



PRAIRIE WATER DIRECTIVE



*A Collective Call to Action for Water Security
in the Prairie Provinces*



Credits

A great many people have contributed to the words and ideas in the following 50 pages. Thanks to Tony Maas, who wove the thoughts of Danielle Droitsch, Darrin Qualman, Glen Koroluk, Lindsay Telfer, Meghan Beveridge, Shelley-Lobay Minarik with his own so neatly. Thanks to all those who participated in the creation, evolution and sharing of this document. A special thank you to the team of expert reviewers for providing their advanced knowledge on water management: Merrell-Ann Phare, Bob Halliday, Jeff Olson, Linda Duncan and Sue Gordon. Thank you to Brenda Lucas for her ongoing advice. Thanks to Oliver Brandes, Tim Morris, Michelle Heiser and Rebecca Reeves for providing their policy expertise. Thank you to the Community Foundations of Canada who provided context and connection to local efforts across the region. Thanks to our volunteer researchers, Vlad Levin and Erin Hozelton, who helped research case studies to include in the document. A big thank you to the over 300 people we met across the region who provided their perspectives, their expectations and their stories on water management across the Prairie Provinces. This feedback has strengthened and supported the document while providing clarity and local context. This is a true effort of grassroots democracy.

About Us

We are a collaborative of Prairie Water advocates. The compilation of this *Directive* brought together the diverse experience of environmentalists, residents and water policy researchers from across the Prairie Provinces and beyond. This document began as a series of conversations with the goal of sharing our stories of water advocacy across the region and in exploring what we may be able to do “better” together. The document is informed by the advice and input of numerous community, environmental, social and policy experts and remains open to further contribution as we work to develop a collective vision and expectations for sustainable water management in the Prairie Provinces. It is our belief that this document represents the ‘best’ collective thinking on water management across diverse and important watersheds in Canada - those within the Prairie Provinces!

The development of this document was made possible with the support of the Walter and Duncan Gordon Foundation.



Sustainable water management: A 21st century challenge

Vast river basins – and the waters flowing through them – connect the people and places, livelihoods and landscapes of the Prairie Provinces. As it travels our raging streams and broad rivers, serene lakes and unseen aquifers, fresh water intersects nearly every part of our culture and society.

But all is not well with our Prairie waters. Shrinking glaciers and over-allocated rivers, drought and flood, pollution problems and rising tensions over shared waters pose real and growing challenges for our communities, economies and environment.

As residents of the Prairie Provinces, we expect our governments to make sustainable water management a priority. We expect them to engage us, to listen to us and to lead us in creating comprehensive strategies that commit to action and progress toward a healthy, prosperous and ecologically sustainable future.



Table of Contents

A collective call to action.....	p. 2
Supporting organizations.....	p. 3
A vision for water security.....	p. 4
From vision to strategy: expectations for water security.....	p. 6
A. Ensuring equal access to safe and sufficient water for ALL Prairie residents.....	p. 8
B. Protecting and restoring aquatic and riparian ecosystems.....	p. 14
C. Managing “our” water demand.....	p. 24
D. Responding and adapting to climate change.....	p. 30
E. Strengthening governance for shared waters.....	p. 34
Next steps: realizing a vision for water security.....	p. 39
Appendix 1 - Definitions.....	p. 40
Appendix 2 - Current policy framework: Manitoba.....	p. 41
Appendix 3 - Current policy framework: Saskatchewan.....	p. 42
Appendix 4 - Current policy framework: Alberta.....	p. 43
Endnotes.....	p. 44

A collective call to action

The Prairie Water Directive is a statement of expectations. In the best traditions of democracy, residents call on governments to address concerns that are critical to society's health and wellbeing. Our concern is with fresh water. More specifically, we are concerned with ensuring that human use and management of fresh water protects the water in quality and in quantity for future generations.

The statement-of-expectations approach is borrowed from non-governmental organizations in Ontario who, in the wake of the Walkerton tragedy (where a deadly strain of e-coli entered the towns water supply resulting in the deaths of seven individuals), came together to develop a Statement of Expectations for Watershed-Based Source Protection.² That initiative established a clear and concise direction on how residents expected governments to manage and protect drinking-water sources. Broad and diverse sign-on by organizations gave that statement political force. It has proven an effective and valuable tool for residents to shape water policy.

Inspired by this success, representatives of Alberta, Saskatchewan and Manitoba came together in late 2006 to pursue a similar strategy for the Prairie Provinces. The draft discussion Prairie Residents Water Directive

emerged in the fall of 2007, at which time the Directive was the topic of conversation in over 10 community forums and countless conversations across the three Canadian Prairie Provinces. These discussions have helped to inform the draft you read today by incorporating a wide variety of input, perspectives and community-based expectations for improved water protection.

Our goal has been to work with citizen groups, communities and organizations to collectively and democratically create a platform to advocate for change, participate in decision-making and hold governments accountable for the decisions they take regarding our

precious water.

As supporters of this statement, organizations across the region have joined together across diverse interests to build a collective call for government leadership and action on sustainable

water

management.

Sustainable water management

Sustainable water management requires using and managing water in ways and for purposes that support the needs and aspirations of all residents, while safeguarding the ecosystems that underpin our society and economies. It is holistic, encompassing water quality and quantity, surface and groundwater and the role water plays in community and economic development. Progress toward sustainable water management requires a commitment to protecting ecosystem integrity and biological diversity, recognizing the value of water to all species, developing a dynamic economy and ensuring social equity for this and future generations.¹

We believe that for real progress to be made – to public policy, planning processes and in day-to-day management – our expectations must become shared expectations, our vision must become a shared vision.



Supporting Organizations

We, the undersigned, support the vision and direction of the Prairie Water Directive. We will join with organizations, groups and individuals across diverse interests to advance this collective call for government and community-based leadership and action for sustainable water management across the Prairie Provinces:

Beyond Factory Farming Coalition

~

Big Lake Environment Support Society

~

Centre for Indigenous Environmental Resources

~

Environmental Law Centre

~

Federation of Alberta Naturalists

~

National Farmers Union

~

Lac Ste Anne Community Group

~

Manitoba Eco-Network

~

Meewasin Valley Authority

Pembina Institute

~

POLIS Project on Ecological Governance

~

Safe Drinking Water Foundation

~

Saskatchewan Environmental Society

~

Sierra Club Prairie

~

Southern Alberta Group for the Environment (SAGE)

~

Stop the Hogs Coalition

~

World Wildlife Fund Canada

~

Walter and Duncan Gordon Foundation

~

Water Matters

This represents the supporting organizations at the time of print. For a complete list of current Directive supporters visit www.prairiewaterwatch.ca

A vision for water security

In 2050, the lakes, rivers, streams and groundwater of the Prairie Provinces support sustainable communities and sustainable livelihoods within healthy, ecologically vibrant watersheds. Water is valued as finite and precious—as the foundation of life for all species. All recognize the sacredness of water.

Equal access to safe and secure drinking water is recognized as a human right and is a priority of all governments. Efforts to protect water supplies from contamination, robust water treatment and sound management systems ensure that all residents have access to safe, reliable and sufficient drinking water. Informed by best available knowledge, governments, businesses and residents work together to protect and restore the integrity of the hydrologic cycle and of aquatic ecosystems. We have agreed upon limits to water takings from surface and groundwater sources, existing dams are operated to mimic natural flow regimes, rivers are protected against further fragmentation and diversion and wetlands are no longer drained. Indeed, having recognized the vital importance of healthy aquatic ecosystems to our health and prosperity, significant effort is devoted to their restoration and rehabilitation.

Our communities and economies are strong and resilient. They function within the bounds of finite water supplies naturally available in our watersheds and aquifers. By dramatically increasing water-use efficiency, cities, towns, industry and agriculture continue to thrive while having stabilized (and in many cases reduced) overall water use. We have developed plans and set aside financial resources to help businesses, farmers and communities to avoid or address the consequences of flood and drought. Innovations

in community design, agriculture and industry minimize the negative impacts of human activities on the health of our waters and watersheds. Governments work together in a spirit of collaboration and empower residents to actively participate in decision-making. Recognizing that our river basins and the waters flowing through them intersect provincial and international borders, we anticipate and avoid conflict, water shortages and contamination and environmental decline by building strong relationships, sharing information, ideas and water under a common goal of sustainability. Our society takes pride in knowing that the waters, ecosystems, as well as health and livelihood opportunities we now enjoy have been secured for future generations.

We have come to understand that we all live downstream.

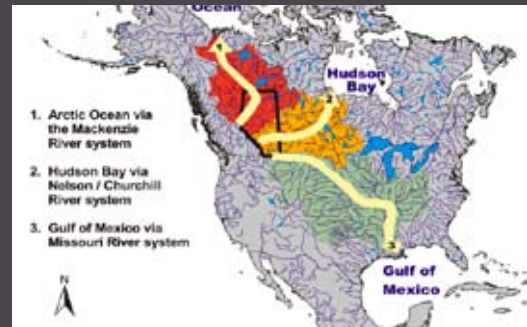


Box 3: Overview of the Prairie watersheds and aquifers

The rivers that flow across the prairies have their origin on the Eastern Slopes of the Rocky Mountains. The waters journey to the Arctic Ocean via the Mackenzie river system, the Hudson's Bay via the Saskatchewan, Nelson and Churchill river systems and the Gulf of Mexico via the Missouri river system.

The Arctic Drainage Basin includes the Slave/Mackenzie, Peace and Athabasca Rivers. With an average volume of approximately 13,400 m³/s (cubic meters per second) the basin drains 25% of the total area of Canada. By way of comparison, the average volume of Great Lakes/St. Lawrence river system is 10,100 m³/s. The Arctic Drainage Basin also contains the world's 3rd, 4th and 8th largest natural lakes: Great Bear Lake, Great Slave Lake and Lake Athabasca respectively.

Present industrial activities are primarily located in the south of the basin and include pulp mills, oil and gas developments and the tar sands. Tar sands development has undergone extremely rapid expansion over the last 20 years and future development plans are under public scrutiny due to current and projected social and environmental impacts. New and proposed oil and gas developments - the Mackenzie Valley Pipeline in particular - pose the greatest threat to the integrity of the northern portion of the basin.



The Hudson Bay Drainage Basin includes the Theron, Dubawnt, Kazan, Churchill, Nelson, Red River/Lake Winnipeg, Assiniboine, Qu'appelle, Saskatchewan, North Saskatchewan, South Saskatchewan, Red Deer, Bow and Oldman River Basins. The Saskatchewan/Nelson system is the largest in the basin and drains 40% of three Prairie Provinces. The basin also includes a number of large lakes, including the Winnipeg, Winnipegosis, Manitoba, Reindeer and Diefenbaker (a man-made lake). Within the region, irrigation is the largest net consumptive user and hydro-electric energy generation is the largest non-consumptive user. Most of the Prairie population also lives within this basin, creating a substantial municipal water demand.

The two major rivers flowing through the Missouri Drainage Basin are the Milk and Frenchman Rivers. As with the other Southern Basin, irrigation is the major water user. Drought is very common in this dry area, which has led to the construction of many small and large storage facilities. An international agreement is in place to regulate both quality and quantity on both sides of the Canada-US border.

Groundwater research and policy is still in its infancy in Canada. Most aquifers, including those in the shared prairie watersheds, are still in the process of being mapped and evaluated. Although there is little documented information on the groundwater aquifers of the Prairie Provinces, allocations continue to be granted.

A permanent water deficit exists in areas of southern Alberta and Saskatchewan. In these areas, average water gain (through precipitation) does not equal water loss (through evaporation, transpiration and withdrawal). This water deficit has significant implications for groundwater use and allocation. Because surface and groundwater are connected, if surface water is over-allocated, groundwater recharge will decrease and availability will decline.

Cities such as Calgary and Lethbridge and industrial activities such as agriculture and the tar sands increasingly rely on groundwater availability for their water needs. In the absence of sufficient quantities and sustainable consumption practices they could run dry. Some areas have already outgrown available groundwater reserves. The town of Humboldt, Saskatchewan and the community of Lacombe/Panoka Alberta, for example, have been forced to build pipelines to divert water from the Saskatchewan River system to obtain water for their communities. The groundwater reserves they had relied upon to sustain their growing needs were no longer sufficient.

International scientists have begun to recommend that groundwater be viewed, in some areas, as a non-renewable resource. The Alberta basin, for example, contains deep groundwater reserves that are tens of thousands of years old. This means that it takes "ten thousand years for the water to recharge down into the very deep aquifer systems. If we extract this water, then we are removing what we would call fossil water and water that will take a very long time to recharge."

From vision to strategy - Expectations for water security

Our vision establishes where we want to go – it describes a future that embodies sustainable water management. What it does not tell us is how to get there – how to create the path that connects today to our desired tomorrow. Mapping and following that path will require concerted, collaborative action on the part of scientists, business and industry, community groups and all residents. Most importantly, connecting today to a sustainable tomorrow will require strong, sustained government leadership.

Our expectations for leadership and action on sustainable water management are organized under five themes:

- A. Ensuring equal access to safe and sufficient water for all Prairie residents.
- B. Protecting and restoring aquatic and riparian ecosystems.
- C. Managing our water demands.
- D. Responding and adapting to climate change.
- E. Strengthening governance over shared waters.

We direct our expectations to provincial and federal governments because they share the constitutional responsibility, spending powers and access to the resources required for action on

sustainable water management. In some cases, we provide specifics on “who should do what”; in many cases we leave the solutions open to collaboration among all orders of government. New policies and institutions, such as Alberta’s Water for Life Strategy, the Saskatchewan Watershed Authority and Manitoba’s Ministry of Water Stewardship, begin to make good on the promise that governments will provide leadership and strategic direction on water policy. The question remains whether governments will direct sufficient public resources toward turning commitments and policies into actions and outcomes.

Progress on various expectations may be at different stages in each of the Prairie Provinces. While this poses some challenges for coordinating efforts within our shared river basins, we see this much more as an opportunity to discuss common challenges, to share experiences and to build and strengthen partnerships. It is an opportunity to develop a Prairie-wide transition toward sustainable water management.

Who is responsible for what in Canadian water management?

Water management in Canada is complex. Federal, provincial, municipal and Aboriginal governments all play a role. Canada’s Constitution divides legal responsibility for water between provincial and federal governments. The authority of provincial governments is based on their constitutional powers over “natural resources.”³ Provinces take the lead role in the majority of water management functions including regulation of water quality, water taking (i.e. licensing) and many aspects of environmental protection. Despite the reality that prairie rivers are intersected by provincial and international boundaries, prairie rivers need to be managed on a watershed basis. Responsibilities of local governments are limited to those delegated to them by their respective provinces. The federal government’s responsibilities include protection of fisheries and fish habitat, shared waters (inter-provincial and international), water on federal lands and First Nations and their reserve lands.⁴ No consistent policy exists for the recognition of Aboriginal rights with respect to water in Canada, although settled land claims and self-government agreements often provide a clearer basis for Aboriginal water management.⁵

Despite substantial powers to progress sustainable water management, federal leadership has significantly eroded over the past 20 years, leaving a vacuum in national capacity to meet ongoing problems and emerging threats. For a comprehensive call for federal leadership on water in Canada see *Changing the Flow: A Blueprint for Federal Action on Freshwater*.



Priority Areas

Expectations

A. Ensuring equal access to safe and sufficient water for all Prairie residents

1. Recognize that, in order to satisfy basic human needs, water is a fundamental human right.
2. Address critical water quality issues on First Nations reserves, Métis settlements and in small communities.
3. Fully implement multi-barrier approaches to safe drinking water.
4. Create stringent and enforceable water quality standards.
5. Develop and implement source water protection plans.

B. Protecting and restoring aquatic and riparian ecosystems

1. Explicitly recognize ecosystems as legitimate water users and fully account for ecosystem needs in water allocation systems.
2. Respect, protect and restore natural water flows by legislating environmental flow needs and establishing strict limitations for on-stream storage and for interbasin and intrabasin diversions.
3. Prevent pollution of aquatic ecosystems and aquifers.
4. Ensure that wetland area and function are maintained in, and environmental flows are integrated into, every aspect of land use, economic development and water management decision-making.
5. Recognize the connection between ground and surface waters ensuring groundwater protection is integrated into all existing policy and legislation.
6. Complete a recreation management strategy for major water bodies across the Prairie Provinces to ensure safe, accessible and educational-based recreation and tourism opportunities compliment, rather than hinder environmental protection and reclamation initiatives.

C. Managing “our” water demands

1. Facilitate comprehensive “full-cost” water efficiency planning.
2. Establish rising block rate structures that secure sufficient and accessible water for priority uses and target excessive use of water, water contamination and removal from hydrological cycle as key cost factors.
3. Direct public resources toward managing demand.
4. Legislate best practices for water-use and prevent misuse of the region’s water.
5. Embark on a full review of water allocation with the goal of identifying a hierarchy of priority uses.

D. Responding and adapting to climate change

1. Prairie governments (municipal, provincial and federal) need to immediately implement aggressive plans of action to mitigate climate change and avoid dangerous levels of average global warming.
2. Enact an aggressive water policy framework that proactively prepares the southern reaches of the Prairie Provinces for drought.
3. Mainstream climate change into water policy.
4. Build resilience for climate change adaptation.

E. Strengthening governance over shared waters

1. Strengthen inter-jurisdictional and transboundary arrangements.
2. Respect Indigenous Peoples’ rights to, and in, water.
3. Improve the scientific basis for planning and management.
4. Identify and enact a clear and transparent process for development and enforcement of water legislation that includes municipal empowerment.

A. Ensuring equal access to safe and sufficient water for all Prairie residents

~A first step toward sustainable water use would be to guarantee all humans the water needed to satisfy their basic needs. ~PH Gleick⁶

Fresh water is essential to human life. We cannot live for more than a few days without it. While most Canadians enjoy access to high quality water, typically whenever and in whatever quantities we desire, digging deeper exposes some startling concerns and management gaps when it comes to our drinking water. In a country as wealthy as Canada, illness due to drinking water quality is largely avoidable and is simply inexcusable. We expect government leadership and action on ensuring all residents have equal access to safe and sufficient drinking water.

A1. Recognize that, in order to satisfy basic human needs, water is a fundamental human right.

“The human right to water entitles everyone to sufficient, safe, acceptable, physically accessible and affordable water for personal and domestic uses. An adequate amount of safe water is necessary to prevent death from dehydration, reduce the risk of water-related disease and provide for consumption, cooking, personal and domestic hygienic requirements.”
~United Nations⁷

When provincial or federal governments acknowledge and respect a human right to water, it means that governments will pursue policies that maximize the ability of all residents and communities to facilitate their own access to safe, secure, unpolluted water for drinking and personal needs. It is not intended as a guarantee to provide a water supply to every resident. Governments need to pursue policies that maximize the ability of all residents and communities to facilitate their own access to safe, secure, unpolluted water for drinking and personal needs. **Governments must retain water as a collective, democratically controlled public trust: they will not privatize**

or sell off water, they will not create a system wherein its basic human uses are allocated by an ability to pay. A commitment to water as a human right means that water for households, water for humans and water for ecosystems will be given priority over water for industry. It means that sustainability – protecting our right to clean, sufficient water into the future – becomes a core policy value. And it means that pollution prevention becomes a key value; water use by some people or industries must not deprive others of their right to use a sufficient amount of water in a clean, safe state.

A growing number of countries, intergovernmental agencies such as the United Nations and the World Health Organization, in addition to influential organizations such as Amnesty International and the World Conservation Union, are part of an emerging international consensus around the need to recognize water as a human right.⁸ The human right to water recognizes a government responsibility to create conditions wherein everyone – regardless of economic, cultural or geographical difference – has equal access to safe water in order to meet basic needs for drinking, cooking, hygiene and sanitation. Governing water as a human right, as opposed to governing water as a commodity, ensures that allocation is guided by basic human dignity, rather than on ability to pay. It would also require government to ensure that there is not interference with the ability of residents to access water.



Some nations' constitutions, South Africa's for example, provide every person the right to clean water. To date in South Africa this approach has ensured the accessibility of clean water to an increasing number of the region's people. Since enacted, 6.5 million people have been given a basic water supply. By mid-2002 27 million people had access to clean water (close to 60% of the country's population).⁹ The rights-based approach requires all municipalities in the country to provide a minimum of 25 litres (about 6.5 gallons) - the approximate amount of water used in North America to brush ones teeth and flush a toilet once¹⁰ - free to each household, regardless of economic means. The target was for full national compliance by 2008.

A2. Address critical water quality issues on First Nations reserves, Métis settlements and in small communities.

Given the federal government's clearly defined responsibility to address issues of concern for the country's First Nations peoples, the federal government must immediately address water quality crises in these communities by providing stable, predictable funding and resources for infrastructure, operator training and water quality monitoring. Regular public reporting on progress is needed to ensure that issues are being resolved. Ensuring safe drinking water in rural areas falls under provincial jurisdiction. Provinces should provide funding and technical resources for oversight of water and wastewater treatment facilities, surface and groundwater monitoring of drinking water quality and public reporting of testing results.

In the Prairie Provinces, as in the rest of Canada, residents of First Nations reserves and Métis settlements bear an inequitable burden of contaminated water and the resulting impacts on public health and community stability. According to Health Canada, up to 97 First Nations communities across Canada were disrupted by drinking water advisories during 2007.¹¹ As of July 27, 2007, this included 10 communities in Alberta, 15 communities in Saskatchewan and

At the time we were growing up, with my fellow old people sitting here with me. That time, one could go to the lake and scoop the water to drink from. There were no effects that time. I could have been anywhere where one walked in the forest, there was always water. There was always rain.

Elder Allan Longjohn of Prince Albert Urban / Sturgeon Lake

~from *Isi Askiwan—The State of the Land*

one community in Manitoba.¹²

Small communities and rural residents are also vulnerable to water contamination. Communities relying on small water systems often lack sufficient treatment or the means to upgrade existing infrastructure.¹³ Estimates suggest that 20 to 40 per cent of all rural wells in Canada have nitrate concentrations or coliform bacteria counts in excess of drinking water guidelines.¹⁴

Drinking water advisories explained

Drinking water advisories are preventive measures intended to protect public health from waterborne contaminants that could be, or are known to be, present in drinking water. They include boil water advisories and "do not drink" advisories. Boil water advisories signal to the public that they should boil their tap water for drinking and for other uses, such as brushing teeth. Do not drink advisories signal to the public that they should use an alternative source of drinking water, like bottled water, for drinking and for other uses. It should be noted that boil water orders, issued under provincial legislation, are common across Canada in small and remote communities.¹⁶ In May of 2008 for example there were 1766 boil water advisories in Canada. Of these, 13 were in Alberta, 126 in Saskatchewan and 59 in Manitoba.



A3. Fully implement multi-barrier approaches to safe drinking water.

Provincial governments must strengthen and build on existing efforts to secure safe drinking water by addressing gaps and making improvements in order to fully implement multi-barrier approaches to safe drinking water. The federal government must make substantial progress to fulfill its responsibilities with respect to ensuring safe drinking water in Canada.

(For more details on specific federal recommendations see “Changing the Flow: A Blueprint for Federal Action on Freshwater”)

While the risk of exposure to contaminated water may be greatest on First Nations reserves, Métis settlements and in smaller communities, estimates suggest that acute waterborne infections may cause up to 90 deaths and 90,000 cases of illness in Canada each year.¹⁶ A recent study documents 288 outbreaks of waterborne disease in Canada between 1974 and 2001 caused by exposure to pathogens including *Giardia*, *Cryptosporidium*, Norwalk-like viruses, *Salmonella* and hepatitis A.¹⁷

There is no single, silver-bullet solution when it comes to securing safe, reliable drinking water supplies. Experts universally agree that a multi-barrier approach – which counters threats to water all the way from watershed landscapes to the household tap – is

necessary for comprehensive drinking water protection. The Prairie Provinces are making progress on implementing comprehensive drinking water

protection, however, some important gaps remain.¹⁸ The first element in the multi-barrier approach is source-protection planning (discussed in more detail below). Source-protection planning offers an opportunity to **first avoid contamination of drinking water** at its source and thus placing an equal significance on the assurance of ecosystem integrity.

A4. Create stringent and enforceable water quality standards.

Governments of Saskatchewan and Manitoba should follow Alberta’s lead and adopt all of the current federal Guidelines for Canadian Drinking Water Quality as legally binding standards. Over the longer term, the federal government (with the active involvement of residents and local governments) should replace current guidelines with health-based, long-term objectives and legally binding minimum national standards for drinking water quality including a move towards the mandatory testing and enforcement of well-water standards. Federal legislation would provide a safety net in provinces that fail to provide the same level of health protection as national standards.²¹ Local enforcement of standards should be encouraged with effective resourcing to ensure adequate monitoring and reporting to residents, provinces and federal government.

The multi-barrier approach to safe drinking water

A multi-barrier approach comprehensively addresses threats to water quality all the way from source to tap and back to source. It is necessary to secure safe, reliable drinking water. A multi-barrier approach can be thought of as having three main components:

1. Keeping water sources clean—protecting the watersheds, rivers, and aquifers that are the sources of our water;
2. Effective water treatment—robust water treatment to remove pathogens; and
3. Ensuring it’s clean—continual testing and monitoring.

In practice, however, a complete multi-barrier approach includes a variety of components: source water protection, adequate treatment, well maintained distribution systems, strong water quality standards, regular inspection, testing, monitoring, operator training and certification, public notice, public reporting and involvement, contingency planning, research, and, especially, adequate funding and rigorous enforcement.²⁰



Assessing progress on securing safe drinking water in the Prairie Provinces²²

	Alberta		Saskatchewan		Manitoba		Federal Government	
Year	2001	2006	2001	2006	2001	2006	2001	2006
Grade	B	B	C	B-	C-	C+	not graded	F
Remarks	<p>Good: treatment standards, contaminant standards, accredited labs for water quality testing, operator certification.</p> <p>Needs improvement: testing.</p> <p>Lacking: public reporting.</p>		<p>Good: accredited labs for water quality testing, operator certification, public reporting.</p> <p>Needs improvement: treatment standards, contaminant standards, testing.</p>		<p>Good: accredited labs for water quality testing, operator certification, public reporting (planned).</p> <p>Needs improvement: treatment standards, contaminant standards, testing.</p>		<p>Needs improvement: evaluation and regulation of chemicals, formulation of standards for guidelines.</p> <p>Lacking: First Nations drinking water safety, binding minimum drinking water standards, tracking national drinking water data.</p>	

The federal government's Guidelines for Canadian Drinking Water Quality provides recommendations for treatment techniques and maximum allowable concentrations (MAC) of more than 80 microbial, chemical and physical contaminants and 78 natural and artificial radioactive contaminants in drinking water.²³ However, in their current form, these guidelines are not enforceable. It is up to the provinces to voluntarily establish some or all of the guidelines as legally binding standards. Of the three Prairie Provinces, only Alberta has adopted all of the federal guidelines as legally binding standards.²⁴

In addition to municipal drinking water standards, provincial governments should roll out safe drinking water education programs for rural and remote communities to inform on the risks and uncertainties that exist in many rural and groundwater drinking water supplies. This should be coupled with well monitoring and reporting

programs to ensure that residents relying on well water are equipped with the knowledge and ability to ensure the safety of their drinking water. No-cost, easily accessible well water testing programs are an important first step.

Guidelines vs. standards

The difference between guidelines and standards is critical. Standards can provide a superior level of protection for human health, compared to guidelines, because standards are legally binding and enforceable – failure to comply will result in punishment. Guidelines, on the other hand, are essentially voluntary targets that water providers may strive towards but are not required to achieve. The World Health Organization states that there should be legally binding national standards for drinking water quality in all countries.²⁵

A5. Develop and implement source water protection plans.

Provincial governments must create and rapidly implement effective source water protection strategies. These strategies should be supported by legislation, provide technical and financial resources for planning, engage citizen groups and river-basin residents in decision-making and ensure that polluters are held accountable for contamination of drinking water sources.

Aboriginal peoples must be meaningfully involved in the development of these strategies. To ensure that their Aboriginal and treaty rights are upheld and honoured, they must be consulted and their concerns accommodated.

Source water protection – the first barrier under a multi-barrier approach – is based on the understanding that a healthy environment is the foundation for safe drinking water. In its first steps toward your taps, water trickles across the landscape; what is on the landscape will end up in your water.

Source protection is proactive, aiming to prevent, minimize or control activities that may impair water quality and quantity through comprehensive planning and management of land and water use. The planning process typically involves four steps: defining the source water protection area, identifying potential threats to water sources, assessing the potential for threats to impact drinking water supplies and developing and implementing management strategies.²⁶

Source protection requires careful consideration of our agriculture, mining, forestry and other land-use practices. The identification of limits to water taking and ecosystem thresholds for the addition of contaminants are needed to ensure land-use activities occur within the natural

constraints of available and prioritized water uses and that they do not make water unsafe through pollution. Source water protection planning must include a detailed analysis of groundwater and surface water interactions, identify threats and develop management strategies to ensure safe access to groundwater drinking sources. Further, Aboriginal and treaty rights (including rights and interests in self-government agreements) that may relate to (or be dependent upon) source waters must be respected and accommodated. Source water protection is the least developed link in a critical chain of actions that can, together, ensure safe drinking water in the Prairie Provinces.

Source water protection requires the active involvement and cooperation among all governments and departments because many jurisdictions and ministries affect land and water use. Integration of key decisions, regulations and objectives is imperative if source protection is to be successful.

Source Water Protection Success Story – New York City and the Catskill/Delaware watershed protection plan

In 1997, the New York's Catskill/Delaware watershed region of New York State developed a groundbreaking watershed protection plan with a goal of maintaining drinking water protection for the city through preservation of the area's source water while concurrently protecting wilderness and forest areas and minimizing soil pollution. The plan established a partnership with the upstate communities and organizations that constitute the watershed (signed by New York City, New York State, EPA, the CWT, Catskill Center for Conservation and Development, Hudson Riverkeeper, Trust for Public Land, Open Space Institute, New York Public Interest Group and some 70 upstate towns and villages). The agreement serves as a blueprint for the city's watershed management strategy for the Catskill/Delaware area. Implementation of the plan was expected to cost approximately \$1.5 billion over 10 years. To date it has saved the city of New York an estimated \$3 to \$6 billion in filtration and construction costs.²⁷



Status on ensuring equal access to safe and sufficient drinking water for all residents.

	...in Manitoba	...in Saskatchewan	...in Alberta
Human right to water	Manitoba's Water Protection Act recognizes in its preamble that "access to sufficient, safe acceptable and affordable water for personal and domestic uses is internationally recognized as a fundamental right of residents."	Saskatchewan's Safe Drinking Water Strategy explicitly states that access to safe drinking water is NOT a right. "The Province will: help people understand their roles and responsibilities to conserve and protect water and to recognize that safe drinking water is not an inherent right and that water is a valuable, limited resource."	No recognition of the human right to water.
First Nations, Métis settlements and small communities	A 2006 expert panel on safe drinking water submitted a report to the federal government highlighting the difficulties of integrating provincial water standards on First Nations reserves. Primarily this is due to the sole federal jurisdiction in this area. The report further outlined an option to develop water legislation based on First Nations' customary laws. "This task would start with, and be driven by, First Nations across the country. The objective would be to incorporate into federal legislation the basic tenets of customary law as they relate to water." In addition to this the report recommended the establishment of a First Nations Water Commission and Tribunal. The federal government has not accepted this recommendation.		
Drinking water standards	Manitoba recently enacted the Drinking Water Act and regulations that adopts legal standards for about a dozen microbial, chemical and physical contaminants.	Have not adopted federal drinking water guidelines as provincial standard.	Has adopted federal drinking water guidelines as provincial standard.
Multi-barrier approaches	Manitoba's water strategy supports the use and application of the multi-barrier approach but does not explicitly discuss this in the strategy.	The Saskatchewan government applies a multi-barrier approach to safe drinking water/water protection.	Government buys in and has adopted the multi-barrier approach.
Source-protection planning	Thirty sub-watershed areas have been targeted for plans. Seven have been initiated with the intent of beginning five new plans per year.	Both the South Saskatchewan River Watershed and the North Saskatchewan River Watershed are nearing completion. The Saskatchewan Watershed Authority plans to designate a number of new watershed planning areas once the North and South Saskatchewan River Watershed Plans reach their conclusion.	Source water protection is currently at the stage of strategic plan development and no plans have been completed.

B. Protecting and restoring aquatic and riparian ecosystems

~[Canada] needs to move past its own myths of limitless water abundance to create a new national water ethic based on conservation and different formulae for valuing water as a resource in its own right. ~Rosenburg International Forum ²⁸

Rivers, lakes, wetlands, aquifers, riparian land and watershed landscapes are all elements of integrated ecological systems linked together by the fresh water flowing through them. These systems are foundations of our health and economic well-being. Human communities are utterly dependent on the functions and ecological goods they provide and maintain – water supplies for agriculture, industry and municipal use, flood control, purification of human and industrial waste and fish and wildlife habitat.²⁹

Sustainable water management requires that we situate our demands on the hydrologic cycle and aquatic ecosystems within limits prescribed by nature. Freshwater is a finite resource and aquatic ecosystems can only tolerate so much pollution and disruption. Limits exist to the amount of water we can responsibly withdraw and consume, the amount of waste we can discharge and the degree to which we can disrupt natural water flows before the integrity and productivity of aquatic ecosystems and the hydrologic cycle become severely compromised. Over the long term, we cannot prosper by overtaxing and further degrading our ecological foundations.

We expect all governments (federal, provincial, Aboriginal and municipal) to take action to protect and restore aquatic and riparian ecosystems.

B1. Explicitly recognize ecosystems as legitimate water users and fully account for ecosystem needs in water allocation systems.

Federal and provincial governments should create clear standards and legislation that explicitly recognize ecosystems and non-human species as legitimate water users and place priority on securing water required to sustain ecosystem integrity and productivity. These standards should serve as foundations for all water-related legislation, regulation, policy and planning.

Ensuring that water allocation schemes for human uses fully provide for the water needs of aquatic ecosystems and species (environmental flow needs) will require collaboration among provincial, federal and Aboriginal governments. Provincial governments should take the lead in establishing clear limits (i.e. sustainability boundaries) on withdrawals from surface and groundwater sources, creating programs to return water instream for over-allocated systems and modifying water allocation systems to clearly establish when ecosystem needs take precedence to human economic demands. The federal government should support this work by strengthening its enforcement of fish habitat protection under the Fisheries Act and by developing decision support tools and scientific support for assessing ecosystem needs for water. Aboriginal governments should be involved in all activities to ensure protection of their rights, identify the needs of their peoples and their ecosystems and determine their management roles.



Recognizing the importance of environmental flows.³⁰ (From: The Brisbane Declaration)

South Africa's National Water Act states, "the quantity, quality and reliability of water required to maintain the ecological functions on which humans depend shall be preserved so that the human use of water does not individually or cumulatively compromise the long-term sustainability of aquatic and associated ecosystems." Similarly, the Council of Australian Governments (COAG) water reform framework (WRF) sets out water sharing rules ensuring environmental water needs are met. However, as with Canada's federal framework, Australian states and territories have primary responsibility over natural resources, so specific legislation must be created at that level. Both countries prioritize water for ecosystems and basic human needs over that demanded for economic activity.

Representatives of the Australian Government, along with more than 800 scientists, economists, engineers, resource managers and policy makers from 57 nations drafted the Brisbane Declaration that identifies environmental flows as being essential for freshwater ecosystems health and well-being. The declaration goes on to identify a series of policy recommendations to ensure the maintenance of environmental flows.

The delegates to the 10th International River Symposium and Environmental Flows Conference call upon all governments, development banks, donors, river basin organizations, water and energy associations, multilateral and bilateral institutions, community-based organizations, research institutions, and the private sector across the globe to commit to the following actions for restoring and maintaining environmental flows:

- Immediately estimate environmental flow needs everywhere. Environmental flow needs are currently unknown for the vast majority of freshwater and estuarine ecosystems. Scientifically credible methodologies quantify the variable – not just minimum – flows needed for each water body by explicitly linking environmental flows to specific ecological functions and social values. Recent advances enable rapid, region-wide, scientifically credible environmental flow assessments.
- Integrate environmental flow management into every aspect of land and water management. Environmental flow assessment and management should be a basic requirement of Integrated Water Resource Management (IWRM), environmental impact assessment (EIA), strategic environmental assessment (SEA), infrastructure and industrial development and certification, and land-use, water-use, and energy-production strategies.
- Establish institutional frameworks. Consistent integration of environmental flows into land and water management requires laws, regulations, policies and programs that: (1) recognize environmental flows as integral to sustainable water management, (2) establish precautionary limits on allowable depletions and alterations of natural flow, (3) treat ground water and surface water as a single hydrologic resource, and (4) maintain environmental flows across political boundaries.
- Integrate water quality management. Minimizing and treating wastewater reduces the need to maintain unnaturally high stream flow for dilution purposes. Properly treated wastewater discharges can be an important source of water for meeting environmental flow needs.
- Actively engage all stakeholders. Effective environmental flow management involves all potentially affected parties and relevant stakeholders and considers the full range of human needs and values tied to freshwater ecosystems. Stakeholders suffering losses of ecosystem service benefits should be identified and properly compensated in development schemes.
- Implement and enforce environmental flow standards. Expressly limit the depletion and alteration of natural water flows according to physical and legal availability, and accounting for environmental flow needs. Where these needs are uncertain, apply the precautionary principle and base flow standards on best available knowledge. Where flows are already highly altered, utilize management strategies, including water trading, conservation, floodplain restoration and dam re-operation to restore environmental flows to appropriate levels.
- Identify and conserve a global network of free-flowing rivers. Dams and dry reaches of rivers prevent fish migration and sediment transport, physically limiting the benefits of environmental flows. Protecting high-value river systems from development ensures that environmental flows and hydrological connectivity are maintained from river headwaters to mouths. It is far less costly and more effective to protect ecosystems from degradation than to restore them.
- Build capacity. Train experts to scientifically assess environmental flow needs. Empower local communities to participate effectively in water management and policy-making. Improve engineering expertise to incorporate environmental flow management in sustainable water supply, flood management, and hydropower generation.
- Learn by doing. Routinely monitor relationships between flow alteration and ecological response before and during environmental flow management, and refine flow provisions accordingly. Present results to all stakeholders and to the global community of environmental flow practitioners.

Our water is polluted. Even though we have running water, we were told not to drink it unless we boil it thoroughly. Our rivers ... barely flow anymore ... we used to drink that water. Now they are stagnant and not fit for drinking.

Lillian Lathlin of Shoal Lake, MB
~From *Isi Askiwan—The State of the Land*



Aquatic ecosystems and species have unique requirements for water quality, quantity and timing of flows to maintain their health, integrity and productivity.³¹ No clear basis exists for protecting these requirements when they come into conflict with the demands and impacts of human economic activities. As a result, decisions to expand urban, agricultural and industrial developments tend to neglect, underestimate or marginalize ecological water requirements and impacts on aquatic ecosystems.³²

Traditional approaches to water allocation tend to favour economic production over ecosystem health. Water is first allocated to “productive” human uses such as agriculture, industry and urban development with only residual amounts left in our rivers, lakes and wetlands.³³ Sandra and Postel illustrate, on the following page, the impacts of this “20th Century approach” and propose a new approach based on the idea of a “sustainability boundary.” Establishing a sustainability boundary ensures human water demand does not exceed the limited water supplies available in our watersheds and aquifers and recognizes the need to secure sufficient water to sustain healthy, productive aquatic ecosystems.

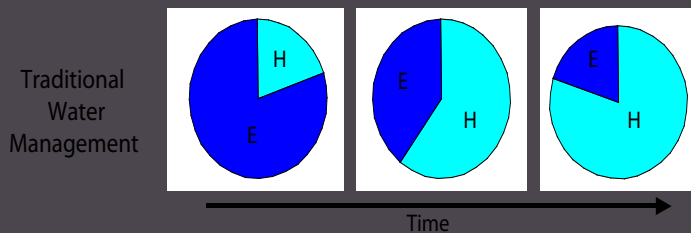
Evidence abounds that the 20th Century approach is outdated and that a new basis for water allocation in the Prairie Provinces is needed. In Northern Alberta, **tar sands**

operations use two to four-and-a-half barrels of Athabasca River water to produce one barrel of oil, contaminating most of the water and thus returning little to the river.³⁴ Despite this, plans for expansion - that the river may be unable support - are proceeding. The Peace-Athabasca Delta, which includes the McClelland Lake Wetland Complex, is internationally recognized as a wetland of importance under the Ramsar Convention.³⁵ With tar sands activities, pipeline proposals, intensive conventional oil and gas development and major hydro proposals on the Peace River all placing immense stresses on the Delta, maintaining the integrity of this ecosystem is of utmost priority.

A number of southern rivers, including the Bow, Oldman and South Saskatchewan are over-allocated, meaning, that if all licensed takings were exercised to their full extent, little water would remain instream during low-flow periods, upsetting the fine balance of water temperature and oxygen levels required to support fish, other aquatic species and surrounding riparian habitat.³⁶

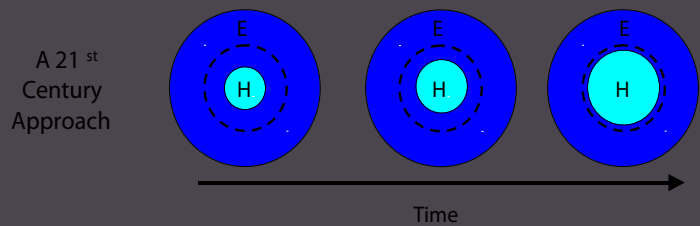
Agriculture and irrigation account for substantial withdrawals in the southern water basins, making up sixty-seven percent of the total surface water allocations in Saskatchewan.³⁷ Crop shifting from agricultural food crops to fuel crops may place an increasingly heavy drain on water resources. Ethanol manufacturing, for example, requires over nine litres of water for every one litre of fuel produced. Additionally, 1.2 billion litres of water in a year - or close to a million gallons per day - will be used for the grain-based ethanol plant in Minnedosa, MB.³⁸





The conventional approach to allocating water is to permit human uses (H) for agriculture, cities, and industries to keep expanding leaving for natural ecosystems (E) whatever slice of the “water pie” happens to remain. Over time this residual slice becomes too small to support ecosystem functions adequately, causing the disappearance of species and the loss of valueable ecosystem services.

Adapted from Postel and Richter (2000)³⁹



In this new approach to allocating water, scientists and policymakers define the quantity and timing of flows needed to support freshwater ecosystem health and then establish a “sustainability boundary” that protects these flows from human use and modification. Human uses of water (H) can increase over time, but only up to the sustainability boundary. At that point, new water demands must be met through conservation, improvements in water productivity and reallocation of water among users. By limiting human impacts on natural river flows and allocating enough water for ecosystem support (E) society derives optimal benefits for river systems in a sustainable manner.

B2. Respect, protect and restore natural water flows by legislating environmental flow needs and establishing strict limitations for on-stream storage and for inter-basin and intrabasin diversions.

Governments must establish and ensure minimum and protective standards for environmental water flows. Across the region, governments should collaborate to develop and implement ecologically based operating plans for existing dams and diversions based on the goal of mimicking, as best as possible, natural flow regimes.

All proposals for new large dams⁴⁰ must be subject to:

- 1) A comprehensive assessment of social, cultural, economic and ecological benefits and cost;**
- 2) An assessment of qualitative costs and benefits, including regional analysis on where benefits rest versus where burden of impacts are felt and a full analysis of impacted community perceptions;**
- 3) The need to demonstrate that other means of meeting human needs (i.e. through**

efficiency and conservation measures) have first been exhaustively examined and implemented. For instance, demand reduction (conservation) must be fully implemented before supply expansion (dams) should be considered.

4) An assessment of the impacts on treaty and Aboriginal rights

A decision to proceed with a large demand must be made on the basis of the above assessments and must accommodate the local concerns, and impacts of local communities.

Large diversions between major watersheds (inter-basin diversions) and smaller watersheds (intra-basin diversions) must be expressly prohibited. In very exceptional cases, residents may democratically decide to vary that prohibition and allow a intra-basin diversion, but only after plans for the diversion have been shown to meet strict ecological, social and economic criteria to protect ecological integrity and those living within the watershed. Provincial governments should take the lead on these initiatives with support and oversight from the federal government. The federal role must be strengthened when projects impact multiple provinces or US states.

For much of the 20th Century, water management has focused on modifying natural water flows to increase the volume and predictability of water supplies, produce hydro-power and control flooding. These efforts have been important for the expansion of our economies and the safety of our communities, but they have also resulted in significant adverse consequences for the aquatic ecosystems and species that have evolved with the natural movement and variation of water through watershed environments.⁴¹

Dams and diversions alter the timing and volume of flows, water temperatures, transport of nutrients and sediments and block migration of fish and other aquatic species. Despite these well-known impacts, substantial public resources have been directed to proposals such as the Highgate Dam on the North Saskatchewan River, the Meridian Dam on the South Saskatchewan River and Conawapa Dam on the Nelson River.

Moving water across watershed boundaries – referred to as inter- or intra-basin diversion – can introduce invasive species to aquatic ecosystems which upset natural food webs, reduce biological diversity and can potentially eliminate native species. For example, the threat of invasive species to the commercial fishery in Lake Winnipeg – worth \$15 million annually – is a cause of significant concern, and the primary reason for opposition to North Dakota's Garrison Diversion and Devils Lake Outlet projects.⁴²

With climate change looming and water supplies expected to tighten as the Prairies heat up, many fear that dams and water diversions may be promoted as ways to increase and manage water availability. It is, however, a misconception that storage will mean more water. While water storage can help time flow, large reservoirs evaporate much water and the irrigation projects

that go along with dams create huge water demands. Due to this evaporation and increased extraction, big dams reduce total flows downstream.

Rather than dams and diversions, proactive policy solutions, such as diversifying agricultural production to low irrigation crops, should be examined. Future water policy options that place sustainability at the forefront will advocate for doing more with less, for adjusting human needs to match the capacities of local ecosystems.

Review of interbasin and intrabasin transfers in Alberta

Albertans' are increasingly concerned over the handling of water transfers between watersheds in the province. The Water Act does prohibit water transfers between the province's seven large basins, but Alberta currently has no formal policy to limit water transfers within these vast basins. Applications for intrabasin transfers - transfers between watersheds within the same water basin - are treated like any other water licensing application, regardless of their scope and potential for harm. Meanwhile, despite the prohibition, Acts of Legislature do grant interbasin transfers. In fact, Alberta's Legislative Assembly most recently approved two such proposals in December 2007. No publicly accessible policy exists to ensure that interbasin or intrabasin transfer decisions in this province take sufficient account of potential environmental, socio-economic, and cumulative impacts.⁴³



B3. Prevent pollution of aquatic ecosystems and aquifers.

[T]hey ruined my trap line. They put water on that land and the water is black and now there are no animals in that area. Instead of trying to help nature, the land is dry.

Once they are finished ruining the land, they go away.

Elder Tom Pelly

~From *Isi Askiwan—The State of the Land*

Impacts of dams and reservoirs

Canada's Prairie Provinces are home to 770 dams, most of which are in the South Saskatchewan river basin. Impoundment of water in reservoirs has significant impacts on downstream flows. Impoundments that fluctuate widely often decrease production of native macro-invertebrates, which in many instances are replaced by smaller, shorter-lived species of less value for supporting fish stocks. Impoundment also impacts water temperature, and these thermal impacts (i.e. increased water temperature) can be felt for 110 kilometres below reservoirs. While widely touted as a clean source of electricity, dams are not as environmentally neutral as was once thought. Impoundments can increase mercury concentrations in the water and increase both carbon dioxide and methane release.⁴⁴



Provincial governments need to establish regulatory frameworks that focus on protecting and restoring ecosystem integrity and on preventing pollution. Proper regulations within those frameworks then need to be developed and enforced. Permission to discharge wastes should be based on the carrying capacity of the receiving ecosystems – and the watershed ecosystem as a whole – rather than technological or economic feasibility. Federal and provincial governments should collaborate on pollution prevention by supporting research and implementation of strategies such as the recycling and reuse of wastes and waste waters and substitution of toxic substances used in production with non-toxic alternatives.

Pollution from our communities, agriculture and industrial activities inevitably finds its way into aquatic ecosystems. Sources of pollution are typically divided into two categories: point and non-point. Point sources are distinct, localized discharges from operations such as industrial facilities, sewage lagoons and municipal wastewater plants. Non-point sources are distributed broadly across the landscape. They include manure, pesticides, fertilizers, oils, metals and other toxic substances that run-off the land into rivers, lakes and wetlands or find their way into aquifers.

The current condition of Lake Winnipeg is a telling example of the cumulative impact of pollution on aquatic ecosystem health. Nutrients from across the Prairie Provinces and a number of US states are concentrating in “Canada’s sixth Great Lake.” In 2006, this pollution caused a 6,000 square kilometre blue-green algae bloom to develop, sucking the oxygen out of the lake and threatening commercial and recreational fisheries.⁴⁵ Part of the problem is that policies and regulations focus on end-of-the-pipe discharges rather than on the carrying capacity of the ecosystem (i.e. the ability of receiving aquatic

Many are sick in the lungs, in the kidneys, things like that. Over a period of years, there may not be much poison that may accumulate, but over a period of ingestion, over a period of years of that particular chemical, that particular water they have been drinking, affects them. As they get older, that is when that substance will get them sick, that chemical laced on the land and that flowed into the water.

Elder Norman Henderson

~From Isi Askiwan—The State of the Land

ecosystems to deal with the pollution) or on preventing pollution in the first place.

An aggressive policy framework for addressing phosphorus loading of Lake Winnipeg would place limits on phosphorus discharges by upstream industrial polluters. This would need to include those upstream in Canada as well as the United States and would therefore necessitate active federal involvement and leadership. All upstream users need to be part of the solution for Lake Winnipeg, however, the Manitoba government must show leadership in this regard, taking the first steps to limit phosphorous pollution generated from within the provincial borders.



Intensive Livestock Operations and threats to water quality⁴⁶

~adapted from Beyond Factory Farming Coalition Fact Sheet

At one time, crop and livestock production were complementary enterprises on mixed family farms – the number of animals was kept in proportion to the number of acres that grew crops for the animals' food. As well, because production was spread widely across the landscape, most of the nutrients originating from those animals were returned to the soil in the same area. Today, most cattle, hogs and poultry are concentrated in large holdings (such as giant feedlots of 20,000 cattle or more, mega hog barns of 5,000 to 20,000 hogs or more, poultry batteries of 100,000 birds or more) on small land areas and are raised under intensive conditions. The animals' feed is often grown far from the operations and manure is spread or sprayed onto fields and pastures as raw, untreated liquefied slurry in quantities that exceed the nutrient needs of crops. Using hog manure as an example, the combination of the composition of the manure, the massive amount of manure produced, and the less-than-state-of-the-art ways it is disposed, creates an enormous threat of pollution (elevated levels of nitrogen and phosphorus specifically) to both surface and ground water – the source of drinking water for most Canadians. In order to protect surrounding ecosystems and human populations from contamination as a result of intensive operations, it has been recommended that limits to livestock operation populations be put in place. In addition, livestock monitoring must include and make public:

- Manure management plans that ensure manure production does not exceed what can be utilized by crops grown on the land;
- Soil test data to see if nutrients are building up in the soil;
- Monitoring wells on manure storage facilities to see if groundwater is being contaminated;
- Water usage data to see if individual and cumulative operations are over exploiting a local or regional water source; and
- A list of ingredients in the feed rations, so that we can start to monitor other pollutants such as antibiotics that enter our environment.

Making a transition to sustainable agriculture and socially responsible livestock production is by far the most effective way to improve the environment and protect our water resource.

B4. Ensure that wetland area and function are maintained in, and environmental flows are integrated into, every aspect of land use, economic development and water management decision-making.

Governments must work to better integrate land-use, economic activity and water management by considering the carrying capacity and overall health of watershed ecosystems in policy and planning. Provincial governments should work with municipalities to create urban growth boundaries to constrain sprawl and adopt water-sensitive urban design techniques to minimize the impacts of urban development on ecosystem health.⁴⁵ Provinces should also work to slow and reverse the loss of wetland and riparian ecosystems, create more and larger buffer zones alongside surface water bodies and promote beneficial practices such as zero till agriculture, shelter belts and increased forest cover. Federal, provincial and Aboriginal governments should work together to develop watershed-based frameworks to assess the impacts of all development activities on the health of watershed ecosystems. This includes ensuring adequate perennial cover, forested areas and sufficient shelterbelts.

As municipal governments largely have jurisdiction over land-use planning and development, the creation of a consistent municipal development plan structure that includes the identification and protection of natural water bodies and boundaries may be necessary to ensure efficient land-use planning, and development that protects a region's water bodies. Such identification must take place prior to any land use planning and development approvals that have the potential of impacting surface and/or groundwater sources.

As the discussion of non-point source pollution above illustrates, substances released on the land show up in the water. But our land-use activities affect more than water quality. Impacts

of agriculture, mining operations and urban development also impact the integrity of the hydrologic cycle and the health of aquatic ecosystems. For example, **approximately 70% of southern Prairie Provinces' wetlands have been drained** and loss of wetlands and riparian areas to agricultural and urban expansion continues, compromising functions such as water storage, flood control and fish and wildlife habitat.⁴⁸ Urban sprawl increases the extent of impervious surfaces – replacing meadows and forests with roads, parking lots, driveways and roofs – so that rain can no longer seep into the ground to replenish aquifers.⁴⁹

At a broader level, the economic activities we choose to pursue, and where we choose to pursue them, also impacts the hydrologic cycle and ecosystem health. Decisions to expand or pursue activities such as tar sands operations, coalbed methane production or mineral mining seldom consider the capacity of local watersheds, aquatic ecosystems and water supplies to support them. Corporations focused on making billions of dollars in profits are not well positioned to sincerely evaluate their impacts on ecological integrity.

Integration between our land-use and water-use decisions is clearly needed. Often development and building permits (land-use decisions) are issued before water needs and availability are assessed. The recent case in Balzac, Alberta clearly shows this disconnect. In this example, a building and construction permit was issued for the development of a water intensive entertainment complex including a mall, casino and horse track. The approved development had extensive water needs but was in the Bow River basin, a basin that has a moratorium on new water licenses. In the end, an agreement was made with the Western Irrigation District to trade a portion of their water license. The Government of Alberta made the correct decision to ensure a 10% conservation hold-back, thus returning 10% of the traded license back to the Bow River – a move that is not required by government. These questions however, must be asked and answered before a decision to proceed with a proposed development is granted.

B5. Recognize the connection between ground and surface waters ensuring groundwater protection is integrated in all existing policy and legislation.

Government plans and policies must recognize the interconnection between surface and groundwater. This recognition should apply to all existing legislation and regulations.

Groundwater quantity and quality assessments need to be complete before additional industrial licenses to extract are issued. Governments should require hydro geological studies for all projects involving groundwater withdrawals or impacts before approvals are granted. Such studies should identify impacts and recommend strategies to avoid and/or minimize any potential environmental impact. If the impacts are deemed too great or unknown, regulators must begin to question the validity in issuing approvals.

As surface waters become increasingly over-allocated, governments, industry and water users, are turning to groundwater sources to fill a growing demand for water. Groundwater accounting has not been completed across the Prairie Provinces. As mapping of groundwater reserves, including assessments on aquifer geography and volume, is actively ongoing, approvals to access groundwater aquifers continue to be granted. This has led to calls that groundwater access should be limited until the completion of aquifer mapping. An important part of this study includes a broadened understanding on the connection between groundwater and surface water flows.

Groundwater scientists are clear that there is an inter-connection between ground and surface waters. Groundwater sources often act as a source of replenishment in surface water systems. It therefore raises the question: if we are turning to groundwater allocations in areas

Oil or water - which is more important?

The oil industry in Alberta has a great thirst for water. Tar sands mining, steam injection tar sands drilling (in situ production) and conventional oil production currently place considerable demands on water resources. And the pressure is increasing. Alberta's reserves of bitumen are among the largest oil deposits in the world, second only to Saudi Arabia. Production of these reserves is expected to double within five to seven years and to triple by 2020. Unless policies and practices change, this will create massive and unsustainable demands for water. In the case of tar sands mining, this demand removes large quantities of water from the hydrologic cycle by storing waste water in tailings pond containing toxic byproducts from the extraction process. The trends are troubling; in some parts of the province - Alberta will soon have to decide which is more important: water or oil.⁵⁰



where surface water is already diminished, are we not just adding to the problem?

Over-withdrawals, aside from the obvious contribution to overall regional water shortages, have other ecological impacts, including land subsidence and harm to wetlands. Wetlands are closely connected to groundwater systems.⁵¹ Caution must be executed with issuing access to groundwater, as the impact of excessive withdrawals is not fully known.





acceptable and clearly designating regions where all motorized activities are restricted.

Governments must also ensure that adequate funding is in place for enforcement, recreation management, and education staff, equipment and signage.

Aquatic and riparian species must be monitored and important ecosystem areas (nesting sites and spawning areas) must be protected from recreational water users. In addition, a detailed water safety and regulations education (signs, brochures, information distributed by officers or parks staff) program must be implemented to ensure users and public are aware of regulations and reasons for enforcement.

Both government agencies (federal and provincial), and local municipalities have a responsibility to ensure that our water bodies are not only healthy ecosystems, but are also places that provide safe, education-based and ecologically friendly recreation opportunities. The beauty of our diverse water bodies in the prairie region, such as lakes, reservoirs, rivers and streams, are places that communities gather, explore and connect with the natural environment. With recreational activities becoming increasingly motorized and invasive we need leadership and accountable governance to ensure outdoor recreational activities are not a threat to ecosystem sustainability.

B6. Complete a recreation management strategy for major water bodies across the Prairie Provinces to ensure safe, accessible and educational-based recreation and tourism opportunities compliment, rather than hinder environmental protection and reclamation initiatives.

Governments across the region should develop and support implementation of recreation management strategies. Strategies should include: development and communication of clear regulations which identify appropriate recreation activities, a clear enforcement strategy for such regulations (including recreation restrictions and guidelines), assurance of clearly posted access points to encourage managed and appropriate water access points with waste disposal, toilets and fish cleaning stations and a monitoring program to inform annual updates on regulations. Recreation management strategies should be developed in conjunction with adjacent regions to ensure that a variety of recreation experiences are available. For example, ensuring that there are rivers and creeks that only permit non-motorized activities (paddle boats, canoes or sail boats), while other water bodies permit motorized activities. The same determinations must be developed for all-terrain vehicle (ATV) use, to clearly identify areas where ATV use is



C. Managing “our” water demand

~As we peer into the twenty-first century, water conservation is looking far more like an imperative than an option. ~A. Vickers⁵²

Climate change, finite local water supplies and the need to secure water for aquatic ecosystem protection all represent constraints on the water available for human activities, now and in the future. Respecting these constraints while also maintaining our prosperity and well-being will require a rapid shift away from the tradition of increasing water supplies and towards strategies aimed at better managing our water demands. Put differently, our focus must shift from managing our watershed ecosystems toward managing ourselves.

Reducing and better managing demand is widely recognized as the best means of finding “new” water for community and economic development.⁵³ Not only are comprehensive and long-term water conservation and efficiency strategies often cheaper than developing new sources of supply, but such strategies can be implemented quickly and incrementally in response to changing water availability and with far less damage to aquatic ecosystems.

We expect governments to lead the shift from expanding water supplies to managing water demands.

The soft path for water

The realities of the 21st Century demand a more comprehensive and long-term approach to water conservation and efficiency than our current piecemeal efforts. The water soft path concept provides a framework for such an approach. Rather than constantly seeking out and developing new sources of supply, the soft path approach strives to maximize the productivity of existing infrastructure and water takings. It does so by integrating water-efficient technologies, conservation-oriented water fees and public education to create comprehensive management strategies. But the soft path goes further – asking why we use water at all for certain purposes. Why, for example, do we fast track rainwater off the urban landscape into rivers and almost simultaneously pump river water, subject it to energy-intensive water treatment and then apply it onto lawns? By asking such questions, the soft path approach exposes innovative options for water management that are often dismissed simply because “that’s not the way we’ve always done it.”⁵⁴

A recent study by the University of Victoria’s POLIS Project on Ecological Governance illustrates the potential of the soft path approach in concrete terms. The study compares scenarios of future water use for a model Canadian community with a base population of 200,000 in 2005 that grows by 50% to 300,000 by 2050. Results indicate that under a soft path approach, water savings of almost 44% are possible compared with the business-as-usual scenario. Water saving of this magnitude would mean the community could offset a population growth of almost 75% through comprehensive water conservation and efficiency, eliminating the need for major expansion of water supply infrastructure.⁵⁵ As a result of this and other studies on water soft paths, interest in implementing the approach at the community scale is increasing rapidly. For example, the 2008 Federation of Canadian Municipalities Sustainable Community Conference includes a half-day workshop to train municipal water managers on the soft path approach.⁵⁶



C1. Facilitate comprehensive “full-cost” water efficiency planning.

Municipal, agricultural and industrial sectors and operations should be required to create and implement comprehensive water efficiency plans that include hard targets that reflect best practices for their sector and clear timelines for implementation. Provincial and federal governments should enforce such requirements by making infrastructure grants and applications for water licences contingent on the preparation and implementation of these plans.

In some sectors and in some regions the shift toward better managing our own human demand for water is already underway. Most large urban municipalities now incorporate water efficiency programs in their management strategies. Some, like Calgary, are looking to meet all future growth by better managing water demand. Too often, unfortunately, these programs are reactionary, stop gap measures put in place until new supply can be secured rather than planned responses to deal with long-term water needs within limited local water availability.

The story is similar in other sectors. Despite improvements to the efficiency of irrigated agriculture, old proposals to dam up Prairie rivers have resurfaced, threatening to further fragment these fragile ecosystems. There remains a clear need to link water efficiency planning across sectors. For example, reductions achieved in in-house water use (for example, through mass installations of low-flow showerheads and/or low-flush toilets) can easily be swallowed by upstream expansions in irrigation. If our potatoes, chickens, bread and cooking oil are increasingly supplied from operations that are making the transition from rain-fed agriculture to irrigation agriculture, then the river water content of the food you consume in your house might go up, despite best efforts at in-house reductions.

This points to the necessity of “full-cost accounting” in our water use and the need to

holistically integrate water use accounting and policies. **True water conservation must unify thinking about the water we see in our houses (in sinks, toilets and showers) and the water we do not see (in our food, energy and industrial goods).**

C2. Establish rising block rate structures that secure sufficient and accessible water for priority uses and targets excessive use of water, water contamination and removal from hydrological cycle as key cost factors.

Rising block pricing schemes should be considered which secure sufficient and accessible water for priority uses and target excessive use of water, water contamination and removal from hydrological cycle as key cost factors. Provincial, federal and Aboriginal governments should implement programs to ensure fees for provision and management of water reflect full costs. In the development of fee systems, privatization schemes of water and water distribution systems must be expressly avoided.

Fees for water services in Canada are among the lowest in the industrialized world. The OECD (1999) has gone so far as to call Canadian water “cheaper than dirt.” Typically, our fees do not reflect environmental costs and, in many cases, do not even cover the full financial costs associated with developing, treating and distributing water and administering water management programs. Although “full costs” are ultimately paid one way or another (generally through the tax system), shifting more of the costs into water fees encourages conservation by revealing the cost to large water users and upholds polluter pays principles of full cost accounting. When such costs are factored into an understanding of the true “costs” of decisions, it is easier to recognize how keeping water clean in the first place is often the best way

to prevent pollution.

A full examination of rate structures will provide opportunity for ensuring a full-cost fee system employs the values of publicly protected water while ensuring that excessive water users are paying ‘full-costs’ for use.

Flat-rate structures exist where a flat fee is charged to all water users regardless of the amount of water consumed – it has been identified that users consume significantly more than if they pay by the volume they use. Constant rate structures – in which one is charged for each unit of water used irrespective of end-uses – may foster a degree of conservation but do not have mechanisms to identify priority uses. Block rate structures, on the other hand – where consumers are metered for water use and charged at an exponentially increasing rate as consumption increases - may offer the best opportunity for identification of priority uses within a rate scheme while concurrently affording an opportunity to include in the rate structure a pollution index as well as inclusion of fees for practices that remove water from the hydrological cycle. Basic water services can be provided at no cost to make certain that all users have equal access. Costs for water would increase through a series of “blocks” as use becomes more excessive and/or polluting, thus ensuring wasteful and non-essential water users cover the costs to society of their water use and/or abuse.

C3. Direct public resources toward managing demand.

Governments are entrusted with managing public resources for the public good. Federal and provincial political leaders must make the shift toward demand management a priority. This would involve directing necessary financial

Prohibit Private Public Partnerships (P3s)

Under P3 arrangements the private sector plays a key role in financing, designing, building, operating or even owning facilities or infrastructure that are otherwise designed to be public services. While the forms of P3s vary, they can allow private corporations to plan, finance, build, and operate public facilities – usually at a much higher price than if a municipal government were to retain control.

When private companies take over a public project, the focus shifts away from the public interest and meeting community needs, to ensuring a profit for the companies’ shareholders. We, therefore, believe water and water services remain in the public trust and run by our public institutions.

Adapted from P3 materials by the Council of Canadians

resources, personnel and knowledge capabilities of government agencies and departments toward improving efficiency of water use and conserving scarce supplies – rather than on expanding supply-side infrastructure to increase water use.

Reconciling human water demands with the water needed to sustain healthy, productive ecosystems will require that we innovate and plan strategically for managing demand – that we not only use water more efficiently, but that we use it wisely. Urban populations are likely to grow, but research shows that by investing intensively in demand management population growth can occur in the absence of expanding water supplies.⁵⁷

In food production, there is a need to continue improving irrigation efficiency, as well as a need to examine the social returns of further expanding highly subsidized irrigation projects. Farmers, governments and all residents must work to shape irrigation and food policies that create sustainable livelihoods for farm families and also protect aquatic ecosystems and maximize overall gains for our communities and economies.

Shifting away from supply expansion toward demand management will require a parallel shift in public resources. For example, in the agricultural sector, funding currently directed at



Natural capital – ecological goods and services

According to the International Institute on Sustainable Development, natural capital is the land, air, water, living organisms and all formations of the Earth's biosphere that provide us with ecosystem goods and services imperative for human survival and well-being. Furthermore, it is the basis for all human economic activity.

Natural capital, therefore, recognizes that the human 'economy' is based within a broader ecological world that both impacts and is impacted by human economic activity. Natural capital provides a mechanism to recognize the benefits (to humans and non-humans) that arise from ecological functions of healthy ecosystems. Examples of ecological goods include clean air, clean and abundant fresh water and a diverse and healthy soil. Services include carbon sequestration, erosion control, purification of water and air, water retention and maintenance of biodiversity, as well as contributing the capacity to meet our fundamental cultural, spiritual and intellectual needs.

In a recent review of agriculture-water policy across the Prairie Provinces, the IISD citing the United Nations' Millennium Ecosystem Assessment, concluded that the use of economic instruments to support ecological goods and services is a necessary policy response to ensure health of both agricultural and water systems.⁵⁸

If natural capital assets are not maintained, ecosystem goods and services will decline. Therefore, investment in natural capital health and integrity is necessary to ensure the planet remains habitable for human beings and all other life.



expanding infrastructure such as dams and pipelines should be shifted to finance: studies and implementation of innovative demand management techniques such as water scheduling; efficient end-use technologies; public education; reducing losses in conveyance systems; water reuse and recycling; and exploration into (limited and carefully planned) use of minimal off-stream storage.

Municipally, a shift from large centralized treatment and distribution systems further exploration emphasizing local place-based water systems that use technology appropriate to the local land and water carrying capacity. Research on solid waste management strategies that do not require water is necessary.

C4. Legislate best practices for water-use and prevent the misuse of the region's water.

Governments must limit, deter and/or prevent the misuse of the region's valuable water resources by legislating best practices for water use and encouraging economic activity that values water conservation. Such economic activity would promote research into and adoption of new technologies and practices, such as agricultural crop varieties that are naturally drought resistant, and would further eliminate practices that waste fresh water, such as the contamination of fresh water through use in oil recovery and extraction.

Municipalities should be mandating best practices into municipal building code bylaws as well as exploring the use and identification of urban growth boundaries or growth limits as they pertain to local ecosystem carrying capacity and water availability.

Provincial and municipal governments should collaborate in developing an infrastructure program that would identify and fix inefficiencies in the system, including leakage and extreme infrastructure waste in water provision programs throughout the province.

As in energy discussions, conservation and efficiency measures offer policy makers some of the greatest leverage with which to promote an agenda of improved water management. By simply reducing water demand by implementing currently available and affordable technologies, it has been estimated that total urban water use could be reduced by as much as 30%.⁵⁹ Current building code standards often deter a water conservation agenda instead of promoting best practices. For example, codes across the Prairie Provinces consistently prevent the use



of grey water in household or business water systems.⁶⁰ Buildings should be altered to reflect the best new technologies in water conservation, including the encouragement of water re-use technology and rainwater recycling for yard maintenance. Further, policy makers should legislate water use standards in dishwashers, washing machines, hot-water furnaces, faucets and toilets.

Communities across the region are starting to acknowledge the advances that can be made by embracing such strategies. The city of Okotoks, for example, has acknowledged its water-constrained future by imposing an urban growth limit on the community, which has effectively guided the development of innovative and unique solutions for the management of limited resources, such as water.

In addition to household and municipal activities, it is imperative that solutions be directed at industrial and agricultural best practices as well. Questioning development proposals on their use of (or misuse) of a regions water supply is imperative. Unacceptable uses of water should be identified and expressly prohibited.



C5. Embark on a full review of water allocation with the goal of identifying and protecting priority uses.

Provincial governments should review their water allocation systems and ensure that the systems are designed to maintain the integrity of natural water systems based on current and future anticipated availability. Ensuring adequate and sustainable quantities to maintain ecosystem functioning should be the top priority. Second, but nearly equal, should be the priority of providing for basic human/household needs.

Water allocation systems establish the rules used to regulate water withdrawals and establish priorities for water taking, which are used to decide who gets to take water when, how much and what it is used for. Water allocation systems vary among the Prairie Provinces. Until recently, all were based on the principle of “first in time, first in right” (FITFIR), which basically means that rights to withdraw water are based on the date of the license application, with older licenses taking priority over newer ones. Alberta’s system strictly adheres to the FITFIR principle. Manitoba operates under a modified FITFIR system that assigns priority if or when two licenses are applied for concurrently. Priority is designated as follows: 1) domestic, 2) municipal, 3) agricultural, 4) industrial, 5) irrigation, 6) other. Manitoba’s modification to FITFIR also allows the minister to deny or suspend a license if there are (or will be) negative impacts to the aquatic ecosystem (including environmental flow needs). Saskatchewan has recently abandoned the FITFIR approach and currently has no established system to prioritize uses.⁶¹

Any system of use and priority must recognize and reconcile Aboriginal and treaty rights claims to water. Current FITFIR systems or modified allocation schemes fail to recognize these claims and this must be rectified through the involvement of both federal and Aboriginal governments in development of appropriate schemes for allocation of water.

As Alberta’s southern river basins have recently been closed to new water allocations, there is a growing need to reallocate limited water supplies among competing water needs. In Alberta, the reallocation of water is increasingly occurring through market-based transactions without any regard for ecological protections or recognition of the fundamental human right to basic water needs. **Governance over water in any of the Prairie Provinces must embrace the protection of aquatic ecosystems and a basic human right to water as fundamental; not subservient to market forces. Using economic markets – the ability to pay – to allocate water threatens the public interest and environmental integrity – damaging current and future generations.**

In large regions of the southern Prairie Provinces, managing water uses in times of scarcity will determine future successes of water policy. Having a clear hierarchy of uses allows for quick decisions to ensure that water for people and ecosystem are met before all other additional water users.



D. Responding and adapting to climate change

In the near future, climate warming, via its effects on glaciers, snow packs and evaporation, will combine with cyclic drought and rapidly increasing human activity in the western Prairie Provinces to cause a crisis in water quantity and quality with far-reaching implications.
~Schindler and Donahue⁶²

The jury is in on global climate change. Evidence of increasing air and ocean temperatures, rising sea levels and widespread melting of snow and ice packs has led the scientific community to conclude that, “warming of the climate system is unequivocal.”⁶³ This conclusion has profound implications for sustainable water management. The climate system and the hydrologic cycle are intimately linked. Changes in climate have profound impacts on water quality and availability and on ecosystem health – impacts that Prairie residents are already experiencing. Further, certain residents, specifically Aboriginal Peoples, are often the first and hardest hit by impacts, since many of their livelihoods and rights are dependent upon and interconnected with the environment.

Since the 1850s, most of the large glaciers in the headwaters of the Saskatchewan, Athabasca and Bow Rivers have shrunk considerably and this change has accelerated in recent years. From 1975 to 1998 the size of glaciers decreased by 50% in the South Saskatchewan River basin and by 23% in the North Saskatchewan River basin.⁶⁴ Average stream flows in the Athabasca River have decreased by about 20% since 1958, with minimum flows projected to diminish by a further seven to ten as early as 2026.⁶⁵ The thriving algal blooms already threatening the water quality and ecological health of Lake Winnipeg are expected to worsen with the warmer temperatures predicted due to climate change.⁶⁶

D1. Prairie governments (municipal, provincial and federal) need to immediately implement aggressive plans of action to mitigate climate change and avoid dangerous levels of average global warming.

Given the relationship between climate variability and water availability, melting glaciers and the hydrologic cycle, and given that human-induced climate change will have significant impacts on water availability and quality, immediate and proactive action is required.

The International Panel on Climate Change has identified that a global average increase of above 2°C would result in catastrophic impacts. Global average temperature rise must, therefore, be kept within this 2°C threshold. To meet this challenge, all governments and all industries must aim to reduce absolute greenhouse gas (GHG) emissions by 30% below 1990 targets by 2020 and by over 80% from 1990 levels by 2050. Inappropriate timelines and reduction targets by several governments, Canada included, continue to make international targets difficult to attain. This cannot, however, be used as an excuse for inaction. We must and can set forward a path towards a low-carbon future – the health of Prairie water systems quite clearly depends on it. Recognizing the value of wetlands as a natural carbon sink may prove an important tool (one of many needed). By protecting wetlands on the ground important reduction in atmospheric greenhouse gases can be achieved.



D2. Enact an aggressive water policy framework that proactively prepares the southern reaches of the Prairie Provinces for drought.

Dealing with the challenges of climate change will require strategies based on the twin pillars of mitigation and adaptation. Mitigation efforts aim to stabilize and to ultimately reduce the concentration of greenhouse gases in the atmosphere by reducing emissions and increasing “sinks” for carbon dioxide (e.g. increasing permanent land cover with trees and other vegetation). Adaptation strategies minimize our vulnerability to climate change impacts by enhancing our ability to anticipate and respond to current and future impacts. We expect governments to take assertive action on both fronts and to recognise that, for Aboriginal Peoples, the ability to adapt is precarious given the existing levels of poverty.

Such a policy framework must, according to David Sauchyn from the University of Regina, minimize the adverse impacts of drought and increasing aridity through implementation of adaptation strategies for soil and water management practices given the likelihood of climatic variability.

Agricultural regions of the Prairies traditionally experience relatively long winters, short summers and low precipitation. It is the relatively good soils and adequate precipitation patterns that have driven an agricultural sector that accounts for 50% of Canada’s farms and over 80% of its total farmlands.⁶⁷ Due to the potential for moisture deficits – specifically in regions to the south – extensive irrigation systems have been developed to support and stabilize higher levels of production. In the Prairies, 630,000 hectares of agricultural land currently rely on irrigation, almost 500,000 hectares of which are in southern Alberta.⁶⁸

The other thing that will happen is a lot of vegetation will grow on the lake because of the warm climate. Sure enough, there is a lot more weeds; the anglers will not go there because there are too many weeds that tangle their hooks. When we commercial fish during the day, we get in trouble with these weeds. So these are the changes I have seen and what the warm climate will do.

Elder Oscar Beatty

~From Isi Askiwan – The State of the Land

This is important to understand in the context of climate change. Expected impacts from climate change in the region include increased moisture deficits – less net available water, as evaporation losses increase faster than rainfall amount (or as rainfall amounts fall). Recent research into the paleo-climatic patterns of the southern Prairies in Canada shows that severe drought episodes have been common in the region over the past 1,000 years. Moreover, the research shows that prior to colonial settlement in the area, drought conditions “far exceeded anything experienced in the last century.”⁶⁹



The research suggests that natural cyclical drying should further be expected in the region. This, coupled with information emerging from climate forecast models showing that any precipitation increases will be trumped by expected temperature increases (i.e. increase potential for evapotranspiration), gives us due warning that climate change impacts in the region will be large and disruptive to economies and ecologies alike.⁷⁰

The region is, therefore, in need of a proactive water strategy that prepares for natural cyclical droughts while aggressively working towards the mitigation of climate change. As it is expected that a certain degree of climate change is unavoidable, due partly to inaction of governments in Canada, adaptation strategies are also important to include in a proactive water strategy.

The costs of inaction in this area are simply unacceptable. The regional droughts of 1984-85 cost Canada at least \$1 billion. In 1991, emergency payments to farmers exceeded \$700 million.⁷¹

D3. Mainstream climate change into water policy.

Federal, provincial and Aboriginal governments must work to mainstream climate change into all aspects of fresh water management by undertaking a comprehensive review of water policies and programs. Such a review would identify gaps and inconsistencies, strengths and opportunities, with the overarching goal of determining if our management capabilities are sufficiently developed and resourced to address climate change.

Responding to more frequent and extreme flood and drought is only one aspect of water management that must be adapted to deal with the impacts of climate change. Indeed, because climate systems and the hydrologic cycle are so closely linked, climate change profoundly influences all aspects of water management. Climate change introduces new uncertainties and issues that will require new knowledge and strategies. To respond effectively, we will need to integrate – or “mainstream” – climate change into all aspects of water policy.



What is mainstreaming?

Most adaptive actions are not adopted in light of climate change alone. To have a practical impact, it is important to integrate climate change adaptation initiatives with other programs, such as resource management, coastal zone management, community development and livelihood enhancement.⁷² This integration is what some refer to as mainstreaming.⁷³



Resilience defined

The term resilience has its roots in the science of ecology. Ecosystem resilience is defined as the ability of an ecosystem to tolerate disturbance without collapsing or shifting into a different state. A resilient ecosystem can withstand shocks and rebuild itself when necessary. When applied to social systems, this definition is expanded to also include the ability of humans to anticipate and adapt to the future.⁷⁴



Water sharing in Alberta

The 2001 Southern Alberta Water Sharing Group was formed in response to drought conditions. Rather than the government strictly enforcing allocations based on the “First in Time, First in Right” regulations, water users, including irrigation districts, farmers, livestock operations, recreational facilities, towns, villages, industries, local and provincial governments and First Nations came together to negotiate a shared strategy. This is an example of an effective adaptation strategy that ensures water is distributed as effectively and fairly as possible under abnormally warm and dry weather conditions.⁷⁵ This water-user process relies heavily on personal communications and a mutual commitment – it illustrates that crisis intervention depends a lot on pre-existing relationships and institutions.

D4. Build resilience for climate change adaptation.

Federal, provincial and Aboriginal governments should collaborate to create and fund comprehensive drought and flood-response strategies. Municipalities will require technical assistance and resources to develop emergency response plans. Financial resources should be allocated to equitably compensate industries, farmers and communities impacted by severe floods and or droughts. Over the longer term, policies and programs should be developed to compensate farmers and other rural landowners for protecting and restoring ecological goods and services. Provincial governments should build buffers into water supply calculations to deal with uncertainties in future availability and integrate mechanisms into water allocation systems to ensure supplies are distributed fairly in the event of drought. The federal government must renew and fully fund its Flood Damage Reduction Program to ensure flood-vulnerable development does not occur in high-risk areas.

Effectively responding to current and future impacts of climate change on water will require that we build resilience in our communities and economies. This means developing plans and strategies to help us anticipate and adapt to changes in water availability and to respond to increasingly frequent extreme events, such as drought and flood events, which are expected to become more severe as temperatures warm.⁷⁶ Strategies for adapting to such events include flexible water sharing approaches, building safety buffers into water supply calculations and flood, drought and emergency response planning.

E. Strengthening governance for shared waters

~“The water crisis is largely a crisis of governance.” UNESCO⁷⁷

Sustainable water management is a shared responsibility. While our Constitution does not definitively articulate responsibility over all aspects of water management, in practice, Aboriginal, federal, provincial and municipal governments, water users and civil society organizations all influence and are impacted by management of prairie waters. The issues we face in the 21st Century – climate change, ecosystem degradation and increasingly scarce water supplies – increase the potential for conflict among these many interested parties.

The challenge of sustainable water management is thus a governance challenge. Many of the problems and the solutions needed to address them relate much more to social and institutional factors than to a lack of basic scientific understanding or adequate technology. Effectively addressing the challenge will require the strengthening of existing organizations and institutions and the development of new arrangements to reconcile the often conflicting needs, values and interests of various stakeholders without further compromising the integrity and productivity of ecological systems.⁷⁸ We expect governments to facilitate effective governance over our shared waters.

Water governance and the nested watershed approach

“Water governance refers to the range of political, social, economic and administrative systems that are in place to regulate the development and management of water resources and provision of water services at different levels of society.”⁷⁹ Effective water governance is often impeded by jurisdictional fragmentation, gaps in responsibility and a lack of coordination among various organizations and actions. Part of the problem is that, traditionally, water governance has been conducted according to political boundaries. However, the focus is increasingly towards more integrated, holistic approaches focused on the watershed scale – toward a “nested watershed approach.”

The nested watershed approach matches the scale of the watershed to the scope of the management body and is increasingly recognized as the model framework for achieving coordinated action for sustainable water management. Local organizations will generally have a better understanding of the particular needs and characteristics of their local sub-watershed than a body with regional scope. By contrast, management bodies with regional scope will have a greater appreciation for the overarching needs of the river basin and its regional influences than a local organization. The success of the nested watershed approach is highly contingent on the willingness and commitment of various orders and agencies of government to collaborate, cooperate and resource a consistent policy direction and coordinated management approach.⁸⁰



E1. Strengthen inter-jurisdictional and transboundary arrangements.

Challenging the effectiveness of transboundary water management

While the PPWB – and the Master Agreement on Apportionment it administers – has served as an effective mechanism for water sharing in the eastward flowing water courses of the Prairie Provinces, the pressures of climate change, growing water demands and new dam proposals could put the cooperative spirit of the agreement under considerable stress. Unlike the PPWB, the influence and effectiveness of the MRBB (and the Transboundary Waters Master Agreement) has been minimal. Little progress has been made in negotiating water sharing and other responsibilities among the provinces and experts expect little movement in the near future, noting that, without a strong presence of the federal government, “upstream jurisdictions will either delay negotiations, or only agree to modest undertakings, so as not to constrain their own future uses of inter-provincial waters.”⁸¹ Accordingly, a true watershed management approach to our interprovincial rivers necessitates that the federal government take an active role in the interjurisdictional management of shared waters.

There are also challenges at the international level. Historically envied around the world as an exemplary model of international cooperation over shared waters, the IJC is becoming increasingly ineffective as a result of declining financial, technical and political support.⁸² For example, the Devils Lake dispute was deliberately withheld from the organization’s purview in favour of unilateral actions – actions which ultimately led to North Dakota opening the controversial Devils Lake Outlet despite the fact that it had not installed the advanced filter to guard against invasive species as was required in an agreement with Manitoba and the Government of Canada.⁸³ Water sharing in the St. Mary-Milk River system is another potential flashpoint for conflict that will challenge the IJC unless both United States and Canadian governments enhance the organization’s support.⁸⁴

Federal and provincial governments must collaborate to modernize and strengthen agreements and institutions governing transboundary waters. The Prairie Provinces Water Board (PPWB) and Mackenzie River Basin Board should develop comprehensive management plans, consistent with the nested watershed approach, that address water quality and quantity, surface and groundwater and account for ecosystem needs for water. To facilitate this, the federal government should create a binding dispute resolution process to encourage provinces to negotiate stronger and more equitable arrangements among themselves and to ensure a fair and sustainable outcome if an agreement cannot be reached.

The PPWB and MRBB should facilitate the completion of cross border watershed plans for those regions where watersheds span provincial borders. It is not appropriate for watersheds to only be defined within provincial boundaries, which in no way were constructed to reflect natural ecosystem boundaries.

At the international level, the federal government should work with its American counterparts to strengthen the financial, technical and staff support which will be required to address new and emerging challenges. As recommended by the IJC, Binational Watershed Boards should be established in all significant international boundary basins to work collaboratively with provinces, states, local organizations and residents to build cooperation at both regional and local levels.⁸⁵

Much of the area of the Prairie Provinces rest in two major river basins, the Mackenzie and the Saskatchewan-Nelson, which we share with British Columbia, the Yukon, the Northwest Territories and a number of American states. Furthermore, 32 stream crossings of the Canada-United States border exist in the Prairie

E2. Respect Indigenous Peoples' rights to, and in, water.

The federal and provincial governments have the responsibility to work with Indigenous Peoples to ensure third parties respect water rights. Given this duty, federal and provincial governments should work together to:

- 1) Assume a leadership role to ensure Aboriginal rights and interests in water are recognized and respected;**
- 2) Ensure provincial and municipal governments honour reserve allotments of water, if they exist.**
- 3) Ensure that all governments uphold their treaty promises and their obligation to consult and accommodate with Aboriginal Peoples.**
- 4) Rather than waiting for a protracted and expensive legal decision to transform the water policy landscape overnight, the federal government should take a proactive stance to work with Aboriginal governments and communities, as well as the provinces and territories, to fully and fairly implement a cooperative approach to recognizing Aboriginal water rights.**

Water-related inequities for First Nations are not limited to poor quality drinking water. Security of water quantity is also an issue on First Nations reserves. Some reserves, when created by the

Provinces between the Rocky Mountains in the west and Lake of the Woods in the east. Bridging the gap between these physical and political realities has led to the development of a number of unique governance arrangements. The Prairie Provinces Water Board (PPWB) and the Mackenzie River Basin Board (MRBB) are federal-provincial partnerships established to manage the waters of these vast river basins. Provincial partners in the PPWB include Alberta, Manitoba, and Saskatchewan. The MRBB includes the Yukon, British Columbia, Alberta, Saskatchewan and the Northwest Territories. The federal government is party to both organizations.

At the international level, agreements guide our relationships and activities over shared river and water systems with the United States. The International Joint Commission (IJC), a bi-national institution created under the Boundary Waters Treaty of 1909, is responsible for resolving disputes over boundary and transboundary waters shared between Canada and the United States. More recent agreements, specifically the North American Free Trade Agreement (NAFTA), have elevated concern over protection of Canada's water. NAFTA elevated concerns over privatizing Canada's water resources. The agreement makes explicit reference that once water "enters into commerce" it is subject to NAFTA rules and regulations. Bottled water provides the clearest example of water that has been commodified. Although NAFTA contains provisions excluding water from commodification while it remains in its natural state, the international agreement contains clear openings for the use of "water markets" and the push for privatization. Given recent discussions of opening NAFTA for review – water exports and provisions preventing clean water legislation must be expressly prohibited in any renegotiations.



federal government, included explicit allotments of water, however, provincial governments have not always honoured these allotments. For reserves created without an explicit allotment, no formal recognition of reserve water rights currently exists in Canada.

Increasingly intensive and expanding natural resource, energy and industrial development remain a constant cause for concern for Aboriginal People. For example, tar sands expansion in Northern Alberta threatens further adverse effects on the quality and quantity of water flowing in the Athabasca River – water that is critical to the ecological integrity of the Peace-Athabasca Delta ecosystem, and the health of several thousand Aboriginal People. Productive aquatic ecosystems are critical to their sustenance and livelihoods and are at the basis of Aboriginal rights entitlements. Healthy lakes and streams – and the many species that they support – are integral to Aboriginal spirituality.

When water is depleted or polluted and fish or other aquatic species become contaminated or threatened, Aboriginal Peoples lose part of their cultures and traditions.⁸⁶

In Canada, Aboriginal title, Aboriginal rights and treaty rights have been recognized on paper through our Constitution and in legal decisions. However, in practice, characterization of these rights and their relationship to other types of rights in Canada is an ongoing process.

Water and Indigenous culture

“The traditional economy of Indigenous Peoples is closely intertwined with water and when water is degraded, polluted or unavailable, all aspects of our physical, social, cultural and economic well being are affected. Indigenous Peoples are often the first to feel these impacts and often feel these impacts more severely than others. The traditional foods which sustain Indigenous Peoples require healthy and pure water, including salmon, trout, wild rice, moose, deer, geese, berries, roots, ducks, deer, clams, whales, caribou, corn, beans, squash, ptarmigan, lobster, herring, eel, seaweed, as well as all other fish, plants and animals. When water becomes polluted, the traditional food sources that our peoples have relied upon for centuries become polluted and the survival of our cultures and societies is endangered.” ~A. Walkem and N. Schabus.⁸⁷

Meaningful participation of Aboriginal Peoples in water management remains a challenge and decisions often progress without proper consideration of the impact of water management and use on Aboriginal treaty rights or on their traditional laws and customs. This often leads to inequities in access to safe water supplies, adverse impacts on Indigenous cultures and livelihoods and increasingly strained relations among federal, provincial and Aboriginal governments. This deserves immediate attention of federal and provincial governments.

E3. Improve the scientific basis for planning and management.

Governments must invest in improving the scientific basis for decision-making – both the acquisition of data and the development of new science to fill knowledge gaps.⁸⁸ Provincial governments should ensure integrated watershed-based monitoring, assessment and reporting systems exist to collect, organize and report data on all significant water parameters (e.g. water quality, availability, use). This information gathering should engage independent scientific analysis by reinstating the important role of academia in providing critical information and research. All information should exist in formats that make it easy to coordinate across upstream and downstream jurisdictions and which are accessible to all stakeholders, including residents and local organizations. Indigenous and local knowledge should be integrated into knowledge-gathering exercises and should influence governmental decision-making.

Financial and technical resources to improve and expand monitoring infrastructure, including stream flow gauges, groundwater monitoring wells, water quality sampling and meteorological stations, will be critical for

success. Federal governments have an essential role to play in funding research to fill knowledge gaps such as climate change impacts, ecosystem needs for water, groundwater recharge and cumulative impacts of pollution.

Sustainable water management depends on up-to-date information on climate, water quality and availability and ecosystem conditions. Equally important is data on our water use, including the volume of withdrawals (both licensed and actual amounts), the amount consumed, the timing and purpose of use and the quality of water returned to the environment.

Western Canada suffers from an absence of reliable and commonly useful hydrologic information. Critical data is often missing or incomplete because of short-sighted budget decisions, and the information that does exist is often difficult to access because it is scattered among various levels of government, private and public entities.⁸⁹

As the saying goes, “what gets measured gets managed.” In the absence of information, water managers are unable to assess the impacts, positive or negative, of policies and programs. Without ongoing research to improve our knowledge base, planners and policy makers are forced to make decisions blindly, with little understanding of the nature of the problems they are trying to solve or the effects of the actions they undertake. Without access to information, residents are unable to participate effectively in decision-making, advocate for change or hold governments accountable for their actions.



E4. Identify and enact a clear and transparent process for development and enforcement of water legislation that includes municipal empowerment.

Governments across the Prairie Provinces should conduct shared governance reviews to assess the success in building governance models that integrate decision-making across government jurisdictions with inclusion of watershed communities. Such reviews should identify strategies to ensure government-to-government decision-making between appropriate levels and the region's First Nations and Métis populations. It should further increase accountability, authority and appropriate resources to regional municipalities to make stronger bylaws around water protection and to strengthen local watershed groups. Shared-governance systems must be guided by an overall plan that spans watersheds and ensures the integrity of water basins in their entirety.

“The current level of knowledge about mountain hydrology is insufficient to meet the challenges of the future. This lack of knowledge will make sustainable water management and the long-term assessment of vulnerabilities more difficult than it needs to be.”

~Vaux, H., & Sanford, R. ⁹⁰



Next steps: Realizing a vision for water security

Sustainable water management is among the most significant challenges of the 21st century. In moving forward we will face many challenging decisions on the many aspects of fresh water policy. But we must also contemplate where it is we want to go – the “bigger picture.” In essence, two options lie before us: re-plumb Prairie rivers and watersheds, or rethink human activities and economies.

Should we dam and divert rivers, drill and pump aquifers, destroy wetlands and pollute lakes to meet the insatiable demands of a business-as-usual economy? Or should we rethink what it means to live and prosper in the Prairie Provinces, working to optimize our water use and shaping our actions to respect natural limits? Do we transform our watershed ecosystems or do we transform ourselves?

For many decades, we have relied primarily on governments to make these decisions. That is changing. Increasingly, civil society organizations – often at the local or community level – are assuming a greater role in water management and governance. Over the past decade, provincial governments in the Prairies have begun to rise to the challenge of sustainable

water management. However, to take root and flourish, these efforts must be nurtured by sustained government leadership and engaged watershed residents.

Deciding which option we pursue ultimately comes down to value questions. Good science can help, but it alone cannot set thresholds for acceptable impacts of pollution or water taking on human and ecosystem health or establish acceptable tradeoffs between economic development and ecosystem protection. For that, we must democratize water management and governance. We must bring these decisions into the public realm through high level debate and through local level planning.

The Prairie Water Directive is intended to help with this democratization. It sets forward a long term strategy that requires several short-term actions. Achieving the vision laid out here will not come overnight. We need to identify what those short-term items may be to establish our foot direction down the sustainable path.

We expect our governments to move us quickly toward the goals laid out in our vision. We expect governments to act on our expectations. And we expect all residents and governments to work together to forge and implement truly sustainable water management. A sustainable future will require that we draw less from the river and draw more from our collective creativity and our desire to safeguard our lands and waters for our children. Faced with increasing demands for an increasingly limited supply of a necessary resource like water, the challenge will require an effort to be innovative, creative and leading edge in every way of our thinking and planning. It will require us to take risks in thinking outside of the box and in trying new ways of organizing, planning and doing.



Appendix 1: Definitions

Aquifer – An aquifer is an underground geological formation or group of formations that contain water.⁹¹

Basin – A river or drainage basin is an area identified by the surface flow of water where precipitation (rain and/or snow) drains into streams, rivers, lakes or oceans. Basins are subsequently divided by their watersheds and subwatersheds. The Prairie Provinces have three primary basins including the Arctic (or Mackenzie) Basin, the Hudson Bay Basin and the Missouri Basin.

Ecosystem-based management – Ecosystem-based management takes the ecosystem as the basic unit of analysis and is committed to ecosystem integrity. It emphasizes the need to adapt economic, political and social processes to fit within that unit. Instead of managing a watershed as an adjunct to water supply, maintaining healthy watersheds is considered a prerequisite to water management. Under ecosystem-based management, human activity is situated within the structure and functions of natural contexts – a shift that requires humans to manage themselves to fit into nature, not the reverse.⁹²

Ecosystem integrity – Ecosystem integrity defines what a region's carrying capacity is. It identifies a clear limit to what levels of disturbance a region can withstand while maintaining core ecological functions.

Groundwater – Groundwater is subsurface water or water stored in pores, cracks and crevices in the earth. Groundwater is a source of water for wells and springs and is often a significant source for lakes and rivers.⁹³

Hydrological cycle – The endless circulation of water from the atmosphere to the earth and its return to the atmosphere through condensation, precipitation, evaporation and transpiration is called the hydrologic cycle.

Instream Flow Needs (IFNs) – IFNs are river flow regimes, as well as the timing of surges and subsidences, that are needed to sustain aquatic ecosystems. The existence and effectiveness of efforts to maintain IFNs are critical benchmarks for determining whether a river management framework is sufficient to protect aquatic ecosystems.⁹⁴

Subwatershed – The land drained by an individual tributary to the main watercourse.

Watershed – The land drained by a river and its tributaries. A watershed is a discrete ecosystem, the state of which is affected by the environmental condition of its component subwatersheds and by the condition of the main stem river.⁹⁵



Appendix 2: Current policy framework Manitoba

Current context: Manitoba, located at the bottom of the Hudson Bay Basin, receives water as far south as South Dakota, west from the Rocky Mountains and east from an area approximately 50 kilometres west of Lake Superior. Flooding and regional drought are major challenges. Nutrient overloading of surface water bodies and in particular, eutrophication of Lake Winnipeg are Manitoba's largest water issue. Climate warming will only exacerbate these problems. Including hydro-generation, Manitobans are Canada's highest per capita users of water.

Recent policy development: Manitoba developed the Manitoba Water Strategy April, 2003. To complement the strategy, The Water Protection Act was proclaimed January, 2006. The enabling legislation provides the framework to develop watershed plans, water conservation plans and drought plans and allows for the development of regulations for water quality management zones, invasive species and standards, objectives and guidelines for water quality. The Act established the Ministry of Water Stewardship, a stand-alone department dedicated to water stewardship. Manitoba recently passed the Nutrient Management Regulation the first regulation under the Water Protection Act and has introduced new legislation to ban phosphates in dish detergent.

Implementation of the water strategy: Manitoba's water strategy is guided by Manitoba's water policies, which were developed in the early 1990s. The three elements for implementing the water strategy are new legislation (as captured in the Water Protection Act and other Acts relating to water), improved financial foundations and management on a watershed basis. While the province has moved on enacting new legislation and has initiated watershed planning, it is slow in providing the financial resources to fully carry out and implement the Manitoba Water Strategy. As a high priority, Manitoba established the Lake Winnipeg Stewardship Board which recently issued a report recommending various actions to remediate Lake Winnipeg.

Perceived government priorities: A recent investigation by the Manitoba Clean Environment Commission reports that Manitoba has a well-developed legislative and policy regime but there is a need to fully implement these policies and regulations in relation to water management. The CEC also reports that there is a need to review Manitoba's policies and regulations in relation to water extraction and allocation. These concerns, plus the fact that there are inadequate financial and human resources, has placed constraints on Manitoba's ability to protect water.

Public engagement/consultation on water policy: Conservation districts are the main bodies engaged in watershed planning. Since 2006, a total of 13 integrated watershed management plans have been launched under the direction of 10 conservation districts. Manitoba plans to launch five new watershed planning exercises a year to cover all 35 watersheds within Southern Manitoba. Watershed planning priorities include a "state of the watershed report" and the development and implementation of a source water protection plan within the first three years. Manitoba has also embarked on a three-year planning process for managing groundwater in the south-eastern region of Manitoba.

Largest non-consumptive user of water: Manitoba Hydro for energy generation

Largest consumptive user of water: Irrigation and agriculture

Particular challenges: Devils Lake Outlet is proceeding without an IJC reference and without adequate water treatment technologies to treat invasive species. Red River Valley Water Supply Project and Northwest Area Water Supply Project (both in North Dakota) propose to divert water across the continental divide from the Mississippi Drainage Basin to the Hudson Bay Drainage Basin. In two recent reports, the Office of the Provincial Auditor Manitoba was critical of Manitoba and the responsible regulatory agencies for not adequately protecting well water and for mismanaging the province's environmental livestock program.

Appendix 3: Current policy framework Saskatchewan

Current context: There is significant geographic variation in water supply in the province (lots in the north, much less in the south). Flows are regulated or modified on most rivers in southern Saskatchewan. Increased water use upstream in Alberta means that one of Saskatchewan's most important rivers, the South Saskatchewan, may soon approach full allocation. While the Saskatchewan Watershed Authority (SWA) was created in 2002 to lead an integrated approach to watershed management, there continues to be no legislated requirement for source water protection. There is also no legislated ability to address cumulative impacts on any watershed or aquifer. Planning for source water protection has been completed in five watersheds (one yet to go to print) and one aquifer. The planning process is beginning/continuing in three other watersheds. However, the final recommendations are the decision and primary financial responsibility of the stakeholder members of Watershed Advisory Committees.

Legislative context: The Long Term Safe Drinking Water Strategy (LTSDWS) was introduced in 2002 as a response to the Report on the Commission of Inquiry into the North Battleford cryptosporidium outbreak. The Integrated Water Management Framework (1999) included nine goals and 16 specific objectives under the themes of Protection, Management & Development, and Co-ordination & Public Involvement. A Provincial "Green Strategy" was released in Spring of 2007 and includes a strategy for integrated water resources management. Permits are required for any non-domestic use of water that exceeds an annual equivalent of 14,000 liters per day. Approvals are often for a five to 20-year term. The historical "first in time" philosophy was officially removed from legislation in 1984.

Implementation: The LTSDWS is implemented by Saskatchewan Environment, SaskWater, and the Saskatchewan Watershed Authority. There is a strong regulatory approach and focus on source water protection planning through community-based and regional watershed planning. Saskatchewan has an open accountability framework for measuring progress on the strategy (as does every department). The LTSDWS is also reviewed by an interdepartmental review process at the deputy minister level. Public awareness has been strengthened through a water quality information website (www.saskh2o.ca). The Saskatchewan Watershed Authority released a "State of the Watershed" report in March, 2007. This report was developed using the "Watershed Reporting Framework" developed in January, 2006. It assessed the health, stress impact of human activities, and management responses within the 29 Watersheds defined in Saskatchewan. The report is being used to assist in continued Watershed planning through the Saskatchewan Watershed Authority.

Public engagement and consultation: The province is currently engaging the public regarding the drafted Watershed Protection plan for the Upper Qu'Appelle River and Wascana Creek.

Perceived government priorities: A new government (the Saskatchewan Party) was elected in November, 2007. Industry and economic development are definite priorities for this government, ensuring water supply to support the biofuel industry as well as planning towards tar sands development up North.

Specific challenges: Addressing instream flow needs (there is currently no formal system to do so), especially with most rivers dammed or regulated. Countering the idea of rural revitalization through "enhanced water use" (increased dams and diversions) outlined in the recent "50-Year Plan for Water Development" released by the Sask. Agrivision Corporation. Largest user and consumer of water: Agriculture (almost 70% of withdrawals, approximately 15% of this is intensive livestock operations). Municipal use is 21%.



Appendix 4: Current policy framework Alberta

Current context: Increasing water stresses from dramatic population growth, growing agricultural and industrial use of water, and extended droughts. Also increasing concern about long-term flow reductions and other water-related impacts of climatic change. The two main surface water users in Alberta are irrigation (71%) and commercial/industrial operations (15%). Municipalities account for 5% of surface water consumption. The three main groundwater users are commercial/industrial (53%), agricultural operations (25%) and municipalities (18%).⁹⁶ Oil and gas uses are of increasing concern, particularly the deep well injection of fresh water for “enhanced recovery” and myriad hydrological effects of tar sands mining and in situ operations.

Legislative Context: The 1996 Water Act superimposed a modern emphasis on aquatic ecosystem protection on a century-old water rights allocation system. On the one hand, the Act required the Environment Minister to adopt a province-wide “water management framework” including a “strategy” for aquatic ecosystem protection. The Act also allows the province to include restrictive conditions in new allocations, adopt water management plans and quantity and quality-based “water conservation objectives,” and establish basin-specific frameworks for water rights transfers. On the other hand, the Act grandfathered pre-existing water licenses and retained the long-standing “first in time, first in right” allocation principle.

The 2003 Water For Life Strategy (W4L) is a broadly worded vision document that emphasizes knowledge and research, partnerships and water conservation. The strategy is based on three overarching goals: safe secure drinking water supply, healthy aquatic ecosystems and reliable quality water supplies for a sustainable economy. It provides for a provincial multi-stakeholder water advisory committee, promises provincial support for Alberta’s roughly 70 watershed stewardship groups and promotes watershed planning with considerable input from provincially sanctioned local watershed advisory councils. W4L also includes a goal of increasing efficiency of water by 30%, and calls for further study and consultation on water pricing (after years of public debate on the subject to date).

W4L Implementation: In early 2008, the Alberta Water Council released a renewal report for implementation of the Water for Life Strategy. In reviewing the “success” of Water for Life the report showed that the ecosystem objectives contained in the strategy were not being met. A primary priority is on the completion of a wetlands strategy that will protect the health, viability and benefit of the provinces wetland ecosystems. Through the South Saskatchewan River Basin (SSRB) planning process, Alberta has adopted a framework for water rights trading and proposed interim closures of several over-allocated sub-basins to new allocations, a cap on future allocations in the Red Deer sub-basin and flow-based “water conservation objectives” (WCOs) for several SSRB river reaches. Proposed WCOs are generally lower than the instream flows needed for aquatic ecosystem protection. Besides formal watershed planning for the SSRB and several other basins, Alberta has focused on managing water uses for oil and gas production. In this context, Alberta has adopted policies to discourage non-renewable, deep-well injection of fresh, potable water for “enhanced recovery” of conventional and non-conventional reserves, proposed an interim framework for managing threats to the lower Athabasca river ecosystem from tar sands withdrawals and proposed requiring baseline monitoring of water wells to assess potential impacts from coalbed methane extraction.

Specific challenges: Providing sufficient resources and determining appropriate roles for local watershed councils. Meeting instream flow needs in heavily allocated river systems. Developing cooperative, creative, watershed-based management solutions in the context of provincial policy honouring pre-Water Act allocations with no expiration dates. Integrating land-use decision making with water policy, allocations and protection.

Endnotes

1. Adapted from: Richter, B. D., Matthews, R., Harrison, D. L., & Wigington, R. (2003). Ecologically sustainable water management: Managing river flows for ecological integrity. *Ecological Applications*, 13(1), 206-224; and FitzGibbon, J., Mitchell, B., & Veale, B. (2006). Sustainable water management: State of practice in Canada and Beyond: Canadian Water Resources Association.
2. McClenaghan, T., & Finnigan, D. (2004). Protecting Ontario's Water Now and Forever: A Statement of Expectations for Watershed-Based Source Protection from Ontario Non Governmental Organizations: Canadian Environmental Law Association & Environmental Defence.
3. Brandes, O. M., Ferguson, K., M'Gonigle, M., & Sandborn, C. (2005). At a Watershed: Ecological Governance and Sustainable Water Management in Canada. Victoria, BC: POLIS Project on Ecological Governance, University of Victoria; and Rueggeberg, H., & Thompson, A. R. (1984). *Water Law and Policy Issues in Canada*. Vancouver: Westwater Research Centre, UBC.
4. Boyd, D. R. (2003). *Unnatural Law: Rethinking Canadian Environmental Law and Policy*. Vancouver: UBC Press; Brandes, O. M., Ferguson, K., M'Gonigle, M., & Sandborn, C. (2005). At a Watershed: Ecological Governance and Sustainable Water Management in Canada. Victoria, BC: POLIS Project on Ecological Governance, University of Victoria
5. Walkem, A. (2007). The Land is Dry: Indigenous Peoples, Water and Environmental Justice. In K. Bakker (Ed.), *Eau Canada: The Future of Canada's Water* (pp. 304-319). Vancouver: UBC Press.
6. Gleick, P. H. (1996). Basic water requirements for human activities: Meeting basic needs. *Water International*, 21, 83-92. United Nations Economic and Social Council, 2002 p. 2.
7. United Nations. Retrieved on July 20, 2007 from at www.un.org/events/water/TheRighttoWater.pdf,
8. Amnesty International. Retrieved July 20, 2007, from <http://web.amnesty.org/pages/ec-water-eng>; Scanlon, J., Cassar, A., & Nemes, N. (2004). *Water as a Human Right?* Gland: IUCN - The World Conservation Union; and World Health Organization. (2003). *The Right to Water*. Geneva: World Health Organization.
9. Government of South Africa (2007). Department of Water Affairs and Forestry. Retrieved, January 7th, 2008, from <http://www.dwaf.gov.za/FreeBasicWater/>.
10. Government of Canada (2007). Environmental Resources – Investigation of Water Uses. Retrieved January 7th, 2008, from <http://www.environmentandresources.ca/projh2o/default.asp?lang=En&n=E93A16CB-1>
11. Health Canada. (2007, August 14, 2007). Drinking Water Advisories. Retrieved August 15, 2007, from http://www.hc-sc.gc.ca/fnih-spni/promotion/water-eau/advis-avis_concern_e.html
12. Lydon-Hassen, K. (2007). Research Officer, First Nations & Inuit Health Branch, Health Canada; Email communication.
13. Christensen, R. (2006). *Waterproof 2: Canada's Drinking Water Report Card*: Sierra Legal Defence Fund. P. 44.
14. Van der Kamp, G., & Grove, G. (2001, September 16-19, 2001). Well Water Quality in Canada: An Overview. Paper presented at the 2001 An Earth Odyssey: The 54th Canadian Geotechnical Conference, Calgary, Alberta. p. 45-49
15. Health Canada. (2007, August 14, 2007). Drinking Water Advisories. Retrieved August 15, 2007, from http://www.hc-sc.gc.ca/fnih-spni/promotion/water-eau/advis-avis_concern_e.html
16. Environment Canada. (2001). *Threats to Sources of Drinking Water and Aquatic Ecosystem Health in Canada*. Burlington, ON: National Water Research Institute.
17. Schuster, C. G., Ellis, A. G., Robertson, W. J., Charron, D. F., Aramini, J. J., Marshall, B. J., et al. (2005). Infectious Disease Outbreaks Related to Drinking Water in Canada 1974-2001. *Canadian Journal of Public Health*, 96(4), 254-258.
18. Christensen, R. (2006). *Waterproof 2: Canada's Drinking Water Report Card*: Sierra Legal Defence Fund.
19. Honourable Dennis R. O'Connor, Report of the Walkerton Inquiry, The Events of May 2000 and Related Issues (2002) Part Two, at Chapter 3. Available at: <http://www.attorneygeneral.jus.gov.on.ca/english/about/pubs/walkerton/part2/>
20. Boyd, D. R. (2006). *The Water we Drink: An International Comparison of Drinking Water Standards and Guidelines*. Vancouver, BC: David Suzuki Foundation; and Federal-Provincial-Territorial Committee on Drinking Water. (2004). *From Source to Tap: Guidance on the Multi-barrier Approach to Safe Drinking Water*. Winnipeg: Canadian Council of Ministers of the Environment.
21. Christensen, R. (2006). *Waterproof 2: Canada's Drinking Water Report Card*: Sierra Legal Defence Fund
22. Boyd, D. R. (2006). *The Water we Drink: An International Comparison of Drinking Water Standards and Guidelines*. Vancouver, BC: David Suzuki Foundation
23. Boyd, D. R. (2003). *Unnatural Law: Rethinking Canadian Environmental Law and Policy*. Vancouver: UBC Press p. 21; and Boyd, D. R. (2006). *The Water we Drink: An International Comparison of Drinking Water Standards and Guidelines*. Vancouver, BC: David Suzuki Foundation p. 5
24. Bakker, K. (2007b). *Eau Canada: The Future of Canada's Water*. Vancouver: UBC Press (Appendix 1); and Christensen, R. (2006). *Waterproof 2:*



Canada's Drinking Water Report Card: Sierra Legal Defence Fund

25. Adapted from Boyd, D. R. (2006). *The Water we Drink: An International Comparison of Drinking Water Standards and Guidelines*. Vancouver, BC: David Suzuki Foundation p. 7-8.

26. Goucher, N. P., Lagacé, E., Michaels, S., & Schaefer, K. (2007). *Towards Understanding the Linkages Between Science and Source Water Protection Policies in Canada: A Survey of Provincial and Territorial Source Water Protection Policies*: Environment Canada and Canadian Water Network.

27. National Research Council (2000). "Watershed Management for Potable Water Supply: ASSESSING THE NEW YORK CITY STRATEGY." Retrieved online December 27th, 2007, from http://books.nap.edu/openbook.php?record_id=9677&page=R1

28. Rosenberg International Forum on Water Policy (2007). "Forum Synopsis and Lessons Learned for Canada and Alberta." Retrieved online on May 16th, 2008 at <http://rosenberg.ucanr.org/forum5.cfm?displaysection=7>

29. Baron, J. S., Poff, N. L., Angermeier, P. L., Dahm, C. N., Gleick, P. H., Hariston, N. G., et al. (2002). Meeting ecological and societal needs for fresh water. *Ecological Applications*, 12(5), 1247-1260; and Carpenter, S., & Postel, S. (1997). *Fresh water Ecosystems Services*. In G. Daily (Ed.), *Nature's Services—Societal Dependence on Natural Ecosystems*. Washington: Island Press.

30. Brisbane Declaration. (2007). Viewed online on May 16th, 2008 at http://www.riverfoundation.org.au/index.php?option=com_content&task=view&id=71&Itemid=104

31. Baron, J. S., Poff, N. L., Angermeier, P. L., Dahm, C. N., Gleick, P. H., Hariston, N. G., et al. (2002). Meeting ecological and societal needs for fresh water. *Ecological Applications*, 12(5), 1247-1260

32. Schindler, D. W., & Donahue, W. F. (2006). An impending water crisis in Canada's western prairie provinces. *Proceedings of the National Academy of Sciences, Early Edition - April 2006*, 1-7.

33. Postel, S., & Richter, B. (2003). *Rivers for Life: Managing Water for People and Nature*. Washington, DC: Island Press.

34. Bruce, J., & Tin, T. (2006). *Implications of a 2°C global temperature rise on Canada's water resources*. Toronto: Sage Centre & World Wildlife Fund Canada.

35. *The Convention on Wetlands of International Importance*, 1971

36. Schindler, D. W., & Donahue, W. F. (2006). An impending water crisis in Canada's western prairie provinces. *Proceedings of the National Academy of Sciences, Early Edition - April 2006*, 1-7.

37. Saskatchewan Environment (2006). From <http://www.se.gov.sk.ca/>

38. Husky Minnedosa Plant Environmental Assessment Project Proposal, submitted by Husky Oil Limited April 18, 2005 to Manitoba Conservation

39. Postel, S., & Richter, B. (2003). *Rivers for Life: Managing Water for People and Nature*. Washington, DC: Island Press.

40. The World Commission on Dams (WCD) defines a "large dam" over 15 meters in height.

41. Baron, J. S., Poff, N. L., Angermeier, P. L., Dahm, C. N., Gleick, P. H., Hariston, N. G., et al. (2002). Meeting ecological and societal needs for fresh water. *Ecological Applications*, 12(5), 1247-1260; Richter, B. D., Matthews, R., Harrison, D. L., & Wigington, R. (2003). Ecologically sustainable water management: Managing river flows for ecological integrity. *Ecological Applications*, 13(1), 206-224

42. Government of Manitoba. (2001). *Manitoba's Concerns: Garrison Diversions and Devils Lake Outlet*. Retrieved July 30, 2007, from <http://www.gov.mb.ca/waterstewardship/transboundary/positions/man-position/backgr.html>

43. Alberta Environment as a matter of practice, however, does consider some of these concerns for interbasin transfer applications.

44. Adapted from comments by David Schindler in Vaux, H., & Sanford, R. (2006). *Rosenberg International Forum on Water Policy: Synopsis and Lessons for Canada and Alberta*. Banff: Rosenberg International Forum on Water Policy. P. 55

45. Lake Winnipeg Stewardship Board. (2005). *Our Collective Responsibility: Reducing nutrient loading to Lake Winnipeg*. Gimli, Manitoba: Lake Winnipeg Stewardship Board.

46. Adapted from the Beyond Factory Farming Coalition Fact Sheet on impacts of intensive livestock operations and threats to water quality.

47. Brandes, O. M., Maas, T., & Reynolds, E. (2006). *Thinking Beyond Pipes and Pumps: Top 10 Ways Communities Can Save Water and Money*. Victoria, BC: The POLIS Project on Ecological Governance, University of Victoria.

48. Schindler, D. W., & Donahue, W. F. (2006). An impending water crisis in Canada's western prairie provinces. *Proceedings of the National Academy of Sciences, Early Edition - April 2006*, 1-7.

49. Ransel, O. B., Todd, K., Lovaas, J., Stutzman, D., Bailey, H., & Baily, J. (2002). *Paving our Way to Water Shortages: How Sprawl Aggravates the Effects of Drought: American Rivers, Natural Resources Defense Council and Smart Growth-America*,

50. Pembina Institute. (2006). *Troubled Waters, Troubling Trends - Summary Report*. Calgary: The Pembina Institute.

51. Nowlan, Linda. 2005. *Buried Treasure: Groundwater permitting and pricing in Canada*. Walter and Duncan Gordon Foundation.

52. Vickers, A. (2001). *Handbook of Water Use and Conservation*. Amherst, Massachusetts: WaterPlow Press. p. xv

53. Brandes, O. M., Ferguson, K., M'Gonigle, M., & Sandborn, C. (2005). *At a Watershed: Ecological Governance and Sustainable Water Management in Canada*. Victoria, BC: POLIS Project on Ecological Governance, University of Victoria; and Rueggeberg, H., & Thompson, A. R. (1984). *Water Law and Policy Issues in Canada*. Vancouver: Westwater Research Centre, UBC; and Gleick, P. H. (2000). The changing water paradigm: A look at twenty-first century water resources development. *Water International*, 25(1), 127-138.

54. For more see *Alternatives Journal*. (2007). Special Water Soft Path Issue. *Alternatives*, 33(4).

55. Viewed online on February 18th, 2008 at http://waterdsm.org/pdf/BEBF_lowres.pdf
56. Viewed online on February 18th, 2008 at http://sustainablecommunities.fcm.ca/files/2008-SC_Conference/Preliminary_Program-en.pdf
57. Venema, Hank (2006). The Canadian prairies: biophysical and socio-economic context. In *Designing Policies in a World of Uncertainty, Change and Surprise*. Winnipeg: International Institute for Sustainable Development. November 2006. Page79-96.
58. Brandes, O. M., & Maas, T. (2007). *Urban Water Soft Path: 'Back of the Envelope' Backcasting Framework*. Victoria, BC: The POLIS Project on Ecological Governance, University of Victoria.
59. Brandes, Oliver M. and David B. Brooks (2007). Ingenuity Trumps Hard Tech: the water soft path is the best bet for Canada's public and ecological needs. *Alternatives Journal*: Volume 33, Number 4.
60. Greywater, sometimes spelled graywater, grey water or gray water and also known as sullage, is non-industrial wastewater generated from domestic processes such as dish washing, laundry and bathing. Greywater comprises 50-80% of residential wastewater.
61. de Loe, R., Varghese, J., Ferreyra, C., & Kreutzwiser, R. (Forthcoming). *Water Allocation and Water Security in Canada: Initiating a Policy Dialogue for the 21st Century (DRAFT)*. Guelph: Guelph Water Management Group, University of Guelph.
62. Schindler, D. W., & Donahue, W. F. (2006). An impending water crisis in Canada's western prairie provinces. *Proceedings of the National Academy of Sciences, Early Edition - April 2006*, 1-7.
63. IPCC. (2007). *Climate Change 2007: The Physical Science Basis - Summary for Policymakers*. Geneva: Intergovernmental Panel on Climate Change.
64. Pietroniro, A., & Demuth, M. (2006, June 21-23, 2006). Current and Future Trends in Runoff in the Headwaters of the Saskatchewan River. Paper presented at the Proceedings Climate Change and water in the Prairies, Saskatoon, SK; and Schindler, D. W., & Donahue, W. F. (2006). An impending water crisis in Canada's western prairie provinces. *Proceedings of the National Academy of Sciences, Early Edition - April 2006*, 1-7.
65. Bruce, J., & Tin, T. (2006). *Implications of a 2°C global temperature rise on Canada's water resources*. Toronto: Sage Centre & World Wildlife Fund Canada.
66. Runnalls, David (March 2007). *Climate Change Impacts in Manitoba: IISD President looks at farming, the north, Lake Winnipeg and urban life*. International Institute for Sustainable Development (IISD) Commentaries.
67. Sauchyn D. and Kulshreshtha S. (2008) *Prairies*; in *From Impacts to Adaptation: Canada in a Changing Climate 2007*, edited by DS Lemmen, FJ Warren, J Lacroix and E Bush, Government of Canada, Ottawa ON p 275-328
68. *Agriculture and Agri-food Canada's Prairie Farm Rehabilitation Administration, in the year 2000*
69. Venema, Hank (2006). The Canadian prairies: biophysical and socio-economic context. In *Designing Policies in a World of Uncertainty, Change and Surprise*. Winnipeg: International Institute for Sustainable Development. November 2006. Page79-96.
70. *ibid*,
71. *ibid*
72. Smit, B., & Wandel, J. (2006). Adaptation, Adaptive Capacity and Vulnerability. *Global Environmental Change*, 16(3), 282-292.
73. Huq, S., & Reid, H. (2004). Mainstreaming Adaptation in Development. *Institute for Development Studies Bulletin*, 35(3), 15-21.
74. See Resilience Alliance at <http://www.resalliance.org/576.php>.
75. de Loe, R., Varghese, J., Ferreyra, C., & Kreutzwiser, R. (Forthcoming). *Water Allocation and Water Security in Canada: Initiating a Policy Dialogue for the 21st Century (DRAFT)*. Guelph: Guelph Water Management Group, University of Guelph.
76. Environment Canada. (2004). *Threats to Water Availability in Canada*. Burlington, ON: National Water Research Institute., p. xii-xiii
77. UNESCO. (2006). *Water: A shared responsibility - The United Nations World Water Development Report 2: Berghahn Books and UNESCO Publishing*.
78. de Loe, R., & Kreutzwiser, R. (2007). Challenging the Status Quo: The Evolution of Water Governance in Canada. In K. Bakker (Ed.), *Eau Canada: The Future of Canada's Water*. Vancouver: UBC Press.
79. United Nations Development Program. (2007). *Effective Water Governance*. Retrieved August 5, 2007 from http://www.undp.org/water/about_us.html
80. Morris, T.J, D.R. Boyd, O.M. Brandes, J.P Bruce, B. Lucas, T. Maas, L. Nowlan, R. Pentland, and M. Phare, *Changing the Flow: A Blueprint for Federal Action on Freshwater (2007) The Gordon Water Group of Concerned Scientists and Residents*.
81. Saunders, O. J., & Wenig, M. M. (2007). *Whose Water? Canadian Water Management and the Challenges of Jurisdictional Fragmentation*. In K. Bakker (Ed.), *Eau Canada: The future of Canada's Water*. Vancouver: UBC Press. p. 130
82. Pentland, R., & Hurley, A. M. (2007). *Thirsty Neighbours: A Century of Canada-US Transboundary Water Governance*. In K. Bakker (Ed.), *Eau Canada: The Future of Canada's Water* (pp. 163-182). Vancouver: UBC Press.
83. Government of Manitoba (2007). *Devils Lake Outlet*. Retrieved August 24th, 2007 from http://www.gov.mb.ca/waterstewardship/water_info/transboundary/potential.html#e
84. Schindler, D. W., & Hurley, A. M. (2004). *Rising Tensions: Canada/U.S. Cross-Border Water Issues in the 21st Century*. Toronto: Program on Water Issues, Munk Centre for International Studies, University of Toronto.
85. International Joint Commission. (2005). *A Discussion Paper on the International Watersheds Initiative*. Ottawa & Washington: International Joint Commission.



86. Walkem, A. (2007). The Land is Dry: Indigenous Peoples, Water and Environmental Justice. In K. Bakker (Ed.), *Eau Canada: The Future of Canada's Water* (pp. 304-319). Vancouver: UBC Press.
87. Walkem, A., & Schabus, N. (2004). *Our Waters, Our Responsibility: Indigenous Water Rights*. p. 6
88. Vaux, H., & Sanford, R. (2006). *Rosenberg International Forum on Water Policy: Synopsis and Lessons for Canada and Alberta*. Banff: Rosenberg International Forum on Water Policy.
89. Schindler in Vaux, H., & Sanford, R. (2006). *Rosenberg International Forum on Water Policy: Synopsis and Lessons for Canada and Alberta*. Banff: Rosenberg International Forum on Water Policy. p. 58
90. Vaux, H., & Sanford, R. (2006). *Rosenberg International Forum on Water Policy: Synopsis and Lessons for Canada and Alberta*. Banff: Rosenberg International Forum on Water Policy. p. 5
91. Nowlan, Linda. 2005. *Buried Treasure: Groundwater permitting and pricing in Canada*. Walter and Duncan Gordon Foundation.
92. Brandes, O. M., Ferguson, K., M'Gonigle, M., & Sandborn, C. (2005). *At a Watershed: Ecological Governance and Sustainable Water Management in Canada*. Victoria, BC: POLIS Project on Ecological Governance, University of Victoria; and Rueggeberg, H., & Thompson, A. R. (1984). *Water Law and Policy Issues in Canada*. Vancouver: Westwater Research Centre, UBC.
93. Nowlan, Linda. 2005. *Buried Treasure: Groundwater permitting and pricing in Canada*. Walter and Duncan Gordon Foundation.
94. Wenig, Michael M., Arlene J. Kwasniak and Michael S. Quinn (2006). *Water Under the Bridge? The Role of Instream Flow Needs (IFNs) Determinations in Alberta's River Management*. In *Water: Science and Politics*. Edited by H. Epp and D. Ealey. Proceedings of the Conference Held by the Alberta Society of Professional Biologists on March 25-28, 2006, in Calgary, Alberta. Alberta Society of Professional Biologists, Edmonton, Alberta.
95. MOEE. 1993. *Water Management on a Watershed Basis: Implementing and Ecosystem Approach*. Toronto: Queen's Printer for Ontario for the Ministry of the Environment and Energy.
96. Government of Alberta. Facts and information about Alberta's water. Viewed on March 7th, 2008 at <http://www.waterforlife.gov.ab.ca/html/information.html>



*Written By: Tony Maas and Lindsay Telfer
With Assistance of: Meghan Beveridge, Danielle Droitsch,
Michelle Heiser, Glen Koroluk, and Darrin Qualman*