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SUPPLY, QUALITY AND USE OF

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***Water  
in the  
Prairie  
Provinces***



***MANITOBA EDITION***

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# water and the prairies

**Agriculture is the largest single user of water in western Canada, and irrigation is the largest agricultural use.**

Agriculture predominated the settlement of the Prairie Provinces. But it wasn't long before the early settlers discovered that the cyclical precipitation patterns on the prairies also meant periods of water shortages and drought. Some turned to irrigation as a solution. An early leader in this field was the Canadian Pacific Railway. With vast tracts of farmland to sell and the need to increase rail traffic, the CPR was the first large investor in irrigation as a means to increase settlement in western Canada. Over the ensuing years the focus has always been to ensure the sustainable use of the prairie's irreplaceable soil and water resources.

Today, irrigation plays an important role in western Canadian agriculture. Developed irrigated area is estimated at 755,000 hectares of which 65 percent is in Alberta, 16 in Saskatchewan, 16 in British Columbia and 3 percent in Manitoba.

However water is of far greater importance to agriculture than for just irrigation. Although irrigation consumes an estimated 50 percent of Prairie water withdrawals, only about 1 percent of Prairie farm producers utilize irrigation. The other 99 percent of farmers, sometimes called dry-land farmers, depend on rain and snow to provide soil moisture for their crops and on wells, dugouts, sloughs, and creeks for their livestock and domestic water supplies.

As the Prairie region has grown and transformed itself from a rural-based, primary agriculture producer to a diverse urban-based, goods and services economy, many new needs have arisen for water. Growing municipal needs, electricity generation, oil production, food processing plants, intensive livestock operations, manufacturing and other industries, require large quantities of water and all, in turn, will have some impact on both water quantity and quality.

To prosper in the 21st century, the Prairie region must develop its economy based not only on competitive market forces, but also on sustainable environmental practices. The wise and responsible use of water will be vital in meeting these objectives.

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## The wonder of water

The United Nations has proclaimed 2003 the International Year of Fresh Water. Canadians are making plans to use the UN Year of Fresh Water to launch a two-year celebration of the importance of water to our cultural and ecological heritage.



Water is one of the most amazing and important substances on Earth. Its abundance is what makes our planet unique and gives it life. In 2003 and 2004, Canadians will be celebrating how water shapes the land upon which we live and how it defines us as a nation.

Sponsored by Environment Canada and Parks Canada, the two-year Wonder of Water initiative will engage Canadians and their guests in the understanding and appreciation of how com-

munity social well-being and economic vitality are sustained by water, the part it plays in creating a healthy environment and in fashioning spectacular landscapes. Further information on the Wonder of Water is available at: [www.wonderofwater.ca](http://www.wonderofwater.ca).

### PUBLISHER'S PERSPECTIVE

This publication is intended to be a primer on water issues on the prairies, it has been designed to raise public awareness of the importance and role of water and our combined responsibility to protect this most valuable resource.

The publisher acknowledges that there are some troubling issues with respect to water and its management in the Prairie region of Canada. It is the hope that this publication serves the public interest by informing and provoking further pursuit of information on this important subject.

There is growing concern that the planet's climate is changing and that these changes, on balance, are likely to be more negative than positive for the Prairie region. Some of the consequences of climate change and its possible impacts on water are examined in the articles.

Keewatin Publications hopes that this publication provides enough information to help readers make more informed decisions and develop more considered opinions. It is further hoped that the contents are balanced, sufficiently detailed and provide a wide range of perspectives. ♦



## Water in a thirsty world

In many third world countries tap water is unsafe to drink and for many even having a tap would be a luxury. A plentiful supply of healthy water is a blessing for a relatively small part of the world's population.

An average person needs from 30 to 50 litres of fresh water a day for drinking, cooking, sanitation and so on. The average Canadian uses in excess of 300 litres of water a day while Africans use about 10. There are in excess of 1 billion people in the world who do not have safe drinking water; almost 3 billion do not have proper sanitation and 4 billion do not have adequate sewage facilities. Water related diseases kill an estimated 3.5 million people, mostly children, each year. These are sobering statistics.

We Canadians, who shower daily, launder our clothes frequently and make lakes and rivers our playgrounds, simply do not appreciate our good fortune. We take water for granted. Without due care we could squander our wonderful water inheritance. ❖



## Water and our economic health

Canadians are among the biggest water users in the world. Nearly all of our economic and social activities depend on water. How do we use it?

There are two basic ways in which we use water: instream and withdrawal uses. Instream uses include hydroelectric power generation, transportation, fisheries, and recreation. These activities take place with the water remaining in its natural setting, "in the stream".

Withdrawal uses include such things as thermal power generation, mineral extraction, agriculture, (mainly irrigation), manufacturing and municipal use. The water is removed from its natural setting for a period of time and for a particular use. Eventually all, or part of it, is returned to the natural environment. The difference between the amount of water withdrawn and the amount of water returned is water "consumed".

In the Prairie provinces, thermal power generation accounts for about a third of total withdrawals, while agriculture is first at about 50%, municipal, manufacturing and mining account for 10%, 7% and 1% respectively. ❖

## The next Canadian export?

Canada opposes the removal of water from major Canadian water basins including the removal of water for export. Water is a shared responsibility between the federal, provincial, and territorial governments, and each have a role to play in protecting Canada's freshwater resources. Provinces have the primary responsibility for water management while the Government of Canada has certain legislative authority in the areas of navigation, fisheries, federal land, and shared water resources with the U.S.

Water in its natural state, for trade purposes, is not considered to be a 'good' or a 'product', and is therefore not subject to international trade agreements. Nothing in the North American Free Trade Agreement or in the World Trade Organization agreements obliges Canada to exploit its water for commercial use or to begin exporting water in any form. Of course Canadian policy permits the trade of bottled water and other products which contain water on world markets. ❖



## Jurisdictional responsibilities

Division of responsibilities for water is complex and is shared. Under The Constitution Act, provinces own water resources, which includes both surface and groundwater and accordingly they exercise a wide range of responsibilities, including the provision of safe drinking water.

Federal responsibilities with respect to water are in areas that have the potential for significant national economic and environmental impact. Water on federal lands, including the provision of safe drinking water, in National Parks, in the northern territories and on the reserves of Canada's aboriginal peoples also falls under federal jurisdiction. The federal government also has responsibility for boundary and transboundary waters and for Canada's national water policy.

All levels of government in Canada understand that environmental impacts respect neither physical nor political boundaries and that effective management of water requires interjurisdictional cooperation. This co-operation is exercised through numerous federal-provincial consultative bodies and processes pertaining to monitoring, regulation, standards and guidelines, and shared responsibilities on environmental assessments.

In addition to the two senior levels of government, others have responsibilities as well. Municipalities, corporations and individual members of society must also work to protect, conserve, and enhance our water resources. ❖



## Provincial circumstances

Alberta has a growing population, expanding livestock industry, and a growing industrial base. The health of all of these depends on an ample and reliable supply of water. And the last few years have made it abundantly clear just how vulnerable some Albertans can be when it comes to water supplies.

Like other Canadians, Albertans are taking water issues more seriously than in the past. They are deciding how best to balance environmental responsibilities and economic objectives. It will be necessary to more carefully manage the water supplies if the Province is going to meet its future water needs.

In Saskatchewan, the Judicial Commission of Inquiry into the North Battleford *Cryptosporidium* incident handed down more than two dozen recommendations and over five dozen findings. Since the release of the Inquiry report the regulatory responsibilities for ensuring safe drinking water supplies have been tightened.



In addition a number of structural changes have been announced within government, the main one being the reorganization of the Saskatchewan Water Corporation into a 'new' Sask Water, mandated to be the province's water utility and the second is the Saskatchewan Watershed Authority whose mandate is to manage the province's watersheds.

Like its neighboring Prairie provinces, managing water is one of the biggest challenges facing Manitoba. At times Manitoba has to manage high river flows and flooding, while at other times there is also a concern about the diminishing quality of the province's water. Most of the water from the Prairie region flows into Lake Winnipeg. Increasing amounts of nutrients are appearing in this water and published scientific reports indicate quality has deteriorated over the past several decades.

Over the past few years, a variety of consultative processes have taken place in Manitoba to identify and develop solutions, and to provide Manitobans with a new strategy to deal with water issues in the 21st century. ❖

# Rivers in the Prairie Provinces

**Slave River:** represents more than 80 percent of Alberta's river flows, all of which end up in the Arctic Ocean.

**Saskatchewan River:** the combined North and South Saskatchewan flows represent about half of Saskatchewan's river flows and less than a third of the flows into Lake Winnipeg.

**Churchill River:** very little of the flows are used in Saskatchewan, these represent about half of the province's river flows, all of which end up in Manitoba.

**Winnipeg River:** represents close to half of the flows into Lake Winnipeg, most of which originate in Ontario.

**Saskatchewan River:** the combined flows of the North & South Saskatchewan rivers represent less than 15 percent of Alberta's river flows yet supplies most of the province's population & industry.

**Red & Assiniboine Rivers:** represent less than 10 percent of the flows into Lake Winnipeg with about half originating in the United States .

## Master Agreement on Apportionment:

To manage the amount of water that any province can take out of a river that crosses the boundaries with neighboring provinces, the governments of Alberta, Saskatchewan, Manitoba and Canada signed the Master Agreement on Apportionment in 1969. Under this agreement Alberta must ensure that 50 percent of the water that originates in Alberta, flows to Saskatchewan. Saskatchewan must in turn ensure that 50 percent of the water that flows into the province from Alberta and 50 percent that originates in the province flows into Manitoba. The flows are balanced for each calendar year. The apportionment agreement is administered by representatives from the three Prairie provinces and the federal government.

## International Joint Commission:

The International Joint Commission prevents and resolves disputes between the U.S. and Canada under the 1909 Boundary Waters Treaty. It also pursues the common good of both countries as an independent and objective advisor to the two governments.

## Lake of the Woods Control Board:

The Lake of the Woods Control Board manages the waters of Lake of the Woods, Lac Seul, and the Winnipeg and English rivers. It was formed in 1919 and operates under Canadian federal and provincial legislation and a Canada-United States Treaty. The Board consists of four members and serves diverse interests in the basin.

## Alberta

The management of surface water resources in Alberta is complicated by highly variable flows on the tributaries of the Saskatchewan River system. Additional storage would help but this means finding suitable reservoir sites, balancing the costs with the benefits and mitigating environmental impacts. An additional complexity is climate change, which appears to be reducing river flows. Most of Alberta's river flows are on the Athabasca, Peace and Slave River watersheds, away from the populated areas of the province. Transfers of water between these watersheds would be a complex issue of political, environmental, and down-stream user issues. The guiding priority is therefore maximizing the benefits of the available water resources in the regions of use.

## Saskatchewan

The province has two main watersheds, the Saskatchewan and the Churchill. The Saskatchewan River system supplies about half of the province's population with water. The remainder depends mostly on wells and small reservoirs. Most of the Saskatchewan River flows originate in Alberta. As Alberta uses more water, less water will pass to Saskatchewan until, as per the Master Agreement on Apportionment, only 50 percent of Alberta's water will flow across the Saskatchewan border. This decline will be exacerbated by climate change since with reduced flows, 50 percent of a smaller volume of water will be released to Saskatchewan. Growing human and livestock use in Alberta will also mean increased contaminants in the river system. Consequently, Saskatchewan needs to be concerned about both the quantity as well as the quality of the water flowing into the province in addition to managing its own water quantity and quality requirements.

Since many communities and farmers depend on wells and dugouts, ensuring an adequate water supply is further compounded by finding sufficient potable water not degraded by high mineralisation or surface runoff.

## Manitoba

Contrary to the challenges in the western prairies, the Red River valley in southern Manitoba suffers from frequent spring flooding. Consequently much of Manitoba's arable land is made possible through a network of drainage ditches.

Another unique circumstance for Manitoba is that it is at the downstream end of several large drainage basins. Surface pollutants from the U.S., Alberta and Saskatchewan as well as those generated from within Manitoba itself, all end up in Lake Winnipeg. The water quality of Lake Winnipeg has been deteriorating for several decades; and ecosystem health is impaired.

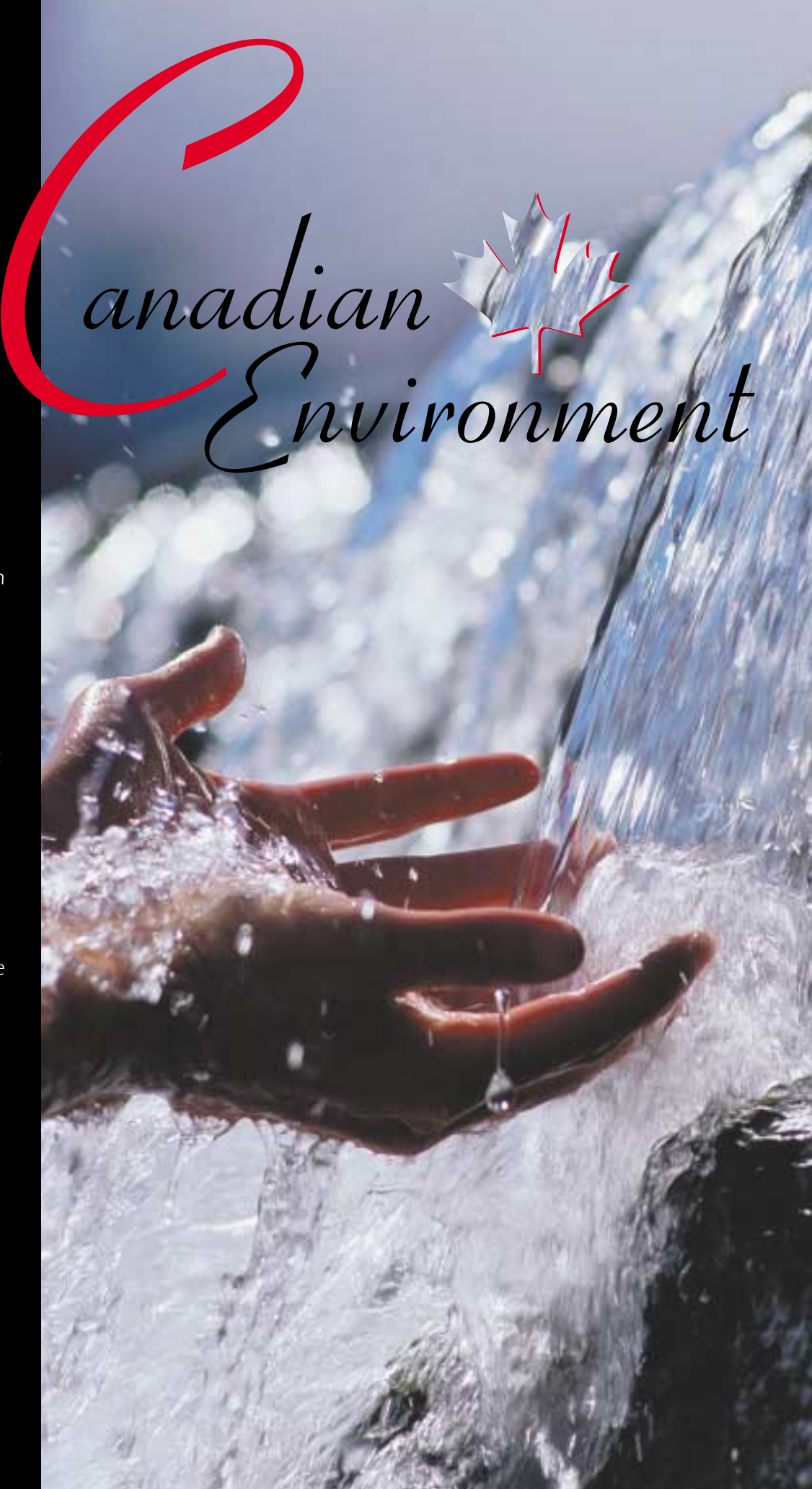
Increased water consumption in Alberta and Saskatchewan as well as climate change are also affecting Manitoba's water supplies. At one time the flows on the Saskatchewan River represented about forty percent of the flows into Lake Winnipeg, today they are about twenty-five percent.

# water and the

# Canadian Environment

When it comes to national water policy, Environment Canada speaks for Canada. It is the key federal agency working on inter-jurisdictional water issues. In partnership with the provinces, and through collaborative arrangements such as the Prairie Provinces Water Board, Environment Canada measures the quality and quantity of water, as well as the aquatic ecosystem health in Prairie rivers. This information is vital for flood forecasting, and for making decisions on economic development and watershed management.

One of Environment Canada's mandates is to protect, conserve and enhance water quality. The department operates 15 laboratories that are equipped to analyze water samples taken from water bodies throughout the Prairie provinces. Scientists develop measures and indicators of ecosystem health and integrity. They provide the science and understanding of the ecological consequences of human activities affecting water quality and inform Canadians on the health of aquatic ecosystems.



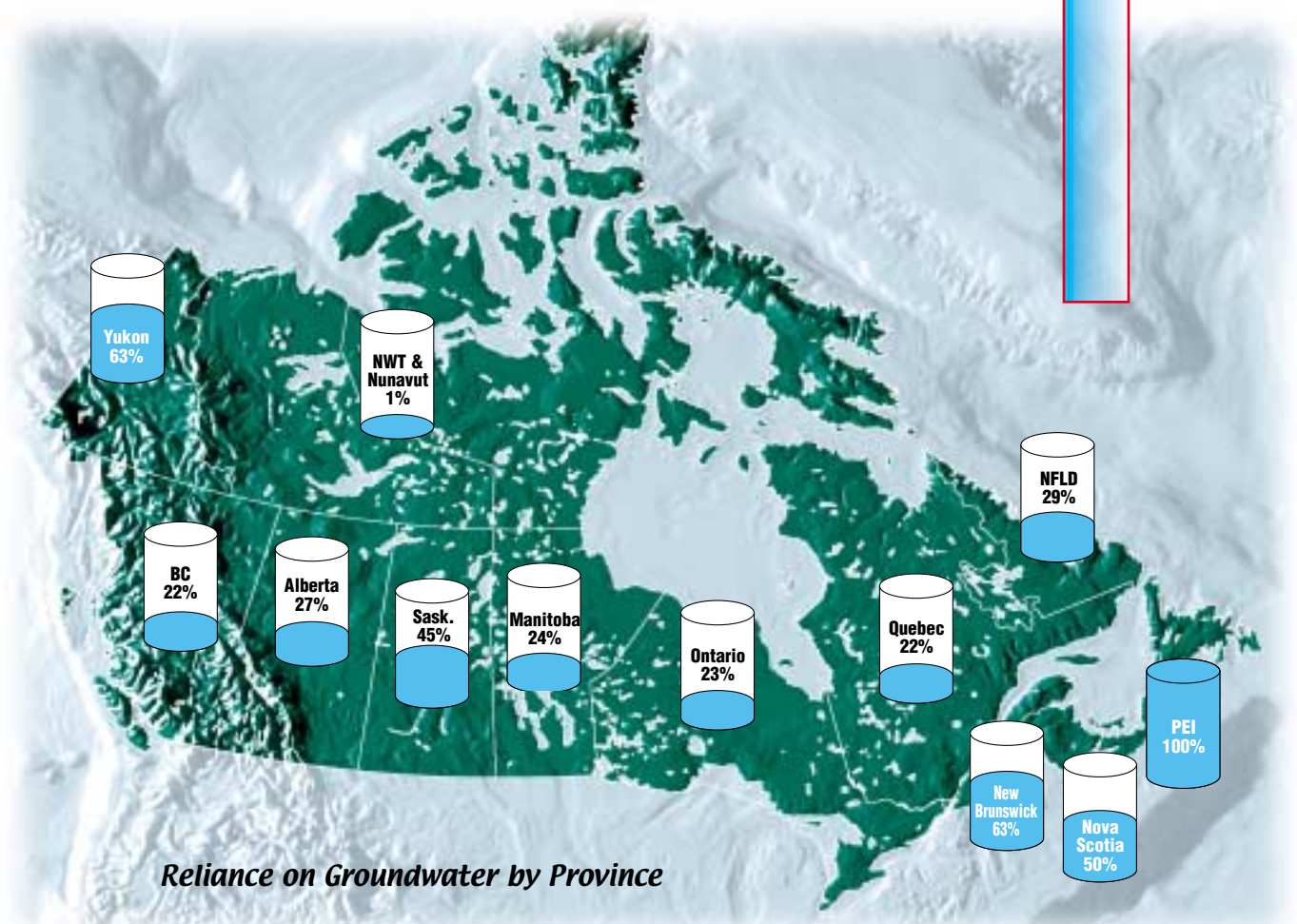
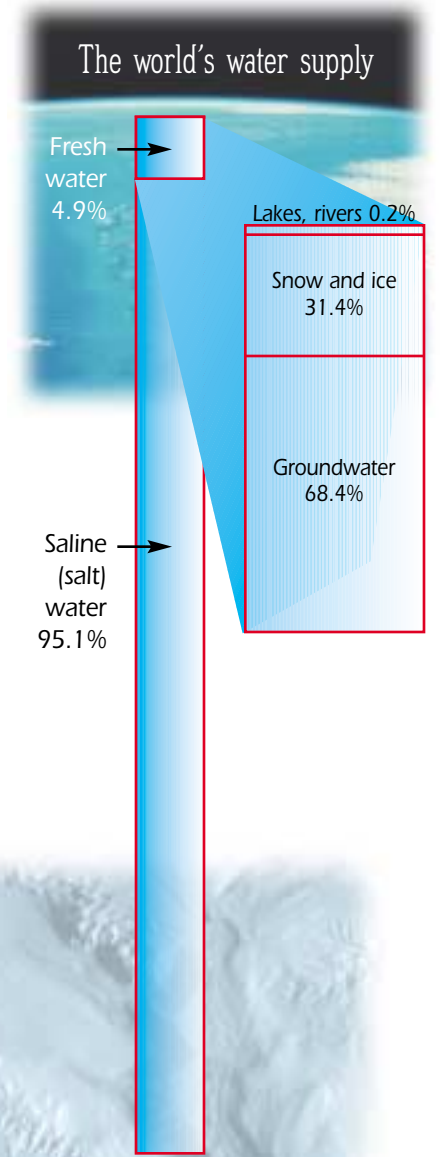
## Groundwater

### Depending on well water

According to some estimates, the quantity of groundwater in the earth would cover the entire surface of the globe to a depth of 120 metres. By contrast, the volume of surface water in lakes, rivers, reservoirs and swamps would cover the earth to a depth of about one quarter of a metre.

In Canada, nearly 8 million people, or about a quarter of the population, rely on groundwater for domestic use. Approximately two thirds, or over five million, of these users live in rural areas. In many areas, wells produce more reliable and less expensive water supplies than water obtained from nearby lakes, rivers and streams. The remaining users are located mainly in smaller municipalities where groundwater is the only practical option.

Groundwater supply and use in the Prairie region is an important issue. Are we in danger of depleting or contaminating our groundwater? Some municipalities are concerned about the potential for aquifer contamination from agricultural or industrial activities. Not all groundwater is potable, much is saline and care must be taken to avoid mixing saline water with potable groundwater. ❖



Reliance on Groundwater by Province

## Diminishing future supplies

It should be apparent to all that as the population in the Prairie region grows and more livestock and industrial plants are built, the available water will diminish. What is not as apparent is that the average annual flows on the Saskatchewan-Nelson and other rivers have declined over the last several decades. The reason for the declines is not totally clear but what is clear is that this has further reduced existing water resources.

Climate change is causing the temperatures to rise and precipitation patterns to change in many parts of the world. Thousands of years ago the average temperature on the Prairies was higher than today. Carbon dating of plant matter in lake bottoms and bogs in the northern spruce forests has confirmed that these warmer periods were also considerably drier. In fact, a large portion of Lake Manitoba was once a grassy plain.

Climate change projections mean that the prairies could become even drier than they are now. Drier does not necessarily mean less rain. It may mean that with higher temperatures the evaporation will be greater. The bottom line would still mean less water for our personal consumption, industries, recreation and the natural environment. The other consequence is that we will have to learn how to adapt and to do more with less water. ❖



## Melting glaciers

Glaciers around the world have been melting at an alarming rate. For example the toe of the Columbia ice field at the headwaters of the North Saskatchewan River basin has been receding since 1900. The Helm Glacier in southwestern British Columbia and the Illecillewaet in the interior have retreated over a kilometre. Some researchers predict that the glaciers in the vicinity of Mount Logan, Mt. Jackson and Mt. Gunsight, in the U.S. Glacier National Park, will be gone by 2030. There are numerous other similar examples throughout the world. They indicate dramatic changes are underway in the world's climate.

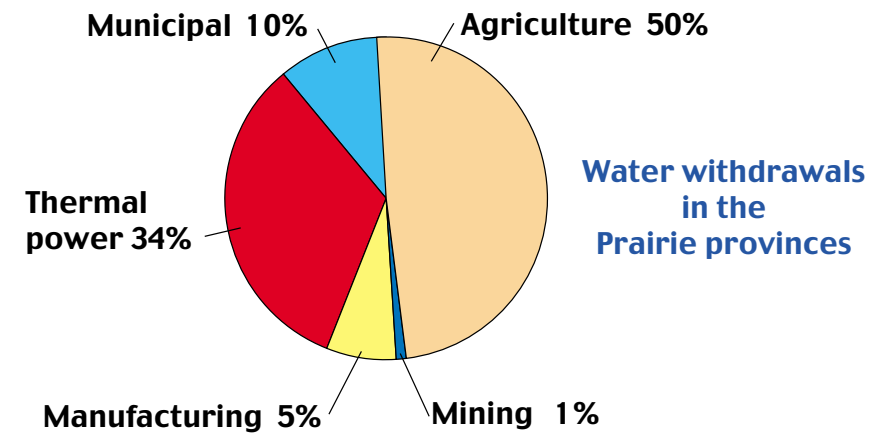


Aside from being a convincing indicator that the earth's climate is changing, melting glaciers temporarily increase the flows on rivers that they feed. These increased flows are not sustainable because, as the glaciers recede and become smaller, so does the amount of melt-water. In addition, flows from glacier-fed rivers will fluctuate more widely from year to year in the future.

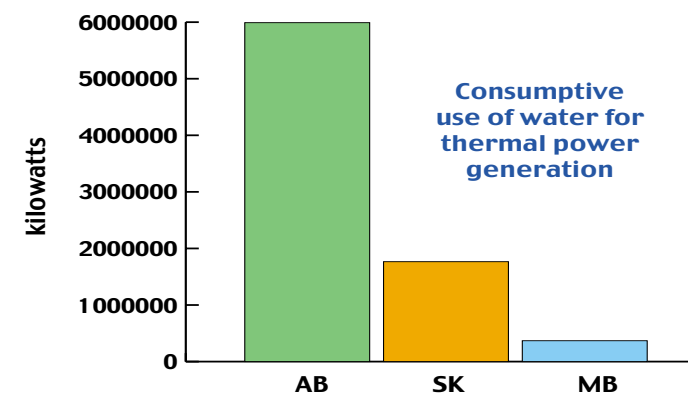
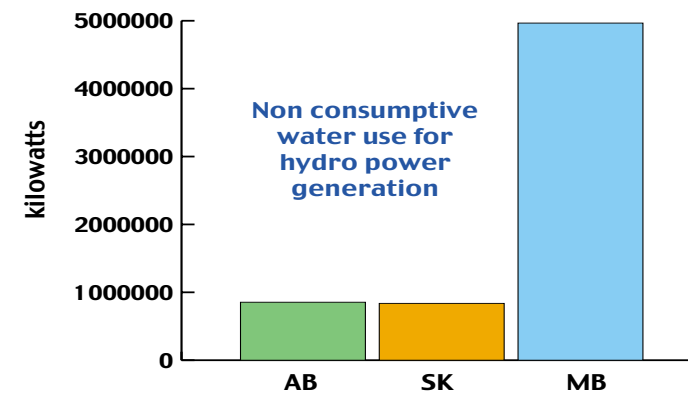
The melting of glaciers is not good news to the Prairie provinces. Greater fluctuations in the river flows will make it harder to manage the downstream water needs. More water storage facilities may be required. Aside from the cost of building reservoirs, these storage facilities can have significant environmental impacts. The most cost-effective approach is to conserve and protect water resources.

In addition to containing about a quarter of the world's fresh water, glaciers are a record of climatic conditions that have existed over the last thousands of years. As they accumulated the net annual precipitation, glaciers also captured small bubbles of air. By analyzing these air bubbles scientists can determine the amount of greenhouse gases that existed in the atmosphere during past centuries. Such information can help to explain why the earth has periodically experienced ice ages and other climatic changes.

Not all people understand the significance of melting glaciers. But most climatologists view this with concern. There can be no disagreement, however, that melting glaciers are a sign of a changing climate and a less certain future for all of us. ❖



Of the water withdrawals in the prairie provinces, slightly more than 40% is returned to the environment as wastewater, such as municipal sewage or as residual water after passing through an industrial process. Slightly less than 60% of the water is consumed and not returned to the environment within a short interval of time. Most of this water is transformed into vapour either by plants as a result of irrigation or by industrial processes that use the water for cooling purposes. Irrigation is the largest single user of water on the prairies. ❖



## Drinking water & sewage treatment

Not too long ago many communities in Canada were able to get their drinking water directly, without treatment, from lakes and rivers. Not any more! The reason is simple: the same lakes and rivers are now often used as the repository for our treated wastewater. Having the same bodies of water perform both functions, not surprisingly, can create problems.

Even without our help, Mother Nature generates some conditions that make surface and groundwater less than palatable. But with our help, all sorts of wastes can get into the water system ranging from municipal wastes, nutrients from livestock operations, industrial wastes, and the list goes on. There are about 100,000 commercial chemicals used in the world today. Many can find their way into water systems. As a result, we must make water suitable for human consumption, by removing odour, killing bacteria and viruses and removing some metals and chemicals. We do this using various combinations of filtration systems, activated carbon, reverse osmosis, ultra violet light and other technologies.

Over 75 percent of Canadians are served by municipal sewer systems. These systems use one or more of aeration, chemical recovery, biological recovery, sedimentation, and screening processes. The wastewater treatment on the prairies is mainly secondary, with tertiary treatment in Regina, Saskatoon and Calgary.

The presence in North Battleford of a sewer outlet located upstream of the drinking water inlet shocked many people. In some densely populated European countries, this arrangement is a requirement, ensuring that it does not become someone else's problem. ❖



# PROTECTING fish is important to humans



Fish are vulnerable to a variety of threats, from land uses that ruin spawning sites by coating them with silt and clay particles, to animal wastes and agricultural chemicals that promote algae blooms capable of suffocating fish by using up valuable oxygen in the water, to drugs and hormones discharged with human waste products. Even other fish and shellfish can present a problem. In Manitoba, rainbow smelt, an exotic species that has recently invaded Lake Winnipeg could undermine its whitefish and walleye fisheries.

Why is protecting fish so important to humans? Aside from the importance of fish as food and a source of recreation, it's also because fish provide humans with evidence of the condition of our water, an essential element to life itself. In many respects fish health indicates water health. This is why Fisheries and Oceans Canada (DFO) is so concerned with things that impact fish. And it's why DFO's Fish Habitat Management Program plays such a pivotal role in the conservation and protection of water quality and fish habitat in Canada. And why its staff are involved in reviews of works and undertakings in or near water; encouraging and monitoring compliance and enforcing the habitat protection provisions of the Fisheries Act; watershed planning; fish habitat enhancement; public education and stewardship.



## The Freshwater Institute - Supporting Scientific Excellence

The Freshwater Institute (FWI) in Winnipeg, houses several programs of Fisheries and Oceans Canada and is recognized as a national centre of expertise in aquatic biology and freshwater and marine fisheries. The FWI serves to focus scientific research in the DFO-Central & Arctic Region on fish, marine mammals, habitat impacts, and oceans management. C&A Region encompasses ON, MB, SK, AB, Nunavut, NWT, and northern Yukon and accounts for 65% of Canada's land area, 73% of the country's freshwater and 60% of it's marine waters.

The Experimental Lakes Area (ELA), located in N.W. Ontario, is a unique field research station operated for over 30 years by FWI staff. The ELA, established jointly by the Federal and Provincial governments, consists of 58 small lakes and their watersheds. The ELA station operates year round and can accommodate up to 60 researchers. Whole lake (ecosystem research) is conducted by government agencies, universities and industry partners on contaminants (i.e. Mercury), fish habitat destruction, aquaculture, climate change and eutrophication (fertilization of aquatic habitat).

## The National Water Research Institute

The National Water Research Institute (NWRI) is a Directorate of Environment Canada's Environmental Conservation Service. The Institute is Canada's largest fresh-water research facility with over 300 staff, including aquatic ecologists, hydrologists, toxicologists, physical geographers, modellers, limnologists, environmental chemists, research technicians, and experts in linking water science to environmental policy.

NWRI has two main centres: the Canada Centre for Inland Waters on the shores of the Great Lakes in Burlington, Ontario, and at the National Hydrology Research Centre, in Saskatoon, Saskatchewan. NWRI is also building smaller satellite research groups to the east and west. In the prairie region, NWRI is working with research organizations including the University of Calgary and the University of Lethbridge.

With partners in the Canadian and international science communities, NWRI conducts a comprehensive program of ecosystem-based research and development needed to resolve environmental issues of regional, national or international significance. ❖



## Prairie Adaptation Research Collaborative

The Prairie Adaptation Research Collaborative (PARC) at the University of Regina was recommended by the National Climate Change Process to research the effects of climate change and to assess future adaptation strategies. The rationale for locating it in the Prairie region was because this area is expected to be adversely impacted by climate change.

Locating PARC in Regina is strategic. It benefits from resident expertise at Environment Canada and at the Saskatchewan Research Council. Start-up funding for PARC was provided through Canada's Climate Change Action Fund and by Western Economic Diversification. The University of Regina is hosting PARC.

To date PARC has reported on 32 prairie projects. The research ranges from impacts of climate change on rural and urban populations to impacts on industries including energy, forestry and agriculture. ❖



## Scientific uncertainty

Science doesn't claim to have all of the answers. Sometimes information may be lacking or conditions may be so subject to change that scientific analysis becomes difficult to apply. Outcomes are sometimes difficult to estimate. There are occasions when not all scientists will agree on the science itself.

To address such cases scientists have developed what is known as the precautionary principle. This means that where science is uncertain about outcomes, and the outcomes could be potentially very harmful, society should err on the conservative or safe side when making decisions.

Misuse of the precautionary principle can occur and if taken to extremes can paralyze most decisions in society. On the other hand, application of the precautionary principle to recognize the potential range of results and risks before proceeding with an important project can be a wake up call that is ignored at our peril. The challenge is understanding how to assess the data and possible risks. ❖





## Nature's processors

Wetlands are the only ecosystem designated for conservation by international convention. They have been recognized as particularly useful areas because:

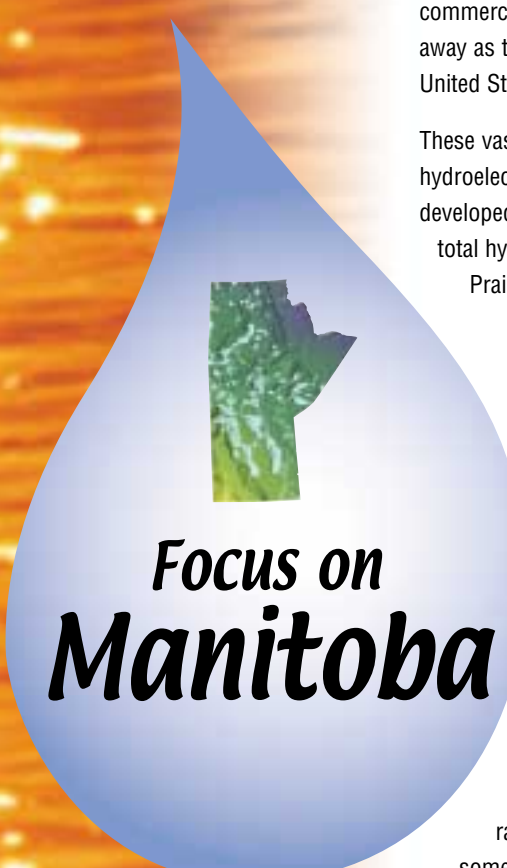
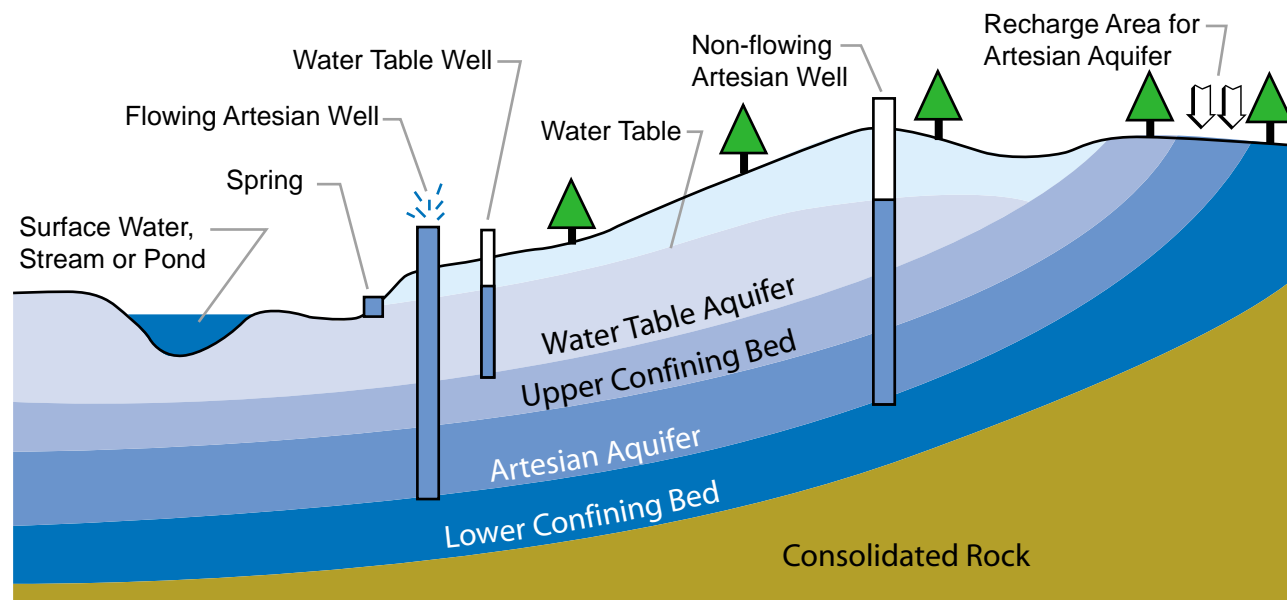
- they help to absorb the impact of hydrologic events such as large waves or floods;
- they filter sediments, nutrients and toxic substances;
- they supply food and essential habitat for many species of fish, clams, crayfish, shorebirds, waterfowl, and furbearing mammals;
- they also provide food (wild rice, fish, wildfowl), energy products (peat, firewood), and building materials (lumber);
- they are valuable recreational areas for activities such as hunting, fishing, and bird watching;
- many wetlands recharge groundwater supplies.



In the past, wetlands were considered wasteland, and many of southern Canada's wetlands were drained or filled in so that they could be farmed or used by developers. The value of wetlands is now widely recognized and efforts are being made to protect these ecosystems. About a quarter of the world's wetlands are found in Canada. ❖

## Aquifers

Although groundwater exists in many areas under the surface, some parts of the saturated zone contain more water than others. An aquifer is an underground formation of permeable rock or loose material that can produce various quantities of water when tapped. The quantity and quality of water can be quite variable from one source to another. Aquifers come in all sizes. They may be small, only a few hectares in area, or very large, underlying thousands of square kilometres of the earth's surface. They may be less than a metre thick, or they may measure hundreds of metres from top to bottom. ❖



Manitoba's major natural resource is fresh water, with 101,592 sq. km. in lakes and rivers. Water represents one-sixth of Manitoba's total area with a total estimated volume of 900 trillion litres. Aquifers contain some 700 trillion litres of groundwater, and the atmosphere over the province holds, on average, another 34 billion litres. Three of the 15 largest lakes in Canada are in Manitoba. Lake Winnipeg, the 10th largest freshwater body in the world (by surface area) is used for commercial transportation, recreation, and commercial fishing. Water flows into Manitoba from as far away as the Rocky Mountains in Alberta, from the northern United States and from within a few miles of Lake Superior.

These vast freshwater resources permit the production of hydroelectric power at costs among the lowest in the developed world. Manitoba possesses 70 percent of the total hydroelectric capacity potential for the entire Prairie region.

Surface water provides nearly 80 percent of Manitobans with their drinking water. It also serves as the focus of much outdoor recreational activity. Groundwater is the main source of water in much of rural Manitoba. Agriculture, forestry, urban, and recreational development are typical of land uses that impact surface water and groundwater. Most of these activities take place in southern Manitoba and collectively they place stress on water resources.

For the men and women who work for Manitoba Conservation, understanding water and all of its ramifications is something they have trained for and something they address every day. Although Manitoba Conservation has many branches and divisions within its corporate structure, whether they be crown land management, wildlife, forestry, fisheries, provincial parks or pollution prevention, they are all concerned with water. It's a big job and it calls for a unique blend of talents and skills; sound public policy and administration, knowledge, specialized personnel, good science, prudent regulation and enforcement capability. These attributes need to be matched with the ability to assist developing projects, assess opportunities and effectively communicate the diversity of Manitoba Conservation's activities to the general public.

Fortunately, for Manitobans, and for the aquatic environment, Manitoba Conservation meets these challenges!

*conserving a natural resource*





## A strategic water plan

Recent public input and a number of significant events have highlighted the need for greater attention to water management. The 1997 flood demonstrated the vulnerability of the Red River Valley and the City of Winnipeg to major floods. The wetter than normal 1990s exposed shortcomings in Manitoba's agricultural drainage network. The expansion of the food processing industry, coupled with the increasing need for water supplies, exposed the need for determining sustainable quantities of water withdrawals, water retention, and treated effluent discharges. Rapid expansion in hog production has raised public concern regarding aquifer and surface water pollution. The events in Walkerton, Ontario alerted people to the importance of monitoring and maintaining water quality and protecting drinking water sources.

In the light of such emerging issues and challenges, Manitoba began a series of public consultations aimed at developing a strategic water plan for Manitoba. The plan will be comprised of four elements: issue-specific water strategies, watershed management planning, an updated and comprehensive legislative framework, and a plan that connects resources to the strategies. ❖



## Issue-specific provincial strategies

Six policy areas are portrayed in Manitoba's new water strategy. These issues were identified by collaborative teams chosen from government, industry and public interest organizations. Each set of issues has a related strategy. The issues are:

- Water Quality
- Water Conservation
- Water Use and Allocation
  - Water Supply
  - Flooding
  - Drainage

A seventh issue is education. All parties involved in the development of Manitoba's new water strategy recognize how important education and understanding will be to the acceptance and success of this new approach. Education is intended to be an integral part of each of the items above. ❖

## Watershed planning

Natural and man-made boundaries are seldom the same. This is especially so when it comes to water. Boundaries created by man reflect various administrative requirements such as international, federal, provincial, First Nations and municipal boundaries, school districts, health districts, agricultural districts, conservation districts and many other types of boundaries. While such boundaries may serve many useful purposes, they mostly fail to address the fundamental reality of what happens upstream affects what happens downstream, sometimes called 'source to tap'.

Watershed planning and management comprise an approach to protecting water quality and quantity that focuses on the entire watershed ecosystem. This is a departure from the traditional approach of managing individual water issues. Over the past few years many public forums and consultative processes have been held throughout Manitoba to discuss land drainage, water usage and allocation, Manitoba's water legislation and regulations, drinking water, agricultural uses, and both the quantity and quality of water. The recommendations of these reviews are for the adoption of watershed management planning. Such action acknowledges the challenge, and the opportunity, for collaborative, community-based problem solving techniques and the design of effective implementation actions that can work across many jurisdictional boundaries. ❖



## Financial underpinning

In order to implement Manitoba's new water strategy, financing arrangements must also be established. Recent reviews have all brought to light the serious shortage of resources devoted to water and water management. In most circumstances these shortcomings result from under-funding by the federal government, the province, municipalities, industry, and individuals. All parties have expressed a willingness to address the funding situation.

The challenge for the leaders of Manitoba's new water strategy is to establish a consensus on funding arrangements that will enable the strategy to move forward. ❖

## Unique opportunity

Over the past few years Manitobans have had the unique opportunity to participate in a comprehensive review and assessment of their water resource, to design strategic plans that address important water issues, and to address the legal and financial frameworks that determine what can be accomplished and how. It has been an important process, one that has prepared policy makers and water users to better address the challenges of the 21st century. ❖

**as a matter of fact...**

**About 83 percent of our blood is water. It helps distribute oxygen, transport waste, and control body temperature.**

## Legislative framework

One of the key components in developing a strategic water plan for Manitoba was the review of provincial legislation applying to water. The legal framework governing water has evolved slowly, over time, and often after a problem was identified. An examination of the various acts and regulations relating to water has disclosed certain inconsistencies, ambiguities, contradictions and voids, all of which suggest that a legislative review is required. Changes are anticipated that will address issue specific strategies, watershed planning and aid, and that will regulate and strengthen water management in Manitoba.

Drafting of legislation is a comprehensive and time consuming task. It will likely require an entirely new act. The contents of new legislation will in part be based on the information gathered from recent public reviews and once drafted, will be subject to further public consultation. ❖



**spud fact**

**Approximately 1000 kilograms of water is required to grow one kilogram of potatoes.**



## Predictions are risky

Predicting water trends is fraught with uncertainty, market trends invariably impact upon economic decisions and the water environment. Weather, variable by nature, is subject to large fluctuations in precipitation. Water flows on the Red River have been recorded as much as 100 times greater from one period of the same year to another period. Snow conditions in the Rocky Mountains can affect water flows in the Nelson River system. Floods can wash fertilizers and other chemicals from fields and cause abnormally high concentrations of chemicals to suddenly appear in a lake, stream or river. ❖

## Best judgements

**Overall water supply** is uncertain. Precipitation is highly variable on the Prairies as is streamflow and there is no statistically significant trend in precipitation on the prairies over the past century. However because Rocky Mountain glacial meltwater is declining and evaporation from Prairie regions is increasing due to a 1.5 - 2 degree Celsius increase in temperatures, surface water supplies are likely to diminish. Wider fluctuations in water variability are predicted to challenge water supply and flood control structures.

**Overall water quality** of surface waters, also referred to as the health of aquatic ecosystems, could deteriorate if water management actions fail to keep up with new knowledge on threats to water quality and quantity. For example increased evaporation due to higher temperatures and longer ice-free seasons could have a net effect of increasing salinity, contaminants and nutrients in surface waters. Wastewater treatment systems must be designed or upgraded to deal with such issues. A major research project of water issues associated with Lake Winnipeg is expected to produce important new findings about current water conditions and future trends.

**Drinking water** of adequate quality will be a continuing challenge, especially for smaller communities. Nutrient and other chemical issues, as well as viral and microbial health, will be increasingly associated with drinking water supplies.

**Groundwater** - While unchanged in northern areas groundwater quality has been showing the effects of long-term use, deterioration in well infrastructure, the lack of maintenance of infrastructure, changing land use and increased use. The carbonate aquifer in Manitoba, which is the dominant and largest aquifer, is under the most pressure in heavily populated areas. Threats include the effects of increased development on its long-term sustainability, and potential for contamination and deterioration in quality. Some southern aquifers may also be reaching their sustainable yield.

**Water monitoring** - Although the network of monitoring stations has been greatly expanded since the 1970s more recent reductions of services suggest that overall, less monitoring of both water quantity and quality is taking place today than ten years ago. This is of great concern since adequate information about water conditions is essential for good water management.

**Wastewater treatment** - Although progress has been made, much more must be done to reduce risks to both human and environmental health. Municipal and industry wastewater managers must keep in step with technology and contemporary best wastewater management practices in order to prevent water quality and aquatic health from deteriorating.

**Contaminants in fish** - Is improving in the North as existing hydro impacts diminish over time but is believed to be increasing in southern areas, because of agricultural, industrial and municipal activities.

**Public participation** - Increased water awareness and diligence by concerned citizens helps to ensure that a better job of addressing water problems is done at the community, provincial and national level. ❖

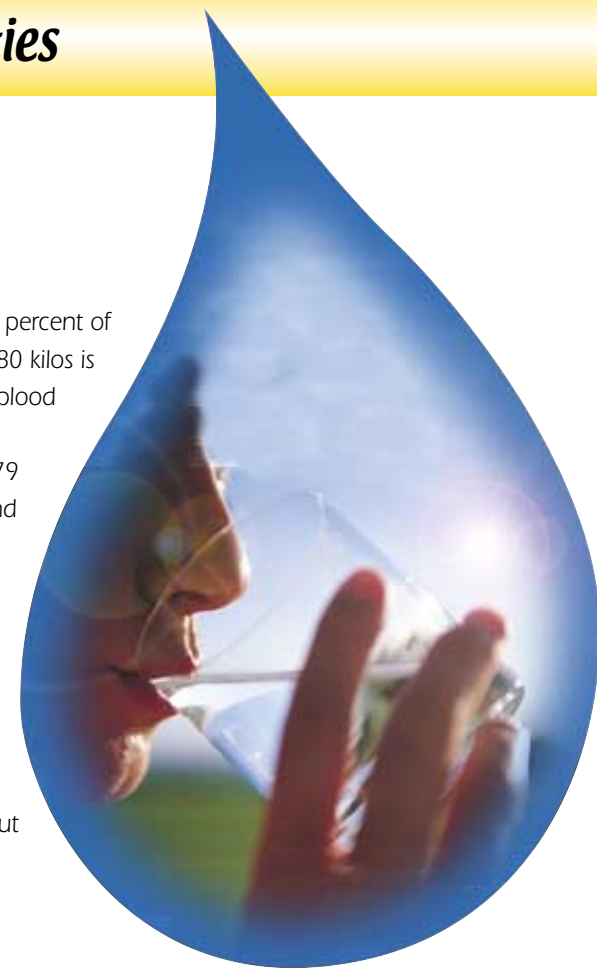


## Water is life

"Water is not essential to life. It is life itself," said French author Saint-Exupéry. Sixty percent of an adult's body weight is made up of water. Put another way, an adult weighing 80 kilos is made up of more than 48 litres of water. A part of this water can be found in the blood which irrigates the body's organs. This water is said to be circulating. The rest is contained in the composition of the organs themselves : 90 percent of the brain, 79 percent of the heart and lungs, 76 percent of the liver, 22 percent of the bones and (who would have believed it?) 10 percent of teeth. These figures are enough to demonstrate the importance of water in our lives.

Fortunately adults absorb about 2.5 litres of water every day. 1.5 litres in drinks, the other litre in food. Water allows us to eliminate toxins, to regulate our body temperature (by perspiration) and to transport vitamins, nutrients and the other minerals throughout the body.

This explains that while a healthy adult can go without food for 30 days, it is impossible to last three days without water. ❖



### Water for People

Water For People (WFP) is a program that helps people in developing countries improve their quality of life by supporting sustainable drinking water, sanitation and hygiene projects. The Western Canada Section of WFP promotes awareness of the drinking water and sanitation problems in developing countries and encourages donations and fundraising activities to support WFP projects that are addressing these issues.

## Chasing technology

Following the recent water contamination incidents in Walkerton and North Battleford, municipal leaders and staff have been bombarded with information on the merits of the numerous water purification technologies on the market. The challenge is making sense of it all. As a primer, the table below provides some basic information on which technologies address which water impurities. The table summarizes only some of the more common technologies; suppliers should be asked for more information on what else is available and the benefits of each type of system. ❖

Technology	Arsenic	Bacteria	Taste & Odour	Chlorine	Fluoride	Heavy Metals	Nitrates	Radon	Sediment	Viruses	VOC*
Activated Carbon	Effectively removes	Minimal or no removal	Effectively removes	Effectively removes	Minimal or no removal	Effectively removes	Minimal or no removal	Effectively removes	Effectively removes	Minimal or no removal	Effectively removes
Reverse Osmosis	Effectively removes	Effectively removes	Effectively removes	Effectively removes	Effectively removes	Effectively removes	Effectively removes	Minimal or no removal	Effectively removes	Effectively removes	Effectively removes
Ultra-Violet	Minimal or no removal	Effectively removes	Minimal or no removal	Minimal or no removal	Minimal or no removal	Minimal or no removal	Minimal or no removal	Minimal or no removal	Minimal or no removal	Effectively removes	Minimal or no removal

Effectively removes      Significantly removes      Minimal or no removal

\*volatile organic compounds



## Habitat and Heritage Rivers

### Jam-packed with life

Take 36 square kilometres of marshland, aspen-oak bluffs and one of the few remaining tall grass prairies and you get one of North America's birding hotspots. Oak Hammock Marsh is located just north of Winnipeg roughly half way between the city and Lake Winnipeg.

The marsh is the home of a couple dozen mammals, almost 300 species of birds and numerous species of reptiles, amphibians, fish and invertebrates. During migration up to 400,000 birds may be at the marsh at any one time. That is one reason why the site was picked as the location for an award-winning interpretive centre.

It is a great place to learn about the importance of water to our ecosystems and mankind. Oak Hammock Marsh is jointly managed by Ducks Unlimited and the Province of Manitoba. ❖

### Unaltered by development

Unaltered by development, the Hayes River has been nominated as a Heritage River. The Hayes River has played a profound role in Canada's history. Ancient campsites and pictographs testify to its importance as a route for Manitoba's First Nations long before Europeans arrived. The Hayes River was the main route from York Factory on Hudson Bay to the interior of western Canada for fur traders, settlers, and explorers from 1670 until 1870, and played a key role in the integration of the Aboriginal way of life with the fur trade. The Hayes remains much as it was when the fur traders traveled on its waters, unaltered by dams and development. ❖



### Preserving habitat is fundamental

Dealing with Fisheries and Oceans (DFO) staff is something new for most prairie folk. DFO's programs provide for sustaining Canada's fish resources and fish habitat amongst other things. This includes the smaller lakes and streams on the prairies as well as the big ones. One of DFO's main jobs on the prairies is to manage fish habitat for the purpose of conserving, restoring, and generally enhancing its productive capacity. So the next time you are planning to work in or near water, consider environmentally friendly practices and designs (for example a floating instead of a sheet piled dock) to ensure that you will be able to continue fishing your favorite streams and lakes. ❖

#### did you know?

Canada's rivers and lakes contain enough water to flood the entire country to a depth of more than 2 metres.

### Manitoba's river heritage

The Canadian Heritage Rivers System (CHRS) was established in 1984 by the federal, provincial and territorial governments to conserve and protect the best examples of Canada's river heritage, to give them national recognition, and to encourage the public to enjoy and appreciate them. There are two designated Heritage Rivers in Manitoba: the Bloodvein and the Seal. ❖



## Water and Economic Diversification

### Hydro power, Manitoba's economic edge

Historically Manitobans have enjoyed some of the lowest power rates in Canada and the U.S. This is a significant consideration when it comes to locating a business in the province. This has been possible in the past because of a series of hydro power plants on the Winnipeg River and more recently because of large hydro projects on the Nelson River.

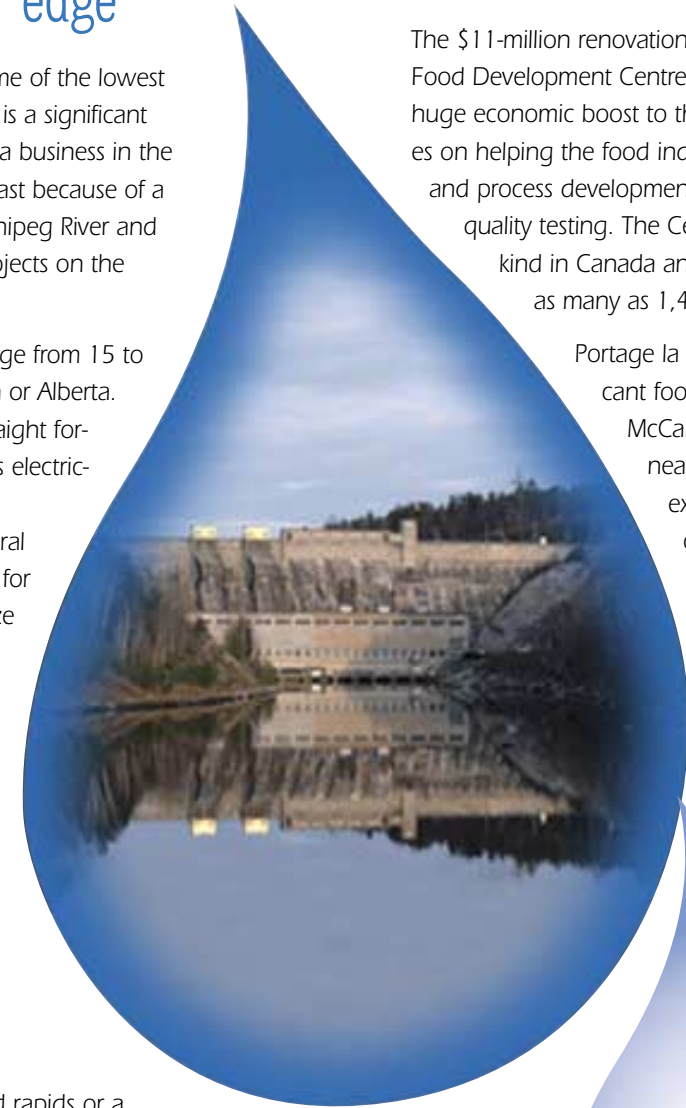
Industrial electricity rates in Manitoba range from 15 to 40 percent below those in Saskatchewan or Alberta. The reason for this price advantage is straight forward; Manitoba generates nearly all of its electricity using hydro while Saskatchewan and Alberta depend heavily on coal and natural gas. Further, Manitoba has low cost sites for its power plants. At most locations the size of the dams are relatively small thus reducing significantly the cost of concrete and other building materials. The other advantage of hydro is that plants last from 50 to 100 years, and water is a renewable resource. ❖

### Hydro reservoirs, a mixed blessing

Anyone who has lugged a canoe around rapids or a snowmobile through the bush in northern Manitoba knows that hydro dams and the lakes they create can be a blessing. The portages and bush trails are shorter. One can cover a lot of territory traveling by boat on a reservoir or even more by snowmobile in winter. Hydro reservoirs have become highways for the north.

While reservoirs destroy one form of habitat, they also create new habitat for fish and waterfowl. This can augment the local economy through increased tourism, trapping and fishing.

But hydro reservoirs are not always a blessing. When reservoirs are initially filling, water leaches mercury from the soil which can accumulate in fish. Reservoirs can also flood critical moose and fish habitat, and cause problems such as blockage of fish runs, and fish mortality in turbines. In winter the demand for hydropower is often the highest. High water flows through power stations can cause the ice to shift and crack, allowing water to flow onto the ice below the snow cover. Many trappers and hunters have driven their snowmobiles into snow-covered slush with unhappy consequences. It's no wonder that the debate gets a bit heated when hydro companies propose new power projects. ❖



### New challenges, new strategies

The \$11-million renovation and expansion for the Food Development Centre in Portage la Prairie is a huge economic boost to the area. The Centre focuses on helping the food industry with food product and process development, food safety and food quality testing. The Centre was the first of its kind in Canada and the project could create as many as 1,400 jobs.

Portage la Prairie has several significant food processors including McCain Foods who employ nearly 500 and has recently expanded their potato processing plant. Simplot is constructing a \$120 million potato processing facility just west of the city. But the focus is not only on jobs. Portage spent \$40 million upgrading their water treatment system. ❖

#### did you know?

To date, only about 40% of Canada's hydroelectric potential has been developed.



## Designed with water quality in mind

Hog barns are popping up on the prairies with many of them in Manitoba. Intensive Livestock Operations are another new face of agri-business. These facilities are one way farmers and businesses see sustaining farm operations and the rural economy.

Hog barns can degrade the environment if not properly built and operated. They must be designed and built correctly in the first place, and then monitored to ensure the design actually works.

Major challenges in hog operations are cleanliness, disease control and ensuring that the surrounding farmland can assimilate the manure without it polluting the ground-water. The other challenge is controlling odour from manure in fields and barns. The manure is held in liquid form in watertight pits and then, periodically spread on farmland. The amount of manure that should be applied on the land must be based on the soil moisture conditions, the type of crops being grown and the level of plant nutrients already in the soil. Doing so avoids runoff into streams or leaching into the watertable.

Ultimately, it's a matter of integrating the hog barn design with the crop and soil sciences applicable to the local area. ❖

## Conserving Manitoba

Manitoba's Conservation Districts Program has been providing a comprehensive, sustainable approach to water and soil management in the province for over 25 years. The Program's success is due to its grassroots approach for balancing environmental concerns and economic growth. A Conservation District is a group of neighbours working together in partnership with the province to develop programs to effectively manage the natural resources of their area. Conservation Districts are established under the authority of The Conservation District Act. Currently, there are 13 Conservation Districts in Manitoba covering approximately 60 percent of Agro-Manitoba. Individual district boundaries depend on the needs of the people and they are usually based on the drainage basin or watershed of the major river in the area. ❖

## Unforeseen consequences

Who would have thought that cancellation of the 'Crow' freight rates, in the 1990s might lead to a possible change in Manitoba's water quality.

Not likely many people. But there is a connection. After the Crow rate was cancelled, agricultural producers looked for ways of utilizing more of their products in Manitoba rather than exporting as much as had been done in an era of subsidized freight rates. One solution was an expansion of activities that utilized grain products within the province, including livestock, poultry and swine production.

With all the added livestock production in the province the nutrient dynamics have also changed. This in turn has affected both water quantity and quality.

For farmers, sustainability means many things, such as protecting wildlife habitat, manure management and protecting water quality. All of these are closely interconnected. That is why

Manitoba's largest farm organization, Keystone Agricultural Producers has about 20 committees to develop policies on these and other issues. Farmers, probably more than most, know the importance of protecting the environment and especially the quality of water. Many depend on shallow wells and dugouts for their drinking water. ❖



## Climate Change Connection: information and leadership

There is a broad scientific consensus on the reality of climate change. Most climate change models for the Prairies show increased temperatures under global warming. Recent models suggest that summer temperatures in Manitoba could increase by 3 to 4°C, and winter temperatures by 5 to 8°C. Such changes would be the largest and most rapid of the last 10,000 years and would have profound effects on ecosystems.

Water quality in Manitoba might be in jeopardy because of the warmer temperatures and lower volumes of rivers and lakes in the summer. As the volume of surface water decreases, pollution levels increase. Increased summer temperatures, together with reduced precipitation and higher evaporation, might create a greater need for more water-intensive irrigation of crops.

Non-government organizations such as Climate Change Manitoba play a leadership role in this area. Their efforts, and those of similar organizations in getting the message out is crucial if we are to be more informed and proactive in the future. ❖

## Manitoba's marine mammals

During June, July and August of each year about 3,500 beluga whales can be found in Manitoba's Churchill River at the estuary where it enters Hudson Bay. Belugas are vulnerable and are on the red list of threatened animals. Since they live only in the Polar regions, no one knows exactly where they go or how they live for much of the year. What researchers have learned is that about 3,500 of the 25,000 belugas in Hudson Bay (about one-third of the world population) return to the Churchill River every June. At Churchill you can see more whales than you can count. ❖

## Water, muskegs and railbeds

The Port of Churchill "Has seen it all". Years ago the Province approved the Burntwood River Diversion to increase the viability of hydro development on the Nelson River. This significantly reduced the river flow at Churchill.

With climate change on the horizon, Churchill is facing new challenges. A warmer climate would extend the shipping season. In parts of the Prairies the distance to Churchill is shorter than to Thunder Bay or Vancouver, requiring less energy and lowering greenhouse gas emissions in transporting grain.

The railway to Churchill was built on rock, permafrost and muskegs. With increasing temperatures the permafrost is melting causing the railbed to slump. There are hundreds of permafrost locations. Massive amounts of fill and ballast will be needed to stabilize the track and innovative ways found to slow down the permafrost thawing. The permafrost and muskegs were a curse when the track was built in the late 1920s and now the melting permafrost is even worse. For the railway operator Omnitrax, this will be a pioneering experience revisited. ❖



**seems backward, but...**

**Approximately 60% of Canada's fresh water drains north.**



## Helping members help themselves

The central theme of the Association of Manitoba Municipalities (AMM) is service to its members. Aside from the usual administrative membership support of most umbrella organizations, AMM operates a trading company and lobbies governments on behalf of its members on important issues such as water infrastructure and resources.

In many rural and smaller communities, water supply of adequate quantity and quality is a major concern to local residents. Adequate sewage and wastewater treatment is also a growing concern in Manitoba as municipal, industrial and agricultural development stress the limits of many existing systems. The AMM makes sure that its members can access information on such things as the Provincial government's 'Strategic Water Plan', environmental sustainability, water treatment, wastewater management and climate change.

The AMM also helps members conserve water and operate treatment plants efficiently. The AMM has developed a series of water efficiency booklets for small and medium-sized communities, hotels, schools, hospitals and others. The booklet provides practical advice for people who have to ensure a reliable and safe supply of water on a day-to-day basis. ❖

## Complex issues

A reliable supply of water is only part of the solution. The challenge facing municipalities, following the Walkerton and North Battleford water contamination incidents, is providing high quality water at affordable prices.

Water from deep wells is usually free of contaminants but may have to be demineralized. Conversely surface water or water from shallow wells can become easily contaminated. There is also the matter of price. Small communities may not be able to afford conventional water purification and sewage treatment facilities.

For communities with declining population and many farms, there may not be any practical cost-effective solutions. So the next time you dream about moving to the country to get away from it all, check out the water first. ❖



## Vision and perseverance

John D. McArthur built more railroad in western Canada than anyone else. It was his toughness and vision of a paper industry in Canada's fledgling west which eventually resulted in the Pine Falls pulp and paper mill. After securing pulpwood permits, he explored the Winnipeg River where he came upon a deep bay with a rock island, the future site of the mill. After several setbacks, the first paper rolled out of this plant in 1927. The plant is now owned and operated by Tembec.

McArthur's pioneering spirit built the Pine Falls mill.

Tembec is now pioneering environmental sustainability at the plant and surrounding area. In 1995, Tembec constructed a \$29 million wastewater treatment plant reducing discharges into the Winnipeg River by up to 99 percent. Tembec also plans to reduce water use in the mill by more than 50 percent. With

these environmental improvements, the plant will achieve 'Impact Zero'.

Other improvements include reductions of greenhouse gas emissions, increased energy efficiency, improved effluent quality and waste reduction. It can and is being done. ❖

### did you know?

**On average, 18 percent of Canada's urban population lives in municipalities that do not provide sewage treatment.**

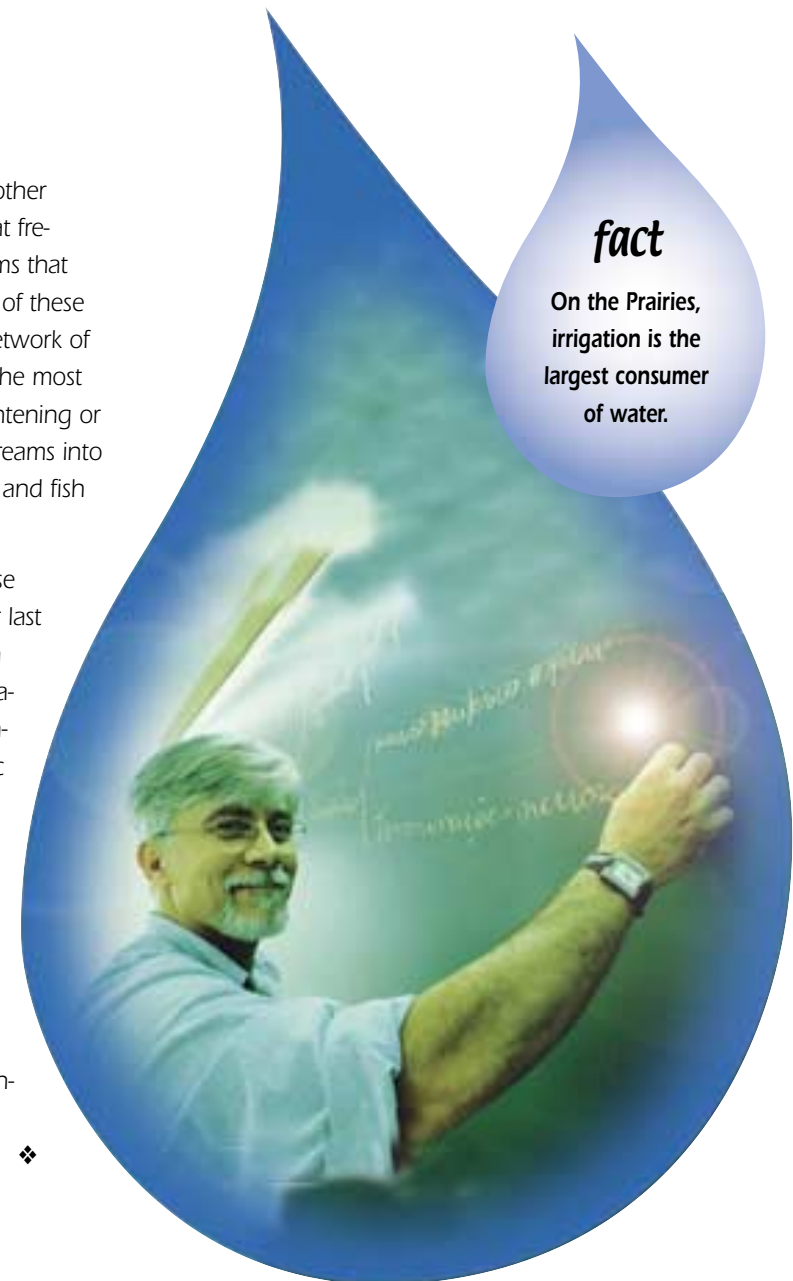


## Ditches, dikes and diversions

Much of the farmland in the Red River valley and in several other places in Manitoba was once marshes, meadows or land that frequently flooded. These lands were drained by natural streams that once had abundant fish populations. Over the years, many of these natural streams have been altered for drainage through a network of ditches, dikes, and diversion channels that created some of the most productive cropland in Canada. However, the stream straightening or widening to convey higher flows turned the once natural streams into sterile aquatic environments, causing damage to fish habitat and fish populations.

Many of these formerly "natural" waterways, particularly those where it has been some time since they were constructed or last cleaned out, have started to revert back to their natural form and once again provide food, reproduction, cover and migratory areas for fish. These waterways are now starting to contribute to fish populations, fish habitat, and a healthy aquatic environment once again.

Due to siltation, the drainage network in Manitoba requires periodic maintenance and doing so can damage or destroy spawning grounds, fish habitat, and cause the transport of large quantities of sediment into downstream lakes and rivers. Department of Fisheries and Oceans (DFO) and Manitoba Conservation are working together with conservation districts, Manitoba's agricultural community and others to ensure that drain maintenance activities can proceed expeditiously, while causing minimal environmental impacts. ❖



### fact

**On the Prairies, irrigation is the largest consumer of water.**

## Teaching the teachers

If our children are going to appreciate the importance of water and do their part in using it wisely, they have to learn about it in school. That is the rationale for Project WET, a program that teaches teachers about water and gets water issues into the school curriculum. Project WET is a nonprofit international program. It now operates in Canada, the U.S. and internationally. WET targets students from K-12.

Teachers participating in Project WET are given training and access to attractive and innovative material on water for their classes or field trips. These materials are hands-on, easy and fun to use. The materials cover a wide range of topics, from local to global, from water purification to wastewater disposal. More importantly, they illustrate the importance of water to the environment, and how humans use and abuse it.

With subject materials and training guides in place, the next step is for everyone to plunge in and get their feet wet. ❖

### check it out

**Glacier ice over 100 000 years old is found at the base of many Canadian Arctic ice caps**

## Concern for Lake Winnipeg

A group of scientists and others have formed the Lake Winnipeg Research Consortium (LWRC). Their first task is to establish baseline information for the lake. Early findings are not encouraging. Examination of sediment cores has revealed a startling increase in accumulations of phosphorus, nitrogen and carbon since about 1965. This was particularly surprising given that phosphorous in detergents was banned about 30 years ago, and most people thought that the algae bloom problems in our lakes was beaten.

The lake whitefish population is exhibiting signs of serious stress. Whitefish will be particularly vulnerable to climate change because Lake Winnipeg is so shallow and therefore vulnerable to warming. Surveys have also identified two exotic species that have invaded Lake Winnipeg from the Laurentian Great Lakes: *rainbow smelt* and a small zooplankton species, *eubosmina coregoni*. These species have the potential to disrupt the foodweb. They and other species amplify and transfer contaminants to commercially important walleye and lake whitefish.

Wastewater, industrial effluent, and agricultural runoff from within Manitoba as well as from other provinces and states may also be factors contributing to deteriorating water conditions since they drain into Lake Winnipeg. The research results of the Lake Winnipeg Research Consortium will be carefully watched by a number of jurisdictions. ❖



### what a difference...

**A five-minute shower with a standard shower head uses 100 litres of water.**

**A five-minute shower with a low-flow shower head uses only 35 litres of water.**

## Lessons learned, solutions shared

The flood of 1997 will long be remembered in the Red River basin of Canada and the United States. Over 100,000 people had their lives disrupted for several months and some still suffer the physical and emotional trauma of the flood. Many of those who were not harmed by the flood recognize that their safety was preserved by only a matter of centimeters.

The International Joint Commission undertook to analyze the root causes of the flood and make recommendations.

Some conclusions of their report are:

- Flooding in the Red River basin is a natural hydrometeorological event. Although the 1997 flood was a rare event, floods of the same or greater magnitude can be expected in the future.
- Wetland storage can provide an economically and environmentally beneficial method of reducing flood flows for smaller floods but would not, by itself, reduce the peaks of large floods.
- Under flow conditions similar to those experienced in 1997, the risk of a failure of Winnipeg's flood protection infrastructure is high. Public safety requires that the city, province and Canadian federal government focus immediate attention to designing and implementing measures to further protect Winnipeg. ❖

## Tampering with nature

Throughout the course of history, mankind has attempted to conquer his environment sometimes without understanding the full consequences of his actions or the impacts that the changes could have on future generations. In this respect, Manitoba's history is no different than the history of many other places. The following article illustrates how actions taken to address one set of challenges can create new and different problems.

Several decades ago it was decided that many of the natural waterways in Manitoba required straightening in order to protect farmland, buildings, roads and other structures from flooding during spring runoff or during heavy rains. The adjoining map shows drainage activities around Lake Dauphin.

As can be seen the streams start off as nice meandering waterways. They start in Riding Mountain National Park, where the topography is steeper and where natural boundaries are protected. However, as the streams leave the National Park boundary and enter the flatter prairie topography, some portions have been straightened. This was done to control runoff.

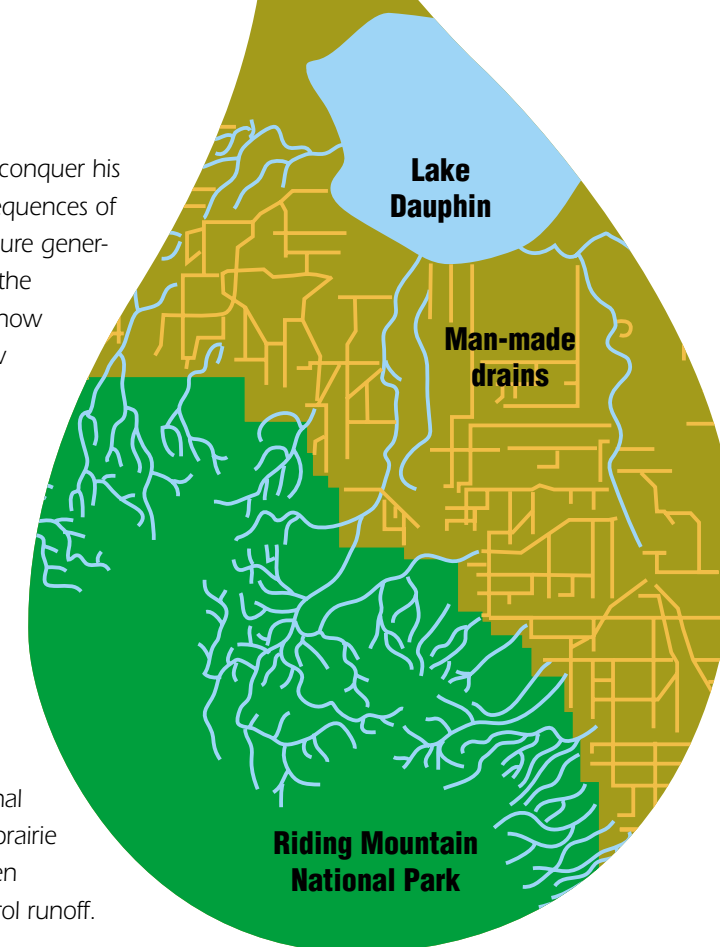
The straightening of these streams has caused an increase in the speed of the water during periods of heavy flow and this increased speed has increased the sediment carrying capacity of the water. This sediment, laden with pesticides, fertilizers, animal waste and other pollutants, ultimately ended up in Lake Dauphin.

Water quality in the lake has declined dramatically. Until 1950, the lake supported a large commercial and sport walleye fishery, but fish harvests have subsequently dropped by 90 to 95 percent. This drop in fish populations is due to the damage to fish habitat caused by the stream alterations as well as to over-fishing.

Another consequence of increasing the runoff rate means that surface water does not have as much time as before to naturally infiltrate into the water table. This results in slower aquifer recharges in some areas. It also results in a reduction of stream baseflow.

The good news is that many of these problems were recognized. A Stream Rehabilitation Program was developed in 1992 to rehabilitate riparian zones and unstable stream reaches within the seven major tributaries of the Lake Dauphin watershed. Between 1993 and 1996, 36 kilometres of straightened channels were rehabilitated and 14 cooperating livestock producers implemented new farm layouts and practices. Under a signed stewardship agreement, landowners committed to maintain the project works and a minimum 10-metre riparian corridor for at least 10 years.

This Stream Rehabilitation Program has been adopted as a model for other watershed level management programs throughout Manitoba. The program has raised public awareness of fisheries, wildlife, recreation, agriculture and land stewardship issues. ❖



### who would have thought?

**The Great Lakes, straddling the Canada-U.S. boundary, contain 25 percent of the world's fresh water in lakes.**



## Sustaining the forests

Tolko's nine manufacturing divisions and four marketing divisions employs about 2,300 people, 700 in the company's two business units at The Pas. Producing more than a billion board feet of wood products and planting over 24 million trees last year isn't bad for a company that started in the early 60s as a planer operation. And this is a company that is committed to sustainable development. Who says it can't be done?

A big part of sustainability is balanced environmental performance. In 2001, for every tree Tolko harvested two trees were planted. Reforestation is but one part of sound forest management. A bigger part is protecting the water table. This is accomplished by minimizing disturbance of the forest floor while harvesting, fire prevention and control, controlling drainage plus encouraging a healthy mix of forest vegetation in the undergrowth. Tolko's plans to have their woodlands ISO 14001 certified. This means they will work continuously to improve their environmental performance. ❖

**amazing**  
Once evaporated, a water molecule spends about 10 days in the air.

## Effective effluent management

For sustainability to be meaningful it has to be all-inclusive. That's why Tolko's policy includes its The Pas Kraft paper mill. The mill produces sack Kraft paper; 'stuff' used to manufacture paper bags and other similar products. As a starter, Tolko's paper products are made from unbleached kraft pulp; this reduces the amount of chemicals used that could eventually get into the environment.

To further reduce plant effluent, Tolko closely monitors its manufacturing process and recycles wherever practical. Specifically, chemicals and water that are used to break down the pulp are constantly recycled and what little is left is treated before being disposed of in compliance with stringent regulations.

To be absolutely sure that the mill is non-polluting, Tolko conducts regular testing of its environmental impacts on the soil, air and water. One such test determines what impact the plant effluent has on fish. Testing by independent agencies has found no evidence of significant effects on either fish or fish habitat in the Saskatchewan River. ❖



## Beyond slogans

Suggestions from staff and other stakeholders on how to improve Tolko's environmental performance are encouraged and the staff have made sustainability their commitment. Tolko is making this happen by controlling and treating chemicals prior to disposal and seeking non-chemical substitute products wherever possible.

Environmental effects monitoring studies were conducted in 1995 and 1999 and another one is scheduled for 2003. They have concluded that there is no evidence of significant adverse effects of Tolko's effluent on fish or fish habitat. Nor did Tolko's operations show any significant effect on the bug community on the Saskatchewan riverbed. Tolko intends to register the environmental management system of its Manitoba Kraft Papers operation under ISO 14001 standard by the end of 2003. ❖



## Attention bird watchers

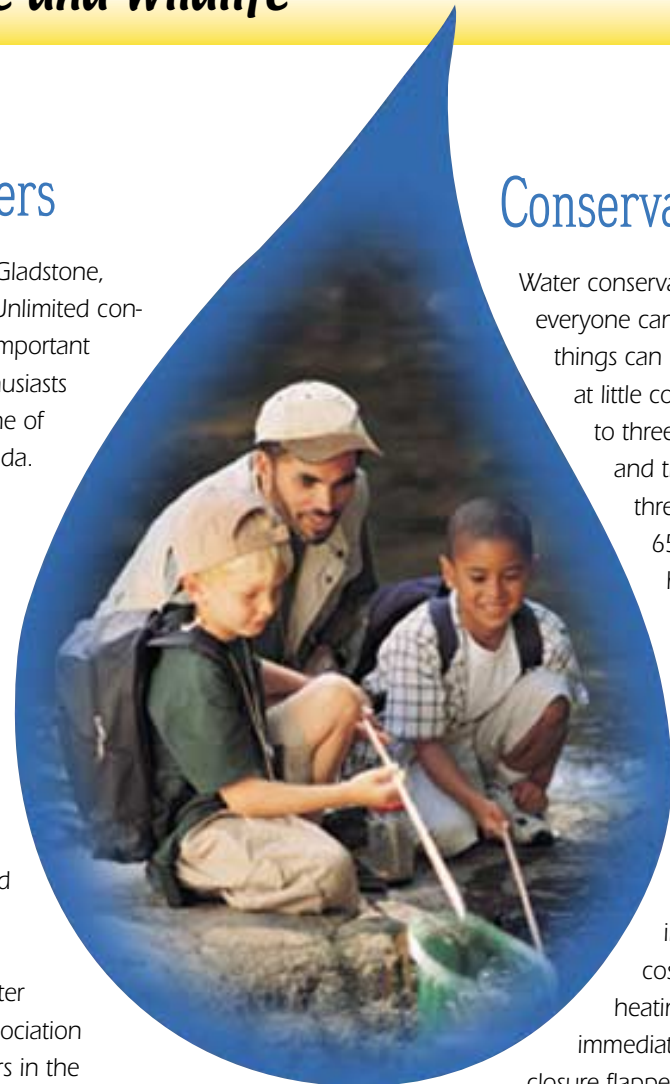
Big Grass Marsh is located just north of Gladstone, Manitoba. This was the very first Ducks Unlimited conservation project, and is considered an Important Bird Area of Canada. Bird watching enthusiasts are invited to enjoy the experience of one of the best bird watching locations in Canada.

## Professional training and development

The Manitoba Water and Wastewater Association (MWWA) is the only non-profit organization in Manitoba dedicated to the certification of water and wastewater personnel. It's a member of the Western Canadian Water and Waste Water Association (WCWWA). This regional association provides services for over 3,000 members in the three prairie provinces. WCWWA was founded 54 years ago to promote the exchange of knowledge of water treatment, sewage treatment, distribution of water and collection of sewage for towns and cities in Western Canada.

"High quality water and safe, effective wastewater treatment are essential to any society and are needs that can only increase in the future", notes the chairman of MWWA. And this organization is there to provide this essential service. Its members are qualified, dedicated professionals, people who are trained to high standards and who continue to learn as the water and wastewater industry advances. ❖

**check it out**  
Many homes lose more water from leaky taps than they need for cooking and drinking.



## Conservation pays

Water conservation is one area where everyone can play a big role. Many things can be done by individuals and at little cost, by paying more attention to three areas, the tap, the shower and the toilet. Together these three items account for about 65 percent of indoor household water use.

An aerator on a tap restricts water flow. It can be installed in a few minutes and at minimal cost. All that's needed is a pair of pliers. Installing a new low-flow shower head is as easy as installing an aerator and the cost of water and water heating will decrease immediately. A toilet dam, an early closure flapper valve, or a water-displacement device in the toilet tank can all

conserve significant amounts of water.

Small things add up: turn off the tap when brushing your teeth, take shorter showers, check toilets for leaks and repair, don't use the toilet as a waste basket, wash only full loads of clothes and make sure your dishwasher is fully loaded before washing. You'd be surprised how these steps will conserve energy, lower your water bill and free up system capacity to serve future generations without costly expansion. ❖

## Next to beavers, they're #1

What started out as protecting duck habitat for hunters has turned out to be a bonanza to the environment. Ducks Unlimited, in partnership with many other organizations in the past 60 years, has constructed over 5,700 dams, regulating structures and helped protect more than 18 million acres of wetland, roughly the size of New Brunswick. About 3.35 million acres are in the Prairies. Manitoba is the home for about a million of these enhanced acres. That is a lot of habitat, much of which was either threatened or in a deteriorated state. ❖

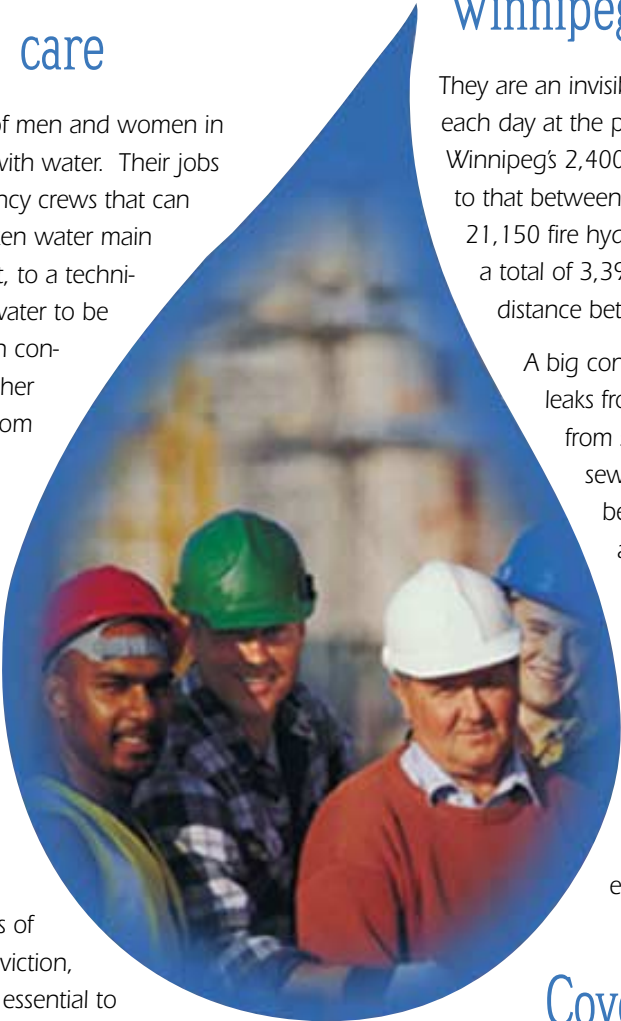


## You bet we care

There are thousands of men and women in Manitoba who work with water. Their jobs vary from the emergency crews that can be found fixing a broken water main on a cold winter night, to a technician testing drinking water to be sure it's safe for human consumption, to a researcher taking mud samples from the bottom of Lake Winnipeg.

The Canadian Union of Public Employees (CUPE) is Canada's largest union, and represents public employees, including a wide variety of water workers throughout the country. The president of CUPE Manitoba speaks of his members with conviction, "Water workers are as essential to society as the most skilled surgeon, you bet we care about water". These views are reinforced by the incoming president of the Manitoba Water and Wastewater Association, "Many of us work side-by-side with CUPE members in a strong professional atmosphere that has contributed to big gains in innovation and adaptation."

Water workers come in all sizes, genders and age groups. Some are self-employed, some work for small service companies like plumbers. Most work for large corporations and government organizations. Some work in computer rooms while others patrol irrigation canals or operate hydro electricity plants. The range of jobs they do is as wide as Manitoba itself. ❖



**WOW**  
During the summer, about half of all treated water is sprayed onto lawns and gardens.

## Winnipeg's water workers

They are an invisible army of men and women who go to work each day at the plants, offices and mobile sites that comprise Winnipeg's 2,400 kilometres of water mains (a distance equivalent to that between Winnipeg and Montreal). They ensure that about 21,150 fire hydrants are in good working order and they maintain a total of 3,391 kilometres of sewer systems (equivalent to the distance between Winnipeg and Moncton, NB).

A big concern with municipal water workers is leaks. Not all leaks from broken pipes well up to the surface. The water from such leaks often finds its way into storm or sanitary sewer lines and escapes from the system without ever being detected. At one time unaccounted for water amounted to almost one-quarter of the entire water processed annually. But Winnipeg's water workers have figured out a way to find many of those leaks; they call it 'listening to hydrants'. By using sound detection equipment and other electronic techniques, and their own knowledge and experience, these workers have identified over 1,000 such leaks since 1999. This saved the City lots of money and reduced demands on the environment. ❖

## Covering the waterfront

There are many non-government organizations (NGOs) in Manitoba and Canada that are concerned with water. Their interests range from water supply, water treatment, water quality, water distribution, water research, and water conservation. Winnipeg Water Watch is one such group. This coalition of community groups and individuals has developed a set of principles pertaining to water. They include:

- water is a public trust. All Canadians have the right to be involved in major decisions affecting water in Canada.
- an adequate supply of clean water for people's daily living needs is a basic human right.
- it is wrong – environmentally, economically and morally – to engage in the large-scale trade of water. Water should not be regarded as a commodity for exchange in the international marketplace.

Water is the lifeblood of the environment as well as being essential for human survival. Each generation must ensure that the abundance and quality of water is not diminished as a result of its activities. Greater efforts must be made to restore the health of aquatic ecosystems that have already been degraded as well as to protect others from harm. ❖



*Winnipeg drinking water just keeps getting better.*

Safe reliable water has been at the center of Winnipeg's success for more than 80 years. In the early part of the 20th century, securing a safe, reliable and abundant water supply was seen as a major challenge to Winnipeg's growth. After much debate, visionary Winnipeggers elected to proceed with a daring proposal to bring water by aqueduct from Shoal Lake on the Ontario-Manitoba boundary to Winnipeg. Shoal Lake was described as one of the best fresh water sources in the world.

The route to Shoal Lake lay across 137 kilometers of wilderness with no road access. The Greater Winnipeg Water District railway had to be built to transport the men, equipment and materials to construct the aqueduct. Construction started May 15, 1915 and Shoal Lake water first flowed from Winnipeg taps April 6, 1919. The total cost of the project was 17 million dollars.

Since completion in 1919, the aqueduct has provided Winnipeg with its entire water supply. By the 1990s the aqueduct was in need of extensive repairs or replacement. The cost of a new aqueduct was estimated at in excess of 500 million dollars and so the decision was made to rehabilitate the existing aqueduct.

The task was challenging since the aqueduct is the primary source of supply for Winnipeg's water and it could not be shut down for periods any longer than 20 days at a time. This 10 year, 57million dollar project is now almost complete and the aqueduct is expected to provide another fifty years of useful service to the 670,000 residents of the City of Winnipeg.

Along with an assured supply of water, the City of Winnipeg is also phasing in a comprehensive water treatment program. The program includes an ultra violet disinfection plant to be in operation by 2004, a chloramination facility to be in operation by 2005 and the balance of the water treatment facilities in operation by 2007. These facilities will reduce the levels of trihalomethanes, protect against potential health risks such as *Cryptosporidium* and *Giardia*, improve the taste, smell and appearance of the water and meet changing drinking water standards. They should also enhance overall customer satisfaction.

*Congratulations Winnipeg, on another half century of superior drinking water service!*



# Earth, air, land and water

In nature nothing exists alone. Living things relate to each other as well as to their non-living, but supporting, environments. These complex relationships are called ecosystems. Each body of water is a delicately balanced ecosystem in continuous interaction with the surrounding air and land.

Ecosystems are comprised of four basic components: water, land (rock and soils), air and living things (plants and animals including humans). Everything in an ecosystem is related to everything else. Consequently, anything that occurs in one of these basic components will have an effect on the other three. Thinking in terms of ecosystems is key to achieving sustainability because an ecosystem approach places equal emphasis on concerns related to the environment, the economy and the community.

The organizations that have supported this publication are concerned with our environment and committed to making it better.

#### For more information:

- [www.dfo-mpo.gc.ca](http://www.dfo-mpo.gc.ca)
- [www.agc.gc.ca](http://www.agc.gc.ca)
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