MAINSTREAM: THE NATIONAL WATER ADAPTATION TO CLIMATE CHANGE FORUM

knowledge mobilization ~ best practices

TORONTO, ONTARIO ~ March 22 and 23, 2012

With funding from Natural Resources Canada's Regional Adaptation Collaborative (RAC) program, and additional support from the following:

~ FORUM RESULTS REPORT ~

March 30, 2012

RERPORT SUMMARY:

This report documents the information contributed by participants during the small group activities, through individual worksheets and plenary discussions during the *Mainstream Forum*. The contents are divided by session, and within each session, further organized by subgroup topic where applicable. Detailed observational content is presented in the appendices. The purpose of this document is to provide a record of participant contributions that will inform the contents of the subsequent Briefing Document and Web-based Compendium (to be released June, 2012). No changes were made to the original notes, except to clarify statements that were unclear as documented verbatim. Changes or additions by the editors of this report are denoted with square brackets – [ ].

CONTENTS

1. CONTEXT

1.1. National Water Adaptation to Climate Change Project

The Toronto and Region Conservation Authority (TRCA), in partnership with the Canadian Water Resource Association (CWRA), the Canadian Foundation for Climate and Atmospheric Sciences (CFCAS), the Institute for Catastrphic Loss Reduction (ICLR) and Conservation Ontario were funded by Natural Resources Canada (NRCan) under the Regional Adaptation Collaborative (RAC) program to mobilize knowledge on water resource adaptation to climate change across Canada.

In NRCan's *National Climate Change Adaptation Benchmark Survey* (2010)[1], "lack of expertise", "lack of information" on, and "not knowing benefits" of climate change adaptation were all identified as barriers to moving adaptation forward in Canada. Several other barriers related to resource constraints, leadership, and social and political attitudes were also acknowledged, but "knowledge/education/reliable information" was identified among the top obstacles by local practitioners surveyed. Addressing this gap by mobilizing high quality knowledge on climate change adaptation in the water resource sector is the main objective of *Mainstream: The National Water Adaptation to Climate Change* project.

More specifically, the *Mainstream* project will contribute to increasing capacity for adaptation through the release of (1) a web-based, updatable compendium of knowledge on water adaptation, and (2) a briefing document highlighting the state of practice and opportunities for advancing adaptation nationally. The project has also sought to increase national water adaptation capacity through process – by providing a venue for dialogue, learning, networking, and knowledge sharing among water and climate change practitioners from coast to coast to coast. The Forum, that took place on March 22nd and 23rd in Toronto,

[1] Available online at: http://epe.lac-bac.gc.ca/100/200/301/pwgsc-tpsgc/por-ef/natural_resources/2010/075-08/report.pdf

was designed to provide an opportunity for a broad range of practitioners to contribute to the *Mainstream* project, and the process of knowledge mobilization.

At the forum, we committed to providing participants with a "summary report from this workshop, highlighting some the things we've learned". We are pleased to release this report in the following pages.

1.2. Forum Objectives

a) To provide learning opportunities for new ways of thinking about water adaptation.

b) To reflect upon the current state of practice and share knowledge on water adaptation projects.

c) To showcase a diverse range of projects led by Forum participants.

d) To stimulate discussion to identify:

- Water adaptation knowledge needs of practitioners (e.g., engineers, scientists, policy analysts, project coordinators, planners, and educators);
- Opportunities for dissemination of knowledge and collaboration towards the mainstreaming of adaptation.

e) To contribute to:

- A national compendium of knowledge on water resource adaptation to be used by practitioners;
- A briefing document on the state of and opportunities for advancing, water adaptation across Canada.

1.3. Agenda Summary

This is a summary of the actual sessions, reflecting minor modifications to Day 2 made during the event.

Day 1: National State of Practice in Water Adaptation

- Forum Opening
- Introduction to the Compendium (plenary presentation)
- Project Profiles, Part I (5 presentations)
- State of Practice Nationally (participatory activity in small groups)
- Evening session: social mixer, dinner and keynote speaker (Robert Sandford)

Day 2: Mainstreaming Water Adaptation Practice – Opportunities & Needs

- State of Practice Nationally (plenary discussion)
- Project Profiles, Part II (5 presentations)
- Mainstreaming Climate Change Adaptation in Water Management (participatory activity in small groups)
- Mainstreaming Climate Change Adaptation in Water Management (plenary discussion)
- Compendium and Practitioner Needs (plenary discussion)
- Forum Closing (including plenary discussion of main messages)

"The trick we need to learn next is how to turn what is presently an under-current into the Mainstream."

Robert Sandford, EPCOR Chair, Canadian Partnership Initiative, United Nations Water for Life Decade

Presented at the Forum as the 10th Annual World Water Day Address

2. MAIN FORUM MESSAGES

At the conclusion of the event, participants were invited to offer any 'main messages' they were taking away from the event (see Figure 1). These messages are described throughout this section.

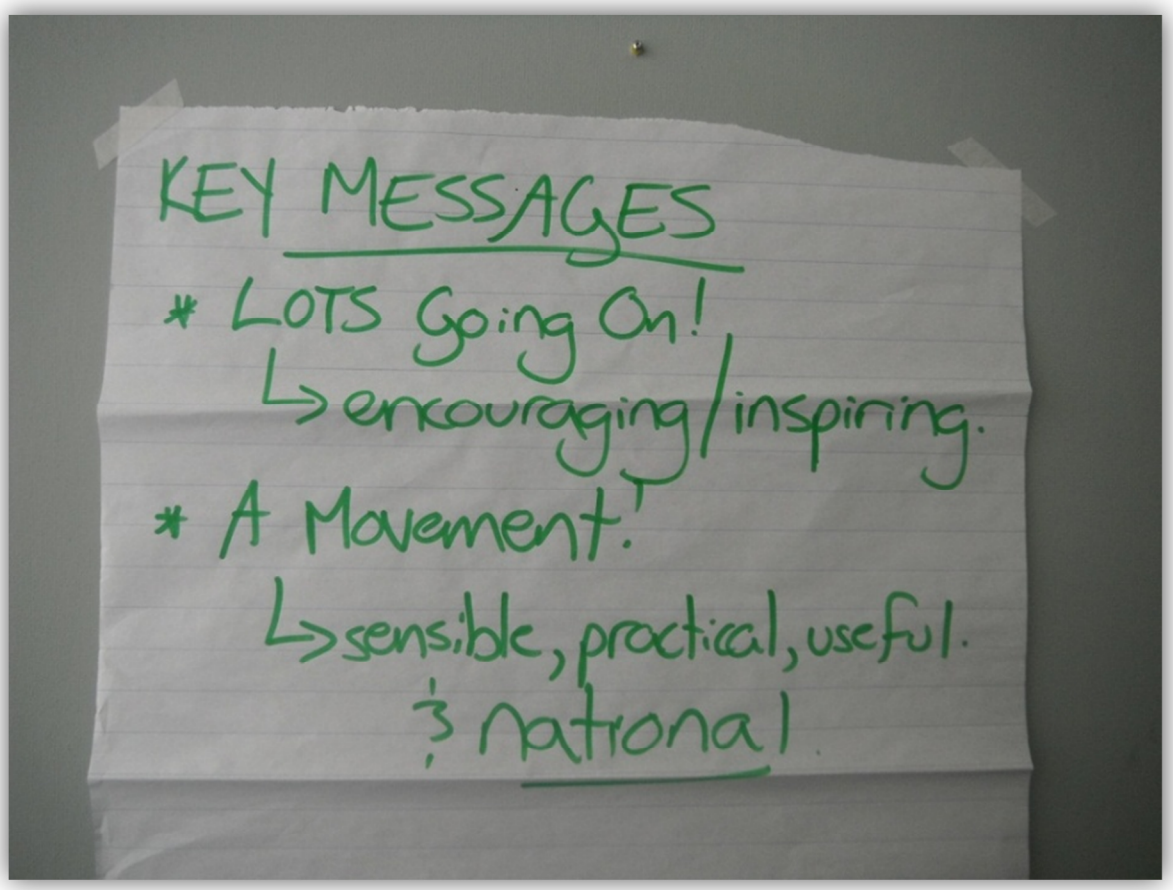

FIGURE 1. MAIN MESSAGES OF THE FORUM, AS PRESENTED BY PARTICIPANTS.

2.1. Observations from participants

- Very encouraged that there is a lot going on – good to see! This inspires us to keep going and to do more.
- There is a movement here that isn't going to stop; its sensible, practical, useful and national.
- [There are] consequence[s] of doing nothing
- [There is] lots of information out there

2.2. Observations from facilitators and organizers

- The challenge related to adaptation is to move it from the undercurrent to the mainstream
- Science is not the barrier to adaptation
- Plain language message communication to move adaptation forward
- Technical level has ways of dealing with uncertainties; not so easy at policy/political level
- Knowledge dissemination can lead to liability
- If we're prepared for [climate change], catastrophes have less impact, recover[y is] faster and to a stronger state than before (storms are good for getting engagement and investment; and opportunities for becoming more resilient)

- We need to wake up and check on water the way we check on the stock market, e.g., monitoring and feedback need to be strengthened
- There is a need for more strategic national/regional level guidelines on strategies for water adaptation
- There is lots happening out there, and our challenge is to maintain the momentum.
- We need ideas form you on how to keep things going. We'd like to continue the dialogue.

3. STATE OF PRACTICE NATIONALLY

3.1. Description of Participant Input

FIGURE 2. NOTES ON THE STATE OF PRACTICE IN THE TOPIC AREA OF STREAM FLOW.

Information to determine the state of adaptation nationally was generated during two sessions.

Session 1: Participants were first divided into six smaller groups, by issue:

- Floodplains
- Stream flow

- Groundwater
- Aridity and soil moisture
- Water quality
- Lake levels and ice cover

Within these groups, they were tasked with answering the following questions:

Q1: What is happening (finished projects and new work) in each issue theme, regarding water resource adaptation to climate change? Figure 2 provides a picture of the results of this activity for the 'stream flow' issue group.

Q2: Complete this sentence: The state of adaptation across this issue is _____? Why? (summarized for all the groups in Figure 3)

Q3: What's next?

Session 2: The results of question #2 were then posted in plenary and participants were asked:

Q4: What common threads do you see across the different themes regarding the state of practice?

Q5: What other observations and insights do you have about the 'state of practice' that you'd like to share?

Q6: Any "ah-ha" moment, epiphanies, or surprises regarding the state-of-practice?

Results of **Q1** (i.e., What is happening…?) are presented in Appendix A, and constitute the 'facts' or 'evidence' to support participant interpretation for **Q2** through **Q6.**

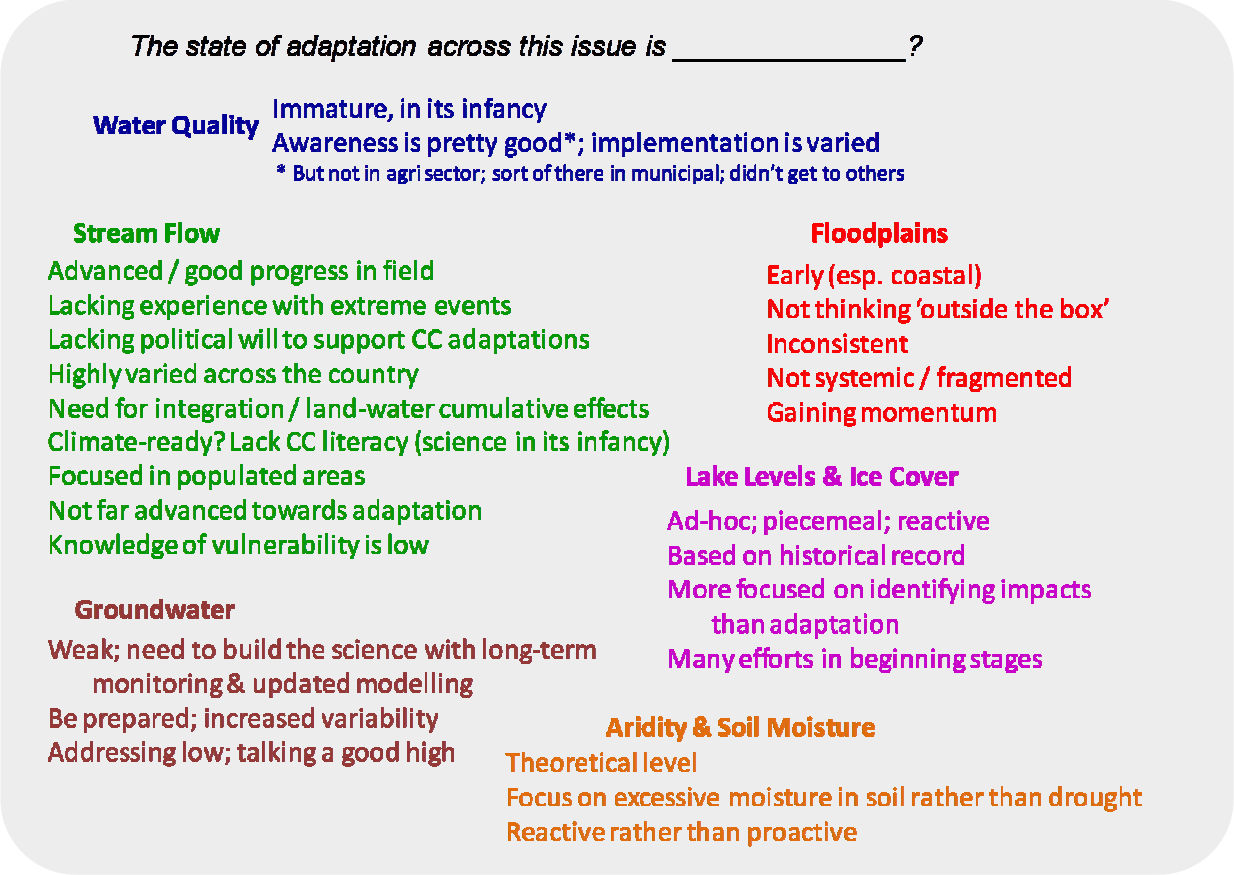

FIGURE 3. SUMMARY OF THE STATE OF ADAPTATION PRESENTED TO PARTICIPANTS ON DAY 2 OF THE FORUM.

3.2. Floodplains

3.2.1. The State of Adaptation

(those with check marks were considered key items by the group)

- ✓early (especially coastal)
- ✓not thinking outside the box
- siloes
- slow on the uptake
- reactive
- ✓inconsistent
- impaired
- ✓fragmented / not systematic
- bottom up (activity) and local
- supported by knowledge
- ✓gaining momentum

3.2.2. What's Next

- thinking outside the box
- breaking down silos / improving communication
- building capacity in decision-makers
- market-based tools / incentives
- national strategy / guidelines (Best Management Practices / toolkit)
- up-to-date floodplain mapping
- common vocabulary / metrics
- socio-economic vulnerability understanding and how to address through adaptation
- integrating disaster financial assistance with climate adaptation (e.g., when replacing infrastructure)
- open data / shared tools / national data infrastructure

3.3. Stream Flow

3.3.1. The State of Adaptation

- advanced [technical methods] – good progress in the field
- not far advanced toward adaptation [in practice] (e.g., infrastructure); knowledge of vulnerability is low in municipalities
- highly varied across the country
- lacking political will to support climate change initiatives
- lacking in experience with respect to extreme events (non-stationarity)
- climate science in infancy; lack of climate literacy
- need for integration (land-water – cumulative effects)
- focused on populated areas

3.3.2. What's Next

- advancing climate literacy
- filling gaps on solution side, i.e., adaptation [measures]
- we have knowledge and resources; we are lacking an understanding of how to apply these; need guidelines and tools
- need to move beyond defensive positions to justify action
- need good demonstration projects on adaptation
- need to be both reactive and proactive to build resilience
- development of site-relevant adaptation measures (following 1 impact assessment)
- learn from other countries

3.4. Groundwater

3.4.1. The State of Adaptation

- weak
- need to build the science with long-term monitoring and updated modelling
- be prepared; increased variability (next steps)
- addressing "low" and talking about "high"
- Incorporation of groundwater indicators into Ontario Low Water Response Region:
    - Stage: beginning state – steering committee set up last month; proposals for technical studies to provide foundation for implementation are being evaluated; need to address high groundwater levels due to increased precipitation related to climate change

3.4.2. What's Next

- Source Protection Planning – next cycle to update plans to incoporate climate change adaptation; focus on groundwater quantity
- issues to be addressed include: (i) how to determine impacts to quality / levels; (ii) develop science and modelling; (iii) impacts on water demand (irrigation, changes in agriculture crops and productivity, population growth, industry); (iv) incorporation of traditional and local knowledge; (v) ecological impacts (interactions between groundwater and streams / wetlands); (vi) ALCES [model] – cumulative effects – assessment process required; and (vii) saltwater intrusion
- Incorporation of groundwater indicators into Ontario Low Water Response Region:
    - What is needed: long-term monitoring data, but are working on "mining" existing data; more resources and stronger political will

3.5. Aridity and Soil Moisture

3.5.1. The State of Adaptation

- theoretical level
- focus is on excessive moisture rather than on drought
- reactive system rather than proactive

3.5.2. What's Next

- Proactive investment will save dollars and improve public safety

3.5.3. Questions that Participants asked in Group:

- Is there any local involvement in terms of monitoring by land users, i.e., farmers, the citizen-scientist?
- Is there any macro (across all Prairie Provinces) understanding of the impacts?
- Are there other major industries other than agriculture involved?
- Have any new insurance models been developed?

3.6. Water Quality

3.6.1. The State of Adaptation

- state of adaptation is immature, in its infancy;
- huge differences among sectors
- pretty good awareness of climate change impacts (except in agriculture sector, and only sort of in municipal sector), but implementation is varied
- policy and regulatory development – Lake Simcoe has the policy, but not yet implemented; Great Lakes has a water quality agreement
- devolution of government responsibility (not what we want, but what is happening), problems with funding

3.6.2. What's Next

- Conservation Authorities (CAs) [in Ontario] working with Municipalities, development community on low impact development approaches for stormwater management
    - e.g., low impact development pilot project and online manual; pollution prevention (Credit Valley Conservation Authority and TRCA)
- need more monitoring, water quality, real time; have four stations operating in the Credit River, and also in the Grand River
- need more work on adaptive management framework for the nearshore zone – see IJC website (http://meeting.ijc.org/fr/workgroups/nearshore-framework-fr)
- there is a paucity of climate change projects, a lack of co-operation and trust; need work on projects relating to sediment deposits and turbidity, sewage (marinas), forestry, mining, fisheries, habitat loss; how do we reduce the impact of forestry/mining/fisheries/agriculture on water quality (e.g., nutrient loading, and chemical nutrient effects)
- agriculture, NGOs, CAs, municipalities, Provinces collaborating to implement rural water quality projects
- managing erosion through different techniques
- naturalization, protection and restoration of wetlands, woodlands, riparian areas
- CAs and others using various tools to promote adaptation, watershed resilience including watershed reporting (report cards) while water quality projects are being implemented
- there is a need to improve understanding of whether and how these projects address climate change impacts; understand where to direct projects to make a difference
- the key is watershed resilience
- Mississippi Conservation Authority and NRCan project on climate change projections and fish populations
- Lake Simcoe framed as water quality issue, but not as a climate change issue (same in agriculture sector)
- For Lake Simcoe, phosphorous reduction has been a focus – development of a strategy, voluntary actions to reduce personal phosphorous use (e.g., fertilizer); collaborating with agriculture and developers to reduce fertilizer in food production, and reduce runoff and atmospheric deposition from construction sites (phosphorus budget tools)
- For Lake Simcoe, guidance on erosion and sediment control measures to control runoff, especially during heavy rainfall
- Lake Simcoe Climate Change Strategy – strategic action on water quality issues across ecosystems, natural resources, and agriculture

3.7. Lake Levels and Ice Cover

3.7.1. The State of Adaptation

- ad hoc, piecemeal, reactive
- Based on historical record
- more focused on identifying impacts than on adaptation action
- many efforts in beginning stages

3.7.2. What's Next

- getting political and economic support
- pilot projects (including monitoring / evaluation)
- bringing government agencies together
- outreach to local communities
- outreach to affected sectors
- more impact studies are needed for ice cover theme

3.8. Plenary Discussion Results

3.8.1. Common Threads across the Different Themes Regarding the State of Practice

- More progress appears to have been made in the streamflow theme than elsewhere. In the other theme areas, the level of awareness is quite variable, and there has been little implementation of adaptation projects. We need to be more strategic and less ad hoc in our approach. There is a need for more integration between the different areas or work.
- Adaptation responses are in their infancy. There is a lack of political will, but stakeholders are interested. We need to strengthen science and interdisciplinary approaches.

3.8.2. Other Observations and Insights about the State of Practice

- We need to be more strategic and less *ad hoc* in our approach.
- Adaptation work is gaining momentum. There is a lack of data and monitoring analyses which could help to cope with uncertainty. A lot of work is being done, but we need to set priorities to get funding and effective implementation. Pilot projects would help demonstrate how to implement adaptation. Focus on key projects that show transition from data (scientific) to action. There is plenty of science, but not much input from the ground level.
- There is a need for education and training for both practitioners and students. These are the people who will handle water adaptation for climate change over the longer term.
- There seems to be a mismatch between what practitioners think and what policy makers think. For example, there is recognition that mitigation measures can be taken for aridity. However, it is very expensive to react to drought impacts; proactive investment can save a lot of money going forward.
- Senior management is very interested in cumulative effects and how to do cumulative effects assessment, e.g., streamflow.
- One of our weaknesses is that data are not always accessible to all researchers. We need to share our results so we can build on our successes and not continually recreate the wheel. Better coordination would avoid duplication of effort.
- We need to build our ability to think outside the box. We are not educating young people about water and the need for adaptation to climate change. We are focused on adaptation and implementation, but to enable thinking outside the box we need to support research that helps us think in new ways.

3.8.3. "Ah-ha" moments, Epiphanies or Surprises about the State of Practice

- There is a need for improved governance. How are we going to organize ourselves? Adaptive management approaches could be helpful. There needs to be institutional support, and long term planning (beyond the electoral cycle). Four year election cycles don't work. Longer term baseline planning is needed to engage accountabilities beyond the electoral cycle. Citizen/public engagement needs to be more formalized.
- There is a need for strong plain language messaging on climate change adaptation that we repeat over and over again. If we can't do this because we are too absorbed in our work, an advertising agency or public relations agency could spread the word.
- We have a serious infrastructure problem, and we are not doing a good job at showing people how the system's ability to cope is compromised. We need to help people visualize what will happen if we don't make changes.
- Canada has much to learn from other countries that are more water-stressed than we are. There is an international movement for watershed governance (agriculture, riparian rights, conflicts among water users). Setting up that kind of governance structure is long term, and there are advantages to getting beyond the electoral cycle.
- There is real lack of understanding about thresholds, i.e., when we cross them the system won't function the same way anymore.
- There is a need for real numbers to guide policy and decision making. We need a number, not a range, to drive policy, because a range enables people to NOT make a decision. However, physical scientists tend to be uncomfortable about giving a single number. We need to get past that discomfort and, based on the best information we have, provide a number that can be used to develop policy. How we convey uncertainty to decision-makers is very important.
- Everything is still in bits and pieces (not cohesive), and a product of linear thinking. We haven't put the picture together yet. In the north, it was individual communities that raised the question of where their water came from, and concerns about the impact on them of the tarsands. We then embarked on 5-10 years of conferences that gathered information from all communities. No real strategies have been forthcoming from the provinces. We are now at the beginning, but where is the middle, and what will the end look like? Perhaps something like a Royal Commission could be used to focus the nation on water. We need to engage students (elementary through university), housewives, farmers – everyone – and talk to them about what is being done, and where the work is leading with respect to water adaptation.
- These water issues appear to be urban-based; our water concerns come from mining development. Developers leave their waste behind because the fines are lower than the cost of cleaning up. There is a conflict between conservation and economic development.
- The City of Windsor's adaptation plan has engaged multi-disciplinary teams (economists, lawyers , parks as well as scientists and engineers) in the planning exercise because we know that climate change will affect everyone. Talking to people in other sectors will help us mainstream adaptation. One problem is that our region is comprised of many smaller municipalities which are not looking at adaptation right now. Some sectors may go to these municipalities to do business as usual, which will slow down our mainstreaming efforts.

4. MAINSTREAMING CLIMATE CHANGE ADAPTATION IN WATER MANAGEMENT

4.1. Description of the Process for Obtaining Participant Input

Information on this topic was generated during two sessions. Participants were first divided into four smaller groups, by sector:

- Municipal water and wastewater infrastructure
- Drinking water
- Energy and natural resources, & agriculture and ranching
- Ecosystems and conservation

Within these groups, they were tasked with answering the following questions:

> **Q7:** In your sector, what is the awareness/understanding of the risk, and the degree of action towards addressing those risks?
> **Q8:** Where along the "mainstreaming continuum" (Figure 4) is your sector?
> **Q9:** What tools, knowledge, guidance, actions etc. is needed to move your sector the rest of the way? How to enable these? What opportunities are there? What are the challenges/barriers? What is needed to address these?

Answers to these questions were documented on sticky notes, flip charts and participant answer sheets. Results of **Q7** (i.e., What is the awareness & understanding…?) are presented in Appendix B, and constitute the 'facts' or 'evidence' to support participant interpretation for **Q8** and **Q9.**

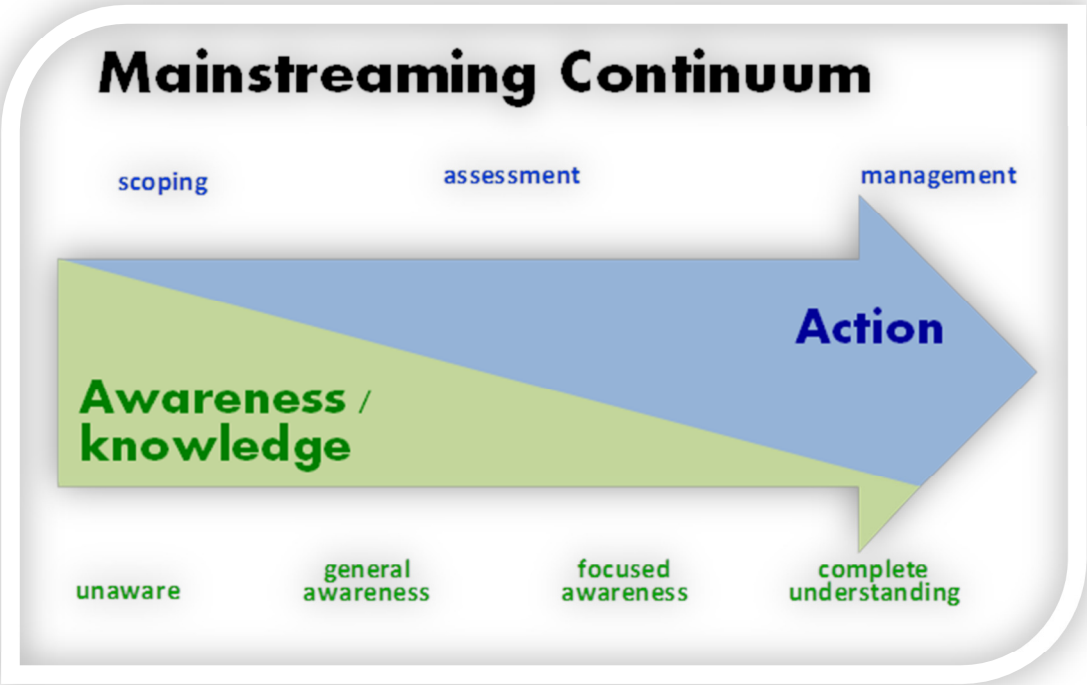

FIGURE 4. GRAPHIC REPRESENTATION OF THE 'MAINSTREAM CONTINUUM' USED BY FORUM PARTICIPANTS TO INTERPRET THE PROGRESS ON ADAPTATION ACCROSS DIFFERENT WATER THEME AREAS.

The results of **Q8** were then presented in plenary, after which participants were asked:

> **Q10:** What commonalities exist among the sectors regarding mainstreaming needs and opportunities?
> **Q11:** What do these results suggest regarding action items for practitioners (especially those in the room)?
> **Q12:** What other interesting observations or insights do you have?

Answers to these questions were documented on flip charts and individual answer sheets, and also by note-takers.

4.2. Municipal water and wastewater infrastructure

4.2.1. Sector Location along Mainstreaming Continuum

- Staff, elected and public (3 audiences regarding mainstreaming situation)
- Long-term vision
  - Public acceptance of upgrades
  - Science back in policy development
- Different audiences (municipal sector, general public, etc.) are in different stages in the mainstreaming continuum.
  - Elective officials are generally unaware-slightly aware, and
  - municipal staff is generally aware but not sure what to do about it

4.2.2. What is needed to Move Further along the Continuum

MOVING FORWARD

- Provincial grants/funding dependent on climate change
- Long-term vision
- Infrastructure replacement schedule
- Science in policy
- Experience is necessary (disasters): non-reactive politics
- United municipalities
- Guide for elected officials
  - Why it is important
  - What's happening without adaptation plans?
- Environmental psychology: learn tactics
- Digest information: use information tools and guides
- Learn by doing (regional collaboration)

BARRIERS

- Encroachment by developers
- Increased amount of chemicals (wastewater) → Increased treatment
- Inertia, boredom, economy (another downturn?), bureaucracy and risk aversion
- Jurisdictions and management
- Scientific defense/justification
- Policy protection
- Understanding of implications
- Storms are good! (experience/public support)
- Case studies = Public support
- Connect municipal information to health, etc. (more holistic approach)
- Relate to public issues
- Public tours (water and wastewater facilities) = increased awareness (TV, documentaries, etc.)
- Insurance industry (disaster information)
- Research/innovation and leadership (include NGOs)

OTHER NEEDS

- Informing the public is a challenge (people generally accept further investments if these are necessary). Tune communication to the type of audience
- There are good policies but they are not enforced. Possible ways to encourage action could be through conditional grants for projects (BC) or through regulation/legislation (by-laws).
- Priorities should be defined in terms of funding for maintenance/upgrading/change works.
- Adapting is dependent on previous experience (don't miss a good disaster!)
- Coordination between municipalities makes for a bigger case
- Guides or other training materials should be available for elected officials/municipal staff and best practices should be available to municipalities.
- Strategies and tactics from environmental psychology could be applied to the water/wastewater sector.
- You have to learn by doing it: implement experimental/case/pilot studies and get feedback in the form of monitoring and evaluation data. Case studies have to be developed to get public support.
- Economic impacts of infrastructure failure: they have to be recognized as part of the risk. These impacts relate to individual experiences: the insurance stories should be made public.
- Since 9/11 public tours in facilities have been stopped or reduced. There is a need to inform and re-engage the public with their water infrastructure systems (TV, documentaries, etc.)
- Emerging chemicals in wastewater pose a significant concern. It is another risk added to the water system.
- Main barriers for action on adaptation are the jurisdiction division/bureaucracies and the 'business as usual' attitude by government officials.
- From Participant Recording Sheets

4.3. Drinking Water

4.3.1. Sector Location along Mainstreaming Continuum

- Public awareness/understanding → political will for change
- Climate change in the silo of environmental issues
- Surface water issues are easier for public to understand vs. groundwater issues
- Land use issues + surface water
- Lack of understanding of climate change by itself/climate change in relation to level use

4.3.2. What is needed to Move Further along the Continuum

- Clean Water Act
- Tools/water budgets/climate change scenarios
- Impediments
- Political action and will (or lack of thereof)
- Municipal, provincial
- First Nations; lack of shared responsibility with federal government
- Places to grow (Official Plan): filter down to municipal level of government
- Conflicting messages: conservation priority but at the same time open for development
- Conflicting land use and development priorities

NEEDS

- Education/outreach/engagement to make technical infrastructure issues relevant to more public from understanding to action
- Changes in a 'digestible format'
- How to relate policies/plans to individuals lives and actions
- Suite of adaptation measures; how to change/adapt current practices (soft and hard)

WHAT ELSE NEEDED?

- Pilot/case studies (identify adaptation measures to transition to management plan)
- Public education and will → Political will to act
- Ministry of Water?
- Water management spread over different ministries; no clear leadership
    - Taking ownership of water issues means also taking ownership of costs
- Fragmented policies within and between ministries

4.4. Energy and Natural Resources, & Agriculture and Ranching

4.4.1. Sector Location along Mainstreaming Continuum

Results of this sector's discussion are presented in Figure 5.

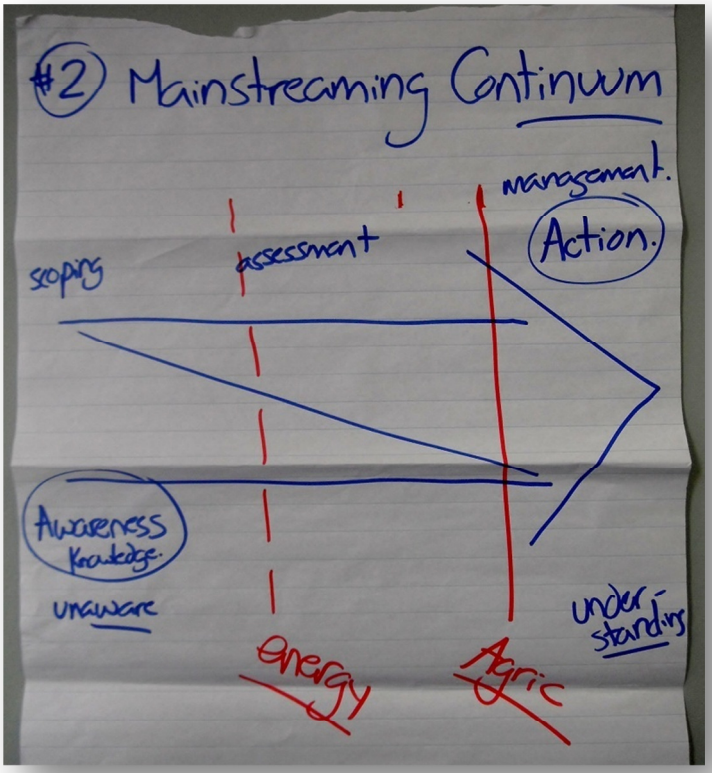

FIGURE 5. AGRICULTURE, RANCHING AND ENERGY SECTORS' VISUALIZATION OF ITS POSITITON ALONG THE 'MAINSTREAMING CONTINUUM'.

4.4.2. What is needed to Move Further along the Continuum

WHAT DO WE STILL NEED?

- Use of paleo-records
- Capture historical lessons learned nationally and internationally (Australia)
- Use and integrate local knowledge (e.g. farmers)
- Scenario planning between sectors to better understand (extreme) limitations and trade-offs
- More detailed climate data (linking hydrographs to temperature and precipitation data)
- Fill policy gaps (BC strategy)
- Increase investments in reservoir capacity (beyond minimum)
- How are natural flow requirements changing? (Challenging? Effective?)
- Put the challenges out to global innovators

- Thinking outside the box
- Natural and social sciences and policy nexus
  - To be reintroduced in the policy making process

4.5. Ecosystems and Conservation

4.5.1. Sector Location along Mainstreaming Continuum

Results of this sector's discussion are presented in Figure 6.

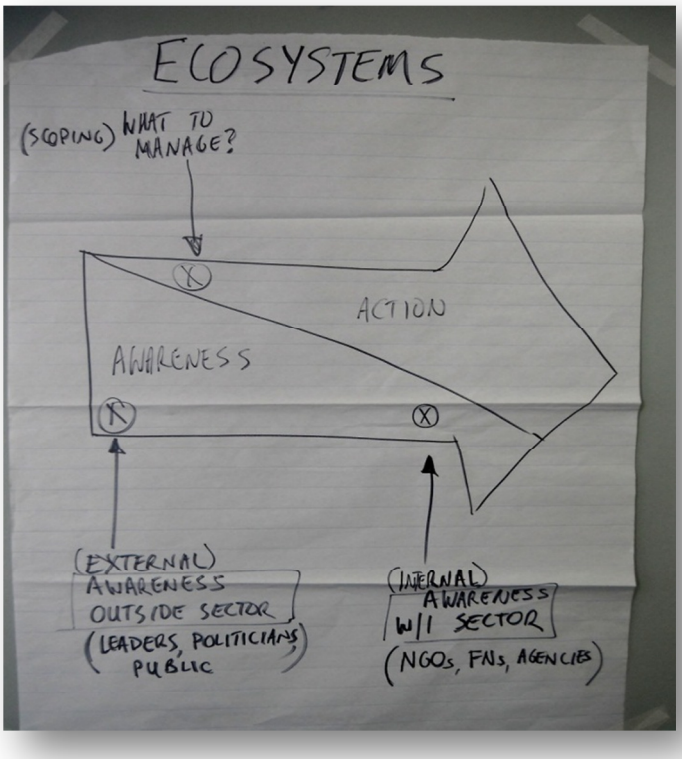

FIGURE 6. ECOSYSTEM AND CONSERVATION SECTORS' VISUALIZATION OF ITS POSITITON ALONG THE 'MAINSTREAMING CONTINUUM'.

- It's not about the science; it's about the people side; a lot of communication comments about First Nations, public. People need to be responsible for the consequences of their actions.
- Conservation is about behavior; consider human nature; need to put the importance of water into the consciousness of people in their everyday lives
- Monitoring/assessment needs – getting knowledge; ecological economics might help get the point across to various audiences
- There has been some assessment of ecosystem vulnerabilities and how they may change, but there seems to be some "circling"; What should we manage? There will be losers; value judgment is needed – do we shift the goal of what we're managing to adapt to CC?

4.5.2. What is needed to Move Further along the Continuum

(A) ECOSYSTEM + CONSERVATION

- Opportunities

- Increase public awareness of the essential role of nature in their lives

- Encourage other sectors to include this sector in their adaptation planning

- Challenges/Barriers

- Complete lack of strong leadership with respect its acceptance that climate change is occurring and that controls and adaptation are essential
- Time lag between conservation action and visible results
- Need for assistance with implementation and guidance for conservation activities; who can help/advise municipalities on what is the best thing to do and how to do it?
-

- Key opportunities

- Consider First Nations people and farther along the continuum with respect to acceptance/awareness; actions that have been denied them may be critical to going forward in terms of action
- Restoring ecosystems may be found in restoring Right Relationships with First Nations people
- Using existing tools to enable adaptation processes at watershed level. Develop and communicate case studies of successful adaptation planning and the benefits of implementation
- Education system (high school/grade school) needs more focus on environment and conservation (not just standard geography class)

(B) MAINSTREAMING ADAPTATION IN CONSERVATION

- The conservation field needs to agree on management principles and goals that are compatible with the reality of a changing climate and the need for both humans and ecosystems to adapt
- Continue to attach values to what ecosystems are gaining or losing in regards to climate change. Clarify who is responsible to ensure those values are kept intact
- Continue to be stubborn and talk about the promotion and forward-thinking of climate change adaptation
- Lobby government to develop adaptation strategies
    - Risk assessments → Vulnerability Analysis → Action Plans
- Lobby government to invest in the above activities and support the groups implementing the plans
- Change present economic model to Ecological Economics
- Full cost pricing/account

(C) AQUATIC ECOSYSTEMS/CONSERVATION SECTIONS

- Opportunities to move adaptation: make ecosystems more resilient
- Be willing to start difficult conversations about goals of conservation in the context of rapidly changing climate; my observation is that is very difficult to do. Recognize that climate change is a threat to conservation and its goals

- Opportunities: What can be done?

- Awareness of threat to ecosystems needs to increase among general public and decision-makers
- Need to determine valued ecosystem components and a way to determine what is valuable (i.e. cultural, scientific value)
- What are the 'no regrets' adaptation measures that provide benefits no matter how climate changes?
- Education opportunities arise every time we have an extreme weather event; we can use the term 'climate change'-it is not a profanity
- We should encourage lay people, interested groups and students to get involved in environmental monitoring as a way to encourage 'buy in'

- Force our local politicians-hopefuls to take a position on climate change
- Develop games and tools that students can use to build awareness and appreciation of the issues

- Future actions:

- Science (scientists) need to be very clear on what specific adaptation actions they want politicians/land and water managers to implement to manage climate change
- Tax payers need to be convinced that funding for climate change actions is a high priority

(D) TO MOVE ADAPTATION FOR ECOSYSTEMS IN RESPONSE TO CLIMATE CHANGE:

- Greater public and political awareness is needed, thus more promotion, advertising and sharing of information is needed
- Political pressure should come from public based on their awareness and concern

- Opportunities:

- Strategic planning to assign responsibility for action (i.e. designated policies and regulation, if necessary)
- Dialogue with First Nations and other leaders in conservation around the world to develop new ways of thinking and new tools
- More assessment/monitoring of ecosystem needs to inform decision making with concrete numbers (we don't need ecosystem services to monetarily inform policy-makers-we can use impact assessment instead or in addition)

(E) GUIDANCE FOR CONSERVATION PRACTITIONERS ON HOW TO EVOLVE APPROACHES/STRATEGIES/TOOLS TO MANAGE UNDER CONDITIONS OF RAPID CHANGE (I.E. FOR RESILIENCE)

(F) DEMONSTRATION PROJECTS OR EXISTING CASE STUDIES HIGHLIGHTING THE CONNECTION BETWEEN THE HUMAN AND NATURAL ENVIRONMENT; HOW RESILIENT ECOSYSTEMS SUPPORT HUMAN WELL-BEING THROUGH THE CONTINUATION OF ECOSYSTEM SERVICES

(G) ENABLING POLICY TO:

- Allow for adaptive (long term planning) actions
- Regulate land use planning in a proactive and 'climate-smart' way

(H) GET POLITICIANS INVOLVED MORE VIGOROUSLY IN SUCH MEETINGS /CONFERENCES AS THE CURRENT ONE. REQUIRING LEADERS TO UNDERGO TRAINING OR A CRASH-COURSE ON THE CURRENT ISSUES WILL BE CHALLENGING BUT VERY NECESSARY

(I) ENABLING POLICIES: LAND USE – LANDSCAPE ACTIONS

- Job opportunity and training
  - Day lights streams
- Restore old streams (larger buffer zones and more vegetation, use of local plants)
- Justice circles and harsher penalties for 'law breakers' (community services, be physically there)
- Mitigate before development (part of accountability)
- Forestry, mining, mills and pulp mills
  - Allow trees to fully mature and stricter regulations and policies (especially with mining, zero tolerance)

(J) OTHER

- There is a need for some enabling policies – e.g., get faster in the adaptive management cycle to address changes that are coming, so we can re-evaluate; need flexible policies around land use planning.

- Opportunities for mainstreaming were related more to the people, relationships, communication, e.g., getting leaders to be more responsible for consequences of actions vs. opportunities to do more science

4.6. Plenary Discussion Results

4.6.1. Commonalities among Sectors

COMMONALITIES ACROSS SECTORS

- People that need to know it, find the answers
- Messaging can be difficult in face of complexity
- Little action resulting from science

COMMONALITIES

- Science not the barrier; policy decision-makers (short term thinking) to realize this
- Lack of commitment (funding)
- Lack of concern (limited understanding)
- Making information more accessible (e.g. social media)
- Need more 'good news' stories (e.g. case studies, demonstration projects)

DISCUSSION NOTES

- Politicians are unaware; lack of leadership –perhaps due to incomprehensible science
- Public is less unaware
- Science is not the barrier
- General lack of commitment and funding to drive action in all sectors
- Differentiating concern and awareness; lots of concern in sectors about climate change adaptation, but not so much awareness, b/c this implies an understanding of scope and breadth of the problem
- Getting info to public and decision makers that is understandable and accessible – use social media?
- Cost to the industry across the boards
- Policy gaps, short-term thinking b/c of the electoral cycle
- People who need to know, they find out; if there is an issue in your sector, you find a way to deal with it
- Complexity message from each sector; science is complicated, so messages can be complicated; simplify to make more accessible. The complexity of science makes it difficult to translate into action
- Lack of action is common; lots of science, but not a lot of action
- Climate change is a bad story; need good stories that can be case studies and demonstration projects, opportunities for education

4.6.2. Next Steps

A. Make the insurance story better known (everyone can relate)
B. No/low regrets measures (e.g. water conservation)
C. Address lack of political will, stop complaining about it!
D. (Better) Direct existing science into policy
E. Broadening the base (issue focused among scientists)
F. Learning scenarios (Schumaker approach)
    - Plausible futures to inform sectors/decision makers
G. Science needs to communicate more directly with public; step out of comfort zones!
H. Just do it: learning by doing demo/pilot projects
I. Language: 'current climate' and 'future climate', 'climate is changing'

J. Change lexicon of climate change. First Nations already mainstreaming adaptation into day-to-day
K. Change in governance structure → flexible and adaptive systems
L. Develop indicators of success in adaptation → implementing risk reducing measures
M. Value chains: new knowledge/technologies/innovations need to clearly identified valued added
    a. Make a business case for adaptation
N. More dialogue/engagement
    a. With industry (Real estate? Insurance?)
    b. With First Nations (right-based discussions, as partners in adaptation)
O. Language: 'current climate' and 'future climate', 'climate is changing'
P. Make stronger connections to La Niña/El Niño

Discussion Notes

- What can we do next to move things along?
- We need to make the story of the insurance issue better known; added insurance costs will be relevant to everyone; will capture people's imagination and bring it home
- "No regrets" measures provide benefit now and into the future no matter how the climate changes; e.g., water conservation is an adaptation measure – there ARE things we're doing now
- Scientists need to be more vocal, communicate more directly with the public; be seen as strong advocates of climate change action rather than as fence sitters or as experts who need to qualify everything to the nth degree or are afraid to make definitive statements; step out of our comfort zone and take on that role
- It's time to stop complaining about a perceived lack of political will, and try to understand and address what's behind it; make better connections between climate change and other pressing social priorities
- "Just do it!", but you have to do it smart; start off with small steps (pilot projects); learn by doing
- Think about the continuing use of the term "climate change"; different for different people; there are still people who argue that climate change is not happening; change the terminology to something that is more accurate; e.g., "current climate" and "future climate"; use the phrase "the climate is changing" which is more active voice and may have more impact on the public
- Action item of "value change", used in industry and engineering; every stage of a process has value and that value is made real by recipients of the product; as we work through the process of piloting projects, value at each stage needs to be identified and sold as such; it's easier to tease out climate change if it's an "add-on" and there will be more buy-in b/c beneficiaries will see the value
- Broaden the base – most people involved are physical or biological scientists, add lawyers, social scientists etc. to broaden the discussion and make tracks to a solution
- More engagement with industry users would be a good step forward
- Real estate industry would like to see flood plain mapping done as flooding is a big risk to their industry
- Do some learning scenarios (?Schumacher? approach) where we have the ability to create plausible futures under climate change, show consequences and interrelationship between sectors in that future to help inform the various sectors and decision-makers just what is coming if we do nothing; would help create a common platform for moving the discussion along; this should be possible NOW
- Dialogue and engagement with First Nations is needed; there have to be some parameters set for this kind of discussion; there was no "extinguishment" of First Nations rights to water; "climate change" is not on the minds of First Nations, but they do recognize that the climate is changing, and they are adapting to it
- Need to lobby for an update to our governance structures so we can take the actions that will give us the resilience we need in the water sector; need flexibility and ability to move fast

- Make the connections for general public and elected officials between El Nino / La Nina and South Pacific Oscillations and the changes we're seeing in the fisheries; what we see this year will impact fisheries for at least the next 2 years; there are some predictable elements to these climatological events
- Develop indicators of successful adaptation; implementation of risk-reducing measures plus a way to measure the success of the actions

5. COMPENDIUM AND PRACTITIONER NEEDS

5.1. Description of the Process for Obtaining Participant Input

Information on this topic was generated during a plenary discussion session. Participants were asked the following questions:

- What are the needs / perceived priorities of end users for knowledge?
- What is the search image / search criteria of end users for this knowledge?
- What level of detail do end users want to see for a knowledge entry?

Answers to these questions were documented on flip charts and individual answer sheets, and also by note-takers.

5.2. Plenary Discussion Results

5.2.1. User Needs / Priorities

A. Degree of practicality as opposed to theoretical
B. How to package scientific knowledge so practitioners use it? Get this into tools
C. Strategies to overcome barriers
D. Regional searches
E. Tools for scenario planning
   - Preparedness
   - Build capacity for sustainable planning
F. Cost/benefit ratio

DISCUSSION NOTES

- There has to be a degree of practicality to the entry in the compendium. People need practical knowledge, less theoretical; good for decision-making
- Package the science knowledge in a form that practitioners would use, e.g., tools; find ways to channel the knowledge into tools that people can use; will have more impact
- Based on what we've heard, strategies to overcome scientific and political barriers will be key
- Add a regional breakdown so people can search by region
- Tools for preparedness planning and scenario tools would be useful; on different scales; build capacity for sustainable planning for today (immediate needs) and for our children (50-70 years)
- Financial assessments – benefit/cost ratios to build a case that it pays to invest
- The interface needs to be simple, e.g., I want to understand how climate change will affect my watershed (along the lines of how the Okanagan Water Supply and Demand project did it); present a pick-list of things that are in the compendium; behind the scenes there can be a decision tree that drills down into the information until it reaches what the user wants

5.2.2. User Search Image

A. Put on site feedback
B. Why adaptation plans and studies? Suggest separating
C. Case studies (one tool people find most useful)
D. Post comment section at the bottom of each entry, to say how the use it

E. Important to distinguish planning tools (tools for doing stuff) vs. assessment tools
F. Is this a data set?
G. Where is monitoring and evaluation information?
H. Would like to see links to other sources (e.g. waterbucket in BC)

DISCUSSION NOTES

- Put a feedback feature on the site; have people start using it (pilot) and give feedback
- Adaptation plans should perhaps not be lumped with studies in the compendium; these are quite different; suggest having adaptation plans as a separate category
- Case studies need to be added, e.g., the community did this, and this was the result; would like to see case studies included in the categories
- Include a "post a comment" feature so people can share how they have used the information
- Distinguish between the different kinds of tools (which are things that can be used to do stuff, e.g., adaptation planning tools and assessment tools – these are distinct from vulnerability assessments)
- Like to see this link to other places to which water sector people [and professionals already] go for information, e.g., Waterbucket in BC (http://www.waterbucket.ca/cfa/?sid=4&id=1&type=single)

5.2.3. Desired Level of Detail

- Assume users have little background
- High use of images and graphics
- Make clear it is national and cross-cutting
- Create children's version (Robo cow)
- [Similar to the] Global Water Network

DISCUSSION NOTES

- Use ctrl-F to add keywords for searching
- High use of images and maps will help people understand, e.g., cross-sections that show groundwater; animation tools that show the hydrological cycle
- Still graphics work well for navigating
- Make sure that it's clear that it's national, and has broad appeal; water is cross-cutting
- Also target children as users, e.g., animation tools

6. APPENDIX A: RESPONSES TO Q1: WHAT IS HAPPENING…? (BY ISSUE)

6.1. Floodplains

ONTARIO:

- Conservation Authority (Ontario) – regulatory mapping
- continued support and enforcement of Ontario Riverine Flood Hazard Policy, including controls on development and redevelopment
- investigating climate change impacts on Probably Maximum Flood and Probably Maximum Precipitation (PMP & PMF) for dam design and operations in Ontario (preliminary)
- investigating climate change impacts on events used to delineate riverine floodplains in Ontario (preliminary)
- enhancing riverine flood forecasting and warning systems in the Greater Toronto Area
- inland provincial policy statement (Planning Policy Ontario)
- Toronto Portlands Revitalization and Naturalization – adaptive planning for 100 year floods; re-naturalizing channelized mouth of the Don River
- the City of Hamilton is renewing its floodplain mapping, and discussing how climate change projections can be included in the updates
- Hamilton is discussing a nearshore study to characterize environmental features, functions and influence of stormwater, and wastewater with a view to establishing water quantity / quality / habitat targets

COASTAL:

- some communities on Vancouver Island are considering climate change in watershed planning
- Primer on options and costs for coastal adaptation; traditional, e.g., dikes, plus new ideas, e.g., retreat, floating homes (BC and Atlantic Canada)
- visualizations of coastal flooding and adaptation options used to engage decision-makers (BC)
- discussion of coastal floodplain management opens the door to broader conversation on floor protection and floodplain management (BC)
- City of Vancouver is using new provincial coastal floodplain guidelines
- City of Prince George-funded climate change and floodplain study considers climate change in floodplain management and many other areas (BC)
- there is a new draft provincial guideline in BC for sea dikes and coastal floodplain designation and development; outreach and engagement to local governments (context: local governments manage dikes and floodplains)
- Coastal Cities at Risk (CCaR) Project – research in Canada (Vancouver) and internationally (Lagos, Nigeria; Manila, Philippines; Bangkok, Thailand) to explore vulnerability, risk, resilience in large coastal cities in light of climate change and the influence on hazards (e.g., sea level rise, riverine flooding) and how to inform urban planning and management
- for coastal Atlantic – flood risk mapping, climate change scenario generation; evaluation of land use planning / development policies; disaster risk reduction strategies; social / cultural risk assessment
- local adaptation plans (http://www.planningforclimatechange.ca/wwwroot/dsp_HomePage.cfm)
- floodplain mapping (various technologies / approaches / tools)
- mitigation measures (earth barriers, rezoning, redesign of facilities, e.g., roads, bridges, municipal infrastructure)
- cross sectional partnerships (community groups, government, NGOs, industry (e.g., insurance), municipalities, federal government)

- data access / knowledge systems (improving, open data)
- marine infrastructure at coasts – risks and measures

INLAND:

- Assessments of Risks (QC dams – inland)
- Don Valley Evergreen Brickworks – floodplain mitigation and management strategies; not strictly designed for climate change, but will certainly help mitigate negative impacts from climate change (i.e., increased flooding and extreme wet weather)
- creek flow (Mud Creek) to Don River – restored site required flood preparation and management integrated into site design; filtering wetlands / ponds (man-made, previously a quarry pit); flood channels with water tolerant plants to absorb excess flow; bioswales channel filtered water to the Don River
- local adaptation plans (http://www.planningforclimatechange.ca/wwwroot/dsp_HomePage.cfm)
- inland flooding – too much focus on remediation rather than prevention
- in Manitoba, there is a task force on flooding, appointed to do a report on 2011 Manitoba floods
- floodplain mapping (various technologies / approaches / tools)
- mitigation measures (earth barriers, rezoning, redesign of facilities, e.g., roads, bridges, municipal infrastructure)
- cross sectional partnerships (community groups, government, NGOs, industry (e.g., insurance), municipalities, federal government)
- data access / knowledge systems (improving, open data)

MISCELLANEOUS:

- integrate standards / guidelines
- Intensity Duration Frequency information
- visualization tools
- Land and Infrastructure Resiliency Assessment Tool (Agriculture and Agri-Food Canada (AAFC), and Prairies)
- Insurance Risk Assessment – municipalities
- Public Infrastructure Engineering Vulnerability Committee (Engineers Canada)
- National Adaptation Measures Database;
- communications guide for municipalities; how to communicate climate change and climate change risk to stakeholders; communicating flood risk is a large component of this

Stream Flow

SOUTH SASKATCHEWAN RIVER:

- Hydroclimatic Variability, South Saskatchewan River Basin (University of Regina)
- Hydroclimate Modelling, South Saskatchewan Regional Planning (Golder Associates); incorporate results from #1 above

HYDRO PRODUCTION:

- Ontario Power Generation – impacts of climate change on hydro production in Ontario
- Hydro Quebec Research Institute – assessment of benefits of adaptive management vs. engineering adaptation (completed); runoff projections at the river basin level

VULNERABILITY ASSESSMENT TOOL:

- “Flowing Forward” – a framework for including climate change information into risk assessment for watershed management, and for building resilience

ONTARIO MINISTRY OF NATURAL RESOURCES AND MINISTRY OF ENVIRONMENT:

- Guide for Assessment of Hydrologic Impacts of Climate Change
- approaches / methods to guide hydrologic assessments of climate change

YORK UNIVERSITY:

- Environmental education and climate change awareness-building in the Jane-Finch neighbourhood
- grad students via the Green Change Project of the Jane-Finch Community and Family Centre (Black Creek Waterworks, etc.)

PILOT DRINKING WATER SURVEILLANCE PROGRAM (DWSP) PROGRAM (NEW WORK - BC):

- using a water budget, conduct a water quantity risk assessment that includes a climate change scenario
- the project would include developing a water budget, assessment of risk that climate change may have on the municipal drinking water source; identification of risk management (climate change measures) to address climate change risk
- Somass Basin Water Management Group
- rising river temperature; rising water levels at Great Central Lake; increased flood risk; fisheries (salmon)

MISCELLANEOUS:

- sub-watershed studies – climate change impacts on streamflow and water quality
- building tools for adaptation to help identify management options (Skeena River); climate sensitive regional cumulative effects analysis tool
- P2FC (by WWF) – Peace / Athabasca; methods for using climate scenarios to inform development of ecological flows (how to move from using only historical data)
- measurement of evaporation and transpiration as a proportion of the energy budget in the Don River watershed (Richmond Hill, Ontario); how do residential and industrial land cover types differ in terms of their evapotranspiration rates diurnally, seasonally, and annually?
- Provincial Future Climate Datasets web application
- Coca-Cola source water vulnerability assessments and protection planning for all manufacturing plants in Canada – ongoing
- development of evapotranspiration network in the Humber River watershed; constructing water and energy budgets for a field and rooftop TRCA/York collaboration
- water balance modelling of tailings facilities to assess the probability of interrupted water cover over acid generating tailings
- evaluation of dam/reservoir hydrology for new Intensity-Duration-Frequency and Probably Maximum Precipitation information
- Professional Infrastructure and Engineering Vulnerability Committee (PIEVC) workshop for clients operating reservoirs and wastewater treatment plants
- stochastic simulation of future daily temperature and precipitation data using existing distributions and trends identified using GCM results

6.2. Groundwater

ONTARIO:

- Canada-Ontario Agreement Integrated Water Monitoring Project; sensitivity assessment of streamwater quality and groundwater; implementation of integrated monitoring in sensitive sites
- Water budget – Tier 1 to Tier 3- Ontario Drinking Water Source Protection program
- Ontario Low Water Response; incorporation of groundwater level triggers from selected Provincial Groundwater Monitoring Network monitoring wells
- extension of groundwater level records from 10 years to 45 years; digitizing and modelling

- Well decommissioning; groundwater protection as an adaptation action
- INCORPORATION OF GROUNDWATER INDICATORS INTO ONTARIO LOW WATER RESPONSE:
  - Region: southern Ontario
  - Sectors: Ecosystems/Conservation, Natural Resources, Drinking Water

ALBERTA:

- LIght Detection And Ranging (LiDAR) [remote sensing] as part of a groundwater resource characterization;
- desktop assessment of data for Old Man River Watershed; problem with proprietary data; cultural perspectives on water; offerings to springs, relation to spirits, traditional knowledge

6.3. Aridity and Soil Moisture

MANITOBA, SASKATCHEWAN, ALBERTA:

- International Institute for Sustainable Development (IISD) Evaluation Tool, and recommendation (piloting)
- Watershed Drought and Excessive Moisture (DEM) Planning (SK)
- Crop Development Drought Resistance
- F + RWIP Water Supply Program (SK)
- Farm Stewardship programming
- Business Risk Management programming
- Agricultural Drought Plans in Alberta and Saskatchewan; these are developing also in Manitoba
- no formal climate change adaptation strategy in Saskatchewan – mitigation is King!
- Alberta Sustainable Resource Development vulnerability Assessment and Risk Assessment in Business Plan (Alberta)
- monitoring – mesonets in Alberta and Manitoba; thinking about it in Saskatchewan

ONTARIO:

- heat unit mapping and projections
- AAFC-led climate change scenario planning in eastern Ontario
- adaptation planning in an agricultural watershed demonstration site (Maitland Valley Conservation Authority)

MISCELLANEOUS:

- downscaling seems to be a bit stagnant as to new information regarding soil aridity
- National Agro-Climate Information Service Drought Watch
- development and implementation of water efficient farming technologies
- analysis of Pacific Decadal Oscillation and El Niño/Southern Oscillation events; interaction with scenarios
- Agriculture Canada / Environment Canada – earth observing to improve soil moisture monitoring
- appointment of industry-based “Drought and Excessive Moisture Advisory Group” for the province
- assess on-farm irrigation demands and water supply options
- enhanced monitoring of mountain snowpack to predict annual water supply for irrigated lands
- development of strategic plan to meet long-term water supply needs for farms and rural residents
- develop models to better predict drought and excessive moisture events
- enhanced network of weather stations more accurately assess precipitation and soil moisture conditions

- improvements in monitoring of drought indices across Canada to improve regional comparability with similar indices
- marginal land being purchased for use as a buffer zone
- North American Drought Monitor

6.4. Water Quality

SEDIMENT-RELATED PROJECTS:

- river erosion risk assessment (Ouranos / A. Roy U. of Montreal)
- present assessment of erosion risk
- flow modelling / climate change scenarios
- future erosion risk
- adaptation – local watershed group is a partner

GREAT LAKES AGREEMENTS:

- Great Lakes Water Quality Agreement – renegotiation, signing in 2012!; new Annex 10, Climate Change Impacts (on water quality)
- Joint Strategic Plan for Great Lakes Fisheries (1997) – mentions climate change, needs more work
- Great Lakes – St. Lawrence River Sustainable Water Resource
- new Canada-Ontario Agreement (COA) in progress (COA Respecting the Great Lakes Basin Ecosystem) – Annex 3 to be enhanced with respect to Expert Panel (Ontario) on Climate Change Adaptation
- two Great Lakes indicator initiatives with respect to water quality and climate change impacts on (i) physical, biological and chemical integrity; and (ii) water for fish, drinking, swimming – the initiatives are the State of the Lakes Ecosystem Conference (SOLEC) and the International Joint Commission (IJC); challenges regarding the state of adaptation for these initiatives relates to their bilateral nature, to the state of devolution of government, and to interjurisdictional mandates

AGRICULTURE:

- some activities are occurring nationally on environmental farm planning, although these are not tied to climate change
- there are some (unfocussed, limited) national activities to determine Best Management Practices to mitigate, or reduce risk of impact of agricultural contaminants, but these are not linked to climate change
- there are some (limited) activities around impacts of poor water quality (natural or anthropogenic) on agricultural production, e.g., irrigation, livestock drinking water, food processing, food cleaning, food security, but these projects are not linked to climate change
- to date, there is limited activity/project work linking climate change and water quality, e.g., agricultural drought occurs naturally, and farmers go to risky water (saline) resulting in cattle deaths
- need a plan

CREDIT VALLEY CONSERVATION:

- intensive monitoring of air temperature, water temperature, dissolved oxygen; changes in seasonal temperatures, changes in peak temperatures, diurnal variations;
- monitoring of ambient water quality and event (snow melt / storm) water quality; real time water quality stations, event sampling, ambient grab sampling
- adaptation – low impact development pilot projects; pollution prevention pilot project; watershshed-wide water quality modelling

FRESHWATER QUALITY PROGRAM:

- monitoring of water quality
- about 450 stations in Canada, very sparse in northern Canada (~2-3 stations only)
- Great Lakes temperature monitoring; there is a lack of adequate monitoring given the large water bodies / rivers in Canada
- there is a lack of science policy development to source water protection, water protection
- there is a lack of publicly funded water quality monitoring stations

BAY OF QUINTE (LAKE ONTARIO):

- long term program to control phosphorous concentrations; point source control has been successful
- water quality monitoring has been overtaken by concerns about (i) zebra mussel; and (ii) climate change projections of warmer, drier summers and storm events
- there is a need for more control of phosphorous concentrations; it's unclear if the primary culprit is point source, urban non-point source (modelling is ongoing), or rural non-point source
- slow to take up the climate change impacts issue; lack of funding is a problem

TORONTO WEATHERWISE PARTNERSHIP:

- broadly thinking about water supply infrastructure
- sewerage system failures arising from extreme weather events leading to increased sediment pollution load in Lake Ontario

WATER TEMPERATURE IN RIVERS / LAKES:

- model development; climate change scenarios being developed
- Fisheries and Oceans Canada (DFO) is a partner; Canadian Science Advisory Secretariat (CSAS) reviews the issue
- adaptation focused on fisheries and fish habitat; temperature control, may entertain closure when temperatures rise

MISCELLANEOUS:

- Lake Ontario Shoreline – water quality monitoring and modelling
- projects are underway to understand adaptation of plant species (including trees); assisted migration
- Fisheries and Technology – 5 day education on fisheries research and impacts for children 6-12 yrs; tried for funding to restore Hawks Creek / Deep Creek watershed; Scout Island Education for Public; Xatsu'll Heritage site/ village – traditional education

6.5. Lake Levels and Ice Cover

- scoping of needs for adaptation plan in Essex Region (Essex Region Conservation Authority)
- Climate Change Adaptation Committee with the City of Windsor – adaptation planning
- Plan BV7 – managing water levels for people and nature: Lake Ontario and St. Lawrence River; also, an adaptive management strategy is being proposed for Lake Ontario and the upper Great Lakes
- IJC – International Upper Great Lakes study completed March 2012; looking at new approaches to managing Lake Superior outflows, including adaptive management strategy for addressing extreme levels and flows
- Ontario Source Protection Plans – identify risks to water vulnerability / lake levels
- Canada-Ontario Water Use and Supply Project for sub-watersheds of Ontario Great Lakes Basin (2000-2007)
- Future of Water Workshop Series – Waterlution, capacity building workshops for next generation of water leaders
- mapping sea ice use in Iqaluit by hunters; mapping natural hazards (McGill University)
- Canadian Ice Service studies of sea ice / shipping lanes in the Arctic

7. APPENDIX B: RESPONSES TO Q7: WHAT IS THE LEVEL OF AWARENESS…? (BY SECTOR)

7.1. Municipal Water and Wastewater Infrastructure

AWARENES OF RISK

- Good
- Understanding of weather (extremes), not climate
- Uncertainty-no[t] [good level of risk awareness]
- Do not want to know the risk (liability and disclosure)
- For politicians, concerned about elections, is not an issue (not sexy)
- Perceived separately from job
- Access to tools/resources: cross-disciplinary
- Do not understand (future) climate
- Public = No information [on risks of climate change]
- Intensity Duration Frequency uncertainty

AWARENESS OF ACTION

- Action is happening
  - Not related to climate?
  - Low
  - Fix leaks
  - Not marketed as 'driver'
  - Low impact development
- Can't wait for information

OTHER OBSERVATIONS ON AWARENESS IN THE SECTOR

- The general level of awareness is fine but specific actions are lacking.
- Risks from extreme weather events are known but the connection to climate change is missing.
- Weather risk is generally understood but not climate risk and the uncertainty associated
- There is a concern for liability (i.e. infrastructure protocols). Assessment methodologies for evaluating the risk of infrastructure exist but the specialists (municipal staff) prefer not to know/face these risks. Political cycles are short and the state of water/wastewater infrastructure is not an issue for politicians.
- Municipal staff generally lacks capacity and guidance to factor in climate change adaptation. There is a compartmentalization of responsibilities within local/municipal governments whereas adaptation to climate change should be part of a cross-council vision.
- There is lack of knowledge/awareness about future climate (uncertainty about future IDF curves) but also most importantly there is a lack of awareness of the systems themselves; people do not know how they are supplied with water and how the wastewater is disposed of.
- It is still possible to act without having all the science/data. Bits of action are already being implemented, perhaps not under the climate change tag. Need to act in the absence of all the required/desirable information (not having the number).
- Adaptation should also be approached from a more general perspective (e.g. population growth); there is a need to adapt and adopt no regret solutions. Let's act (improve infrastructure maintenance, fix the leaks) even if climate doesn't change. Climate change adaptation could be part of broader approach to infrastructure management (include social aspects, etc.)
- Poor maintenance of the systems is an important issue. Improvement of the system is required regardless of climate change impacts.

- Downscaling climate models would be very important. But from many models; which one to use? There are good model and GIS but accurate Digital Elevation Models are required (flood management). Drought and flooding scenarios (need to plan for all the spectrum; increasing safety factor) can help guide the risk analysis.
- Government interested in continuing business as usual rather than considering alternative ways for the provision of water and energy (free up a lot of money and resources)
    - Dry sanitation
    - New paradigms
- There is pressure on the government from developers. They work with short time frames: municipalities get caught up in this process. Groundwater (southern Ontario): example of cooperation between developers, residents, government, etc.

7.2. Drinking Water

PUBLIC AWARENESS

- Walkerton highlighted drinking water issues
- Lack of awareness between drinking water issues and climate change
- East Coast; heightened awareness in coastal areas (i.e. saltwater intrusion)
- 'Hydro-illogical cycle' applied to drinking water
- Agricultural impacts on drinking water quality
- Longer growing season impacts on drinking water
- Links with short-term weather and groundwater shortages
- Beaches/lakes blue-green algae
- Weather and level of risk are not connected
- Urban/rural divide (understanding/knowledge of climate and weather patterns)

7.3. Energy and Natural Resources, & Agriculture and Ranching

- Energy = good understanding (BC Hydro and other industry power producers) and limited acceptance
- Agriculture (used to variability) is the opposite
- Energy: challenges of transmission and grid infrastructure
    - What about the business case for adaptation? (limited understanding)
- Competition for water resources
    - Between oil, gas, agriculture and other uses
    - Trade-offs
- Instream flow needs
    - Non-consumptive uses
    - Science is there
    - Bow Valley example
- Crop yield/productivity?
    - Insurance = yes!
    - Risk management tools = yes!
- Challenge? Moving beyond historical records (100 vs. 1000 year records)
- Fisheries (fish kills): water temperature

7.4. Ecosystems and Conservation

- High awareness
    - Conservation won't work (temperature threshold)
    - Monitoring needed
- Challenge with how to act (at crossroads)
- Current toolbox falling short on action
- Action focused on scoping
    - What are we managing for (e.g. increase in fish common/different species)
- High awareness within sector

    - Invisible within other sectors (human use)
- Communicate breakdown of how ecosystem provides human services
- Problems with the term 'ecosystem services' (treatment plant vs. wetland)
- High awareness for aquatic ecosystem vs. terrestrial ecosystems
- Challenge is related to management options
    - Few long term management solutions
- At political/policy level awareness is low (just getting information in mind)
- Mitigation debate has trumped adaptation discussion (in Saskatchewan)
- Human adaptation and ecosystem adaptation
    - Ecosystems cannot adapt/anticipate
- Need to accept losses (unavoidable)
- Disagreement about how to act; different to decide on adaptation (what are we managing for)
- What are the Valued Ecosystem Components/VECs (cumulative effects assessment)
- Adaptation driven by what we value-management target
- Can't be prescriptive in adaptation (need flexibility)
- Discussion of CEA, VECs, adaptation faced by First Nations at the turn of the century (parallel challenges)
    - Meaningful/appropriate level of engagement
    - Requires relationship to land/water/ecology
    - First Nations values (who we are) affected by climate change adaptation
    - First Nations cultures spanned large variations in climate → reliant on ecosystems/persistance
- How to adapt when loss of SK, which defines culture, food security?
    - Cannot switch/adapt easily
- Action requires incentives (economic models)
- Locked into species management (SAR: Species At Risk)
- Few extra resources
- There is a good level of awareness about the potential impacts of climate change to coldwater fisheries; conservation is not going to work; if water temperature goes up past a threshold, the fish will die; need to be monitoring
- Awareness is high, but challenged with the "how to manage" end of it
- At a crossroads where we are realizing that our current toolbox for conservation is falling short; need to start thinking about things differently; what is it that we are really trying to manage – is it the species for their own sake, or is it the service of having a fish species for food or recreational angling?; use conservation measures differently depending on the management objective; climate change is confounding the way we have conserved/managed in the past; we need to manage for resilience now.
- It's important to distinguish awareness within this sector vs other sectors; there may be a high level of awareness within this sector, but the risks are almost invisible in other sectors; we can see the pre-existing condition of the natural world, and this is an essential part of being human; we require nature to live, so our awareness tends to be better in this sector; we know what needs to be done, but this sector is not independent of other sectors which makes it harder to make progress
- Evaluating ecosystem services has its drawbacks (the monetization of nature), but it can help developers/industry understand how nature provides services for them; at the moment, how social and ecological systems communicate is not currently adequate
- There is better awareness of risk to aquatic ecosystems b/c of the important of fish to people, than there is of risks to terrestrial ecosystems; it's difficult to find long-term management solutions; fish politics is always in the news in BC
- At the political/policy level, awareness is not high; climate change aside, we are just starting to consider instream flow needs for competing interests (e.g., power, fish, agriculture, water-taking, etc.); biological consequences are not being considered; we are so consumed with regulations, that awareness at the political level is not there; haven't yet developed a strategy on adaptation, done the risk assessment, or included instream flow needs

- The ecosystem is not getting the chance to adapt to the changes that are starting to happen; adaptation might mean accepting bass (a warm-water fish species) instead of trout (a coldwater fish species); conservation ethic is built around naturalness; adaptation may compromise this
- Adaptation likely means losses; things won't be the same
- What should the objectives be? Commercially valuable species? Species diversity? There is no convergence/agreement within the conservation community on these questions which will make it harder to go forward
- Need for multi-stakeholder discussions; everyone needs to understand what you are driving for, which will give a better chance to design something that will work
- What are the valued ecosystem components? Is deciding this a community task?; Is it a science task? Combination of both, but how do we do this? Need this for cumulative effects assessment
- Climate change might change what valued ecosystem component are, b/c some may not be able to persist, or saving them might be too expensive under climate change; need to be flexible in management trajectory/goal; what level of risk is tolerable? Manage toward staying within that "OK" window
- The concept of valued ecosystem components is something about which First Nations have been aware for a long time; it is critical to who they are and their way of life; water and buffalo are of paramount importance to plains FNs – highly valued. The conservation movement was borne from the devastation of the buffalo population.
- First Nations in BC are heavily dependent on salmon runs; in some cases, these runs can't be fished anymore; they can't adapt to climate change by simply changing what they value; the level of awareness about climate change is not high among FN, but there is a high awareness of development impacts.
- There is lots of passion, but we need to direct that energy.
- There is some awareness at the government level (e.g., this forum), but there isn't acceptance that action needs to happen NOW; government doesn't see the benefit (in this election cycle) to taking action; if there was acceptance, it could lead to action.
- Investment in adaptation to climate change hasn't happened in this sector b/c we are locked into legislation around species at risk (identifying, protecting); not a lot of resources left over for considering other management needs
- Who are we targeting for action – land owners? municipalities? – nobody is taking responsibility, and the buck gets passed.
- Lack of dialog among stakeholders; using ecological economics to account for externalities; changing the economic model might enhance conservation – need to apply the real cost of water to users.

8. APPENDIX C: RESULTS OF INDIVIDUAL PARTICIPANT WORKSHEETS

TABLE 1. RESULTS FROM PARTICIPANT WORKSHEETS – COMMON THREADS ACROSS THEMES

risk analysis, impact and adaptation, regional to local downscaling
adaptation is *ad hoc* and in its infancy; seems to be lack of political will, but stakeholders are showing interest
need to strengthen science and engage multi-disciplinary and inter-disciplinary approaches
linear approach to defining issues, events, opportunities; it's about water – sectoral interests, isolated from teach other – piecemeal
reactive, inconsistent, in early phases, piecemeal/fragmented
all themes need more information; efforts are underway in each theme; lack of public knowledge
preliminary; need for stakeholder buy-in / education; inconsistent implementation, varied
lack of consideration of natural ecosystem features/uses in future water management planning under climate change

protection; data sharing; acquiring new skills to adapt
reactive, inconsistent, fragmented; lack of knowledge, science, literacy
adaptation is at the early stages; there is probably a basic understanding of the need for overarching policy work at the agency level; science has advanced to the position of certainty regarding needs
public education is never done and not at the implementation stage, generally
the state of adaptation across the issues is weak; there is some agreement that there is knowledge and awareness of climate change and water stresses, but this has not advanced to adaptation planning or thinking of water issues that exist already with added stresses of climate change
all topics are in infancy re: climate change adaptation; more theory than practice; lack of over-arching strategy
momentum is building but lack of clear direction or plans to obtain the necessary science and also public / political attention
many weaknesses; knowledge not advanced (time) (infancy)
lack of research that has not covered all realms; bring awareness to the public – more monitoring than acting/adaptation
lack of tools / infrastructure to communicate data across users (from science / research to public)
monitoring and data needs to fill gaps; proactive vs. reactive (commonly occurred); impact vs. adaptation (lack of momentum); different levels of players and achievements; lack of commitment and long-term plan (ongoing)
1. tendency to focus on climate change without integrating natural variability which Bob Sanford pointed out is an important element
2. a need to translate information into decision frameworks based on critical threshold probabilities
continued focus on monitoring and assessment of the problem and concerns related to climate change; very little actual work on “adaptation” implementation
knowledge exists (with various degrees of detail, certainty, sophistication across water issues); it is concentrated on impacts rather than on adaptation; knowledge is heterogeneous
monitoring is a common state of practice – identification of need; modelling is under way; early stages of work / understanding; need for integration
lack of foresight; focused on current / recent events rather than preparing for the future; need for policy direction / support to encourage action
lack of political will; lack of common approaches
need for public engagement; need for integration; *ad hoc* – need to be more strategic; need to communicate across issues; not advanced – in early stages of considering adaptation
strong data / science but weak uptake; inconsistent / *ad hoc*; need for consistent, standard approach; need “how to”; link needed from theoretical / academic to practical implementation
reactive, *ad hoc* (fragmented); in beginning phases (science or plan development)
infancy; need to deal with variability in a proactive, future/forward looking way
science needs; lack of implementation
climate and water related lack of knowledge and experience
fragmented adaptation; lots of talk, but weak action / political will; little proactive work; not much attention to vulnerability
generally work is progressing in each area, but perhaps not as integrated or coordinated as it should be to share learning
lack of data availability / accessibility; need frameworks / platforms to share
look to other jurisdictions for workable strategies
in all themes, except streamflow, awareness exists at different stages; implementation is not very advanced or it is highly variable; streamflow is ahead of the other issues
science varies from good (streamflow) to weak (groundwater); adaptation is happening but is piecemeal, not systematic; adaptation focused on reactive, addressing existing climate variability

TABLE 2. RESULTS FROM PARTICIPANT WORKSHEETS – OBSERVATIONS ON THE STATE OF PRACTICE
data needs and accessibility issues, lack of First Nations studies and projects that were highlighted; lack of industry based data and studies
need more and better science; need to integrate

we do not understand environmental needs and ecological flows
need to involve more social science approaches to help guide decision making
need to adopt longer term thinking and approaches
there is no coherent thought or approach across the country on water, e.g., agriculture, groundwater, floodplains etc., government and industry and municipalities
water and protection of water is a global issue, and needs to be approached with this in mind!
lack of understanding with provincial and federal governments
there is lots of technical enthusiasm for adaptation but institutions are generally way behind growing awareness; International – Economic thinking still predominates
more research is needed; there is a lack of understanding of all the parameters that exist which could affect climate change
need better monitoring / analysis to deal with uncertainty
high level knowledge and concern regarding the potential for climate-driven extreme events and impacts, e.g., phenology
public wants to know about how climate change will impact their communities
water issues need to be framed in climate change contexts; we most often problem-solve water issues (especially water quality) in a development and personal health framework
need more monitoring to inform policy decisions
there should probably be a stronger sense of urgency
the urgency of the issue is not well received by the public; need a better “marketing campaign”
better high school education on weather and climate in order to help people understand the problem when they get into industry
information appears strongly to be from science practitioner side, and not a reflection of water users (agriculture, tourism, First Nations)
different levels of confidence on the readiness of climate change works (either impact or adaptation)
lack of direction and leadership
difficult to address different needs from local → regional → provincial → national levels
1. we seem to be woefully unaware of emerging knowledge in the astrophysics, atmospheric chemistry, etc. areas, that could improve our understanding of the issues
2. the economic trade-offs are not well articulated for the most part
3. there does appear to be some emerging implementation
there appears to be a resistance towards actual implementation of adaptation practices; this may be related to continued challenges related to the science
streamflow is ahead of the game
climate literacy (education and training)
cumulative effects for groundwater as well as surface water
accessibility of data
“you can’t manage what you can’t measure”
monitoring and observation are vital
need for education, especially youth
lack of data; problems with data accessibility
improved education / awareness
cumulative effects need to become a priority
need improved access / sharing of data
decision makers need to be better informed
lack of monitoring data; need “how to” implement
“climate literacy” needs to be a focus, both in government / industry and in the general public

Canada has a lot to learn from other countries; we are water wasters and lack humility
need a National Summit of all sectors to develop an integrated strategy (industry, government, communities)
need grass roots support / understanding across society at all levels
adaptation tends to focus on preserving the status quo in the face of climate change transformation and related ecological transformation
it's a bit like running up the down escalator!; I'd prefer that adaptation be part of visioning and creating a new future

TABLE 3. RESULTS FROM PARTICIPANT WORKSHEETS – 'AH-HA' MOMENTS

cross pollination by collaboration and awareness is needed and this forum facilitates that!
there is a need for leadership, for a national approach and for improved longer-term integration
there is a need to incorporate social sciences in a formal way (citizens, participatory planning), i.e., engagement of people and communities in deliberate and planned approaches using sociological and ethnographic sciences
now we saw, now we know, we can address that in our own minds and the rest will come
a Royal Commission on Water is called for!!
there could be a stronger federal role in facilitating action / reducing inconsistencies, but stronger political will is needed
how can we translate the passion about water in this room into public interest which equates to political interest?
there is a lack of funding available to undertake further research to assist in the development of policy
the Tournament Game harks back to AEAM (Adaptive Environmental Assessment and Management)!
the importance of infrastructure as well as environmental stewardship for water protection
not yet!
we need to shift focus from "converting the converted", e.g., water professionals, and work towards inviting new participants into these events
mentoring at a professional level may help
develop clear, consistent messages and repeat, repeat, repeat, repeat, repeat ...
I liked what the "floodplains" group said about "thinking outside the box"; climate change is not conventional, so the solutions (or adaptation strategies) cannot be conventional either
national watershed governance (look to the international community)
all the solutions to date are piecemeal because we aren't working cohesively across the country
Canada has a major responsibility to be a water leader in the world, but we're not
I know almost nothing about agriculture in Canada, but it's an extremely interesting topic
I was interested to hear how so many of the projects are taking place at the grass-roots level, working with communities in a "plain language" way, not complex science
this is how we will get to the Danny Divito world where all people think about water, and it's not just scientists who are thinking about water
lack of public awareness – how do we translate our findings for others to understand?
how to minimize the uncertainties of GCM scenario results such that they are more useful and meaningful for risk impact assessment / modelling, and subsequently adaptation policy development
perhaps, some sort of national standards are required
governance / decision making will intersect the physical sciences when probabilities of critical thresholds can be articulated efficiently
the science has not yet caught up to policy as it related to climate change
adaptation recommendations will cost significant dollars, and politicians need to have some certainty of success before proceeding, and our scientists are not yet ready to provide any certainty of success
lack of work on adaptation solutions, be they policy or technical, makes me think that practitioners are focused on business as usual responses, e.g., ecosystem-based adaptation, engineering innovation
all provinces seem to manage water in silos; in Ontario, various ministries have differing but the same mandate governing water issues; would it not make sense to create a commission of Water, or a Ministry of Water to handle all water-related programs?

in the streamflow group, there was no mention of a lack of stream gauging
surprise regarding lack of attention to drought and adaptation via crop choices, tilling practices, etc., or forest management in light of dry conditions
poor governance, outside of scientists' control
longer term planning, greater than political terms
lack of constant, simple messaging directed at the public
need clear, simple message from science to allow for effective policy making
planners need to understand and champion adaptation
message needs to focus on priorities in the face of risk and vulnerability
it is so nice / rare to be in a room with so many like-minded people – thank you!
watershed-based governance structures have a lot to offer (see European Union, Brazil, South Africa, etc.)
need "market-based instrument" to influence change in the economy ... steer "choices" towards more climate desirable outcomes
I was surprised that knowledge of drought / aridity is low, as the prairies have been dealing with this for decades!

TABLE 4. RESULTS FROM PARTICIPANT WORKSHEETS –ECOSYSTEMS AND CONSERVATION STATUS GENERAL AWARENESS OF ADAPTATION

There is general public awareness. First Nations understand natural Earth's changes. Politicians are unaware.
High level of awareness within the sector (i.e. fish, coldwater, instream flows) but no political will outside the sector to move towards action and address the risks.

TABLE 5. RESULTS FROM PARTICIPANT WORKSHEETS – STATUS OF ECOSYSTEM AND CONSERVATION SECTOR ALONG THE MAINSTREAM CONTINUUM

There is general awareness with some focused awareness.
Some management but old ways will not work anymore in a climate change context.
Need for more scoping/assessment of new tools.

TABLE 6. RESULTS FROM PARTICIPANT WORKSHEETS – NEEDS TO MOVE THE ECOSYSTEM AND CONSERVATION SECTOR ALONG THE MAINSTREAM CONTINUUM

Need to encourage dialogue with First Nations to understand adaptation strategies engaged in during treaty negotiations and continue to engage with to ensure ecosystem conservation is interconnected and responds to needs (livelihoods).
Assign responsibility for strategic action.
Low impact development integrating ecosystem thinking into all human-use decisions.

TABLE 7. RESULTS FROM PARTICIPANT WORKSHEETS – COMMONALITIES AMONG SECTORS

People who need to know, find out the answers. Those who don't care don't know
Complexity of messages from each sector. Silos are limiting the identification of common themes
Lack of action in common
Those involved in the sector know more about the system and how climate change will affect their system
General lack of commitment, funding and resources to drive action.
Not much action overall
There is more 'concern' than 'awareness' because awareness implies understanding of breadth and scope, which we don't have
Lack of integration of disciplines and sectors in adaptation
Lack of political/executive leadership-but this is due in part to incomplete and incomprehensible science
Need grass roots interest
Climate and science literacy
Short-term vision (gains) may result in long-term pains
Costs to industries.

Policy gaps.
Humans are inherently adaptive- the only thing is unless we have to change we won't!
Need to develop learning scenarios involving key players/stakeholders-moving towards composite scenarios (linkages)
Longer terms for political planning (future generational plans)
Demonstrate projects (education)
Data (including costs)
Good governance
Building support and education
Capacity
Multi-disciplinary approach
Case studies (demonstration projects)
Need for data
Education and literacy in physical and social sciences
Human dimensions of science; issues of governance, adaptation
Good at scoping and assessment but unable to go to the next step
Integration, trans-sector; develop integration tools, methods across disciplines
Need for case studies
Not there yet
Distinction between different stakeholders-some have high awareness and engagement, other very little
Need for better communication

TABLE 8. RESULTS FROM PARTICIPANT WORKSHEETS – NEXT STEPS IN NATIONAL ADAPTATION

Many commonalities in issues; there may be commonalities in solutions too. Sectors must share information/best practices/successes and failures
Case studies: examples of how to tackle/approach a problem (adaptation planning activity)
Insurance stories need to be known; relates to everyone at home
Identify 'no regrets' measures (e.g. water conservation)
Need public and political 'buy in'
Need success stories
Need demonstration for education and some successes
Scientists need to be more vocal/outspoken/advocates
High level political advocates
Scientists need to communicate more openly with the public
Projects (restoration)
Information on insurance regarding the impact of climate change
Water conservation
Scientists more public and vocal
Pilot programs (smaller and easier to manage)
First Nations involvement with traditional knowledge (sustainable living)
Science and research need to play a larger role in future strategic planning
Include more human dimension aspects into climate and water adaptation
Need for integration and nested governance
Incorporate economic analysis (Canadian and international) into scenario planning of possible adaptations

Science needs to be distilled into more communicable information and recommendations
Need to better understand the 'theory' of adaptation and how to balance and integrate natural and social sciences to drive adaptation
Need to engage and learn from practitioners in all sectors and in all areas of the world who may have innovative alternative solutions
More education and demonstration; pilot projects are required
Clearer, simpler messages
Make issues personal and practical
Need to simplify message, perhaps using imaginary
Demonstration vs. Education
Action requires identification of value placed on impacts

TABLE 9. RESULTS FROM PARTICIPANT WORKSHEETS – OTHER OBSERVATIONS OR HIGHLIGHTS

Climate 'risk' and 'vulnerability' instead of climate 'change'
Balance between natural and social sciences will be key
Adaptation is a complicated issue that requires multi-disciplinary approaches
Need to understand why there is a lack of (perceived) political will rather than just complain about it
Need to make connections to other social and political priorities
Need champions to inform and to show adaptation actions and options
We need strong leadership that happens at all orders of scale: local, provincial, regional, and national

TABLE 10. RESULTS FROM PARTICIPANT WORKSHEETS – USER NEEDS AND PRIORITIES

Tools
Geography is important: make it spatial!
Metadata synthesis of what the information relates to
Guidance on how to implement climate change into decision making, policy, resilience, etc., by scientists and engineers
Safe water for drinking, recreation, economy, environment
Sustainable planning for today and for our children (50-70 years)
Capacity (resilience) to cope with stress, whether it is a warming trend, change in precipitation, etc.
Preparedness planning and scenario tools
Climate data and projections
Case studies (international) on adaptation planning and action
Connecting science to policy and action
Overcoming political inertia/inattention
Community involvement and public support
Need to know the associated error with the data
Need to know how (generally) a number was generated or calculated; strengths and weaknesses of the model used
Need the source of the information
Link to other adaptation plans in North America (all if possible)
Different needs/skills with different level of users
Simple, user-friendly visual tools (no more than 3 clicks to get the information)
Operation vs. planning information (separate)
Spatial and scales (different)
It is a spectrum: from synthesis reports to downscaled climate data, impacts models, biophysical data, risk management tools,

financial analysis tools, adaptation benefits, implementation conditions
Tools: adaptation planning, communication/participatory programming (including different assessment tools). I see these as major need for compendium
Need for compiling case studies and tools already in place. This knowledge type will have great applicability outside the water practitioner sector (public use)
How do we translate knowledge to action/adaptation?
Case studies
Understanding of how the different compendiums relate to each other
Practical and usable tools for practitioners
Case studies and examples of work that has already been done
Strategies/experience in overcoming barriers
Scenario tools
Cost/benefit analysis
Effectiveness of adaptation measures
Costs of action
Effective ways to communicate with non-scientists
Experience in policy and practice elsewhere
Simple, plain language applicable actions
Packaged knowledge
Local relevance
What if (range of possibilities)
Integrated
Depth of knowledge available as needed
It could be helpful to have regional breakdown as well
I could imagine using the tool to better understand state of action/initiatives across the country
Wondering if the compendium could also help to identify knowledge/information gaps

TABLE 11. RESULTS FROM PARTICIPANT WORKSHEETS - USER SEARCH IMAGE FOR THE COMPENDIUM

Under tools-games
Add human behavior
Search by geographic/watershed specific
Discussion forums to allow for comments, how they used data
Adaptation planning/Vulnerability mapping
Community mapping/Watershed governance
Boundary communication/Science-policy communication
Maybe there would be value in identifying the level of 'technicality' or 'generality' of documents
Also qualitative/quantitative indication of how 'ready' the knowledge is to be replicated
Different layers of information/tool • Raw data vs. value-added (processed) data • Information tool (general) vs. assessment tool (models) • Background studies vs. in depth studies
Keywords, Location, Physiographic context
'Knowledge type' and other classification schemes proposed seem very rational and effective
Use search images that capture the different knowledge types

Good data, relevant data and information on climate variables (e.g. temperature, precipitation, wind speed, etc.)
Good case studies that can be repurposed for other sectors/situations
Knowledge type
Sector
Temporal
Spatial
Author
Organization

TABLE 12. RESULTS FROM PARTICIPANT WORKSHEETS – DESIRED LEVEL OF DETAILS AND CONTENT FOR THE COMPENDIUM

Depending on the end user, level of resolution will vary in terms of spatial and temporal information and data
Summaries of risk analysis results, recommendations, etc.
Basic: targets simple messages
Medium-technical: more advanced, something akin to a primer/overview of technical detail but clear, not overwhelming
Design to let users drill from simple to details, to serve the different needs/skills of different level of users (public, scientist, modelers, etc.)
They may want to see snapshots images of what each document looks like (e.g. picture of the risk assessment summary table)
Practical, easy-to-use tools, with an option to dig deeper (where more technical information can be made available)
Minimal and, where applicable, more detailed/specific