Balancing Act

Water Conservation and Economic Growth

Water and Economic Growth Initiative Consultations Summary

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BUILDING THE NEW WEST REPORT #40

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BUILDING THE NEW WEST

Balancing Act: Water Conservation and Economic Growth is the final report of the *Water and Economic Growth Initiative.* The initiative is a component of the Canada West Foundation's ***Building the New West Project*** – a multi-year research and public consultation effort focused on the strategic positioning of western Canada within the global economy. Five key priorities emerged from an extensive research and consultation process and provide a framework for the ***Building the New West Project:***

- the West must create the tools to attract, retain, and build HUMAN CAPITAL;
- the West must continue ECONOMIC DIVERSIFICATION;
- the West must strengthen its TRANSPORTATION INFRASTRUCTURE;
- the West must promote the global competitiveness of its MAJOR CITIES; and
- the West must develop new ways of facilitating REGIONAL COORDINATION.

For more information about the Building the New West Project, please visit our website (www.cwf.ca).

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Foreword

The Canada West Foundation embarked on the *Water and Economic Growth Initiative* in 2004 to achieve four related goals.

First, we wanted to highlight the connection between water and the economy – a connection that is often not well-understood. The idea here is to stress that water is a critical factor affecting current and future economic activity, and that water issues go far beyond quality and environmental concerns. If people start to think of water issues alongside economic topics such as international trade, skills training, the availability of venture capital, the unemployment rate, GDP growth, and the price of oil, we will have made some headway in this regard. Underlying this goal is the realization that managing the demands on the water supply so that there is enough for both economic growth and the maintenance of a healthy environment is absolutely vital to the future prosperity of western Canadians. If we don't get this right, our quality of life will be in serious jeopardy.

The second goal is rooted in the first and involves promoting the value of water conservation on *economic* grounds. The case for conserving water for ecological reasons is solid and has been made elsewhere. The ecological case, however, is typically trumped by economic concerns. The point we have stressed throughout the *Water and Economic Growth Initiative* is that conserving water is key to meeting the water use demands of our growing economy. This is especially true given that we need water for everything from urban growth and irrigation to natural resource extraction and manufacturing, and that these needs are running up against the reality of a finite (and possibly shrinking) water supply. Hence, if we want to sustain economic growth, finding ways to increase conservation of a finite resource is both logical and necessary. With that said, the ecological case should not be forgotten given that it is the integrity of our ecological systems that keep the water flowing from year to year.

The third goal is simple but extremely valuable. We decided early on that, given limited time and resources, the best way to achieve the first two objectives was to bring key stakeholders together to talk through the issues, hear what people with different perspectives and priorities have to say, and draw on the expertise of others. A key aspect of this process was a commitment to include a broad range of interests – particularly water users – and direct these diverse points of view toward discussing how the demand for water can be better managed. As an independent, non-partisan, and non-governmental organization without a vested interest in either water use or conservation, the Canada West Foundation was the ideal organization to bring the various stakeholders together on "neutral ground." As a result, two very successful meetings were held in Calgary and Edmonton in the fall of 2004 that brought together over 75 extremely knowledgeable stakeholders to discuss the economy's water needs and how water conservation fits into this picture.

Our final goal is achieved by the publication of this report and the communication efforts in which it is embedded: we wanted to share the results of the consultation process with a broad audience. In this regard, readers will note that the report does not attempt to answer the full range of questions associated with water and economic growth. It is not, for example, a source of empirical data on water demand or the effects of future economic growth on the water supply. The report's focus, rather, is on the insights and ideas gathered at the water consultations that took place in Calgary and Edmonton. This body of knowledge is a rich source of ideas that will help move the debate forward.

I also want to stress that, although the consultations were held in and focused on the Alberta situation, the findings and recommendations derived from them have broad applicability and will be of use across the West and throughout the country.

I trust that you will find the information that follows useful. Your comments and questions are most welcome.

Kind regards,
Robert Roach, Canada West Foundation Director of Research
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Executive Summary

Despite being a relatively water-rich country, Canada's water resources are not infinite and are not evenly distributed. In fact, some regions, such as southern Alberta, are reaching the limits of the local water supply. In Alberta, this problem is compounded by recent periods of drought, rapid population growth, and an expanding economy thirsty for water. As a result, Alberta is facing numerous water management challenges related to growing demand, supply fluctuations, the need to maintain healthy aquatic ecosystems, and commitments embedded in downstream water agreements with Saskatchewan, Manitoba, the North West Territories, and Montana.

Barring putting a cap on new users, or directing development and industry to where there is sufficient water to support them, the challenge is to change how water is perceived and how it is used. If we fail to do so, we face significant economic and environmental costs. In this regard, water conservation options such as recycling water, water-saving technology and price signals represent an under-utilized and promising approach to water management that may be able to help jurisdictions like Alberta to meet the demand for water while helping to preserve the watersheds that supply it. Water conservation is not a panacea, but it is a critical, and potentially very effective, means of addressing the dilemma presented by rising demand for a limited resource.

Based on information gathered at two stakeholder consultations, *Balancing Act* discusses a variety of water conservation policy options that have the potential to reduce demand on Alberta's water resources, identifies barriers to advancing water conservation initiatives, and recommends future directions to overcome the barriers. Although conducted independently, the consultations summarized in this report complement and add to the Alberta government's *Water for Life* strategy that was released in November 2003. As the *Water for Life* process moves forward, information of this sort will prove useful as a means of both stimulating and informing debate.

Based on the findings derived through a consultative process, the following four main barriers to increased water conservation were identified:

1. Current public policy was seen as discouraging the efficient use of water, inadequately managing ecosystem needs, lacking innovation, and failing to integrate new scientific knowledge. The perceived fragmentation of government decision-making, conflicting departmental goals and agendas, and a lack of partnerships, resources, political will, and creativity in government were also identified as public policy barriers.

2. Broadly-held attitudes and perceptions were thought to be impeding the advancement of water conservation in Alberta. More specifically, the myth of abundance, the myth of entitlement, and fears that some water conservation practices are potentially harmful to human health have limited public demand for change. Overall, the lack of public awareness was thought to be a key barrier. Among industry and agricultural users there is the negative perception that water conservation means more government control. Also, technological concerns were raised and water users felt that there are still a lot of unknowns when it comes to the performance of water efficient technology.

3. Lack of data and information on the total supply of groundwater and surface water and the lack of data on actual water use by all sectors render it difficult to make informed decisions. The lack of information on demand management, and the lack of information sharing on technology success stories and lessons learned by other organizations, were identified as barriers to advancing water conservation.

4. Limited resource availability – particularly the lack of human capital within government to develop and implement new water policy and the lack of financial resources to support pilot projects, test technologies, and to fund facility upgrades – and the lack of financial incentives to encourage water conservation were also seen as major barriers.

Based on the discussions at the consultations, the following recommendations for addressing the barriers and improving water conservation policy emerged:

1. A vision that identifies future economic development goals and the role of water conservation in achieving these goals should be developed. It was recommended that the province establish a rationale for water conservation and clearly state its goal. Is it to benefit the ecosystem or to enable economic growth and expansion?

2. Re-evaluating and re-structuring the public policy framework and governance models were identified as necessary steps to advance water conservation initiatives in Alberta. General recommendations include the need to develop a flexible solution that recognizes regional water differences and the need for government to seek partnerships with the public, non-profit organizations, and all water users to advance water conservation policy ideas. A number of more specific recommendations were put forth which include the need to establish water conservation targets at the watershed-level, develop conservation targets based on forecasting and backcasting, and better integrate government decision-making (particularly watershed planning).

3. Investments should be made in education and the promotion of water conservation. All water users (including the public) should have access to up-to-date and accurate information on Alberta's water supplies. Increasing awareness and promoting long-term behavioural change is necessary in order to spark fundamental transformation of how we currently use and value water.

4. Additional research and measurement needs to be conducted and applied to make informed and proactive water policy decisions. A number of research priorities were identified, but one that was strongly emphasized is the need to research and evaluate water conservation initiatives applied in other jurisdictions to determine their applicability in Alberta. Measurements such as the need to quantify provincial surface and groundwater supplies, measure cumulative effects, determine ecosystem demands, and measure actual water use were identified as key ingredients to make informed decisions.

5. The province should ensure that Alberta Environment has the resources to develop policy and implement the recommendations put forth in the *Water for Life* strategy. The province should invest in pilot projects to illustrate the potential economic and environmental benefits of water efficient technologies.

I. Introduction

Water is a renewable resource that is fundamentally important to the regional and national economy. Although it is sometimes treated as such, it is not an infinite resource. There is only so much water available at one time. Water, moreover, is also a highly variable resource on both an annual basis due, for example, to a short-term drought or greater upstream use, and over the long-term as climate cycles lasting decades or even centuries alter the water supply. In addition, both common sense and modern science confirm that a certain amount of water needs to be left in watersheds to maintain a healthy aquatic environment, to sustain ecological systems, and for downstream users. It is not a good idea to drain a river dry or divert every drop of rainwater into a storage tank or to over pump groundwater and severely draw down an aquifer.

As Canadians, we are blessed with a relatively abundant supply of clean water. As with water's renewable qualities, however, this abundance comes with a number of caveats. First, the water is not always *where* it is needed. Some parts of the country, southern Alberta for example, are quite dry. Second, the water is not always available *when* it is needed. For example, if you are a manufacturer who needs water year round, the fact that there is lots of water in a nearby river in spring but very little in late summer can be a problem. Third, population increases and economic growth – particularly when concentrated in one area – increase the demand for water and can overtax the capacity of a watershed (i.e., the ability of the watershed to remain healthy and meet user demands). Finally, Canadians are heavy users of water. Our per capita domestic household use is one of the highest in the world and, in addition, we rely on large amounts of water to irrigate our crops, water our livestock, generate electricity, extract natural resources, and manufacture products for local use and export. Our lifestyles and economic activities require a lot of water.

Our heavy use of water points to a fundamental but not always fully appreciated fact: water is a prerequisite of both our current economic success and our future economic growth. Water is a critical *economic* factor. Urban and rural communities, primary agriculture, the agri-food sector, power generation, oil and gas, and manufacturing – virtually the full width and breadth of the western Canadian economy – rely on water as a basic input. Hence, if we want our economy to continue to function and to grow, we have to make sure that we wisely manage our water resources.

There are three broad options for marrying the rising demand for water with the reality of fixed – if not shrinking – supply. The traditional approach has been to find ways to increase the available supply through infrastructure projects such as dams, pipelines, and increased storage. The downside of this option is threefold: 1) it may come with a hefty price tag; 2) it can have negative ecological effects; and 3) it is limited in the sense that there is only so much water available in the first place. However, we do recognize that supply-side solutions are likely to be a part of any long-term water management plan.

The least likely and least popular option is to put the brakes on population and economic growth. The idea here is simple: if there is X amount of water available for use (assuming that a sufficient amount is left in watersheds to maintain ecological systems), we allow no new water users to come on line once X is reached. If, for example, a city has 1 million units of water available and each citizen uses 1 unit, the population would have to be capped at 1 million. A related option would involve directing population growth and economic development to areas that have sufficient water to support them. Implementing this option is fraught with problems and would require massive changes to public policy and a dramatic increase in the state's role in economic decision-making. It would not, moreover, solve existing water issues.

This leaves water conservation (i.e., reducing the amount of water used rather than trying to manipulate the supply or cap the number of new users) as the most alluring alternative. This may entail reducing overall use as a way of improving environmental performance or it may involve reducing per capita use to allow for a greater number of new users or it might involve a combination of both. Thus, water conservation, over the long-term, has the potential to facilitate economic growth and improve the underlying ecological processes that are essential to healthy and, in turn, productive watersheds. In this report, water conservation is used as an umbrella term for a wide range of policy instruments, initiatives, and management approaches that have the potential to reduce individual and overall water demand (including both conservation and efficiency initiatives).

In order to call attention to the importance of water and water conservation to the economy and to harvest ideas from experts, stakeholders, and policy-makers about water conservation and how to improve public policy in this area, the Canada West Foundation launched a six-month research and communications project called the *Water and Economic Growth Initiative*. This report is the culmination of the initiative and provides a summary of the information gathered during a consultative process. The findings outline the importance of water conservation to economic growth, potential water conservation tools, barriers to their implementation, and ways to move forward. Alberta has been selected as the focus of the research, but the findings and recommendations apply to jurisdictions across Canada.

II. Methodology

This report is based on qualitative feedback gathered at two half-day consultations held in October 2004. One consultation was held in Calgary and the second in Edmonton. The purpose of the consultations was to hear from water experts, stakeholders (especially water users) and policy-makers, identify best practices and new ideas in the area of water conservation, and identify ways to improve public policy.

In order to ensure a broad range of qualified participants at the consultations, the Canada West Foundation partnered with the Alberta Chambers of Commerce, the Alberta Chamber of Resources, the Alberta Irrigation Projects Association, the Bow River Basin Council, and the North Saskatchewan Watershed Alliance to assist with identifying and recruiting consultation participants.

A diverse range of individuals were invited from sectors including thermal power generation, irrigation, manufacturing, mining, oil and gas, government, economic development, research, watershed management, and the environment.

The response to the invitations was positive with 45 individuals attending the Calgary consultation and 33 in Edmonton. Participants were divided into three groups in Calgary and two in Edmonton for focused discussion led by a facilitator. Four broad questions were used to guide the discussion and gather the information for this report. The questions were:

- Is Alberta's water supply experiencing increasing demands and pressures?
- If, and to what degree, is water availability a potential limit to economic growth in Alberta?
- What tools have the potential to manage demand and reduce pressure on Alberta's water supply?
- In your opinion, what are the barriers to demand management in Alberta?

The consultations provided an opportunity for a wide range of stakeholders to come together and share experiences, discuss

Alberta's Water for Life Strategy

Recognizing the importance of water to Alberta's economy, quality of life and environment, the Government of Alberta developed a water strategy outlined in a document called *Water for Life: Alberta's Strategy for Sustainability* that was released in November 2003. The strategy identifies water conservation as a key part of the solution to managing Alberta's water resources to ensure long-term sustainability. The strategy has set a water conservation target – 30% improvement in efficiency and productivity – to be achieved by 2015. The Alberta Water Council (a partnership between government and interested stakeholders) is working on water-related issues across the province and on providing recommendations to government for the implementation of *Water for Life.* More information about the strategy can be found at www.waterforlife.gov.ab.ca.

The Canada West Foundation's *Water and Economic Growth Initiative* seeks to complement the province's efforts to develop a new approach to water management by calling attention to the economic importance of water, independently consulting with experts, stakeholders and policy-makers about water conservation options, and providing policy-makers with objective and accessible information to inform their decisions. In this way, we are hopeful that the *Water and Economic Growth Initiative* will help build the momentum needed to improve water management and the long-term sustainability of water resources in Alberta and across the country.

success stories, exchange ideas, and debate future directions. To gather additional information, individuals who were unable to attend the consultations and others who indicated interest in the project were contacted by phone or email. The feedback gathered at the consultations and subsequent interviews form the basis of this report.

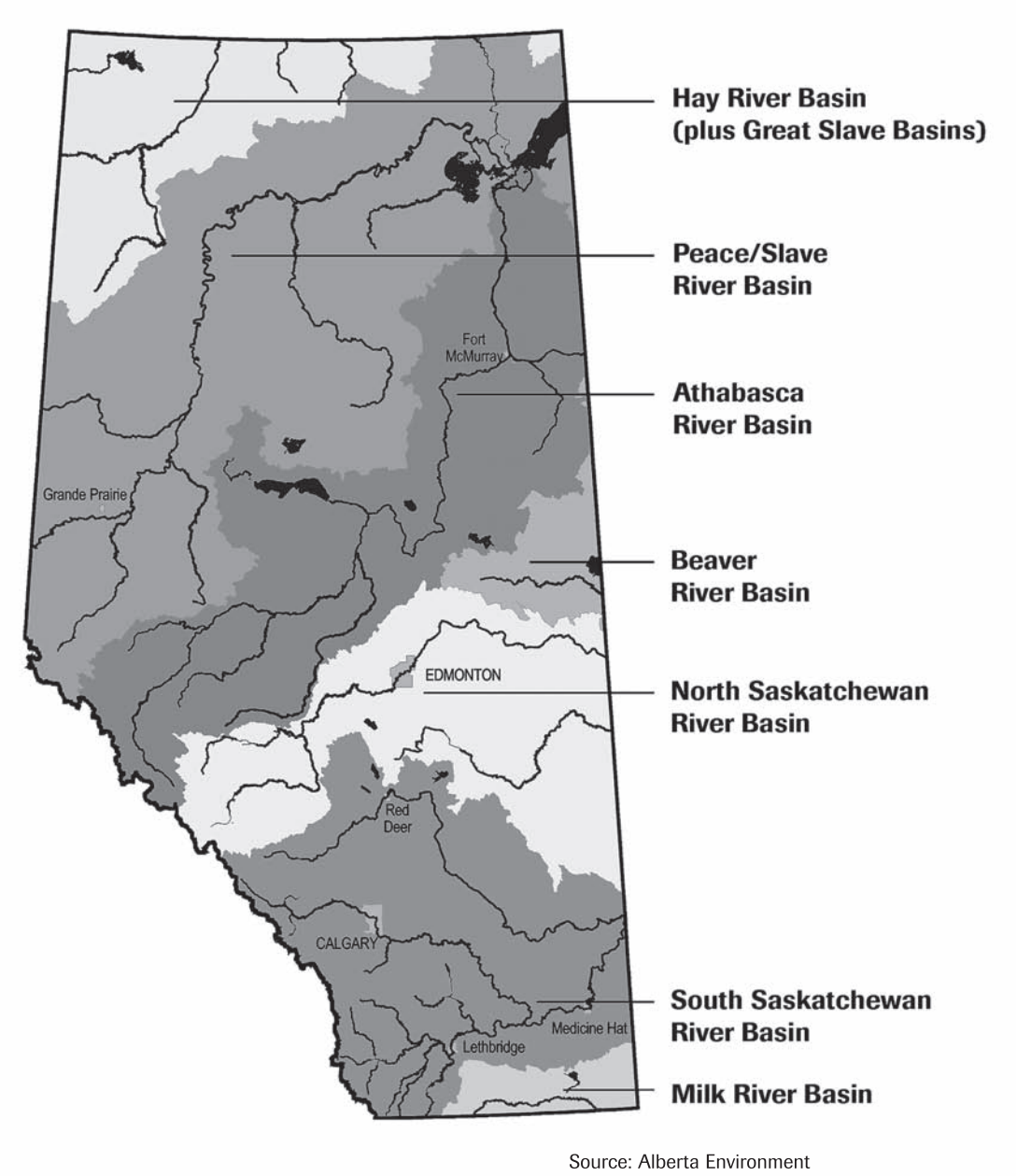
III. Alberta's Water Supply

If you took a snapshot of the Earth from space, the picture would indicate an abundance of water. This image would be correct – approximately 75% of the Earth's surface is covered by water. However, the amount of freshwater available for drinking and agricultural production is much less. In fact, freshwater makes up only 2.5% of the world's water supply – the rest is saltwater.

When comparing Canada's freshwater supply to other countries, Canada can be considered a water-rich nation as it contains 20% of the global supply and only approximately 0.5% of the world's population. But most of this water remains inaccessible. The majority of freshwater is locked in glaciers or in deep underground aquifers (porous underground rock formations containing water). When you remove these inaccessible supplies from the equation, only 7% of the global, renewable, freshwater supply (water that circulates through the water cycle) is found in Canada (Environment Canada 2004). This water, moreover, is not distributed evenly throughout the country; parts of the country have relatively little water compared to other parts. In fact, approximately 50% of Canada's water flows northward and as a result is unavailable to 85% of the population who live along the southern border (Environment Canada 2004).

Alberta contains approximately 2% of Canada's overall supply (Environment Canada 2003). This water naturally occurs in two forms – surface water and groundwater. Surface water is visible on the landscape and comes in a variety of forms including lakes, rivers, streams, wetlands, dugouts, and ditches. Precipitation (in the form of rain and snow) and glacial melt provide the main sources of surface water in Alberta. Surface water makes up the majority of the available water supply and 98% of the water used for population and economic activity comes from surface sources (Alberta Environment 2004).

Figure 1: Alberta's Major Watersheds



Source: Alberta Environment

Groundwater is the other form of freshwater and is found in porous rock, sand, or gravel located below the Earth's surface. In Alberta, the exact amount of groundwater is unknown, and although there are estimates of large reserves in the Foothills region, these are thought to be almost entirely inaccessible or not economically feasible to recover (Alberta Environment 2004). As a result, groundwater makes up only a small portion (2%) of the water used for domestic, agricultural, or industrial activity.

Alberta has seven major watersheds (see Figure 1). Most of Alberta's major rivers originate within the province while others originate from British Columbia (Peace, Wapiti), Saskatchewan (Clearwater, Cold Lake) and Montana (Waterton, St. Mary, Milk). Approximately 87% of the water flowing in Alberta's rivers flows north, while roughly 13% flows east, and only 0.1% flows south (Alberta Environment 2004). Because the majority of the population lives in the southern portion of the province while the majority

of the water flows north, there is a concentration of population and economic activities dependent on a relatively small amount of water. This geographic disparity creates water shortages, from time to time, in areas where water is heavily used (Alberta Environment 2004).

Water is a shared resource – shared among provinces and territories, and between Canada and the United States. Alberta's use of water from the St. Mary and Milk Rivers is governed by the *Boundary Waters Treaty Act* signed in 1909 between Canada and the United States, outlining the use of shared lakes and rivers. Also, the *Master Agreement of Apportionment* signed in 1969 is an agreement between Alberta, Saskatchewan, and Manitoba to ensure that each province has access to approximately equal amounts of the natural river flow that travels across the prairie provinces. This agreement is monitored by Environment Canada and the Prairie Provinces Water Board, comprised of representatives from each province and the Government of Canada. Each province is then in charge of how they use the water that is allocated to them as long as the flow requirements of the apportionment agreement are met.

Alberta contains only 2% of Canada's total available freshwater supply, the majority of this water is not found in the areas that are undergoing rapid growth and development, and the province can only use so much of the water because of downstream flow agreements. This highlights the need for a proactive water policy that provides a framework to make well thought out decisions on how to use the available water wisely.

IV. Who Decides How Alberta's Water is Used?

Alberta Environment is the provincial department responsible for Alberta's water resources. The *Water Act* (Province of Alberta 1999), governs the allocation and management of water, requires individuals, corporations, and municipalities to apply for a license that authorizes the diversion or use of a specific amount of water (surface or groundwater). Under each license a set amount of water is allocated which represents the maximum amount of water that can be used or diverted within a certain time period (this is called a water allocation). All water allocations and licenses remain under the authority of the province.

Even municipalities must apply to the province for a water allocation to provide drinking water for residents. However, most commercial and industrial operations located within cities and towns use water from the municipal water system – therefore not requiring a separate water license from the province.

The water allocations governed by Alberta Environment are outlined in Table 1 (allocations are measured in cubic metres per year).

Water allocations are based on a "first-in-time, first-in-right" principle that has formed the foundation of allocation policy for over 100 years (since 1894) in Alberta. This principle gives priority to those who hold the most senior licenses (the oldest) rather than determining priority based on a particular use of water. The idea is that an existing water user's rights are protected from others that receive or are applying for allocations after them. Licenses are valid in perpetuity unless otherwise specified (many new licenses have a time limitation).

Alberta Environment evaluates a water license application based on the potential impact of a new license on the needs of the

Table 1: Water Allocations in Alberta (2003)

Purpose	*Allocation (m3/yr)*	*Proportion*
Irrigation	4,338,806,625	44.6%
Commercial (cooling)	2,605,258,629	26.8%
Municipal	1,058,306,119	10.9%
Commercial/Industrial	641,838,204	6.6%
Water Management	328,309,355	3.4%
Industrial (oil gas, petroleum)	169,029,136	1.7%
Habitat Enhancement	146,750,300	1.5%
Injection (oil recovery)	138,693,138	1.4%
Dewatering	113,525,831	1.2%
Hydropower	73,673,274	0.8%
Agricultural (other than irrigation)	70,433,012	0.7%
Recreation	19,504,792	0.2%
Management of Fish	18,703,841	0.2%
Wildlife Management	2,045,255	0.0%
Other Purpose Specified by the Director	10,576,328	0.1%
Total	**9,735,453,839**	**100%**

Source: Alberta Environment 2004b

environment (the amount of water that needs to remain in the watershed), on the amount of water required to meet apportionment agreements, and on the amount of water being used by existing water users. There are already areas in the province where maximum allowable allocations have been reached. As Alberta grows and water demand rises – a situation that will get worse if drought conditions prevail – this evaluation process will become increasingly important.

Currently there is insufficient data in Alberta to determine how much water is actually being used. Alberta Environment has detailed records of how much water is allocated to different users (from the licensing process), but less is known about how much of that water is actually being used. There are exceptions, however, and data is available on the actual amount of irrigation, oil recovery and municipal water use.

V. Water Use and the Economy

Although water is critical to human and ecosystem health, this report emphasizes the important relationship between water and Alberta's economy. This is done to draw attention to the economic importance of water today and in the future – a relationship that is not fully appreciated by a wide audience. Water is a key resource for many economic activities in Alberta. As suggested by Environment Canada, "water is the lifeblood of industry. It is used as a raw material, a coolant, a solvent, a transport agent, and as a source of energy."

Water is used in two ways – the withdrawal of water and instream use. Withdrawal users remove water from the watercourse for domestic, agricultural, or industrial purposes, and then return all or part of it to the watershed. Often this water is returned in a different quality and at a different location from where the water was removed.

Water Use Versus Consumption

Water use is defined as the water withdrawn, used for a specified purpose and then returned to the water system. Water consumption is the difference between the amount of water withdrawn and the amount of water returned to the same source. Some economic activities, in particular irrigation, consume a lot more water than they return to the watercourse. However, as some suggest, this water eventually makes its way back into the water system through human consumption and waste. But as others point out, there are concerns over the loss of water from the system it was withdrawn from. On the other end of the spectrum, some municipalities return the majority of the water that is withdrawn. It has been argued that large municipalities, such as the City of Calgary, have little effect on water availability because they return almost 100% of the water they withdraw. Meanwhile, some people argue that during the summer months Calgary returns less water than it removes and the water that is returned to the system is of lower quality. Overall, there are varying opinions on water use versus consumption and each presents its own set of pros and cons.

Withdrawal users include:

- agriculture – irrigation, livestock watering;
- thermal power generation (fossil fuel generated electricity);
- manufacturing – food and beverage, pulp and paper, chemicals, primary metals;
- municipal – residential, commercial, industrial;
- petroleum production – conventional enhanced oil recovery, thermal enhanced oil recovery;
- mining; and
- tourism/recreation – golf courses, ski hills.

Irrigation, which accounts for 44.6% of the annual provincial water allocations, is the largest user of water in Alberta. There are 13 irrigation districts in the province, all of which are located on the South Saskatchewan River Basin. An irrigation district is cooperatively owned by water users (individual farmers and ranchers) and is governed by a board of directors. Each irrigation district is responsible for providing the water and associated infrastructure (series of reservoirs, canals and pipes) to get the water to the users and collect return flows. The irrigation districts account for the majority of the water used for irrigation (1.3 million acres) and the remainder of water used for irrigation (272,000 acres) is administered under private licenses (Alberta Agriculture, Food and Rural Development 2001).

Irrigation has allowed for agricultural activity to expand into drier areas that do not receive sufficient precipitation, and has enabled an increase in the diversity of crops produced, has increased overall crop yield, and has decreased the hazards of drought and crop failure. In fact, crops produced through irrigation account for one-fifth (18.2%) of all agricultural production in the province. The South Saskatchewan River Basin is the source for all (100%) of the water used by the irrigation districts and the majority (80%) of irrigated water under private licenses as well. Irrigation accounts for 78% of the total basin flow available to Alberta (Irrigation Water Management Study Committee 2002). This means that the remaining 22% of the available flow has to meet all other water demands – municipal, industrial and ecosystem (ecological).

Livestock production also requires high quality, freshwater for the animals. This use of water accounts for 0.7% of the total water allocated in Alberta (see Table 1).

Thermal power is the primary method used to generate electricity in Alberta. This form of generation is reliant on the burning of fossil fuels, mainly coal and natural gas, to produce electricity. In this process, water is converted to steam, which drives the generator producing electricity and is also used for condenser cooling, the process where the majority of water is used. Currently only 40% of the energy produced can be converted into electricity while the other 60% is considered wasted energy. This wasted heat (energy) requires water for cooling before it can be returned to the environment (Environment Canada 2004). Although almost 100% of the water used in thermal power generation is returned to the environment, it is often returned 10-15 degrees Celsius warmer (Environment Canada 2003b), which can negatively affect the aquatic ecosystem (can kill off fish populations in extreme cases) and reduce the aesthetic and recreational appeal of the water system. Many fossil fuel plants across Canada have implemented a "closed-loop system" where water is reused and recycled many times before re-entering the environment.

It is estimated that in coal and natural gas plants, 140 litres of water are required to produce one-kilowatt-hour of electricity. When all the water allocations are totaled, thermal power generation is the second largest water withdrawer in the province.

Manufacturing uses water in many ways: for washing, transporting materials, cooling, and in some cases, as a part of the final product. Alberta Economic Development (2004) ranked food and beverage production as the largest manufacturing sector in the province. Water is essential at every stage of this production process and is a major ingredient in the final product, especially in beverages. Pulp and paper production is also reliant on large amounts of water to soften the wood, separate wood fibres, and for bleaching and cooling processes.

Municipal water use includes all residential properties and most commercial, industrial, and institutional users (e.g., hospitals, schools, colleges and universities). In both Calgary and Edmonton, commercial, industrial and institutional water use accounts for approximately one-third (33%) of the overall water use with the rest being used for domestic purposes. The average Canadian uses 343 litres per day for domestic purposes, which is the second highest level of urban water use in the world (Brandes and Ferguson 2004). However in Alberta, the average amount of water used for domestic purposes is slightly lower than the national average although still relatively high when compared globally – provincial average is 285 litres per capita per day, the City of Calgary average is 339 litres per capita per day, and the City of Edmonton average is 195 litres per capita per day (Brandes and Ferguson 2003). This difference in per capita water use between Calgary and Edmonton could be attributed to the use of water meters. The City of Edmonton has 100% of its residential customers on meters while in the City of Calgary, as of February 2004, 70% of residential customers were metered. Both the City of Calgary and Environment Canada have found that non-metered residential customers use on average 50% to 60% more water than metered users. Calgary is working towards 100% metering (residential) by 2014.

Petroleum production uses water for extraction, maintenance, cleaning, reclamation of former drilling areas, and testing pipelines. In terms of petroleum extraction, more than half of conventional light oil in Alberta is extracted through enhanced oil recovery using water (Alberta Environment 2004b). Water is injected into an oil reservoir to maintain pressure required to pump out the remaining stock of oil. In 2001, approximately 83% of the water injected into wells was "produced" water – water found within the reservoir that is produced through the extraction process. Of the remaining 17%, approximately 78.1% of water came from external freshwater sources and 21.9% from saltwater sources (Geowa Consulting 2003). The use of freshwater for conventional oil recovery has declined 40% from 1972 to 2001 (Geowa Consulting 2003).

The use of water for oil recovery has recently attracted both media and public attention. There are concerns over the use of freshwater

injected into deep wells when the province is facing water shortages and especially when there is talk of there not being enough water to support activities that require freshwater (irrigation and municipal use, for example). Also of concern is the "loss" of water used in this process – once the water is injected down the wells it is removed from the water cycle for long periods of time. Oil recovery can use, and is moving towards, other sources such as saltwater to perform the same process. Alberta Environment released a report, *Oil and Water: an overview of water for enhanced oil recovery in Alberta* (2004) that examines the oil industry's use of water.

Northern Alberta's tar sands projects are also reliant on water. Thermal enhanced oil recovery uses water to produce steam that is injected into the heavy crude found in the tar and coal sands. It is estimated that it takes up to five barrels of water to produce one barrel of oil in the tar sands (Ptacek et al. 2004).

Mining in Alberta is dominated by the coal industry. Alberta contains 70% of Canada's coal reserves and has eight mines producing approximately half of Canada's annual coal output (Alberta Energy 2002). The province also supports other non-energy mineral mining such as sand and gravel, cement, salt, silica, limestone and sandstone. Water is an important raw material in mining production.

Tourism and recreation are important industries in Alberta. Golf courses and downhill ski hills are two types of recreational areas that withdraw and use water. Water is used to maintain fairways and the aesthetics of golf courses, and ski hills use water to make snow during warm, dry winters.

Instream use is the other way that water is used in Alberta. Instream differs from withdrawal because the water is used in the environment instead of being taken out of the water system and piped elsewhere for use (as in the activities described above). For instream use, water remains in the system while it is used – although the ecosystem may undergo changes to support economic activity (e.g., dams for hydroelectric projects). Examples of instream uses include recreation activities such as fishing, kayaking, and swimming, ecosystem functions that require water to provide "ecological goods and services," and hydroelectric production where water is used to generate power, but is not removed from the system.

Alberta's vast natural capital is an important element of the province's tourism and recreation industry. In 2002, an estimated 5.2 million people visited from other provinces and countries, spending approximately $2.6 billion (Alberta Economic Development 2003). Some activities are directly dependent on a reliable, healthy water supply – for example, angling, canoeing, kayaking, whitewater rafting. Other activities are more indirectly dependent; hiking and sightseeing, for example, often involve picturesque water features such as lakes, rivers, and waterfalls.

Water remaining in the system is also critical to maintaining aquatic ecosystem health, supporting biodiversity, and providing ecological goods and services. Although not assigned a dollar value, these goods and services are essential to the ecosystem, human health, and economic activity. Some of these essential services include the removal and filtration of pollutants, nutrient cycling, temperature control, and plant production. Non-ecological goods include aesthetics, abundant and diverse native species populations for birding or fishing, and the high water quality needed to support recreational activities.

Hydropower production in Alberta is also an important user of water. There are 20 hydro developments in Alberta, with eleven of these on the Kananaskis/Bow River System (Alberta Environment 2002).

Water is a valuable resource to Alberta's economy and is critical to support the province's strong and vibrant future. Alberta has had the fastest growing economy in Canada (averaging 3.7% a year) over the last twenty years and it is not showing any signs of slowing down. Water availability is likely to become increasingly important as Alberta moves into its second century and as greater demands and pressures are placed on the water supply.

There are aspects of our daily activities where the importance of water is more obvious (e.g., filling up the Brita in your fridge), but there are other activities such as putting gas in your car or turning up your furnace that you wouldn't necessary consider having a connection to water. But water is an important contributor to our quality of life and the province's economic success. Promoting the link between water and the economy is critical and will continue to be an important component of water management and encouraging water conservation behaviour and practices.

VI. Water and Economic Growth

The Canada West Foundation held consultations with individuals ranging from policy-makers and members of the newly formed Alberta Water Council to environmental organizations and water users to hear their opinions regarding the relationship between water and economic growth, how water availability affects their operations and business planning, and to discuss the applicability of demand management in Alberta. A full list of participants is included at the end of the report.

It is important to note that the information presented in this section is based on the opinions gathered from the consultations and has not been verified for accuracy or complemented by external research. This information does, however, provide insight into the importance of water to economic activity, document a variety of stakeholder perspectives, and examine the potential role of water conservation in Alberta's future growth strategies – information that will be useful as the water policy debate moves forward.

Four broad questions were used to guide the discussion at the consultations. The findings have been organized into general themes and are presented for each question.

Future Demands and Pressures

Participants were asked to comment on the demands and pressures facing Alberta's water supply – the water available for use in rivers, streams, and lakes as well as contributing sources such as glacial melt and rainfall. Specifically, the participants were asked: **Is Alberta's water supply experiencing increasing demands and pressures?**

It was generally accepted that water demand is increasing. Many reasons were suggested to explain this increase including:

- Alberta's high rate of population growth is increasing domestic water demand. This demand differs between urban areas, where most of the growth is occurring, and rural areas. Domestic water use is higher in urban areas;

- Alberta's high rate of economic growth – specifically an increase in manufacturing and oil sands development;

- economic expansion is sought by a number of government departments that have not necessarily fully considered water availability, projected water use in other areas, or the overall effects on the water system;

- ecosystem demands (instream flow needs) – these are thought to be increasing because they have long been neglected and not accounted for; and

- uneven distribution of water supplies and a mismatch between development and water availability, which becomes even more pronounced during drought conditions.

A dominant theme emerged at the consultations: demand is not uniform and each watershed faces its own set of unique demands and pressures. For example, irrigation, agri-food business, and booming urban populations are concentrated in southern Alberta (the South Saskatchewan River Basin) while pulp and paper and the oil sands are located in the north (the Athabasca River Basin). Regional variance in water availability and demand was a common point of discussion, and as one participant put it, "80% of the demand is occurring in the southern portion of the province while 80% of Alberta's water is located in the north."

Cumulatively, demands for water add up and can place significant stress on a water system. Other factors affecting the water system include:

- uncertain water supply;
- current allocations and water use;
- water quality;
- water agreements; and
- potential future pressures.

There is growing uncertainty about the amount of water available from year to year and the long-term pattern of water availability in the province. Alberta is already experiencing water declines – river and lake levels have declined between 10% and 20% over the last century, glaciers are shrinking, 70% of natural wetlands have been lost (reducing water infiltration and groundwater recharge), groundwater aquifers are recharging lake levels at a slower rate than in the past, and – in drier times – aquifers themselves are not being recharged. Surface water and groundwater are connected, and changes to groundwater aquifers are expected to have long-term implications for the overall supply of water.

There are also uncertainties associated with seasonal and cyclical climate variations that affect the amount of precipitation and glacial melt. Specifically localized or regional drought conditions affect water availability and also the timing and concentration of water demand (demand increases during the driest years and driest months). Climate projections suggest a multi-year, possibly a decade long, drought. "Drought is about 100% for sure – what remains less unsure is the cause."

"Climate change creates uncertainty that goes beyond seasonal variability." The predictions of climate change, natural or human-induced, will create larger and longer-term uncertainties. Receding and shrinking glaciers are often associated with climate change. This is of particular concern on the Prairies where the majority of major rivers are fed by Rocky Mountain glaciers. Glaciers situated in the southern portion of Alberta – the origins of the South Saskatchewan River Basin – are likely to be more

affected by climate change and are predicted to become "a continually diminishing resource." This water system is already feeling the pressure of existing demands without factoring in the complications of a shrinking supply.

Both seasonal climate variation and long-term climate change affect the amount of water available at certain times of year. For example, a decrease in mountain snowpack and warmer winter temperatures could result in earlier spring runoff, leaving less water flowing downstream during the summer months – the very time when residential and irrigation demand peaks. Mountain snowpack refers to the snow that accumulates in the mountains over the winter months. The snowpack melts and enters surface water sources in late spring and summer. A decrease in the snowpack may lead to a decrease in surface water.

Current water allocations and use were identified by a number of consultation participants as problematic, adding pressure on water systems and the health of aquatic ecosystems, particularly in the southern half of the province. Allocations are based on set flows, but these flows are changing due to drought conditions and shrinking glaciers. It may become difficult to maintain current allocation levels with changing and uncertain water supplies. As one participant stated, "there is no question that we are going to hit the wall in the next 10 to 15 years in terms of water licenses – industry, municipalities, and agriculture – if everyone utilizes the maximum amount of water that they are currently allocated, there will be problems down the road."

In terms of current water use, timing is critical. In drier years, water users demand water all at the same time – often during the summer months. In this case, the pressure associated with a diminished water supply is amplified by seasonal and concentrated demand.

Water *quality* also directly affects water availability – "you can have all the water in the world, but if it is degraded it is not available in the form it is needed." For example, if a lake becomes degraded and has a lower water quality, recreational activities may be limited or discontinued due to human health concerns. Or if E Coli bacteria contaminate a domestic water supply, the water is unsuitable, unavailable to be used. Either situation could happen in a season where there is higher than average water level (water quantity). Therefore, it is important to note that water availability (the amount that is able to be used) differs from the total amount in the water supply. Water treatment to improve the quality is a solution to this issue. However, there is a financial cost associated with new or greater treatment that is likely to be passed along to the individual water user.

Water quantity can also influence water quality. For example, a decreased lake level or river flow (supply) can influence quality since there is less water to dilute effluent that enters the ecosystem. A high level of water quality is not only essential to humans, but also to aquatic ecosystem health and economic activities. In fact, water quality and quantity are so interconnected it was suggested that they should not be considered separately in water policy.

Allocation agreements with Montana and Saskatchewan were identified as a pressure on Alberta's water supply. If the supply of water diminishes, it will become increasingly difficult to meet the allocation requirements within Alberta without compromising the flow agreements with adjacent jurisdictions. There is also concern regarding the potential conflict that these agreements could raise in the future. This has already started: during the summer of 2004 Montana approached the International Joint Commission (the organization responsible for overseeing water issues between Canada and the United States) to review the aging agreement on the St. Mary and Milk Rivers. Pressures on the water system will arise if the interprovincial or international allocation agreements are modified and reduce the flow available for Alberta.

On top of the concerns regarding potential changes to flow agreements, there are other future pressures that may arise. Two that were mentioned at the consultations include interbasin transfers and water exports. Interbasin transfers may be put on the table as a potential technical solution to Alberta's uneven water distribution. This is a supply-side solution to water management that involves moving water from one basin to another in order to meet growing demands in areas with insufficient water supplies. However, this approach does not address the current unsustainable patterns of water use in areas where demand is increasing and supply is decreasing. The ecological and financial costs of inter-basin transfers are predicted to be high, although they have not been quantified, and would likely result in severe, negative ecological effects in the donor and recipient basins.

Water exports were also raised as a potential pressure. There were concerns about water use and availability in the United States. What happens if they run out of water? What will Canada do if the United States wants to "buy" water? These potential pressures need to be addressed and cannot continue to be pushed aside and overlooked. It was also recommended that there is a need to have a framework in place to address this potential situation, and have the information (data and statistics on water supplies) necessary to support both Alberta's and Canada's position on water exports.

Cumulatively, these pressures amount to a lot of uncertainty when it comes to the future of Alberta's water supply. Each pressure would be difficult to address individually, but it is likely that we will experience a combination of pressures at once. Many participants noted that it is difficult to determine the exact pressures facing the water supply because, although there is a lot of anecdotal evidence, there are large gaps in available data to fully account for the balance or imbalance in water use, supply, and demand (especially on a watershed by watershed basis). This is a challenge facing watershed groups who are trying to develop water balance sheets to illustrate total water supply and demand, and present quantified arguments for or against new water allocations. But it is difficult to accurately create a balance sheet without the necessary data.

The lack of data to quantify available water supplies, water demand, and pressures is a major policy challenge facing Alberta. Without this information the effectiveness of public policy will be limited. It is critical that Alberta collects the data and information it needs in order to develop proactive policies, including contingency plans, that can address these potential pressures or at least establish a framework to follow.

Water as a Limit to Economic Growth

The demands and pressures highlight that water systems, particularly in the south, are reaching their limits in terms of the water available for economic activity, unless overall per capita usage levels decrease. Building on these findings, consultation participants were asked: **If, and to what degree, is water availability a potential limit to economic growth in Alberta?**

This issue sparked an interesting discussion at both consultations. There were a variety of opinions put forth that ranged from one participant stating, "in my opinion we ran out of water 10 years ago, but we still haven't put the brakes on" to another suggesting, "water is not in short supply, it just isn't found in the areas that need it. When you look at total water in Alberta there is no water shortage."

Despite the varying opinions, there was general agreement that insufficient water availability is a geographic issue that depends on which part of the province you are talking about. There was, however, less agreement regarding which areas of Alberta will face shortages – all areas south of Edmonton or areas south of Red Deer?

The main themes that emerged from the discussion of this issue are:

- potential economic development limits caused by a lack of water availability are regional issues and not all watersheds are approaching limits;
- some water systems have already reached their limit and additional water allocations are not possible;
- several municipalities are experiencing limits and are faced with having to decide between residential growth or industrial development because they do not have enough water for both;
- aquatic ecosystems also have limits – instream flow requirements need to be determined on a watershed-by-watershed basis to ensure that enough water is being left in the system to meet these needs;
- interprovincial and international water agreements are limits to economic growth in Alberta; and
- water has always and will always be a limit to growth for certain economic activities such as irrigation.

There was a strong belief that if we continue to grow and use water as we do now, that water will likely become a limit to future growth. It was suggested that there needs to be discussion on how to identify and resolve the tradeoffs between all uses or as one participant suggested, "there may be long-term economic limits that result from the unsustainable decisions we make today." However, the discussion was not all doom and gloom. In fact, there was a lot of optimism that water does not have to become a limit to growth. It was suggested that Alberta is in a position of opportunity to be innovative and show leadership. If Alberta invests in growth that treats water as a finite resource, limits can likely be avoided. It comes down to better managing our water resources and being proactive about what type of future growth we want to have in Alberta – growth that uses water efficiently or growth that uses water inefficiently.

Options for Managing Increasing Demand and Pressure

There was a general consensus that Alberta's water resources are facing increasing demand and, in some cases, will limit new economic development, unless something else changes. There was a sense that something needs to be done, but the question of what needs to be done or how to do it was less easily answered. To explore a diversity of policy instruments that may contribute to reducing water demand and increasing efficiency, the participants were asked: **What tools have the potential to manage demand and reduce pressure on Alberta's water supply?**

The intent of this question was to explore a broad range of instruments and to learn about demand management tools that are currently working in Alberta or that have been applied in other jurisdictions. The inventory that follows is not exhaustive, but does represent a variety of policy instruments that are gaining the attention of water users and policy-makers.

The instruments identified at the consultations have been grouped into four categories: 1) economic, 2) technological, 3) educational and 4) trading. Table 2 outlines a list of policy instruments (demand management tools) under each category and presents the positive comments and concerns that were identified. Also, examples discussed at the consultations are included.

Table 2: Demand Management Policy Instruments

Category	Instrument	Positive Comments	Concerns	Examples
Economic	**Pricing** – a dollar value placed on volumetric use of water	• Indicates the true value of the resource • Motivator to reduce water use • Encourages efficiency • Money generated could fund water conservation initiatives • Current generation pays for unsustainable actions rather than passing the costs (environmental degradation) onto future generations	• Does not ensure conservation • Could be a limit to economic growth • One tool, but not the full solution • Perception – viewed as just another government tax • Difficult to determine value (complex issue) • Difficult to implement – do you charge all users the same rate? • May produce unintended consequences • Concerns with putting a dollar value on water – could water become a tradable resource under NAFTA?	• Australia • California • South Africa • Israel • Beijing, China
Economic	**Incentives** – positive measures designed to encourage certain actions or behaviour. Examples include tax breaks, credits, and grants or low interest loans for new technology and upgrades.	• Encourages more efficient use of water • Encourages the use of new technology or facility upgrades that are too expensive otherwise • Perception – viewed more positively than pricing • Easier to implement – in practical terms and politically	• Needs to be a user-friendly system or it will be difficult to get buy-in • Where does the money come from to support publicly funded incentives? • Difficult to determine who should get the incentives – a large-scale irrigator versus an individual household	• United States – Environmental Protection Agency (EPA) offers nation-wide programs • California – "Cash for Grass" program to encourage water-conserving landscapes • The World Bank Group – Water Resources Management is conducting work on economic incentives
Technological	**Water Efficiency** – technology or infrastructure upgrades and new facilities - designed to use less water	• Effective in reducing the amount of water used • Can allow for irrigation or industrial expansion without applying for a new water license to use more water • Can reduce costs over the long-term – for example reduction of energy costs associated with water use • Knowledge and technology already available	• Expensive to retro-fit older infrastructure and facilities • Lack of incentives – relies on "goodwill" of water users • Unintended consequences – for example, loss of wetlands in irrigated areas resulting from leakage improvements	• Irrigation – Alberta, California • Institutional – University of California, Santa Barbara • Residential - water meters in Calgary and Edmonton
Technological	**Water Recycling** – the reuse of treated wastewater for non-potable uses (non-human consumption) or indirect potable* uses (mixed with raw potable supplies such as groundwater) *Potable – water suitable for drinking, but has not been treated	• Reduces demand and pressure on potable water supplies • Provides an alternative water source for uses such as golf course irrigation, industrial use, groundwater recharge and wetland restoration projects • Reduces costs associated with wastewater treatment – water does not have to be treated to drinking water quality for all uses • Reduces wastewater discharge • Benefits multiple users	• Perception – concerns over water quality and human health • Current regulations limit water reuse • Expensive to retrofit or implement new infrastructure	• United States – Florida, California • Japan • Sweden • Germany

Category	Instrument	Positive Comments	Concerns	Examples
Technological	**Alternate Sources** – use of other resources (other than freshwater) to perform the same function. For example, use of brackish water (water with low salt content, not considered saltwater) by the oil and gas industry.	• Reduces demand and pressure on freshwater supplies • Capitalizes on available non-freshwater resources • Recognizes that freshwater is too valuable for uses that do not require it • Illustrates innovation, leadership, and corporate social responsibility	• Water quality concerns • Cost of facility and technology upgrades • Lack of information – don't know how much brackish water there is or how it is connected to the larger hydrological system • Lack of test (pilot) projects to illustrate the costs and benefits • Lack of knowledge in some cases – there may be opportunities in industries other than oil and gas, but Canada has little experience	• Oil and gas industry – use of brackish water and CO2 enhanced recovery is being introduced in Alberta. However, further research and evaluation are required to determine the long-term costs and benefits of this practice.
Educational	**Public awareness** – programs to engage citizens and provide information on the importance and value of water (economic, social, and environmental), and the consequences of unsustainable water use	• Promotes attitudinal changes – to see water as a valuable resource that should not be wasted • Influences behavioural change – reduce individual and overall water use • Increases public demand for government action on water conservation • Large-scale benefits – overall reduction in demand and use by all users (rather than just one sector)	• Difficult to change social values • Benefits are not immediate, but rather long-term • Perception versus reality – need to make sure public receives correct information	• Public concern over water use by the oil and gas sector in Alberta prompted government and industry to measure water use, conduct research, and implement alternatives
Trading	**Water trading** – a system where a portion of annual water allocations can be traded. If a water user does not use 100% of their annual water allocation, they could sell/transfer the remaining water to another user.	• Provides an incentive to encourage conservation and efficient use of water • Encourages cooperation between water users to share water especially during drought years • Potential for environmental benefits – a claw-back for conservation on all transferred water (10% claw-back used in Alberta) • Generates money to offset costs of infrastructure upgrades to improve efficiencies – money generated by selling off remaining water allocations	• Total water use could increase and leave less water in the ecosystem • Does not ensure aquatic ecosystem health • Requires more information and research • Complex system and likely difficult to implement • Negative view of government's control over claw-backs • Individual farmers do not hold water licenses – irrigation districts hold the licenses. How would an individual farmer benefit? • Currently there is no marketplace to support selling and trading of water allocations	• Australia – Murray-Darling Basin • Alberta – South Saskatchewan River Basin (a few trades to date) • British Columbia – South East Kelowna Irrigation District • South Africa • California – Water to Water program • Green house gas credits and trading system created under Kyoto

Several key themes emerged during this discussion of policy instruments. There was strong agreement that determining the true value of water is central to demand management. The current value system treats water as essentially free. This has led to the mistreatment and unsustainable use of water resources. As a participant stated, "the cost of water is so insignificant right now that companies are using excess water to dilute effluent to meet water quality regulations." Without placing a quantified value on water, it will be difficult to promote conservation. Beyond agreeing that a value needs to be assigned to water, this issue is very complex, requires more evaluation, and raises several concerns. Yet, "despite the complexity, the value of water can no longer be ignored, it is fundamental to the way that we value and use this resource."

The importance of education and the role of the public were also key themes. Increasing awareness and engaging the public were viewed as essential components in creating long-term, large-scale change. The public has a major role to play, and if interest around water policy and the need for water conservation is increased, the government would be more able to implement significant reforms.

The discussion also acknowledged that Alberta should explore and learn from the experience of others. "Probably very few water conservation situations haven't already taken place in other areas. We need to look at these solutions, evaluate the costs and benefits, and adopt the tools that are appropriate for Alberta." "We should not be re-inventing the wheel or starting from scratch." However, there may be areas and situations that are unique to Alberta, which offer an opportunity to show leadership. Research efforts should focus on those activities that are unique to Alberta (e.g., oil sands development).

Learning from the experiences of others will help to identify some of the unintended consequences that may result from water conservation initiatives. As identified in Table 2, one of the consequences of improving irrigation technology in southern Alberta has been a reduction in the amount of water leakage. This leakage created wetlands that provided an important source of prairie habitat. The loss of wetlands is a growing concern for environmental organizations. This unintended outcome highlights the need to "think through" each policy instrument, learn from others, work to minimize unintended consequences, and evaluate tradeoffs.

It was also strongly felt that Alberta should not focus on implementing just one tool. Rather, efforts should be directed towards a suite of tools that could complement one another and work to achieve a greater result. In particular, there was concern over focusing solely on pricing. Pricing could and possibly should be part of the solution, but must not be viewed as the panacea of conservation.

Barriers to Demand Management in Alberta

Demand management is not a new concept – in fact some policy tools have been debated for over 30 years. The discussion around potential policy options highlighted the diversity of tools, technologies available, and examples where demand management has been applied in other places. But, demand-side solutions have not become a priority nor have they been implemented on a grand scale in Alberta. Determining the reasons behind this shortfall is critical to advancing demand management policy instruments from the status of good idea to an integral part of the solution.

To identify potential reasons why demand management is not widely applied, participants were asked: **In your opinion, what are the barriers to demand management in Alberta?**

Consultation participants indicted that the implementation of demand management has not been plagued by a lack of technology or a lack of knowledge, but has been restricted by "our policies, beliefs, and values that are entrenched in century-old thinking." The discussion at both consultations centred on the barriers created by out-dated policy, fragmented government decision-making (both vertical – among orders of government – and horizontal – among departments, agencies, and different jurisdictions within one order of government), lack of public awareness, and misperceptions about demand management (by both the public and other users).

Four main categories of barriers emerged: 1) public policy; 2) attitude and perception; 3) data and information; and 4) resource availability. Each type of barrier is described using details and examples gathered at the consultations.

Public Policy

- water licenses (allocations) – the "first in time, first in right principle" is one of the main barriers to change since senior license holders (i.e., the oldest) are not willing to give up their water allocations or renegotiate a new license. The current system "holds values formed 100 years ago and limits these values from evolving based on what we know today."

- inadequate management of ecosystem needs – the current allocation system does not prioritize instream needs, restricts the use of water licenses for conservation purposes, and current allocations have degraded aquatic ecosystem health in some cases.

- efficient use of water is discouraged – the current allocation system has a "use it or lose it" structure, a lack of pricing, and a lack of incentives to conserve, all of which discourage the efficient use of water. The relative lack of pricing mechanisms was discussed at length. It was argued that it is difficult to encourage conservation when water is a practically free resource and, in some cases, becomes cheaper the more you use it (called a decreasing block rate).

- gap between science and policy – public policy has been slow to respond to new knowledge and information.

- disconnect between land use and water policy – a lack of consideration for how land use affects water undermines the effectiveness of water policy.

- lack of innovation – current policy does not, for example, allow for water reuse among different users.

- fragmentation of decision-making (vertical and horizontal) – decision-making has been divided into multiple government departments and agencies within one order of government (e.g., Department of Fisheries and Oceans and Environment Canada both work on water and water-related issues at the federal level), among different orders of government (federal, provincial, and municipal), and among multiple jurisdictions within the same order (multiple provinces and multiple municipalities). For example, a downstream municipality has little or no say in upstream land use decisions despite the fact that these decisions will directly affect the quality and amount of water that enters their jurisdiction.

- unclear roles and responsibilities – there is a confusing dispersal of responsibility among different government departments and agencies and orders of government that have similar mandates. For example, fish habitat is the responsibility of both

the Department of Fisheries and Oceans (federal government) and Alberta Sustainable Resource Development (provincial government). The interrelationship between the two is unclear and partnerships are not well defined.

• conflicting goals and agendas – this can occur among various government departments and agencies. For example, one participant suggested that "Alberta Agriculture, Food, and Rural Development wants to expand irrigation and use more water while Alberta Environment wants to reduce water usage."

• lack of partnerships – participants noted a lack of partnership within government (among government departments and agencies, among the orders of government, among provinces, and among municipal governments). A lack of partnerships among governments, academia, industry, and nonprofit organizations were also seen as a major barrier, although some see these as improving over time.

• lack of resources – participants noted the reduced capacity of governments to devote the human resources needed to manage information, consider alternatives, and develop innovative and proactive public policy.

• lack of political will – a lack of political will at the top levels to implement large-scale demand management solutions was seen as an ongoing barrier to change. The *Water for Life* strategy was viewed as a step in the right direction, but it was argued by some that a more aggressive approach to water conservation is needed.

• lack of creativity – numerous participants argued that governments are "not always open to innovation and change" and generally resist creative policy options.

Attitude and Perception

• myth of abundance – the notion that there will always be more, "water will always be clean, plentiful, and free" and that "supply and infrastructure solutions are the answers to water shortages" undermine efforts to pursue greater conservation.

• myth of entitlement – for many, access to clean, free water is seen as a right. This attitude dampens support for water conservation alternatives.

• societal values – Canadians tend to prefer lifestyle options that are harmful to water supplies. Examples include green, manicured lawns that are planted with ornamental, water-dependent species, golf courses that require lots of water to maintain fairways, and urban sprawl, which is harmful to both water quantity and quality.

• perceived fear – water recycling and water reuse is viewed by many as harmful to human health.

• afraid of change – many participants noted that Canadians "are set in their ways and dislike change." This attitude is a barrier to developing public support for changing how we view, value, and use water.

• more government control – it was argued that industry sees water pricing as just another government tax and more red tape that will harm the economy: as "government benefits and industry pays." Examples of counterproductive attitudes include: "pricing will impede market competitiveness," "costs of demand management will outweigh the benefits," "why should I have to pay?" and "government benefits at the cost of industry."

• lack of technological confidence – industry does not want to invest in technology that has not proven to be effective. A lack of test/pilot projects and lack of information on costs/benefits impede change in this area.

Data and Information

• lack of data to make intelligent decisions – insufficient data on the total supply of groundwater and surface water, insufficient tracking of actual water use by all sectors and other data gaps make it difficult to make informed decisions. In addition, debate often bogs down over disagreements about the facts.

• lack of demand management information – a lack of pilot/test projects, lack of data to highlight costs/benefits and lack of best practice information mean that water conservation options are not well understood.

• lack of information sharing between different users – there is little opportunity to exchange information on technology, efficiency, lessons learned, and success stories.

• lack of public awareness – a general lack of knowledge regarding where water comes from, how much it costs to treat and deliver, where it goes downstream and other aspects of the water system all make it difficult to mobilize change.

Resource Availability

• lack of human capital – a lack of human capital (resources) to collect, analyze, and develop water policy within government, a lack of trained water auditors who can evaluate current water use and provide suggestions on how to improve water efficiency (residential, agricultural, and industrial water use) make it difficult to develop and implement new water conservation policies.

• lack of funds – in general there is a lack of financial resources available to support pilot projects, to establish technological confidence, and to fund the upgrading of older facilities that use water inefficiently. There is also a lack of financial incentives to encourage upgrades and better use of water.

• combined lack of human capital and funds – for example, in smaller towns water treatment facilities often operate below standards because they lack the funding and people required to plan and implement a new, upgraded system.

VII. Future Directions

Based on the barriers identified, options for overcoming the obstacles were discussed. Some of the recommended future directions are relatively obvious and easy to address, while others involve more fundamental change. Despite the complexity and long-term commitment required, fundamental change was viewed as necessary in order to develop support for water conservation

policy instruments and to develop an effective water policy that balances economic growth, sustainable ecosystems, and a high quality of life.

Five areas of public policy action emerged during the consultations: 1) develop a vision for the province; and 2) re-evaluate and re-structure the public policy framework and governance model to overcome the current public policy barriers; 3) invest in education and the promotion of water conservation to overcome the attitude and perception barriers that currently exist; 4) conduct additional research and measurement to overcome the gaps in current data and information; and 5) ensure that resources required to implement the *Water for Life* strategy are in place. These future directions should be thought of as a package; no single recommendation is sufficient to adequately address the collection of barriers that were identified.

1. Develop a vision for the province

Developing a vision for Alberta will be a critical component in encouraging support for water conservation. Without knowing what Alberta is striving for and the role of conservation in achieving this target, it will be difficult to promote the rationale for water conservation. It was thought that the following questions must be answered to create a vision for Alberta:

- What do we fundamentally want as a province?
- What kind of communities do we want?
- What kind of economic development do we want?
- What are Alberta's choices? What are the tradeoffs?
- Is water conservation a solution or does it just buy us more time?
- What is the goal of water conservation? Is it to benefit the ecosystem? Or is it to allow for greater economic growth and expansion? Is it both?

2. Re-evaluate and re-structure the public policy framework and governance model

A variety of changes were recommended to overcome the barriers to change and advance demand-side solutions in Alberta. These comments range from general future directions to specific policy recommendations.

In terms of general policy directions, it was suggested that Alberta needs to be proactive and capitalize on current opportunities and momentum to create a new, comprehensive water conservation policy before there is a situation of water shortage, demand for water export, or demand for interbasin transfers that would result in reactive policy. "Hard decisions need to be made, but these are only going to get harder if we continue to put them off."

It was suggested that provincial policy should be flexible as a "one-size-fits-all solution" will not be successful. It was also recommended that the complexity and diversity of issues in Alberta are regional and need to be addressed accordingly. Participants recommended that the development of a water conservation strategy should be based on a series of regional (watershed-level) approaches framed within a provincial strategy. This type of approach would more adequately address the different issues facing individual basins.

The *process* of developing and implementing a water conservation strategy was identified as a critical success factor. Participants pointed to the need for the provincial government to seek collaboration and partnerships and to recognize the role of nonprofit

organizations. A three-way partnership among the public (including nonprofits), water users, and government should be sought.

In addition to these general future directions, specific changes to current public policy were also put forth and included:

- re-evaluate the current water allocation system:
  - evaluate potential changes to the current system – maintaining fairness and historical uses;
  - establish a new baseline regulatory standard where minimum flows (instream needs) are in place first and then determine water allocations second – i.e., reverse of current system;
  - evaluate the use of claw-backs on "unused" portions of allocated water to meet instream needs;
  - evaluate and implement economic instruments (including pricing and incentives) for water use; however, no charges should be applied to instream needs.

- establish conservation targets based on forecasting and backcasting – this approach looks forward and determines where we want to be (e.g., 30% overall reduction in water use by 2015 as outlined in the *Water for Life* strategy) and looks backward to determine what needs to be done today to ensure the future target can be achieved. Conservation targets should be developed for each type of water user since some sectors may have more opportunity to change their practices than others (e.g., oil sands development versus irrigation);

- develop conservation strategies at the watershed-level to address the unique supply and demand issues facing individual basins;

- integrate land use and water policy to ensure future land development takes into consideration the potential effects on water quantity and quality;

- integrate decision-making – evaluate other governance models such as the Natural Resources Conservation Board or the Energy and Utilities Board to determine if this approach could also work for water;

- integrate planning at the watershed level – create a system of cooperation that links upstream and downstream users, and provides the best tools and information available for decision-making;

- provide leadership and commitment – governments need to take the lead and adopt water conservation initiatives in-house to illustrate their commitment to change;

- pursue innovation – governments need to be supportive and willing to invest in alternative solutions and technologies; and

- increase partnership and collaboration – develop partnerships with other stakeholders throughout the creation of water conservation policy.

3. Invest in education and the promotion of water conservation

Increasing awareness and educating all water users (including the public) with updated and accurate information was also recommended at the consultations. It was suggested that increasing awareness and promoting long-term behavioural and social value changes will result in "fundamental transformations in how we use and misuse water." More specifically the recommendations for an education strategy include:

- address the issue of "perception versus reality to gain buy-in" and create a level of understanding that is based on facts rather than anecdotal information;
- focus on changing behaviour – "we have to get to the people and industries that don't care and generate awareness to influence change;"
- "tap into self-interest" – relate the need for water conservation and the consequences of not conserving, to highlight the importance of change;
- increase awareness of the true value (economic, social, and environmental) of water;
- increase awareness of the importance of water to Alberta's economy and our way of life;
- increase awareness on the true costs of water use and the economic benefits of water conservation; and
- take the information that specialists understand and put it at a basic level for everyone to understand.

Education using accurate information was emphasized as it has the potential to overcome the problems of knowledge and attitudes based on anecdotal evidence and incorrect notions of water use and availability. It is anticipated that education and awareness will heighten concern for water conservation and develop a broad base of support, including public and political will, for such initiatives.

Promotion, although interconnected with education, was also identified as a necessary future direction. It was recommended that marketing be used to promote the success of alternative technologies to overcome attitude and perception barriers. For example, there is a misperception that low flow toilets don't work. The challenge is that some low-flow toilets don't work as well, while others do. There is a need to identify and promote those technologies that are effective. The idea of promotion and marketing goes beyond just low flow toilets and could be influential in gaining the attention and confidence of other water users.

4. Conduct additional research and measurement

The need for more data, statistics, and information was a common theme at the consultations. A number of research priorities were identified:

- develop a comprehensive inventory of provincial water supplies (surface and groundwater);

- conduct further research on the connection between groundwater and surface water;

- research the causal factors (including climate change) that lead to water shortages, and map their effects on water supplies (rate and extent of change);

- develop a series of future economic growth scenarios and associated water use that can be used to evaluate tradeoffs and provide data to make more informed choices;

- research and evaluate case studies of demand management initiatives from other jurisdictions;

- research interbasin transfers, water export scenarios, and the potential implications of water pricing (the findings should be used to create a policy to deal with these unknowns);

- conduct research and pilot projects for alternative technologies to establish confidence and evaluate costs and benefits; and

- determine (quantify) instream flow needs required to maintain healthy aquatic ecosystems.

Measurement was also identified as a key ingredient in making effective water management decisions. As previously stated, Alberta does not adequately measure the provincial water supply, user and ecosystem demand, and actual water use; therefore the following recommendations were put forth:

- accurately measure the total water supply (surface and groundwater);

- measure cumulative effects at the watershed level;

- determine and monitor ecosystem demands (water quantity and quality);

- collect data on actual water use rather than just allocation data; and

- develop a system of annual reporting for all water users to illustrate how much water is being used (instead of relying on allocation data) and to monitor the water use changes that result from implementing water conservation.

Further research and measurement would enable the creation of a water balance sheet – measuring supply, demand, and actual use – on a watershed by watershed basis. This information is necessary in developing effective conservation strategies and water use targets. But it is important to note that there needs to be a "best-case scenario for information because Alberta cannot wait forever and there is a lot we can do now with the information we have."

5. Invest in the necessary resources

The need to invest in resources was emphasized at the consultations. It was strongly felt that Alberta Environment has the ability, but lacks the resources necessary to develop and implement new policy. The need for government to show leadership and be a

role model for investing in water conservation technologies was also suggested. More specifically, it was recommended that the provincial government:

- commit more resources to research, gathering scientific information, and policy development;

- provide more resources to Alberta Environment to carry out the *Water for Life* strategy – to implement the recommendations put forth in the strategy, establish watershed planning and advisory councils and ensure working partnerships with watershed groups; and

- invest in pilot projects and incentive programs – research, evaluate, and implement pilot projects and incentive programs that would encourage the adoption of water conservation technologies and behaviours for all water users ranging from individual household to large manufacturers.

VIII. Looking Ahead

The time is right in Alberta to move forward and to pursue a new water policy that takes water conservation to heart. As this process moves forward, there needs to be a dual focus on establishing the foundation necessary to make good, proactive policy decisions and on developing watershed level conservation strategies that are connected within a provincial framework. Building this foundation involves the collection of data, information, research, and measurement. Based on this foundation, the attention needs to turn to developing a water policy that outlines how Alberta's 30% reduction target will be met, the conservation targets for individual industry sectors, and the water conservation policy instruments that will be employed. It is important that this policy provides guidance and yet remains flexible and adaptable so that it is applicable at the regional and individual watershed level. A collection of watershed conservation strategies from across the province that focus on reducing the overall demand in individual basins can be added together to meet the overall provincial water conservation targets.

There is an important role to be played by all orders of government, nonprofit organizations, water users, and the general public in this process. Developing partnerships, evaluating tradeoffs and making hard decisions will be necessary components of this process. There will be a lot of benefits to gain by undertaking this process and committing to developing water conservation strategies. Alberta has the opportunity to ensure its citizens a high quality of life, future economic success, and healthy aquatic ecosystems. Beyond our borders, Alberta has the opportunity to be a good neighbour to downstream users, and to become a leader in water management and a model of best practices.

IX. Conclusion

There are a lot of reasons for Canadians to care about our water resources and become interested in water policy. A sustainable water supply is fundamental to our quality of life, to the integrity of our natural ecosystems, and to our economic prosperity. There are aspects of water management that are better understood than others and it is often the economic importance of water that gets less attention. This is not to say that water for the economy is more important than conserving water for human or ecosystem needs, but a focus on the economic importance of water enables the need for water conservation to be packaged in a new way that promotes the link between water and economic prosperity.

In Alberta, the need to upgrade water policy to address the current and future pressures on water resources is increasingly an issue of concern, particularly in the southern portion of the province. Although there are a number of growing pressures on Alberta's water supplies, different watersheds are facing different levels of growth and demand. But this is not a reason to ignore watersheds that are less taxed or experiencing less demand for water – there are many proactive steps that can be taken to prevent future stresses. The growing pressures on our watersheds are not likely to subside and if we continue to use water as we do now, these pressures will increase and limits to economic growth may become a reality. This does not have to be the case. If alternative policy options are implemented, limits can likely be avoided.

If we want to have enough water to maintain and grow the economy as well as sustain ecosystems, water conservation needs to be part of the answer. There are ways to use less freshwater, use it more efficiently, and not use it at all. Some of the demand management policy options have been tried and others need to be carefully thought through and tested, but in both cases there are potential solutions out there and Alberta does not have to start from scratch. The trick will be finding a balance between economic goals, maintaining aquatic ecosystem health, and our quality of life.

The consultations reinforced many of the ideas put forth in the Government of Alberta's *Water for Life* strategy. However, the information gathered goes beyond just reinforcement and highlights where action needs to happen, recommends how it should take place, suggests what the options are, identifies the barriers that need to be addressed, and proposes the future directions necessary to advance water conservation strategies. Identifying and overcoming barriers will be a key part of creating and implementing a comprehensive water policy.

Water is a complex topic; the policy environment is complicated and involves all the orders of government and a large number of stakeholders. Water users are diverse and range from individual homeowners to large-scale irrigators, and each has their own interest and concern for ensuring a reliable, quality water supply to support both current and future needs. However, the complexities should not deter us from moving forward as water is too important to our way of life. As the *Water and Economic Growth Initiative* consultations illustrate, the situation is not all doom and gloom, but action is required and alternatives need to be promoted and implemented. Water is becoming a hot topic, gaining the attention of water users, policy-makers, and the public. The time is right to capitalize on this opportunity and rethink our current, unsustainable use of water resources and move forward to create a proactive water policy that aims to balance water conservation and economic growth. CWF

Definitions

Climate change – long-term change in atmospheric and/or ocean conditions due to natural or human activity. Climate change is sometimes used synonymously with the term global warming, but climate change is a broader term because it includes natural changes in climate.

Demand-side management – an approach that aims to conserve water by using a variety of policy instruments to reduce demand and increase efficient use. This approach recognizes that water is a finite resource.

Drought – periods of less than average precipitation over a certain period of time. Drought is naturally occurring and can cause imbalances in the hydrologic system.

Inaccessible freshwater supply – water locked in glaciers and deep underground aquifers that is unavailable for use.

Instream use – activities that use water while it remains in the environment (in rivers or lakes for example) and is not withdrawn. Instream water use supports a number of recreational activities and provides the water necessary to sustain the aquatic ecosystem.

Potable water – water that is suitable for human consumption, but has not been treated.

Renewable freshwater supply – water that circulates through the water cycle.

Supply-side management – an approach to water management that focuses on capturing and pulling more water out of the watershed. Infrastructure and storage (dams, pipes, canals, etc.) are often the focus of supply-side solutions.

Water allocation – the amount of water that can be diverted or withdrawn for a specific use. Water allocations are assigned under a water license approved by the province.

Water consumption – water that has been removed from its source and is no longer available for use because it has evaporated, transpired, been incorporated into products and crops, or consumed by humans or livestock. Consumption is the difference between the amount of water withdrawn and the amount of water returned to the water system.

Water cycle – the circuit of water movement from the atmosphere to the earth and its return to the atmosphere through various stages or processes such as precipitation, interception, runoff, infiltration, storage, evaporation, and transpiration. This process is also called the hydrologic cycle.

Water supply – quantity of accessible water found in lakes, rivers, streams, and groundwater sources.

Watercourse – any natural or artificial channel that carries water (e.g., rivers, creeks, streams and irrigation canals).

Watershed – an area of land that catches precipitation and drains it into the same water system. For example, the North Saskatchewan watershed includes more than just the river, it consists of the entire land base that drains into this river system.

Withdrawal – freshwater removed from surface water or groundwater supplies and used for domestic, agricultural, or industrial purposes Water that is used, but not consumed is either returned to its original source or can be reused if water quality standards are met.

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