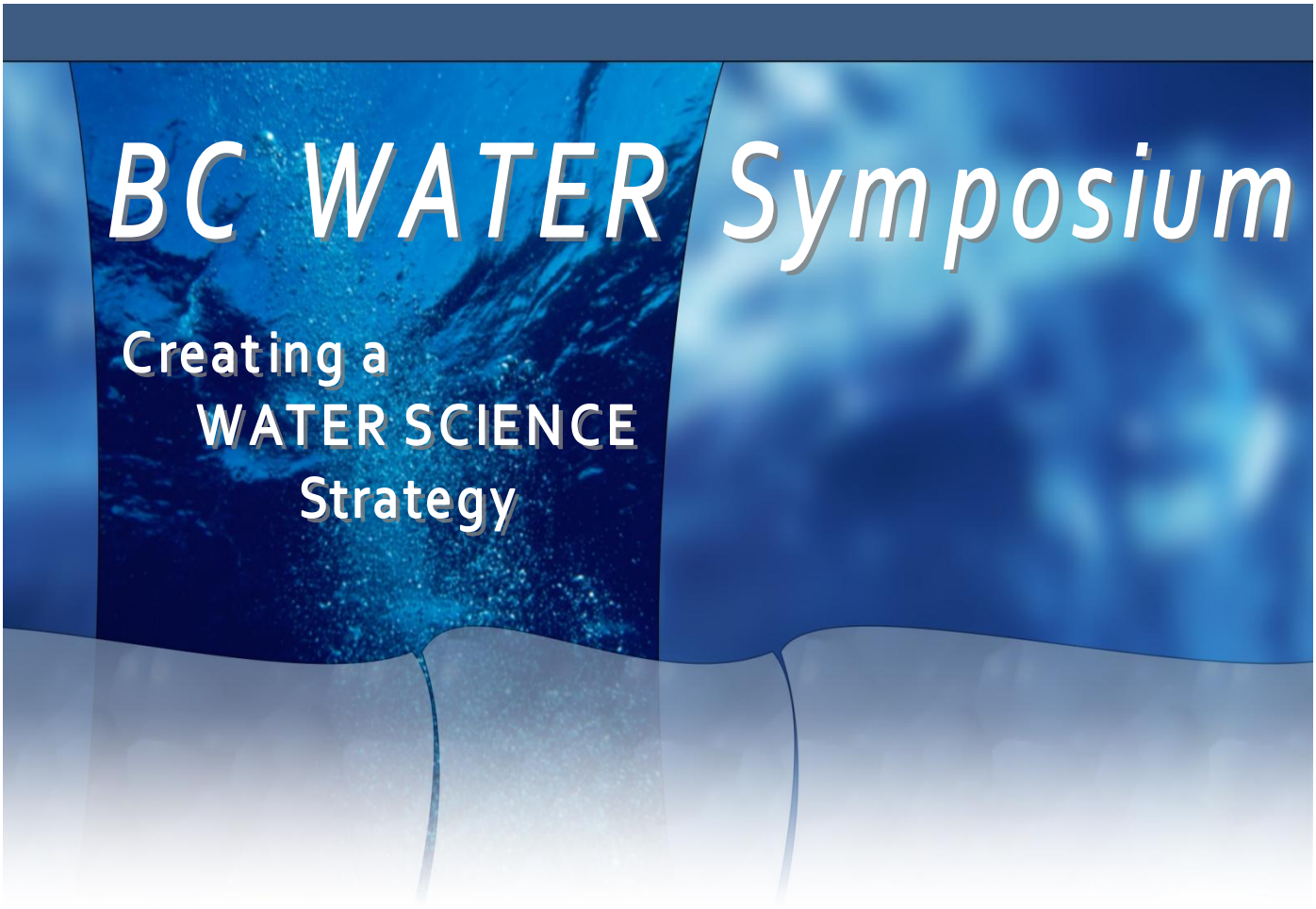

Discussion Paper

August 2010

Table of Contents

BC Water Symposium Discussion Paper

1. Introduction

The BC Water Symposium will allow participants to take an interdisciplinary view of the challenges and opportunities around the creation and sharing of information and knowledge to support the sustainable management of water resources and aquatic ecosystems. The objectives of the symposium are to:

- *discuss current and emerging water issues;*
- *develop new collaborative relationships; and*
- *work together to build the foundations for a BC Water Science Strategy (WSS).*

The Symposium will be held concurrently in Prince George, Kelowna and Victoria featuring sessions that are linked together via webinars as well as local independent sessions and discussion. This approach will allow participants to listen to ideas from some of BC's top researchers as well as a guest from Australia, while still having a chance to discuss information and knowledge challenges specific to their own region.

The focus of the BC Water Symposium and the Water Science Strategy is information and knowledge creation and knowledge translation and exchange as it pertains to the sustainable management of water resources and aquatic resources. Developing a Water Science Strategy (WSS) is a commitment made by the BC Government in *Living Water Smart: BC's Water Plan*. The Government's intention is to facilitate a collaborative process with multiple partners, including First Nations, to produce a strategy that can be used by organizations across the province to bridge the gap between those that create and hold water related knowledge and those that apply this knowledge to make decisions, develop policy and create operational procedures.

The purpose of this discussion paper is to stimulate dialogue at the BC Water Symposium, and therefore, in no way, does this paper represent government policy or the official view of government. Information presented in this paper was gathered from the academic literature and responses to a pre-symposium survey[1] circulated by the BC Water Symposium Advisory Committee[2] to their colleagues. The responses from that survey were used to inform this discussion paper.

Earlier this spring, the Ministry of Environment held a series of workshops across the province to solicit input on modernizing the province's Water Act. The engagement process and results are summarized in a Report on Engagement that will be available on the Living Water Smart website[3]. The importance of water data, information and science, were often mentioned during discussions on Water Act modernization and have also helped to inform this paper. However, the BC Water Symposium is not intended as a forum for discussing specific policy options for managing water in BC. The emphasis of the Symposium is to allow participants to discuss information and knowledge creation and exchange.

---

[1] For survey questions please see Appendix A.
[2] Advisory members are listed on the Symposium website: www.mitacs.ca/goto/bcwatersymposium
[3] www.livingwatersmart.ca

Given their special relationship with and unique knowledge of water, First Nations are specifically encouraged to participate in the Symposium. It is recognized that First Nations have distinct interest and experience in water management throughout the province. The Symposium is an opportunity to learn from each other and generate ideas to help increase the flow of information and knowledge.

By participating at the Symposium, you will be adding your individual voice and ideas to the process of creating a Water Science Strategy. Participants are invited to bring their wealth of experience, knowledge, and creativity to share ideas and to contribute to developing new ways to improve the flow of information and knowledge necessary to manage water resources and aquatic ecosystems sustainably. Participants' ideas offered at the Symposium will be used to further this goal. Participants are not expected to represent any specific group or organization. The Ministry of Environment is facilitating the process of bringing people together to discuss ideas.

2. Water Science Strategy

One of the main objectives of the Water Symposium is to initiate dialogue on creating a Water Science Strategy. The need for this strategy emerges from the recognition that the sustainable management of our water resources and aquatic ecosystems requires information from a variety of disciplines to adequately understand the hydrological, biological and social factors that need to be considered when making decisions and creating policy. Watershed based information is geographically unique; meaning that the hydrology, geomorphology, climatology, biology, economic and social factors that are important in one watershed are often different for another watershed. General concepts, frameworks, communication tools, and other helpful ideas, however, can be shared amongst watersheds.

Though decisions are often not based on scientific information alone, having reliable information and knowledge of the environmental systems can help evaluate different options, inform the consequences of decisions, and increase the likelihood that decisions will be made to minimize impacts to water resources and aquatic ecosystems. Making decisions without access and attention to adequate information and knowledge leaves us all vulnerable. For example, engineers need hydrological information to build stable bridges, planners need to know where biologically sensitive areas are to protect endangered species and ecosystems, and policy developers need information on water economics and aquatic ecosystems to best manage water use. The interdisciplinary natures of water management means not all information and knowledge can be held within one organization. Collaboration and sharing is therefore essential to the sustainable management of water resources and aquatic ecosystems.

To guide the development of a BC Water Science Strategy, it may be useful to look at the components of Living Water Smart, British Columbia's Water Plan[4]. The plan provides a vision for the sustainable management of BC's water resources and aquatic ecosystems as well as government commitments to help BC achieve this vision. Living Water Smart states that "By 2012, all land and water managers will know what makes a stream healthy, and therefore be able to help land and water users factor in new approaches to securing stream health and the full range of stream benefits." To be successful, this initiative will require the translation of knowledge from aquatic ecologists to land and water managers and from managers to land and water users. Other statements made in Living Water Smart illustrate the

[4] http://www.livingwatersmart.ca/book/

role a Water Science Strategy can play to improve knowledge translation and exchange to support our ability to adapt to change, to improve our efficiency and to manage water in a different way.

3. Scientists, Policy-Makers, End-Users, Stakeholders and First Nations

At the Symposium, participants will be discussing information and knowledge as it pertains to the management of water resources and aquatic ecosystems. Some of the main questions will be around the characteristics of the information needed by different groups with interests in water, and how these groups are communicating. To assist with this discussion it can be helpful to differentiate some main groups and the processes by which they operate. The descriptions of these groups provided below are generalizations and can be criticized for depicting each group as a homogenous whole - when in reality there is great diversity and interaction within and among these groups. Gooch and Stålnacke (2010) describe this heterogeneity for scientists:

> The rationality of economics does not necessarily combine comfortably with that of ecology, nor does the understanding of the world presented by anthropologists fit easily into the mathematical constructions of modelers. Yet, all of these disciplines are parts of 'science' and all of them have something to contribute to improving water management (pg 2).

However, as the Symposium is bringing together people from many different areas of society, it is worthwhile to group people together that share similar characteristics when viewed through a lens of information and knowledge creation and knowledge translation. Although Stakeholders are listed as a separate group, in essence all groups listed below and all individuals with an interest in water could be considered stakeholders. The groupings below also do not specifically mention citizens that are concerned with the state of our water. These individuals may consider themselves as part of larger group that best describes their concerns and interests (e.g. NGO, rancher, fruit grower). A series of questions below are offered to stimulate thought on bridging gaps among these groups.

3.1. Scientists

For the purposes of discussing a Water Science Strategy, a scientist is defined as a social or natural science researcher, technical person (such as someone who collects data in a monitoring program), a technical specialist or other person who provides scientific expertise on water science and issues. This is a broad definition to include all people who aim to create objective information and hold knowledge gained from empirical observations.

Water scientists may be part of universities, industry, government, and non-governmental organizations (NGOs). Water scientists may conduct basic and applied research and technical persons may collect data as part of government monitoring and inventory programs or as part of citizen science initiatives. Science programs tend to be methodical, multi-year programs designed to answer a specific question or to test specific research hypotheses, and most environmental science programs are designed to gain a better understanding of how different stressors (e.g. climate change, road building) are affecting natural systems. It is often difficult, however, to generalize the results of these studies, as watersheds possess unique characteristics. Also, watersheds are large, complex systems making it difficult to communicate simple messages about the implications of proposed activities.

- *How can the knowledge translation of water science be improved in BC?*
- *Could non-government researchers play a more prominent role in providing information for policy development? What mechanism would be helpful to facilitate dialogue and knowledge exchange?*

Holders of local and traditional ecological knowledge (TEK) also fit under the science umbrella as experts on local, regional, and global ecological and environmental systems. Traditional ecological knowledge has been described as a "knowledge-practice-belief complex" (Berkes 1999) held by societies, which have observed and relied on the natural resources of a local environment over many, many generations. Traditional ecological knowledge combines incredibly diverse, holistic and varied information, and may, for example, combine harvesting techniques with resource management and conservation (Turner and Berkes 2006). First Nations holders of traditional ecological knowledge possess incredible knowledge wealth. In addition, First Nations communities continue to expand on this knowledge by creating and contributing to scientific knowledge in ways that are based in historical experience, and which support sustainable management.

- *How can traditional ecological knowledge be better incorporated into policy decisions, operational procedures, monitoring and planning research?*

3.2. Policy Makers

Policy often goes hand in hand with decision making. An established policy can guide decision making by providing guidance on issues to consider, the decision making process, and how to decide among conflicting values. Policy development is the process by which an issue is framed, objectives are set (what does the policy hope to achieve), policy options are developed and assessed, a decision is made and the policy is implemented. Policy development does not just occur within local and senior governments but also applies to First Nations, industry and other large organizations where a formal arrangement is necessary to guide actions and decisions of the members.

Public policy and decision makers consist of elected officials and politicians, political advisors, and policy analysts within the civil service. The process of developing policy is influenced by multiple factors, such as institutional arrangements (e.g. jurisdictional authority, administrative capacity), competing interests (e.g. political, societal stakeholders), and different ideas (e.g. science, values, public safety) (Lavis 2006). These factors can interact to create a "policy window" where a sense of urgency is generated based on political will, societal pressure, or external events such as a drought or recession.

- *How can policy developers support and participate in the creation of information and knowledge?*
- *How can scientists participate more fully in the policy development process?*
- *How can we reconcile the different time horizons of science (multi-year projects) and policy-development (months)?*

3.3. End-Users

An end-user can be thought of as a "policy doer". These are the people who implement policy by carrying out operational procedures and making site-specific decisions. These people must apply water information and knowledge in a very practical way to shape activities such as forest harvesting, urban planning and development, road building and water management, which occur on and off First Nations'

reserves. End-users integrate information and knowledge from a variety of sources to manage a diversity of tasks throughout their workday.

- *How can the knowledge held by end-users be applied to policy development and to informing scientific programs such as monitoring and research?*

3.4. Stakeholders

Stakeholders are usually thought of as groups that have a vested interest in water in some way (Gooch and Stålnacke 2010). In actuality, this includes all of society, including the groups listed above, as we all depend on water, but for discussions at the Symposium we can think of Stakeholders as groups of people within society that share specific concerns. Examples include groups representing the water interests of agriculture, tourism or power production, as well as those groups, such as NGOs and local stewardship groups, who work to protect, conserve and restore freshwater systems. Dependent upon the mandate of the stakeholder group, members may collect data; run education, restoration and/or stewardship programs; develop policy recommendations; and/or lobby government. First Nations cannot be grouped with stakeholders given their unique historical and present relationship with water, as well as the fact that Aboriginal Title extends to water.

- *How can Stakeholders be involved and included in knowledge creation and sharing as part of a provincial water science strategy?*

3.5. First Nations

First Nations people have a strong cultural and spiritual relationship with water. Legally, water is an area of Aboriginal Title, Rights and Treaty Rights concern. The courts have recognized Aboriginal Title continues to exist unless a Nation cedes this to the federal government. Aboriginal Title, Rights, and Treaty Rights are protected under S. 35 of the Constitution Act, 1982, and landmark cases continue to define how these Rights can be exercised. International instruments, importantly the United Nations Declaration on the Rights of Indigenous Peoples, uphold Indigenous Rights over water and recognize the special relationship that First Nations have with water. The New Relationship Vision[5] sets out a joint vision with the Province to move forward in a spirit of reconciliation that recognizes Aboriginal Rights and recognizes that these inherent rights flow from Indigenous Nations' historical and sacred relationship with their territories.

- *How can First Nations be involved and included in knowledge creation and sharing as part of a provincial water science strategy?*

4. Information and Knowledge Creation and Knowledge Translation

People that collect information and create and hold knowledge are not always the same people that need to apply this information and knowledge for making decisions. Often knowledge creators and knowledge users are in different divisions of an organization or in different organizations all together. They often have a different understanding of the problem and may communicate the information or their need for information in a manner that does not easily translate to other disciplines or match the

[5] See http://www.newrelationship.gov.bc.ca/index.html for more information

needs of other organizations. These challenges impede the flow of information and hinder the exchange of knowledge.

Creation of scientific information involves collecting data; storing and analyzing this data; and communicating the results in a larger context. Quite often the same people or organizations do not conduct all the steps. Academics (researchers and students), government technicians and researchers, First Nations, NGOs, industry and individuals involved in citizen science groups all collect data. Although there are a number of active groups collecting data, it can be unclear how and where the data is stored, making it difficult for others to access. Sharing of data can also be an issue as some researchers will not release data while journal publications are pending and some industries will not release proprietary data. Also, unless part of a formal research program, it may be unclear who's responsibility it is to analyze the data and communicate the results, as well as determine the target audience for these results.

- *How can we improve data sharing and access?*
- *What mechanisms would improve the analysis data and communication of the results?*

Information and knowledge are not synonymous, and, when considering knowledge translation, the distinctions need to be clarified. Information is defined as "facts about a situation, person, event, etc.", whereas knowledge is defined as "understanding of, or information about, a subject which a person gets by experience or study, and which is either in a person's mind or known by people generally" (Cambridge Dictionary Online 2010). The distinction between these two terms is that knowledge is held by people and can include tacit knowledge, such as that based on culture or field experience, which is difficult to codify in written texts. Information, by definition, is just the facts.

Knowledge translation can be thought of as the processes that close the gap between knowledge and practice or "to change something into a new form, especially to turn a plan into reality" (Cambridge Dictionary Online 2010). So it is taking the knowledge created through the experiences and activities within one group and translating this knowledge so it can be absorbed, adopted and applied by another group. In the literature this is most often framed as increasing communications in a linear direction from scientists to policy makers and end users. But knowledge is also held by policy-makers and end-users in relation to specific issues, constraints and competing values that are necessary to consider when developing policy options. Traditional ecological knowledge and knowledge held by local communities and stakeholders can also provide deep insight into local social-ecological links and complexities.

- *Do we need to shift from a uni-directional knowledge translation to knowledge exchange? What would this look like?*
- *How do we break out of disciplinary and organizational divisions that prevent a collaborative approach to knowledge creation and sharing?*

5. Introduction to Symposium and Break-out Discussions

This Symposium is designed to foster conversations among participants with the intention of developing collaborative relationships and promoting more coordinated, interdisciplinary approaches to tackling issues related to water management. The Symposium will begin with a public lecture and will have a mix of plenary talks from local and international experts, panel discussions, break-out discussions,

networking breaks, as well as a poster reception. The structure of the break-out sessions will be the same in each location, though participant dialogue will likely differ among locations. The break-out discussions will be facilitated by government volunteers with facilitation experience. The facilitators will guide the group discussions to keep them on track as well as create a safe atmosphere where all voices can be heard.

The four break-out discussion groups are designed to create information for each of these four objectives:

- *Identify current and emerging issues and information needs*
- *Identify specific information needs for each group*
- *Explore ways to improve information and knowledge creation and knowledge translation*
- *Determine critical elements of a WSS and identify ways to continue the WSS dialogue*

5.1. Break-out Discussion I – Identifying Current and Emerging Issues and Information Needs

In the first break-out discussion, we will divide ourselves by topic to bring together experts and those that are particularly interested in a specific topic. These topic areas are:

- *Surface and groundwater hydrology*
- *Watershed health (cumulative effects on aquatic ecosystems and human health)*
- *Water governance (social, policy and regulatory tools to better conserve and manage water)*

Within these topic areas, we will work together to list current and emerging issues pertinent to the sustainable management of water resources and aquatic ecosystems, identify which of those issues is information poor, and identify information sources that may be available for these issues.

A list of initial issues and information needs has been created from the pre-symposium survey results (see Table 1 at end of document). This list will be used as a starting point in the break-out groups.

5.2. Break-out Discussion II – Identify Group-Specific Information Needs

In this second break-out discussion, participants will be asked to move randomly to the different rooms to allow a mix of topic experts in each room. Participants will brainstorm the characteristics of the information needed by the different groups (scientist, policy-maker, end-user, and stakeholder) and the considerations necessary to make the information useful to the receiving groups.

One way of thinking of the types of information that these different groups create and use is to think of the information in terms of spatial scale, temporal scale, practical application, and to what degree the information is documented. For example, at one end of the spectrum, a scientist conducting basic research might aim to create information that can be universally applied, is rigorously documented, but may not necessarily be readily applicable. In contrast, an end-user or stakeholder may be interested in information that applies to a local situation, can be applied in a practical manner and is considered trustworthy. In this example, policy-makers would then need to integrate across the spectrum to consider scientific information about the way things work but also methods to reach their policy objectives in a manner that is practical for end-users and stakeholders.

Similarly, knowledge held by scientists conducting basic research is based on their experiences investigating the forms and patterns of nature in controlled and often isolated settings. In contrast, the knowledge held by end-users and stakeholders will be drawn from their experiences operating on landscapes where the many different social and natural factors affecting their work are interacting. And knowledge held by First Nations groups is grounded in culture, beliefs, experience, and a unique connection to the land and water. It is a challenge to think then of ways to translate knowledge so people in other groups can absorb it and apply it.

Pre-symposium survey respondents were asked about the successes and challenges they have experienced when communicating and receiving water data and/or scientific information. Some generalizations taken from the survey responses are listed below.

Successes experienced when *communicating* water related data and/or scientific information

- *Public forums that promote discussions and empower participants*
- *Public presentations*
- *Publishing work in Streamline Watershed Management Bulletin*
- *Discussions with colleagues and contacts at water events*

Challenges experienced when *communicating* water related data and/or scientific information

- *Difficult time incorporating uncertainties in all aspects of water science and management*
- *Overcoming institutional "silos" during multi-agency initiatives*
- *Disagreement amongst experts*
- *Difficulty in communicating complex issues to non-technical audiences*
- *Submissions to government receive no response or feedback, so difficult to gauge impact of effort*
- *Decision making process unclear, so not sure how and when to contribute information*
- *Getting approval to release research results in a timely manner*

Successes experienced when *receiving* water related data and/or scientific information

- *Receiving information in person when dynamic interaction is possible*
- *Access to real-time hydrological data*
- *FORREX watershed management listserv*
- *Collaborating with multiple agencies to gain access to data*

Challenges experienced when *receiving* water related data and/or scientific information

- *Limited chances to discuss information with authors*
- *"The need to transmit information to our community and to our officials can be overwhelming. Opportunity and access to these two entities can be time consuming and sometimes difficult".*
- *Inconsistent methodologies for collecting data make comparisons difficult*
- *Data and/or models not regionally specific*
- *Difficult to access data held by governments*
- *Scientists giving presentations that are not suited to non-technical audiences*

Some of the responses to question 7[6] of the pre-symposium survey are listed below and give some examples of other things to consider:

- *Information has to be relevant to the real world in both scale and impact.*
- *"Data by itself without an understanding of how to use the data is very dangerous."*
- *"We often don't have the required scientific data that is needed to build or support good policy."*
- *Policy and decision makers tend to be reactive.*
- *Unclear about the needs of policy makers as well as how the data will specifically be used for decision-making.*
- *"One challenge is the need to provide information that is sufficiently complete and compelling so that policy makers can more accurately evaluate the environmental risks of different policy options…."*
- *"A lot of the key work that needs to be done is not 'glamorous'. It is slogging away bringing data sets together and this is usually not easy to fund."*
- *"Monitoring and collecting the necessary data and incorporating the key components that need to be assessed takes time and resources. Outside of academia, there is little support to allocate the necessary time and effort to do this."*
- *"Two aspects: (1) independent academic research provides the data which informs policy development (i.e. science has demonstrated that climate is changing, and hence we need to be adaptive to this in our water resources policy), and (2) policy needs drive scientific research (i.e. BC needs more hydroelectric power, and thus science on river flows is needed). Which is more important? Or useful? If (2), then it is not commensurate with academic funding (i.e. NSERC), and thus data/information should come from MoE, WSC etc".*

5.3. Break-out Discussion III – Explore Ways to Improve Information and Knowledge Creation, Knowledge Translation and Knowledge Exchange

Building from the first two break-out discussions, the third discussion will explore new ways to improve information and knowledge creation, knowledge translation and knowledge exchange. Ways to improve information and knowledge creation may need to consider all the steps that lead to its creation; including funding models, data storage, data analysis, and communication. When considering knowledge translation, it is important to remember that knowledge translation moves beyond just communicating knowledge to colleagues within your group that share the same experiences and perspectives, but, instead, translating knowledge so it can be absorbed, adopted and applied by other groups. Knowledge exchange moves us one step further to relationships where knowledge is shared and applied among groups. In this way we truly begin to close the knowledge-to-action gap.

In the literature, knowledge translation strategies are typically reduced to the science-management connections and are discussed as either scientists "pushing" information into the realms of policy and operations or policy developers and end-users "pulling" the information from scientists. Some common "push" strategies include improving scientific credibility to deliver a clear message devoid of conflicting claims; including policy makers and end-users in program or research development; and packaging information specific to target audiences. Policy makers and end users may "pull" information by

[6] Survey question: What are the challenges to getting scientific data and/or information incorporated into policy development, decision making, land-use planning and/or on-the-ground operations?

articulating information needs; becoming involved in research and science programs; and improving their ability to seek and filter information (Roux et al. 2006).

Although these efforts of pushing and pulling information offer a good starting point, they do not necessarily create a common understanding of the issues and information necessary to develop solutions. Without on-going communication and sharing of experiences, the interface among the groups becomes limited to accessing documents rather than a true knowledge exchange which can "facilitate the co-evolution of values, priorities, intent, and action that provides robustness to decision making" (Roux et al. 2006).

Multi-directional communication and knowledge exchange may be difficult in current social/institutional settings where managers are expected to deal with pressing management problems that fall within the organizations mandate rather than to participate in future-focused program design. Similarly, scientists that are focused too heavily on management problems may see their publication rates drop off and therefore face diminished credibility within their peer group. First Nations, local governments and stakeholder groups may have limited structural and financial capacity to contribute to knowledge exchange efforts. These are not insurmountable barriers, but they are mentioned here to increase awareness so they can be overcome.

Some suggestions for new ways of working together include[7]:

- *Increase opportunities for multi-directional communications to allow the different groups to collaborate – e.g. more access to government workshops, online discussion forums, and joint creation of programs.*
- *Through the creation of joint strategies that would allow the integration of many perspectives working on a single problem. For example, develop a Water Management Strategy that "clarifies the link among all legislative/regulatory requirements for decision-making and related decisions …, the management objectives and tradeoffs guiding these decisions, the data requirements (e.g., which variable at which time-space scale), and key management uncertainties. Key management uncertainties would represent research priorities for scientists. This strategy could then be published as an evolving document and used as a reference for scientists."*
- *Provide more opportunities for professional development to allow individuals to increase their knowledge on water issues and the underlying science. For scientists, this would include learning more about the policy development process, how their work could support policy decisions, and best practices for communicating science to non-technical audiences.*
- *Provide management recommendations as part of scientific studies and include specifically how to make decisions with given uncertainties.*
- *Work with members of other groups to create specific action plans for dealing with management issues that include funds for research and/or information collection and knowledge translation.*
- *Create a group of knowledge brokers or "interface leaders" (Roux et al. 2006) that would operate within more than one group. These individuals could develop a common language that would help to bridge communication divides.*

[7] These have been selected from pre-symposium survey responses. Quotations indicate verbatim responses.

5.4. Break-out Discussion IV – Moving Forward

One of the goals of the Water Symposium is to create ideas for a BC Water Science Strategy. A water science strategy is a new idea, and this initiative is the first of its kind in Canada. The Australian National Water Commission is working nationally in Australia to develop a water science strategy for the nation. Ken Matthews, the Chair and CEO of the Commission will be speaking at the Symposium on September 1st about this initiative. Other nations have met the challenge of knowledge translation by investing in extension experts who act as knowledge brokers. In BC, FORREX Forum for Research and Extension in Natural Resources works to fulfill this function to support sustainable natural resource management[8]. Canada's health sector, in some ways, has lead progress in the area of knowledge translation. These efforts include strategies to "push" and "pull" knowledge mentioned in section 5.3, as well as initiatives by research funders to design programs that are specifically targeted to support partnerships between policy makers and researchers (Lavis 2006).

Getting information and knowledge into the hands of those who need it, given the many different sources of information and diversity of people who hold knowledge, is a challenge that will involve all the groups described above. It is not clear what needs to be included in a water science strategy, as this initiative is breaking new ground. One thing is clear, however, that the development and success of a water science strategy will take the collaborative effort of many people and groups across the province to put in place certain tools, frameworks, and/or actions to facilitate information and knowledge creation and knowledge translation and exchange.

During this session, we will be brainstorming critical elements that will need to be included in a Water Science Strategy. These will be divided into three topics:

- *Social/institutional arrangements – this includes things like setting up new councils, committees, or creating positions that span more than one organization.*
- *Tools – such as internet based tools (e.g. wikis, discussion forums)*
- *Actions – this may include starting a community of practice, or having another workshop to follow up on specific topics*

We will also brainstorm ways we can continue to work together to create a Water Science Strategy.

6. Conclusions

The intention of this paper is to stimulate ideas leading into the BC Water Symposium. The questions posed within this paper have no clear or obvious answers but act as an introduction to the dialogue that will be encouraged at the Symposium. Through open and appreciative questioning and dialogue, participants may find that there are many opportunities for improving collaboration and knowledge exchange among groups and organizations. Barriers will likely also be identified, and hopefully, novel ways to overcome these barriers will be revealed through dialogue.

The Ministry of Environment is committed to the process of developing a Water Science Strategy and has been actively involved in coordinating the Symposium and providing material to support the

[8] For more information on FORREX please visit: http://www.forrex.org/

Symposium (such as this discussion paper). The Ministry will write and circulate proceedings from the Symposium to participants.

7. References

Berkes, F. and N. J. Turner. 2006. Knowledge, learning and the evolution of conservation practice for social-ecological resilience. Human Ecology 34:479-494.

Cambridge Online Dictionary. Accessed July 2010. URL: http://dictionary.cambridge.org/

Gooch, G. D. and P. Stålnacke. 2010. Introduction: The Science-Policy-Stakeholder Interface (SPSI). In Science, policy, and stakeholders in water management: an integrated appraoch to river basin management, edited by Gooch, G. D. and P. Stålnacke (London: Earthscan).

Lavis, J. N. 2006. Research, public policymaking, and knowledge translation process: Canadian efforts to build bridges. The Journal of Continuing Education in the Health Professions 26:37-45.

Roux, D. J., K. H. Rogers, H. C. Biggs, P. J. Ashton, and A. Sergeant. 2006. Bridging the science-management divide: Moving from unidirectional knowledge transfer to knowledge interfacing and sharing. Ecology and Society 11(1):4. URL: http://www.ecologyandsociety.org/vol11/iss1/art4

Turner, N. J. and F. Berkes. 2006. Coming to Understanding: Developing conservation through incremental learning in the Pacific Northwest. Human Ecology 34:495-513.

Tables

Lists of initial issues and information needs has been created from the pre-symposium survey results and divided by topic area. *Italics* indicates direct quotes from survey.

Table 1-A Surface and ground water hydrology

Issue	Information Needs
Effects of climate change on water supply and usability of water	• Climate change modeling results for hydrological runoff models suitable for smaller watersheds • Figures on drought projection and climate change impacts that can be shown to the general public and understood
Lack of current data Integrity of basic hydrometric data network (especially continuation of stations with long records)	• Hydrometric data for small streams • Climatic data for high elevation sites • Accessibility of analysis of extreme high magnitude-short duration events • *The single biggest gap is the lack of a publicly available model for estimating hydrological parameters for ungauged streams, e.g. a "community model", available online, GIS-based. Such a model is available in some other provinces (e.g. Quebec) and much of the US.*
Resource quantification Glacial/ground water reserves - peak water?	• Accurate water supply projections for the sub-basin supplying storage reservoirs • Resource data (hydrometric or modeled data), water supply reports for moderately sized basins or regionalized updates • Water extraction rates (SW & GW)
Groundwater-surface water interaction	• Aquifer characterization

Table 1-B Watershed Health

Issue	Information Needs
Climate change	• Regionally-specific information on the effects of climate change on natural disturbance regimes and water quality, watershed hydrology, stream channel integrity, aquatic thermal regimes, and fish population/habitats
Source water protection challenges from non-point sources	• Data on source water characterization • Surface water quality monitoring • *I lack a clear understanding about the measurable objectives and tradeoffs required for managing water supplies across resources uses (energy, forestry, mining, etc.) and multiple ecosystem components (salmon, bull trout, riparian zone, etc.)*
Maintaining watershed, riparian, and aquatic ecosystem functions and within regimes of multiple land use/forest management Maintaining, enhancing, and rehabilitating aquatic drainage connectivity and fish passage at stream crossings	• More research on watershed processes around the province and response to disturbance (climate, wildfire, logging, mining, urbanization, etc). • Information on cumulative effects management strategies. *Most research and policy development is based on one set of stresses/measures/metrics – the real problem for water resources is that they are affected by multiple stressors within watersheds and it is the cumulative effect of these stressors that is the killer. For example, policy and legislation for mining discharges to freshwaters are based on the impact of isolated mines, not the cumulative effect of all mines in a watershed or indeed mines within the context of other stressors. To me, cumulative effects is the key to water resources management*. • Determining instream flow needs (cost effective allocation strategies that ensure maintenance of aquatic ecosystem health) • Better information on fish distribution
Storm water management	• The nature and quantity of unregulated and un-monitored discharges (e.g. what people flush down their drains)
Emerging contaminants	• Health data on emerging contaminants

Table 1-C Governance

Issue	Information Needs
Enforcement	
Changing public behavior, lack of value attached to water resources	
Implementation of effective demand and drought management plans	• Strategic plans and needs assessments for water use for current water needs and those projected for the medium (10-20 years) and long term (>50 years)
Delivery of water and waste water systems	• Standardized provincial indicators to assess and compare utility performance
Myriad of legislation and agencies responsible for directly and indirectly managing water (too confusing)	• *To make a case for modernizing legislation, I need supporting materials including business cases, quantitative data, and technical analyses. Also need to apply a cost lens and implications for stakeholders. Need to tell a compelling story to politicians.*
How to make government an effective agent for social change Adaptive governance	• How to make decisions with imperfect and incomplete information • Better understanding of institutional resilience in the face of uncertainty (i.e. institutional connectivity via social network analysis, adaptive governance strategies)
Managing growth and development & Transparent decision making	• Economic valuation of watershed ecosystem services • Economic drivers • First Nations involvement
Aging infrastructure	• Impacts of changing regulations on infrastructure

BC Water Symposium Discussion Paper – Appendix A

Pre-Symposium Survey Introduction

The purpose of this survey is to gather information and opinions for a discussion guide which will be circulated prior to the BC Water Symposium. The guide will provide some background on the challenges associated with applying scientific information to decision making and policy development processes; and introduce questions for small group discussion. The results of the survey will help us to form the questions that will be asked at the symposium. The discussion paper will also summarize what we have heard so far; drawing on the survey results and submissions received from the Water Act Modernization.

Survey Questions:

1. What are the top three emerging issues pertinent to the sustainable management of water resources and aquatic ecosystems (100 word max)?

2. What information (including governance, natural and/or social sciences) are you missing, pertinent to the sustainable management of water resources and aquatic ecosystems, which you need to do your job (100 word max)?

3. Please give an example of a success you have experienced when communicating water related data and/or scientific information (100 word max)?

4. Please give an example of a challenge you have experienced when communicating water related data and/or scientific information (100 word max)?

5. Please give an example of a success you have experienced when receiving water related data and/or scientific information?

6. Please give an example of a challenge you have experienced when receiving water related data and/or scientific information?

7. What are the challenges to getting scientific data and/or information incorporated into policy development, decision making, land-use planning and/or on-the-ground operations (100 word max)?

8. How could water information users (e.g. decision makers, water managers, planners, policy developers) become more involved with science (how to increase policy → science link) (100 word max)?

9. How could water scientists become more involved with decision making and/or policy development (how to strengthen the science → policy link) (100 word max)?

10. What tools (communication, databases, guidelines, etc.) and/or institutional arrangements could be developed to aid collaboration and the incorporation of science into policy development, decision making, land-use planning and/or on-the-ground operations?

11. Would you consider yourself a (please tick all that apply):
    a. Natural Science Researcher
    b. Social Science Researcher
    c. Technical person (collector of data in monitoring or stewardship programs)
    d. Technical specialist (provides scientific expertise)
    e. Decision maker (individuals who make decisions on behalf of organizations that could affect water quantity, quality or aquatic species and habitats)
    f. Water Manager (someone who manages the supply of water to individuals such as water purveyors, municipalities and drinking water experts)
    g. End user (person who applies water information and knowledge to site-specific decisions such as forest harvest or silviculture plans, urban planning, and stewardship groups)
    h. Policy developer (person who develops policy on behalf of government)
    i. Other (please specify)

12. What field best describes your work (please tick all that apply)?
    a. Water allocation
    b. Drinking water management
    c. Ecology or ecological restoration
    d. Water conservation
    e. Watershed stewardship
    f. Water governance
    g. Forestry operations
    h. Mining or petroleum operations
    i. Agriculture
    j. Hydro power operation
    k. Water quality
    l. Land use, community or watershed planning
    m. Other (please specific)

13. Which of the following symposium themes does your work best fit within?
    a. Surface and groundwater hydrology
    b. Watershed health (ecological health of aquatic ecosystems)
    c. Water governance (social, policy and regulatory tools to better conserve and manage water)
    d. None of the above

14. Which region does your work fall within (please tick all that apply)?
    a. Skeena
    b. Peace
    c. Omineca
    d. Cariboo/Thompson
    e. Kootenay/Boundary
    f. South Coast (Lower Mainland)
    g. Coast Region (islands and north coast)

15. Which of the following organizations are you affiliated with (please tick all that apply)?
    a. Consulting
    b. Local government
    c. Provincial government
    d. Federal government
    e. First Nations
    f. NGO or stewardship group
    g. Industry
    h. Academia
    i. Other (please specify)