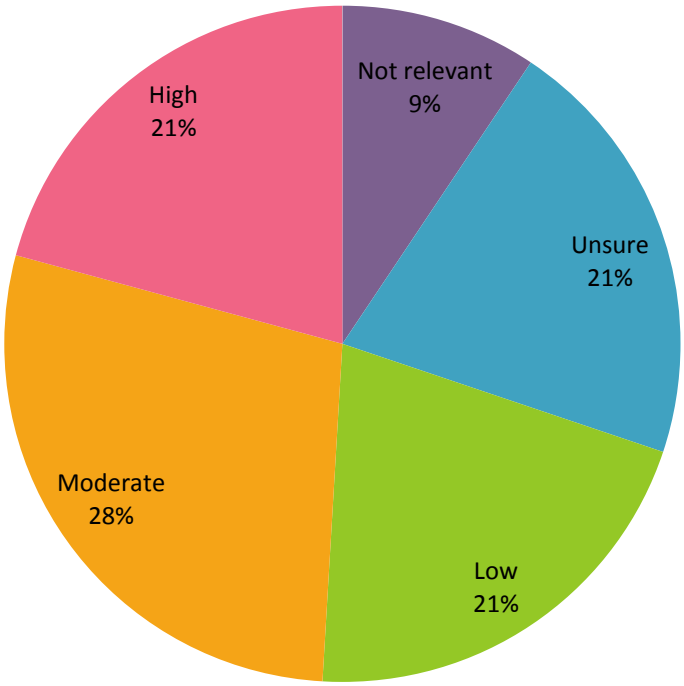
Value	Percent	Count
Unsure	1.9%	1
Low	1.9%	1
Moderate	26.4%	14
High	69.8%	37
	Totals	53

44. Monitoring and reporting on water resources (groundwater, surface water, climate).



Value	Percent	Count
Unsure	1.9%	1
Low	1.9%	1
Moderate	22.6%	12
High	73.6%	39
	Totals	53

45. Additional requirements related to water taking for the purpose of water bottling.



Value	Percent	Count
Not relevant	9.4%	5
Unsure	20.8%	11
Low	20.8%	11
Moderate	28.3%	15
High	20.8%	11
	Totals	53

46. If a topic was missed in the preceding questions that you feel would be important for the MOECC to consider in enhancing its framework for managing water use in Ontario please provide details below.

Response
Ecological integrity regarding riverine systems, including groundwater depending ecosystems, streamflow assessments, use of advanced technology i.e. remote sensing and GIS
Integration with ECA approvals and reporting integration with planning stages of municipal development approvals and subwatershed studies/planning
Permanent dewatering to support development. Groundwater is not a consideration for intensification areas. Also - decommissioning of abandoned wells and uncontrolled flowing wells. Who's looking at these issues?
Collaboration between government and local water users is very important they feel left out of any decisions made by people not familiar with local issues
Ban bottle water companies from extracting ground water and improve the regulation of plastics.
verification of well records and actual regulations - confirming that all wells installed are verified/signed off by qualified professional
providing adequate funding to measure, monitor and protect water resources developing management partnerships with municipalities in water resources
We should consider priority of use, in particular municipal and domestic priority. The need for allocation should be reviewed. Regional water management boards or groups should be considered
Cost and timeliness of decisions.
MOECC should collaborate with other agencies that are involved in the protection of water resources.
Decisions must be based on science not NIMBYism, therefore, it depends what is meant by collaboration in the questions. A provincial framework should be followed by regulators and the need for public/stakeholder involvement would be reduced.
Data management and availability.
While the answers above represent the opinion of the author, they do not necessarily represent the views of any particular First Nation in Ontario.
The First Nations of Ontario have not relinquished the fiduciary responsibilities of our governments to honor all aspects of water as identified in the Treaties.

APPENDIX C

Workshop Attendance List

Table 1: **Attendee List of Water Manager Workshops in Guelph, Kingston and Toronto (April 24-27, 2018)**

Name	Association
	GUELPH
Bob Fields	Norfolk County
Christine Furlong	Triton Engineering
Christopher Neville	Professional Engineers Ontario (PEO)
Colin Baker	Centre Wellington
Craig Jacques	Long Point Region
Dave Stevenson	Brant County
David Belanger	City of Guelph
Diane Bloomfield	Halton-Hamilton Source Protection
Dino Masiero	Centre Wellington
Emily Stahl	City of Guelph
Emily Vandermeulen	Centre Wellington
Heather McGinnity	Town of Orangeville
Jarrod Craves	Thames Centre
Jennifer Don	Kettle Creek Conservation Authority
Jo-Anne Rzadki	Conservation Ontario
Jo-Anne Harbinson	Saugeen Valley Conservation Authority
Kelly McLagan	Stantec Inc.
Kyle Davis	Wellington County
Luis Lasso	Peel Region
Marco Silverio	City of Hamilton
Martin Keller	Grand River Conservation Authority
Martin Shepley	Wood PLC
Peter Rider	City of Guelph
Richard Wootton	Region of Waterloo
Rob Olivier	Ontario First Nations Technical Services Corporation
Ryan Post	Nottawasaga Valley Conservation Authority
Sonja Strynatka	Grand River Conservation Authority
Stephanie Shifflett	Grand River Conservation Authority
Todd Gregg	Oxford County
Wayne Galliher	City of Guelph

Name	Association
	KINGSTON
Amy Dickens	Quinte Conservation Authority
Brian Stratton	Rideau Valley Conservation Authority
Chris Critoph	Raisin Region Conservation Authority
Christine McClure	Quinte Conservation Authority
Claire Milloy	Rideau Valley Conservation Authority
Gord Mountenay	Mississippi Valley Conservation Authority
Jennifer Boyer	City of Ottawa
Jennifer North	Mississippi Valley Conservation Authority
Jessica Mueller	Ganaraska Region Conservation Authority
John Pyke	Malroz Engineering
Mark Boone	Quinte Conservation
Mathieu LeBlanc	South Nation Conservation Authority
Matt Craig	Mississippi Valley Conservation Authority
Matt Millar	Conservation Ontario
Matthew Richmond	Township of Stirling-Rawdon
Nader Nakhaei	Mississippi Valley Conservation Authority
Sandra Mancini	South Nation Conservation Authority
Tessa Di Iorio	City of Ottawa
	TORONTO
Bonnie Fox	Conservation Ontario
Caroline Hawson	Lake Simcoe Conservation Authority
Chitra Gowda	Conservation Ontario
Don Ford	Toronto and Region Conservation Authority
Fred Carpio	Central Lake Ontario Conservation Authority
Iryna Shulyarenko	Kawartha Conservation
John Bittorf	Grey Sauble Conservation Authority
Jon Clark	Halton Region
Lindsay Jupp	Matawa
Melissa Carrthers	Midland Conservation
Michelle Jakobi	Oro-Medonte
Mike Fairbanks	York Region
Paul Pentikainen	Town of Innisfill
Rick Gerber	Oak Ridges Moraine Coalition
Simon Gautrey	Wood PLC
Tom Hogenbirk	Lake Simcoe Region
Tricia Hamilton	Ontario First Nations Technical Services Corporation

APPENDIX D

Workshop Agenda, Presentation Slide Decks and Workshop Worksheet

WATER MANAGERS WORKSHOPS AGENDA

April 24th, 25th and 27th, 2018

9:00 AM – 12:30 PM

Locations

Innovations Guelph, 111 Farquhar Street, 3rd floor, Guelph, ON N1H 3N4 (April 24th)

InVista Centre, Meeting Rooms A & B, 1350 Gardiners Road Kingston, ON, K7P 2Y2 (April 25th)

MOECC Building, 125 Resources Rd, Etobicoke, ON M9P 3V6 (April 27th)

Objectives:

- Introduce water quantity science and jurisdictional best practices reviews
- Share findings related to:
  - Assessment of **cumulative effects** (in consideration of climate change, population growth and environmental flow needs)
    - Assessment of **environmental flow needs**
  - Management of cumulative effects, including environmental flow needs (in consideration of scale, governance and adaptive management)
- Gather feedback on the applicability of approaches and tools found in the science and jurisdictional reviews to Ontario

9:00 AM – 9:30 AM	***REGISTRATION***	
9:30 – 9:45 AM	**1. Welcome** (15 mins) • Welcome and acknowledgment of Indigenous Peoples & Traditional Territory (MOECC) • Brief introduction and context (MOECC) • Meeting agenda overview and objectives (BluMetric) • Survey finding summary (BluMetric)	Speakers: MOECC – Cynthia Carr and Sarah Olinski BluMetric - Wayne Ingham
9:45 – 10:15 AM	**2. Presentation: Assessing and Managing Sustainable Water Quantity Resources** (30 minutes) • Overview of Science and Jurisdictional Reviews • Share findings related to: ▪ Assessment of cumulative effects including environmental flow needs, all in consideration of climate change, population growth and environmental flow needs ▪ Management of cumulative effects, including environmental flow needs (in consideration of scale, governance and adaptive management)	Speaker: BluMetric - Tiffany Svensson Natalya Melnychuk
10:15 - 10:30 AM	**3. Presentation: Managing Water Resources when Water is Scarce** (15 minutes) • Approaches for drought planning and priority of water use	Speaker: BluMetric - Natalya Melnychuk
10:30 – 10:45 AM	***BREAK***	
10:45 – 12:10 PM	**4. Breakout Groups (6 to 8 people per group) Discussions to focus on tools and approaches:** • Assessing and managing cumulative effects and environmental flows on an area basis (watershed, aquifer, municipal, other) • Drought planning and priority of use as a conflict resolution tool • Applicability of approaches and tools for use in Ontario based on the Water Managers regional and local experiences	Facilitators MOECC – Cynthia Carr and Zdana Fedchun BluMetric - Wayne Ingham and Francois Richard
12:10 – 12:30 PM	**5. Report Back from Breakout Groups & Wrap-up** • Wrap up key/top messages from the break out group discussions (BluMetric) • Thank you and Next Steps (MOECC)	Speakers: BluMetric Group Leaders and Wayne Ingham MOECC - Heather Brodie-Brown

Water Managers Workshops for Ontario's Water Quantity Management Review

Ministry of the Environment and Climate Change (MOECC)
BluMetric Environmental Inc.
April 2018

Meeting Agenda

9:00 – 9:30 AM	Registration	
9:30 – 9:45 AM	1. Introduction	MOECC & BMEI
9:45 – 10:15 AM	2. Presentation: Assessing and Managing Sustainable Water Resources	BMEI
10:15 – 10:30 AM	3. Presentation: Managing Water Resources when Water is Scarce	BMEI
10:30 – 10:45 PM	Break	
10:45 – 12:10 PM	4. Breakout Session	ALL
12:10 – 12:30 PM	5. Report Back from Breakout Groups & Wrap-up	ALL

1. Introduction

i. Welcome & Acknowledgment (MOECC)

ii. Introduction and context (MOECC)

iii. Meeting agenda and objectives (BluMetric)

iv. Survey findings (BluMetric)

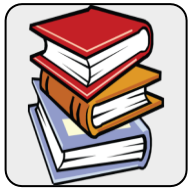
Water Quantity Management Review

Is Ontario's existing water quantity management framework adequate to manage existing or anticipated regional water scarcity considering climate change, population growth?

Water quantity management framework: means **policies, programs and science**, including data collection and assessment tools, used in the management of water use.

Ontario

Review of Scientific and Jurisdictional Best Practices



Review scientific literature, guidance, leading jurisdictions for best practices

- **Science practices and tools**
- **Management approaches**
- **Legislation, regulations, policies, and guidance**

Seek input on findings – consider Ontario context

- Regional workshops with external water managers (municipal, conservation authorities, Indigenous communities)
- Provincial water managers (MOECC, MNRF, OMAFRA)
- Presentations and feedback from Water Quantity External Working Group

Evaluate best practices against Ontario's water use management framework

- "framework" = policies, programs and science, including data collection and assessment tools used in the management of water use and permitting
- gaps and opportunities identification

Recommend improvements to Ontario's water use management framework appropriate to Ontario's legislative framework and environmental conditions

Project Review Process

Research & Analysis

2017 – 2018

Science Review
+
Jurisdictional Review
+
Water Manager Workshops

= **Evaluation Report**:
evaluation of science & jurisdictional best practices, gap analysis, recommendations

Assessment of water quantity in:

Water Quantity Study Areas (WQSA)
+
Water Bottling Study Areas (WBSA)

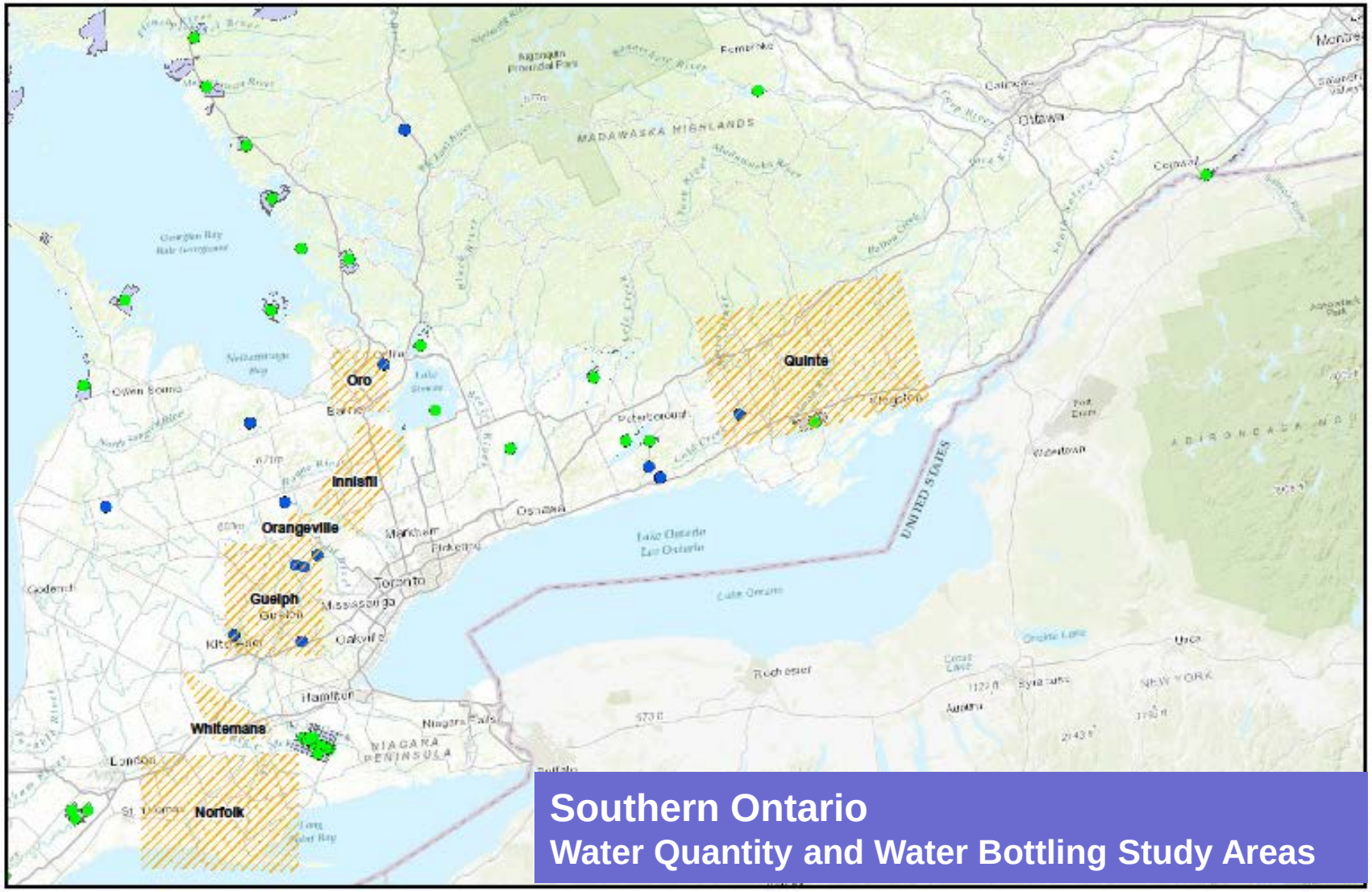
Ministry Analysis

Timing TBC

Develop and Discuss Options (TBC)

Develop and Make Recommendations (TBC)

Ontario



Southern Ontario Water Quantity Study Areas

Date: February 14th, 2018

Legend

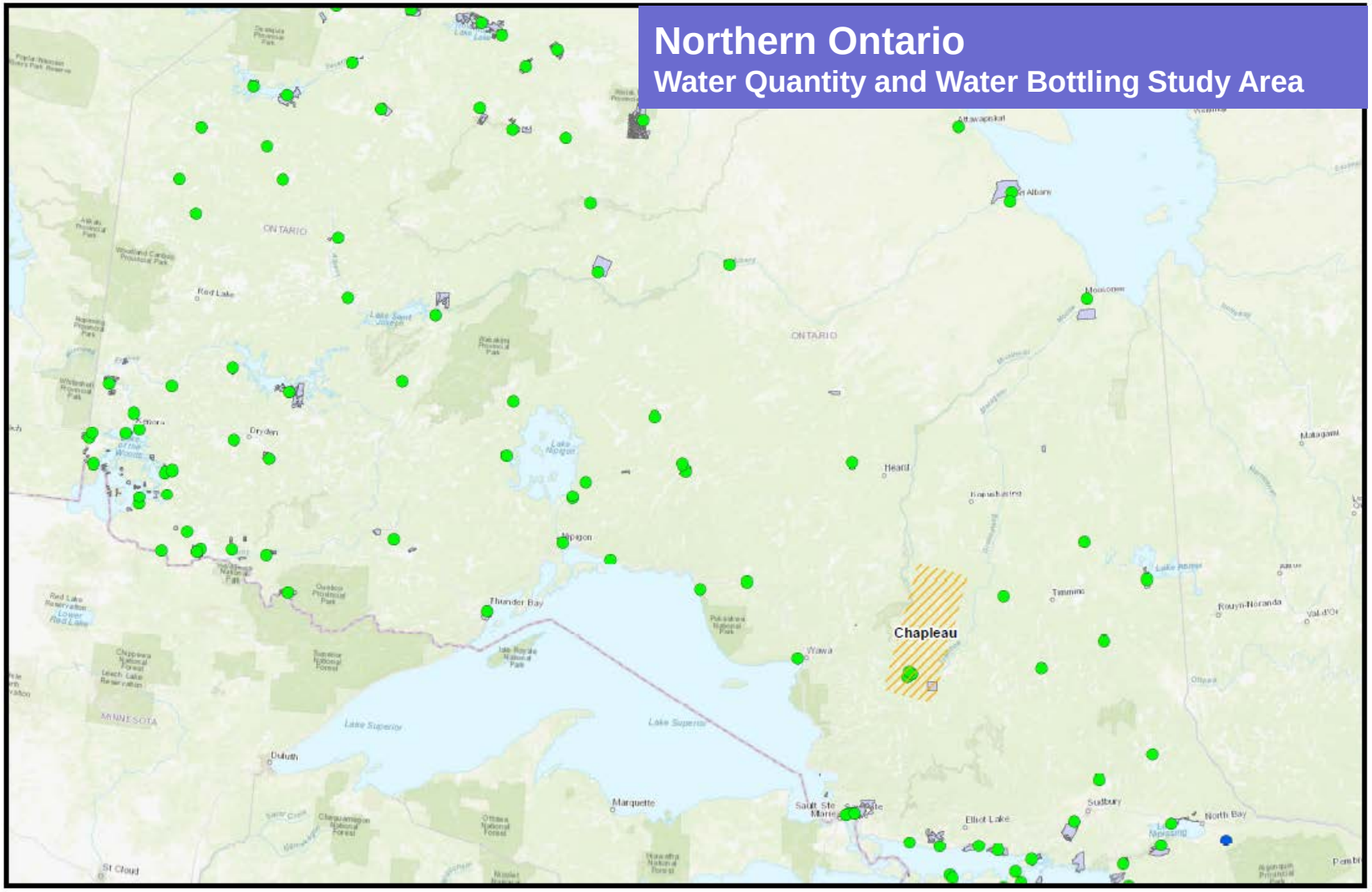
- Water Bottlers
- First Nation Communities
- First Nation Reserves
- Study Areas

Ministry of Environment and Climate Change Source Protection Programs Branch Information displayed on this map is the best available data provided by the MOECC. This map is for information purposes only. ©Queens Printer Ontario, February 2018

Scale: 1:2,306,200

0 15 30 60 90 120 Kilometers

Northern Ontario
Water Quantity and Water Bottling Study Area



Northern Ontario Water Quantity Study Areas

Date: February 14th, 2018

Legend

- Water Bottlers
- First Nation Communities
- First Nation Reserves
- Study Areas

Ministry of Environment and Climate Change Source Protection Programs Branch Information displayed on this map is the best available data provided by the MOECC. This map is for information purposes only. ©Queens Printer Ontario, February 2018

Scale: 1:5,215,000

0 30 60 120 180 240 Kilometers

Meeting agenda overview and objectives

Survey overview;

Presentations on two specific topics capturing science and jurisdictional reviews (Hold questions to the end of the presentations);

Break (refreshment and bio) and reconvene into facilitated discussion groups on the topics presented to get input and advice (group identifiers on name tag);

Following discussion groups everyone will reconvene to review findings and consider next steps.

Survey finding summary

General Information

- 51 complete responses (11 partial responses)
- Partial responses not included in analysis
- High representation from CAs (45%); significant representation from others
- Good distribution of responses from various drinking water supply sources
- 90% indicated completed Water Budgets (Tier 1, 2 or 3) for their area
- Comprehensive distribution across the board for water quantity management concerns

Survey finding summary

Approaches & Tools

- % respondents who have the necessary tools & data to adequately assess the following, or tools & data are not required

~35%	Water resources from a quantity perspective
~25%	Environmental flow needs
~20%	Effects of climate change on water resources (quantity perspective)
~30%	Effects of population growth & changing land uses on water resources (quantity perspective)
~30%	Cumulative effects of multiple water takings on water resources
~35%	Water security assessment
~20%	Sustainability assessment

Survey finding summary

Value of Data

- % respondents who consider the following sources of data valuable to their work or could be if made more available

>90%	PTTW
>85%	Actual daily water taking volumes in the WTRS
>80%	Groundwater level monitoring data in the PGMN
>90%	Stream flow monitoring
>80%	HYDAT stream flow gauge low-flow statistics
>95%	Climate data - meteorological
>90%	Climate data - current climate change projections
>95%	Population growth projections
>85%	Well Records (WWIS)
>85%	Base flow data
>90%	Cold water fisheries mapping
>90%	Your organization / community's own data sets

- ~ 20 respondents provided additional relevant data sources

Survey finding summary

Ontario's water quantity management framework

- With regards to their region, % respondents who consider the following inadequate

~50%	**Regulatory and policy** for managing water takings to respond to current or potential future water **scarcity caused by human factors**
~60%	**Regulatory and policy** for managing water takings to respond to current or potential future water **scarcity caused by drought, climate variability & climate change**
~55%	Available provincial & local **data, science, and management tools** to support water taking decisions to respond to current or potential future water **scarcity caused by human factors**
~55%	Available existing **data, science, and management tools** to support water taking decisions to respond to current or potential future water **scarcity caused by drought, climate variability & climate change**.

- ~75% of respondents indicated that apart from PTTW decisions, there are other water and land use planning decisions that strongly influence water quantity in their geographic region.

Survey finding summary

Considerations for Sustainably Managing Water Resources in Ontario

- Water Managers ranked most topics as moderate or high in importance for the MOECC to consider in enhancing the framework for managing water use.
- A number of additional topics were provided for the MOECC to consider

Survey results are posted with charts illustrating responses to each question.

2. Presentation: Assessing and Managing Sustainable Water Resources

Ontario

3. Presentation: Managing Water Resources when Water is Scarce

Ontario

4. Breakout Groups & Discussion

Ontario

Topic 1: Assessing and Managing Sustainable Water Resources

Assessment of Cumulative Effects		Managing Cumulative Effects (including EFN)
Cumulative Effects	**Environmental Flow Needs**	
1. Which approaches (existing, presented) could allow us to assess, or improve how we assess cumulative effects at different: o scales (site, local to site, aquifer / watershed / etc.) o levels of complexity 2. What are the benefits and challenges, including barriers and possible solutions, of implementing the cumulative effects assessment approaches identified in Question 1 considering: o appropriate scale(s) of assessment o data/science needs o technical capacity o defensibility o management needs	3. Which approaches (existing, presented) could allow us to assess, or improve how we assess, environmental flow needs at different o scales o levels of complexity 4. What are the benefits and challenges, including barriers and possible solutions, of implementing environmental flow needs the approaches identified in Question 3 considering? o appropriate scale(s) of assessment o data/science needs o technical capacity o Defensibility o specific site or area management needs	5. What policy / program enhancements could be considered for Ontario to better assess and manage cumulative effects and environmental flow needs? 6. Under what circumstances might we need to manage water takings on an area-basis (e.g., basin, aquifer) to consider cumulative effects, including protection of environmental flows?

Topic 2: Managing Water Resources when Water is Scarce

Drought Planning	Priority of use
1. Under what circumstances should drought management & preparedness actions be required? What are the triggers for implementing drought management & preparedness measures with respect to groundwater and surface water? 2. What types of drought management & preparedness actions should be considered? Water conservation measures? Water supply contingency measures? 3. Should implementation of water conservation and efficiency practices by water users be taken into account when imposing reductions (i.e., should water users with no water efficiency measures in place be expected to reduce more than those who have existing water conservation and efficiency practices in place)?	4. In your opinion, are priorities of water use needed in Ontario? Under what circumstances and how should they be used? 5. Where should priorities of water use be established? Priorities that apply province-wide? Unique priorities for specific areas (e.g., a watershed or aquifer with water quantity concerns)? 6. Who should determine priorities of water use? The province? Local communities and water users?

5. Report Back from Breakout Groups & Wrap-up

i. Key messages from break out group discussions (Blumetric)

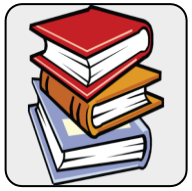
ii. Next steps (MOECC)

Key messages from break out group discussions

Ontario

Next Steps

Review of Scientific and Jurisdictional Best Practices



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Provide input on potential improvements to Ontario's water use management framework appropriate to Ontario's legislative framework and environmental conditions

Ontario

Next Steps

- Additional feedback on the discussion questions may be provided to the Ministry for inclusion in the Water Managers Workshop meeting notes by May 8, 2018
  - Please send to: EMRB.Coordinator.moe@ontario.ca
- Meeting notes from the Water Managers Workshops will be shared with participants in summer 2018
- Information gathered from the Water Managers Workshops will contribute to the evaluation of scientific and jurisdictional best practices, and ultimately, BluMetric's recommendations to the ministry for potential improvements to Ontario's water use management framework

Ontario

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Ontario

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Assessing And Managing Sustainable Water Resources

Ministry of the Environment and Climate Change (MOECC)

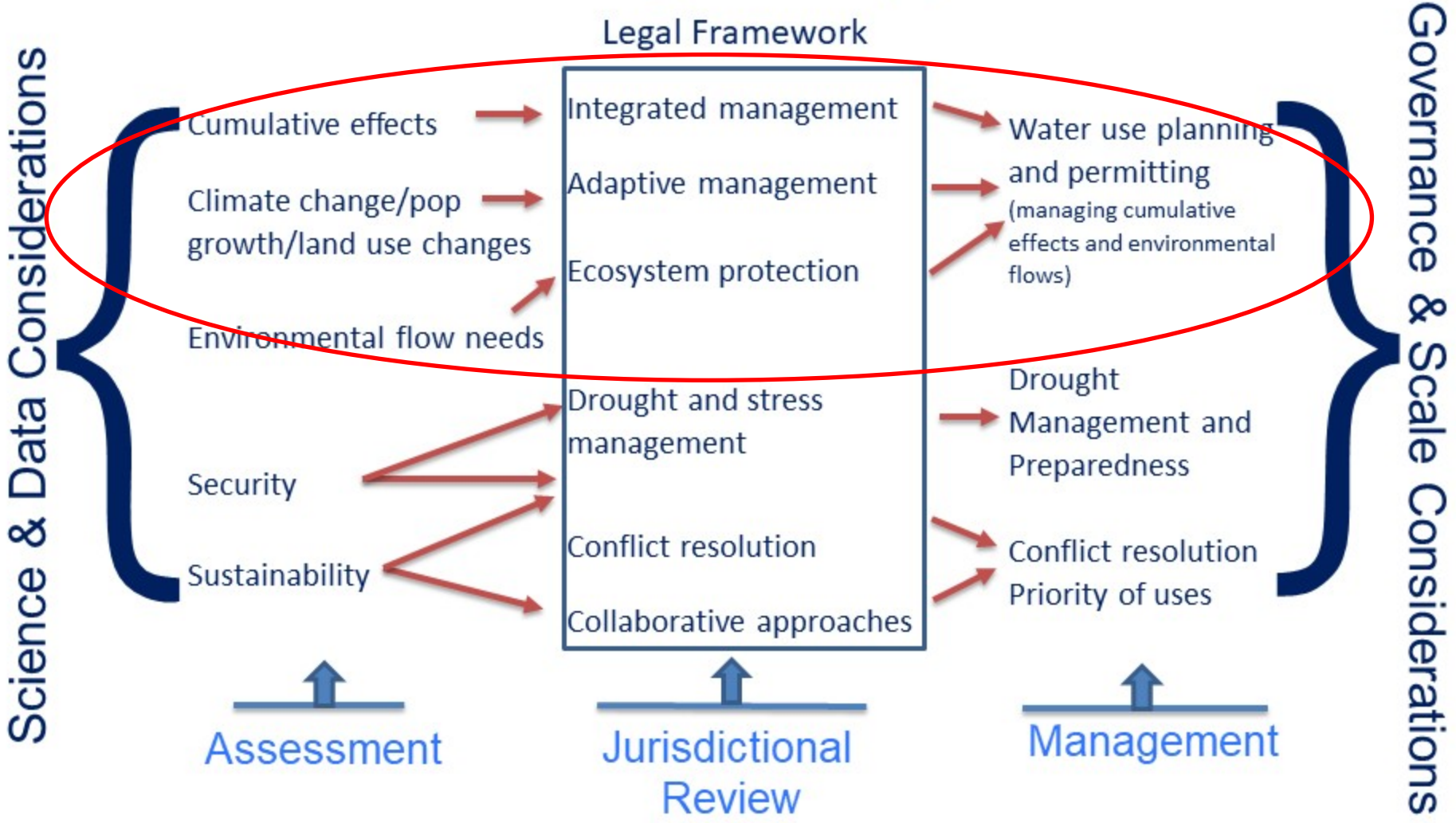
Water Managers Workshops

(Guelph April 24th, Kingston April 25th and Toronto April 27th, 2018)

Workshop Objectives

- Introduce water quantity science and jurisdictional best practices reviews
- Share findings related to:
  - Assessment of **cumulative effects** (in consideration of climate change, population growth and environmental flow needs)
    - Assessment of **environmental flow needs**
  - Management of cumulative effects, including environmental flow needs (in consideration of scale, governance and adaptive management)
- Gather feedback on the applicability of approaches and tools found in the science and jurisdictional reviews to Ontario

Methodology and Approach



Science Review

Objective

To identify and understand the science and science tools that may be needed to improve management of water quantity in Ontario, taking into consideration climate change, population growth, ecological impacts and cumulative effects.

Scope

A literature review on the science of water quantity management:

- Compile and assess a digital library of historical, current and more recent literature found in peer reviewed journals, scientific reports, and other publications and relevant documents;
- Set the context by documenting Ontario's existing water quantity science – environments, approaches and tools; and
- Identify and evaluate best available science, and the best scientific practices including approaches, methodologies and tools that could be applicable to assessment needs in Ontario considering purpose, risk, scale of assessment, physical setting (geology, geography, hydrology, hydrogeology, climate) and data and tool needs and availability.

Key topics in Science Review

- Review is looking at opportunities to enhance Ontario's water quantity related assessment approaches and science tools including:
    - Incorporating the following in a Water Resource Assessment
        - groundwater surface-water interaction and integrated resource assessment
        - Indigenous values and knowledge
        - environmental flow needs
        - climate change and population growth
    - Enhancing our ability to assess
        - cumulative effects
        - water security
        - water resource sustainability

Jurisdictional Review

Objective

To identify policy and law in other jurisdictions that could be used to inform Ontario's approach to water quantity management

Scope

Examination of the available legislative, regulatory, policy, by-law, guidance and other management practices related to water quantity issues relevant in Ontario

Key topics in Jurisdictional Review

- Review is looking at opportunities to enhance Ontario's water quantity management related policy and program approaches and tools including:
  - Water Users
  - Cumulative Effects
  - Integrated Water Management
  - Environmental Flow
  - Water Stress
  - Priority & Conflict
  - Drought Planning
  - Stakeholder Involvement
  - Role of Indigenous nations
  - Water Bottlers

Ontario

① Watershed Management

- Lake Simcoe Protection (Act & Plan)
- Great Lakes Protection (Act & Strategy)
- Oak Ridges Moraine Conservation (Act & Plan)
- Planning (Act & Provincial Policy Statement)
- Conservation Authorities (Act)

② Water Use & Water Taking

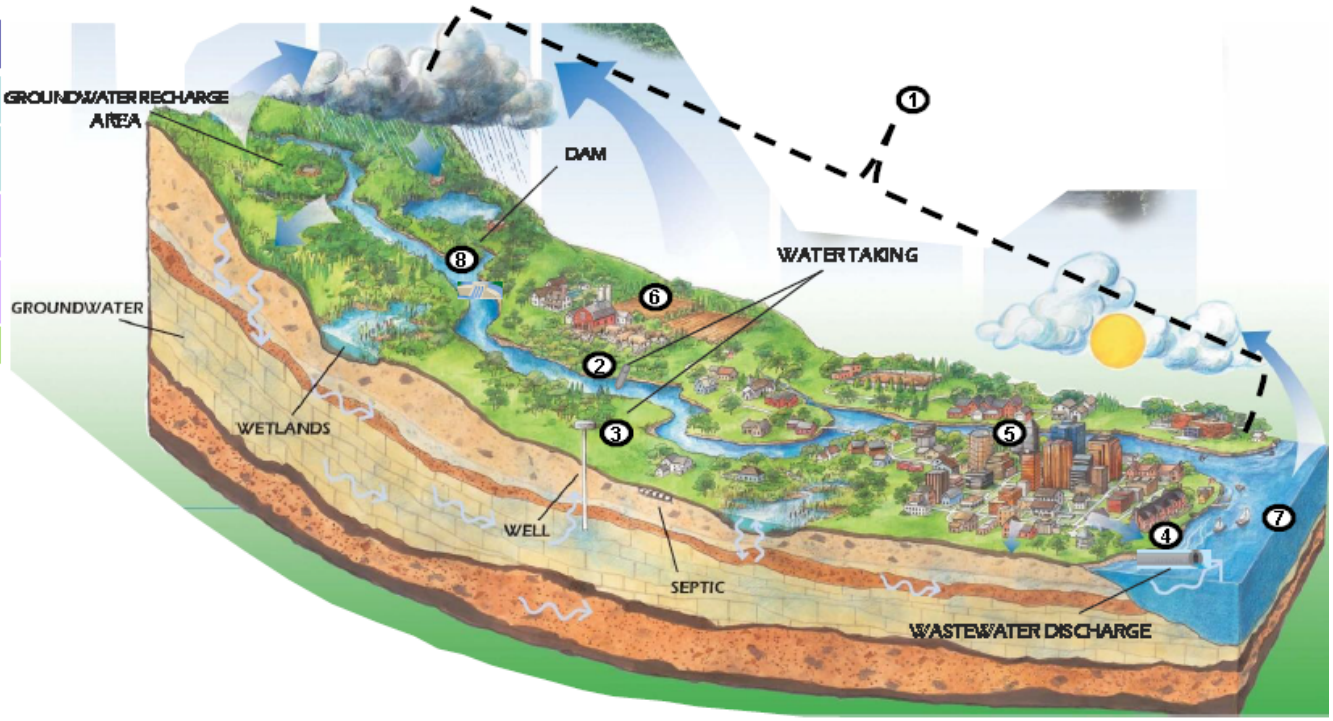
- Ontario Water Resources Act
- Water Management Policies, Guidelines, and Provincial Water Quality Objectives
- Ontario Low Water Response Plan

③ Municipal Water Supply

- Municipal Class Environmental Assessment
- Clean Water Act
- Safe Drinking Water Act
- ② Water Taking also applies

Lead Agency

MOECC | MNRF | MMA



④ Wastewater Discharge

⑤ Land Use

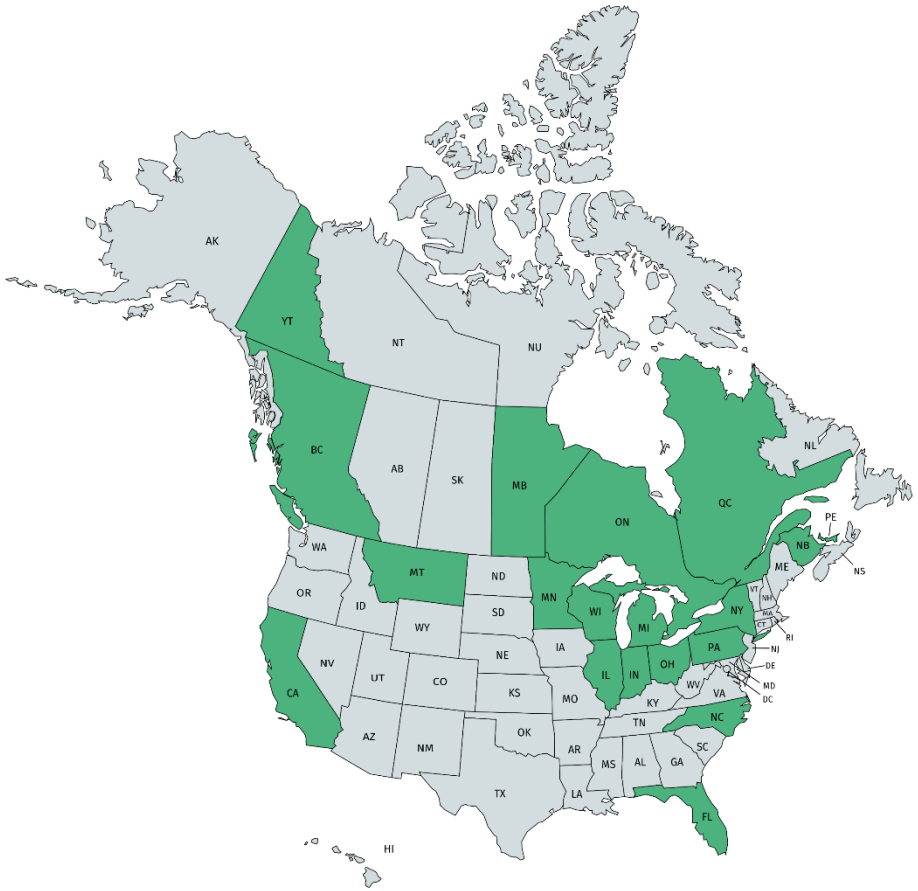
⑥ Drainage

⑦ Great Lakes Water Levels

⑧ Water Control Structures (dams)

Image modified after Conservation Ontario

21 Jurisdictions Reviewed



British Columbia
California
England/Wales
New York
Florida
Illinois
Indiana
Manitoba
Michigan
Minnesota
Montana
New Brunswick
New Zealand (Waikato)
North Carolina
Ohio
Pennsylvania
Prince Edward Island
Quebec
South Australia
Wisconsin
Yukon

Key Considerations for Science and Jurisdictional Reviews

Scale

- Site (e.g. site / local to site)
- Area-wide (e.g. aquifer / watershed /municipal/ FN, etc.)

Governance

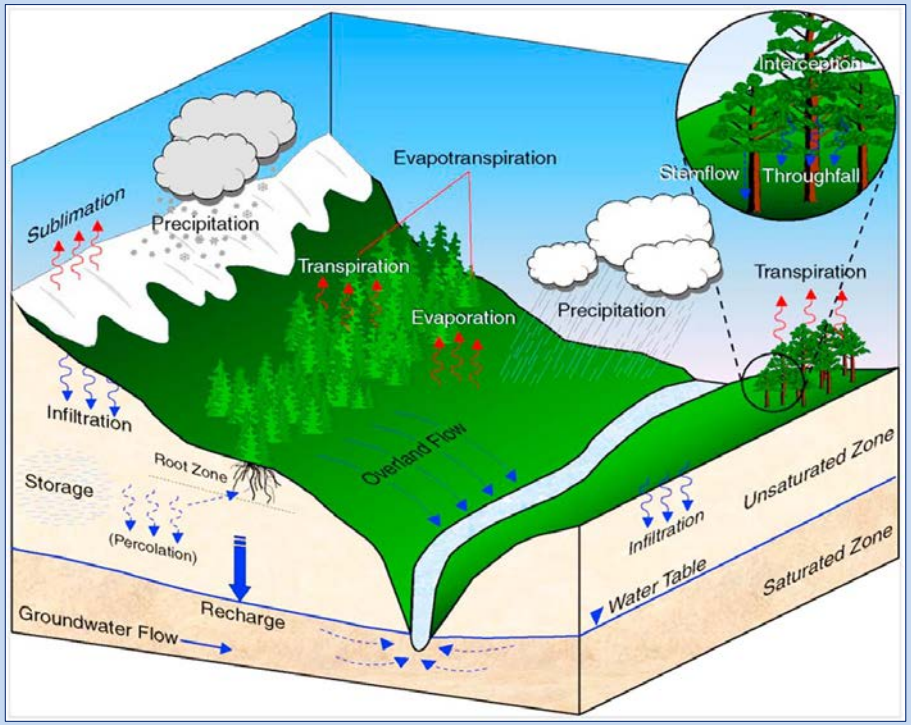
- Permit vs Group of Permits in Area
- Decision maker (e.g. local area, province)
- Adaptive management

Water Quantity Assessment

Water Quantity Assessment: Ontario's Approach

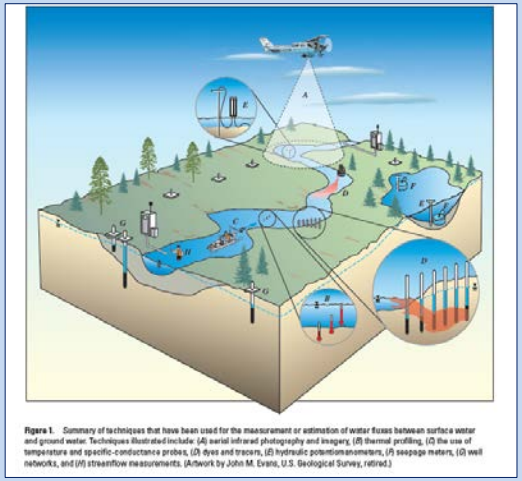
- Approaches used depend on scale of assessment (regional / aquifer/watershed vs. local / site specific), area specific considerations (environmental conditions, data availability, etc.) and assessment purpose, and include:
  - Resource characterization through field work, analysis including use of conceptual models and water budgets built on provincial, regional and local data
    - Generally field methods are used for assessing impacts to the environment or other water users for PTTW applications (e.g. determining stream flow for a PTTW with a surface water taking; or assessing water levels in nearby monitoring wells for a PTTW taking from groundwater).
  - Groundwater or surface water models are typically used to support, source protection and land use planning applications
    - More regional models such as those used for Tier 3 water budgets are used to identify water quantity risk and develop and implement management policies.
  - Integrated groundwater – surface water interaction assessment
- Ontario's water resources assessment approaches and practices are generally consistent with best science and scientific practices / guidance

Water Budget Approach

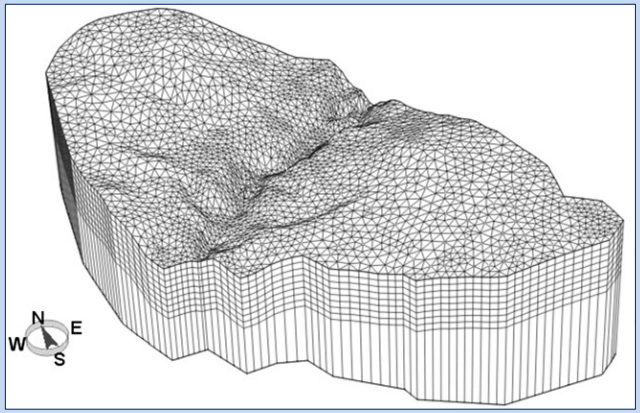


$$P + Q_{on}^{sw} + Q_{on}^{gw} = ET^{sw} + ET^{uz} + ET^{gw} + R_0 + Q_{off}^{gw} + Q^{bf} + \Delta S^{snow} + \Delta S^{sw} + \Delta S^{uz} + \Delta S^{gw}$$

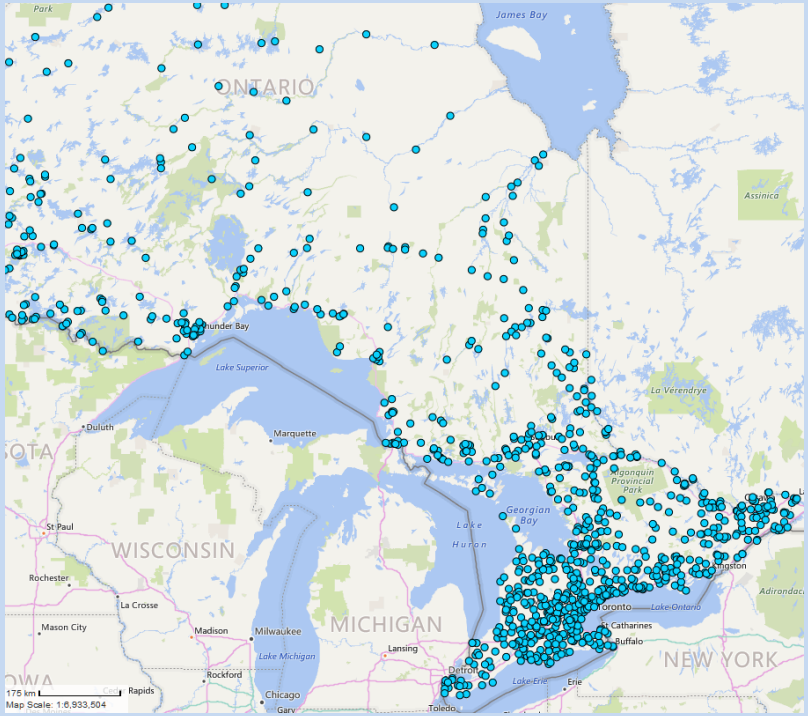
Field methods



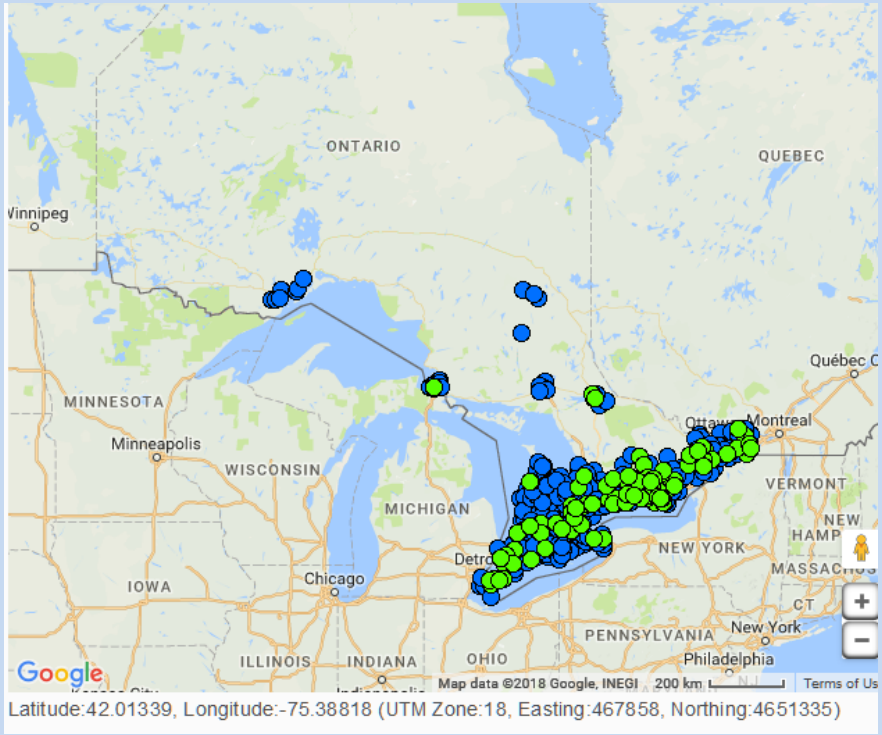
Numerical methods



Surface Water



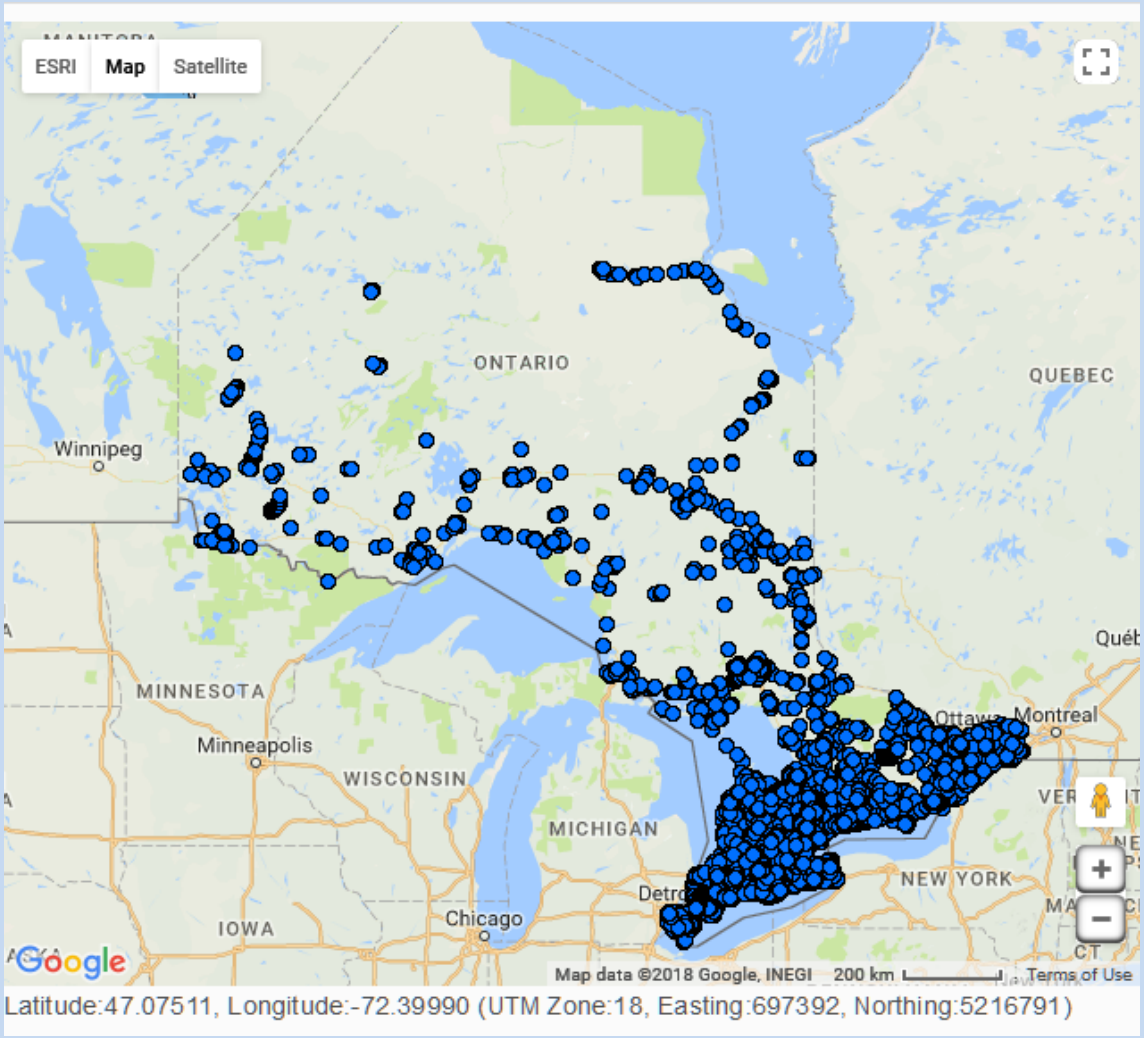
Groundwater



HYDAT stations
Real-time hydrometric data from rivers, streams, and lakes across Canada
(https://ec.gc.ca/rhc-wsc/default.asp?lang=En&n=9018B5EC-1)

PGMN
Water level trends.
(https://www.ontario.ca/environment-and-energy/map-provincial-groundwater-monitoring-network)

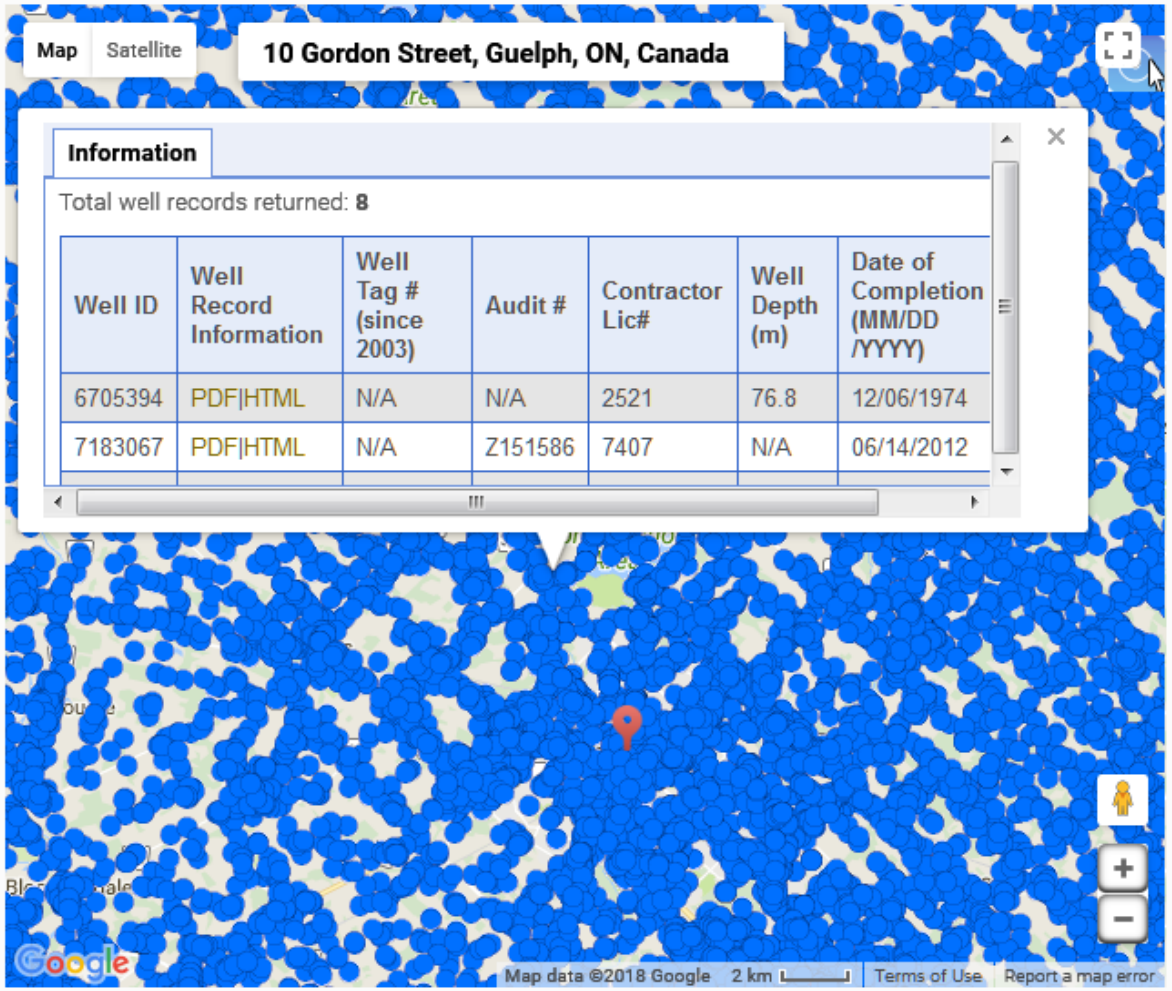
Permits To Take Water (PTTW)



PTTW Permitted takings

https://www.ontario.ca/environment-and-energy/map-permits-take-water

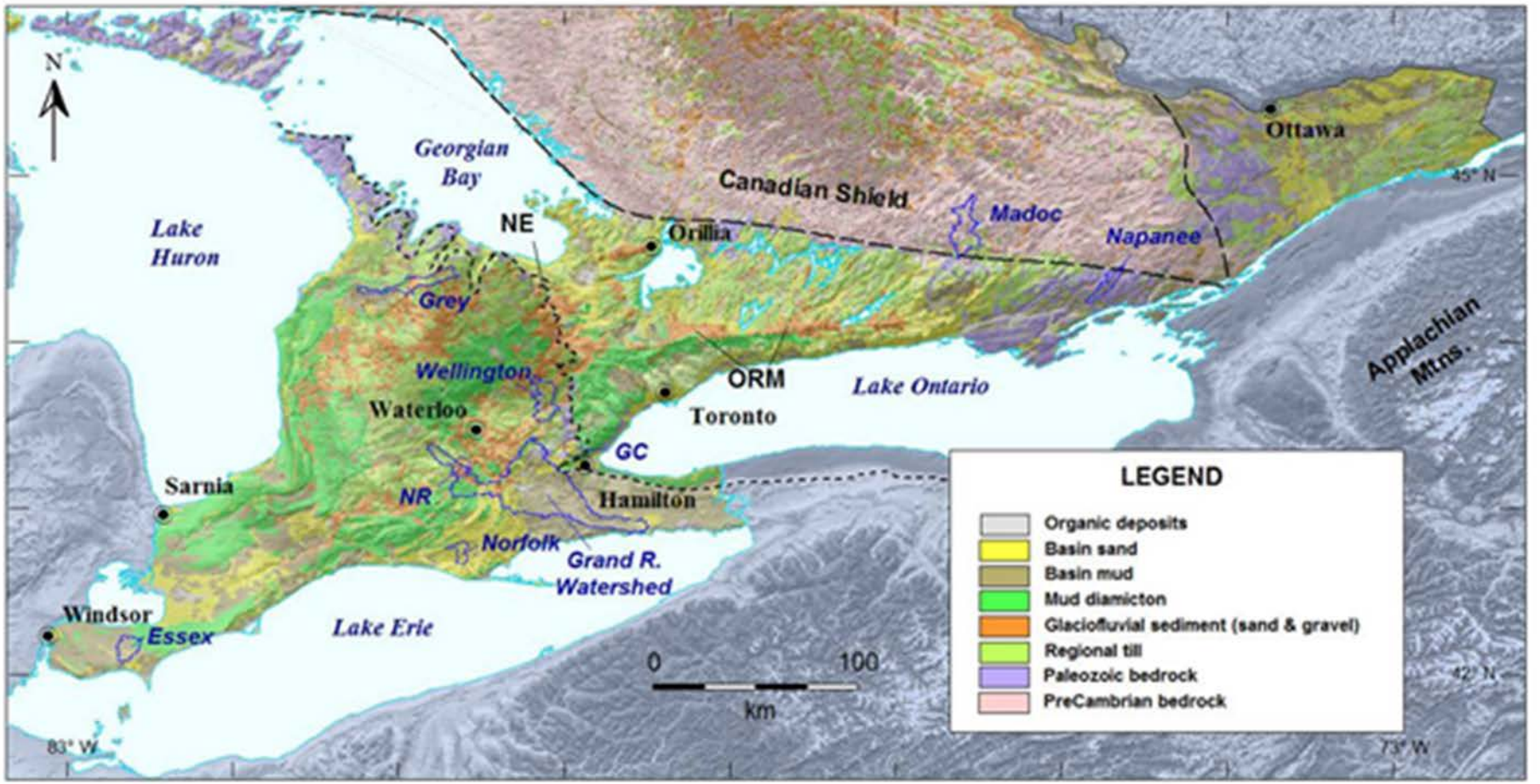
Water Well Information System (WWIS)



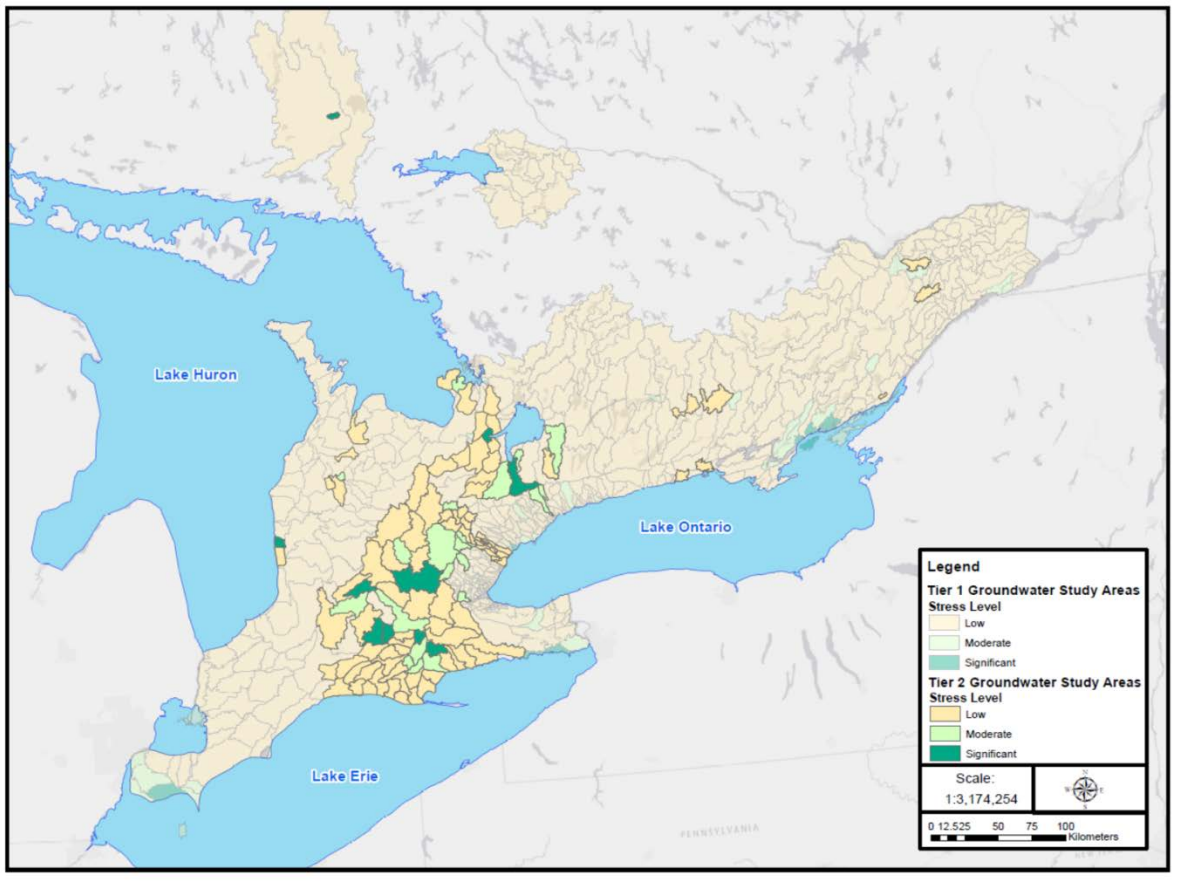
Well record Information

https://www.ontario.ca/environment-and-energy/map-well-records

Regional and Local Understanding Built On Water Well Information System (WWIS)



Municipal Source Protection



Source Protection Water Budgets - *Groundwater*

Climate Change in Ontario

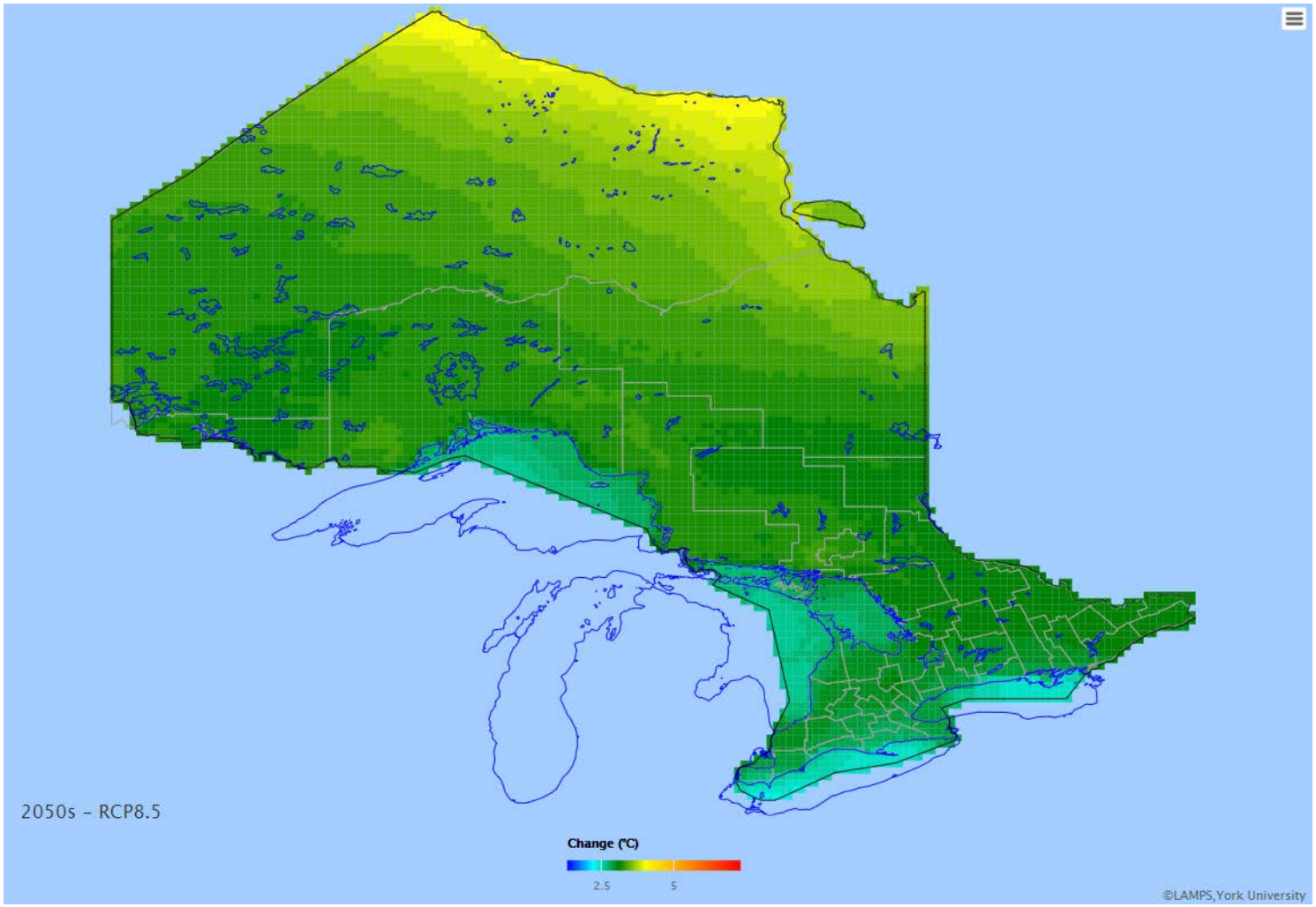
Projected Changes by 2050s (relative to 1986-2005) under the Business as Usual Emission Scenario (RCP8.5):

- Annual mean precipitation over Ontario could increase by ~9%
  - Summer, **decrease** up to ~3% at locations in Southern Ontario
  - Winter, **increase** up to ~16% at locations in south and up to ~35% in north
  - More winter precipitation is very likely to fall as rain
- Very heavy precipitation intensity (≥ 99%tile): increase by ~30%
- Severe winter storms increase in intensity
- Annual mean temperatures could increase by ~3.2°C over the Great Lakes Basin
- Greatest warming: in Northern Ontario during winter
- Changes in extreme warm temperatures > Changes in the annual mean temperature
- Heat waves and drought more frequent and long lasting

Ontario-specific climate projections are based on the most up-to-date data from the Ontario Climate Data Portal.

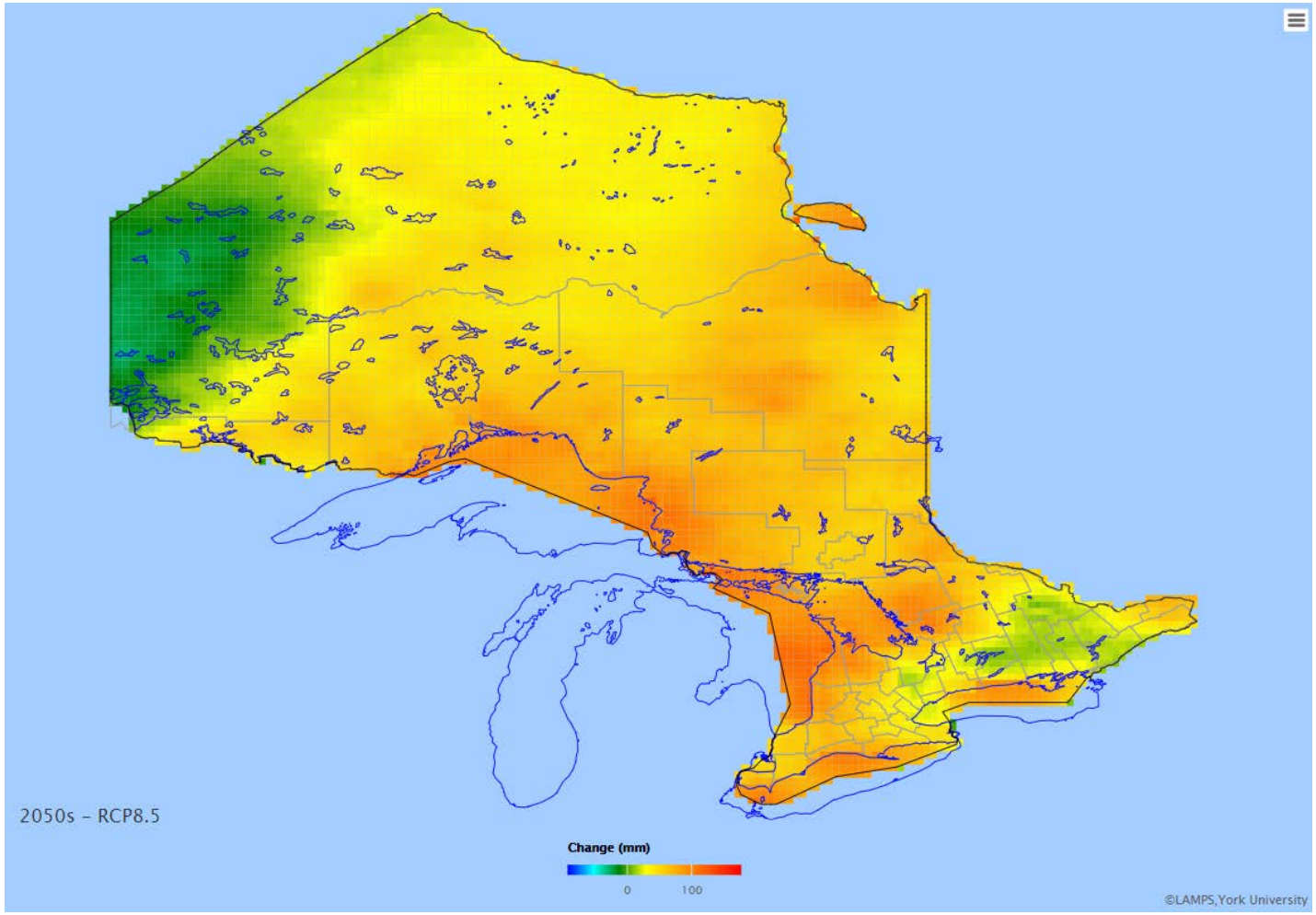
Projected Temperature Change by 2050s

Business as Usual Emission Scenario (RCP8.5)

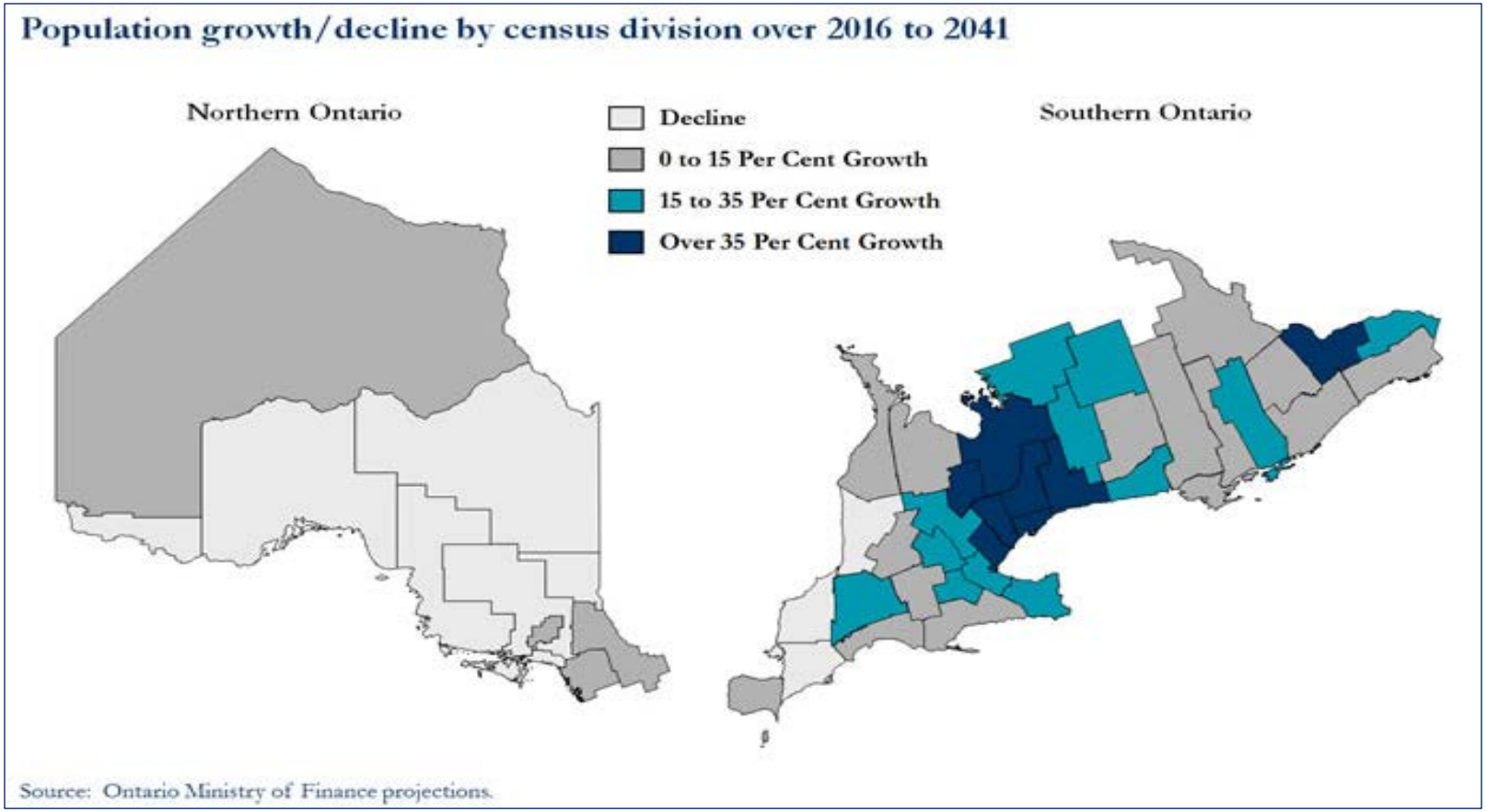


Projected Precipitation Change by 2050s

Business as Usual Emission Scenario (RCP8.5)



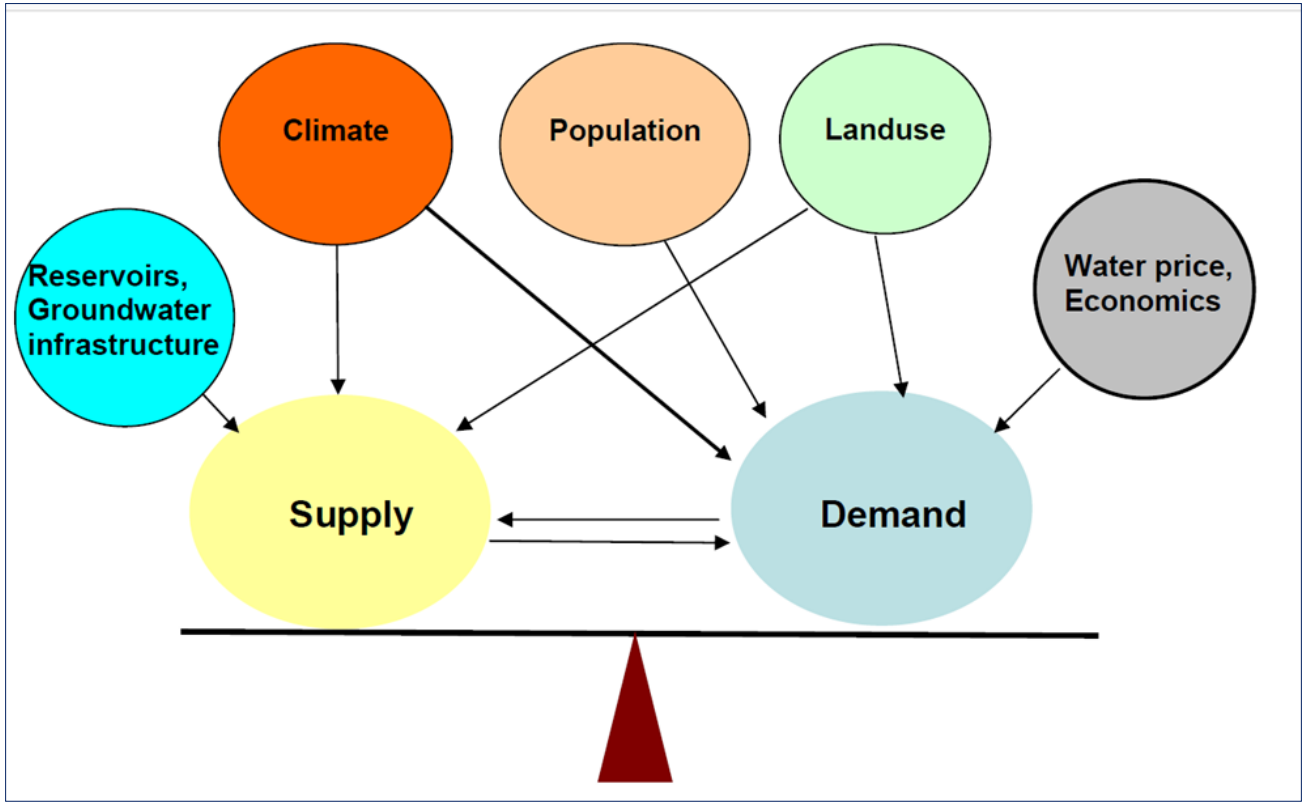
Population Growth Projections



Cumulative Effects

Cumulative Effects Definition

The changes to surface water or groundwater resources that are caused or altered by an action in combination with other human or natural actions or conditions



Assessing and Managing Cumulative Effects (CE) in Ontario

- MOECC Statement of Environmental Values (SEV): “consider the cumulative effects on the environment; the interdependence of air, land, water and living organisms; and the relationship among the environment, the economy and society”
- Formally considered through PTTW program; Principal #4 of the PTTW in Guideline
  - Technical Guidance Document for Surface Water Studies in Support of Category 3 Applications
  - Technical Guidance Document for Hydrogeological Studies in Support of Cat 3 Applications for PTTW
  - Interim Procedural and Technical Guidance Document for Bottled Water Renewals (2017): Permit to Take Water Applications and Hydrogeological Study Requirements
- PTTW Director refers to Average Annual Flow map or Summer Low Flow map (Water Taking and Transfer Regulation), PTTW purpose considered on a watershed basis
- Permit holders have to record daily taking volumes and report annually - data is used to support PTTW decision making
- Source Protection (Tier 1, 2 and 3)
  - Watersheds classified as high, medium or low for water stress
  - Cumulative impact of water takings on municipal wells are assessed using Tier 3 water budgets in high stress watersheds
  - Tier 3 budgets include assessment of CE to natural systems, but only indicate stress. Further work is required to determine adverse effect. Used for predictive purposes NOT yet used for allocation purposes

Assessing Cumulative Effects (CE)

Best Science and Practices

- looked at different approaches in use as well as recommended approaches
- CE assessment approaches in general
  - VERY complex and typically limited available resources
  - Most done for areas prioritized/ identified as high risk areas sensitive to water takings
  - Typical intent is to 1) assess change 2) predict risk of impact 3) identify dominant causal factors
  - Effects based approach OR stressor based approach
    - Need to include multiple stressors and responses in each approach
    - Needs to establish benchmarks or limits (ecological/ hydrological/ hydrogeological)
  - To assess existing/ baseline conditions you always need traditional field methods to build models or to calibrate existing models (groundwater, surface water, integrated)
  - Monitoring data is arguably the most deficient aspect of CE assessments world wide
  - Many but not all jurisdictions factor in groundwater withdrawals into CE on surface water
  - Always need models to assess future conditions based on climate, land use or population growth scenarios
    - Compare the output of individual numerical models with hydrological/ ecological indicators and thresholds (determined separately based on local values and priorities) one can assess potential CE
    - Flow is the most commonly used indicator to support management decisions for CE
  - Canada/ Ontario: recognized gap / challenge: determination of appropriate baseline conditions

Assessing Cumulative Effects (CE)

Best Science and Practices

- Water Withdrawal Assessment Tool (WWAT) (Michigan, US)
  - Basin scale
  - Used to predict the potential impacts of new surface water and groundwater withdrawals on nearby streams and rivers
  - Output used to make decisions on water withdrawal permitting
  - Data needs high, including streamflow, predictive flows of ungauged streams
  - Main weaknesses of WWAT are: 1) lack of resolution of small-scale aquifer characteristics variability, 2) historical flow data are lacking and therefore it is difficult to evaluate if the tool outcomes are accurate or not, 3) the tool also does not account for downstream cumulative withdrawal impacts beyond the boundaries of the particular watershed, 4) reservoirs, dams and lakes are not considered in this tool and 5) small permitted abstractions are not incorporated in this model.

Assessing Cumulative Effects (CE)

Best Science and Practices

- Resource Assessment and Management (RAM) (England)
  - Basin scale
  - Spreadsheet tool, whose outputs are used to calculate the current resource availability for each water body at different flow percentiles and forms the basis of risk screening for abstraction decision making on an ongoing basis
  - Moderate data needs including streamflow measurements, predicted flows of ungauged streams, and permitted abstraction amounts
  - The weaknesses of this approach are: 1) the evaluation of cumulative impacts is based on average annual flows and therefore, there is potential to miss potentially significant seasonal effects that may have ecological impacts, 2) the uncertainty associated with the annual flow duration curves are neglected, and 3) uncertainties associated with the reliability of abstraction data, discharge data, and the volume of effluent discharge that is then available for withdrawal downstream

Assessing Cumulative Effects (CE)

Best Science and Practices

- Healthy River Ecosystem Assessment System (THREATS) (Canada)
  - Basin scale
  - Four integrates components 1) monitoring at local scales consistent with regional scales, 2) watershed planning, 3) assessment of accumulated watershed state, and finally 4) use of modeling to predict future states of watersheds using various development trajectories
  - These components are required on an ongoing basis and the outcomes from each are required by the others
  - Outputs of this framework are then compared with the existing environmental indicators (and their threshold values) to detect potential hydrological, hydrogeological, ecological or biological changes
  - High data needs including having existing environmental indicators and thresholds
  - Baseline monitoring of limited temporal and spatial scope and therefore inadequate to establish the level of natural variation necessary to establish spatial and temporal reference conditions for key indicators
  - Elements of THREATS studied in 7 watersheds of 4 provinces and 2 territories including Grand River, ON

Assessing Cumulative Effects (CE)

Best Science and Practices

- StateMod- surface water planning and StateCU- consumptive use and groundwater models (Colorado, US)
  - Basin scale
  - Surface water planning model used for predicting cumulative impacts of surface water withdrawals, incorporates flow from dams and reservoirs, as well as groundwater use
  - Model predicts consumptive use, primarily for crop irrigation
  - Moderate data needs for surface water including streamflow measurements, and meteorological data
  - High data needs for groundwater modelling (MODFLOW CDSS)
  - A weakness of the current system is that the use of climate data is limited which can be solved by installing more weather stations for collecting data and/or by using of radars in remote areas
  - Another weakness of this approach is the lack of actual water use data

Assessing Cumulative Effects (CE)

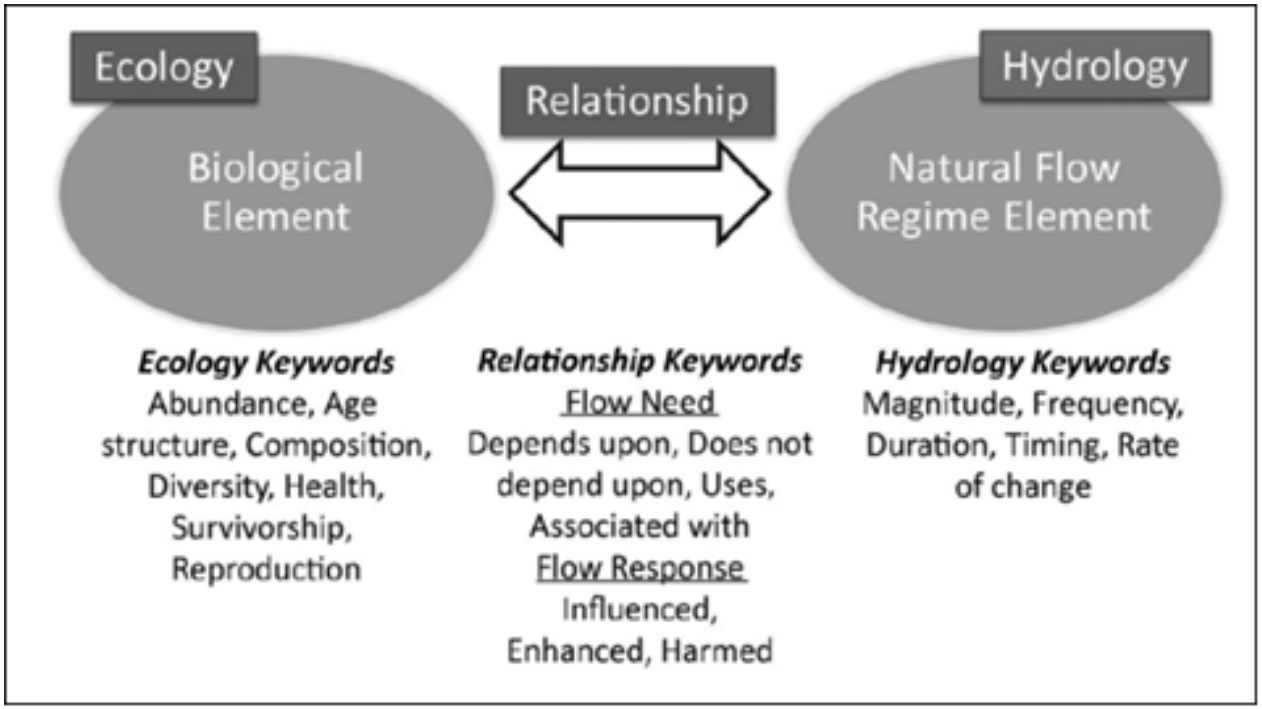
Strengths and Weaknesses Compared to Ontario setting

- All approaches use models, basin scale, high to moderate data needs
- Prioritize where the CE needs to be assessed
  - Source Protection Tier 3 Models in Ontario
- Data resolution temporal and spatial a universal issue
  - Same in Ontario
- Some use CE model outputs in risk screening for water taking decision making on an ongoing basis
  - Not currently the case in Ontario
- Consumptive water use data needed
  - Ontario starting to get consumptive use data, not universally available

Environmental Flow Needs

Environmental Flow Needs Definition

The flows (quantity and timing) and water levels required in a water body to sustain freshwater ecosystems and the ecological function of the flora and fauna present within that water body and its margins.



Assessing Environmental Flow Needs (EFN)
Ontario Approaches

- Ontario regulations, guidance / tools and programs focus on natural flow regime assessment and protection - do not specifically address flow-ecology relationships.

Ontario Low Water Response Program (OLWRP)

- Serves as a general guideline for water conservation/preservation of flows based on long-term historic summer streamflow conditions and precipitation norms.
- During different low water conditions restrictions are initiated
- Generic low flow conditions (Levels 1, 2 and 3) meant to serve as guidance for the entire province are specified and trigger intonation of
  - Levels are representative of a hydrologic method (Tennant) for determining flow thresholds.
  - Thresholds for action are defined based strictly on the definition of low flow conditions without consideration (or identification) of specific ecosystem benefits of maintaining the flows or of distinctive hydrological (defined in terms of magnitude, timing, duration, frequency, and rate of change of flow) or hydraulic (bed morphology) components.

Assessing Environmental Flow Needs (EFN)
Ontario Approaches

Permit to Take Water (PTTW) Program

- PTTW Applications deemed potentially higher risk to environment or other water users (Category 3) require assessment of withdrawal on aquatic ecosystems and other users
  - For a groundwater taking: applicant assesses and ministry reviews
    - Surface water features within the zone of influence must be considered including evaluation of stream/river flows or water levels (lake or wetlands)
  - For a surface water taking: ministry surface water specialists review
    - may include requirements for restrictions to the water taking based on stream flow or water levels. (e.g. development of a threshold flow beneath which no water may be taken or restrictions on the portion of stream flow that can be taken at any given time)
- 7Q20 calculation may be used to determine risk and triggers
    - > 5% is a Category 3 and a detailed assessment is required to assess the potential impact of a surface water taking for rivers and streams (3rd order or higher).
    - < 5% is a Category 2 and a detailed assessment is not required

Assessing Environmental Flow Needs (EFN)
Ontario Approaches

Taking and Water Transfer Regulation (O. Reg. 387/04)

- indirectly considered – application process requires impact or "potential" of proposed water takings on the natural variability of water flow or water levels, minimum stream flow, habitat that depends on water flow or water levels, and interrelationships between groundwater and surface water
- Does not specify need to protect ecosystem functions or breadth of ecosystem

Streamflow Analysis and Assessment Software (SAAS).

- diagnostic tool to support environmental flow assessments being used in Ontario
  - http://people.trentu.ca/~rmetcalfe/SAAS.html
- The distinct difference of this method compared to commonly used Index of Hydrologic Alteration (IHA) and Range of Variability Approach (RVA) is the ability to analyze hourly flow records
  - Makes SAAS suited for assessing large changes in flow regimes over very short temporal scales (i.e. hourly) similar to those observed downstream of hydro peaking facilities.
- Tool being tested in several parts of Canada including Ontario, Quebec and the Atlantic provinces
  - Jones et al, 2015 MNRF. High Flows and Freshet Timing in Canada: Observed Trends.

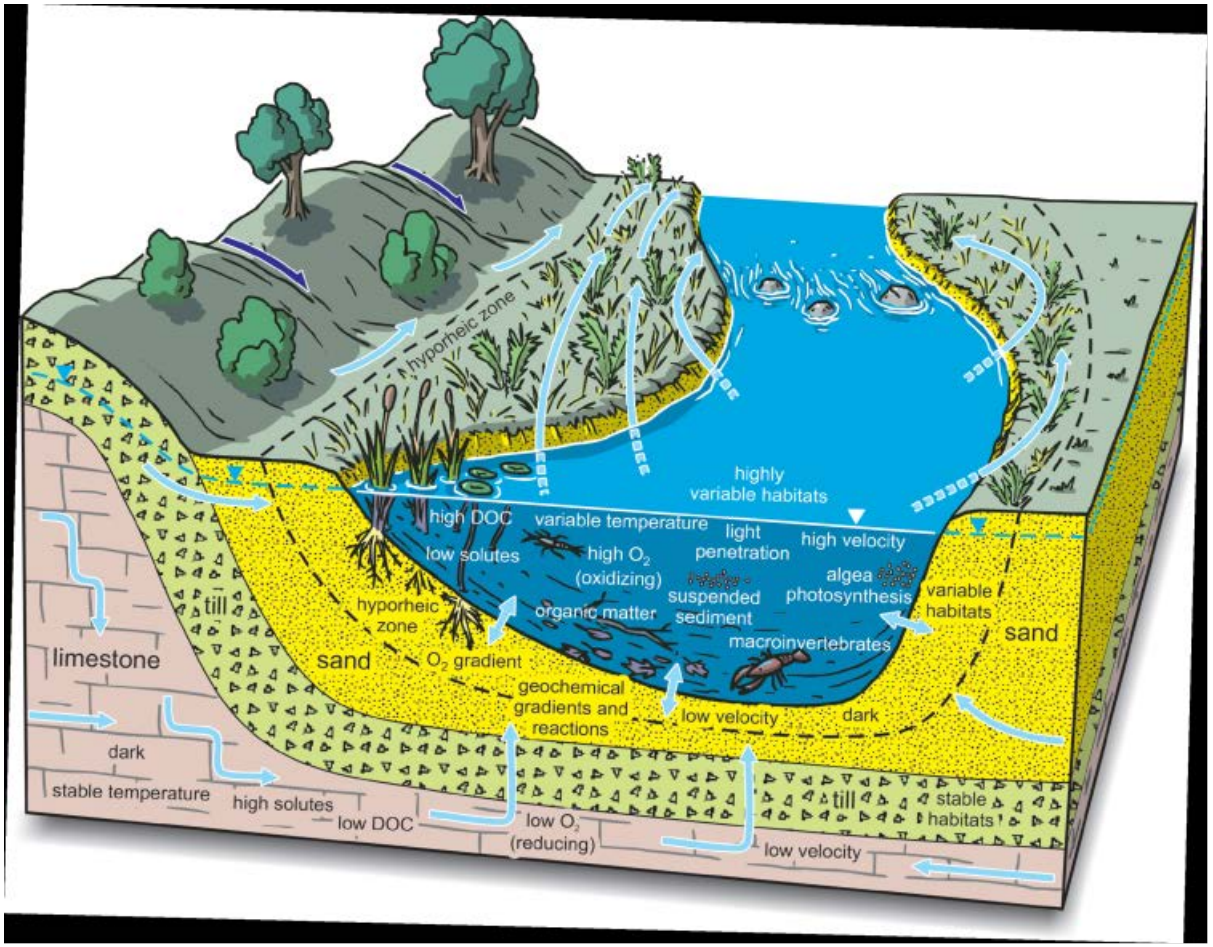
Summary: Cumulative Effects Assessment Tools

Assessment Tool	Used in:
Water Withdrawal Assessment Tool	Michigan
Resource Assessment and Management	England
Healthy River Ecosystem Assessment	Fraser River, BC; Athabasca River, AB; The Peace and Slave Rivers, NT; Yukon River, YT; South Saskatchewan River, AB and BC; Grand River, ON, and the Saint John River, NB
StateMod- surface water planning and StateCU- consumptive use and groundwater models	Colorado
MODFLOW-CDSS Groundwater models	Colorado

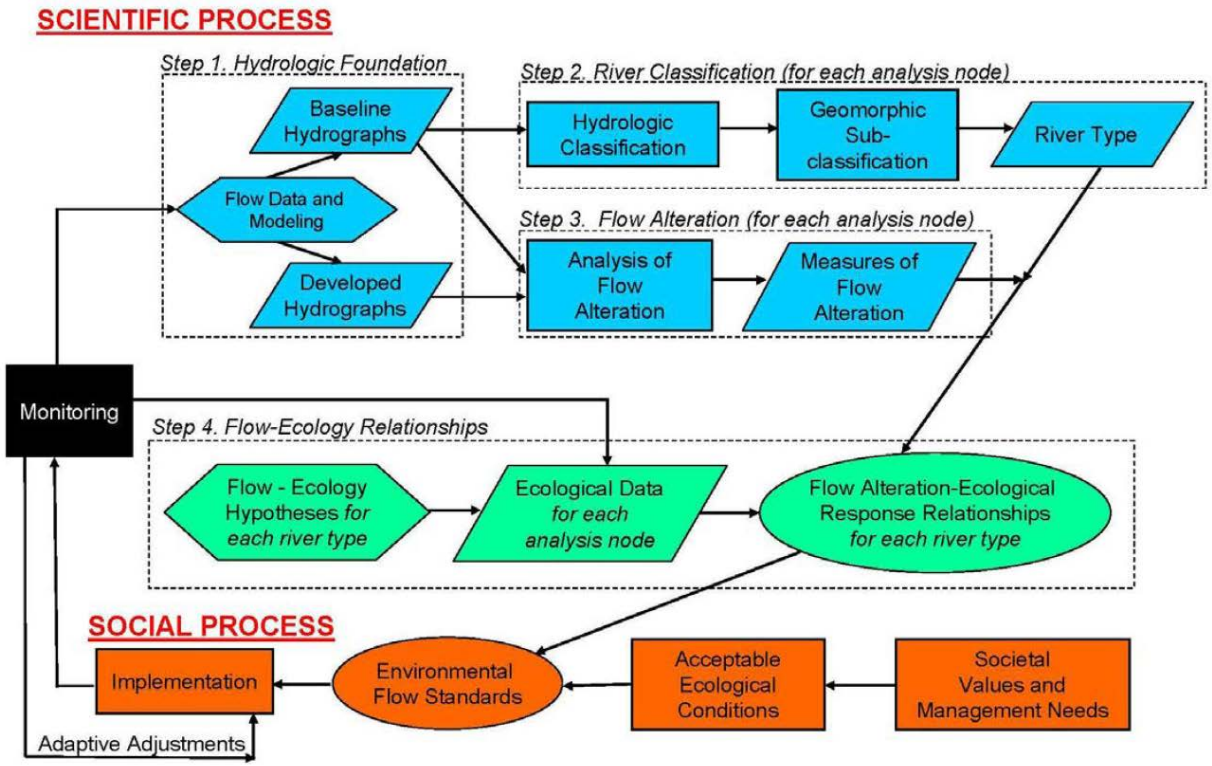
Summary: Environmental Flow Needs Assessment Tools

Assessment Tool	Used in:
Hydrological	
Tennant method	Montana, Canadian Atlantic Provinces
Aquatic Base Flow Method	New England, Maine
$7Q_{10}$ and $7Q_2$	Brazil, Quebec
Index of Hydrologic Alteration	Initially developed in USA but used worldwide (Asia and Europe)
Range of Variability Approach	Initially developed in USA but used worldwide (Asia and Europe)
Habitat Simulation	
PHABSIM	North-America, also used in Germany, South Africa, New Zealand, Italy
Generalized (statistical) Habitat Models	France
Holistic	
Building Block Method	South Africa
DRIFT – Downstream Response to Imposed Flow Transformation	South Africa
Benchmark Methodology	Australia
ELOHA - Ecological Limits of Hydrologic Alteration	US, Australia

Environmental Flow Needs (EFN)
Habitat Simulation Approach Example



Environmental Flow Needs (EFN)
Holistic Approach Example
ELOHA - Ecological Limits of Hydrologic Alteration

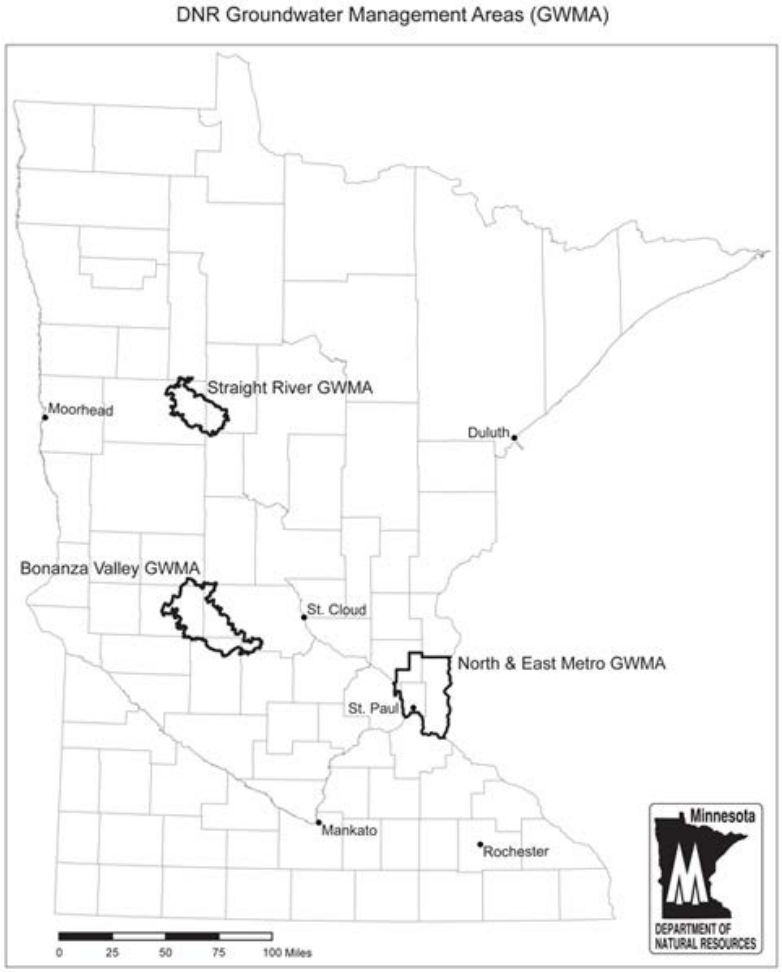


Managing Cumulative Effects including Protection of Environmental Flow Needs

Summary: Managing cumulative effects and protecting environmental flow needs in permitting

- **Legal framework** for managing cumulative effects: legislative, regulative, planning based
  - E.g., Great Lakes Compact, England/Wales Catchment Abstraction Management Strategies, Waikato Regional Plan
- **Scale** at which to consider cumulative effects and EFN: site-specific, sub-watershed, watershed & aquifer (area-based)
  - Cumulative effect consideration at multiple scales within one jurisdiction (e.g., Minnesota); EFN considered at state/provincial, regionally, sub-watershed levels (e.g., PEI & Florida)
- Water Supply Plans (Minnesota) & Mitigation Banks (Florida) are examples of various **adaptive approaches** to managing cumulative effects & EFN needs
- Mixed management approaches – single and multiple takings considered

Minnesota Groundwater Management Areas



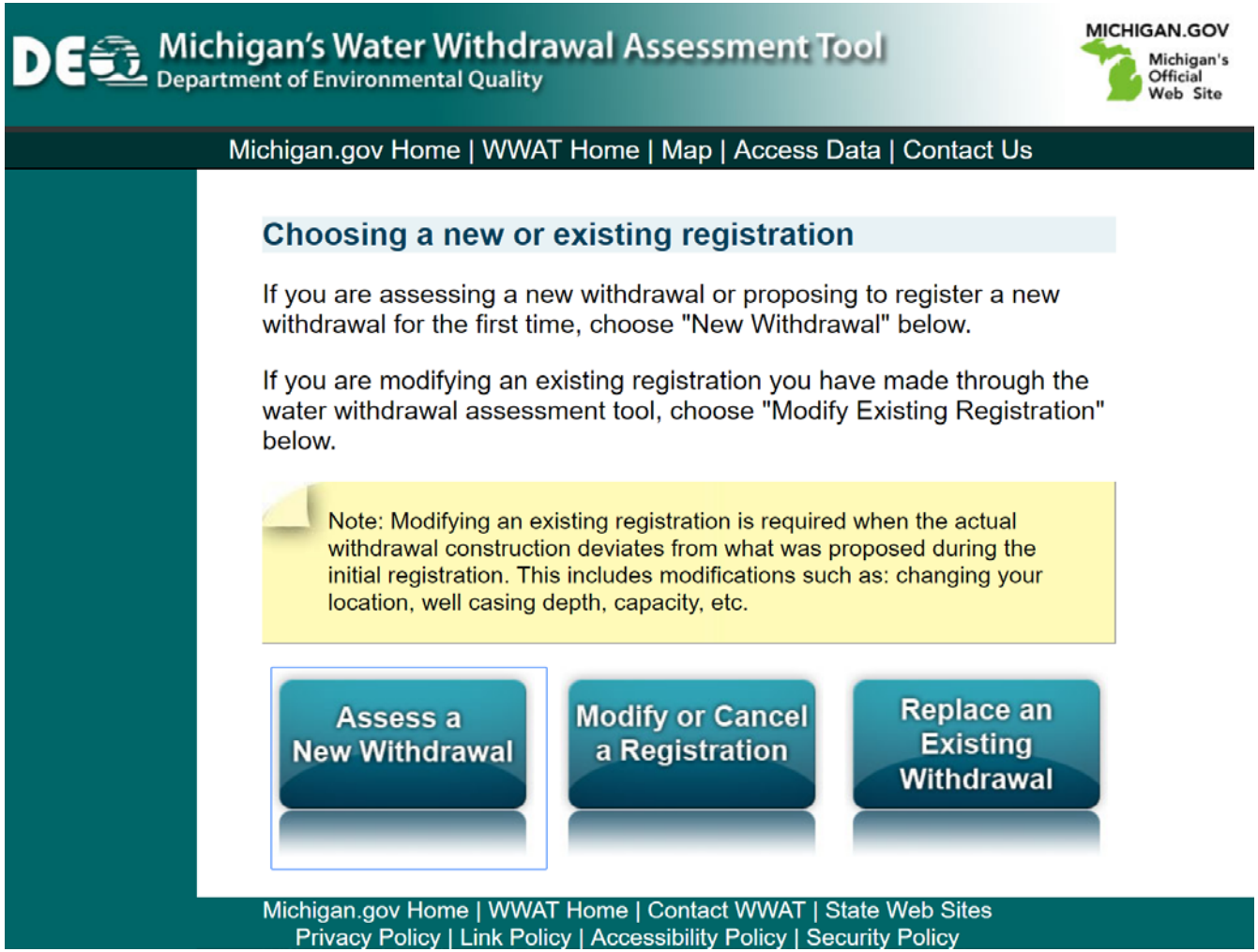
- A water use/allocation planning and management tool for groundwater appropriation
- Provides state with special authority to reduce pumping limits and limit new water appropriations to protect aquifers and connected surface waters
- Cooperation and local partnership is key

Summary: Managing cumulative effects and protecting environmental flow needs in permitting

Roles and Responsibilities – about who assesses cumulative effects and EFN and sets EFN protection levels

- Provincial/state-wide & sub-watershed scale existing as both top-down and bottom-up approaches where state/provincial agencies make assessments and where water users/takers report information
- Protection levels typically set at state/provincial level or regional scale (e.g., Florida)
- Information and data considerations that inform these decisions ties directly to the types of assessment approaches that are used

Managing Cumulative Effects including Environmental Flow Needs



Managing Cumulative Effects including Environmental Flow Needs

Water Withdrawal Assessment Tool (WWAT): Michigan

- Three models interact
  - Withdrawal model
  - Stream flow model
  - Fish impact model
- Cumulative impacts of takings on a sub-watershed basis
- Used to estimate likely impact of a water withdrawal on nearby streams and rivers
- Requires a significant amount of different types of data

Summary: Managing cumulative effects and protecting environmental flow needs in permitting

Application:

- **Approaches to environmental flow need assessment**
  - Statistical modeling and ecological frameworks – varying data requirements and complexity
- **Setting ecological protection levels –** either by category (e.g., cold water/warm water system) or by ecology (fish/ benthic zones)
  - E.g., Michigan's Zones of Risk based on fish response curves tied to 11 stream/river classifications (based on size/temperature) that are used to make permitting decisions
- **Timing** – important to consider when to revisit/reassess cumulative effects and EFN to incorporate existing new water takers
  - EFN assessment – assess for all flows or limit to low flows (summer), or certain periods of water taking

Approach to managing to protect environmental flows
Florida: Priority Streams List and Schedule

- An organizational approach to prioritizing environmental flow needs (Minimum Flows and Levels (MFLs))
- Florida's five water management districts set and prioritize assessing and managing MFL needs annually to support water use planning and withdrawal permitting
- Uses scientific peer review and public input when making MFL decisions

Florida: St. Johns River Water Management District – Priority Streams

SJRWMD Minimum Flows and Levels to be adopted in 2018

New or Re-Evaluation	Waterbody Name	Waterbody Type	County(s)	Voluntary Peer Review to be Completed?	Cross-Boundary Impacts?
New	*Butler*	*Lake*	*Volusia*	*Yes*	*No*
New	*Lochloosa*	*Lake*	*Alachua / Marion*	*Yes*	*Yes*
Re-Evaluation	*Brooklyn*	*Lake*	*Clay*	*Yes*	*Yes*
Re-Evaluation	*Geneva*	*Lake*	*Clay*	*Yes*	*Yes*

SJRWMD Minimum Flows and Levels to be adopted in 2019

New or Re-Evaluation	Waterbody Name	Waterbody Type	County(s)	Voluntary Peer Review to be Completed?	Cross-Boundary Impacts?
New	*Apopka**	*Lake*	*Lake/Orange*	*Yes*	*Yes*
New	*Griffin*	*Lake*	*Lake*	*Yes*	*Yes*
New	*Beauclair (or other Harris Chain lake)*	*Lake*	*Lake*	*Yes*	*Yes*
New	*Dora (or other Harris Chain lake)*	*Lake*	*Lake*	*Yes*	*Yes*
New	*Eustis (or other Harris Chain lake)*	*Lake*	*Lake*	*Yes*	*Yes*
New	*Harris (or other Harris Chain lake)*	*Lakes*	*Lake*	*Yes*	*Yes*
New	*Little Wekiva and associated springs**	*River and springs - 3*	*Seminole/Orange*	*Yes*	*Yes*
Re-Evaluation	*Wekiva at SR46**	*River*	*Seminole/Lake*	*Yes*	*Yes*
Re-Evaluation	*Wekiwa**	*Springs - 2*	*Seminole/Orange*	*Yes*	*Yes*
Re-Evaluation	*Rock**	*Springs - 2*	*Orange*	*Yes*	*Yes*

Links and Common Themes

- Most literature examples and case studies are from areas that have already experienced far reaching and long lasting water shortages.
- Scale, availability of specific data, complexity of the system are key considerations when selecting non-modeling approaches.
- Always need models to assess future conditions based on climate, land use or population growth scenarios

Thank you

Questions & Answers

APPENDICES

Assessing Cumulative Effects (CE)

Approach	How it works	Data and tools needed	Applicable scales	Considerations
Water Withdrawal Assessment Tool[1,2,3,4] Michigan, USA.	The Michigan Water Withdrawal Assessment Tool (WWAT) is used to predict the potential impacts of new surface water and groundwater withdrawals on nearby streams and rivers. The outcomes of this tool are used to make decisions on water withdrawal permitting.	Streamflow measurements, predicted flows of ungauged streams, and permitted abstraction amounts. In the case of using the groundwater withdrawal component of WWAT, the months when the well will be pumped, the well capacity, the days per week that the well will be pumped during those months, and the hours per day pumped must be provided.	Basin scale	Water users can use any method to estimate or measure their water usage. WWAT uses median flow for the lowest flow month to evaluate the potential impact of water withdrawals on stream flows. If any withdrawal could result in an Adverse Resource Impact (ARI) then a site-specific assessment of flows has to be completed by a local hydrologist with full access to available hydrology data. The Michigan Ground Water Inventory and Map (GWIM) database information was used to assign transmissivity, streambed conductance, and storage coefficient in WWAT. WWAT received criticisms from both industry and environmentalists. Main weaknesses of WWAT are: 1) lack of resolution of small-scale aquifer characteristics variability, 2) historical flow data are lacking and therefore it is difficult to evaluate if the tool outcomes are accurate or not, 3) the tool also does not account for downstream cumulative withdrawal impacts beyond the boundaries of the particular watershed, 4) reservoirs, dams and lakes are not considered in this tool and 5) small permitted abstractions are not incorporated in this model.

Assessing Cumulative Effects (CE)

Approach	How it works	Data and tools needed	Applicable scales	Considerations
Resource Assessment and Management (RAM)[1,5] England.	Resource Assessment and Management (RAM) is a spreadsheet tool that incorporates actual reported water withdrawal information to assess the cumulative impacts of water taking. It is used to inform water licensing decisions using flow data, groundwater recharge, discharge, resource allocation for the environment and details of abstraction licenses (volumes and location). In this approach, flow for ungauged sites is calculated using the commercial Low Flow Enterprise software tool. The outputs of this tool are used to calculate the current resource availability for each water body at different flow percentiles and forms the basis of risk screening for abstraction decision making on an ongoing basis.	Streamflow measurements, predicted flows of ungauged streams, and permitted abstraction amounts.	Basin scale	The outputs of this tool are periodically used for cumulative impact assessments using natural flows and recent abstractions data in hydrological models. Moreover, evaluation of scenarios assuming that all water licenses use their full allocation, and the Recent Actual water abstractions are used to indicate levels of local and downstream protection relative to the Environmental Flow Indicator (EFI) and the percentage of time for which further consumptive abstractions might be licensed. The weaknesses of this approach are: 1) the evaluation of cumulative impacts is based on average annual flows and therefore, there is potential to miss potentially significant seasonal effects that may have ecological impacts, 2) the uncertainty associated with the annual flow duration curves are neglected, and 3) uncertainties associated with the reliability of abstraction data, discharge data, and the volume of effluent discharge that is then available for withdrawal downstream.

Assessing Cumulative Effects (CE)

Approach	How it works	Data and tools needed	Applicable scales	Considerations
Healthy River Ecosystem Assessment System (THREATS) [6,7,8] Canada.	Four components are integrated in this framework to assess cumulative effects at a watershed scale. These components are: 1) monitoring at local scales consistent with regional scales, 2) watershed planning, 3) assessment of accumulated watershed state, and finally 4) use of modeling to predict future states of watersheds using various development trajectories. These components are required on an ongoing basis and the outcomes from each are required by the others. The results and outputs of this framework are then compared with the existing environmental indicators (and their threshold values) to detect potential hydrological, hydrogeological, ecological or biological changes.	Land-use development data, background levels of physical–chemical and biological parameters, hydrological and hydrogeological measurements, and meteorological data.	Basin scale	In this framework: 1) land-use and watershed planning need to consider different development alternatives on a landscape, the limits that are possible for such development, and ideally should reflect the interests of people, industries, and agencies in that particular region, 2) Accumulated state assessment has to establish the current watershed status or condition relative to these limits including increases in development and changes that have occurred in aquatic indicators, 3) Scenario models are developed to predict alternate future conditions of key indicators based on different development trajectories and 4) All components are dependent on monitoring that is arguably the most deficient aspect of such studies worldwide. Reference condition monitoring should quantify background levels of physical–chemical and biological parameters at locations that are least developed or ideally non impacted by anthropogenic disturbance. According to analyses conducted during the development of this approach, baseline monitoring conducted for Canadian Environmental Impact Assessments is of limited temporal and spatial scope (typically sampling 1 to 4 times per year for 1-2 years before project development in a local area) and therefore

Assessing Cumulative Effects (CE)

Approach	How it works	Data and tools needed	Applicable scales	Considerations
StateMod- surface water planning and StateCU- consumptive use and Groundwater models.[9,10] Colorado, USA.	StateMod is a surface water planning model used for predicting cumulative impacts of surface water withdrawals. The StateMod model incorporates flow from dams and reservoirs, as well as groundwater use. StateCU is a consumptive use model that predicts consumptive use, primarily for crop irrigation.	Streamflow measurements, and meteorological data. Data from diversion gauges and well meters are also used in some instances.	Basin scale	In contrast to similar aforementioned models, small permitted abstractions (< 0.28 m^3/s) are also incorporated into the Colorado models by aggregating small permits in a local area and attributing it to the general area of the watershed. In contrast, large withdrawals (> 0.28 m^3/s) are modelled at their specific location within the tool. Ungauged stream flow is calculated using correlation to neighboring stream gauges or those in a similar watershed. Meteorological data such as snowpack are increasingly being incorporated into these models to inform the amount of available water supplies. Stream flows are measured and tracked in real-time at USGS and state stream gauges across Colorado; the real-time tracking of flows is key to maintaining agreements concerning flow requirements with downstream states and is an important strength in the tracking of cumulative impacts of water withdrawal. A weakness of the current system is that the use of climate data is limited which can be solved by installing more weather stations for collecting data and/or by using of radars in remote areas. Another weakness of this approach is the lack of actual water use data. There is a reluctance from some municipalities to give information on

Assessing Cumulative Effects (CE)

Approach	How it works	Data and tools needed	Applicable scales	Considerations
MODFLOW-CDSS Groundwater models.[11] Colorado, USA.	MODFLOW-CDSS is a three-dimensional, finite-difference groundwater-flow model based on well-known groundwater code MODFLOW-2005. Two modifications were made to MODFLOW-2005 to fulfill needs identified by the Colorado Water Conservation Board. These modifications include a new Partition Stress Boundaries (PSB) capability and an option to allow execution to continue when the selected solver fails to converge. This model is used in a few basins to assess effects of groundwater withdrawal.	Drain Package, Drain Return Package, Evapotranspiration Package, Evapotranspiration Segments Package, General Head Boundary Package, Recharge Package, River Package, Well Package may need to be invoked to define a complete set of boundary conditions for the groundwater flow simulations. Hydrological data required	Basin scale	The Partition Stress Boundaries (PSB) capability enables the user to partition a selected subset of MODFLOW's stress-boundary packages, with each partition defined by a separate input file. Separate volumetric water-budget analyses are also generated and listed by the code. The "allow execution to continue" capability of the code enables the user to specify that execution of a simulation should continue despite failure of the solver to satisfy convergence criteria, for example in case parameter estimation. Data sets related for groundwater modelling have been developed by Colorado Decision Support System for the San Luis Valley as part of the Rio Grande Decision Support System and for the South Platte alluvial aquifer system as part of the South Platte Decision Support System (RGDSS Phase 6 Groundwater Model & Response Functions). These datasets can be used as a baseline dataset or as a starting point for the development of other datasets. Similar to all other modelling analyses, low temporal and spatial resolution of baseline conditions and hydrodynamic properties are limiting factors that could affect the reliability or the responses generated by numerical models.

Assessing Cumulative Effects (CE) References

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10. CDSS - Colorado's Decision Support Systems. StateCU http://cdss.state.co.us/Modeling/Pages/ConsumptiveUseStateCU.aspx
11. CDSS - Colorado's Decision Support Systems. Groundwater http://cdss.state.co.us/Modeling/Pages/GroundWaterMODFLOW.aspx

Assessing Environmental Flow Needs (EFN)

Approach	How it works	Data and tools needed	Applicable scales	Considerations
Hydrological	Hydrological approaches for determining thresholds rely on existing historical data to determine the natural flow regime and to provide an overall flow level that aims to conserve the biotic integrity of a stream.	Streamflow measurement	Regional scale	These methods are based on the assumption that more water provides the best insurance for river biota, and some low threshold need to be sustained to reduce risk to the biota. These methods are easy to apply as they do not require detailed ecological data or field visit, however accurate long-term real or simulated flow records for the river system must be available which often limits their application. Because hydrological methods are easy to use, these methods should always be used to check the suggested environmental flow regimes derived using other assessment methods. If hydrological methods are used for flow recommendations, appropriate validation in the target region must be carried out, and different flows should be assigned at different times of the year.

Assessing Environmental Flow Needs (EFN)

Approach	How it works	Data and tools needed	Applicable scales	Considerations
Habitat simulation	Examination of change in the amount of physical habitat for a selected set of target species as a function of discharge.	Streamflow measurement, hydraulic measure of a river (usually wetted perimeter or depth) and habitat suitability criteria.	Applied at a study site / river segment scale, upscaling to whole river level based on the assumption of representative sites.	These methods are even more data-intensive than hydrologic methods as detailed field measurements of the geomorphology, the hydraulics and the instream habitat are required.

Assessing Environmental Flow Needs (EFN)

Approach	How it works	Data and tools needed	Applicable scales	Considerations
Holistic	Holistic methods are a group of methods, or rather, environmental flow frameworks which are based on the need to maintain some resemblance to the natural hydrological regime in order to sustain healthy river and riparian ecosystems. Holistic methods aim to merge human and ecosystem flow requirements into a seamless assessment framework. Holistic frameworks integrate social, cultural and economic values within ecosystem protection goals. Holistic methods are sometimes referred to as expert panel approaches, where environmental flow standards are developed in a workshop setting where river-specific data is considered by a multi-disciplinary team of experts.	Social use of riverine resources data, flow regime evaluations (historic and present), hydraulic data, geomorphology, water chemistry, groundwater and biological data, aquatic invertebrates and fish.	Regional or river specific scales.	Holistic methods can be categorized into two main approaches, i.e., bottom-up or top-down approaches. In bottom-up procedures it is assumed that it is possible to prescribe the critical components of a flow regime that needs to remain in the river, while in top-down methods it is assumed that the entire natural flow regime is ecologically important but some flow components can be modified or removed without ecological risk. All holistic approaches share some common properties: 1) some components of the natural flow regime cannot be scaled down, and must be retained in their entirety, 2) other components of the natural flow regime can be scaled down, 3) other components of the natural flow regime can be omitted altogether, 4) the variability of the regulated flow regime should mimic that of the natural flow regime.

Assessing Environmental Flow Needs (EFN) Common Hydrological Approaches

Approach	How it works	Data and tools needed	Applicable scales	Considerations
Tennant Method[1,2]	The method establishes streamflow requirements on the basis of a predetermined percentage of the mean annual flow (QMA), and associates aquatic-habitat conditions with different percentages of QMA. Minimum streamflows for small streams during summer are established by the Tennant method as 40, 30, and 10 percent of the QMA, which represent good, fair, and poor habitat conditions, respectively.	Streamflow measurement	Regional scale	This approach bases its streamflow requirements on the observation that aquatic-habitat conditions are similar in streams carrying the same proportion of the mean annual flow (QMA). The Tennant method was developed using data from rivers in Montana and does not take into account different stream types and flow regimes. Moreover, neither are different species and life stages of fish considered by this method. A modification of the Tennant method, used in the Canadian Atlantic Provinces, designates 25 percent of the QMA as the minimum streamflow requirement in summer (Armstrong et al, 2004).

Assessing Environmental Flow Needs (EFN) Common Hydrological Approaches

Approach	How it works	Data and tools needed	Applicable scales	Considerations
ABM – Aquatic Base Flow Method[2,3]	This method calculates streamflow requirements for gauged, unregulated, free-flowing rivers, and uses default streamflow requirements for regulated rivers, rivers that have a drainage area of less than 50 mi^2 (129.5 km^2), rivers without streamflow records, or rivers whose streamflow-gauging stations have poor-quality streamflow records or have a period of record of less than 25 years.	The medians of selected monthly mean flows. The ABF-method sets default streamflow requirements for August (summer), February (winter), April and May (spring).	Regional scale	The ABF August median-flow statistic was developed by the U.S. Fish and Wildlife Service to be used as a conservative flow threshold for the protection of aquatic resources. The scientific support for selecting the August flow was because it typically is the month with the lowest flows as well as higher water temperatures in New England where this approach was first proposed. Currently, the New England ABF method is used on a more seasonal basis than the previous August. For example in the state of Maine, the Seasonal ABF is determined as the median flow for six different time periods.

Assessing Environmental Flow Needs (EFN) Common Hydrological Approaches

Approach	How it works	Data and tools needed	Applicable scales	Considerations
$7Q_{10}$ and $7Q_2$[2]	The $7Q_{10}$ and $7Q_2$ statistics are used to define low flow thresholds in some jurisdictions.	The $7Q_{10}$ is the lowest seven-day average flow that is expected to occur (on average) once every 10 years. The $7Q_2$ is the lowest seven-day average flow that is expected to occur (on average) once every 2 years.	Regional scale	The flow in a watercourse is unlikely to reach the $7Q_{10}$ or $7Q_2$ except under extreme drought conditions. Application of these statistics as a threshold may therefore not be protective of aquatic habitat. The $7Q_{10}$ is commonly used in Brazil and was widely used in the eastern USA while the $7Q_2$ has been mostly applied in Quebec. The $7Q_2$ methods results in somewhat higher flow thresholds than the $7Q_{10}$ because of the 2-year rather than 10-year recurrence interval. The $7Q_{10}$ and $7Q_2$ approaches have been strongly criticized as lacking any scientific support for their use in setting environmental flow standards for fisheries, and could lead to severe degradation of fishery resources.

Assessing Environmental Flow Needs (EFN) Common Hydrological Approaches

Approach	How it works	Data and tools needed	Applicable scales	Considerations
Index of Hydrologic Alteration[2,4]	The Index of Hydrologic Alteration (IHA) represent a subset of 33 ecologically-important hydrological parameters based on variability of the annual flow regime. The Index of Hydrologic Alteration simply compares hydrologic attributes of a site before and after a certain project activity, or two sites with different kinds or levels of impacts. It provides a statistical measure of change in the central tendency or degree of variation of an attribute of interest.	Calculated from daily flow data, the IHA parameters quantify the magnitude (size), frequency, timing, duration, and rate of change/flashiness of the annual flow regime.	Regional scale	The Index of Hydrologic Alteration was developed into a software program (called IAH) by The Nature Conservancy. IAH software is a tool that calculates a diverse range of simple, but meaningful statistical metrics to characterize the alteration (in magnitude, frequency, duration, timing, rate-of-change, and variability) of the ecologically relevant components of an impaired flow regime. This readily available tool could be employed in hydrological methods wherever there are discharge time series of pre- and/or post-impact hydrographs.

Assessing Environmental Flow Needs (EFN) Common Hydrological Approaches

Approach	How it works	Data and tools needed	Applicable scales	Considerations
RVA – Range of Variability Approach[2,3,5]	RVA was proposed as a simple rule to sustain a normative pattern of hydrologic variability in regulated rivers in the absence of strongly defined empirical flow-ecology relationships. The concept behind the RVA approach is that ecosystems are naturally dynamic and native species have adapted to disturbance-driven fluctuations in their habitats. Therefore, the potential for survival of any given species may diminish if temporal and spatial patterns of species' habitats shift outside their natural range of variation.	RVA is based on more than 20 years of daily hydrological data because this amount of data is required to capture the natural variability of a system.	Regional scale	The RVA approach is dependent on the availability of long term historical data collected at a frequency sufficient to quantify for long term and short term variability in the system in order to statistically identify the natural limits of flow parameters.

Assessing Environmental Flow Needs (EFN) Common Habitat Simulation Approaches

Approach	How it works	Data and tools needed	Applicable scales	Considerations
PHABSIM[2,6,7]	Physical Habitat Simulation System methods consist of two integral parts that are linked together: 1) physical, or hydraulic modeling providing information of changes in the physical habitat as function of discharge and 2) modeling of the biological associations with their physical environment (assumed to be fixed across a range of discharges).	PHABSIM enables the quantitative prediction of suitable physical habitat in a river reach for chosen species and life stages under different river flow scenarios, based on field measurements, hydraulic calibration, and species physical habitat preferences (depth, velocity, and substrate).	River segment scale, applicable to larger scales.	In many jurisdictions, habitat simulations are considered more accurate than hydrological and hydraulic methods to determine flow thresholds levels, and habitat simulation is recommended in high-risk projects. However, the extensive use of PHABSIM has been criticized by some authors who argue that it no longer conforms to standard practices in the wider fields of ecological and wildlife modeling, specifically in its use of inappropriate spatial scales and out-dated methods for modeling habitat preference. PHABSIM cannot consider variation in flow over time, whereas dynamic flow regimes are now considered essential. However, considering flow variability in the assessment of flow-ecology relationships is still difficult for practical implementation, therefore PHABSIM remains a useful tool for EFN assessment as it is relatively simple to implement. Criticism of its use is therefore focused on studies which apply PHABSIM outcomes without

Assessing Environmental Flow Needs (EFN) Common Habitat Simulation Approaches

Approach	How it works	Data and tools needed	Applicable scales	Considerations
Generalized (statistical) Habitat Models[2,5,8]	Because applications of conventional hydraulic-habitat simulation models require considerable field effort and experience, generalized hydraulic-habitat models have been proposed as an alternative. The notable difference between the traditional habitat models and generalized habitat models is that the latter are not based on hydraulic model, but the change in hydraulic variables with varying discharge are computed statistically and as an average distribution at a study reach scale.	The biological data input for generalized habitat models is similar to hydraulic habitat models and the data can be either collected within the studied river or can be obtained from literature. The use of generalized habitat models requires limited experience and field effort and the model output is WUA curves that can be interpreted similarly to the WUA curves derived from hydraulic habitat simulations.	River segment scale, applicable to larger scales.	Generalized habitat models were developed and have been extensively used in France. Examples of generalized habitat models include STATHAB and ESTIMHAB, both of which were developed by the National Research Institute of Science and Technology for Environment and Agriculture (IRSTEA) in France. As the distributions of habitat variables are calculated as average reach conditions, the models are spatially non-explicit (unlike hydraulic habitat models). Six major statistical approaches which can be applied to modeling and predicting site and species specific ecological responses to flow variation as part of EFN assessment are Simple Linear Models, Generalized and Nonlinear Models, Hierarchical models, Functional Linear Models, Machine Learning Approaches, Bayesian Networks.

Assessing Environmental Flow Needs (EFN)
Common Holistic Approaches

Approach	How it works	Data and tools needed	Applicable scales	Considerations
BBM - Building Block Method[2,9]	BBM was developed in South-Africa in the early 1990s to produce rapid advice on the environmental flow standards using limited amounts of data. BBM is designed to construct a flow regime for maintaining a river in a predetermined condition as determined under a specific set of assumptions. There are three main parts in a BBM: 1) A comprehensive information gathering phase. 2) BBM Workshop. 3) Follow-up activities linking the workshop with the engineering and planning concerns.	Data on social use of riverine resources, flow regime evaluations (historic and present), hydraulic analysis, geomorphology, water chemistry, groundwater and biological surveys for vegetation, aquatic invertebrates and fish.	Regional or river specific scales.	The BBM method does not examine alternative flow scenarios as it is designed to build one consensus-based flow regime that supposedly results in a predefined river condition based on best available scientific data. The main assumptions of BBM methods are: 1) The river biota can cope with frequent, naturally-occurring low flow conditions, and may be reliant on higher flow conditions that naturally occur at certain times (i.e. specific floods). 2) Identification of the most important components, or "building blocks", of the natural low flows and floods, and combining them as the modified flow regime, will facilitate maintenance of the river's natural biota and processes. 3) Certain flows influence channel geomorphology more than others, and incorporating such flows into the modified flow regime will aid maintenance of natural channel structure, and diversity of physical biotopes.

Assessing Environmental Flow Needs (EFN) Common Holistic Approaches

Approach	How it works	Data and tools needed	Applicable scales	Considerations
DRIFT – Downstream Response to Imposed Flow Transformation [2,5,10]	The Downstream Response to Imposed Flow Transformation (DRIFT) methodology evolved out of the BBM as a, scenario-based alternative founded on a similar basis of flow-ecology relationships. The methodology employs experienced scientists from different biophysical disciplines which include hydrology, hydraulics, fluvial geomorphology, sedimentology, chemistry, botany and zoology. Data analysis in this approach includes the use of 10 hydrological statistics that are used to summarize daily flow records, and hydraulic modelling that translates flow changes into variables that are needed to evaluate the flow-related impacts on biota.	Data on social use of riverine resources, flow regime evaluations (historic and present), hydraulic analysis, geomorphology, water chemistry, groundwater and biological data, aquatic invertebrates and fish.	Regional or river specific scales.	The DRIFT framework consists of four modules: 1) Biophysical module where the present ecosystem condition in the river is discussed, 2) Sociological module where groups of people directly affected by flow alteration (i.e. stakeholders), and potential social impacts of flow alteration are identified, 3) Scenario development where the different environmental flow regime scenarios are drafted (typically less than five), and 4) economics module where costs of mitigation and compensation for people who are directly impacted by proposed flow alterations are calculated. The implementation costs of the DRIFT framework can be significant depending on the scope of the research carried out in the biophysical module.

Assessing Environmental Flow Needs (EFN) Common Holistic Approaches

Approach	How it works	Data and tools needed	Applicable scales	Considerations
Benchmark Methodology[2,5,11,12]	The Benchmark Methodology is a framework for EFN assessment which was developed in Australia. The methodology is designed to link information on alterations of natural flow regimes to ecological consequences of flow regime change. Comparisons are made between near-natural reference reaches and a set of benchmark reaches that have experienced differing levels of impact resulting from existing water resource development (e.g., dams, weirs, pumped abstraction, or interbasin transfers of water). The methodology can generate many scenarios of hydrologic alteration that are used to forecast likely ecological consequences and thus inform recommendations for flow regime implementation.	Flow regime evaluations (historic and present), hydraulic analysis, geomorphology, water chemistry, biological data.	Regional or river specific scales.	There are four suggested steps in the Benchmark Methodology Frameworks: 1) Develop classification for reference streams where groups of similar streams are defined using ecologically-relevant flow statistics that are identified in an analysis of the respective natural hydrographs. 2) Develop frequency distributions selected flow variable in each class where rivers within a similar reference group have natural variability with respect to the selected ecologically-relevant flow statistics. By combining the information from multiple rivers within the same reference class, a composite hydrograph is developed and can be used as a "norm" within each class of river. 3) Frequency distributions are compared between flow modified and natural streams within the same class and a measure of deviation from the norm is obtained for each ecologically-relevant flow statistic. 4) Develop flow-response relationships using selected ecological health indicators from

Assessing Environmental Flow Needs (EFN) Common Holistic Approaches

Approach	How it works	Data and tools needed	Applicable scales	Considerations
ELOHA - Ecological Limits of Hydrologic Alteration[2,13,14,15]	The Ecological Limits of Hydrologic Alteration (ELOHA) is an operational framework for broadly assessing EFN when time or resource constraints preclude in-depth studies for all rivers in a region. ELOHA takes a regional and multi-site approach towards assessing relationships between human-caused river flow alterations and social–ecological benefits. ELOHA allows for, but does not specify, a social process with practical guidelines for incorporating social preferences into management problems that analyse flow–ecology relationships alongside stakeholder defined preferences. ELOHA is quite flexible and can be used in most situations irrespective of the level of water resources development or the cause of flow alteration. ELOHA is comprised of two components: The scientific process and the social	Historic and present flow regime data and ecological data.	Regional or basin scale.	The main steps of ELOHA are to: 1) build a hydrologic foundation, 2) characterize river types according to their flow regimes and geomorphic features, 3) compute present-day degrees of flow alteration, 4) define flow alteration-ecological response relationships, 5) use flow alteration ecological response relationships to manage environmental flows through an informed social process. The ELOHA framework has been widely used and tested in the United States and other countries. For example, in Australia the Tropical Rivers and Coastal Knowledge (TRaCK) research program, a collaboration of national research institutes, has adopted ELOHA to integrate its existing EFN related studies. As ELOHA is intended for use on regional or basin scale EFN assessments, it is not appropriate for the assessment of individual river reaches.

Managing cumulative effects and protecting environmental flow needs (M-CE)

Consideration	Description	Jurisdictional Examples
Legal framework for considering cumulative effects	• Statue; e.g., Great Lakes Compact • Regulation; e.g., England/Wales, Town and Country Planning Regulations • Planning; e.g., New Zealand (Waikato)	**All eight Great Lake States:** The Great Lakes—St. Lawrence River Basin Water Resources Compact (ORC § 1522) requires all parties "to coordinate the collection and application of scientific information to further develop a mechanism by which individual and Cumulative Impacts of Withdrawals, Consumptive Uses and Diversions shall be assessed" (Section 4.1). **England/Wales:** The Catchment Abstraction Management Strategies (CAMS) ledgers contain details of all the abstraction licences (e.g., volumes and location and discharges) and are updated every time a new licence is issued, changed or revoked to inform future licensing decisions. Each abstraction permit is added to CAMS ledger, which tracks water allocation. **New Zealand:** Policy 11 (Consent Application Assessment Criteria – Surface Water) and Policy 12 (Consent Application Assessment Criteria – Groundwater) outline the factors that must consider when assessing resource water consent applications for groundwater/surface water "takes" and water use. The policies discuss these factors at length, and include cumulative effects with regard to Indigenous (Tangata Whenua) uses and values.

Managing cumulative effects and protecting environmental flow needs (M-CE)

Consideration	Description	Jurisdictional Examples
Scale at which cumulative effects are included in decision making	• Site; e.g., BC • Sub-watershed; e.g., Michigan • Catchment-level; e.g., New Zealand • Watershed & Aquifer level; e.g., Minnesota	**BC:** Cumulative withdrawals from a source are commonly considered across the province in the technical review of an application **Michigan:** For the Water Withdrawal Assessment Tool, cumulative effects are measured on a sub-watershed basis **New Zealand:** Catchment-based allocation is assessed at the point of take and cumulatively with all takes downstream. For groundwater, conservative management yields have been set for some geographic areas (particularly those areas with the greatest allocation pressure) **Minnesota:** The Department of Natural Resources must consider the cumulative long-range ecological effects of the proposed appropriation from a basin. **Minnesota:** In Groundwater Protection Areas decisions are made for new well permitting by considering the cumulative effect on the aquifer

Managing cumulative effects and protecting environmental flow needs (M-CE)

Consideration	Description	Jurisdictional Examples
Scale at which environmental flow needs are considered	• Province/state-wide; e.g., Minnesota • Water Management Districts; e.g., Florida • Sub-watershed; e.g., Michigan	**Prince Edward Island-** "'Geologically" the Province is underlain be essentially a single, relatively flat lying sandstone aquifer. This makes the calculation of water budgets and application of the surface water and groundwater extraction criteria simpler than might be the case in more complex geological environments. **Florida-** Water Resources Act requires [WMDs] to establish minimum flows and level (MFL) for surface waters and aquifers within their jurisdiction **Michigan-** Michigan's Water Withdrawal Assessment Tool determines the level of risk associated with proposed withdrawals by water temperature and catchment area (zones of risk tied to stream/river classifications)

Managing cumulative effects and protecting environmental flow needs (M-CE)

Consideration	Description	Jurisdictional Examples
Ability / tools to manage cumulative effects/EFN adaptively	• Water Supply Plans; e.g., Minnesota • Mitigation Banks; e.g., Florida • Recovery or Prevention Strategies; e.g., Florida	**Minnesota:** All public water suppliers in Minnesota that operate a public water distribution system serving more than 1,000 people and/or all cities in the seven-county metropolitan area, must have a water supply plan approved by the Department of Natural Resources (DNR). Water supply plans are updated every ten years. **Florida:** Mitigation banking is a practice in which an environmental enhancement and preservation project is conducted by a public agency or private entity (banker) to provide mitigation for unavoidable wetland impacts within a defined region (mitigation service area) **Florida:** If actual flows or levels are, or during the next twenty years are expected to be below established minimum flows or levels, the District develops and implements a recovery or prevention strategy (Chapter 40D-80, F.A.C.), in accordance with state law. **Michigan:** Water Withdrawal Assessment Tool provides cumulative effects consideration on an ongoing basis incorporating new well/fish/baseflow data

Managing cumulative effects and protecting environmental flow needs (M-CE)

Consideration	Description	Jurisdictional Examples
Management approach – groundwater / surface water / integrated / other (single or multiple taking)	• Multi-taking/integrated prioritizing groundwater e.g., Minnesota • Single-taking/integrated; e.g., Michigan	**Minnesota:** Groundwater Management Areas - a water use/allocation planning and management tool for cumulative assessing groundwater appropriation considering surface water and groundwater interactions **Michigan:** Water Withdrawal Assessment Tool assesses on a single taking basis cumulative impact using three models for assessment of ground and surface water considerations

Managing cumulative effects and protecting environmental flow needs (M-CE)

Consideration	Description	Jurisdictional Examples
Roles and responsibilities: Who does the assessment of cumulative effects and sets the protection levels?	• Top down; e.g., Michigan • Bottom up; e.g., Florida, Illinois	**Michigan:** Cumulative adverse resource impacts evaluated by the department based upon available information gathered by the department **Florida:** Cumulative effects of water withdrawal are monitored by each of the five Water Management Districts in Florida; to assist in assessment, water users report use data monthly, quarterly or annually, depending on the management district, with the exception of agricultural use, which is collected only in some areas **Illinois**: The Illinois Water Inventory Program (IWIP), is a comprehensive program to inventory water use throughout the state and collects data in three major categories: water withdrawal, water use, and water returns. Each water-using facility inventories the amounts of water withdrawn from surface water and groundwater sources, as well as significant amounts of water purchased from other facilities. The EPA considers this information in new permitting applications

Managing cumulative effects and protecting environmental flow needs (M-CE)

Consideration	Description	Jurisdictional Examples
Roles and responsibilities: Who does the environmental flow needs assessment and who sets environmental flow need protection levels?	• Province/state-wide; e.g., **Minnesota** • Sub-watershed scale; e.g., **Michigan; Florida**	**Minnesota-** River Ecology Unit to determine the necessary annual exceedance flow. A state-wide effort using a network of over 240 stream gauges and regression modeling is being used to form a water use index that identifies the percentage of water that is extracted for consumptive uses across the state **Michigan-** Michigan Department of Natural Resources (MDNR), and stream flow data from the USGS' stream gage network **Florida-** Water Management Districts monitor and enforce regulations based on best available data. Each district is required to establish MFLs for waters the state lists on the MFL Priority Water Body List.

Managing cumulative effects and protecting environmental flow needs (M-CE)

Consideration	Description	Jurisdictional Examples
Application: Approaches to environmental flow need assessment	<u>Statistical</u> • Regression modeling- **Minnesota** • Water Withdrawal Assessment Tool- **Michigan** • Numerical modeling- **PEI** • Risk Management Levels- **BC** <u>Ecological</u> • Life Phases of Sensitive Species- **BC**	**Minnesota-** A state-wide effort using a network of over 240 stream gauges and regression modeling is being used to form a water use index that identifies the percentage of water that is extracted for consumptive uses across the state. **Michigan-** Michigan's Water Withdrawal Assessment Tool (WWAT) uses three models: a groundwater model that predicts stream flow depletions caused by pumping wells, a regression model that estimates stream index flow everywhere in the state; and a model that predicts the impacts on fish populations from stream flow depletion. Adverse resource impacts to rivers and streams are defined in terms of impacts to fish populations and stream index flow, based on the size of the water body and the water temperature. **Prince Edward Island-** Surface water extraction must be stop when a maintenance flow in the stream is less than 70% of the median month flow from the monitoring station. Pumping test and numerical modelling tools are used to determine stream flow impact by proposed well to extract groundwater. Groundwater withdrawals must not cause a reduction in stream baseflow of more than 35% of monthly values during the low flow periods of July – September. **Florida-** minimum levels and minimum flows are calculated using water budget computer models taking into account both existing surface and groundwater withdrawals on flow levels **British Columbia-** Withdrawal thresholds are subdivided into Risk Management Levels 1-3. Level 1: Sufficient natural water availability withdrawal thresholds can range from 5 to 15% of the natural or naturalized flow, with the more conservative threshold for streams or flow periods that are naturally flow sensitive. Level 2: Flow-limited withdrawal or that cumulative water withdrawals are greater than a specified threshold of concern, which ranges from 5 to 20% of the natural or naturalized flow. Level 3: Very flow-limited withdrawal; or that cumulative water withdrawals are greater than a specified threshold of concern, which ranges from 5% for the most flow sensitive to greater than 20% cumulative withdrawals in a low sensitivity scenario. If there are sensitive species or habitats present, additional information may be considered, such as a regional fish periodicity chart that provides minimum flow recommendations for life phases of species of significance

Managing cumulative effects and protecting environmental flow needs (M-CE)

Consideration	Description	Jurisdictional Examples
Application: setting ecological protection levels	By category (fresh water system vs. warm water system) E.g. **Michigan** By Ecology (fish, benthic) E.g. **BC**	**Michigan-** varying cold river systems, cold transitional river systems, warm river systems and specific environmental flow requirements indicating the acceptable percent of withdrawal reduction for each type of system. Sub-watersheds are delignated as 'water management areas' and do not take into account downstream watersheds except when a cold-transitional sub-watershed is immediately downstream of the affected sub-watershed. In that case, the stream flow depletion limits for the cold-transitional sub-watershed apply. Stress areas are identified as a part of "zones of risk". Part 327 of the NREPA has a narrative standard for adverse resource impacts in inland lakes, based on impacts to fish populations and other uses of the lake. Within this legislation, water risk is established on a graduated scale – Zones A-D are based on fish response curves with Zone 'A' as less likely for adverse impacts and Zone 'D' as high risk for adverse impacts. These Zones are tied to 11 stream/river classifications (based on size/temperature) and given as a percentage of flow available that can be withdrawn in consideration with fish population responses. **British Columbia-** If there are sensitive species or habitats present, additional information may be considered, such as a regional fish periodicity chart that provides minimum flow recommendations for life phases of species of significance. These include species designated "threatened" or "endangered" under B.C. Wildlife Act or Federal Species at Risk Act (see BC Conservation Data Centre for most updated list), site-specific identifying species or aquatic habitat with flow related concerns, and regionally important fish species that may include red or blue-listed species and populations that are considered vulnerable in B.C. because they are rare and (or) have limited distributions.

Managing cumulative effects and protecting environmental flow needs (M-CE)

Consideration	Description	Jurisdictional Examples
Application: Timing, incorporation of existing and new water takers, and reassessment for environmental flow needs	Annual Reporting-Minnesota Site Specific Reporting-Florida	**Minnesota-** Sub p2. 103G.282 gives authority to the commissioner to determine the frequency of measuring and specifies that measurement reports must be made annually to the commissioner. Permit holders also must annually report (by February 15th) their monthly water volume pumped and pay fees based on volume (Minnesota Statutes 103G.261, sub d. 6). DNR tracks data and follows up with permit holders who may be violating one or more conditions of their permit. **Florida-** water use data are reported monthly, quarterly or annually, depending on the management district, with the exception of agricultural use, which is collected only in some areas of the state. If minimum targets for minimum flow/level cannot be met, there is a mandate that a 20-year prevention or recovery plan **Michigan-** Existing large quantity water withdrawals that reported their water use to the State of Michigan by April 1, 2009 are considered baseline capacity and are not required to be authorized under Part 327 of the NREPA. New or increased large quantity withdrawals greater than 100,000 gallons per day (gpd) and up to 2,000,000 gallons per day are required to be authorized through the on-line Water Withdrawal Assessment Tool or by a site-specific review by the Michigan Department of Environmental Quality (MDEQ). There is no fee to be authorized by either the Water Withdrawal Assessment Tool or by a site-specific review by the MDEQ. **South Australia-** Water Allocation Plans, which are required under the Natural Resource Management Act at least every three years, are prepared by the regions of South Australia.

Managing Water Resources when Water is Scarce

Ministry of the Environment and Climate Change (MOECC)

Water Managers Workshops

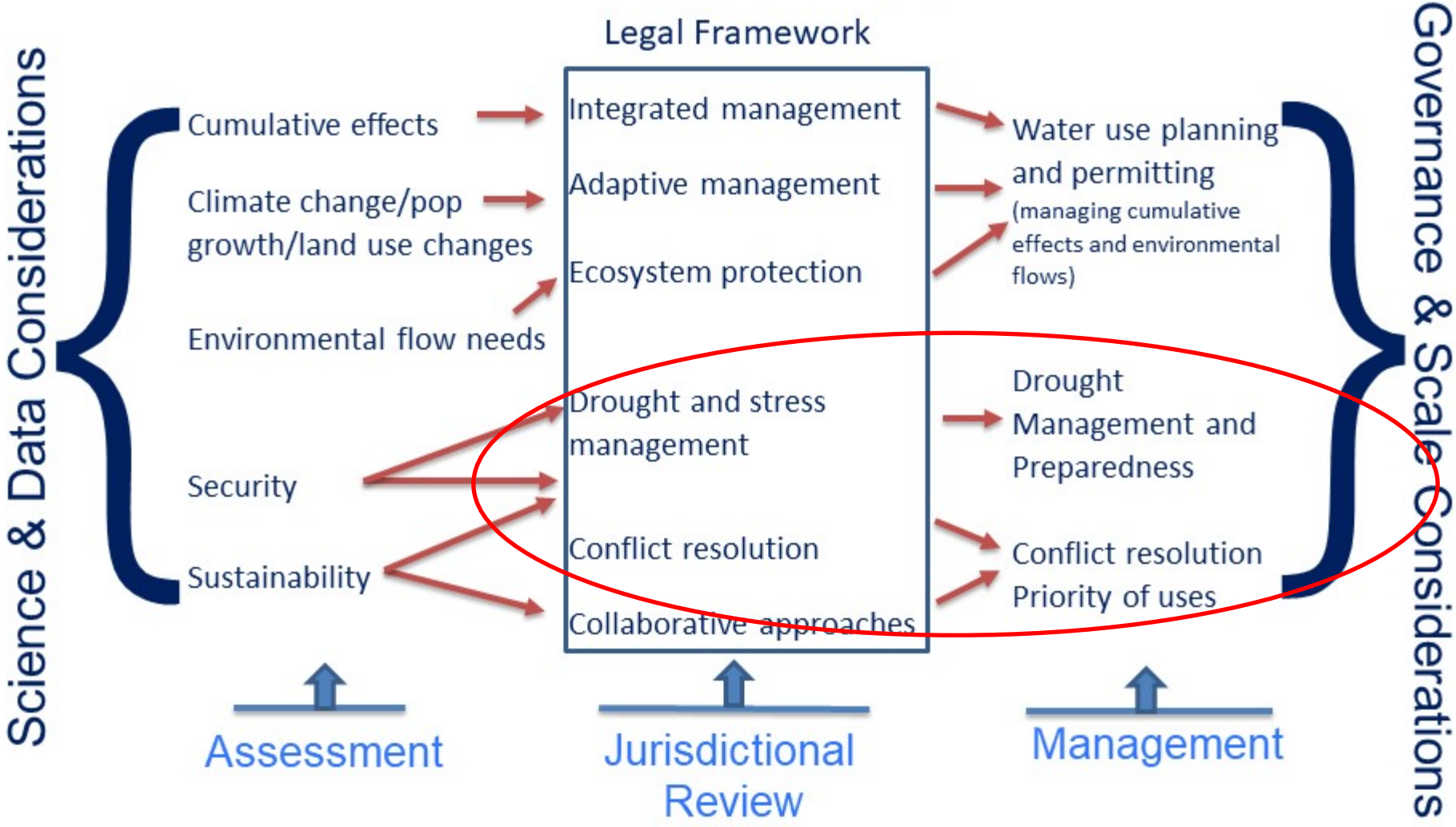
(Guelph April 24th, Kingston April 25th and Toronto April 27th, 2018)

Objective

To share policy and legal approaches and considerations gained from the jurisdictional review to inform a discussion on managing water use in times of scarcity, focussing on:

- How water users and water managers can prepare for and respond to drought or water scarcity using tools such as:
  - Drought management & preparedness: proactive assessment and management prior to drought
  - Priority of water use as a potential tool for managing conflict between users

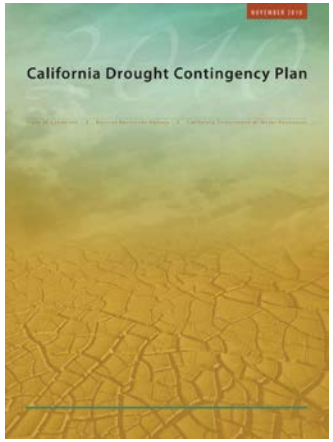
Methodology and Approach

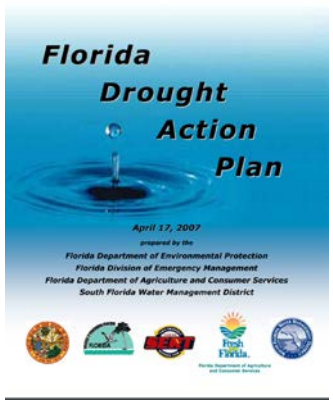


Drought Management & Preparedness

Drought management & preparedness actions are typically organized in Drought Management Plans

- **Format:** plan age, plan length and detail, time frame variations
- **Governance considerations:** legal authority and leadership (who is primary; who is collaborating; who is advising versus taking action)
- **Types of actions:** preparing versus responding versus recovering from a drought; communicating versus reducing/conserving/restricting versus planning versus monitoring
- **Scale:** jurisdiction-wide versus area-specific





Drought Management & Preparedness Actions

Considerations	Description	Jurisdictional Examples
Drought Plans – Scale at which drought plan developed, who develops the plan	• Province/state; e.g., **California, Illinois, Florida, Montana** • Regional; e.g., **Montana, Florida, South Australia** • Municipal; e.g., **Michigan** • Other; e.g., **Northern Cheyenne Tribe Reservation in Montana**	**California-** California Drought Contingency Plan (California Natural Resources Agency & Resources, 2010) **Montana**- State Drought Management Plan (Montana Department of Natural Resources & Conservation, 2016) developed by the state, however local conservation districts have created Drought Mitigation Plans (e.g. Northern Cheyenne Tribe Reservation) **Florida-** Drought Action Plan is developed by the state, however water management districts also have developed their own Water Shortage Plans **Illinois-** there is a state-wide drought action plan, however individual communities within the state have their own drought response plans that set their own restrictions and actions. **South Australia-** The Natural Resource Management Act 2004 establishes eight regional boards across South Australia. Each is responsible for developing a Natural Resource Management Plan for its region. **Michigan-** mandatory regulation of water uses by municipal governments

Drought Management & Preparedness Actions

Considerations	Description	Jurisdictional Examples
Drought Plans - Who implements the plan/drought management measures?	• Federal; e.g., **Montana** • Provincial/state; e.g., **Montana, Wisconsin, New Zealand Waikato Region** • Regional/ Municipal; e.g., **British Columbia** • Individual water takers; e.g., **New Zealand Waikato Region** • Water Use Sector; e.g., **Michigan**	**Montana-** The State Drought Management Plan provides an outline of state, federal, and local response actions. When necessary (which is quite often), the governor issues executive orders related to measures combatting drought including legal specifications and outlining current and applicable drought conditions (Drought and Water Supply Advisory Committee, 2006) **New Zealand Waikato Region-** roles and responsibilities of both the region and its individual water takers are described in the Water Shortage Risk Mitigation Plan **Wisconsin-** Statewide Water Conservation and Efficiency established in Chapter 281.346(8) ("Water and Sewage," 2011) outlines that the department shall develop a statewide program to promote environmentally sound and economically feasible conservation measures. Chapter NR 852 ("Water Conservation and Water Use Efficiency," 2010) is Wisconsin's Administrative Code that outlines water use conservation and efficiency measures. **British Columbia-** Regional and municipal management are noted as creating specific bylaws, planning initiatives, and agencies (e.g., Columbia Basin Trust) **Michigan**- Public Act 35 of 2006 requires that each water use sector develop voluntary guidelines for generally accepted water management practices

Drought Management & Preparedness Actions

Drought Management & Preparedness Actions	Description	Jurisdictional Examples
Contingency and Conservation measures	• Required measures; e.g., **Michigan and Montana** • Voluntary measures; e.g., **Minnesota, Illinois** • Triggers for measures; e.g., **Minnesota**	**Minnesota** - Statute requires public water suppliers to adopt and enforce water use restrictions when the governor declares a critical water deficiency. The restrictions must limit sprinkling lawns, washing vehicles, irrigating golf courses and parks, and other nonessential uses and have appropriate penalties for failure to comply with restrictions. All measures noted are **voluntary** until a governor declares a critical water deficiency based on Q90 low flow stream threshold. Local water supply plans are also required for all public water users, which include the development of conservation and efficiency plans **Michigan-** educational programing for demand conservation that can be carried out by all government levels, mandatory regulation of water uses by municipal governments, and temporary changes to water rate pricing to encourage water users to conserve. These conservation efforts are always in effect, and the water rate pricing changes based on the assessment of availability of water. **Montana-** the governor issues mandatory executive orders related to measures combatting drought including legal specifications and outlining current and applicable drought conditions based on the monthly state-wide assessments (Drought and Water Supply Advisory Committee, 2006) **Illinois-** During a drought, communities send out press releases and voluntary conservation techniques. In a more severe drought, the Governor, through the Illinois Emergency Management Act, may respond to a drought emergency and implement mandatory conservation measures.

Drought Management & Preparedness Actions

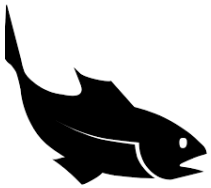
Drought Management & Preparedness Actions	Description	Jurisdictional Examples
Drought conservation measures considering existing measures	• Water usage transfers; e.g., **Montana, California and South Australia** • Cost-savings; e.g., **Michigan** • Priority given for efficiency; e.g., **New Zealand Waikato Region**	**Montana-** Water rights can be sold or leased to other users, but they do not own the water, they only own the right to use the water. In times of drought, water users can choose to sell or lease their water, especially if they have conservation techniques allowing them to consume less water **California-** The water right permit specifies how much and during which season water can be diverted, and other conditions, such as special terms to protect instream flows. Temporary transfers of water from one water user to another have been used increasingly as a way of meeting statewide water demands, particularly in drought years. **South Australia-** Water license trading is the primary mechanism being used within AU jurisdictions to deal with conflict and re-allocate scarce resources. If someone needs water, they can buy temporary or permanent rights to take more water from someone who has excess water allocation available and/or is financially better off selling their water than using it. **Michigan-** water users with conservation measures in place save money with conservation efforts in place as the water rate pricing increases during times of drought **New Zealand Waikato Region-** Policy 18 on "Levels of Priority to Apply During Water Shortages" uses a priority based system for water takers, describing that water takers that consume less will have priority over other water takers in an industrial and agricultural setting

Drought Management & Preparedness Actions

Considerations	Description	Jurisdictional Examples
Triggers for drought management actions	• Low precipitation triggers; e.g., **New Zealand Waikato Region** • Below surface water thresholds; e.g., **Minnesota** • Recurring low water/low precipitation conditions e.g., **Montana**	**Montana -** the DNRC issues a monthly drought report outlining drought conditions in the state, and a drought plan to respond to these conditions **Minnesota-** A Q90 low flow stream threshold (of the August median flow) as a surface water trigger **New Zealand Waikato Region** – low precipitation levels increase mitigation efforts for the Water Shortage Risk Mitigation Plan

Priority of Use

- **Tool to manage conflict: meet changing needs, reduce over-allocation, transparent and equitable approach to balancing/managing social and environmental trade-offs**
- **First in time versus priority of purpose**
  - **Variation over what is prioritized based on societal water values; no objective or universal approach**
  - **Varying experience of use**


Priority of Use in Ontario

- The legal basis for managing water takings in Ontario is English common law as modified by the Ontario Water Resources Act (i.e. requirement to obtain a permit to take water (PTTW)).

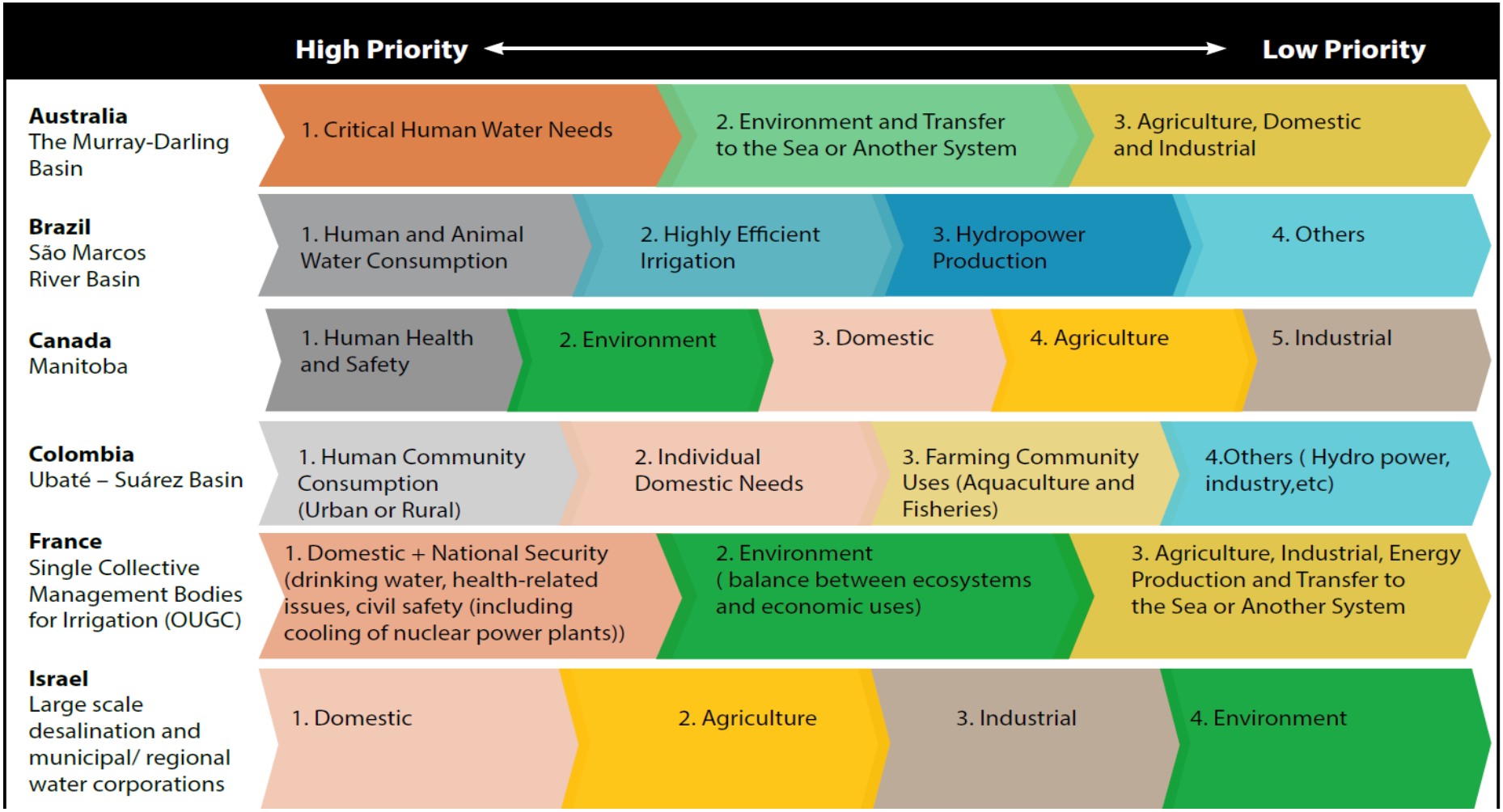
- MOECC policy for water quantity management is to ensure the **fair sharing, conservation and sustainable use of the surface and ground waters in the province**.
  - The "Blue Book" contains a guideline setting out a priority of water uses when evaluating the relative priority of uses in an area where there is insufficient water to meet established and new uses.

- Priority of water use is also guided by:
  - The "high use watershed policies" under the Water Taking and Transfer Regulation: example of setting priorities of water use in stressed areas i.e., permits for new and expanded water takings for specific uses are prohibited.
  - Ontario's Low Water Response Program: if a Level 3 condition is declared, the Water Response Team can ask the MOECC to impose mandatory restrictions on those holding Permits to Take Water, following a model for priority water uses (unique to each watershed):
    i. essential,
    ii. important, and
    iii. nonessential.

Priority of Use – Jurisdictional Examples

First in time	Priority of purpose
Montana: Under Article IX of the Montana Constitution ("The Constitution of the State of Montana," 1972), all waters belong to the state for the use of its people and are subject to appropriation for beneficial uses. The legal structure is based primarily in prior appropriation, or “first in time, first in right”.	**Indiana:** Rule 312 IAC 6.3-4-1, ("Water Withdrawal Contracts from State Reservoirs," 2008), establishes the following water withdrawal priorities from State financed reservoirs under the provisions of IC 14-25-2: A) First Priority is for the use of water for domestic purposes as described in IC 14-25-1-3. B) Second priority is for the use of water for health and safety. C) Third priority is for the use of water for power production that meets the contingency planning provisions of the drought alerts described in 312 IAC 6.3-5-2. D) Fourth priority is for the use of water for industry and agriculture (not described in A, B, or C) that meets the contingency planning provisions of the drought alerts described in 312 IAC 6.3-5-2. E) Fifth priority is for the use of water for a purposed described in clause (C) or (D) that does not meet the contingency planning provisions of the drought alerts
Yukon: Waters Act s.27 “(1) Where two licensees have licences permitting the use of waters, the licensee who first filed an application with the Board in accordance with the regulations made under paragraphs 31(1)(d) and (e) is entitled to the use of waters in accordance with that licensee's licence in precedence to any use of the waters by the other licensee	**Manitoba:**Water Rights Act S. 9 "The order of priority of the purposes for which water may be used or diverted, or works constructed, established or maintained, in accordance with this Act is as follows: 1. domestic purposes; 2. municipal purposes; 3. agricultural purposes; 4. industrial purposes; 5. irrigation purposes; 6. other purposes."

Priority of Uses (OECD, 2015)



Priority of Use

Considerations	Description	Jurisdictional Examples
When are priorities applied/what is the trigger?	• Low precipitation triggers; e.g., New Zealand Waikato Region • Below surface water thresholds; e .g.. Minnesota • Recurring low water/low precipitation conditions; e.g., Montana	**New Zealand Waikato Region** – low precipitation levels trigger; Policy 18 on "Levels of Priority to Apply During Water" **Minnesota-** A Q90 low flow stream threshold (of the August median flow) as a surface water trigger **Montana -** the DNRC issues a monthly drought report outlining drought conditions in the state, and at a severe level "first in time, first in right" water usage applies **Manitoba-** Water Rights Act S 9.2 "The minister may suspend or restrict the rights under a license for a specified period if (a) in the minister's opinion, (i) a groundwater level, (ii) a water body level, or (iii) an in-stream flow, is insufficient to ensure that aquatic ecosystems are protected and maintained."

Priority of Use

Considerations	Description	Jurisdictional Examples
Scale	- Province/state E.g. **Montana** - Municipal governments E.g. **Michigan** - Management area E.g. **Florida**	**Montana-** state-wide assessment determines state-wide priority for water usage **Michigan-** mandatory regulations of water uses and priorities determined by municipal governments **Florida-** water management districts have developed their own Water Shortage Plans for priority of use. During a time of water scarcity the priority usage can effect the whole state, or individual districts within the state

Priority of Use

Considerations	Description	Jurisdictional Examples
What are the outcomes of applying the priorities of use?	- Mandatory conservation measures E.g. **Montana** - Timing/coordination of withdrawals E.g. **Montana** - Restricted water use/reduced water taking E.g. **Minnesota and British Columbia**	**Montana-** Governor makes conservation efforts mandatory at times of drought, reducing certain industry water taking. Some withdrawals are also only allowed during specific times e.g. Irrigation April- October. Water rights can be sold or leased to other users, but they do not own the water, they only own the right to use the water. In times of drought, water users can choose to sell or lease their water, especially if they have conservation techniques allowing them to consume less water **California-** The water right permit specifies how much and during which season water can be diverted, and other conditions, such as special terms to protect instream flows. Temporary transfers of water from one water user to another have been used increasingly as a way of meeting statewide water demands, particularly in drought years. **South Australia-** Water license trading is the primary mechanism being used within AU jurisdictions to deal with conflict and re-allocate scarce resources. If someone needs water, they can buy temporary or permanent rights to take more water from someone who has excess water allocation available and/or is financially better off selling their water than using it. **Pennsylvania-** Priority only declared in a state of drought emergency - 4 Pa. Code Chapters 119-120 outlines non-essential water use restrictions and water rationing. **British Columbia-** date of precedence establishes who is allowed their full allocation of water first **New York-** Environmental Conservation Law states that with respect to the use of the waters of the state and the water courses thereof, due consideration shall be given to the relative importance of different uses. Private riparian rights are subordinate to the public trust doctrine, giving the state the right to reduce commercial, industrial, and agricultural usage in order to sustain domestic demand.

Priority of Use

Considerations	Description	Jurisdictional Examples
Roles & responsibilities: Who develops priorities?	- **Provincial/state** agency E.g. **Montana and Minnesota** - District E.g. **New Zealand Waikato Region** - Management area E.g. **Florida**	**Montana-** The Constitution of the State of Montana **Minnesota-** Minnesota Statute 103G.261 **New Zealand Waikato Region**- "Levels of Priority to Apply During Water Shortages" in the Waikato Regional Plan (Waikato Regional Council, 2010) **Florida-** water management districts have developed their own Water Shortage Plans outlining priorities of use
Roles & responsibilities: Who implements the priorities?	- Province/state E.g. **Montana and Minnesota** - Management area E.g. **Florida**	**Montana-** the governor sets the conservation efforts and water usage priorities every month following a state-wide assessment **Florida-** water management districts have the authority to enforce priorities of use supported by Florida Administrative Code **Minnesota-** water users base priority on "first in time, first in right" and enforced by the state
Is the environment/ ecosystem part of the priority list?	- High Priority- **British Columbia, FIT-FIR** - Medium Priority- **Minnesota, FIT-FIR**	**Minnesota-** restricts water appropriations via Chapter 103G.285, Subdivision 2: "Water appropriations from water courses during low-flow periods may be suspended to protect water availability for instream uses (recreational and fish habitat) and higher priority water users." **British Columbia-** priority for the use of water is first given to essential household needs and critical environmental flows, and then managed according to the precedence of water rights or first-in-time, first-in-right

Discussion Caveats

- **The implementation of the different approaches discussed are not "best practices," rather they are lived experience that are constantly developing**
- **Each approach has been formed for a specific localized issue - hard to make a direct comparison**
- **Today's presentation provided a limited sampling**
- **Application to Ontario must consider multiple factors** (e.g., identified local gaps, Ontario legislation, Ontario environmental context, population growth/climate change/ land use change, implementation cost, etc.)

Thank you

Questions & Answers

Table 1: Assessing and Managing Sustainable Water Resources Discussion

Water Manger Workshop	TOPICS REVIEWED in Presentations	DISCUSSION QUESTIONS		
		Assessment of Cumulative Effects		Managing Cumulative Effects (including Environmental Flow Needs)
		Cumulative Effects	Environmental Flow Needs	
Assessing and Managing Sustainable Water Resources	• Assessment of cumulative effects (in consideration of climate change, population growth and environmental flow needs) o Assessment of environmental flow needs • Management of cumulative effects, including environmental flow needs and considering: o Scale o Governance o Adaptive management	1. Which approaches (existing, presented) could allow us to assess, or improve how we assess cumulative effects at different: o scales (site, local to site, aquifer / watershed / etc.) o levels of complexity 2. What are the benefits and challenges, including barriers and possible solutions, of implementing the cumulative effects assessment approaches identified in Question 1 considering: o appropriate scale(s) of assessment o data/science needs o technical capacity o defensibility o management needs	3. Which approaches (existing, presented) could allow us to assess, or improve how we assess, environmental flow needs at different o scales o levels of complexity 4. What are the benefits and challenges, including barriers and possible solutions, of implementing environmental flow needs the approaches identified in Question 3 considering? o appropriate scale(s) of assessment o data/science needs o technical capacity o defensibility o specific site or area management needs	5. What policy / program enhancements could be considered for Ontario to better assess and manage cumulative effects and environmental flow needs? 6. Under what circumstances might we need to manage water takings on an area-basis (e.g., basin, aquifer) to consider cumulative effects, including protection of environmental flows?

Table 2: Managing Water Resources When Water is Scarce Discussion

Water Manger Workshop	TOPICS REVIEWED in Presentations	DISCUSSION QUESTIONS	
		Drought Planning	**Priority of use**
Managing Water Resources when Water is Scarce	How water users and water managers can prepare for and respond to drought or water scarcity using tools such as: • Drought management & preparedness: proactive assessment and management prior to drought o Triggers for drought management actions • Priority of water use as a potential tool for managing conflict between users	1. Under what circumstances should drought management & preparedness actions be required? What are the triggers for implementing drought management & preparedness measures with respect to groundwater and surface water? 2. What types of drought management & preparedness actions should be considered? Water conservation measures? Water supply contingency measures? 3. Should implementation of water conservation and efficiency practices by water users be taken into account when imposing reductions (i.e., should water users with no water efficiency measures in place be expected to reduce more than those who have existing water conservation and efficiency practices in place)?	4. In your opinion, are priorities of water use needed in Ontario? Under what circumstances and how should they be used? 5. Where should priorities of water use be established? Priorities that apply province-wide? Unique priorities for specific areas (e.g., a watershed or aquifer with water quantity concerns)? 6. Who should determine priorities of water use? The province? Local communities and water users?

APPENDIX E

Individual Discussion Group Summaries

Facility Discussion Summary – Guelph Water Managers Workshop			
Date: **Time:**	April 24, 2018 9:00 a.m. – 12:30 p.m.	**Location:**	Innovations Guelph – 777 Farquhar Street
Topic 1:	**Assessing and Managing Sustainable Water Resources**		
Facilitator:	Cynthia Carr	**Note Taker:**	Ayana Aden
Group Participants:	Luis Lasso (Region of Peel), Heather McGinnity (Town of Orangeville), Todd Gregg (Oxford County), Colin Baker (Township of Centre Wellington), Martin Shepley (Wood PLC), Craig Jacques, Sonja Strynatka (Grand River Conservation Authority)		

The following Overall Summary is prepared as a summary of key points and comments raised in the breakout session/ group discussion. It is based on a compilation of comments captured as part of several different recordings of the discussion including the summary comments noted on a flip chart, digital notes taken during the discussion as well as clarification provided during and after the workshop as obtained through telephone conversations, email and formal written submissions.

Discussion Summary

- **Data:** More data is needed to fully understand the impacts of water takings on an aquifer for Cumulative Effects (CE). For example, private sector water taking data and data on takings under 50,000 L/day (below the permitted threshold) is needed.
- **Michigan Tool to Assess CE:** Participants were concerned that the Michigan tool was too simplistic for use across Ontario, potentially unreliable and categorical for assessing CE. The tool could potentially work at a regional (i.e. municipal) scale but not across Ontario as the only tool. Ontario covers a broader area and range of environmental / water resources conditions and issues (i.e. the environmental issues are a bit more complex than Michigan tool can accommodate).
- **Models/Programs (including Source Water Protection (SWP)):** Current models for assessing CE are available in Ontario (e.g. Tier 3 models) but are underdeveloped and need to be optimized. The mandate of the Source Water Protection program could be expanded beyond municipal supplies. Models to assess CE need to integrate both surface water and groundwater and should be based on the need (e.g. ecological flow needs). Models are also needed for different scales; need a local approach to take into account local conditions and takings. When modelling CE the modeller and model users need to be cognizant of the limitations of the model.

- **Example Model/Tool:** An example model/tool which the MECP could look at is from the United Kingdom. The tool integrates surface water and groundwater information and is therefore one model which avoids conflicting results and inconsistencies.
- **Case Study:** Whitemans Creek was mentioned as a case study which modeled CE using local conditions and data.
- **Funding:** Funding is needed to support model maintenance and data needed to manage the assessment of CE.
- **Scale:** Need provincial direction and guidelines with local implementation for assessing CE and Environmental Flow needs (EFN). The selection of tools and modelling should be at the regional (sub watershed) scale with enough flexibility to incorporate local conditions and requirements. In addition, provincial support and guidance is needed on the available tools when a region does not have a model.
- **Integration of Policy:** One integrated provincial approach is needed for managing CE. Currently there is conflicting advice between government agencies (e.g. Ministry of Environment, Conservation and Parks (MECP) and Ministry of Municipal Affairs and Housing (MMAH)).
- **Communication:** Better communication and coordination is needed between municipalities located in the same watershed and subject to the same Source Protection Plan. Also, better communication, education and outreach to private water takers is needed on water quantity management (CE and EFN). Private takers need to collect and report their own data but it would be helpful to be able to share and compile this data with public water taking data in order to better assess CE and EFN in an area of interest.
- **Triggers** which could prompt the need for more detailed studies on CE and/or EFN include multiple takings; irrigation; historical issues; municipal supply; population growth; and protecting EFN including cold water fisheries.
- **Priority of Use/Scale:** Priority of Use would be beneficial for protecting municipal supplies and key sensitive areas of environmental interest. These priorities and scales should be set by the local jurisdiction.

Facilitated Discussion Summary – Guelph Water Manager Workshop			
Date: **Time:**	April 24, 2018 9:00 a.m. – 12:30 p.m.	**Location:**	Innovations Guelph – 777 Farquhar Street
Topic 1:	**Assessing and Managing Sustainable Water Resources**		
Facilitator:	François Richard	**Note Taker:**	Sarah Olinski
Group Participants:	Stephanie Shifflett (Grand River Conservation Authority GRCA), David Belanger and Wayne Galliher (City of Guelph), Jennifer Don (Kettle Creek) , Ryan Post (Nottawasaga Valley Conservation Authority, NVCA), Richard Wootten (Waterloo), Emily Vandermeulen (Centre Wellington), Jared Craves (Thames Centre), Tiffany Svensson (BMEI)		

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Discussion Summary

- **Scale:** Provincial guidance and leadership is needed on conducting Cumulative Effects (CE) assessments. Provincial guidance is also needed on methods for protecting ecological flow needs, as well as allowing for a variety of acceptable approaches that could be implemented locally. Assessments cannot be completed province-wide and should be done locally. Different tools may be required in different local areas.
- **Baseline Data/Information:** Baseline data/information is needed for assessing CE now and into the future. Gathering baseline data for local CE assessments is challenging. Provincial guidance on data requirements would be beneficial in justifying the need for this data. The following data gaps were mentioned: more geographic coverage is required within the HYDAT monitoring stations network (there are limited points in Guelph) and a greater density of Provincial Groundwater Monitoring Network (PGMN) groundwater monitoring wells (data) is needed; there is a lack of surface water data especially for cold water creeks; and small watersheds have limited to no data. There is a need to define adverse impact: what % reduction in baseflow is not acceptable? Businesses want definitive targets to make business decisions.

- **Data QA/QC:** Available and reliable data is needed to manage and model CE. There also needs to be a feedback mechanism developed for Conservation Authorities (CAs) to report to Ministry of Environment, Conservation and Parks (MECP) inaccuracies in provincial data.
- **Data Access:** Access to current Water Taking Reporting System (WTRS) data is needed.
- **Policy/PTTW:** Provincial guidance documents need to be updated to incorporate examples of CE Assessments in the PTTW application process.
- **Funding:** Provincial source protection funding is risk based, for example, if risk/problems are identified, assessment proceeds to the next tier (e.g., Tier 2 to a Tier 3 water budget); however, funding is also required to sustain assessments and for management, such as data acquisition, collection, infrastructure, retaining staff and monitoring.
- **Priority:** Stressed areas should be a priority for assessment of Environmental Flow Needs (EFN).
- **Case Study:** Whitemans Creek was provided as an example of an assessment of EFN which incorporated stress to fish within the model. Data and individuals with local knowledge were needed to complete the assessment. The CA completed a Climate Change Assessment using the Ministry of Natural Resources and Forestry (MNRF) climate change guidance for water budgets. CA did not use MNRF Ontario Low Water Response (OLWR) definition to identify the three levels of low water conditions. Used a definition that included stress to fish, substituted site specific Level 2 definition and included ecological response (when fish cannot move between pools and become stressed). This CA found the assessment useful as a first step in climate change assessments; however the CA is moving away from climate scenario modeling and more towards Risk Assessments for climate change planning. (Comment based on clarification email).
- **Local Knowledge:** Local knowledge and awareness is often necessary for assessing and protecting EFN.
- **Database:** The Oak Ridges Moraine database was mentioned as a model platform that could be applied province wide (other priority areas).
- **Policy Integration:** Policies and programs need better integration across ministries (e.g. MECP/MNRF/OMAFRA/Planning/Municipal Act).
- **Multijurisdictional Integration:** Some Source Protection areas/municipalities include multiple CAs/watersheds. There is a need to harmonize data and some parts of Source Protection Plans across jurisdictions.

- **Area Based Management Priorities:** CE should be managed on an area basis where water quantity has been identified as a significant drinking water threat (Environmentally Significant Groundwater Recharge Areas) and/or when there is recognized and regular interference between multiple takers.
- **CE Management Benefits/ Challenges:** The Ministry should consider a suitable timeline to revisit Tier 2 water budgets to incorporate and prepare for impacts of climate change and population growth. The Whitemans Creek example is a result of different triggers: OLWR triggers as well as interference on a municipal well from a cluster of PTTW. The originally work was a Tier 2 water budget, but when the CA plotted where all the PTTW sources were located they were clustered. MECP/MNRF funded a pilot study.
- **Data:** It would be helpful if certain key permit holders where required to collect certain types of data / level of info as part of permit renewal (e.g. Nestlé CE Study). Possibly require similar data collection by municipalities.
- **EFN Management Benefits/ Challenges:** An EFN Assessment is a useful decision making tool that is needed for better comprehensive future planning and management since it considers surface water groundwater interaction and therefore improves and protects environmental flow needs. However, it is a complex and multidisciplinary science and requires integration of expertise. EFN is often solely focused on assessing the impact on fish but approach should be flexible enough to be able to incorporate other environmental priorities if local knowledge indicates a need. The defensibility of the assessment depends on the quality and quantity of the data used (how much, how long).
-

Facilitated Discussion Summary – Guelph WMW			
Date: **Time:**	April 24, 2018 9:00 a.m. –12:30 p.m.	**Location:**	Innovations Guelph – 777 Farquhar Street
Topic 2:	**Managing Water Resources When Water is Scarce**		
Facilitator:	Wayne Ingham	**Note Taker:**	Eva Ammentorp
Group Participants:	Chris Neville (Professional Engineers Ontario), Diane Bloomfield (Conservation Halton), Dino Masiero (Centre Wellington),Emily Stahl (City of Guelph), Jo-Anne Rzadki (Conservation Ontario), Martin Keller (Grand River Conservation Authority), Rob Olivier (Ontario First Nations Technical Services Corporation)		

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Discussion Summary

- **Assessment:** Drought Planning is needed and should be based on an assessment which looks at potential risk areas that could be impacted by drought (i.e. based on history and potential climate change impacts). The assessment needs to be at the correct scale.
- **Proactive:** A proactive approach to drought planning is needed. The following areas could be considered for proactive planning: conservation and efficiency of new infrastructure (buildings); and the establishment of drought plans, contingency plans and priorities of use developed prior to drought conditions (opinions varied on the need for priority of use).
- **Enforcement:** Existing rules and regulations should be implemented and enforced before developing any new requirements. For example, provision to provide water supply already assigned priority in O. Reg 170. Some developments beyond a certain size have mandatory requirement for a regulated small water system which mitigates installation of multiple wells and septic systems as area grows until a huge multi-million dollar system is needed. Still happens regardless of planning rules.
- **Scale:** Any new rules around Drought Planning and Priority of Use may require high level Provincial guidelines with local development and/or implementation.

- **Scale/Priorities:** Any priorities for water use should be developed proactively and collaboratively, and include all levels of government.
- **Multiple Jurisdictions:** Drought preparedness is challenging when there are cross jurisdictional issues. Maps could be used without community limits to manage water and therefore look at how to best manage the water source and not manage by political boundaries.
- **Resiliency:** Drought Planning should focus on increasing resiliency in the water supply system. Ground water and surface water should be looked at as one system. Water reuse regulations should be developed to reduce the need for fresh water for some irrigation purposes and enhancing building code to ensure water conservation measures.
- **Policy Integration:** Drought Planning should be coordinated among agencies and across related programs (example Ontario Low Water Response (OLWR) Program and the Source Water Protection Program (SWP)).
- **OLWR:** The OLWR has challenges such as declaring drought conditions too late, for example, for Guelph their surface water intake is not useable because of low water levels well before an OLWR declaration; however, the Program is supported particularly by smaller municipalities as it provides a definitive time when water reductions should be made. It is not clear how low water declarations will be made in the future as the program is undergoing changes, moving away from watershed management toward emergency response.
- **Priority of Use:** Voluntary water conservation plans (schedule E) are included as part of the Permit To Take Water (PTTW) Application but it is unclear how well these are confirmed as accurate or implemented. Reducing some takings for specific permits that are impacting water quantity may be more effective than reducing all permitted water takings equally by a smaller amount. PTTW could have conditional clauses in times of drought to enforce reductions. Target industries that don't have conservation and efficiency measures in place (e.g. industries with open loop ground water systems where water goes to waste). Water use restrictions arising during relatively dry seasons, imposed on deep bedrock sources for bottled water, are political, not science-based. Permit holders/ sectors that have already implemented efficiencies and reduced takings should not be asked to make the same reductions as permit holders in sectors that have not implemented efficiencies for the purpose of reducing takings. Non permitted takings can have a big impact on small municipal systems (example provided that one house near a small municipality uses 14,000 L/day).

- **Database:** There needs to be an accessible database available and a process for the ministry and others (municipalities, Conservation Authorities) to provide information to it. This would make clearer why a PTTW is allowed. Nestle for example, would show the public what the environmental effects are and the effects of the water taking on other users.
- **Data/ Models:** Data is needed on what water is actually taken under a given PTTW. This data should be made available to everyone (e.g. Conservation Authorities, public). Variability in models and water budgets resulting in margins of error that is difficult to account for. Variability will be the same in the future and made worse by the variability of climate change and population changes as it will be different for different areas (e.g. some areas may lose population (rural) and some may gain (urban)). There is a disconnect between models and how they consider Permits To Take Water. Most models look at water availability over 'average' days this contrasts with PTTWs that are set at permitted water taking rates which are usually more than actual water taking. More water is allowed to be taken than is actually taken. Also there are times (days, weeks, months or years) when water is not taken under a permit and therefore the effects of the PTTW on the water system are not considered in a model looking at daily averages. The difference between actual water taking and permitted rates in the PTTW adds a buffer to the area of interest being managed. A fire (or other emergency) could drastically increase short term needs for a municipality for example. PTTW cannot be easily reduced to only reflect actual water taking.
- **Modelling and Scale of PTTW:** Good modeling assessments needed for PTTW scale. Large scale assessment models are available but PTTW scale is smaller (often site specific). PTTW takings cannot be accounted for in the scale used in Source Water Protection assessments. Need data shared on what water is actually being taken under a PTTW. The maintenance and ownership of models / assessment tools needs to be more available/less proprietary. Some small municipalities have wanted to take Source Water Protection (SWP) Tiers to next level. There are municipalities that didn't meet risk factors set out by SWP program. These smaller municipalities still have issues that threaten the municipal system.
- **Jurisdictional Model Example:** California model is an example of planning for resilience in the water supply system. This model could be looked at in terms of how it addresses all water sources.

- **Education:** Public Education and Outreach on water use related activities should be increased. Education and Outreach in urban areas about what other sectors face during water scarcity is particularly important. For example, private lots create a perception of an issue when there may not be one: golf courses reduce and have brown grass but grass on private lots is green. Private lots and water taking under 50,000 liters a day are probably not causing a problem but some are causing the perception of a waste.

Facilitated Discussion Summary – Guelph Water Managers Workshop			
Date: **Time:**	April 24, 2018 9:00 a.m. –12:30 p.m.	**Location:**	Innovations Guelph – 777 Farquhar Street
Topic 2:	**Managing Water Resources When Water is Scarce Discussion**		
Facilitator:	Zdana Fedchun	**Note Taker:**	Kendra Leek
Group Participants:	Peter Rider (City of Guelph), Marc Silverio (City of Hamilton), Christine Furlong (Triton Engineering), Jo-Anne Harbinson (Saugeen Valley Conservation Authority), Kelly McLagan (Stantec), Bob Fields (Norfolk County); Dave Stevenson (Brant County); Kyle Davis (Wellington County)		

The following Discussion Summary is prepared as a summary of key points and comments raised in the breakout session/ group discussion. It is based on a compilation of comments captured as part of several different recordings of the discussion including the summary comments noted on a flip chart, digital notes taken during the discussion as well as clarification provided during and after the workshop as obtained through telephone conversations, email and formal written submissions.

Discussion Summary

- **Multiple Jurisdictions:** Drought preparedness is important especially when watersheds cross jurisdictional/municipal boundaries.
- **Funding:** Conservation Authorities and low water response teams need capacity (funding and staff) if tasked with implementation of drought plans.
- **Scale:** Provincial guidance of drought planning is recommended with local (municipal level – subwatershed) implementation and enforcement. Tier 3 water budgets under the Source Water Protection Program started this process. Employment of municipal/local by-laws with enforcement would be helpful. Priority of use is needed in Ontario – especially during drought conditions and periods of severe weather conditions. Province should develop tools (tool kit) to assist municipalities with local delivery. A firm directive from the Province is needed with local flexibility.
- **Communication:** Improved communication and messaging (e.g. regarding voluntary reductions) to all stakeholders is needed, including public, private takers, agricultural water takers. Different communication methods are required. The same message should be presented to all (both urban and rural).

- **OLWR/Voluntary Reductions:** OLWR is mainly triggered by low flows in surface water and precipitation amounts and includes voluntary reductions. Voluntary reductions can be challenging. Current drought planning policies and plans need tweaking with better communication and compliance.
- **PTTW:** PTTW program could be used to require reductions during drought conditions, keeping in mind the sensitivity of source and use. There needs to be flexibility.
- **Data:** There is a lack of groundwater data for drought planning especially regarding takings below 50,000 L/day, agriculture and/or exempted uses. A means of plotting groundwater levels as close to real time as possible would also be useful.
- **Regulations/Enforcement:** Proactively try to regulate water conservation before mandatory reductions are required. For example, require water auditing for industries or large takers. When voluntary conservation does not work, mandatory implementation of conservation measures with an ability to enforce the requirements is needed. A PTTW could establish priority of use. Quantification of local EFN is needed before issuing permits. Could add condition in PTTW to automatically reduce takings under drought conditions to meet established EFN, keeping in mind sensitivity of uses (i.e. agriculture, municipalities) and sources (groundwater and/ or surface water). The reductions should be flexible based on types of users and sensitivity of the source. Price water for conservation; gaps in pricing include agriculture users.
- **Data:** More data is needed on what water is being taken and when in order to quantify required reductions. Need to quantify water level and flows to sustain both EFN and business needs. Information is needed about actual volume of water takings and impact of reductions to ask water takers to reduce water takings in times of droughts; should be asking permit holders to reduce based on actual takings (as opposed to maximum permitted). A follow up is needed after reductions to discuss/assess effectiveness of reductions and impact of reductions.

Facilitated Discussion Summary – Kingston Water Managers Workshop			
Date: **Time:**	April 25, 2018 9:00 a.m. –12:30 p.m.	**Location:**	InVista Centre - 1350 Gardiners Rd
Topic 1:	**Assessing and Managing Sustainable Water Resources**		
Facilitator:	Cynthia Carr (MECP)	**Note Taker:**	Ayana Aden (MECP)
Group Participants:	Mathiew LeBlanc (South Nation), Matt Miller (Conservation Ontario), Claire Milloy (Rideau Valley Conversation Authority), Mark Boone (Quinte), Matthew Richmond (Township of Stirling-Rawdon)		

The following Discussion Summary is prepared as a summary of key points and comments raised in the breakout session/ group discussion. It is based on a compilation of comments captured as part of several different recordings of the discussion including the summary comments noted on a flip chart, digital notes taken during the discussion as well as clarification provided during and after the workshop as obtained through telephone conversations, email and formal written submissions.

Discussion Summary

- **Scale:** A Subwatershed scale is appropriate for assessing Environmental Flow Needs (EFN) and Cumulative Effects (CE). MECP could develop a decision making matrix to guide which approach / tool to use. For management of EFN multi-agency coordinated water management plans are needed on a municipal planning scale. EFN need to be water body specific and are dependent on the specific ecology.
- **Triggers:** A potential trigger to complete a CE assessment is where there are a cluster of takers located near a sensitive area. For example, 3-4 aggregate takers located near an ecologically significant area. A groundwater trigger in the Ontario Low Water Response (OLWR) is needed. Currently OLWR is triggered by surface water levels and precipitation; Relevant in Prince Edward County where shallow wells regularly go dry.
- **Source Water Protection (SWP):** SWP Water Budget Tier 3 models and tiered risk based approach is liked. This approach could be used for CE assessment as well.
- **Funding:** Small municipalities will need substantial support to assess CE and EFN. Support includes funding, additional staff and available/appropriate methodologies and tools.

- **Enforcement:** Current plans/policies have limitations with respect to enforcement. Permits are individually managed but enforcement is often watershed scale. A resource planning working group of all relevant bodies municipalities/Conservation Authorities/ Province and key private stakeholders could be formed to ensure a coordinated approach; formalize to ensure attendance - similar to the Low Water Response Teams.
- **Education/Permits:** For rural municipalities reducing permit to take water (PTTW) volumes upstream of the municipal drinking water system may not necessarily be a significant amount therefore may not change aquifer or stream levels. For example, in the Township of Stirling-Rawdon there are no nearby upstream large water users as it is a very rural community. The only water taking upstream would be from non-permitted water takings from farmers. The focus needs to be on public education instead. (Revised comment based on follow-up email)
- **CE and EFN Assessments:** CE models should incorporate local conditions. For example, in parts of Ontario, more rain may not result in increased levels in groundwater but may increase runoff). Another example that could be used by other municipalities is the groundwater studies completed in the South Nation watershed. These studies were completed on a municipal scale; CA, Ontario Geologic Survey (OGS) and municipalities worked together. The results were turned into advice, and a data management tool was created so that data could be shared. In this example the data tool is used to support development permits in areas with poor water quality. The studies reduced the sample spacing based on OGS methodology to develop the plots and identify areas where development permits were unlikely to be granted due to poor water quality.
- **Available EFN Assessment Options:** The approach needs to be stream specific and ecology dependent. The assessment will require outside (provincial) help funding as monitoring EFN is resource intensive. Currently the area does not have the necessary stream flow data / gauges to complete an EFN assessment. Approaches discussed and associated issues included; frequency analysis of 7Q20 for Environmental Activity and Sector Registry (EASRs) not really possible or reliable; the Geological Survey of Canada (GSC) has their own guidelines where they use base flow assessments using HYDAT data (both the federal method and MNRF's Ontario Flow Assessment Tool (OFAT)). These methods need to incorporate other factors such as surface water / groundwater interaction and geological setting; and the Ontario Stream Assessment Program (OSAP) which includes a module on identifying groundwater upwelling in streams. Of note, Quinte Conservation has data (benthic data, flows, water quality) but needs support combining and analyzing data.

- **Data Expertise:** Quinte Conservation has data (benthic data, flows, water quality) but needs support combining and analyzing data.
- **PTTW/SWP:** Coordination is needed between PTTWs, Source Water Protection program and water takings for private well development for subdivisions. These developments need PTTWs.
- **Communication/PTTW:** MECP needs to improve communication with municipalities and CAs with respect to PTTW applications.
- **Data:** The PGMN needs enhancement. This network has valuable data and could be enhanced by installing additional shallow aquifer wells in priority areas or collecting additional shallow aquifer data. For EFN, there is a need for additional data and instrumentation in priority areas including: stream flow data and gauges. Some regions have data but need support combining and analyzing the data collected.
- **Communication/Reporting:** Water Taking Reporting System could be enhanced to be more helpful. This would include requiring more frequent reporting during scarcity; and approved WTRS data need to be sent to CAs more quickly so that the data is more current. Where there is a high public interest in the water taking reporting real time on websites would be beneficial.

Facilitated Discussion Summary – Kingston Water Managers Workshop			
Date: **Time:**	April 25, 2018 9:00 a.m. –12:30 p.m.	**Location:**	InVista Centre - 1350 Gardiners Rd
Topic 1:	**Assessing and Managing Sustainable Water Resources**		
Facilitator:	François Richard	**Note Taker:**	Sarah Olinski (MECP)
Group Participants:	Tiffany Svensson (BMEI), Chris Cristoph (Raisin River Conservation Authority, RRCA), Brian Stratton (Rideau Valley Conservation Authority, RVCA), John Pyke (Malroz Engineering, ME), Sandra Mancini (South Nation Conservation Authority, SNCA)		

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Discussion Summary

- **Roles and Responsibilities:** Clarification of roles and responsibilities of municipalities, Conservation Authorities versus provincial level government are needed during drought conditions as it relates to assessment of Cumulative Effects (CE).
- **Data:** Better data management and access are needed for assessing CE. Better groundwater data is needed (PGMN) as well as optimization/accessibility of existing data. There also needs to be increased sharing of data from consultants and the MECP.
- **Data/PTTW:** In order to assess CE and the impacts of takings, actual takings needs to be used rather than permitted amounts. This information is missing.
- **Funding:** Funding is needed to collect baseflow data which is key for the assessment of CE and EFN.
- **Indicators:** Drought indicators need to be on a local scale as they are variable by regions. The local scale requires indicator data for establishing triggers for determining low water conditions under the Ontario Low Water Response (OLWR) program. This approach is not adequate when data and information is not available. For example, baseflow data was not available in one region for certain creeks and a Level 3 drought could not be declared.

- **Development /Planning:** Integration of mandates need to be coordinated between Ontario Ministry of Municipal Affairs and Housing (MMA) regarding growth and drought planning programs (MECP/MNRF). Water supply needs to be better integrated into development planning (e.g. subdivisions).
- **Local Capacity:** Local capacity is being built after 2016 drought.
- **Local Knowledge for EFN:** Based on the 2016 drought there is an understanding that fish are at risk. A local mitigation approach was implemented based on the knowledge of local biologists. This plan included moving fish from ponded areas by hand. Local knowledge can be used to identify at risk areas as well as to assess and monitor those areas.
- **Policy Integration**: Integration is required between various programs and levels. For example the PTTW program should be linked with OLWR (Permit could specify conditions during Level 1/2/3 drought). Currently OLWR program is disconnected from other tools.
- **Scale:** Flexibility is needed to manage CE and EFN at a local level and at an appropriate scale.
- **Communication:** Communication of different messages is sometimes needed based on source of water (groundwater or surface water) and reduction needs/requirements. An example included the conflicting messages between the message being communicated by SNC and the City of Ottawa during OLWR Level 2 conditions in the watershed in 2017.

Facilitated Discussion Summary – Kingston Water Managers Workshop			
Date: **Time:**	April 25, 2018 9:00 a.m. –12:30 p.m.	**Location:**	InVista Centre - 1350 Gardiners Rd
Topic 2:	**Managing Water Resources When Water is Scarce**		
Facilitator:	Wayne Ingham (BMEI)	**Note Taker:**	Shari Sookoo (MECP)
Group Participants:	Matt Craig and Gord Mountenay (Mississippi Valley Conservation Authority, MVCA); Jennifer Boyer (City of Ottawa); Amy Dickens (Quinte Conservation)		

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Discussion Summary

- **Proactive:** Proactive adaptive and resilient drought planning is needed.
- **Integration of Policies:** There is a need for integrated policies and plans between agencies (e.g. MNRF and MECP) with clear communication about the process.
- **Scale:** Provincial guidance is needed for drought planning with local implementation, as conditions (physical, socioeconomic and local agency capacity) and available data are very different between areas and regions of the province.
- **Funding:** Municipalities and conservations areas (CAs) would need more funding if required to create/implement drought plans.
- **Scale:** With respect to Priority of Use, MECP should lay out priorities (list of parameters) and provide guidance with local regions/municipalities selecting those relevant to their local situation.
- **Conflict:** Province should make decisions when a conflict arises.
- **Scale/triggers:** Multi-tier approach where the province provides guidance at a watershed level for use and triggers to assist municipalities with making decisions.
- **Data/Information Needs:** Provincial guidance is needed on what data/information is required for drought planning and declaring and defining a Level 3 drought.

- **Data:** Additional data is needed to support/defend decisions (e.g. land use planning and reductions / conservation decisions). This data is also useful for conflict resolution. Additional groundwater data is needed and real time, readily accessible groundwater monitoring data points would be beneficial (surface water data is sufficient). Additional soil moisture data could also be beneficial for drought triggers and planning. Existing MECP data needs to be more available. A database could be created.
- **Enforcement:** At present only communication and education are available as tools for implementing reductions - enforcement is needed. Currently only voluntary reductions are available with the exception that municipalities can create by-laws which restricts water usage times when water is scarce to assist in conservation, however, there is no way for municipalities to monitor private wells and coordination between messaging around reduced takings is needed. For example, situations arise where permit takers are asked to reduce takings and other nearby users are not (e.g. City of Ottawa versus Golf Courses).
- **Development:** The MECP could update guidance D-5-5 Private Wells: Water Supply Assessment for subdivision/development projects to include drought considerations.
- **Communication/Education:** More communication and education of the public is needed for drought planning and water consumption reductions.

Facilitated Discussion Summary – Kingston Water Managers Workshop			
Date: **Time:**	April 25, 2018 9:00 a.m. –12:30 p.m.	**Location:**	InVista Centre - 1350 Gardiners Rd
Topic 2:	**Managing Water Resources When Water is Scarce Discussion**		
Facilitator:	Zdana Fedchun	**Note Taker:**	Kendra Leek
Group Participants:	Nader Nakhaei (Mississippi Valley Conservation Area); Christine McClure (Quinte Conservation); Tessa Di lorio (City of Ottawa); Jennifer North (Mississippi Valley Conservation Authority); Jessica Mueller (Ganaraska Region Conservation Authority)		

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Discussion Summary

- **Roles & Responsibilities:** Drought planning, preparedness and management is needed with a clear understanding of the roles and responsibilities of all stakeholders (province, municipalities, Conservation Authorities, and water takers).
- **Funding:** In order to implement drought planning, funding and sufficient staff resources need to be taken into consideration.
- **Scale:** The province should provide drought planning guidelines and standard tools for regions, Conservation Authorities to select from.
- **Assessment/Tools:** Climate-Driven Drought needs to be considered in drought planning. An assessment of the impact of climate versus water takers is needed. To prepare for climate-driven drought, tools which can be considered include: education; having back-up water supplies; planned sharing of resources between municipalities and overall proactive planning.
- **Triggers:** Ontario Low Water Response (OLWR) is based on surface water triggers. A trigger is also needed for groundwater as private wells have run dry in this region. Ecological assessments and triggers are also needed. Soil moisture could also be a potential trigger (soil moisture data would be needed).

- **Communication/Education:** Increased/better communication and education is needed, such as communicating the definition of non-essential uses (under OLWR Program) as well as an assessment of which water reductions will make an impact. There is a provincial role for broader education to change use and behaviour in all sectors (e.g. water reuse and low impact developments). There are different communication messages with respect to different source. For example, the City of Ottawa source water from river doesn't need to conserve but groundwater users do need to conserve. Individuals don't know where their water is coming from - equality issue with neighbour when different sources.
- **Industries:** Standardized water conservation measures/practices for local industries would be beneficial which include contingency planning, and continual reassessment during drought. Individual users could develop what works for their industry to reduce. Clarification around who is included in type of use (small versus large business). For example, nurseries need a lot of water in first three years of growth – do you treat them differently? There needs to be flexibility in approach to accommodate for different types of water users. Water conservation for agriculture is a consideration. For example, there are more efficient irrigation methods and diversification of crops.
- **OLWR Teams:** There were challenges in building a low water response team. You want to involve different stakeholders but they may not always be available or willing to participate. Conversely, the membership of the Low Water Response Team balloons and it is difficult to manage. Need guidance on how to keep everyone informed but decision team smaller.
- **Enforcement:** A method is needed to enforce mandatory measures and ensure they are being followed.
- **Data/Measurements:** A tool / method is needed to be able to quantify the impact of voluntary water reductions once water takers are reducing. In addition, increased access to real-time groundwater data is needed. PGMN provides some data but then an assessment is needed of the accuracy of this data and how representative it is. With respect to PTTW data, water managers need access to actual water taking data as opposed to maximum allowable to provide measureable targets.
- **Technology:** Engineering solutions and appropriate technology should be a part of drought planning. For example, in California they use black balls on reservoirs to control evaporation.

- **Priority of Water Use/Scale:** Water reduction targets should be planned prior to drought (within drought plans) to avoid conflict. Various opinions where provided on implementation but agreed the targets should be science based and the need to take a stakeholder determination approach. One option is an initial broad approach for reductions and then target specific users based on impact and priorities. Priorities, if needed, should be made on a local scale with provincial support/guidelines.
- **Vulnerability Assessment:** Need a vulnerability assessment to prioritize water supplies – certain areas will have a higher priority over others.
- **Source Water Protection (SWP) Model:** Expand SWP model beyond municipal areas.
- **Development/Planning:** Guidance is needed on how to assess impact of private takers (e.g. subdivision or industrial operation). For private takers guidance is needed on how to complete a water budget and have a good review process and how to assess private well from non-permitted users. There is the potential to approve developments that perhaps would not be approved if assessed appropriately with respect to CE. There is some guidance available from storm water management guidelines. Also, need assessments of scale of developments in comparison to neighbouring users.

Facilitated Discussion Summary – Toronto Water Managers Workshop			
Date: **Time:**	April 27, 2018 9:00 a.m. – 12:30 p.m.	**Location:**	125 Resources Road, Etobicoke ON (MECP)
Topic 1:	**Assessing and Managing Sustainable Water Resources**		
Facilitator:	Cynthia Carr (MECP) with Zdana Fedchun [ZF] (MECP)	**Note Taker:**	Ayana Aden (MECP)
Group Participants:	Simon Gautrey (Wood PLC), Lindsey Jupp (Matawa), Caroline Hawson (Lake Simcoe Conservation Authority), Melissa Carruthers (Midland), Fred Carpio (Central Lake Ontario Conservation Authority (CLOCA)), Tricia Hamilton (Ontario First Nations Technical Services Corporation)		

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Discussion Summary

- **Models:** There is a need to integrate groundwater and surface water into models to assess for environmental flow needs (EFN). Source water protection models can be used and supplemented by base models such as models used by Oak Ridges Moraine (ORM) and ecologically significant groundwater recharge models to assess impacts of takings and impacts on specific features.
- **Case Study Model:** An initial hydrological numerical model at CLOCA was developed under the Source Water Protection (SWP) Program. Using this SWP numerical model as a base, CLOCA was able to develop more numerical models including, the ORM Conservation Plan Model and the Ecologically Significant Groundwater Recharge Areas (ESGRA) Model. CLOCA Staff identified areas of ecological importance, such as wetlands, stream channels and natural features and provided the information to their consultants, in order for the consultant to use the existing ESGRA model to delineate groundwater recharge areas that feed the identified ecological features. Details of the study and full report can be downloaded from CLOCA website: http://cloca.ca/spp/index.php (This point is follow up information that was gathered by email).

- **Data:** More data is required including actual water taking data versus the maximum permitted taking. More baseline flow data is also needed. Data can be used for modelling and to assess development impacts. In addition, data needs to be timely and accessible.
- **Data (SWP):** Significant data exists within source protection regions where there has been a tier 1, 2 and 3 study completed. It would be beneficial to have the same type of data for areas outside of SWP regions across the province (comment from a follow up letter from a discussion member's organization).
- **Tools (SWP):** There is a need for water quantity management tools to assess the impacts of water takings in areas outside of SWP Areas as well as those not covered by Conservation Areas. This is especially true for Northern Ontario. Northern areas would like to be included in SWP and/or have more Conservation Areas/Authorities.
- **Proactive:** Proactive water management is needed. Available data should be used to detect trends and early warning signs of drought.
- **Priority:** At risk systems (those with high growth rates and significant water takings) should be a priority for EFN assessments.
- **Mitigation/Policies/Development:** Some jurisdictions "require" a "net zero" approach to maintaining post-development recharge in residential areas in municipal systems with a risk of water quantity stress. This approach could potentially be considered more broadly. The water balance of a system should be maintained through: mitigation of infiltration deficits including technical solutions and mandatory mitigation in significant groundwater recharge areas; policy creation which maintains the water balance of a system and considers the carrying capacity of the system (currently there are conflicting priorities between EFN and population growth/human needs); and consideration of monetary compensation as a last resort (should be within same watershed).
- **Development/Growth:** There is a need to have more prescriptive requirements for growth areas and requirements for where growth is allowed.
- **Policy Mining Act:** Water management within the Mining Act should ensure quarries; mines etc. are putting water back into the groundwater system and not just in surface water.
- **Scale:** Management scale should be on a watershed scale with individual areas looked at separately. Local representation and local decisions are needed. A multi scale approach could work with local assessment done by local agencies and other assessments done by the Province.

- **Scale/Framework:** The Province is encouraged to consider how to implement the policy framework outside of the Conservation Authority Model. The concept of implementing on a watershed scale is supported but using non-conservation authority organizations and potentially ministries (in areas of the province where there would be a gap) must be an option with a delivery framework (comment from a follow up letter from a discussion member's organization).
- **Scale/SWP:** The north in general has water quantity concerns (e.g. the Albany River only had a few feet of water over the drinking water intake); currently, there is no Conservation Authority or Source Protection Area (e.g., Mattawa area); there is a need to create one – want to create a Source Protection Area.
- **First Nations/Funding:** First Nations should be enabled and provided funding to do their own water monitoring. More collaboration/liaising with First Nations is required.
- **Funding:** Although this is a Provincial framework it is generally implemented through municipalities and watershed-based organizations. It is strongly recommended that the Province consider the development of an appropriate funding model for long-term, ongoing financial support for water managers and their organizations. Organizations and municipalities are struggling to meet current implementation requirements through their various planning responsibilities. Any proposed framework must have implementation funding to be successful (comment from a follow up letter from a discussion member's organization).
- **Funding/Scale:** To successfully implement any framework the use of local, regional and/or provincial models will be needed. These normally come at a great expense and need updating to stay current. Guidance documents need to be created on these types of models to keep the approach consistent as well as develop a reliable funding model to help with the financial strains associated with staffing, data collection, and computational overhead (comment from a follow up letter from a discussion member's organization).

Facilitated Discussion Summary – Toronto Water Managers Workshop			
Date: **Time:**	April 27, 2018 9:00 a.m. – 12:30 p.m.	**Location:**	125 Resources Road, Etobicoke ON (MECP)
Topic 1:	**Assessing and Managing Sustainable Water Resources**		
Facilitator:	François Richard (BMEI)	**Note Taker:**	Sarah Olinski (MECP)
Group Participants:	Tiffany Svensson (BMEI), Tom Hogenbirk (Lake Simcoe Conservation Authority), Mike Fairbanks (York Region), Jon Clarke (Halton Region), Don Ford (Toronto Region Conservation Authority, TRCA), Chitra Gowda (Conservation Ontario, CO)		

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Discussion Summary

- **Indicators:** Soil moisture could be used as an indicator to better understand drought conditions. Wetland functions/levels could be used as potential indicators for Cumulative Effects (CE) and Environmental Flow Needs (EFN).
- **Data/Database:** Data exists (e.g. precipitation models, PGMN) but often water managers are not aware of or cannot find the available data. More sharing of data is required including the integration of data sets between Conservation Authorities, Water Managers, the Province and Consultants in order to manage, monitor, make decisions and set triggers for CE. A data portal or database could be beneficial; however it is not always practical or possible. One challenge with the sharing of data is the intellectual property rights of consultants. An example database is the York, Peel, Durham, Toronto groundwater program (Oak Ridges Moraine Groundwater Program) where lots of data is provided to a common source and available to all for a fee. Consider continual data collection wherever possible. Enhanced temporal data density is key when assessing CE since conditions are often dynamic.
- **Models/Funding:** Models need to be maintained and updated; this includes the underlying information and data sets. More funding and staff resources are needed to maintain the models; this includes local experts to run the models.

- **Ontario Low Water Response (OLWR) improvements:** A targeted and prioritized assessment is needed. OLWR needs to be focused on source of water in area. Groundwater indicators should be considered within the program. The program needs to be more targeted to be more effective with a focus on main stresses in each area.
- **Source Water Protection (SWP):** Source water protection process could be expanded to not only protect municipal drinking water supply sources but cover other areas with water quantity needs (e.g. EFN).
- **Tools:** Remote sensing provides rapid/continuous measurement versus gauges. The MECP / Water Managers could consider using remote sensing to assess drought conditions.
- **Tool/Program:** The PTTW program is a key tool for policy program enhancements for CE and EFN. Timely reporting of actual takings is needed as the permitted taking is typically for much more water than what is actually taken. Reduction conditions linked to the OLWR Program should be included in PTTWs.
- **Policies:** Policies, management and decisions need to be supported by science.
- **Integration/Development:** Better integration of land use planning and water quantity policies are needed for decision making purposes. Land use planning and developments need to consider water supply quantity in the approval process. Legislative tools are required to restrict developments as needed in high risk areas.
- **Communication:** Establish (re-establish) community networks to identify local needs, stresses, and priorities. OLWR committees should be meeting more often even when there is plenty of water and this is a challenge due to time commitment.
- **Policy Enhancements/SGRAs:** Significant groundwater recharge areas need policy enhancements. Currently only weak policies limited to education and outreach are available to apply.
- **Scale**: Consider regional as opposed to local (manage on area basis); manage where there are a high density of takings, stresses, ecological impacts on environmentally sensitive features; use historical and local knowledge as both can be critical in gaining confidence in the assessment; always consider water use and how it impacts the entire area.

Facilitated Discussion Summary – Toronto Water Managers Workshop			
Date: **Time:**	April 27, 2018 9:00 a.m. –12:30 p.m.	**Location:**	125 Resources Road, Etobicoke ON (MECP)
Topic 2:	**Managing Water Resources When Water is Scarce**		
Facilitator:	Wayne Ingham (BMEI)	**Note Taker:**	Eva Ammentorp
Group Participants:	Bonnie Fox (Conservation Ontario), Iryna Shulyarenko (Kawartha), John Bittorf (Grey Sauble), Michelle Jakobi (Oro-Medonte), Paul Pentikainen (Innisfill), Rick Germer (Oak Ridges Moraine Coalition)		

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Discussion Summary

- **Proactive:** Proactive drought planning is needed.
- **Roles and Responsibilities:** The roles and responsibilities with respect to drought planning of various stakeholders/agencies needs to be clearly defined and communicated. This includes identifying who has authority over the various elements of drought planning.
- **Data:** Better data management is required to support drought planning. There is a lot of information/data collected by various groups; however, there is a lack of communication and sharing of data between groups. Also, there is a need for analysis of data, e.g., the PGMN has been collecting data for years but this data has not been analyzed yet to its full potential.
- **Maps/Tools:** A provincial hydrogeological / hydrological properties map is needed/could be developed to understand where the largest water takings / withdrawals are and mapping availability and vulnerability of water resource zones across the province. Develop map based on risk (example map growth areas first). Also, map out high risk areas and of low, medium and high vulnerability (example, resiliency of groundwater resources; provincially significant wetlands etc.). Map could be tiered process based on sensitivity of environmental features.

- **Triggers/PGMN data:** To support the development of drought triggers past available PGMN data gathered during drought conditions could be analyzed and compared with data collected from biologists/ecologist during the same drought period.
- **Growth/Development:** Municipalities need drought plans; however, there are conflicting interests: municipalities require growth to increase tax base but need to limit growth in water scarce areas. Municipalities may need more incentive to do more than the minimum requirements.
- **SWP:** Expand the source water protection program to go beyond protecting sources of municipal drinking water. For example, the Ministry could also include private wells. This program is already well understood by water managers and other stakeholders.
- **Scale:** For drought planning there should be a provincial framework with local flexibility in the system allowing for local adaptive management. Contingencies and mitigation measures should be developed locally. However, PTTW falls under MECP jurisdiction and during drought conditions MECP permitting staff would need to understand priorities. The Province would need to set guidelines for revoking permits.
- **Enforcement/Funding:** Ontario Low Water Response needs legislation/regulation to enforce water reductions. Funding for this is also required. Sector specific conservation measures could be required in PTTW approvals.
- **Developments** require greater assessment from a water quantity / drought planning perspective prior to allowing development. The following was discussed with regards to development:
    - An entity is needed to better regulate developments based on water availability;
    - A PTTW should be required for a large development.
    - Assessments need to occur during the planning phase – PTTWs assessments come too late in the process.
    - Municipalities need to be involved in development planning if the development can affect its water supply regardless of whether it is within the municipality.
    - Watershed planning is contained in the Provincial Policy Statement (PPS) which is land use planning. Municipalities use the PPS to develop their official plans and to guide and inform decisions on other planning matters. PPS provides a mechanism to download responsibilities to municipalities but the Province needs to be involved. For example, the Province still needs to support municipalities and Conservation Authorities with identifying vulnerable areas (groundwater recharge areas, etc.).
    - The environment needs to be considered in the use planning process.

  - Functional servicing studies was suggested as a tool that could be considered to address / incorporate permitting at the planning stage (pre development). Water needs should be looked at before land is broken into individual service lots.
  - To obtain a building permit there needs to be a requirement to demonstrate enough water supply in areas of water scarcity.
- **Costing:** Increasing the cost of water improves conservation and efficiency