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ADAPTATION TO
CLIMATE CHANGE TEAM

SUMMARY FOR DECISION-MAKERS
**CLIMATE CHANGE ADAPTATION AND
WATER GOVERNANCE**



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S U M M A R Y R E P O R T

CLIMATE CHANGE
ADAPTATION AND
WATER GOVERNANCE

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This document summarizes the conclusions drawn from the accompanying extensive Background Report, which includes case studies on the Okanagan, BC; the Bras d'Or Lakes region, NS; and the Northwest Territories. Please refer to the Background report for extensive data, research and resources on climate change adaptation and water governance.

PARTNERS

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Zurich Financial Services was a key sponsor for this research session and conference series. Zurich is taking an active role when considering change to the earth's climate and the associated risks it presents. We aim to help customers manage the risks associated with climate change through a dedicated climate change unit exploring approaches to help global businesses respond to this emerging risk, including solutions for customers participating in the growth carbon credit market.

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Please note: The views expressed herein reflect solely those of the authors and do not necessarily represent the views of the Partners.

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EXECUTIVE SUMMARY



Serious water conservation measures must be put into place immediately to reduce the risk of water scarcity, and additional measures ... to ensure that water quality and allocation issues related to reduced supply can be effectively managed.

In most parts of Canada, climate change is increasingly affecting the way water moves through the hydrologic cycle, which up until now has fluctuated within a fixed envelope of certainty. This relatively stable regime is termed ‘stationarity’ by hydrologists. The hydro-climatic conditions that are emerging in response to climate change are increasingly outside this established range to which Canadians have demonstrated an ability to adapt over the last century.

We are beginning to experience increasingly frequent, deeper and more persistent droughts. Simultaneously, we are beginning to experience the same intense rainfall and flooding events that are becoming more common all over the world.

According to climate models, this variability is likely to become greater in the future, which will result in extensive and costly on-going damage, not just to public infrastructure such as roads, bridges and water treatment plants, but to our entire built environment. The fear is that the cost of this ongoing damage may in time be substantial enough to make it difficult to sustain prosperity as we know it today and still keep our cities, towns, national transportation systems and other crucial infrastructure in functional repair.

The economic costs are already clear and rising. The insurance industry is already warning us of these concerns. In August of 2011, the Insurance Bureau of Canada observed that the number and severity of storms is having a negative effect on the industry and that insurers are particularly worried about the rapidly increasing rate of water-damage claims. An industry spokesman reported that, while historically most insurance claims were related to fire and theft, half of every dollar now paid out by insurance companies is for water damage related to extreme weather events. The industry is lobbying governments to invest in infrastructure, including improving sewer systems, to prevent future worsening of the problem.

Warming temperatures will affect water quality widely in Canada especially in areas dominated by lakes and large rivers. Canada’s Arctic will be particularly affected. In some areas, changes in hydrological patterns will also affect water security, including southern British Columbia and much of the prairies. This does not mean water security issues won’t appear elsewhere. Serious water conservation measures must be put into place immediately to reduce the risk of water scarcity, and additional measures such as those described in this document’s recommendations need to be considered to ensure that water quality and allocation issues related to reduced supply can be effectively managed.

Climate change is becoming a risk-multiplier that will test fundamental Canadian ideals related to the social contract that promises citizens peace, order and good government. The primary response to climate change in Canada thus far has focused principally on mitigating impacts by reducing greenhouse gas emissions. While such action is crucial, it is also inadequate by itself. Current and projected atmospheric concentrations of greenhouse gases are substantial enough to mean that further climate change will occur, and indeed is already occurring, regardless of our success in reducing emissions. Therefore, it is important to couple our efforts to mitigate the cause of the problem—in the case of climate

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change: greenhouse gas emissions—with efforts to adapt to the current and anticipated effects of climate change. As water is an essential resource in all aspects of life, social, economic and environmental, one of the most crucial ways to adapt to the growing number of negative consequences and costly feedbacks associated with climate change is to manage water effectively.

Because there is less confusion and debate in Canada about the importance of water than many other resources, the affirmation of a new “water ethic” could be a means of ultimately achieving greater adaptive capacity to climate change, while generating a great many other lasting social, economic and environmental benefits along the way. This, however, will require new governance structures that break down existing jurisdictional fragmentation and institutional territoriality. The breaking down and reformation of governance related to the management of water will, in itself, require a high degree of committed and effective collaboration among jurisdictions.

During the research carried out for the development of this report, however, the authors heard from coast to coast to coast that, even in the face of clear and obvious climate change threats, planners and government bureaucrats are too financially strapped and lack human resource capacity at the levels at which they are working to undertake the kinds of deep reform required to manage water differently, and more effectively, than it is being managed now. Fears were expressed in all but one jurisdiction that we consulted that our country’s political structures and institutions are in fact incapable of dealing with such complex reforms, and that we are doomed as a nation to inferior approaches to adapting our water management practices to increasing climate change effects. Strong evidence from that one jurisdiction, however, suggests that, in fact, this may not be the case.

The federal, territorial and Aboriginal governments with jurisdiction over water in the Northwest Territories have recently demonstrated that there is nothing in the Canadian federalist political structure that makes the kinds of reform necessary to adapt successfully to climate change impossible. The Government of the Northwest Territories and its federal and local partners assumed timely, complete and proactive responsibility for broad community collaboration leading to the development of a new and fully integrated watershed-based territorial water stewardship strategy. In so doing, these three senior levels of government demonstrated that the legal powers are in the appropriate hands and the necessary policy avenues exist to make such changes in governance possible. What is required, however, is pro-active, well-informed, and visionary political leadership.

The Northwest Territories example suggests that the same strong, inspired political leadership applied at national and provincial levels could create the policy reforms necessary to achieve the level of adaptive capacity we need as a nation to respond to the climate impacts on water security that we expect to emerge in the coming decades. We should be cultivating that leadership – and public support for that leadership – now.

Effective governments prefer proposition to opposition. This report outlines a new national proposition on water that aims to strengthen Canada's economy and assure its sustainability while at the same time enhancing our adaptive capacity in the face of growing climate impacts on our national identity and well being, and therefore our nation's future.

Fortunately, Canadian consciousness of our overall good fortune in terms of water resources, and popular understanding of water issues, is growing. We also know from world example much of what needs to be done. Time is of the essence. Our changing climate and hydrology demand that we shift out of the coping zone of stationarity, and adapt to new circumstances.

The extent of adaptation that is likely to be demanded will require that a new set of values must underlie water governance in Canada in the future. The creation of a new water ethic in Canada that addresses this shift comprehensively can be achieved in a series of steps, as outlined in the recommendations summarized below. Please see page 22 for full details.

Short-term Recommendations (in the next 3 years)

1. Firm steps should be taken immediately at federal, provincial and municipal levels to value water appropriately, and promote its wise use and conservation by establishing **national and regional water conservation guidelines**;
2. Governments at all levels should be urged **to formally allocate water to meet nature's needs** and ensure its use is consistent with sustaining resilient and functioning ecological systems;
3. Established knowledge and experience in prediction should be recognized and valued through **the strengthening and harmonizing of flood protection strategies** nationally;
4. Governments at all levels should be encouraged to formally **support the design and sustainability of water supply and waste disposal infrastructure based on ecological principles** and adaptation to a changing climate, with special attention to meeting the needs of First Nation communities;
5. **The value of comprehensive on-going monitoring must be recognized nationally and regionally** and the need for accessible up-to-date information required to manage water in a changing climate fulfilled on a permanent and reliable basis.

Medium-term Recommendations (in the next 3-5 years)

6. **The role of education in public understanding** of the importance of water to our way of life in Canada **should be recognized and formally supported**;
7. **Water must be recognized as a human right** integral to security and health;
8. Holistic approaches to **managing watersheds through collaborative governance** should be supported;
9. **The importance of groundwater must be recognized** and governments at all levels urged to understand and value its role in creating a sustainable future for Canada;
10. Coordinated long-term **national strategies for sustainably managing water in the face of climate change should be valued and developed**.

Long-term Recommendations (in the next 5-10 years)

11. The value of **creating a non-statutory National Water Commission** to advance policy reform and to champion a new Canadian Water **ethic as outlined in this document should be considered**;
12. In order to identify those who care and gain their support for both the necessary reforms and for the leadership that will make those reforms possible, **the government of Canada**, in association with provincial, territorial and Aboriginal governments **may wish to fully articulate and actively and publicly promote a new Canadian water ethic**.

Proposals for reforms of the magnitude listed above should not be dismissed as too ambitious or beyond the capacity of government to successfully achieve. The *Northern Voices, Northern Waters* Northwest Territories water stewardship strategy demonstrates that it is possible to undertake fundamental water policy reform at the provincial or territorial level that incorporates ambitious principles of good water management as defined by the best international example.¹ The strategy demonstrates that it is no longer acceptable to say that such levels of reform are not possible because of legal, legislative, policy, political, or bureaucratic obstacles.

Governments do not have to be limited to playing around at the edges of reform; they are capable of making real change happen. What is needed is leadership. We need to cultivate that leadership now – and find ways to ensure that Canadians support that leadership as it does what needs to be done – if we do not want water availability and quality issues associated with climate change to limit the promise of our social, environmental and economic future.

FIRE & WATER IN THE OKANAGAN

It was August of 2003 and rain had not fallen in British Columbia's Okanagan Valley for 44 days. It had been hot with daytime temperatures over 30° Celsius for weeks. Winter snowpacks, which were lower than average, had long disappeared. This was the driest summer since 1899 and there were no signs that the drought was about to end. Rapidly growing populations and the need to keep the level of Okanagan Lake at acceptable levels for the region's critical tourism economy had put huge pressure on already limited water supplies. Rationing had been imposed in the cities, but conservation was not saving enough water to meet all needs. Deep and persistent drought was breaking down water governance structures. Various jurisdictions – from irrigators in rural districts up to the provincial and federal governments – began arguing over which users were legally entitled to water first. Though not the only dispute over water that summer, what happened with Trout Creek put climate-related water governance challenges in the Basin and elsewhere in Canada into clear relief.

Trout Creek enters Okanagan Lake near Summerland, BC. As the second largest tributary watershed to Okanagan Lake, Trout Creek provides domestic and agricultural water supply, as well supporting important sport fish – notably rainbow trout and kokanee. In 2003, water storage and intake diversions for irrigation resulted in greatly reduced stream flows. As the drought progressed, less and less water remained in Trout Creek. When ordered by Fisheries and Oceans Canada to restore flows to levels that would protect aquatic ecosystem health, the Municipality of Summerland refused to do so. But it wasn't just the supply of water that had everyone on edge. Water exists in close relation to its symbolic and diametric opposite – fire. Apprehension had been growing for good reason about the fire hazard in surrounding forests. Without water, neighbouring forests had completely dried out.

On August 16th, the worst fears of emergency services experts were realized. What some have called one of the greatest natural disasters in history of British Columbia was initiated by a typical summer lightning storm in the middle of the night. The fire started in Okanagan Mountain Park, a 10,000-hectare wilderness that separates Kelowna from Penticton. It was so dry that when lightning struck a single tree it instantly candled into a fireball. Before the resulting conflagration was controlled, 25,000 hectares of forest were reduced to ash; the Canadian Army was called in; and 30,000 people – a third of the City of Kelowna – were forced to flee their homes in what became the second largest evacuation in Canadian history. Though no lives were lost, 250 homes burned to the ground.

After the smoke cleared, the residents of the Okanagan rebuilt – but with new respect for what the relationship between climate and water might mean to their future. What the Okanagan Basin Water Board learned in looking to the future is that, under some climate models, the conditions that occurred in 2003 could on average present themselves every second year by 2030. Models suggested that similar conditions might exist in one of every four years in the Okanagan by 2018. They discovered also that they could not adapt to such circumstances under current water governance structures and institutional arrangements.

New ways of managing water are necessary if communities in the Okanagan Basin are to become sustainable in the face of a warming climate in what is already the driest inhabited region of Canada. With the help of a wide range of provincial and federal agencies and many local partners, the Okanagan Basin Water Board has started down the difficult road toward water policy reform as a means of adapting to climate change. Like similar organizations all over Canada, however, the members of the Okanagan Basin Water Board are worried that accelerating climate change effects may cause the road they are on to disappear from beneath them before they reach their goal.

1 Northwest Territories Ministry of Environment and Natural Resources (2010)

INTRODUCTION

The goal of this ACT policy research project is to explore the relationship between climate change adaptation and water governance in Canada. Preliminary analysis of the effectiveness of water governance structures in three widely different geographic regions suggests that overwhelming obstacles stand in the way of urgently required action on climate change adaptation. In brief, these barriers are: the fragmentation of water governance under the Canadian constitution; reactive governance and lack of a nationally binding policy framework; and information gaps that limit wise management of water in a changing climate. The findings of this study also revealed nested opportunity in addressing the need to change the way we manage water in this country. Put simply, water management in Canada is presently barely coping with the effects of a changing climate and requires more focussed attention to properly address adaptation on the longer term. This paper presents a road map for making the necessary changes to water governance in this country.

Water policy in many parts of Canada has not kept pace with changing political, economic and climatic conditions. While the established division of responsibilities and jurisdiction with respect to the management of water has served our country adequately for more than a century, the policy vehicles that currently dictate how water is allocated, used, and its quality protected were built for an earlier and very different time when the population was lower and more dispersed, and when we had fewer competing uses for our water supplies.



Kelowna then and now: As is the case throughout most of Canada, water law in British Columbia was created for a different era, one in which populations were much smaller and the number of economic uses for water were much fewer than they are today. Climate change will further exacerbate the limits of outmoded water laws, policies and practices. Unless water governance structures can be harmonized and streamlined, the potential to adapt to climate change will be greatly limited in many parts of Canada.

Because water policy in Canada has not kept up with population and economic growth, we find ourselves confronted today with two converging challenges, both of which are being exacerbated by a changing climate. First, much of our legislation was crafted to meet 19th century water allocation needs within the context of 20th century technology and hydrological understanding. Second, the way we currently manage water in Canada is not adequate to 21st century circumstances, in which the integration of nature's need for water and broader ecological protection of water sources while adapting to climate change have become crucial factors in sustaining economic and social development.

Because of the manner in which jurisdiction over water is atomized in Canada, it is difficult to change our water management practices quickly enough to address the growing array of surface and groundwater problems that are

appearing across the country, or to take full advantage of new technologies and best practices that could greatly improve the efficiency of water use in both economic and environmental terms.

Both these challenges are affected by a changing climate. Climate change effects on water have been clearly identified by researchers all over the world. Warming temperatures have already begun to alter the extent and timing of precipitation and run-off in some regions of Canada. We are also beginning to understand the direct link that exists between water and its diametric and symbolic opposite – fire. The effects of climate change are expected to accelerate and compound in ways that are neither predictable nor uniform as global temperatures continue to warm, with potentially alarming effects on water security in some areas of the country. This is not something we can ignore.

In places like the Okanagan, climate change is already making our outmoded system of water management more vulnerable to disruption with potentially disastrous future impacts on the economy and way of life. Even in relatively water abundant areas, such as Nova Scotia and the Northwest Territories, climate effects on the delicate balance of water supply to natural systems is of growing concern.

On the positive side, many municipalities, regional districts, some provinces and territories, and a number of federal agencies have committed to formal processes of evaluation of adaptation potential at various scales in different regions of the country. Much of this focus on adaptation to climate change has been on ensuring reliable water supply, not just for domestic and industrial needs, but also for economic and environmental sustainability now and under changing conditions in the future.

Municipal leaders and policy-makers across the country are discovering that improved water management for its own sake has the potential to achieve a number of important sustainability goals in a broad range of economic sectors, which together will add up to greater adaptive capacity.

Provided that climate change is contained within reasonable limits by fossil fuel emissions reductions, the harmonizing and streamlining of federal, provincial, regional and municipal water governance structures and functions will go a long way to make adaptation to climate effects on water resources possible even in already water-stressed areas of the country.

FOLLOW THE WATER: WATER POLICY REFORM AS A VEHICLE FOR ADDRESSING BROADER ENVIRONMENTAL & ECONOMIC CONCERNS

In the course of this project, we visited three Canadian communities. While each was at a different stage in the adaptation process, the communities, which were as widely separated as Kelowna in British Columbia; Sydney, Nova Scotia; and Yellowknife in the Northwest Territories, had each arrived at a common conclusion about how to most effectively begin the process of adapting to climate effects that are already beginning to appear. Expert observers in each of these communities stated that the most effective way of quickly defusing the climate threat is to manage water more effectively and in a more integrated way. They have seen that better water management in itself will make it possible to solve a number of other problems, while at the same time assuring that climate-related water quality and quantity issues don't threaten their economic and social future.

This point was particularly well made by former Deputy Minister of Environment for the Government of Nova Scotia, William Lahey, at a forum held as part of this project on Cape Breton Island in the autumn of 2010. Mr. Lahey indicated that a new Canadian water ethic might be what is needed to bring about widespread change in the way we manage and protect water, not just in Nova Scotia, but also everywhere in the country. Effective policy change, he explained, needs an organizing principle or ethic around which the people and the politicians that represent them can rally.

By way of demonstrating the power of such an ethic, Mr. Lahey cited the health care debate that took place in Canada during the 1960s, when the ethic of universal access to health care for everyone emerged as the driving principle in the reform of our country's health care system. Mr. Lahey noted that, though simple, the ethic at the heart of this principle was strong enough to survive repeated attacks on it even by powerful interests advocating for private health care.

Mr. Lahey suggested that climate change adaptation in Canada could be rapidly advanced if Canadians got behind a new water ethic in the same way. Mr. Lahey further argued that, if that were to happen, political leaders in many parts of Canada could – because there is less controversy and debate about water than many other resources – move quickly to address a good many related environment problems simultaneously en route to better water management.

The affirmation of a new water ethic, he pointed out, could be a means of ultimately achieving greater adaptive capacity to climate change while generating a great many other lasting social, economic and environmental benefits along the way.

EXISTING WATER GOVERNANCE ISSUES

Most studies cite population growth as the principal driver of increases in the global demand for water.² Although there are uncertainties surrounding future population projections, research shows that medium-range growth in the world population is likely to be 30% between 2000 and 2025 (to a total of 8 billion), and 52% between 2000 and 2050 (to a total of 9 billion).³ At a minimum, the fact that medium-range growth in global population is expected to lead to 9.3 billion people on the planet by 2050 invites questions as to whether there will be sufficient water to support increases of this magnitude. The concern becomes more urgent when we take into account the fact that that nearly all of this growth will occur in developing countries, many of which had inadequate or barely adequate water supplies to support the population levels that existed in 2000. Furthermore, economic development is likely to fuel increased demands for water both directly, in the growth of water-consuming industries, and indirectly, in the form of dietary and other life style changes that tend to be more water consumptive.

In short, the global picture is almost inescapably one of growing demand in the context of static or shrinking supplies. It is becoming ever more evident that a new world order is about to emerge out of the collision between population and economic growth and our planet's rapidly changing hydrology. Already, the divide is growing globally between freshwater "Haves" and "Have-nots." Many analysts believe that this explosive fault-line is likely to widen across the entire 21st century political, social and economic landscape.⁴ We should expect global water security, and its implications for food security, health and industry, to be among the most pressing political issues of our time.

The amount of water available to a given nation will determine its industrial capacity and the quality of life that citizens enjoy as a result of nature receiving the water it needs to make places worth living in. Prosperous countries in the future will be those that have enough water for food, for cities, for industry and for nature – and that know how to ensure that each gets what it needs.

Canada stands to be a leader in this emerging new world water order, but only if it can ensure that the serious problems and unfortunate paralyses that have emerged so widely elsewhere in the world with respect to the management of water do not gain a permanent foothold in this country.⁵ Although the same population growth and economic pressures that together have created a global water crisis elsewhere have already begun to appear here, Canada has begun to move in the direction of governance changes that, if more effectively and widely focused, could place it in a leadership position.

While this report focuses largely on climate impacts on freshwater and how governance processes might adapt to them, climate change is only one of many threats affecting water security in Canada as identified by Environment Canada.⁶ These threats include: a growing number of water-borne pathogens; the growing effects of persistent organic pollutants and mercury; the widespread contamination of streams, rivers and lakes throughout southern Canada by agricultural run-off; aquatic acidification; the ecosystem effects of genetically modified organisms; urban run-off and municipal wastewater effluents; industrial point-source discharges; mine water, landfills and waste disposal contamination; and growing concerns over the concentration of endocrine-altering substances in our water supplies. Together these problems contribute to ongoing loss of biodiversity and to diminished ecosystem function.

2 LeRoy, 1995; Gleick, 1998; Gleick, 2000; Vörösmarty, Green, Salisbury and Lammers, 2000; and Cohen and Kulkarni, 2001

3 United Nations, 2010

4 Solomon, 2010

5 Sandford, 2009

6 National Water Research Institute, 2002

WATER, CLIMATE CHANGE & FIRST NATIONS

Two workshops were held in Canada, one in the east and one in the west, to identify potential policy directions relating to First Nations water security and climate change. Eighteen participants from First Nations across Canada took part in each of the workshops along with five to six staff from ACT and its partner and co-host, the Centre for Indigenous Environmental Resources (CIER).

Participants in the workshops were of the common view that Canada requires a clearly expressed vision of the future of its waters. It was noted that the last time Canada attempted to set out a vision that could unite its citizens and set the boundaries of and direction for development in Canada was with its 1987 Federal Water Policy. Despite the comprehensiveness of this policy at the time, subsequent governments have not, for the most part, honoured its commitments. Now, over twenty years later, the world climate is experiencing massive shifts, and Canada has no contemporary national, let alone federal, water policy to address the changing pressures on our water, in particular those resulting from climate change.

It appeared to participants in the forums that there has been a retreat from the commitments made in the Federal Water Policy due to a shift in perspective by the federal government which means it now sees its role in water management as more limited, and certainly less relevant, than that of the provinces. Many disagree with this retreat, and instead are mobilising renewed efforts to articulate a national vision for water in Canada in order to ensure the protection and sustainable use of our water, for ourselves and all other species that live, or will live, here. This is particularly important given the threats and shifts that have occurred, and will continue to occur, due to a changing climate.

Many First Nations are of the view that their contributions to a national vision for water extend beyond rights considerations to include those Indigenous teachings and knowledge that could help to inform Canadians towards a better understanding about the interconnections, and dependency, that we have with and upon water. Indigenous cultural values can remind us, even re-educate us, about a relationship with water that is about sustainable use and respect. Many First Nations that participated in the ACT Policy Forums indicated that they were seeking to employ in their planning and management activities the principles and practices that flow from traditional relationships with water; this approach could also be the foundation of a national visioning exercise. A national vision for water, one that, in particular, sets out the way we will govern ourselves with respect to water management, would assist to coordinate water governance and management activities across Canada. In particular, as there is increasing momentum behind developing regional watershed area plans, this would aid in ensuring consistency between them where possible.

Water rights are also a concern among First Nations. Water rights are described in many ways, but generally they range from rights to use water (for example, through having riparian rights, or a water use license granted by a provincial government) through to full 'ownership' of water. Most Canadian governments claim full ownership of the waters within their boundaries; as a result, there is great disagreement as to the scope of rights possessed by First Nations. First Nations have long held that water was not the subject of treaty negotiations, and oral histories indicate that the early treaties intentionally left out discussions about water because it was so sacred. The numbered treaties did acknowledge that First Nations would continue "to hunt, fish and trap and more generally to live off the land" which suggests that water rights were included in the protections granted by the treaties. However, because these rights were not explicitly laid out, what they might look like and how they might be implemented continues to be debated and as such, remains an unresolved issue in most areas of Canada.

CLIMATE CHANGE AS A RISK MULTIPLIER

Climate change is a serious risk multiplier. As noted above, Canada's water resources and related ecosystems are already under increasing strain; climate change will compound these existing problems as well as creating new challenges. Our current fragmented approaches to water management stand in the way of addressing these water challenges in an integrated way, increasing our vulnerability to the effects of climate change.

Changes in Canada's climate are already affecting water systems across the country, with ongoing impacts anticipated as these changes accelerate and intensify. Climate change influences the hydrologic cycle, which in turn affects surface water and groundwater, ice and snow, ecology and habitat, weather patterns, the oceans, and other environmental factors.⁷ Experts predict that climate change will increase precipitation, evaporation, water temperatures, and hydrological variability across Canada, all of which will negatively affect the quality of our water.^{8,9,10,11,12} While climate change and climate influences on water show general consistency across the country, regional differences are also apparent. Table 1 outlines some of the region-specific climate change impacts on water.

Table 1 - Potential impacts of climate change on water resources across Canada¹³

REGION	POTENTIAL CHANGES	ASSOCIATED CONCERNS
Yukon and Coastal British Columbia	Increased spring flood risks (BC), impacts on river flows caused by glacier retreat and disappearance	Reduced hydroelectric potential, ecological impacts (including fisheries), damage to infrastructure, water apportionment
Rocky Mountains	Rise in winter snowline in winter-spring, possible increase in snowfall, more frequent rain-on-snow events	Increased risk of flooding and avalanches
	Decrease in summer streamflow and other changes in seasonal streamflow	Ecological impacts, impacts on tourism and recreation
Prairies	Changes in annual streamflow, possible large declines in summer streamflow	Implications for agriculture, hydroelectric generation, ecosystems and water apportionment
	Increased likelihood of severe drought, increasing aridity in semi-arid zones	Losses in agricultural production, changes in land use
	Increases or decreases in irrigation demand and water availability	Uncertain impacts on farm sector incomes, groundwater, streamflow and water quality
Great Lakes Basin	Possible precipitation increases, coupled with increased evaporation, leading to reduced runoff and declines in lake levels	Impacts on hydroelectric generation, shoreline infrastructure, shipping and recreation
	Decreased lake-ice extent, including some years without ice cover	Ecological impacts, increased water loss through evaporation and impacts on navigation

7 Lemmen et al, 2008

8 Ibid.

9 LiveSmart BC, 2010

10 Lemmen and Warren, 2004

11 NRCan, 2011

12 Environment Canada, 2010

13 Lemmen and Warren, 2004

REGION	POTENTIAL CHANGES	ASSOCIATED CONCERNS
Atlantic	Decreased amount and duration of snow cover	Smaller spring floods, lower summer flows
	Changes in the magnitude and timing of ice freeze-up and break-up	Implications for spring flooding and coastal erosion
	Possible large reductions in streamflow	Ecological impacts, water apportionment issues, hydroelectric potential
	Saline intrusion into coastal aquifers	Loss of potable water and increased water conflicts
Arctic and Sub-Arctic	Thinner ice cover, one- to three-month increase in ice-free season, increased extent of open water	Ecological impacts, impacts on traditional ways of life, improved navigation, changes in viable road networks
	Increased variability in lake levels, complete drying of some delta lakes	Impacts on ecosystems and communities

The sheer extent of the projected impacts of climate change on water resources across Canada should serve as a strong incentive to ensure that we adapt appropriately to minimize negative effects. Yet our current approach to water management is so far proving largely ineffective at enhancing our resilience in the face of climate change. A June 2010 report from the National Round Table on Environment and Economy confirms that Canada’s water management approach is out-dated, and highlights climate change as one of the four most important water sustainability issues affecting the nation, predicting that it will transform the way we manage water.¹⁴ One of the top concerns associated with climate change is the growing problem of change in what hydrologists term “stationarity.”

THE CRUCIAL ISSUE OF WEATHER STABILITY

Stationarity is the notion that seasonal weather and long-term climate conditions fluctuate within a fixed envelope of relative certainty.¹⁵ Stationarity therefore implies stability and a relatively high degree of certainty when it comes to predicting and managing the effects of weather and climate on our cities and our agriculture. For instance, the fact that we have determined that natural phenomena fluctuate within a fixed envelope of relative certainty suggests that winters will only be so cold and summers so hot; that melt from winter snow packs will always contribute roughly the same amount of water to our rivers; that rivers will rise only so high in spring and fall so low in autumn; that lightning will strike only so frequently; and that tornadoes will only occur at the most extreme margins of the weather conditions we have come to expect.

Stationarity gives us the comfort we need to build our houses to withstand winds of a certain speed and snowfalls of a certain weight. It suggests we have to build storm sewers only to a certain size because we know from history that rainstorms last only so long and result only in so much runoff. Stationarity also suggests that sea level won’t rise dramatically; that earthquakes will happen only so often; and that major meteor strikes will occur only at certain geological intervals.

Stationarity is the foundation for determining insurance rates related to risks associated with the protection of our homes, property and food crops from fires, flood, tornadoes, hurricanes and droughts, as well as the foundation of the reliable function of the natural ecosystem processes that provide a stable and resilient backdrop to human existence.

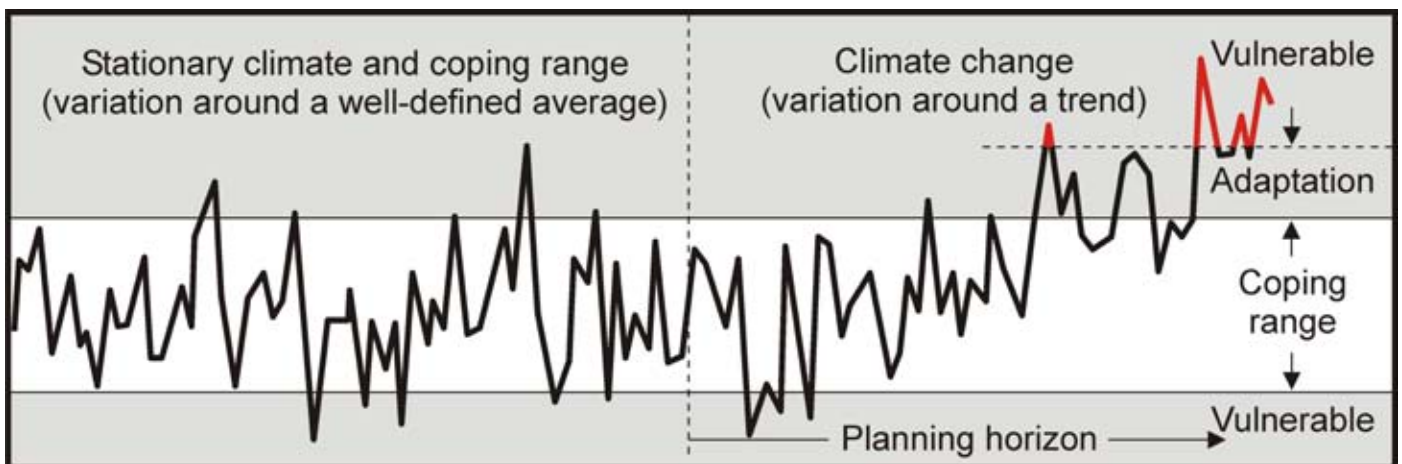
¹⁴ Canada National Round Table on the Environment and the Economy (2010)

¹⁵ Milly et al, 2004

Now, increasing average temperatures, climate change impacts on weather patterns, and extensive changes in land use globally are altering the patterns of water’s movement through the global hydrological cycle. This means that statistics from the past related to how surface, subsurface and atmospheric water will act under a variety of given circumstances are no longer reliable. Unfortunately, we have made the stationarity associated with those statistics – the notion that natural phenomena fluctuate within a fixed envelope of certainty – the foundation of risk assessment in engineering upon which we depend for the construction of our buildings, roads, bridges and other infrastructure. We have also made stationarity the foundation of planning for the future.

Hydrologists throughout the Western Hemisphere have observed that, because climate and earth systems are in constant change, it can in fact be argued that what we have actually done is establish our own mathematical interpretation of the range of natural climate variability in the global hydrological cycle that represented too brief a period of record. We then built our society and the entire infrastructure that supports it around that range which we now increasingly realize no longer represents reality.

We do not as yet have an adequate replacement for stationarity statistics. Until we find a new way of substantiating appropriate action in the absence of stationarity, risks will become increasingly difficult to predict or to price. So will the prospect of conflict associated with those risks.



The term Adaptation Deficit was coined by Dr. Ian Burton, one of Environment Canada’s leading experts on climate change adaptation. Essentially, adaptation deficit refers to not recognizing or fully acknowledging the evidence that our climate system and related services are moving in a direction that is beyond the range of our current capacity to adapt. This graph illustrates the fixed envelope of relative certainty in which we have come to expect our weather and climate to fluctuate over a typical period of time that engineers would consider in the design of major infrastructure such as bridges and highways. It also illustrates the increasing number of extremes to which we will have to adapt over time. The graph illustrates that the loss of stationarity is, in fact, making our society increasingly vulnerable to accelerating climate change effects.¹⁶

WATER & CLIMATE CHANGE IN THE OKANAGAN

The Okanagan Basin is a semi-arid valley in south-central British Columbia that has a growing population, significant agricultural development, and existing areas of stressed water resources. Statistics Canada identifies the Okanagan as having the smallest per capita freshwater availability in Canada.

The Okanagan has responded to the need for effective water management, and has made significant progress in preparing for the anticipated impacts of climate change and population growth with the development of adaptations for water management.

Scientific research since 2000 involving climate trend analysis, general circulation model application, and hydrologic modelling/analysis projected a broad range of expected influences of climate change on water resources in the Okanagan Basin. These include a decline in Okanagan Lake inflows; a change in streamflow timing, with earlier onset of seasonal peak streamflow and an extended low flow period; increased frequency of drought and/or longer drought periods and an increase in crop water demand (longer, drier, hotter growing season). Other projected effects included increases in residential water demand during the growing season (with additional increases due to population growth); increases in late summer water shortages; high variability (both seasonal and yearly) in both water supply and water demand, and increases in health related issues associated with water quality.

The evolution of climate change adaptations for water resources management in the Basin (since the early 2000s) is a process that has been influenced by components of a regional climate change adaptation framework. Within this regional framework, a decade of collaborative discussions and research, combined with the need for adaptations and the existing governance structure, has led to and legitimized the actions proposed in the Okanagan Sustainable Water Strategy (OSWS). The OSWS outlines 45 actions dealing with source protection, security of water supplies, and delivering the strategy. The actions in the OSWS are currently at the pre-implementation to implementation stage. The OSWS represents a coordinated approach that will promote regional adaptation to climate change as the actions are collectively applied.

Key factors or concepts that have influenced the successful development of water management adaptations in the Okanagan include:

- A governance structure which has characteristics of a distributed-multi level approach
- A history of multi-stakeholder involvement
- Availability of knowledge and research
- Preparation
- Regional thinking
- Educated and innovative policy makers
- Effective communication

The Okanagan Basin Water Board hopes that these factors may be useful to guide other regions as they move forward with adaptations to climate change.

THE CONSEQUENCES OF LOST STABILITY

While some Canadians may welcome some warming associated with a changing climate, they will not welcome the loss of hydro-climate stability that accompanies that warming. Take Toronto, for example, which has endured four 1-in-100 year storms in the past 20 years. This means that storms that could be expected once a century, or had a 1% chance of happening in any given year, occurred four times in only two decades. One of these storms caused \$550 million in infrastructure damage in two hours.¹⁷ The same increase in the frequency of extreme weather events has been observed in other Canadian cities, including Victoria, Vancouver, Edmonton, Calgary, Saskatoon, Winnipeg and Halifax. It is here, with the immediate prospect of more frequent floods and more intense drought, heavier rainfalls and bigger snow storms, that our climate woes could really begin.

La Niña years, in which cooler temperatures and greater precipitation occur, often leading to record snowfalls, have encouraged some people to keep believing that nothing is changing, but these events will be less frequent over time. Researchers at NASA concluded in January of 2010 that, despite large year-to-year fluctuations associated with the El Niño – La Niña cycle of tropical ocean temperature, the global temperature continued to rise rapidly in the past decade. Evidenced by the worst fire season in history in Russia, the world reached record high global temperatures last year (2010) as measured by instrumental data.¹⁸ Pakistan experienced the fourth highest temperature ever recorded, 53.7°C, in June 2010.

Ever more frequent extreme weather events continue to drive home the realization that the enormous cost of repairing the damage could make it very difficult to sustain our prosperity, while at the same time protecting and improving our environment.



Because urban infrastructure in Canada was designed for earlier, less turbulent, climate regimes, extreme weather events are causing huge damage in many Canadian cities. A 2005 storm in Toronto, illustrated above, caused \$550 million in damage to roads and water systems in only two hours. (Photograph courtesy of the City of Toronto.)

17 Sandford, 2009

18 World Meteorological Organization, 2011

LOOKING FORWARD IN THE OKANAGAN

The drought and fires of 2003 were a crisis point in the Okanagan, but one that brought the valley's vulnerability into sharp relief and illuminated the need for change. A movement began, in which community leaders worked across political boundaries to create a vehicle to collaborate on water management. Created in 1970, the Okanagan Basin Water Board had never been fully tested in its role of encouraging local governments to pool resources and make joint water management decisions. Following 2003, however, it was given a new mandate to take the lead on regional science and policy for climate change adaptation, population growth, and other shifts in society and the environment.

In the Okanagan, the first steps have been to build partnerships and strengthen communication with stakeholder groups, research institutions, and other levels of government. The Okanagan Water Stewardship Council was established as a formal way to bring together these groups to advise the Water Board, and to create the Okanagan Sustainable Water Strategy. The Council, and other, more ad hoc, partnerships have paved the way for basic water science studies and to rebuild water monitoring networks – calculating real water needs for fish, for food production, and for basic sanitation. Plans built on good science are more durable, and level the table for working on agreements with mutual benefits. Good planning will then shape the form of development and the design of infrastructure – the bones of communities.

This is a new era for the Okanagan. The people in this region have learned that adaptation or “sustainability” isn't a state that a region arrives at. It is a process of responding flexibly to situations as they arise – armed with good information. Collaboration, especially for water management, allows for that flexibility.

The Okanagan example underscores the fact that we are perhaps one of the few countries in the world that could create a new water ethic. Unlike so many other places in the world, Canada still has room to move in how it manages its water resources. By breaking down jurisdictional barriers to integrated water management we could become a sustainable society. By becoming a sustainable society with respect to water use and management we have a far better chance of adapting to climate change. If this is what we desire, however, we should be working hard now to break down barriers to enhancement of adaptive capacity while the room to move is still there.

WE ARE COPING, NOT ADAPTING

Despite groundbreaking work being done in places like BC's Okanagan Basin and by various levels of government, even the most progressive jurisdictions are only in the pre-implementation or early implementation stages of effective adaptation. This report suggests that it is unwise to take too narrow or isolated a view of what climate change is going to do or mean. Most Canadians are still thinking linearly about climate change, and not learning that these are repeated events; still thinking the effects will be local, minor and cumulative, when in fact it will not be long before climate change will be affecting everyone everywhere, simultaneously compounding regional, economic, social and political disparity. As this happens, we should expect the costs associated with droughts in places like the Okanagan and floods in places like Manitoba to rise. As those costs rise, we should also expect the potential for general tensions and conflict to rise with them.

THE NEED TO ADAPT

The primary response to climate change thus far has focused principally on mitigating it by reducing greenhouse gas emissions. While such action is crucial, it is also inadequate by itself. Current and projected atmospheric concentrations of greenhouse gases are substantial enough to mean that further climate change will occur, and indeed are already occurring, regardless of our success in reducing emissions.^{19,20} Therefore, it is important to couple our efforts to *mitigate* the cause of the problem—in the case of climate change: GHG emissions—with efforts to *adapt* to the current and anticipated effects of climate change.

Adaptation is intended to reduce vulnerability and enhance resilience, which is defined as follows by the Intergovernmental Panel on Climate Change (IPCC): Resilience is “the ability of a social or ecological system to absorb disturbances while retaining the same basic structure and ways of functioning, the capacity for self-organization, and the capacity to adapt to stress and change.”²¹

¹⁹ Field et al., 2007

²⁰ Meehl et al., 2007

²¹ Parry et al., 2007, p. 37

In 2009, ACT investigated and confirmed the effects of climate change on biodiversity. In his Summary Report,²² lead policy author Jon O’Riordan recommended that governments transition to governance structures in which all land and water-based decisions are either made by a single agency, or coordinated across several agencies through the oversight of a single agency and that there be an alignment of legislation and regulations to ensure resource decisions are based on ecological principles that support ecosystem resiliency in a changing climate. British Columbia adopted this approach with the creation in 2010 of the Ministry for Natural Resource Operations, which consolidated all resource decision making into a single integrated decision-making model. The government is currently analysing how water decisions will be made under the proposed Water Sustainability Act, which will balance efficiency of decision making with sustaining the ecological health of watersheds.

This approach, however, is at odds with the linear system of engineering that was and continues to be the main paradigm governing water management in the 20th century. In linear system engineering, physical projects are designed to supply water, control floods, improve drainage and support transportation. Although subject to environmental assessments, these projects have tended to degrade ecological system functionality and require large fiscal and engineering resources. In an adaptive paradigm, the emphasis should switch to ‘engineered ecology’, in which maintaining or restoring ecological function is paramount to retaining ecosystem resiliency. Examples include ‘low impact design’ in the management of rainwater to increase use of natural drainage systems rather than engineered solutions; demand management and water conservation to reduce the need for new water supply projects; and protecting wetlands and flows in rivers and streams to sustain ecological function.

Such strategies underscore the value of adaptive rather than reactive approaches to managing water. One key example is embedding the concept of ‘public trust’ in water governance. This means that all levels of government have a fiduciary duty to protect public rights to clean and secure water supplies and to maintain healthy ecosystems, and that these interests override private rights through licensing and water allocation. Public trust is the heart of an adaptive approach to water management that builds natural ecological resilience by increasing the capacity of a given water system to absorb disturbances, making it more responsive to change.²³ It requires a focus on maintaining ecological integrity of watersheds; using water more than once; an experimental approach that promotes learning; management at the basin scale; multi-level governance; stakeholder participation; open, coordinated sharing of learning; strong and persistent leadership; and; the creation of financial and insurance mechanisms that promote appropriate attitudes toward water use and protection.

The most commonly recommended adaptation options for the water resources sector all represent ‘no-regrets’ approaches, meaning that their implementation would lead to benefits irrespective of the effects of climate change. These include:

- Water conservation measures;
- Providing ecological flows in watersheds;
- Retaining properly functioning ecosystems;
- Improved planning and preparedness for droughts and severe floods;
- Improved water quality protection from cultural, industrial and human wastes;
- Enhanced monitoring efforts; and
- Improved procedures for equitable allocation of water.²⁴

It is important, however, to emphasize that adaptation involves more than merely a new approach to designing infrastructure and investing in new technology. Truly effective adaptation demands a holistic approach, which includes “adjusting *decisions, activities, and thinking* because of observed or expected changes in climate in order to moderate harm

22 Adaptation to Climate Change Team, 2009

23 Blumm, 2010

24 Lemmen and Warren, 2004

or take advantage of new opportunities.”²⁵ Well-planned, practical policy options are essential if we want to effect lasting, sustainable change in our water governance in Canada. But even the most progressive water management approach cannot succeed in creating the level of adaptation required without the breaking down of jurisdictional and other barriers to improved watershed governance.

FOLLOW THE WATER

In many areas of Canada, water is the most visible and immediately relevant measure of climate effects and changes. Liquid water, snow and ice respond directly, visibly and measurably to temperature. If we follow what is happening to our water, it will tell us what is happening to our climate. As was proposed in Nova Scotia and embodied in public policy in the Okanagan and the Northwest Territories, the affirmation of a new water ethic can be a means of ultimately achieving greater adaptive capacity to climate change while generating a great many other lasting social and economic benefits along the way.

BARRIERS TO EFFECTIVE ADAPTATION

While the need for a holistic approach to adaptation in the water resources sector in Canada is clear, ACT has identified several key obstacles to achieving this goal, including: the high cost of infrastructure replacement, jurisdictional fragmentation, reactive governance, policy gaps, and gaps in information. Other organizations, such as the Canada West Foundation, have also identified these obstacles.²⁶ The following sections briefly outline each of these barriers:

THE HIGH COST OF INFRASTRUCTURE REPLACEMENT

Adaptation to the water-related effects of climate change will require expensive infrastructure upgrades. The cost of such infrastructure and the limited fiscal capacity of governments to replace infrastructure are enormous obstacles to increasing resilience and therefore pose significant barriers to effective adaptation.

JURISDICTIONAL FRAGMENTATION

Responsibility for water resource management in Canada is fragmented due to the Canadian Constitution, which divides legislative power over freshwater between the federal government and the provinces, producing a complex regulatory web that spans municipal, regional, provincial and federal orders of government. Although no powers are explicitly delegated for “water” or the “environment”, the constitution identifies many responsibilities that necessarily include these topics. The federal government has constitutional power over fisheries, transboundary waters and First Nations lands; provincial governments have power over water quality regulation, allocation rights and land use; and municipalities are most often responsible for land-use zoning, water services and infrastructure.²⁷ Furthermore, different ministries and departments have their own internal requirements, standards and regulations that are often not well coordinated. The intersections of these responsibilities both vertically and horizontally create competing pressures that both cause key issues to slip through cracks, and throw up confusing barriers for practitioners and politicians alike. Many of the same kinds of problems exist within and among Aboriginal governments.²⁸

25 Policy Research Initiative, 2009

26 Gibbins and Sommerfeld, 2011

27 Cote, 2004

28 Phare, 2009

The complexity, fragmentation and lack of coordination of water policies in Canada creates policies that are often inconsistent with one another with respect to drinking water quality standards, ecosystem protection, allocation rights and climate change adaptation. According to Dr. Karen Bakker, editor of the book *Eau Canada: The Future of Canada's Water*, the trend of “passing the buck” between orders of government creates “an ill-coordinated downshifting of responsibilities leaving key areas in a policy vacuum.”²⁹ As Canada's water resources come under increasing pressure from climate change in the coming decades, exacerbating existing challenges and creating new ones, it is crucial that all orders of government address this source of vulnerability by working toward the inter-jurisdictional harmonization of water regulation and the movement toward the integration of land and water management at the watershed scale.

WATER & CLIMATE CHANGE IN THE BRAS D'OR LAKES REGION OF NOVA SCOTIA

The Bras d'Or Lakes region has created initiatives and organizations that are groundbreaking in their efforts to drive collaborative governance of water and ecosystems, placing the region in an advantageous position to design and implement adaptation measures. For instance, the multi-level governance and stakeholder NGO CEPI (Collaborative Environmental Planning Initiative) brings people from all relevant organizations together, makes connections and creates networking – all based on positive reinforcement.

However, the region's governance organizations are still struggling with limited resources, aspects of jurisdictional fragmentation, and lack of information about climate impact projections, as well as a need for greater access to data analyzing climate impacts that the region must prepare for, actions they would be well advised to take and associated socio-economic implications.

Climate change itself has not constituted a strong driver in the formation of organizations nor initiatives and decision-making in this region to date. Adaptation has yet to become a strong concept, but was acknowledged as a useful approach and a much-needed one as climate change accelerates. Due to the unique marine/freshwater interface of the Bras d'Or Lakes, sea-level rise is seen as one of the biggest impending threats unique to climate change with specific responses required; other threats to water such as higher temperatures and shifting ecosystems were also acknowledged but can be addressed with more general water governance standards and approaches that encompass a variety of concerns and drivers (i.e. “sustainability”).

REACTIVE GOVERNANCE AND POLICY GAPS

Due to the jurisdictional fragmentation outlined in the previous section, Canada lacks a clear national vision for managing our water resources – as evidenced in part by the fact that the last federal water policy was tabled in Parliament over two decades ago and has never been fully implemented.³⁰ Water tends to be governed in a “reactive, crisis management mode” as we have seen for example in the oil sands of Alberta and in the case of the appearance of large-scale toxic algal blooms in Lake Winnipeg.³¹ This reactionary approach to water governance has left Canada with wide-open gaps in policy, particularly in terms of water quality regulations where major inconsistencies exist regarding public safety across the country. As a result of inadequate governance and funding cutbacks in departments responsible for water management, Canada is one of the very few developed countries that does not have legally enforceable water quality standards.

29 Bakker, 2007

30 Pentland and Goucher, 2010

31 Muldoon and McClenaghan, 2007

INFORMATION GAPS

Jurisdictional fragmentation has also contributed to the decline over time of surface and groundwater monitoring as well as water research in Canada. While Canada used to be a world leader in these areas, cuts to government funding have resulted in the loss, not just of leadership in these important domains, but a great reduction in our own capacity to acquire and share the water data and information necessary to support climate change adaptation, especially in relation to our groundwater sources, of which less than 20% are currently mapped.³² Commenting on this issue, the Standing Senate Committee on Energy, the Environment and Natural Resources stated, “we cannot manage and protect that which we do not properly understand...when it comes to water, there are still too many questions to which we do not yet have satisfactory answers,”³³ and, “this information gap is more than regrettable; it is unacceptable...this stems in large part from the Government of Canada’s retreat from water management issues and from funding relevant research.”³⁴

More recently, the federal Commissioner of the Environment and Sustainable Development echoed the Committee’s stance when he reported in 2010 that Environment Canada “is not monitoring water quality on most federal lands... It also does not validate the data collected through the water quality monitoring program. As a result, Environment Canada cannot assure users that its water quality data is fit for use,” and, “[Environment Canada] does not know what monitoring, if any, is being done by other federal departments.”³⁵

The extent of change that will be required to reform water governance in Canada is daunting, especially within the context of relatively brief current terms of political office of any given government. For this reason, many leaders view broader water policy reform as fraught with political hazard.

GOVERNMENTS ARE ALREADY ON THE MOVE

Despite the obstacles we have outlined above, governments in Canada have started working together for a secure water future. Examples of water-oriented climate change adaptation initiatives are emerging in communities across the country. Interest in water security issues as they relate to climate change is also growing widely at senior political levels. The Canadian Council of Ministers of the Environment and the Council of the Federation, which is composed of all the country’s provincial and territorial Premiers, have turned their attention to water matters.

The Province of British Columbia recently unveiled its *Water Smart* water stewardship strategy.³⁶ The modernization of the provincial Water Act in British Columbia includes climate change as a key driver. Alberta has had its *Water for Life Strategy* since 2003. The province of Saskatchewan has allocated millions of dollars to studies related to the security of their water supply.

With the passage of the *Water Opportunities and Water Conservation Act*, the provincial government in Ontario has moved significantly toward a focus on innovation in water conservation and treatment technology as an engine of economic development. In Quebec the focus is on the St. Lawrence River, with special attention being paid to how climate-related reductions in flow regimes are affecting shipping lanes. Interest in climate-related water issues is also growing in Atlantic Canada. Nova Scotia launched its own *Water for Life Strategy* in December of 2010.

One of the most interesting developments with respect to water policy in Canada is the recently released Northwest Territories (NWT) *Northern Voices, Northern Waters* strategy. This water strategy is particularly innovative for three reasons: Firstly, NWT developed its water strategy before they were in trouble with climate-related water issues. Secondly, NWT and their Indian and Northern Affairs Canada partners started from the ground up by including Indigenous peoples in development of the strategy from its inception. Thirdly, the *Northern Voices, Northern Waters Strategy* took an

32 Standing Senate Committee on Energy, the Environment and Natural Resources, 2005

33 Ibid

34 Ibid

35 Office of the Auditor General of Canada, 2010

36 BC Ministry of Environment, 2010

integrated approach to unifying nature's need for water with the needs of the people who rely upon aquatic ecosystem function for their cultural identity, and ultimately for their prosperity. These elements were included in the strategy by consensus of the interests that worked together to create the strategy.

Many Indigenous peoples in Canada are facing serious water quality issues and are actively raising the public profile of these problems. For instance, the annual First Nations Mother Earth Water Walk, begun by Anishinabe grandmother Josephine Mandamin and others, is designed to bring attention to the combined threats of pollution and climate change to fresh water supplies.³⁷

Some urban municipalities, such as the City of Toronto, have implemented water conservation under the aegis of climate change action plans.

These examples suggest that, thanks to innovative leadership and an increasing level of education and awareness about the issues, Canada may be in a better position than many nations to address the water-related challenges of a warming climate. Such initiatives are invariably more successful when the federal government is present to collaborate on solutions. Natural Resources Canada (NRCan) has provided matching funding for cross-Canada provincially-based Regional Adaptation Collaboratives, all of which identified water as their top priority, and are focused on actions to implement adaptation to water impacts.³⁸ In partnership with Parks Canada, NRCan is also supporting important new research on climate-related impacts on water supply associated with glacial recession in the Rocky Mountain national parks. Work on climate change adaptation for water management in the Okanagan, led by Dr. Stewart Cohen of Environment Canada and Dr. Denise Neilsen of Agriculture and Agri-food Canada, has been integral to the development of other water-related initiatives in this region.³⁹

As has already been noted, technological innovation in areas such as water conservation and re-use have been shown to be stimulated through the creation of incentives such as those that came into existence with the passage of the *Water Opportunities and Water Conservation Act* in Ontario.

Multi-agency collaborative processes are also breaking new ground in the area of transboundary water management issues aimed at avoiding dispute over waters shared between Canada and the United States. One such process is the Lake of the Woods Water Quality Initiative, which involves federal, provincial and state interests in both Canada and the United States. The involvement of the International Joint Commission, reliance on sound science, the good will generated, and the basin scale approach that define the success of this initiative deserve attention.⁴⁰

Unfortunately, it will be difficult, if not impossible, for any of these initiatives to fully realize their goals unless widespread jurisdictional fragmentation with respect to water governance is overcome. The reform of water governance structures in Canada would not only ensure that existing initiatives aimed at more productive management of water are more successful, but would also lead to an enhanced national capacity to adapt to climate-related impacts on our environment, our economy, and our identity as a people.

Such reforms as are necessary; however, they will not be easy to undertake. A great deal has been invested in the status quo, and the myth of limitless water abundance remains deeply embedded within the Canadian psyche.⁴¹ While Canadians in some parts of Canada remain divided over the climate change question, polls suggest there is a growing understanding about the need for better stewardship of water in face of a changing climate.⁴² While acceptance of the need for water policy reform is growing at all political levels across Canada, the problem of fragmented jurisdiction over water stands in the way of meaningful progress.

37 Mother Earth Water Walk, 2010

38 Natural Resources Canada, 2011

39 Neilsen et al., 2001; Cohen, Neilson and Welbourne, 2004; Cohen and Neale, 2006; Okanagan Basin Water Board Water Supply and Demand Study listed at <http://www.obwb.ca>

40 Lake of the Woods Water Sustainability Foundation, 2011

41 Sandford, 2009

42 R.B.C., Canadian Water Attitudes Study, 2010

PROBLEM ANALYSIS & PRIORITIES

Governments have not yet properly responded to what to some appears to be a contradiction between the fundamental human right to water and appropriate pricing of water supply and sanitation services. Governments at different levels are responsible for promoting the fundamental right to water while at the same time introducing appropriate pricing for water services. We cannot choose one or the other; sustainable water management demands both.

Though there is growing public concern over water security, there has been no change in prevailing water use. In the minds of most Canadians water remains an abundant resource, a free good, an inexhaustible commodity that does not need to be conserved. There is therefore a need in Canada to shift to a conservation society. If this shift does not occur quickly, water security in many parts of the country will be compromised. Climate change will result in more frequent extreme weather events that will increase flooding, property damage, and insurance costs and add to our already serious infrastructure maintenance and replacement deficit nationally. Water quality will continue to deteriorate widely. Conditions on First Nations reserves will be even more difficult to address than they are today. Wetland loss and other climate-related impacts will combine with human activities to result in reduced ecosystem services, which will in turn result in lower flows for fisheries, more erosion, reduced groundwater recharge, compounding problems with nutrient and pesticide loading and more problems with toxic algae, adding further to water treatment costs. These impacts will compound in direct relationship with climate effects and cost more and more over time, reducing our quality of life and diminishing Canada's economic competitiveness globally.

As noted, many changes in governance to date at the provincial level are oriented in the right direction, but to meet the growing challenge posed by current and projected climate effects on water security in many parts of Canada governance has to become more focussed and actively coordinated across the provinces. This can be achieved through the Council of the Federation, which recently approved a new water charter and has already committed to working with all Canadian provinces and territories, as well as related organizations such as the Canadian Council of Ministers of the Environment, to build watershed stewardship capacity throughout the country. The Council of the Federation has also established a role for expert advisors outside of the public sector to contribute views on new water governance approaches. This development respects one of the advantages of Canadian federalism in that it demonstrates that experimentation at a variety of scales can produce effective coordinated regional responses to national issues. This approach could be the bridge upon which to build a truly national approach to water policy reform that could become the foundation for successful climate change adaptation, at least as it relates to the management of vital water supplies and the ecosystems that both provide and rely upon those supplies for their integrity and sustainability.

WATER & CLIMATE CHANGE IN THE NORTHWEST TERRITORIES

Participation in the Yellowknife roundtable was outstanding, with senior representatives of all sectors, including the Deputy Premier and the Deputy Minister for Environment, attending. The focus of the forum was the newly created **Northern Voices, Northern Waters** Water Stewardship Strategy.

The Northwest Territories' new water strategy promises to be a groundbreaking piece of legislation and policy innovation that will encapsulate many of the standards and actions required in other parts of Canada to respond to the challenges of climate impacts on fresh water. Key issues in this roundtable included the challenges of both transboundary negotiations from the point of view of a downstream negotiator faced with upstream neighbours committed to high levels of water consumption, and complexities of land claims agreements and First Nations government in a territory approaching devolution.

In the big picture of Canada's water governance as a nation, the proposed NWT water strategy represents an extraordinary opportunity to place ecosystems and water above consumption pressures that, once in place, are deeply challenging to reverse. Awareness of climate change is unusually high in the region due to their northern location, in which the warming and associated impacts are impossible to ignore. This raises questions being asked around the world by less developed nations in terms of culpability behind the causes of climate change.

Of the three roundtables, awareness of climate change issues was highest and perceived as most urgent in the NWT, and the water strategy features climate changes and their current and projected impacts as one of the key drivers for its design and implementation. As such, the **Northern Voices, Northern Waters** Water Stewardship Strategy represents one of the most significant adaptation initiatives in Canada in the context of water governance.

RECOMMENDED POLICY ROAD MAP

Our changing climate and hydrology require that we shift out of the coping zone of stationarity and adapt to the “new normal.” The extent of this adaptation will require that a new set of values must underlie water governance in Canada in the future. Fundamental among these values will be the need to balance the water needs of nature with those of people.

The creation of such a water ethic in Canada can be achieved in a series of steps as outlined in the recommendations listed below. This is an ambitious agenda, but one that must be addressed by all levels of government if we are truly to adapt water governance to meet the new challenges of a changing climate.

In this document, we call on Canadian leaders at all levels to champion this cause, and consider the potential of these actions.

SHORT-TERM RECOMMENDATIONS

(IN THE NEXT THREE YEARS)



Our changing climate and hydrology require that we shift out of the coping zone of stationarity and adapt to the “new normal.”

RECOMMENDATION 1.

Value water appropriately, and promote its wise use and conservation through the establishment of national water conservation guidelines

- Set national and regional water conservation guidelines that recognize the value of water
- Encourage water conservation as a fundamental Canadian ethic in support of water conservation goals by municipalities (e.g. cities and regions of Canada could compete to be “water smart”);
- Establish national conservation standards for smart metering and for water-using devices in building codes for new homes, with similar standards to radiate outward into all economic sectors;
- Other provinces should emulate Ontario by expediting clean technology development to encourage water conservation and water-smart engineering by creating tax and other incentives and through the support of independent research clusters that incubate innovation;
- Encourage home audits of water conservation analogous to energy audits;
- Explore implementation of variable pricing instruments to encourage water conservation that do not discriminate against the poor, such as increasing block pricing and seasonal pricing;
- Provide education so that the public is aware of water conservation opportunities in their homes and businesses, stressing how water savings are an important practical measure in our national effort to adapt to climate-related impacts on water security;
- Strategically link agricultural policy to water policy to reduce agricultural impacts on water quantity and quality;
- Strategically link water policy to food security in Canada and abroad;
- Strategically link energy policy to water policy to reduce the impacts of energy production on water quantity and quality.

WHO SHOULD DO THIS?

All provinces, territories, First Nations, municipalities, business associations, real estate associations, the expanded Canadian agricultural community and Canada’s energy sector, with the support of the federal government.

All provinces, territories and First Nations governments should adopt legislation in accordance with agreed-upon standards for establishing, codifying and protecting ecological flows for nature.



RECOMMENDATION 2.

Urge governments to value water to meet nature’s needs and ensure its use is consistent with sustaining resilient and functioning ecological systems

- All provinces, territories and First Nations governments adopt legislation in accordance with agreed-upon standards for establishing, codifying and protecting ecological flows for nature and resources that are relevant now and that will be relevant in a climate-altered future;
- Increase the resilience of aquatic ecosystems to adapt to a changing climate through the establishment of legally defined ecological sustainability boundaries, and invest in ecosystem restoration within established watershed management frameworks;
- Establish legislative mechanisms that ensure that the value of ecosystem goods and services and environmental externalities such as pollution are accurately and uniformly accounted for in all development decisions.

WHO SHOULD DO THIS?

All provinces and territories with the Government of British Columbia (with its Water Sustainability Act) and the Government of the Northwest Territories (with its Northern Voices, Northern Waters water stewardship strategy) taking the lead.

RECOMMENDATION 3.

Recognize and value established knowledge and experience in prediction by strengthening and harmonizing flood protection strategies nationally

- Develop a joint federal/provincial program for integrated flood prediction, prevention and management
- Strengthen municipal emergency planning to deal with the “new normal” in natural variation of water cycles, i.e., non-stationarity
- Reduce the projected economic costs of flooding, droughts and climate-related extreme events through protection of intact natural systems

WHO SHOULD DO THIS?

The federal government through Environment Canada, the Federal Department of Public Safety, the Canadian Federation of Municipalities, the insurance industry and the provincial emergency agencies.

RECOMMENDATION 4.

Support the design and sustainability of water supply and waste disposal infrastructure based on ecological principles and adaptation to a changing climate with special attention to First Nation communities.

- Set new standards for the design and function of water-related infrastructure to ensure sustainable adaptation to the effects of a changing climate on hydrological variability based on the principles of engineered ecology;
- Seek revenues through water metering, equitable water service delivery pricing, and technological innovation to support infrastructure costs—reuse of treated water, energy from treated wastewater; integration with energy from solid organic wastes (food waste, garden clippings, wood waste, agricultural waste and biomass, etc.);
- Integrate rainwater management with wastewater management to reduce costs of treatment and energy required to transport water and treat sewage;
- Engage the professional engineering and water management community in innovative re-design of infrastructure that encourages the regeneration of the ecological health of watersheds through the principles of engineered ecology;
- Address the critical challenges for access to clean and secure water supplies in numerous First Nation communities.

WHO SHOULD DO THIS?

The provinces and the Canadian Federation of Municipalities with the support of the federal government.

RECOMMENDATION 5.

Recognize the value of comprehensive monitoring and fulfill the need for the accessible information required to manage water in a changing climate

- Re-affirm the importance of the rigorous national framework of consistent and regular hydrologic and water quality monitoring already established within Environment Canada through the National Water Survey and its provincial and territorial partners to provide a permanently supported baseline of information in support of on-going assessment of the effects of a changing climate on water security;
- Create a permanent national data base of hydrological information that can support enhanced forecasting and prediction of potential climate effects on water security;
- Establish and permanently support the monitoring of health effects of changing water cycles nationally but especially on First Nations reserves;
- Strengthen public reporting of monitoring programs;
- Consistently fund ongoing science that will analyze the broadest possible range of water issues associated with changing climate;
- Continue to support centres of excellence on science, particularly as it relates to climate monitoring and water-related adaptations to climate change.

WHO SHOULD DO THIS?

The federal government and the provinces through Environment Canada, Aboriginal Affairs and Northern Development Canada and the National Water Survey; university research institutes.

MEDIUM-TERM RECOMMENDATIONS

(IN THE NEXT THREE TO FIVE YEARS)

RECOMMENDATION 6.

Recognize, value and support the role of education in public understanding of the importance of water to our way of life

- The provinces and territories may together decide that a national public education and social media campaign is required to dispel the myth of limitless abundance of water in Canada and to establish and advance the principles of a new water ethic. Such a campaign could serve to:
- Reshape public understanding of the importance of water to our Canadian way of life by dispelling the myth of limitless abundance;
- Explain the global water crisis and what it means to Canada;
- Assist in the transition to adaptation by outlining changes in habits and other measures that Canadians need to undertake in order to assure water quality and security in the face of growing populations, increased economic activity and climate change;
- Outline the extent of jurisdictional and legislative changes that will be required to achieve the ideals of the new Canadian water ethic;
- Lay the foundation for public support of political leadership that will reform and harmonize water policy at all levels of political jurisdiction over the coming two decades.

WHO SHOULD DO THIS?

All provinces and territories in collaboration with the Government of Canada through the auspices of the Council of the Federation.

RECOMMENDATION 7.

Recognize water as a human right integral to security and health

- Honour the principle of public trust which recognizes the value of water as a public resource for the betterment and enjoyment of present and future generations;
- Honour the responsibility principles inherent in Canada's founding First Nations' water ethic – that (1) the relationship between humans and water is one of mutual responsibility and reciprocity and this must be kept in balance; and (2) the relationship between humans and water is deeply spiritual, and thus water must be respected and honoured;
- Honour Indigenous rights to clean water and sanitation as a means of equity and as a means to enhanced adaptive capacity in the face of climate-related effects on water security;
- Develop and enforce national drinking water standards;
- Consider a public interest doctrine for water;
- Discourage the creation of water markets until full analyses have been undertaken with respect to how current water quality can be addressed and how this will be addressed in changing hydrological regimes in the future.

WHO SHOULD DO THIS?

Consideration should be given to holding a First Nations National Summit on water security organized in conjunction with the provinces, territories and the federal government.

RECOMMENDATION 8.

Support holistic approaches to managing watersheds through collaborative governance

- Advance the process of water policy reform in Canada by aligning responsibilities set out for the federal, provincial, municipal and First Nations governments so that they work in conjunction rather than in competition to achieve the principles of climate-related adaptation and the Water Charter;
- Strengthen the Water Charter from the Council of the Federation to include the principles for water security as defined by the proposed new Canadian water ethic in the revised charter;
- Undertake whole watershed assessments, not assessment of parts of watersheds;
- Include water management as a central element in all land-use planning that projects climate-related effects forward at least until 2050.

WHO SHOULD DO THIS?

Federal and provincial governments in association with First Nations and the Canadian Federation of Municipalities.

RECOMMENDATION 9.

Recognize the importance of groundwater and urge governments at all levels to understand and value its role in creating a sustainable future for Canada

- Comprehensive coordinated national groundwater protection and management strategies should be developed to address current inadequacies in groundwater mapping and monitoring;
- This strategy should unify the efforts that need to be made at all levels of government to ensure the protection of increasingly important groundwater resources, particularly in the face of climate change.

WHO SHOULD DO THIS?

All provinces and territories in collaboration with the Government of Canada.

RECOMMENDATION 10.

Recognize the value of developing coordinated long-term national strategies for sustainably managing water in the face of climate change

- Establish a firmer climate change adaptation approach to water management across the nation;
- Identify tangible changes in key management approaches—water conservation, flood protection and emergency measures, improved monitoring and science;
- Make substantive improvements in drinking water protection and water infrastructure on First Nation reserves;
- Develop new water allocation models based on priorities and flexibility to deal with droughts and water shortages;
- Further identify jurisdictional, institutional and legal obstacles to water policy reform and harmonization;
- Undertake policy reform and harmonization at local, regional, provincial, territorial and federal levels in order to improve the way we manage water in Canada so as to ensure sustainability and security of water supply and quality in the face of a changing climate.

WHO SHOULD DO THIS?

The provinces in association with the most senior levels of the federal government and Canadian Federation of Municipalities.

LONG-TERM RECOMMENDATIONS (IN THE NEXT FIVE TO TEN YEARS)

RECOMMENDATION 11.

Consider the value of creating a non-statutory National Water Commission to champion the new water ethic

- The Council of the Federation may see fit to become or create a non-statutory National Water Commission that will undertake a thorough on-going examination of the kinds of legal, legislative and policy reforms that will be necessary to ensure water everywhere in Canada can be managed in a manner consistent with integrated land and watershed management principles rather than through the fractured jurisdiction of artificial management units imposed by political boundaries;
- It will be crucially important to undertake this examination not just within the context of the hydrological circumstances that exist across Canada today but within the context also of the hydrological realities that have and might come into existence as a result of climate change;
- After identifying and prioritizing specific legal, legislative and policy barriers to holistic water management, the National Water Commission will then request that the Council of the Federation facilitate negotiations between all relevant levels of government and with affected economic sectors to gradually but persistently bring about necessary reform.

WHO SHOULD DO THIS?

All provinces and territories through the auspices of the Council of the Federation.

RECOMMENDATION 12.

Continue to articulate and promote a new Canadian water ethic

The Canadian constitution requires a multi-faceted governance model for water management. By definition, no one level of government can implement all the policies necessary to improve water security. The Council of the Federation issued a Water Charter in August 2010 as an initial step in establishing a number of water stewardship principles that would bind all four levels of government. This is an important step toward on-going water policy reform in Canada.

The Council of the Federation may wish to consider that advancing the recommendations above will build on its Water Charter to articulate a new Canadian water ethic that redefines the way Canadians value and relate to water. The values inherent in that ethic include:

- Recognition of the crucial need for comprehensive on-going monitoring of the state of our waters;
- Recognition of water as a human right integral to human health;
- Recognition and respect for the water rights of Indigenous peoples;
- Recognition of nature's need for water;
- Acknowledgement of the need to break down jurisdictional barriers to more holistic management of water;
- Recognition of the need for governments at all levels to further advance appropriate economic signals that affect positive change with respect to how water and water infrastructure is valued and managed;
- Recognition that successful adaptation to climate change will require adoption of this ethic, but that successful adaptation to climate effects on water will be made possible as a result.

WHO SHOULD DO THIS?

All provinces and territories with the support of the Government of Canada.

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