

AN ANALYSIS OF CANADIAN AND OTHER WATER CONSERVATION PRACTICES AND INITIATIVES: ISSUES, OPPORTUNITIES AND SUGGESTED DIRECTIONS

EXECUTIVE SUMMARY

Background and Objectives

This report has been prepared for the Canadian Council of Ministers of the Environment (CCME) Water Conservation and Economics Task Group (WCETG). It is intended to document relevant strategies and actions that Canadian governments, communities, businesses and households can pursue to ensure that water is used in an efficient, productive and sustainable manner.

Advancement of water conservation goals and initiatives across the country continues to be identified as a priority by the Council's member governments. Ten years have passed since CCME released its 'National Action Plan for Encouraging Municipal Water-Use Efficiency' and progress has been made on a number of fronts. Notwithstanding this progress, there is mounting evidence that a more coordinated, comprehensive and multi-sectoral approach to managing water use and demand is needed to ensure the long-term sustainability of Canadian communities, businesses and individual livelihoods and the protection of aquatic ecosystems. Rapid urbanization, intensification of agricultural operations, growth in the energy-production sector, industrial expansion, and increasing recreational water demands are heightening local and regional concern over the sustainable use of water resources and sparking debate over priorities of use. Adding to these concerns are the increasingly apparent water resource impacts of climate change and variability.

Scope and Methodology

The analysis examines water conservation approaches in use across Canada and in several other countries. It focuses on how freshwater resources are used and managed in the dual contexts of geographic areas and water use sectors. Major sectors include municipal supply, agriculture, thermal power generation, resource extraction, manufacturing, and recreation. These are further subdivided where necessary to get at distinct water-use characteristics and associated conservation aspects.

Jurisdictions selected for study encompassed Canada with all of its provinces and territories, Australia and a couple of its member states, the United States and the states of Arizona, California, Florida and New Mexico, and the European Union including England, Wales and France. Reference is also made to a number of other jurisdictions where certain approaches and practices were felt to be of particular interest and benefit.

Research stressed compilation and analysis of web-based information (covering legislation, policies, reports, manuals, fact sheets and case studies) found within state/provincial, municipal, industry association, individual company, resource and environmental NGO, professional organization and university/college websites. Phone interviews and draft materials circulation helped ensure the currency, accuracy and completeness of the information and analysis. WCETG members assisted in this task.

Conservation Needs and Drivers from a Canadian Perspective

Canada is widely seen as a nation rich in water resources. A comparison of total annual water renewal rates vs. total annual demands puts Canada in the top tier of countries whose renewable supplies far exceed its current water-use demands.

This view of abundance masks other realities regarding the ready availability of these resources for human use. It also discounts the significance of the growing list of situations where resource and investment sustainability concerns exist or are emerging at the local and regional levels.

It also fails to account for the substantial economic costs and foregone opportunities associated with inefficient and less productive uses of water.

- Sixty percent of Canada's water resources flow north while more than 85% of the population and the vast majority of the country's economic activity are located in more southern regions.
- Many agriculturally important areas have semi-arid climates and face growing competition for limited water supplies. Crop and livestock production and many local communities have become dependent on water diversions and constructed storages to meet their needs.
- Many other areas exhibit seasonal and more-prolonged patterns where cumulative demand for water results in competition over supplies and threatens aquatic ecosystems.
- Climate change predictions show that many parts of the country are likely to experience increasing risks from reduced water availability and increased demand.
- Inefficient and non-productive uses of water continue to drive avoidable expenditures and debt accumulation for the construction, expansion, operation and rehabilitation of both municipal and private water and wastewater infrastructure. They also result in excessive energy consumption and contribute to the inefficient use of other resources.

Conservation Benefits

Using water more efficiently and productively has been shown to:

- Prevent or reduce conflicts among water users who share a common resource;
- Contribute to the protection of environmental flows and to the health of aquatic ecosystems;
- Make water resources available for further growth and development;
- Avoid or defer the need to expand the capacity of water and wastewater infrastructure;
- Eliminate the need to augment water supplies through potentially harmful or undesirable diversions from other watersheds;
- Free-up public funding for investment in other priorities including the renewal of outdated water and sewage infrastructure;
- Increase the ability of water users to withstand the impacts of low-water conditions resulting from inherent weather variability and climate change;
- Conserve energy, other resources and raw materials and improve business profitability;
- Enhance wastewater treatment efficiency and reduce environmental emissions; and
- Enhance leverage with other jurisdictions on issues relating to shared waters.

Sectoral Opportunities and Approaches

The review of conservation measures being applied within individual sectors indicates that many globally recognized 'best practices' are already in use within some Canadian communities and businesses. What distinguishes Canada from most other study jurisdictions is the lack of more comprehensive and uniform uptake or application of these measures. The following is a sector by sector overview of more apparent water efficiency opportunities, of the rationale for their broader adoption and of key considerations that need to be addressed in their implementation.

Municipal

Sustainability issues in the municipal water supply sector transcend the question of balancing availability and demand. This is especially so in the case of growth communities where water efficiency improvements can be the key to avoiding or limiting expensive investments in water and wastewater infrastructure.

Strong pressures to implement full cost accounting and cost recovery in the municipal sector favour implementation of universal metering and conservation-oriented rate structures. The first is fundamental in making all users aware of the scope of their demands and in achieving greater equity in the distribution of costs. The latter offers an incentive to use water wisely. The case can also be made for minimizing distribution system losses and for capitalizing on the mutual benefits (to community and consumer) of moving toward the mandatory use of water efficient plumbing fixtures, appliances and other devices in new construction as well as in retrofit and replacement.

Higher per-capita servicing costs faced by many small communities (<1000 residents) and northern communities may warrant more direct senior government involvement in helping to fund upfront implementation costs. Government intervention in seeking an appropriate level of water pricing harmonization among municipalities may also be warranted to restrict the destabilizing use of subsidies as a tool in attracting business development.

Agriculture

Irrigated-crop production is recognized as a contributor to water sustainability concerns and user conflicts across Canada and in other countries. Production activities tend to be concentrated within contiguous areas; water demands are intensive, cumulative and overlapping; and these demands typically coincide with periods of lowest water availability. Overall demands are expected to grow as a result of pressures to expand production, to irrigate crop types not currently irrigated, and to make up for a predicted increase in the incidence and severity of drought like conditions.

Solving or preventing serious water management problems will almost certainly involve both demand management and supply management approaches. Demand management opportunities exist to minimize water losses in conveyance systems, to better coordinate the scheduling of irrigation use by individual farmers and groups of producers, to use more efficient application technologies, and to more carefully determine the net economic return in irrigating certain lower-value crops. The substantial investments required pose tough issues for producers and governments in determining appropriate rates of return and in arriving at a workable division of funding responsibilities. The basic issues of mandatory water-use monitoring and reporting, full-cost accounting and cost recovery need to be dealt with in these deliberations.

Thermal Power Generation and Cooling

In Canada more water is withdrawn for cooling, condensing and steam generation purposes than for any other purpose. The majority of these withdrawals are used in thermal power generation but also constitute a key component of water usage within the resource extraction, primary processing and manufacturing sectors.

The dominance of cooling-related withdrawals within Canada's overall water use picture is made even more pronounced by the long-standing practice of once-through cooling. While use of closed-loop systems and air cooling has been growing in popularity, Canada has not as aggressively followed the regulatory lead of many other countries that clearly favour their use in new and retrofit applications. A country-wide examination of environmental and financial arguments for and against continued use of once-through-cooling appears warranted in light of what is happening elsewhere. Such a review is also timely in view of the ongoing restructuring within the industry.

Industrial

The breadth of the industrial or manufacturing sector adds to the complexity and diversity of water quantity management issues and opportunities. The interests and practices of self-supply water

users are also often quite distinct from those who draw from municipal systems, i.e. self-supply users have a less obvious cost-driven incentive to conserve.

Many Canadian companies within all manufacturing sectors have reduced water withdrawals as an adjunct to other objectives such as reducing energy consumption or assisting with the management and reduction of wastewater emissions. Levels of achievement appear to be highly variable perhaps reflecting inconsistencies in pressures and/or incentives for dealing with these multiple objectives.

Beyond taking more obvious steps to reduce waste through repairing leakages and to increase water recycling and reuse, companies within every sector can ready access to documentation involving same-sector companies who have successfully reengineered processes, replaced equipment or implemented other measures to directly or indirectly reduce water demands. It may now or soon be possible to develop 'best practices' guidelines or standards that quantify acceptable industry performance with respect to water-use efficiency and water-use productivity within individual sectors or sub-sectors.

Resource Extraction

With the exception of enhanced oil recovery operations, water quantity management issues in the resource extraction sector generally focus on questions of diversions and impoundments rather than conservation and efficiency.

Process water recycling has been a common practice in mineral mining operations for many years as a means of minimizing wastewater discharge volumes. Evaporative losses from tailings impoundments and from the use of water for dust suppression are generally minor, particularly in the case of hard rock mining. Consumptive losses can be of greater concern in connection with refining of metallic ores (water may be used both as a coolant and as a reagent in byproduct recovery) and processing of non-metallic minerals that requires the creation of intermediate or final-product suspensions or slurries.

Enhanced oil recovery operations (EOR) involving the use of water or steam have raised public concerns over potential impacts on other extractive interests and the environment. Disposal of contaminated water from these operations can also involve the use of permanent deep well injection further adding to the consumptive nature of EOR water usage. These concerns have led governments, particularly in Alberta, to curtail the granting or scope of new freshwater withdrawal approvals and forced the industry to pursue other alternatives including the use of saline water sources along with increased water recycling and reuse. Since EOR and heavy bitumen operations are vital and expanding components in Canadian energy production the use of these and other alternatives for minimizing freshwater use can only grow in importance.

Recreation

Public concern over the impact of water usage by the recreational sector continues to grow in many parts of the country. The focus of much of this attention is golf course operations that, like agricultural and landscape irrigation, exert high seasonal water demands. Ongoing expansion in the number of courses in close proximity to major cities and within city regions will increase pressure on governments and the industry to find management solutions that stress water efficiency improvements over increases in withdrawals. Newer courses can be sited, designed, constructed and operated to make more efficient and sustainable use of water than what is the norm for most existing courses.

Building Support and Overcoming Challenges

Understanding the interests and perspectives of key stakeholders is critical to overcoming challenges in moving forward. The consensus-based views of several well-recognized organizations representing a range of public utility, business, environmental and professional interests appear to support strengthened government initiatives in water conservation. Some of these groups have, however, voiced concerns over how any new initiatives would be structured and want to be part of the process for deciding on the appropriate balance between voluntary and regulatory approaches and for arriving at workable alternatives in the assignment of implementation costs and responsibilities.

Canadian Stakeholder Perspectives on Water Conservation

GROUP	POLICY OR PERSPECTIVE
MUNICIPAL & WATER UTILITIES	
Federation of Canadian Municipalities (FCM)	FCM calls upon senior governments to work together in establishing policies and legislation aimed at water-use efficiency and sustainable infrastructure development. FCM supports: <ul style="list-style-type: none"> • Per capita consumption goals • Universal metering • Public education regarding alternatives • Building code requirements for water-efficient plumbing fixtures and other devices • Full cost accounting and cost recovery • Special support for small communities.
Canadian Water and Wastewater Association (CWWA)	CWWA supports: <ul style="list-style-type: none"> • Adoption of water conservation policies and programs by all municipal utilities • Universal metering • Full cost accounting and cost recovery • Integration of environmental, public health and sustainable development principles in municipal planning, decision-making and day-to-day operations • Watershed management • Coordinated government intervention in funding municipal water and wastewater infrastructure taking into account differences in the financial capacity of smaller and northern communities.
MANUFACTURING	
Forest Products Association of Canada (FPAC)	FPAC has not identified water conservation as a "current issue" facing the industry. It does, however, report that its members continue to seek ways to recycle and use water and other resources more efficiently.
Canadian Chemical Producers Association (CPPA)	CCPA's Responsible Care® program principles support water conservation. Member companies are expected to: <ul style="list-style-type: none"> • Apply options including reducing, reusing, recycling and recovering [resources and materials] to minimize impacts on the environment.
Canadian Steel Producers Association (CSPA)	CSPA's sustainable development principles commit its member companies to: <ul style="list-style-type: none"> • Maximize resource efficiency in the development, production and use of steel products including efforts to use energy and water more efficiently.
Canadian Petroleum Products Institute (CPPI)	CPPI's guiding principles for the environment' commit member companies to "develop management systems that support efficient utilization of natural resources".

GROUP	POLICY OR PERSPECTIVE
RESOURCE EXTRACTION	
Mining Association of Canada (MAC)	MAC's Environmental Policy commits member companies to: <ul style="list-style-type: none"> • Develop, design and operate facilities based upon the efficient use of energy, resources and materials.
Canadian Association of Petroleum Producers (CAPP)	CAPP policies require or encourage its members to: <ul style="list-style-type: none"> • Measure and annually report on water-use productivity as a stewardship benchmarking parameter • Develop new technologies to monitor, report and reduce water usage • Support research into and adoption of innovative water conservation and materials recovery measures.
AGRICULTURE	
Canadian Federation of Agriculture (CFA)	CFA does not have a specific position on water conservation and water-use efficiency. On the broader issue of environmental protection, CFA requests governments to consider: <ul style="list-style-type: none"> • Long-term and stable funding for environmental farm planning • Capital cost allowances for environmental investments • Funding for stewardship initiatives undertaken for public environmental benefits.
RECREATIONAL INDUSTRIES	
Royal Canadian Golf Association (RCGA)	RCGA's Environmental Principles encourage golf course designers, developers, owners and operators to: <ul style="list-style-type: none"> • Design and operate irrigation systems to use water efficiently and responsibly • Consider alternative and supplemental sources of water including use of reclaimed water and stormwater runoff.
OTHER	
Canadian Water Resources Association (CWRA)	CWRA supports government, business, public and professional collaboration to encourage water conservation through: <ul style="list-style-type: none"> • Recognizing the value of and limits on water resources and the costs of providing water in adequate quantity and quality • Balancing education, market forces and regulatory systems to promote choice and recognition of shared responsibilities to pay for use of the resource. • Restoring and enhancing government commitments to hydrometric and meteorologic monitoring networks.
Organization for Economic Cooperation and Development (OECD)	In its 2004 Key Environmental Indicators Report, OECD observes that: <ul style="list-style-type: none"> • Most OECD countries [including Canada] face seasonal and/or water quantity problems that serve as a constraint to sustainable development and to the sustainability of agriculture • Solving these problems will involve reducing losses, using more efficient technologies, increasing recycling, using a watershed approach, and applying user-pay principles.

Suggested Directions

Successful water conservation programs and initiatives are founded upon informed decision-making with respect to problem identification, goals, objectives, available alternatives and expected benefits. They also incorporate a good understanding of water conservation's important linkages to other sustainable development initiatives.

Potential partners and major stakeholders need to be engaged in the development of objectives and targets and in the identification and resolution of implementation issues. A range of tools and measures should be evaluated with due consideration to the expected contribution of key water-use sectors. The rationale for harmonization at the provincial/territorial and national levels should also be considered. The resulting water conservation strategy and plan will clearly define the purposes, objectives, targets and actions, will prescribe roles and responsibilities and institutional arrangements and will identify how implementation is to be resourced.

Suggested Government Directions in Support of Water Conservation

<p>Sustainable Resource Development and Use Policies</p> <ul style="list-style-type: none"> • Promote water conservation and water-use efficiency as components of broader sustainable development goals and commitments. • Set water conservation and water-use efficiency targets to address watershed and service-area sustainability objectives while also ensuring inter-regional and cross-sectoral harmonization. • Integrate water conservation goal-setting, messaging and implementation with initiatives targeting conservation of energy and other resources and the protection of water quality and aquatic systems. • Integrate the use of regulatory and non-regulatory tools for managing water use. Give due recognition to the capacity and responsibility of users and the benefiting public to share in the costs. • Develop business-renewal strategies for the creation of new economic opportunities based on more-productive water uses. • Support urban development standards and practices that encourage attenuation of stormwater runoff and protection of groundwater recharge. • Implement full-cost accounting and cost recovery across all levels of government in the management and delivery of water-related services. Have regard for the limited financial capacity of smaller communities and some business sectors. Factor in the projected costs of renewing and replacing failing and outdated infrastructure.
<p>Legislation and Regulation</p> <ul style="list-style-type: none"> • Introduce regulatory measures that i) require self-supply water users to prepare water conservation /efficiency plans, ii) establish water-efficiency standards/guidelines for individual sectors, iii) protect in-stream uses and aquatic systems, and iv) implement cost recovery. • Introduce or amend legislative mechanisms that will enable government agencies to address situations where reprioritization, redistribution and/or reduction in allocations are essential for the protection and advancement of the public good.
<p>Monitoring, Reporting and Analysis</p> <ul style="list-style-type: none"> • Implement mandatory requirements for the metering/measurement and reporting of water usage by all self-supply water users. Harmonize data collection and reporting requirements to facilitate information compilation and analysis across sectors and among jurisdictions. • Implement mandatory metering for all customers served by public/municipal water systems. • Expand and intensify surface and ground water level and flow characterization studies and monitoring networks. Assign priority to areas of existing or emerging water-use conflict or concern. • In high growth watersheds, compile information on projected increases (10-50-yr planning horizons) in water demands across all sectors. • Enhance support for the development, refinement and use of watershed and aquifer-based water allocation and conservation planning tools. • Summarize and publicly report on water availability, water usage and conservation information and analysis on a routine and frequent basis.

Outreach and Education

- Review existing outreach and education initiatives at all levels of government. Ensure they are effective in reaching water users and in providing essential information on conservation benefits, options and implementation strategies. Tailor initiatives according to sector.
- Document and disseminate more detailed technical and cost information required by industry, agricultural producers, and other businesses.
- Expand and enhance coverage of water conservation and stewardship goals and measures within school curricula at all age levels.

Consultation and Involvement

- Engage municipalities, industry, business and other stakeholders in target setting, identifying preferred efficiency measures, and in finding innovative resourcing approaches.
- Enlist the support of water conservation innovators and champions within each sector in spreading the conservation message and knowledge to their colleagues.

Economic Instruments

- Accelerate the use of full-cost accounting and cost recovery approaches in the provision of water management services and activities including those pertaining to water conservation and efficiency.
- Phase out the use of flat-rate and declining block-rate pricing and the use of preferential pricing for large-volume water users. Introduce conservation-oriented rate structures while providing appropriate forms of rate relief for low income households.
- Make development of and commitment to a water conservation plan a condition of eligibility for funding assistance in connection with all water and wastewater infrastructure expansion and renewal projects.
- Develop and implement appropriate strategies for addressing the more limited implementation capacity of smaller and northern communities and of smaller business operators.

Research and Development

- Examine the benefits and drawbacks of encouraging or requiring use of closed-loop cooling systems in thermal power generation, industrial, commercial and institutional water-use applications.
- Investigate the feasibility of national or regional water-use efficiency standards or guidelines based on best technologies and/or practices in major water use sectors and sub-sectors.
- Expand research into the impacts of global warming and climate change on water resource availability and demand with a focus on improving regional-level quantification of those impacts.

Implementation

- Acknowledge that the attainment of water efficiency and sustainability goals is likely to take longer in some areas and sectors than in others. Require all new growth and development to use best practices and technologies while setting realistic timeframes for attaining targeted improvements within existing development. Seek continuous improvement.
- Work toward devolving day-to-day water management decision-making to the lowest practicable level subject to the application of clearly defined policies and principles and the provision of appropriate over-sight. Assist local and regional/watershed authorities in developing capacity to assume these responsibilities.
- Integrate and harmonize conservation planning and implementation among all levels of government and between the public and private sectors.

Potential Roles and Responsibilities

The goal of ensuring that Canada and Canadians develop and use the nation's water resources to the sustainable benefit of all interests can only be realized if responsibilities and accountability are broadly shared. The following roles and responsibilities are suggested.

CCME

- Provide a forum for the discussion, analysis and harmonization of current and proposed federal and provincial/territorial water conservation initiatives.
- Facilitate sharing of conservation experiences across all Canadian jurisdictions.
- Conduct periodic reviews of implementation progress and concerns.

Federal Government

- Facilitate cooperation among the provinces and territories and with federal departments.
- Continue and expand support for shared federal-provincial/territorial networks and programs designed to characterize and monitor streamflows, water-levels and groundwater-elevations.
- Continue to survey, analyze and report information on water use across all major use sectors and on a country-wide basis.
- Implement conservation measures at all federal facilities and properties.
- Seek US support and commitment to conservation initiatives impacting on boundary waters.
- Monitor conservation initiatives and practices in other countries.
- Provide coordination and support for the evaluation, development, adaptation and demonstration of new or improved water-use technologies and practices, e.g. closed-circuit cooling.
- Provide coordination and support toward development of sectoral best practices standards and guidelines for water-use efficiency.
- Examine the feasibility of introducing a national water-efficiency labeling program for plumbing fixtures, household and commercial appliances, and other water-use related devices.
- Adopt taxation policies and cost-share infrastructure eligibility criteria that encourage and facilitate adoption of water-efficiency measures by municipalities and businesses and discourage new or ongoing investment in the use of inefficient practices and technologies.

Provincial and Territorial Governments

- Use provincial building codes to require the mandatory use of water-efficient plumbing fixtures in all new residential, commercial and institutional construction and retrofits.
- Require self-supply water-use licence and permit holders (as a condition of approval) to:
 - Prepare water conservation plans and implement water efficiency measures
 - Accurately meter/monitor and routinely report daily water usage
- Adopt criteria that make municipal and private sector eligibility for water-related infrastructure grants and other government funding conditional upon the preparation and adoption of an acceptable water conservation plan and practices.
- Support development of sectoral best practices water-efficiency standards and guidelines.
- Restrict new water takings and prioritize uses in areas subject to existing or impending conflicts between demand and supply.
- Require and facilitate the preparation of drought-response plans for areas subject to recurring water shortages.
- Implement conservation measures at all provincially-owned facilities and properties.

- Use sectorally targeted outreach and education to promote and encourage conservation.
- Provide support for the evaluation, development, adaptation and demonstration of new or improved water-use technologies and practices.
- Establish economic incentives to encourage water users to adopt water-efficient practices and technologies and/or disincentives to discourage new and continued use of inefficient practices and technologies.
- Adopt permit fees and other water charges to cover the costs of water management programs and activities and to support conservation behaviours.
- Continue and expand support for cost-shared monitoring networks and programs used to characterize and measure streamflows, water-levels and groundwater-elevations.
- Require and support the use of supply and demand forecasting and water budgets/balance analyses in all critical-use watersheds/aquifers.
- Monitor conservation initiatives and best practices in other jurisdictions for potential adoption or adaptation.
- Support interprovincial and national harmonization of conservation and sustainable use initiatives.
- Support coordinated conservation and sustainable use initiatives in Canada-US transboundary watersheds.

Municipalities

- Make conservation and water-use efficiency programs a municipal priority.
- Approach conservation planning and implementation in a comprehensive and systematic manner; seek continuous improvement.
- Set water savings targets and implementation timelines.
- Implement universal metering for all customer sectors; commit to regular meter inspection and calibration.
- Minimize distribution system losses through:
 - Leak detection and correction
 - Pressure modulation
 - Scheduled watermain replacement
- Enact bylaws that do some or all of the following:
 - Require use of water-efficient plumbing fixtures and appliances
 - Appropriately restrict lawn watering and other outdoor uses as needed
 - Require the use of rainfall sensors and automated controls for regulating rates of flow and on-off cycles of landscape irrigation systems
 - Limit the impervious area portion of a building lot
- Implement water pricing based on full-cost accounting and recovery.
- Use increasing block, seasonal use and other conservation-oriented rate structures.
- Encourage and subsidize residential, commercial and institutional plumbing-fixture retrofits.
- Promote xeriscaping and use of drought tolerant plants.
- Require or encourage (and subsidize) water-use audits and conservation planning among large-volume users.
- Use outreach and education to encourage good conservation practices.
- Implement conservation measures at all municipally-owned facilities and properties.
- Monitor progress and report on accomplishments.
- Monitor practices in other municipalities for potential adoption or adaptation.

Business and Professional Organizations

- Adopt a water conservation and efficiency code of ethics and require member adherence to it.
- Stay current with advances in sectoral Best Management Practices (BMPs) and disseminate this information to members through seminars, fact sheets, case study reviews, etc.
- Support and participate in pilot and full-scale BMP demonstrations.
- Support and participate with governments in the development of sectoral water efficiency standards and guidelines.
- Routinely monitor and report on sector performance.
- Represent member interests in provincial/territorial and national consultations on water management.