Workshop Report

Sustainable Water Infrastructure Management in Canada Workshop Vancouver, May 5th, 2008

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INTRODUCTION

A workshop on Sustainable Water Infrastructure Management in Canada was hosted by the University of British Columbia's (UBC) Program on Water Governance at the Peter Wall Institute in Vancouver, BC, on May 5th, 2008.

The objective of the workshop was to build and disseminate knowledge on effective programming for conservation and efficiency in municipal water supply in Canada. In terms of results, it was expected that the workshop would:

- Clarify and support the implementation of best practices;
- Contribute to the refinement of a policy document on how governance can be improved to facilitate and encourage water conservation and efficiency; and,
- Provide networking opportunities.

There were 30 invited participants at the workshop, including consultants, academics, provincial and federal public servants, employees of municipalities and water utilities from across the country, as well as representatives of non-governmental organizations (research institutes, environmental groups and water-related associations).

Discussions were supported by a draft report on the results of the research project, "Sustainable Water Infrastructure Management: Linking Governance and Efficiency in Canada" (Furlong and Bakker 2008) which was circulated to participants in advance of the workshop. This draft report was revised based on the results of the workshop and follow-up advice from workshop participants.

The workshop agenda was full, with the emphasis on facilitated discussions amongst participants to share experience and work towards the objective of the day. Workshop conveners began the proceedings with an overview of the Program on Water Governance and the Municipal Supply Project. A summary of their presentation is in Appendix 1.

Key themes arising from the research project provided the framework for the remainder of the workshop discussions – namely, roles of the three levels of government in advancing efficiency in demand management, effective programs for sustainable water supply, utility governance at the municipal scale, and principles of good governance as a guide to developing effective programs. This document is organized around these four themes. Each theme was first investigated by a group of workshop participants through an "interview matrix" process, tackling a research question related to the theme. The participants shared their research results with the full workshop and interactive discussion ensued. The small group "interview results," and the full workshop discussion are amalgamated under emergent sub-topics in this document. In some cases additional small group discussions and/or written input from participants are also included in the write-up.

A lunchtime presentation by Kim Stephens looked at responses to climate change and other aspects of dealing with uncertainty and managing risk in water supply. A summary of this presentation is included in Appendix 2.

At the close of the workshop the conveners and participants reflected on what they had learned through the exchange of ideas. Their insights are summarized in the closing section of these proceedings.

1 THEME 1: ROLES OF THE THREE LEVELS OF GOVERNMENT IN ADVANCING EFFICIENCY IN DEMAND MANAGEMENT

The main discussion question posed in connection with this theme was: "What are the most effective roles for municipal, provincial and federal governments in advancing efficiency in demand management in municipal water supply?" The discussion group that focused on this question used the following "headline" for their report to the workshop: "National Water Strategy Needed." Other points reported by the group and raised in workshop discussions are listed below.

Relationships between levels of government

Workshop participants emphasized the need to look at connections between levels of government:

- The relationship between the various levels of government is like a Russian nesting doll; they each form part of the whole and must be engaged for effective governance.
- The roles of the different levels of government need to be strategically developed, including consideration of whether appropriate governments are engaged in coordination.

Framing water management

Several suggestions were made in connection with the overall framing of water management:

- **A national water strategy needs involvement beyond the federal government.** A national water strategy is not a federal water strategy. While the federal government provides the foundation, the national strategy does not happen through federal leadership alone. A national water strategy would be a difficult sell across the country unless it comes up from the bottom-up and each province believes it is important. It requires a national discussion, generated by appropriate key players about how to do things differently.
- **A top-down and bottom-up approach is needed.** Work is needed at the local watershed level so there is a common approach across the country, with national standards evolving upwards. Yet this nested approach to a national strategy also depends on maintenance of a power structure at the top, providing structure for work by municipalities and ensuring the implements minimum standards (e.g. through enforcement).
- **The Canadian Council of Ministers of the Environment (CCME) is well-placed to play a lead role.** The CCME could be a good place to instigate a national policy. It is an important body that is instrumental in creating equity guidelines, standards and sustainable strategies. CCME is about to release a municipal wastewater strategy, which will have tremendous momentum.
- **Agenda setting that is clear and well designed is a key priority for moving water management forward.** A clear agenda, set through dialogue, can guide the framing of issues, provide a learning opportunity and help achieve coordination. New narratives and constructs that move to the required social learning must be developed.

- **The process should bring all the stakeholders together to discuss what matters.** Alberta's Water for Life, emerging land use frameworks and other integrated approaches are examples of ways to bring stakeholders together. Following this process, municipalities can all take a role in achieving good governance of water. Provincial political will is required to enable this multi-stakeholder approach.

Four levels of government

Workshop participants emphasized that there are four levels of government: Federal, Provincial, First Nations, and municipal. A dialogue regarding First Nations constitutional issues and water rights in the context of these different levels of government is needed. There are current issues in court regarding the Tsiksika Nation in Alberta and their right to withdraw water on the Bow River and there is a similar case with the Xeni Gwetin in the Chilcotin area of B.C. Participants commented that these cases are calling into question standard use of the provincial licensing regime and will impact how the levels of government work together with First Nations around water rights.

Federal role

Current federal roles identified at the workshop include:

- **Advancing efficiency in demand management:** The federal role in advancing efficiency in demand management generally involves providing good science, leadership and policy, and taking a role in research and education.
- **Watershed management in connection with fisheries:** The federal government is chiefly responsible for fisheries and therefore the Department of Fisheries and Oceans has significant influence over watershed management. Revisions to the *Fisheries Act* will put forward a process for a national water policy that includes devolution of water management and will be relevant to an effluent wastewater strategy.
- **Water management across international basins:** There are several federal boards and commissions involved at this level.

Workshop participants also identified the following new or strengthened roles for the federal government:

- **Benchmarking:** National benchmarking could happen more at the federal level. Metrics could be used to provide the necessary incentive to garner financial support at the provincial or federal level, to get funding for drinking water. This will force the achievement of higher standards by municipalities.
- **Codes:** The federal government could establish a mandatory national plumbing code and a national building code to promote water use efficiency.
- **Inclusive approach to law and policy revision:** The federal government needs to include all interested parties in current processes of revising laws and policies concerning water management, to ensure appropriate and effective design, reflecting the values of the country. The *Canadian Environmental Assessment Act* is under review, and changes may reduce public/stakeholder involvement. Changes to this and the *Fisheries Act* will have implications for the federal role in advancing efficiency in demand management. There is some dialogue on the *Fisheries Act* occurring through a CCME process. Federal policies could recognize that improving water use efficiency essentially provides a source of water.

Provincial role

Current provincial roles identified at the workshop include:

- leadership,

- regulation of policy and adopting and enabling a federal strategy (primary implementation of policy),
- research and education,
- management of inter-basin sharing if international boundaries are not crossed,
- governance of regional service delivery if local decision-makers are unable to provide an adequate and safe supply of water to citizens.

In particular, it was emphasized that provinces play a key role in legislating water efficiency and conservation because provincial jurisdiction over water is dominant. Two examples of where laws and regulations are required include:

- price setting/full cost recovery and standards for water using devices (e.g. provincial legislation, with national guidelines, could ban the sale of large water consumption units like 13 litre toilets);
- in connection with full cost accounting, legislation that will regulate or enable recycling of wastewater (e.g. a pre-condition for licensing should be to provide a complete financial and water management plan including reuse).

Workshop participants said that strategic development of the provinces' role is needed, and suggested that the provinces could:

- support innovation in municipalities while providing templates and bylaws and establishing benchmarks to guide local issues on a larger scale;
- supply independently audited and measured, province-wide oversight;
- take a lead role in water allocation changes, through licensing provisions.

Role of municipalities

At a general level, workshop participants said that within the setting of national policies/standards and enabling legislation from higher levels of government, the municipal role is to spell out the "how" of policies set at higher levels. Municipal governments are closer to customers; they know local issues and can change faster. More specific municipal roles identified at the workshop include:

- water protection;
- customer service;
- provision of adequate water supply to citizens;
- land use planning, which is key to water use planning;
- allocation, taking into account factors such as mid-summer flows and ecological restraints (also a provincial role);
- infrastructure management;
- input into governance choices such as regionalization or privatization
- assessing and improving performance through data gathering related to federally set benchmarks for leakage and per capita usage.

Other themes or issues regarded as relevant to the municipal level raised by workshop participants but not fully discussed in this context were:

- structure and limits,
- social learning and policy learning,
- place based approach,
- performance based solutions.

Some roles involving more than one level of government

Workshop participants emphasized the need to involve all levels of government at the watershed level with is regional rather than specific to any of the four levels. For example, Alberta is providing financial resources to basin councils to manage on a watershed basis, with the strategy being to enable the appropriate scale of management.

Specifically, participants pointed out that current data limitations are something that all levels of government can help to overcome, making the following arguments:

- That which is not being measured cannot be managed. None of the governments know how to collect data at a watershed boundary level rather than at a political boundary level, let alone for watersheds that cross provincial boundaries. Government needs to have a strategy that will allow that to happen and the political will to implement that strategy.
- Natural Resources Canada is not undertaking hydrometric monitoring across the country. While some areas such as Metro Vancouver are doing their own monitoring, the federal government needs to take full responsibility with the provinces contributing.
- Ground water resources are largely unknown, as they have not been mapped. This lack of knowledge of the resource impedes management.

There are two strong perspectives on infrastructure financing:

- Some feel that senior levels of government should not be involved in financing infrastructure because as long as the carrot is held out by the province, the municipality does not do full cost accounting on infrastructure. Furthermore, infrastructure grant programs do not reward good management and do not encourage innovation. Health and environmental issues are top criteria for funding.
- Another view is that some municipalities are too small to cover the costs of infrastructure.

This latter topic is explored further under Theme 3: Utility governance at the municipal scale.

2 THEME 2: EFFECTIVE PROGRAMS FOR SUSTAINABLE WATER SUPPLY

The main discussion question posed in connection with this theme was: "In your experience, what programs have worked well in advancing sustainable water supply?" The "headline" from the discussion group that focused on this question was: "I will become efficient when it costs more to be inefficient than efficient." The summary below incorporates other points reported by the group and ideas from other workshop participants, as well as topics from small table discussions and priorities submitted by participants on forms provided for this purpose.

Note that various tools for sustainable water supply are also mentioned under other themes. For example, metering and rates is a topic under theme 3.

Relative effects of various tools to motivate change

Participants at the workshop explored the effectiveness of licensing, pricing and regulation in motivating water conservation. The participants recognized that these are only three of the many tools in the box and a diversity of tools should be used. An integrated approach, taking into account all the elements of the water system, can help coordinate the appropriate application of different tools. Overall, it was noted that uptake of tools for efficiency can be low, including in the pursuit of mitigating climate change.

The three specific tools were discussed as follows:

- **Licensing:** An example of efficiency being driven by rising costs of inefficiency is when limits on licensed water supplies lead to efficiency within the agriculture sector.
- **Pricing:** Some feel that the effectiveness of pricing in reducing demand is a fact – this tool works with energy too. But a question is, will water efficiency create a cycle in which those who use it efficiently have the ability to ask for more, and more gets used? Social equity issues may also become a concern.
- **Regulation:** There are at least two points of view on regulation. Some believe that programs for sustainable water supply have to be mandated since voluntary approaches do not work. Others feel that incentive based measures can be effective. A nuanced view is that, to the extent that we rely on altruism or a sense of responsibility to the environment, regulations or incentives (economic etc.) are desirable to "guide" the altruistic action. Regulation also supports equity, by ensuring that those who would take action voluntarily do not provide a free ride to those who would not take measures unless required to.

Encourage Innovation and Share Success

Participants made a number of points related to innovation, leadership and learning from experience, which are organized into two groups of suggestions below.

Encourage innovation:

- Concrete action, initiative and immediate change are necessary to build momentum.
- There is a central role for risk takers early in program development. There needs to be flexibility for innovation, including exploring soft paths and the potential for technological developments to reduce adverse environmental impacts of water consumption.
- Tools should be deliverable, meaningful, well researched, based on credible sources and practical.

Follow the leaders, through practical examples:

- Communities that are embarking on water efficiency should lead by example. For instance, the new Calgary Water Centre harvests water, recycles grey water, uses waterless toilets, and has xeriscaping and a green roof.
- Tangible results and demonstrated successes are important.
- Examples should be shared and celebrated. Early, easy success stories should be pursued and publicized – to counter the perception that there isn't a lot that can be saved. For example, cities could focus on reducing their own use of water and publicize the savings.
- Results, including benefits, need to be quantifiable and validated.
- A matrix of communities and systems/tools being employed would be helpful as a resource for communities. The matrix would help municipalities see where they fit and provide appropriate paths forward based on successful experiences of others.

Addressing Political will

Participants felt that, to a large extent, certain programs and instruments have been proven to work and have showed efficiency, so the gap is not with science or methodology; it is the willingness at the political level to implement tools that is the problem.

Participants suggested the following approaches for overcoming lack of political will:

- Encourage people to get to know their MP and MLA and talk to elected officials about water issues to help gain political support.

- Partner on the delivery of programs with NGOs or local organizations, e.g. in rebate programs. Choose local NGOs with credibility that are trustworthy and are arm's length to government.
- Develop a shared community vision and leadership to recruit water users to the cause.
- Promote tools that are well researched, meaningful and practical (required to build trust in leadership).
- Find a public champion, since political leadership does not necessarily depend on politicians. (A public champion can be pivotal to both public and political buy in. The champion can promote programs, while encouraging actors to at least take small steps.)
- Place the long-term focus on building support among the public supporters of decision-makers.

Public education and marketing

Workshop participants pointed out that to gain public support for water conservation and efficiency, it is important to get people involved, apply CBSM, educate the public and school-aged youth, raise awareness, and disseminate information appropriate to various audiences by various media. Specific suggestions are listed below.

Information or messages on the following topics should be included in public education and marketing:

- the facts/data/science behind the economic basis (cost benefit analysis) and the efficacy of the tools being promoted;
- full cost accounting;
- water metering;
- minimizing outdoor water use, e.g. through landscaping;
- water waste;
- the need to restrict water consumption during the summer months;
- connecting people with watersheds and where water comes from;
- environmental literacy – e.g. the fact that salmon and other species have needs and we share the water with other life.

Various types of media or mechanisms for education and awareness-raising can be used, including:

- collaboration and financing from municipalities to participate;
- recruitment of students who can gather information and communicate the rationale for conservation;
- public events;
- curriculum development in the school system;
- education program integrated with watershed management and activities in streams and in the entire watershed (e.g. multi generational educational program in the three Metro Vancouver watersheds, including bus tours);
- salmon stewardship programs;
- children's poster competition for water conservation;
- media coverage of climate change and the need to take action.

Targeting messages/programs to audiences requires attention to values, as reflected in the following comments:

- There is a need for different approaches to reach people with different value sets. The values-based approach depends on understanding the values of different audiences.

- There is a tendency to communicate everything in terms of economic value, whereas a growing number of people are self-motivated, altruistic, or compelled by doing the 'right thing' rather than by market based elements. Focusing on the costs of being inefficient does not speak to the people who are driven by quality of life. Furthermore, people who can afford to be inefficient may not be swayed by economic arguments. The message has to appeal to people's sense of spirituality.
- It is about setting new norms for behaviour.
- The term "water stewardship" encompasses more that economics and thus addresses some of the normative questions.
- The qualitative outcome can be the most important incentive. For example, the municipality of Cochrane started with the values of the community, showed them the watershed and tapped into their values as part of the program. The municipality has experienced a 25% reduction in household water consumption from lowest recorded levels and people felt pride in being part of the community.

Constraints and barriers must be identified and addressed:

- The CBSM approach includes a process to identify constraints and barriers along with good information sources and good delivery of meaningful, practical solutions to get stakeholder participation.
- Focus groups or facilitated meetings can be used to identify barriers to the behaviors being advocated and what it will take to overcome them.
- Marketing, education and awareness-raising do not make a difference on their own. People need to be given tools by which they can act and the knowledge of how to use them. For example, people need to have clear options about what they can do in their garden other than simply growing turf and watering grass, and other water saving options such as what to replace their failing appliances with.

Metering

Participants expressed two points of view related to metering: One is that smart meters are effective because they raise awareness among consumers. The other is that they are not a good investment, at least on their own. Points made in connection with these views are listed below.

Smart meters and awareness-raising:

- The writing is on the wall – water is priced no differently than hydro, so making people aware of how much they are spending to water the lawn or on other outdoor water use is smart. Toronto is hoping to pilot smart metering technology in the city. They do not currently have time of use billing, but will begin to do so in residences.
- To make the results of water use and conservation obvious to people a smart meter can be installed in the kitchen to display usage and cost. Software can calculate real time use. Smart metering is about raising consciousness rather than money saved.
- Successful metering programs need an education component, which can be achieved via smart metering.
- A suite of tools is appropriate to increase everyone's responsibility. Everybody needs to have a water budget. At the watershed level usage has to be within the carrying capacity of the watersheds. At a household level residents need to budget their bank accounts, so they can budget their water.
- Smart metering can help utilities/municipalities identify leaks and provide answers to questions.

Metering should be coupled with other incentives, especially water restrictions:

- But do smart meters make a difference? How effective is it to know how many cents it costs to do things, given that resources are limited and the technology is expensive? Without universal metering, smart meters are a low priority. People who consider installing them are already on board. An example of potential tradeoffs is an apartment building that is metered only once at the building so it

is difficult to monitor use in the individual units; however the manager can replace all the toilets with low flush toilets, incurring savings without having to educate all the tenants on their water usage.

- Along with 100% metering, establishing and enforcing water restrictions is a widely supported tool. Metering and restrictions should apply to both indoor and outdoor use. In the Southwest US there are different rates for indoor and outdoor meters.
- Incentives to reduce outdoor use include water use ban advisories via the media to curb outdoor water use during peak demand conditions.
- The Capital Regional District (Victoria, BC) Demand Management Program sets three levels of restrictions and tickets violators. There is 100% monitoring and effective enforcement. Yet only 10% of people need enforcement to comply rather than taking responsibility for obeying restrictions. Another 80% are waiting to be told what to do – they need the guidance but not the enforcement. The remaining 10% know what to do and are even doing more.

A criticism of water restrictions was put forward, as follows:

- Some say that water restrictions are an indication of a failed program. When other measures are not available, the 'stick' approach of restrictions tends to be employed. Yet different land use patterns or successful implementation of other tools would preclude the need for restrictions. While drought can be a driver for imposing metering and restrictions, successful planning should prevent even this need arising. Yet it is difficult to be fully prepared in the face of the extreme events associated with climate change.

Appropriate pricing

Workshop participants made the following points in connection with pricing:

- Full disclosure, full cost accounting and/or full cost pricing of water are important tools.
- In Canada the highest consumption occurs in summer due to outdoor use. It should be possible to establish priorities so that pricing could vary seasonally and with the time of day.
- One argument is that if customers are paying for what they use, why should they have to restrict water use? Thus 100% metering can lead to push-back.
- Another option is buy back on the demand side. This way the ability to affect change is improved because it is cheaper to buy back demand.

Addressing Leakage

Participants emphasized that sound management of infrastructure is critical to addressing leakage, via the following suggestions and examples.

- Use leak detection and full metering, and up-grade infrastructure regularly. By doing so, Calgary has kept the volume of water it takes from the Bow River more or less constant for 25 years.
- In Halifax, water managers used International Water Association methodology for leak detection. They had a recognized problem with leakage in the distribution system. They conducted research and found a strategy from Europe through which they were able to measure progress clearly against goals with an ILI. Then they got people to buy in by rewarding them for progress. Incentives were provided for staff to find leaks and chase the result. These incentives (including a steak BBQ and a lobster dinner) worked. But now, they are spending a dollar to save a dollar; the system is at its economic limit. The Corporate Balance Scorecard showed savings of $600,000 per year system as the input decreased from 168 megalitres/day (Ml/day) to 132 Ml/day.

Benchmarking

Cautionary comments were made in connection with benchmarking, including the following:

- Benchmarks are a good idea but care must be taken regarding the metrics used and the quality of the information. For example, some feel that litres per capita per day is a limited measurement that works for households but does not work with manufacturing. The Canadian Water and Wastewater Association has a contract from Ontario to develop performance indicators for water use beyond litres per capita per day, because of the mobility of ICI (Industrial Commercial Institutional sectors).
- Another caution respecting benchmarks is the need to be wary of differences in accounting practices because there is such variability across Canada. The effectiveness of calculating efficiency using litres per capita depends on the assumptions that go into the assessments, and on whether the meters are accurate and calibrated. If there is no understanding of the level of leakage occurring, then the infrastructure leakage index (ILI) can be manipulated. When there is poor quality information the ILI increases.

Conservation incentives connected with progress

Participants noted that incentives to change do not depend on smart metering, but the ability to measure results helps – including the incentive of a reward for a positive result. Suggested approaches to building progress in water conservation into incentives for ongoing efforts included:

- Financial incentives should encourage implementation of water conserving processes/approaches in the ICI sector and then success can be advertised. This way others within a given sector can take note and consider following suit.
- Competitive reductions in water use should be promoted in the ICI sector – possibly also for neighborhoods.
- Measuring progress and celebrating and rewarding success should be linked to benchmarking and provide powerful incentives to staff in water management systems and to consumers. The Halifax example (above) illustrates the incentive of winning as a community rather than competing as an individual. Incentives that focus on group recognition may be more effective than individual incentives because of the complexity of behaviour change. They are able to capitalize on pride of ownership and pride of community.
- A constant cycle of successful programs and celebration of successes should reinforce good daily practices and remind people at the ground level of them too.

Low flow device incentives

Participants noted that incentives related to products and hardware distribution of low flow fixtures, subsidies and rebate programs or swaps for the adoption of low flow toilets, water saving showerheads, timers on hoses, etc. It was noted that, if there is an incentive to use a product, ensure that it is available in stores.

3 THEME 3: UTILITY GOVERNANCE AT THE MUNICIPAL SCALE

The main discussion question posed in connection with this theme was: “What are the challenges and opportunities for utilities in advancing the sustainability of municipal water supply?” The “headline” reported by the discussion group that focused on this question was: “Challenges and opportunities are opposite sides of the same coin.” The group also offered this “take home message”: “Meter, meter, meter and communicate.” Other key findings reported by this group, as well as topics covered in the full workshop discussions, are reported below.

Political Will

The issue of lack of political will to support sustainable water infrastructure was raised, as a "dearth of leadership," with local politicians focused on maintaining the lowest possible water rates. A couple of ways of responding to this were put forward, as follows:

- Administrators need to be more persuasive and help politicians understand what they are looking for. (Sometimes they don't communicate with politicians as well as they do to the public.)
- Giving politicians a view of the status of infrastructure that is hidden underground can help; e.g., putting a tuberculated pipe on the desk of a politician after a watermain break can create understanding.

Jurisdictional issues

At least three jurisdictional issues were raised by workshop participants, as follows:

- **Passing on responsibility for demand management:** In a two-tier system there is a supplier and a distributor of water. There may be two or three operators in the source-to-tap model. Each party wants the other party to be responsible for demand management.
- **Responsibility for water protection distant from water users:** In source water protection, when the watershed is in one jurisdiction and the users in another, the user community is dependent on the adjacent municipality to protect what their voters don't drink. In any case, water protection is a provincial jurisdiction although the municipalities can give development approvals etc.
- **Lack of water management perspective in land use planning:** Since utilities don't do land use planning it can be difficult to get land use controls integrated with water management values. This is a jurisdictional and dependency issue.

Responsibility, and varying expectations

Different players have different targets or objectives based on their perspectives, mandates, and interests. Workshop participants put forward the following challenges in this respect:

- One of biggest challenges is that governments cannot do this alone; they need the public to accept responsibility. The public is not accepting their responsibility to protect and conserve water – they expect government to do it.
- Utilities themselves are too narrowly focused on delivery of a volume of water, rather than on how we reduce the volume. A broad view of the world is needed, developing a culture of efficiency within water supply organizations is part of this.
- There may be reluctance on the part of private producers to encourage conservation because of the resulting loss of revenue.
- Negotiations between utilities and environmentalists about how long it takes to achieve targets/results in demand management can be difficult. Sustainability requires working together with a longer-term view. ENGOs have a short-term view in that they are not happy about how slow improvements are – they want change now. Politicians have a very short-term view due to the need to get re-elected, and are more likely to feel that fees are too high. Managers are always negotiating the operating of the utility with different temporal critiques.

Small communities, and clustering

At the workshop, small communities were defined as follows:

- A small system can be anywhere from 12 customers to 50,000. Between 50 and 500 connections are technically called a small system. The USEPA gives guidance as to what constitutes small.

The challenges raised in connection with small communities included:

- Small and remote systems have challenges attracting and retaining skilled employees. They do not provide good healthy water if the staff are not trained or experienced.
- When small municipalities purchase bulk water from larger municipalities, the situation can be insecure from the perspective of the small municipality. This is because their allocation may be clawed back over time as larger communities continue to grow.
- Small communities may not willingly give up control and become part of a larger regional management system, even though the latter can provide access to financial and technical assistance, etc. For example, A large part of the angst and reaction to the Watertight report (Ontario) is related to the recommendations for cluster assistance of small municipalities, and the proposal for a provincial water board.
- If municipalities hold out from amalgamating, they are likely making that decision based on their constituents' wishes. The municipal level is best placed to make those decisions. Municipal councilors are elected by citizens and are motivated to perform to the public good.
- In Alberta water is allocated in some communities through licenses – small towns of less than 50,000 have to negotiate with neighbouring, possibly larger communities or communities that may have extra water. The problem is not about not being able to get a plant – rather it is about not being able to get a license. There is no level playing field as larger communities have control of the licenses.

Participants also identified opportunities related to small systems, including examples from Ontario, Nova Scotia and Alberta:

- Small systems have the chance to "get it right" with innovation and technology because at that level it may be easier to implement and test new tools.
- Water *distribution* can be amalgamated while water *management* can be regionalized without physically linking the systems. Cluster assistance does not require that communities be geographically connected. For example, support such as staff positions can be provided and shared between communities. Some cases may suit a regional distribution system whereas in others a regional management system is called for.
- In Ontario it is more efficient to provide services from a central system. At the same time, small communities are limited in growth due to water, and unlimited water could cause sprawl in communities that want to stay small.
- In Cape Breton (CBRM), where there are issues like declining population and tar ponds, they do not apply anymore for provincial and federal funding for water because water has the capacity to pay for itself. Money for infrastructure (roads, recreation, and schools, etc) comes from taxes and is politically motivated. The only source of money to pay for water infrastructure is water rates so it is necessary to be creative with water rates and this encourages diligence in water operations.
- Alberta is moving to regional distribution, e.g. with one big plant and a pipeline in each region, physically linking with a large facility and piping out to communities. The incentive is greater funding through a regional system with joint staffing.

Metering and rates

Participants recognized that meters are a challenge to get in place but they are an opportunity to manage demand. It was noted that once metering is in place it is possible to move on and put higher demands on the organization beyond the meters. For example, the Capital Regional District (Victoria, BC) has universal metering and now that it is in place it is no longer fundamental to the success of demand management. Participants identified the following considerations to be made in the context of metering:

- Replacement of infrastructure needs to be included in calculation of costs of providing water.

- Seasonal usage is important to the extent that some communities may triple in size at different times of the year.
- Fairness and transparency principles should be followed in setting rates. For example, in Nova Scotia, when the Nova Scotia Utility and Review Board holds hearings for approving new water rates, community members often come to challenge and intervene.
- Social equity has to be taken into account, stemming from the fact that not all can afford to pay for water. Yet utilities are not social services. Solutions regarding the inability of customers to pay their bills are not the responsibility of utilities but of social service agencies.

Revenue streams for water

Workshop participants generated several priorities related to revenue streams, especially regarding separation:

- **Integrate budgeting and planning timelines:** The finance department in the municipality receives revenue from metering. Finance departments typically work with five year timeline for revenue, while the relevant timeline for infrastructure planning is about 25 years. These different timelines need to be integrated. Any downturn in revenue due to a downturn in the economy means that capital is not there for infrastructure, whether revenue from metering decreases or not.
- **Buffer utilities from pressures to keep taxation low:** There seems to be pressure on keeping property taxation low. A self-liquidating, separate utility is buffered from this. Therefore, water and wastewater need independent utilities funded from water rates that are not connected with property taxes.
- **Separate revenue streams:** Issues arise when revenue streams are tangled, even if there is a user pay system. The finance department may be addicted to revenues from water because they are not charged with making sure that the capital is there for the next expansion. For example, utilities could subsidize taxation if water rates are high enough (through higher internal charge-backs, eg. PILS). West Vancouver may be a case in point where there is close to a 0% property tax increase but utility expenses and water prices facing double digit increases.
- **Consider separation of storm and sewer:** When storm water and sewer are combined it is not possible to split out the wastewater treatment portion of costs. In Toronto storm and wastewater are combined. Much of the revenue is based on how dry the summer is. Forecasting into the future, they subtract out conservation effects to net out revenue. It may not be worth investing in the separation of storm and wastewater – there is a billion dollar plan over the next 25 years for storm water in Toronto and sewer separation is not part of it.

Participants made the point that conservation can lead to a reduction in revenue through a reduction in demand, e.g.:

- Reduction in revenue could occur through conservation initiatives which, for example, could produce a 2% drop in water consumption.
- If revenues go down because usage goes down, costs also go down, but not proportionally.

Several explained that this issue is complex: revenue reductions may not be the problem that they are perceived to be and can be addressed in certain ways, as follows:

- Recognize that population growth will increase revenues: Growth in city population is likely to eventually increase demand, regardless of conservation measures, so conservation will pay off financially in the longer term. However, this is a fine line.
- Make water revenue neutral: The strategy used in Okotoks was to say that once 75% of consumer accounts are below the target threshold for water use increasing the rate will not impact them. Water becomes revenue neutral and metering and charging become accepted in the community. Okotok's program was successful because the consumption based rate strategy / reward was transparent.

Reduce consumption before increasing the rate. Small towns provide opportunities to innovate and measure results in juggling these different factors.

- Consider the starting point to be an infrastructure deficit: Begin by stating that there is a huge water and wastewater infrastructure deficit and that becomes the underpinning of asking for the revenue. Keep chipping away at renewal needs so as not to accrue a backlog.

Business Models

Some workshop discussion addressed the question of who decides which model to use:

- The reality is that one size does not fit all – when it comes to water and water rates different models work differently in different locations. A spectrum of business models is required, addressing the roles of the municipal department, the Public Utilities Commission and so on. Through examples, a guide could look at the different business models and see what works for governance in a particular setting.
- Because of the variability from case to case, some feel that the municipal level is the best level at which to make decisions about the structure of water provision, be it public, regional or private systems. Leave the decision in the hands of the local decision-makers rather than having the province decide and enforce its decision.

A few comments were made in connection with operations contracts:

- Public private partnerships (PPPs) have not taken off in Canada. Operations and maintenance contracts tend to be more suited to the needs of small as opposed to large municipalities. EPCOR and OCWA are examples of publicly owned corporations that provide reliable, quality services to smaller communities.
- An issue with the PPP model is the difficulty of accessing information. The public can request information from the regional government but cannot ask a private corporation.

Participants offered examples of innovative approaches and called for more research:

- In BC, the Public Sector Accounting Board is applying for full cost recovery across sectors. Water utilities in the province have infrastructure leakage deficits, and so they are considering establishing an asset base and depreciating those assets.
- More information about the different business models could answer various questions, including: How do the two business models relate: being part of a municipality vs. privatization? What is it that EPCOR does or does not do? What is the capacity or learning of that company? What is their experience Compared to Europe?

4 THEME 4: PRINCIPLES OF GOOD GOVERNANCE AS A GUIDE TO DEVELOPING EFFECTIVE PROGRAMS

The main discussion question posed in connection with this theme was: "How can efficiency and demand management programs be designed/developed in a way that is consistent with the principles of good governance?" The "headline" reported by the discussion group that focused on this question was: "Be firm in vision and adaptable in practices." These priorities, and other commentary put forward by the discussion group as well as in wider workshop discussions, are summarized below.

Vision, and setting priorities

Workshop participants emphasized that a clear vision and concrete goals are important, and the province needs to be involved in developing an overarching vision and structure with ways to achieve the goals. The vision needs to be a jurisdiction's official policy so as to have teeth.

Process ideas related to vision included:

- Generate a vision first and then principles to fulfill the vision after.
- As new issues come forward, adapt to them without compromising the vision. Stay firm in the vision and stay adaptable in practices through flexible policies.
- Be respectful of differences, as one size does not fit all. Shared community visions will be different and everyone must be mindful of this.
- Ensure higher political levels hold to the vision: To have legitimacy, processes have to work consistently from the political (top) and community (bottom) levels. For example, a water commission (more so than a utility) has an unenviable but essential task to be responsive to the citizens, getting information back and forth, reacting and sharing information and maintaining rapport. At the same time a political structure above the commission that is elected (to which the commission reports) has to hold to whatever the vision and principles are, with the political will to carry out their mission in an accountable way. For example, if there is a water shortage and a proposal for more golf courses is submitted the elected officials should not countenance the proposal, based on their principles.

An Alberta example was offered:

- Alberta is bringing together agriculture, municipalities, oil companies and others, and having them define the overarching vision. Then they build down to determine what management will be. Those involved in generating the vision will take ownership and thus agree to the action management tools that grow out of it. This process is time-consuming. People understand the vision in Alberta and although it is not perfect a lot of progress has been made.

Participants touched on the importance of determining relative priorities and relationships among principles and values:

- Understanding the interplay between vision and principles will help set priorities. Start with broad level principles, and then nest smaller scale principles within this and prioritize. For example, at the water management scale as a whole, there may be some key principles like ecosystem management and stewardship that become priorities. In the context of a conservation program, there could be different principles, such as social equity or transparency and engagement
- Deriving principles for managing water should be possible due to the importance of water, which is part of the Canadian heritage.

Democratic, participatory management

Participants identified a number of principles related to democratic, participatory management:

- Management should be democratic.
- Government cannot achieve integrated water stewardship alone so communities need to participate. For example, community groups could do most of the monitoring.
- Public participation and involvement is important initially and in an ongoing way, thereby providing for responsive governance and generating needed dialogue.
- Transparency is important.

Equity

The principle of equity received some attention, e.g.:

- Cultural/social equity relates to issues that arise when people are unable to pay water bills.
- Pricing should be undertaken with a view to inclusion – taking into account social and economic equity. There can be a "lifeline rate" for people in lower income brackets to help them meet their water needs.

Proactive approach

Participants mentioned the importance of being proactive several times, e.g.:

- Principles can be seen as preventative, in the sense of management protocols and the precautionary principle.
- Citizens want proactive water managers, rather than discovering over night that the reservoir is too low. They want to be reassured that what is life sustaining is in proactive hands.
- In all governance pro-action is prevention.

Integrated approach

Suggestions for taking an integrated approach included:

- Practice integrated resource management and be mindful of coordination, including with all the other systems that are involved that impact decisions. Cooperation is needed between people within and between systems. Integration, coordination, cooperation are not abstract; in fact, they are very practical principles.
- Make a commitment to watershed management and manage within the limits of the watershed. Consider ecological demand and groundwater demand. The hydraulic connectivity of groundwater has to be managed and maintained.
- To achieve integrated system thinking jointly consider: a) source water and wastewater, b) water conservation and energy conservation, c) ground water and surface water, and, d) social/ecological and economic considerations.

Data and water budgets

Workshop discussions emphasized the need and demand for water budgets:

- Utilities are in the business of managing the relationship between supply and demand. A focus on when the water is available should drive programs. A different solution may be required for every utility.
- If budgets are done on a watershed basis it is more obvious how individual budgets relate to the ecosystem. Linking water usage to groundwater and watersheds will help conservation happen. This is a key paradigm shift.

At the same time, participants described lack of data as a challenge in budgeting:

- Experts are supposed to provide managers with water budgets and balances, yet there is no data because meters are not in place. Without data there is no credibility. Without metering, modeling is impossible. Electricity is metered. Carbon budgets are being developed – water meters can be easily installed.
- In addition to water meters, development of a water budget requires data on what water is coming out of rivers and being discharged back in. There are over-allocated rivers in BC, and the federal government or provincial government needs to monitor them. River flow is not known and is under monitored. In Athabasca there is no monitoring below the oil sands (while there is real time

monitoring for the Bow River in Alberta). Monitoring and a data warehouse that is open to the public are needed.

5 INSIGHTS

In the closing session of the workshop, participants were asked, "What is one new insight you will take away from this workshop?"

The workshop conveners, Karen Bakker and Kathryn Furlong, offered some thoughts on what they had heard through the day before participants provided their perspectives:

- Regarding the vision and principles that fall out of the report, the principles need to be not only smart but grounded in common sense. People must understand them.
- The report's final section on taking action needs specific suggestions. Within the report there needs to be a box that looks at different governance models – and a matrix of communities and systems. (The factors of success can sometimes conflict and do not work in all contexts.)
- In terms of the roles of government, what is loud and clear is that the provincial role is goal-posting and benchmarking. The key nexus is provincial water strategies. Without provincial management, we are not going to see conservation measures move ahead.
- Involvement from senior levels of government is important in setting regulations, for example, in the provision of a national plumbing code.
- We have heard about the need for a National Water strategy, noting the difference between a federal water strategy and a national strategy and the need for it to be collaborative.
- It is noted that there are four levels of government, including First Nations – not three.
- Small communities/municipalities have both challenges and advantages.
- Efficiency is a step toward a goal but not a goal in itself.
- Regarding utility governance, it will be useful to tease out the relationships between business models and action on sustainability. There is a need for leadership.
- Market-based programs need to be combined with value-based action.
- Education is of particular importance when combined with actions people can take.
- Political will is required, with actions, to get there.
- Participation in and coordination of a vision can have much impact.

Workshop participants offered the following insights, on reflecting about their experience of the workshop.

Urgency and magnitude of change required

- This is about basic survival – and dealing with massive population growth in parts of Canada where the water is stressed already. How can water be conserved to accommodate that level of growth? It is an overwhelming issue.
- Within BC there is a different conversation than at this workshop. In 2003 the province suffered flood, drought and pestilence. The discussion is about basics rather than about governance. At the same time the Premier is raising the bar. It is about innovation, building bridges between water and land use. For example, in land development they are building practices that can maintain a foot of soil, etc. It is inappropriate to manage in a silo. A paradigm shift is required – there is a crunch already and if the population doubles then the situation becomes even more serious.

Vision

- Themes of vision and leadership arise because they are more complex than specific issues. A vision needs to be generated holistically. Mobilizing leadership is the piece needed to get things happening – in water and land use. The alignment of vision and leadership is critical, as one cannot get the same result with research alone.
- A vision can also help at the watershed management level. Something that really worked was setting outcomes for a municipality or watershed with everyone around the table. With this foundation, the prescription does not matter as everyone can pick from the suite of tools. Leadership is a framework and within this there are tools that can be used to achieve the outcomes.
- There is a need to look locally and have a vision down the road and plan for how to get there.

Leadership

- The challenge is to put pressure on the respective levels of government that have been outlined.
- Don't let leaders claim that there is a lack of money to protect the environment, with the notion of water for life in mind.
- Work with politicians to make decisions. Take some risks to challenge political thinking when they respond to constituents that do not want change (e.g. to continue watering their lawns).
- Governance really matters – broad governance issues. Political leadership and support needs to happen together with practitioner innovation in management techniques.
- Good leadership comes from both top down and bottom up working together. Demand comes from users so they need the tools to manage that well.

Complexity, and tailoring solutions

- Good governance is going to be inherently difficult for water – it is the nature of water. It is complex, in the sense of running all through the economy. There are demands on the supply side as well as the demand side. People call for a one-window approach but that is over-simplifying the situation. The job that municipal water managers are working on is a very tough one.
- This is a diverse country and that means that one solution does not fit all. Even in BC the issues are different on Vancouver Island from Prince Rupert, so governance needs to be area specific.
- The complexity of the problem and the range of people who have input into the goals are diverse and the input is also complex, so there is a need for more community engagement to come up with the answers.
- Practitioners hesitate to move forward on a particular solution often because they do not have the science. Policy should be developed from this work that Karen is doing. It is very important to find the right solution and the best way forward with something that can be implemented and is practical.
- There is a consensus that there is no universal solution. For every municipality there is an individual solution. We have a full toolbox of tools – but how they are implemented depends on local, social, political and geographic factors.

Demand management

- Unaccountable money has a negative connotation – unaccountable water doesn't – let's make water accountable. If we could nationally ban the concept of unlimited water that would be a big step forward.
- In the case of EPCOR that manages Edmonton water, demand management vanished once the corporation took over and stewardship was lost. The choice of business model will determine the level of emphasis on demand management.

- Water metering can do a lot for water conservation. Good leaders should impose this – perhaps not systematically, but based on arguments about how to monitor and base pricing on social equity. Financing water meter installation is a challenge.

Public education

- There has been a lot of talk about multiple stakeholders, many solutions, many levels of government, while one area of agreement is water conservation and public education. Therefore, start immediately with public awareness and education. It is important to make the energy and water connection. It is mainstream right now. Connect climate change and water.
- Public education is very important – members of the public are those who need to reduce waste, so they need to know the impact of water wastage.

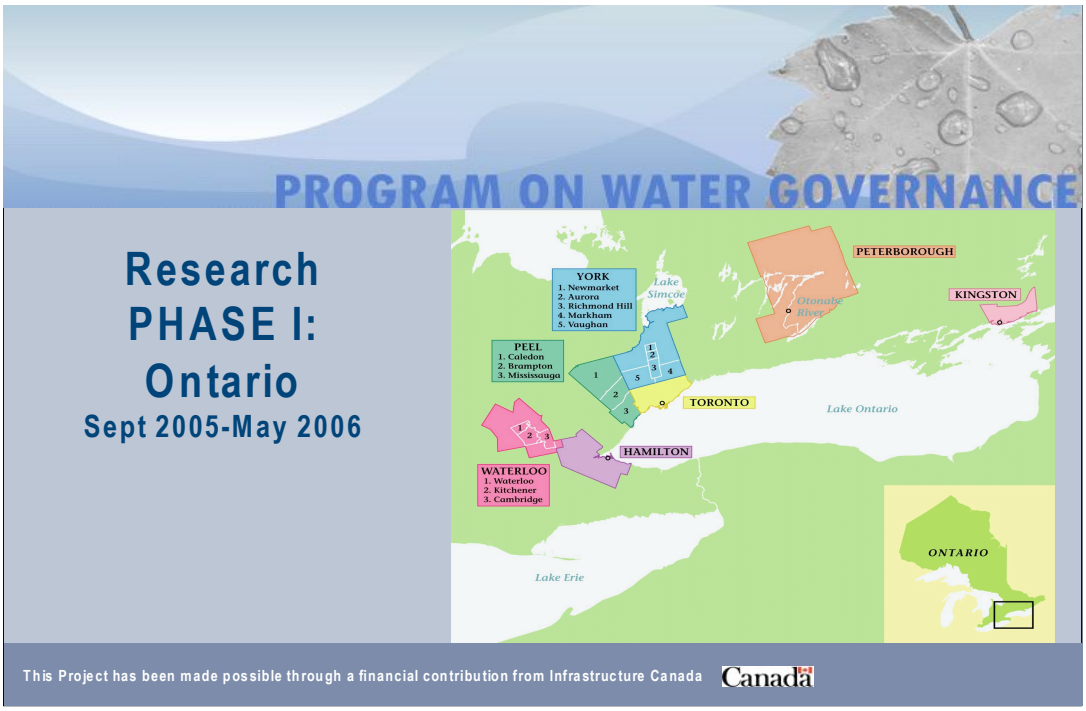
Bringing together diverse expertise, sharing experience

- The quality of ideas that came forward at this workshop and the passion of expression and willingness to attack that which needs to be done is a good sign if it reflects what is happening "out there."
- Ten years ago the sophistication of the people in this room would never have happened. Now there is more diverse expertise engaged in finding the solution.
- Grasp opportunities based in the level of experience heard here today – take what the lessons about what people are doing elsewhere and go home and apply these great ideas. A systematic way of doing this would be to create incubator sites nationally. They are coming in Alberta.

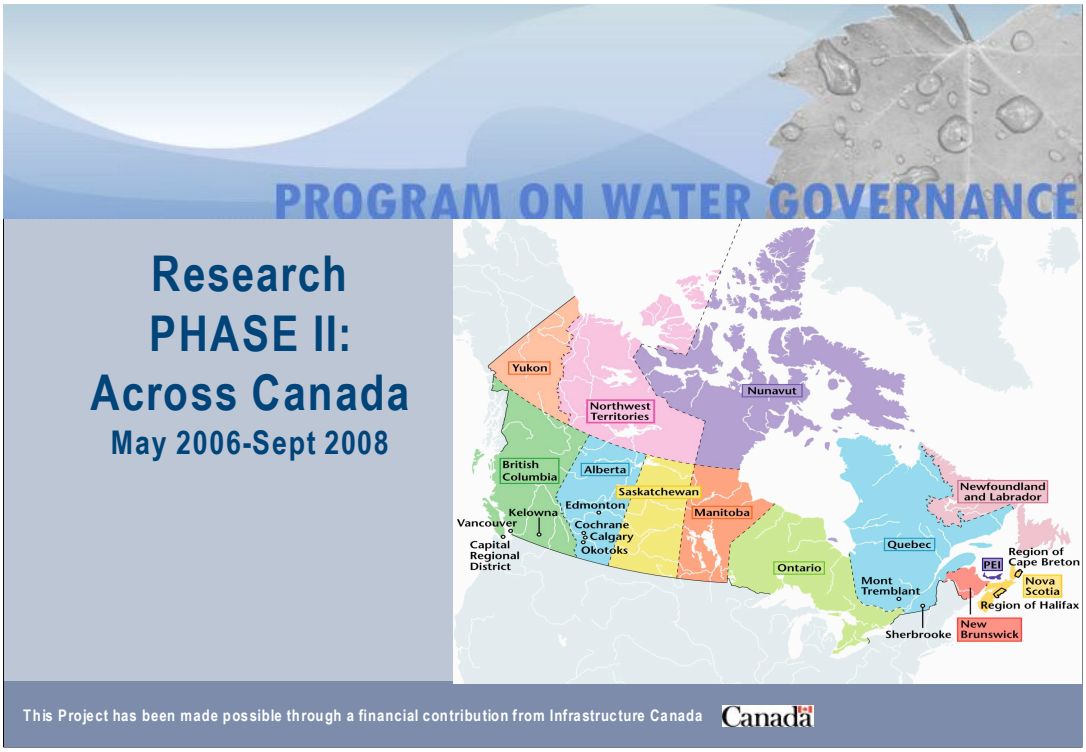
APPENDIX 1:
OVERVIEW OF THE PROGRAM ON WATER GOVERNANCE AND THE MUNICIPAL SUPPLY PROJECT

The Sustainable Water Infrastructure Management in Canada Project is based in the Geography Department at UBC and funded by Infrastructure Canada and the Canadian Water Network. The Principal Investigator is Karen Bakker, Associate Professor Geography, UBC, and the Co-Researcher is Kathryn Furlong, Geography, UBC. To provide context for workshop discussions, Drs Bakker and Furlong reviewed the research approach and results to date.

The research project has been conducted in two phases, with the first focused on Ontario, 2004-07, and the second expanding Canada-wide in the fall of 2007. The research methods included expert questionnaires, eighty key informant interviews and two expert workshops (this is the second). Municipal case studies were central. The selection of Phase I cases studies is illustrated in the following slide.



The Canada-wide case studies of Phase II are illustrated in the next slide.



Key themes arising from the research have been analysed in the draft report, "Sustainable Water Infrastructure Management: Linking Governance and Efficiency in Canada" (Furlong and Bakker 2008).

One area of emphasis is principals of good governance. Research to date has found that

- Certain aspects of good governance (e.g. participation and social equity) are often overlooked in Canadian water supply, but are compatible with current directions in water management.
- Continuous improvement and sustainable water management are mutually supportive and broadly achievable. Both depend on the implementation of mutually reinforcing metering and pricing strategies. Even under budget strain, these can be achieved with appropriate governance arrangements.
- Sustainable water management requires shared governance and a long-term vision. Without a long-term vision, decisions taken today can constrain possibilities and choices long into the future.

Programs for sustainable infrastructure management require action from different levels of government, directly and indirectly, for both their implementation and their success. Certain programs are beyond the mandate of utilities entirely, in which case progress can only be made through action by provincial or federal levels of government.

Another key research theme is shared or multi-level governance. Findings include:

- Increased municipal autonomy can create space for municipal innovation, but does not substitute for provincial and federal action.
- Provincial and federal governments have many unfulfilled mandates in which other governance bodies would like them to engage on issues such as:
    - *Price Regulation:* Independent regulation to ensure that sustainability goals – once agreed upon – continue to be met.

- *Device Regulation and Standard Setting*: Broad support for federal regulation that sets efficiency requirements for water using devices, takes an expansive approach, and is supported by federal standards for manufacture and retail.
- *Allocation and Reuse:* Requires leadership from provincial governments. Important steps include linking water allocation to water efficiency and the removal of legislative barriers to water reuse.

- Municipalities and utilities are seeking collaborative leadership from higher levels of government, including:

  (a) Funding mechanisms that are transparent, accessible and consider the long-term financial commitments that they may impose on municipal service providers;
  (b) Coordination among the various bodies and stakeholders involved in water supply; and
  (c) Renewed commitment to research, innovation and knowledge dissemination.

In terms of governance at the municipal scale, the research indicates that:

- Municipal government can influence sustainable water management in a variety of ways. Working through municipal governance structures can facilitate creative programming through partnerships, and can enable more progressive bylaws. Further, municipalities can facilitate local bureaucracy, seek creative means of bylaw enforcement, and engage creatively in consumer protection.
- Governance and demand-side management (DSM) are mutually influencing. Business models influence sustainable infrastructure management and organizational arrangements for DSM reflect decisions about governance. For example, municipal departments enable more negotiated programs, while arms length models allow easier implementation of economic instruments. Funding and organizational arrangements for DSM programs reflect decisions about the division of responsibilities between municipal government and utilities.
- Small municipalities have particular challenges and opportunities with respect to sustainable water management that can be improved through governance. Creating economies of scope through a variety of strategies would improve capacity for sustainable water management. Small municipalities can avail of particular DSM techniques whose effectiveness is greater in small areas. In particular, this includes community based social marketing (CBSM).

The research leads to the following initial conclusions on governance strategies:

- Reworking business models with a view to how sustainable water management is influenced –
  - In particular, business models can affect the breadth of and support for efficiency programs.
- Broadening governance models, in particular to include distributed governance –
  - Distributed governance can counterbalance some effects of business models.
- Engaging senior governments in their roles to support municipal efforts –
  - E.g. supportive legislation and incentives for efficiency and cost-recovery.
- Fostering capacity for small municipalities –
  - Inter-municipal cooperation and targeted programming can facilitate sustainable water management in many cases.

Dr. Furlong thanked participants for their contributions to the research, in the past and at this workshop, and invited further input through email, noting that the website for the research project is: www.watergovernance.ca/Institute2/municipal.

APPENDIX 2: DEALING WITH UNCERTAINTY AND MANAGING RISK IN WATER SUPPLY

In a lunch hour presentation, Kim Stephens, Program Coordinator for the Water Sustainability Action Plan in BC, looked at how we can adapt to climate change in managing water, and dealing with risk and uncertainty in water supply more generally, using the example of Convening for Action on Vancouver Island. Themes from Mr. Stevens' presentation are summarized below.

Some ideas to keep in mind from a "blue ecology" perspective on climate change include:

> "Climate change is about water and its transformation from one state to another."
>
> "From a water-first perspective, we need to think about how and where the rhythms of water are changing and, most importantly, how we can mitigate the impacts from an interdisciplinary and ecosystems management approach."
>
> "Water needs to be acknowledged by Western science for its central functional and spiritual roles in our world."

An imperative for achieving sustainability is to "design with nature" – a term coined by Ian McHarg that calls on us to mimic the natural environment. The focus is sustainability with respect to terrestrial and aquatic habitat. Design with nature helps us remember that where and how land is developed determines how water is used – i.e., the sustainability of supply and how water runs off the land. Even soils can be severely affected by urbanization. For example, construction equipment significantly reduces the infiltration and groundwater recharge capabilities of soils. Thus, after a few months, a newly graded and sodded lawn can develop a hard "pan," or layer, on or just beneath the topsoil that prevents water from filtering through. The result is that the soils can become almost impervious and have runoff characteristics similar to pavement. Some other consequences of compacted soils are that lawns require more watering and fertilizers and poor soil conditions develop so that there is loss of plant vigor. Since 38% of water use is outdoor, processes like this are important.

As climate change and urban growth and densification processes progress, water risks increase. But we can adapt, or change direction, by improving the built environment and protecting the natural environment. Cumulative benefits accruing over time include sustainable community living. A designing with nature approach is key to climate change adaptation and includes the following measures:

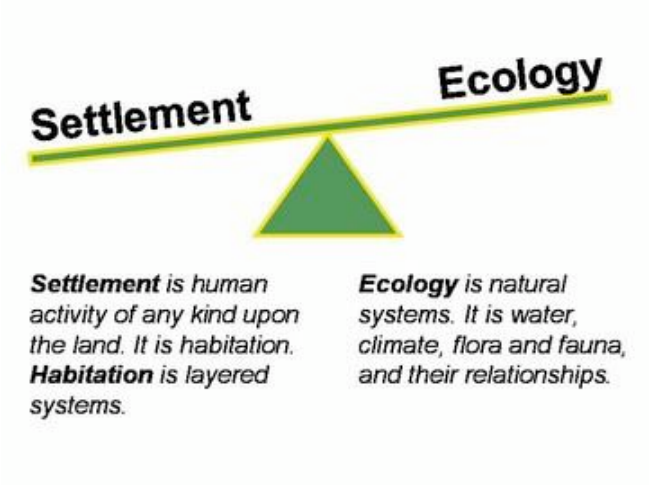
- Develop compact, complete communities.
- Increase transportation options.
- Reduce the loads on water, waste and energy systems.
- Protect and restore urban 'green' space.
- Strive for a lighter 'hydrologic footprint'.
- Achieve higher levels of receiving water protection.

Densification is part of this picture, and workshop participants emphasized the need to consider optimum levels of densification for particular areas. They also noted that that function is relevant as well as structure – how dwelling units are shaped and how the space is used. Equity is another important consideration. Climate change affects some people more than others in terms of how

the impacts are distributed, with the most vulnerable being the elderly and the poor. We may be able to draw lessons from large cities outside of Canada.

Mr. Stephens went on to describe an initiative called Convening for Action on Vancouver Island (CAVI), as a bridge to new forms of water governance. Characterized as "The New Business As Usual," CAVI aims to provide leadership in water sustainability. The initiative has visualized what we want Vancouver Island to look like in 50 years. It promotes water-centric planning and a design with nature way of thinking and acting to create livable communities in balance with ecology. CAVI makes it easy for people to connect, bringing together those who plan and regulate (local government), those who build (developers) and those who provide the legislative framework (the Province). In addition to seeking a common vision, CAVI creates learning and networking opportunities, focuses on the relationship between land and water, and promotes sharing of ideas and experience.

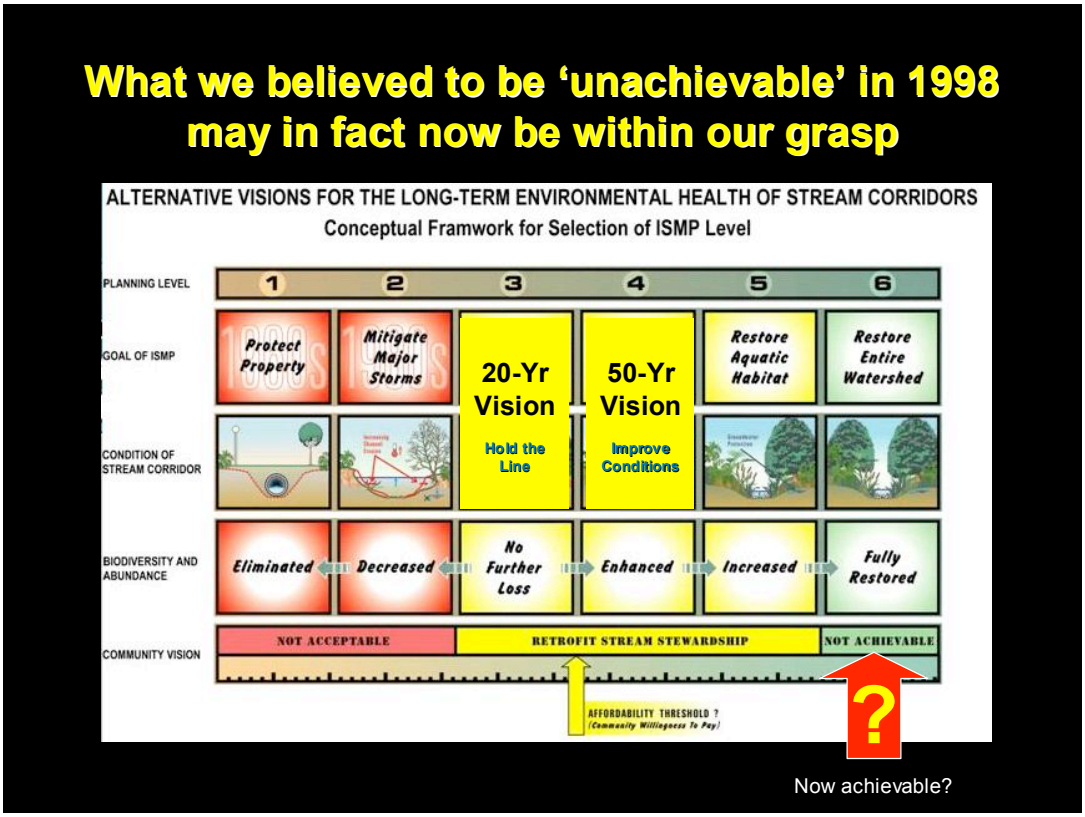
CAVI promotes taking actions on-the-ground that add up to a positive settlement strategy…so that benefits exceed liabilities.



We can create our future in the face of climate change if we keep in mind that getting to the big picture requires starting with the smallest pieces. The essence of effective project management is to operate on two tracks: one track is the big picture, which is the destination; the other track is comprised of the details, because if you don't take care of the details you can be easily derailed. And to deal with uncertainty and manage risk we need to build resiliency incrementally.

There is no silver bullet; we need to do many small things because the flip side of a problem is an opportunity; hence, the flip side of a cumulative impact is a cumulative benefit – over time the benefits accumulate.

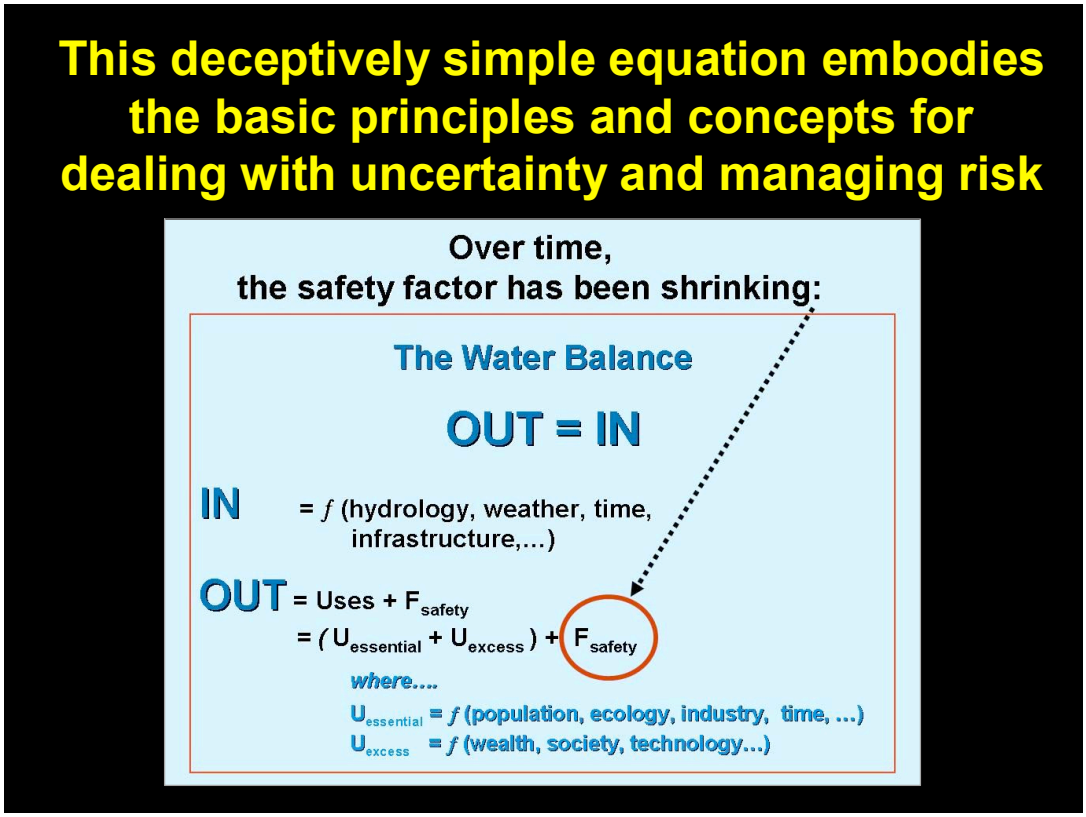
Ten years ago we might have believed that the best we can do with regard to sustainable water management would be to "hold the line." According to the thinking outlined above, there may now be grounds for believing that what once felt unachievable is now within our grasp. The following slide illustrates this prospect.



Yet, over time, the safety factor with regard to our water management calculations has been getting smaller. Considering that a simple version of water balance assumes that out = in, inherent variability on both sides of the equation creates uncertainty which in turn creates risk. There are multiple WHAT IF combinations and permutations.

Looking at BC in particular, while it rains a lot, we do not have an abundance of supply when demand is greatest. Most communities in BC have been vulnerable for decades because we typically tap small creeks and we have few major groundwater aquifers. The nature of the BC geography / topography is that we are typically storage-constrained, and the storage we do have is measured in weeks to months. In short, the issue already is one of "under supply." We already have an efficiency issue, and climate change is aggravating an existing vulnerability. So, if we are vulnerable on the IN side of the equation, then we have to build in resiliency on the OUT side. But where will we do that, keeping in mind that everything is in flux? We look for the little things that will yield cumulative benefits – for example, requiring a foot of soil for all development sites so that there is a sponge that reduces water need and prevents water runoff.

Some of the factors in the logic of this deceptively simple "in-out" equation are illustrated in the following slide.



This quote is offered in conclusion:

> "And finally, we still need to remember that it is not solely wisely developed or green urban infrastructure but human behaviour which ultimately determines our sustainability" (Peter Andzans, Manager, Community Sustainability City of Abbotsford, January 2008)