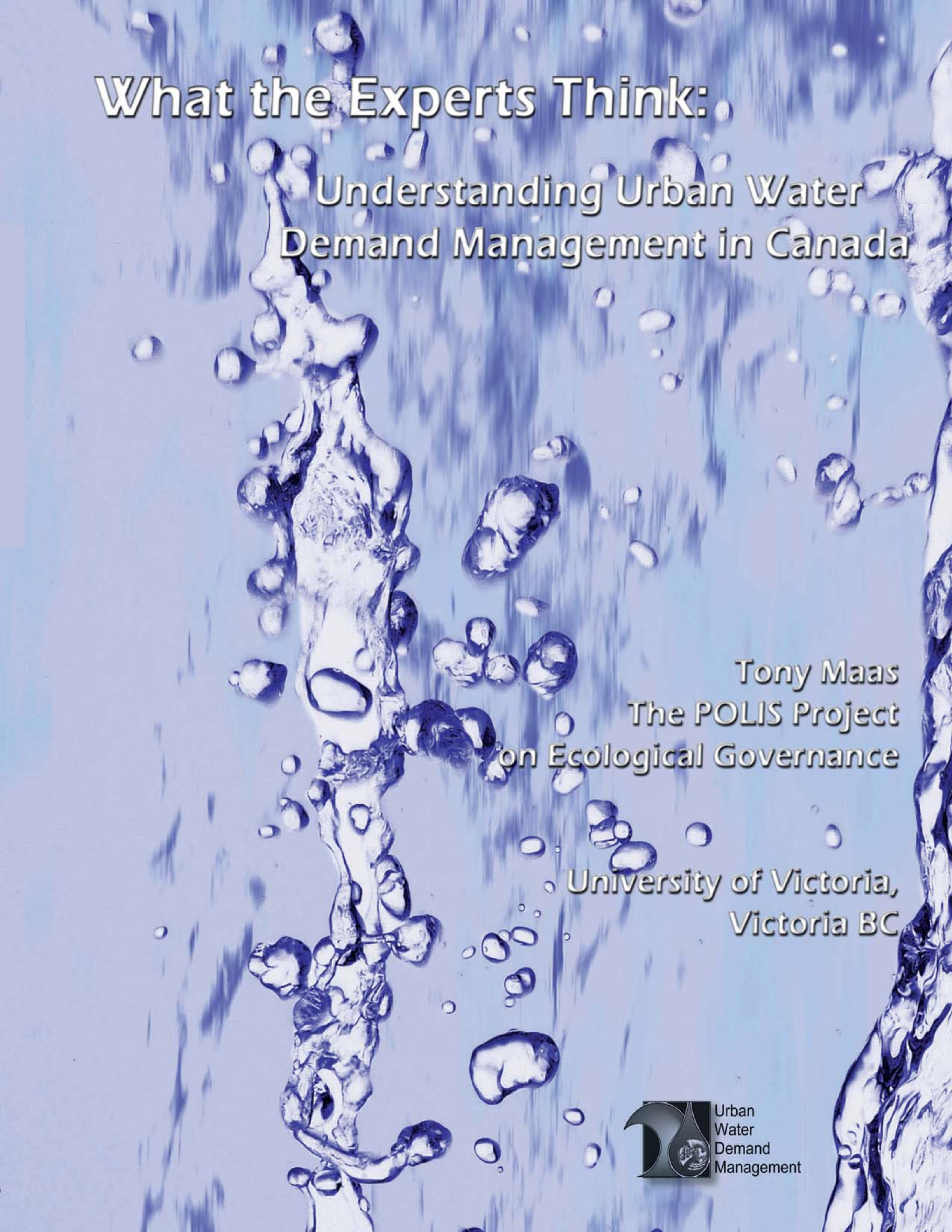

What the Experts Think:

Understanding Urban Water Demand Management in Canada

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on Ecological Governance

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Urban Water Demand Management

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BUILDING ON CANADA'S STRENGTHS

There is, after all, a 'living library' of experts throughout the country – in the private sector, academia, civil society and at all levels of government

The demand-side approach brings increased flexibility to urban water management by building demand considerations into planning and decision-making

"water quantity concerns in Canada are local and multidimensional, encompassing source water availability and quality, and water and wastewater infrastructure capacity"

"we cannot pretend that natural systems are plumbing networks that can be endlessly manipulated by humans"

"simply expanding supply to meet an unrestrained demand just doesn't make sense in most cities"

"our water shortages are the result of taking water for granted – we want it to come out of the reservoirs for free and we do not want to deal with the consequences of excessive consumption"

"water conservation is not a technical issue; the technology and know-how are well developed"

"The scale for water reuse is unlimited – from household greywater systems to communal collectives to municipal wastewater reclamation"

What the Experts Think: Understanding Urban Water Demand Management in Canada

Tony Maas

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University of Victoria, Victoria BC

"one of the major challenges with moving forward on water reuse may not be public health, but public perceptions regarding health risks"

"until we get the prices right, we will continue to have water supply problems"

"because we don't price according to distance and/or peak demands, utilities have extended their services too far and built capacity too large"

"Rate structures are as important to the DSM approach as the actual prices charged"

"water pricing is about sustainable resource management and social equity, not about privatization"

. . . pricing reform is not a 'silver bullet' solution, integration of the available policy instruments is key to the success of the DSM approach

"we have so much knowledge about water that we are not using; we know what we should be doing, it's just a matter of getting on with it"

. . . a general lack of political leadership on water issues is the most challenging obstacle to furthering the progress of DSM

. . . effective governance is central to addressing and resolving many of the major barriers to the progress of DSM

"water laws and policies must evolve to reflect the ecological realities of limited water supplies, limited capacity to absorb pollutants, and the needs of aquatic ecosystems"

Executive Summary

1. Introduction and background

Throughout Canada and the industrialized world, urban water management has long been characterized by a 'supply-side' paradigm. The primary concern of this approach is to secure sufficient water to meet forecast demand. However, an alternative approach that can reduce the need for new supplies by "managing demand" is now gaining recognition.

"Demand-side management" (DSM) seeks to influence the efficiency and timing of urban water use through a diversity measures including: education, use of low flow fixtures and appliances, reuse of wastewater, and conservation-based pricing structures. Under this approach, decisions to build supply infrastructure are contingent on first investigating opportunities to lower demand.

This report provides a background on urban water DSM in Canada, including many of the barriers to its adoption. It takes an unusual approach by drawing on an extensive set of interviews with Canadian experts to provide an analysis of "what the experts think."

2. Is there a need for DSM in Canada?

Urban water management poses many logistical and financial challenges in Canadian communities. These challenges are made all the more difficult by ever-increasing levels of water use, recurring conditions of local drought, deteriorating infrastructure, and the continuous erosion of the health of aquatic ecosystems.

By increasing water use efficiency, DSM can mitigate many of the impacts of human water use on overstretched municipal infrastructure and overstressed aquatic systems. Despite these benefits, DSM is seriously underutilized in Canada.

3. Framing the DSM approach

DSM can be divided into two broad categories of activities: providing the **means** for reducing demand, and creating the **policy instruments** to motivate these means. Two basic means exist: changing the water use behaviour of individuals and institutions, and making physical changes to increase efficiency. Policy instruments can be grouped into three categories: education, economic incentives, and regulatory mechanisms.

These policy instruments operate in a synergistic manner, making effective implemention of DSM programs complex. As well, overarching obstacles pose additional barriers to the widespread adoption of DSM.

4. The means for reducing water demand

The goal of **behavioural change** is to modify water use habits and activities so as to reduce existing levels of wastage and inefficiency. Entrenched values and habits of water managers and users pose major barriers, making behavioural change difficult to achieve and often unreliable over the long-term.

Physical measures for reducing demand focus primarily on technology to increase efficiency or reduce water losses. Examples include the use of water-efficient fixtures, repairing leaks, and reusing wastewater. Opportunities for such physical measures exist at all scales, from individual households, to large institutions and whole industries, to municipal water and wastewater networks.

The technological capacity to increase urban water use efficiency is well established. What is lacking is motivation.

5. Policy instruments to motivate change

Education can raise awareness about the need and potential for water conservation, and its benefits. Education programs must, however, be supplemented by other motivating factors.

Economic incentives, such as higher prices, are often considered to be the most effective DSM policy instrument. But water pricing is also contentious, and requires policy makers to address difficult policy issues such as social equity, financing, and privatization.

Water experts generally agree that the lack of a strong pricing stimulus is the pre-eminent barrier to reducing water demand. Nevertheless, many also note that pricing is not a 'silver bullet' but works best as part of an **integrated policy package**.

In addition to education, a package to motivate behavioural and physical changes would include mandatory or **'command and control' mechanisms**, such as building and plumbing codes and regulations. Current building and plumbing codes fail to promote the use of water efficient fixtures, and do not encourage water reuse.

6. Overarching obstacles

The experts also noted the existence of a number of overarching administrative and institutional obstacles to DSM. These include: entrenched, supply-oriented engineering approaches; fragmentation in management, both horizontally among various agencies and vertically between different levels of government; and lack of political leadership. Many of these obstacles are not specific to DSM, or even the field of water resource management, but are symptomatic of limitations in the decision-making processes and institutional priorities affecting the environment generally.

7. Future directions

In the future, emphasis must be placed on overcoming the overarching obstacles as much as on initiatives specific to DSM. Developing institutional capacity to design, implement, and administer effective DSM programs is critical. This requires broadening beyond the traditional supply-side orientation in resource management by taking a more 'ecologically innovative' approach to technology and engineering, as well as incorporating 'social scientific' techniques that influence the demand side.

To instil a lasting 'water ethic' in Canadians will demand greater emphasis on effective, long-term education programs. Such programs include additions to school curricula, on-going professional seminars and workshops, and explicit statements in government policy.

In conjunction with these programs, water prices and rate structures must be established that better reflect the 'true' costs of water. These pricing systems must also ensure equitable access to potable water and encourage water conservation.

Regulatory changes must also be made. Provincial governments should amend building and plumbing codes to mandate a variety of water-efficiency measures, including support for the reuse of wastewater. Funding transfers from federal and provincial governments to municipalities should be conditional on the incorporation of DSM measures at the local level. Ultimately, funding should be designated specifically for DSM programs.

New approaches to planning are needed to engage the public in water management, coupled with the explicit commitment to water efficiency in community plans. More generally, water policy and management must move beyond today's utilitarian and anthropocentric orientation to include a broader commitment to ecosystem health and integrity.

Finally, the shift to DSM will require informed leadership at all levels of government. To facilitate this informed leadership entails an active contribution from Canadian water experts.

Foreword

Understanding the implications of demand side management and the effectiveness of the various tools and strategies for implementing it is a complex task. This Report provides a very useful compilation of arguments for and examples of water demand side management - or water demand management as it is traditionally referred to in the urban water supply sector. The authors are to be complemented for assembling a large amount of information on the practices and tools developed and current in the sector and presenting it in a concise and well-structured Report. It is a useful contribution to the ongoing need to create a wider awareness of the value of water in our society and how we can manage it in a sustainable manner.

T. D. Ellison
Executive Director
Canadian Water and Wastewater Association.

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British Columbia Water and Waste Association

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Water Demand Management Coordinator,
Capital Regional District, BC

1. Introduction and background

To conceive of water scarcity in Canada seems illogical to many. With mighty rivers and countless lakes, Canada is among the fresh water 'have' nations of the world. In most countries, locating and developing clean, reliable water supplies to satisfy the needs of burgeoning human populations is a significant challenge. In contrast, by simply increasing supply, Canadian water authorities have historically met growing water demands with relative ease. Even today, little concern exists for future availability, a pattern that is beginning to pose challenges for many communities.

A closer look at Canadian municipal water systems and the aquatic ecosystems on which they rely suggests that current levels of water use are not sustainable given the implications of population growth, urbanization, pollution of sources and climate change. To resolve this conundrum, a number of experts in the field of water management recommend demand-side management (DSM) as a plausible alternative to current and future water supply challenges.

There is, after all, a 'living library' of experts throughout the country – in the private sector, academia, civil society and at all levels of government

1.1 Purpose and Overview

The purpose of this report is to provide background and insight on the theory and practice of urban water demand management in Canada. It identifies key barriers to widespread adoption of demand-oriented policies and practices, and offers some prescriptive measures and recommendations to overcome these barriers.

The report takes an unusual approach. Drawing on an extensive set of interviews with Canadian experts in the field of water resource management, the report synthesizes their views into a comprehensive analysis – what the experts think. There is, after all, a 'living library' of experts throughout the country – in the private sector, academia, civil society and at all levels of government. By reading through this library, we hope to present a synthetic understanding of the status and progress of DSM in Canada, and an informed discussion of the barriers to moving DSM forward.

This Introduction outlines the methodology used in collecting information for the report, and briefly discusses the supply-side and demand-side paradigms of water management. Chapter 2 provides background on the need for DSM in Canada's urban areas. Chapters 3 to 6 discuss the DSM approach in detail. Chapter 3 outlines the DSM process and provides a framework for the following three chapters. Chapter 4 discusses the means for reducing water demands, Chapter 5 deals with the policy instruments related to water DSM, and Chapter 6 introduces some overarching obstacles that impede the progress of this approach. Chapter 7 concludes with some prescriptive measures to address the challenge of shifting from supply to demand-side management of Canada's urban water resources.

Appendix 1 is a key component of this report – the 'DSM Directory'. This resource includes brief profiles and contact information for all of the experts interviewed for the report. It also includes profiles and contact information for a growing network of individuals and groups practicing and promoting DSM across the country. The directory is intended as a resource for those engaged in water policy development and the practice of water DSM. Our hope is that it will foster further dialogue on the implementation of DSM, and serve as a networking tool for further research, policy development, and information about best practices throughout Canada.

1.2 Methodology

Interviewees were selected to represent a cross-section of DSM practitioners from a range of disciplines and sectors of society. The report includes the perspectives of policy makers, researchers, engineers, water conservation officials, public servants, and civil society.

Interviewees were identified from a number of sources including literature on DSM and water resource management, websites of government agencies and academic institutions, and through professional associations active in water management. Many of the experts identified through this process recommended additional interviewees and resources.

Each interview involved approximately one hour of detailed discussion on water management in Canada, with particular emphasis on DSM in urban areas. Interviews were based on a general framework of questions to guide the conversations, and individual experts were encouraged to develop and expand on their specific areas of expertise.

Information and direct quotations from each interview were analyzed and, based on this analysis, organized into relevant topic areas and synthesized into the discussion paper that follows. While the report is primarily based on interviews with the experts, key literature on DSM and water resource management is used to supplement the interview information.

Readers will notice widespread use of the acronym 'PC' (personal communication) in citations throughout the document. This is used to identify the information provided by the experts during the interview process. All interviewees were given the opportunity to review the content and context of their input as it appears in the text.

1.3 Paradigms of urban water management

Most Canadians take municipal water services for granted. Unlimited access to high quality water, whenever and in whatever quantities desired, has become an expectation in Canadian communities.

Recently, increasing occurrences of local water shortage and the tragedies of Walkerton and North Battleford have shaken public confidence in municipal water management. Concerns surrounding the technical reliability of water systems and the institutional capacity of administrative bodies suggest that the traditional management approach may not be capable of dealing with growing demands for water in Canada's urban centres.

DSM is not a new concept to the municipal water supply sector. Ellison (2003: PC) notes, "water providers from the first well digger and water supplier to the current large, sophisticated urban water utilities have always had to address the question of how to balance water supply (taking into account water availability and the capacity of the infrastructure system to treat, store and distribute water) with water demand." This task is becoming ever more complicated as modern urban centres continue to expand and legitimate needs for clean water grow.

Shifting toward a demand-side paradigm in water management is no simple task. Regulatory regimes and political policies are still often oriented to meeting all demands for abundant, high quality water supply. There is pressure on water mangers from all levels of society to remain in the status quo, given that many of the social expectations for high quality water are legitimate. Breaking from this mode is difficult, but there is increasing evidence that the lack of funds for infrastructure expansion and the acceptance of the concept of sustainable communities are aiding in this shift (Ellison, 2003: PC). To be effective, DSM must work with supply-side options to create sustainable water systems.

1.3.1 The supply-side approach

The 'supply-side' approach has been the basic paradigm of water management throughout the industrialized world, including in water-scarce areas such as the American southwest (Gleick, 2000). Canada's perceived abundance of water has played a significant role in defining urban water management and patterns of use in this mode across the nation. According to Tate (1999: 1), "water management in Canada has focused on manipulating the country's massive supplies of fresh water to meet the needs of Canadians."

"water management in Canada has focused on manipulating the country's massive supplies of fresh water to meet the needs of Canadians"

Underlying this paradigm is the assumption that social water 'needs' are exogenously determined - simply a function of projected population and economic growth - and are insensitive to policy and behavioural changes (Renzetti, 2003: 1; Shrubsole and Tate, 1994: 1). Therefore, the primary concern of supply-side management has been securing and treating sufficient quantities of water to meet forecast demand.

This approach has produced a sprawling stock of infrastructure that marks the countryside and lies beneath urban landscapes. Indeed, with 54 inter-basin diversions and over 150 large dams, Canadians rank among the world's most advanced practitioners of the 'science of water development' (Shrubsole and Tate, 1994: 2).

The dams, diversions, treatment and distribution systems typical of the supply-side approach perpetuate excessive water use as rising demand is continually met with additional supply. These high throughput water systems increasingly strain the long-term economic stability of municipal water utilities and the integrity of the aquatic ecosystems on which they rely (Shrubsole and Tate, 1994: 2; Gleick, 2000: 128).

As centralized water supply and wastewater services extend further into sprawling urban areas, urban societies become increasingly disconnected from the natural systems that provide this vital resource. The self-reinforcing result of this disconnection is an ever-diminishing appreciation of the primacy of healthy freshwater ecosystems in supporting the well-being of Canadian communities.

1.3.2 Demand-side management

After much conflict (particularly through the 1970s and 1980s), DSM became a core component of planning in the energy sector throughout the industrialized world. Indeed, in the intervening decades, new energy needs have been met largely through enhanced conservation and efficiency gains, rather than through the construction of new supply-side projects such as nuclear facilities or hydro dams.

DSM is now gaining recognition in other resource fields, from transportation to paper production to water. In dealing with future urban water supply challenges, DSM is becoming recognized as an alternative, or more accurately, a complementary strategy, especially where a more comprehensive view of the associated environmental and economic costs and benefits is taken.

Adopting DSM into urban water management is intended to reduce, or at most maintain, the current throughput of municipal water systems. In the context of population growth and urbanization, this means increasing per capita water use efficiency so as to reduce or maintain a community's current level of water withdrawals and wastewater discharges.

In general, DSM involves the implementation of policies and programs designed to influence the amount, composition and timing of demand for a given commodity, resource or service. In the context of urban water systems, DSM entails any measure or group of measures that influence the efficiency and timing with which water is used.

DSM takes an integrated approach to urban water management. Increasing water use efficiency reduces the amount of water withdrawn, the volume and quality of wastewater flows, and the ecological impacts related to excessive water use. Brooks and Peters (1988: 10) define water DSM as "any measure which reduces or reschedules average or peak withdrawals from surface or groundwater sources while maintaining or mitigating the extent to which return flows are degraded." Tate (1990: 1) builds on this definition, stressing that the measures taken to increase water use efficiency should be socially beneficial, in the sense that the benefits to society should outweigh the costs.

The demand-side approach brings increased flexibility to urban water management by building demand considerations into planning and decision-making. It expands the perspective of management beyond the large, centralized engineering projects typical of the supply-side approach to include economic, socio-political and physical measures that change behaviour and increase water use efficiency (Tate, 1990). Furthermore, DSM seeks to use existing capital stock more efficiently, with decisions to build additional infrastructure contingent on first investigating opportunities to lower demand.

The demand-side approach brings increased flexibility to urban water management by building demand considerations into planning and decision-making

2. Is there a need for DSM in Canada?

Concern over the sustainability of freshwater supplies is mounting worldwide. Even in Canada, more and more communities are experiencing problems with local water supplies. This section briefly discusses water supply concerns in the Canadian context. See Brandes (2003) for a more detailed and in-depth discussion of urban water use in Canada.

2.1 The Earth's water

The Earth's water is in a constant state of flux. In its migration through the atmosphere, land, freshwater systems and oceans, water intersects almost every aspect of the natural environment and human culture.

Less than 3 percent of all water on Earth is fresh water. Two-thirds of this is locked in glaciers, polar ice caps and permanent snow cover, and is therefore inaccessible for human use. Estimates suggest that only 0.77 percent of the world's freshwater resources are in forms useful to humans (Postel, 1996: 785).

Only the fresh water constantly moving through the hydrologic cycle is considered renewable. Terrestrial renewable fresh water is that fraction that falls over land as precipitation and runs off via rivers and streams, recharging groundwater aquifers and replenishing lakes en route to the sea (Postel, 1996: 785).

On an annual basis, the global hydrologic cycle provides more fresh water than is required to sustain the world's current human population. However, uneven temporal and spatial distribution of the terrestrial portion poses significant supply challenges in many urban centres around the world (Postel, 2000: 941). This water is also critical to the integrity of aquatic and terrestrial ecosystems, and the many species with which humans share this vital resource.

2.2 Fresh water distribution in Canada

In comparison with many areas of the world, Canada is rightly regarded as a water-rich nation. However, notions of 'super-abundance' have resulted in perceptions that Canada has more water than it needs. This entrenched 'myth of abundance' is a result of the confusion between renewable freshwater supplies (i.e. flows) and the stock of fresh water contained in lakes and aquifers (Sprague, 2003: 28). Barring a decision to substantially reduce lake levels and groundwater supplies (our water 'capital'), terrestrial freshwater flows (our water 'interest'), which are far more limited, are the crucial concern for water management and policy (Brooks, 2003: 30).

Despite possessing 6.4 percent of the world's renewable fresh water, Canada is not exempt from the challenges posed by unevenly distributed resources (Sprague, 2003: 28). Sixty percent of the nation's renewable fresh water flows northward through sparsely inhabited territory. This leaves only 40 percent (or 2.6 percent of the world's supply) accessible to the majority of the Canadian population that inhabits a narrow band along our southern border (Sprague, 2003: 28).

This entrenched 'myth of abundance' is a result of the confusion between renewable freshwater supplies and the stock of fresh water in lakes and aquifers

2.3 The urban water challenge

Fresh water plays a defining role in the development of cultures, societies and cities. From the aqueducts that transported water to cities of the Roman Empire to the dams and diversions that bring potable water to contemporary urban centres, the infrastructure created to capture, store and move water has influenced landscapes, economies and cultures since the dawn of civilization (Kaika and Swyngednow, 2000).

Modern industrial societies have dramatically modified the natural flow of the Earth's freshwater systems. As early human settlements have grown and evolved into today's modern cities, urban water infrastructure has come to represent a significant part of the hydrologic cycle.

The pumps, pipes and treatment facilities that comprise municipal water systems transform water from its 'natural' state to a potable form, and in so doing, act as material mediators of a culture's relations with nature. Given the 'distancing' effect of this infrastructure, few people associate fresh water in lakes and rivers with the potable water delivered to their homes. The structures through which this transformation takes place have become a basis for urban life, but are also an integral component of culturally-driven social and economic development in contemporary urban settlements (Kaika and Swyngednow, 2000).

Urban water issues in Canada are becoming increasingly complex. Growing urban populations and excessive water use place significant pressure on local water sources and infrastructure across the country. As de Loë (2003: PC) suggests, "water quantity concerns in Canada are local and multidimensional, encompassing source water availability and quality, and water and wastewater infrastructure capacity." Indeed, while some municipalities struggle to secure additional, high quality supply to meet rising demands, others grapple with ways to treat and dispose of large volumes of wastewater resulting from excessive water use. Many also face severe financial burdens from infrastructure maintenance, upgrade and expansion.

2.3.1 Canadian urban water use

Canadian residents are profligate water users. Nationally, municipal water use accounts for 12 percent of overall freshwater withdrawals, third only to thermal power generation at 64 percent and manufacturing at 14 percent (Environment Canada, 2003). On a per capita basis Canadian urban water use exceeds that of most industrialized countries, with residential water use twice that of many nations sharing similar levels of wealth and standards of living (Brandes, 2003: 12; OECD, 1999).

> ***"water quantity concerns in Canada are local and multidimensional, encompassing source water availability and quality, and water and wastewater infrastructure capacity"***

Water demands in Canada's urban centres are on the rise. After increasing by almost 50 percent from 1972 to 1986, average per capita residential water use appears to have stabilized between 330 and 350 litres per day (Environment Canada, 2001: i). However, due to population growth and increasing urbanization, total water use in the municipal sector continues to rise (Brandes, 2003: 21).

This trend of increasing growth and urbanization is likely to continue. Population growth in the range of 15 to 20 percent is expected over the next 25 years, with the majority occurring in large urban areas and smaller regional centres (Shrubsole, 2001: 5).

Residential demands account for just over half of total municipal water use (Brandes, 2003: 15). As withdrawals and the concomitant wastewater discharges intensify, municipal finances and local aquatic ecosystems are subjected to growing pressures.

2.3.2 Urban water availability

Local and regional water shortages are becoming common in Canada. Environment Canada's 'State of the Environment - 1996' report indicates that, in 1991, one in five municipalities with water supply systems reported availability problems during the previous four years. Even in areas surrounded by some of the world's largest freshwater sources, there are signs of limitations. Between 1989 and 1999, 79 percent of municipal water systems in Ontario experienced at least one water supply problem (Shrubsole, 2001: 4).

The majority of Canadian cities rely on surface water for potable water supply. In these areas, issues of water availability are highly dependent on annual precipitation levels. For example, recent drought conditions resulted in the lowest water supplies in the Great Lakes Basin in over thirty years (Environment Canada, 2000). At present, such conditions are typically temporary and seasonal; however, the long-term reliability of many water sources is questionable given the uncertain impacts of global climate change (SOE, 1996).

Water availability is an even more significant challenge in areas relying on groundwater supplies since replenishment times are often longer than for surface water sources. Current over-pumping of groundwater may result in long-term declines in local supply, and may ultimately necessitate the development of additional sources of supply. For example, to keep pace with regional growth, and in response to concerns over groundwater depletion, the Regional Municipality of Waterloo has prepared plans to construct a 120 km pipeline to Georgian Bay (SOE, 1996).

Many other municipalities are also considering development of more distant sources to augment existing supplies. Sproule-Jones (2003: PC) notes that, "although there is enough water available in southern Ontario because of the Great Lakes, at the community level there are challenges due to poor quality local sources and therefore more efforts to tap into larger lakes." While such options may be technically feasible, the associated financial and environmental costs are significant.

In Canada, reliable, high quality sources of fresh water in close proximity to urban centres have become increasingly scarce or overextended. As Brooks (2003: PC) notes, "many of the best sources of municipal water supply have already been tapped."

2.3.3 Urban water infrastructure

Water quantity problems in many Canadian communities are the product of deteriorating or inadequate infrastructure, and the associated costs of upgrade and repair. According to Brooks (2003: PC), "water issues in many urban centres are capacity and capital problems."

Much of Canada's existing water supply system was constructed prior to World War II (Tate, 1990: 11). Water and wastewater utilities were expanded in many communities during the 1960s in response to increasing urbanization. However, since that time, little attention has been paid to maintenance and upgrade of these systems (Renzetti, 2003: PC; Blease, 2003: PC). This neglect has led to inefficient water systems in many areas. Shrubsole (2003: PC) suggests that some communities lose up to 40 percent of treated water from leaking distribution systems.

"we cannot pretend that natural systems are plumbing networks that can be endlessly manipulated by humans"

Decades of such neglect have resulted in a large urban water infrastructure 'deficit' in Canada. The National Round Table on the Environment and the Economy estimates that the cost of unmet infrastructure requirements just to maintain existing capital stock and service is between $38 and $49 billion. Demands for new capital are expected to exceed $41 billion by 2015 (NRTEE, 1996: 10). In an era of scarce public funding, the financial challenge is formidable if municipal governments are just to maintain and upgrade existing infrastructure, let alone provide additional supply.

2.3.4 Ecological demands

While the ability to secure and distribute large amounts of water plays a pivotal role in the growth and development of Canadian cities, it also has significant ecological impacts. Traditional water management approaches pay little attention to the integrity and health of the natural systems from which water supplies are withdrawn (Gleick, 2000: 128).

High levels of water use increase both the volume of water withdrawn and the quality and quantity of return flows. In many cases, only a portion of the withdrawn water is returned to original sources, and what is returned is often in a degraded state. For example, summer flows in the Grand River system in southern Ontario are comprised of up to 40 percent effluent from wastewater treatment facilities (Sproule-Jones, 2003: PC).

Dams, diversions and excessive groundwater pumping affect the timing, volume and physical characteristics of fresh water. As Bocking (2003: PC) notes, "we cannot pretend that natural systems are plumbing networks that can be endlessly manipulated by humans." The many impacts of infrastructure expansion include fragmentation of aquatic ecosystems, changes in water temperature and dissolved oxygen, as well as disruption of natural hydrologic processes and flow patterns. According to Postel (2000: 943), hydraulic infrastructure is literally killing the aquatic world.

Every drop of renewable fresh water flows through an ecosystem to support essential functions including cycling of nutrients, contaminant flushing, and habitat maintenance. From an ecological perspective, a certain volume of water must remain in place to maintain these functions and secure the health of aquatic ecosystems (Brooks, 2003: PC). Under the current management approach, the extent to which humanity manipulates and undermines the integrity of freshwater ecosystems will only increase as urban water demands grow.

2.4 Summary

Urban water management poses complex challenges in many Canadian communities. These challenges are due to a number of factors including increasing water use, seasonal droughts, failing infrastructure and the associated financial costs, and growing concerns for the integrity of aquatic ecosystems.

Communities across the country recognize the need to address the often conflicting economic, ecological and social concerns relating to municipal water supplies and aquatic ecosystems. Many of those interviewed are emphatic that doing so will require a reorientation of urban water management in Canada.

Supply-side management approaches take water needs as given, and treat fresh water as a limitless resource to be harnessed and distributed to meet growing demands. In many areas, however, economic constraints and ecological concerns suggest that dependence on supply-side solutions may no longer be viable. As Ellison (2003: PC) notes, "simply expanding supply to meet an unrestrained demand just doesn't make sense in most cities."

DSM reframes water management by shifting the context to one that does not perceive all human water 'needs' as exogenously determined. It seeks to design and implement policies and practices to induce physical and behavioural changes that increase the efficiency of water use. By increasing water use efficiency, DSM programs mitigate the burdens of human water use on municipal finances and infrastructure and aquatic ecosystems.

Despite these benefits, the extent to which DSM is being applied to water management in Canada is limited. According to de Loë (2003: PC), "in general, the application of DSM is increasing nationally; however, a bias toward supply-oriented approaches remains the norm."

"simply expanding supply to meet an unrestrained demand just doesn't make sense in most cities"

"It has been demonstrated in many countries that saving water rather than the development of new sources is often the best 'next' source of water, both from an economic and environmental point of view" (Wegelin-Schuringa, 2002). Many interviewees echoed this sentiment, stressing that water conserved through demand-side measures must become recognized as reliable 'new' sources of supply. However, efforts to do so are often constrained by widespread perception that DSM is not effective as a stand-alone solution to long-term water supply issues (Shrubsole, 2001: 3). Indeed, as Brooks (2003: PC) suggests, "[additional] supply is perceived as the only real option to deal with water shortages; conservation is seen as something you do in emergencies only."

The following chapters explore the DSM approach in greater detail. They discuss the policies and practices developed for reducing urban water demands, the major obstacles to substantially moving forward in this area, and some prescriptive measures offered by the experts to address these obstacles.

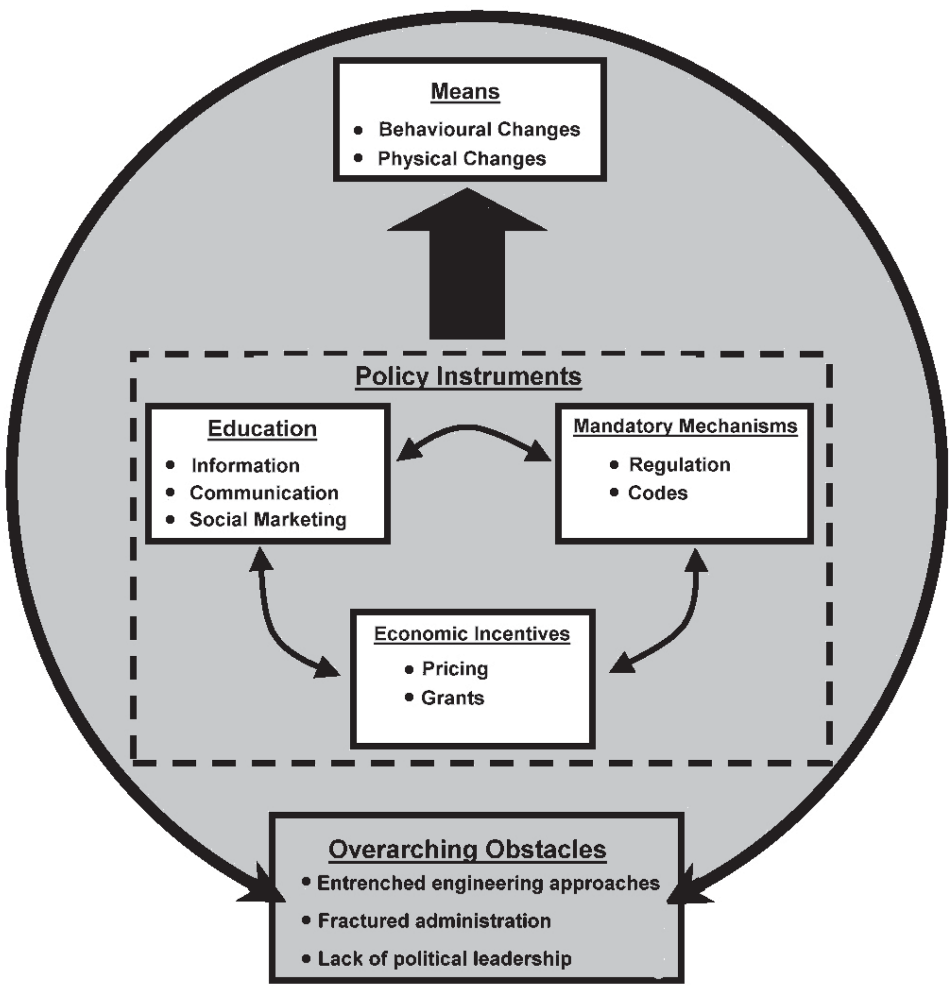
3. Framing the DSM approach

It is widely held that increasing the number of tools available to managers will result in more efficient and effective management. DSM offers increased flexibility to water planners and managers by broadening the range of tools available to them; however, doing so also increases the complexity of management, as many of these tools are interconnected and complementary. Therefore, the challenge of the DSM approach is not one of selecting the correct tool, but rather arriving at an appropriate mix of tools to suit local conditions and values, and to take advantage of the interconnections and synergies among them.

Techniques for increasing water use efficiency are commonly grouped into three categories in the water DSM literature: structural and operational techniques, economic techniques, and socio-political techniques. This report deviates somewhat from this convention to provide a framework for better understanding how the many techniques for reducing demand interrelate, and how associated barriers impede the adoption of DSM.

The process of DSM is divided here into two broad categories: the means for reducing demands, and the policy instruments available to motivate these means. This division is intended to make a clear distinction between the actual activities that increase water use efficiency, and the socio-political and economic instruments that encourage water providers and users to engage in these activities.

Figure 1: A conceptual model of the DSM approach



Two basic means exist to reduce water demand: changing water use behaviour, and making physical changes to municipal infrastructure and at specific points of end-use. These behavioural and physical changes are commonly referred to as structural and operational techniques in the literature.

Behavioural change involves modification of existing water use practices and habits to reduce or eliminate wastage. For example, one can reduce water demand by changing lawn watering to the early morning when losses to evaporation are minimized, or by choosing not to irrigate at all and allowing lawns to 'brown' during periods of drought.

Physical changes refer to structural modifications that increase the efficiency of water use. These changes may occur at the system level (for example, the detection and repair of leaks in municipal distribution lines), or at specific points of end-use, such as through the replacement of older toilets with water-efficient models. Chapter 4 discusses a number of the means for reducing water demands identified by the experts, and the major obstacles to their adoption.

Developing and providing these means do not ensure that they will be adopted and employed. Policy instruments are required to encourage or mandate desired changes to water use behaviour and physical structures. Examples include educational campaigns, pricing policies, and changes to plumbing and building codes. Policy instruments are grouped here into three categories: education, economic incentives, and mandatory mechanisms. These instruments are commonly referred to as socio-political and economic techniques in water DSM literature. Chapter 5 examines the major policy instruments discussed by the experts and the barriers impeding their use.

The framework presented in Figure 1 attempts to conceptualize the process of DSM by illustrating the interconnections among the policy instruments and their (potential) combined influence on the means. It also points to a third and critical dimension to the process of increasing water use efficiency – the overarching obstacles that further complicate DSM, and pose major barriers to its widespread adoption.

These overarching obstacles influence the progress of DSM in two major ways. First, they often impede the process of selecting and implementing an appropriate mix of policy instruments to encourage the application of DSM means. In this sense, they are barriers to the DSM process. Second, these obstacles also influence the degree to which DSM is applied in a given community or region, or if it is applied at all. In this respect, they represent the major barriers to shifting the paradigm of urban water management in Canada from a supply-dominated to a demand-oriented approach. Chapter 6 discusses the major overarching obstacles to DSM identified by the experts, and offers some prescriptive measures to addressing them.

4. The means for reducing water demand

Many behavioural and physical changes are known to reduce urban water demand. This report focuses on those emphasized by the experts during interviews. See Brandes and Ferguson (2004) for a more comprehensive discussion of the many means for increasing water use efficiency.

4.1 Behavioural changes

The goal of behavioural change is to modify activities in which water is used so as to reduce existing levels of waste and inefficiency. Many examples of simple behavioural changes can reduce both indoor and outdoor water use. Within the household, common examples include: reducing the number and duration of showers; closing faucets when not in direct use (e.g. while brushing teeth or shaving); and operating laundry and dishwashing machines only at full capacity.

Common outdoor water use habits are often even more wasteful. During summer months approximately half of all treated water is sprayed onto lawns and gardens (Environment Canada, 2003). Careless irrigation practices such as over-watering and misdirecting flow (for example, onto paved surfaces that direct it into storm sewers) waste much of this water.

Given that irrigation use peaks during dry summer months when supplies are most strained, this waste is of particular concern in communities where seasonal precipitation is highly variable and/or storage capacity is limited. In a number of communities, including Victoria and Vancouver, severe drought conditions in recent years prompted municipal water suppliers to impose major restrictions on outdoor water use in order to maintain sufficient supply for more critical needs.

There is little doubt that altering water use habits can reduce urban water demands. However, entrenched values and attitudes pose major barriers to modifying water use behaviour. For example, according to Pleasance (2003: PC), "one of the toughest things to reduce is lawn watering as it is primarily behavioural change that is needed." As Tate notes (1990: 19), "profligate habits concerning the use of water are deep-seated in the consciousness of most Canadians."

These deep-seated water use habits negatively influence public perceptions of the need for long-term water efficiency programs. For example, Brooks (2003: PC) observes, "Canadians do not view limitations in water quantity as long-term problems; rather, the general perception is that periodic shortages may occur, but these can be resolved with short-term conservation measures."

Speaking at Canada's first national conference on water conservation, Jean Charest, then federal Minister of the Environment, stated, "A major challenge exists to convince Canadians that their water use is a problem. I remember when I was in primary school being taught that Canada had the largest proportion of fresh water in the world. We should not underestimate the effort required to counteract this myth of water abundance" (1994: 430). This challenge is as prominent today as it was a decade ago.

Canada's entrenched myth of abundance is in part what has led us to the water supply challenges now being faced in many communities. As Vassos (2003: PC) notes, "our water shortages are the result of taking water for granted – we want it to come out of the reservoirs for free and we do not want to deal with the consequences of excessive consumption."

"our water shortages are the result of taking water for granted – we want it to come out of the reservoirs for free and we do not want to deal with the consequences of excessive consumption"

4.2 Physical changes

Programs that seek to motivate behavioural change place much of the responsibility for reducing water demand on individual users. While there is potential to reduce water demand by influencing individual water use habits, behavioural change is often difficult to achieve and unreliable over the long-term. Therefore, it is important to consider the physical context within which municipal water supplies are developed, distributed and used in order to achieve lasting demand reductions.

Physical measures for reducing water demands focus primarily on the use of technology to increase water use efficiency or reduce losses in water systems.

One notable exception is the use of water-efficient landscaping practices that use native and drought-tolerant species as a means to reduce watering needs.

4.2.1 Technological efficiency improvements

Countless ways exist to modify or redesign physical water infrastructure to promote greater water use efficiency. Opportunities range in scale from individual households, institutions and industries to municipal water and wastewater networks. Examples include installation of water conserving fixtures and appliances, metering, and detection and repair of leaks in both household plumbing and distribution systems.

The technological capacity required to achieve substantial increases in urban water use efficiency is for the most part well established. In recent decades, a wide variety of 'state of the art' technologies for reducing water demands have emerged in the marketplace. Indeed, "water conservation is not a technical issue; the technology and know-how are well developed" (Blease, 2003: PC).

"water conservation is not a technical issue; the technology and know-how are well developed"

The potential water and financial savings associated with conservation initiatives are significant. For example, the City of Barrie, Ontario, engaged in a replacement program offering high efficiency bathroom fixtures (toilets, showerheads and faucet aerators) to homeowners at no cost. The $4.6 million investment resulted in deferral of $23 million in capital costs for additional sewage treatment capacity (CWWA, 2002). Cochrane, Alberta has realized similar success. There, a multimillion-dollar pipeline was deferred by giving away toilet-tank dams, water-efficient showerheads and faucet aerators (Boyd, 2003: 51).

Those interviewed generally agree that the technical limitations related to increasing household water use efficiency are minimal. In some instances, however, technical concerns do challenge water conservation efforts. Recent research indicates that a number of common ultra low-flush (ULF) toilet technologies do not meet industry performance specifications.

Despite obtaining Canadian Standards Association (CSA) certification, independent testing has demonstrated that four of the ten most popular ULF toilet models currently sold in Canada fail to meet maximum flush volume and/or waste removal performance standards (Pleasance, 2003: PC). While the implications of these findings may seem trivial given that other models are available, the problem is that there is currently no way for consumers to distinguish between models. This problem is compounded by the fact that the failing models are also among the least costly and most accessible products on the market, and as such are typically used in replacement programs and new home construction (Pleasance, 2003: PC).

While these problems manifest as technical issues, they are symptomatic of larger concerns regarding product standards and quality control. According to Pleasance (2003: PC), deficient CSA certification procedures are at the root of these problems. This is clear from the results of the 'Maximum Performance Testing of Popular Toilet Models', a recently completed cooperative project of nineteen municipalities, water utilities and agencies in Canada and the United States.

This study tested over eighty types of toilets against performance-based standards (as opposed to the minimum certification tests used by CSA). Over half of the toilets tested passed the performance testing, illustrating the viability of many ULF toilet designs. Evidence from other jurisdictions (e.g. Australia and Europe) further demonstrates the technical feasibility of ULF technologies. In Canada, however, current certification procedures allow substandard products to enter and remain in the marketplace (Pleasance 2003: PC).

Government has provided little input to address these issues. In Ontario, where the use of these ULF toilets is mandated under provincial building codes, government authorities have failed to offer any form of assistance to address problems with the certification procedures for these products (Pleasance, 2003: PC). Efforts to improve the certification process are primarily being driven by civil society groups. Ellison (2003: PC) notes that the Canadian Water and Wastewater Association (CWWA) is working closely with the CSA on improving the testing and certification procedures.

The persistence of these products on the market and in households has many negative impacts on water efficiency programs. For example, communities engaging in fixture replacement programs may not achieve water reduction targets due to the additional flushing required to compensate for inadequate performance. Furthermore, some interviewees note that substandard products have influenced consumer confidence in water-conserving fixtures, potentially impacting participation rates in voluntary toilet replacement programs. Finally, and perhaps most significantly, Ellison (2003: PC) indicates that many provinces are reluctant to alter building codes to mandate the use of ULF toilets due to these performance issues.

4.2.2 Water reuse

Increasing the efficiency with which existing water supplies are used can substantially reduce urban water demands. In some areas, however, additional sources of supply may still be needed to keep pace with the needs of growing urban populations.

> ***"The scale for water reuse is unlimited – from household greywater systems to communal collectives to municipal wastewater reclamation"***

The conventional approach to meeting these needs is to seek out and develop new, high quality water sources to augment the existing potable supply system. With the best sources of local supply already developed in most areas, many of the experts suggest that reuse of reclaimed wastewater is a more viable option.

The terminology used in discussing water reuse can be confusing. The following definitions are intended to clarify this terminology:

Wastewater reclamation involves treatment of wastewater to a predetermined water quality to facilitate reuse. 'Wastewater' can refer to both municipal wastewater and greywater.

Municipal wastewater refers to wastewater generated from residential, commercial, institutional and industrial sources, which is collected and treated in centralized facilities.

Greywater refers to wastewater from all sources within residential, commercial and institutional settings except that from toilets.

Water reuse refers to the use of reclaimed wastewater for beneficial purposes different from its original use (e.g. use of greywater for toilet flushing).

Water recycling refers to use of reclaimed wastewater for the same purpose it was originally used for. This is most common in industrial applications where wastewater is captured, treated as necessary, and returned to the process.

By increasing the utility of current withdrawals, water reuse can reduce the need for further supply developments and minimize related impacts on freshwater ecosystems. Reclaiming all or a portion of urban wastewater for uses such as toilet flushing and irrigation can also reduce or eliminate the impact of wastewater discharges on receiving water bodies.

In general, any application for which water of potable quality is not required represents an opportunity for water reuse. According to Vassos (2003: PC), "The scale for water reuse is unlimited – from household greywater systems to communal collectives to municipal wastewater reclamation."

Although relatively uncommon in Canada, water reuse systems have been successfully demonstrated in a number of locations. At the household scale, the Toronto Healthy House system treats all wastewater onsite and reuses it up to five times in showers, washing machines and toilets, relying only on precipitation to replenish the home's supply (CMHC, 2003).

On a larger scale, the City of Vernon, BC, reclaims all wastewater from the municipal treatment system for irrigation of agricultural, silvicultural, and recreational lands. This approach has multiple benefits. For example, nutrients in the wastewater that had formerly posed significant ecological stress to Okanagan Lake are now diverted to local lands where they serve as valuable fertilizers (Jackson, 2003: PC).

The proposed use of reclaimed wastewater is often met with public health concerns over human exposure to harmful microorganisms (or pathogens). Despite many successful domestic and international examples, the safety of water reuse in Canada remains an issue of debate. The majority of those interviewed agree that the potential water savings associated with water reuse are substantial, but disagreements persist as to the appropriate scale for reuse systems given the potential for public health concerns.

Most agree that at the community scale, reclamation and reuse of municipal wastewater is a safe and technically feasible management option. In the case of Vernon, BC, the municipality maintains responsibility for the treatment and distribution of the reclaimed water on public lands. In doing so, municipal authorities are able to minimize public health risks by ensuring water quality standards are met, and access to reclaimed water is limited to informed users and appropriate end-uses. According to Jackson (2003: PC), "no documented public health issues have arisen in Vernon's water reuse program since its inception over 25 years ago."

Most of the experts interviewed were also generally optimistic concerning onsite treatment and reuse of wastewater, particularly if limited to the greywater component. Many cited successful cases such as the Toronto Healthy House (discussed above) and the Sooke Harbour House near Victoria, BC, where greywater is treated and reused, as prime examples that demonstrate the technical feasibility and potential for onsite systems. Some, however, were reluctant to endorse onsite reuse, particularly at the level of individual households, citing health issues and costs as major constraints.

"no documented public health issues have arisen in Vernon's water reuse program since its inception over 25 years ago"

According to Rowse (2003: PC), greywater is more difficult to treat than many believe; he suggests that it typically contains enough pathogens to warrant health concerns. Storage of treated water has also been put forward as a persistent technical challenge because bacterial re-growth may result in aesthetic concerns with unpleasant odour and colour. However, Vassos (2003: PC) contends that such issues have largely been overcome and indicates that, although most onsite water reuse systems are still in the demonstration phase, most of the technical issues related to identifying appropriate treatment technologies have been resolved.

A number of interviewees suggest that the proper management and maintenance of onsite systems is the more significant technical challenge. Decentralized treatment and reuse places much of the responsibility for system maintenance on homeowners and property managers. This is of concern to health authorities, as the Canadian public is not accustomed to having water below potable standards within homes and public facilities. Rowse (2003: PC) asserts that household reuse systems should not be considered unless they are under a strict government management structure.

While debate over technical feasibility remains an obstacle, instances exist of greater integration of water reuse into municipal water management. For example, in BC, the Municipal Sewage Regulation permits reclamation and reuse of municipal wastewater and provides guidance for its safe use. This regulation is discussed in greater detail in Chapter 5. Furthermore, a number of organizations, including the CWWA, the Canadian Mortgage and Housing Corporation (CMHC), and the Centre of Sustainable Communities Canada (CSCC) are engaged in the development of national water quality guidelines for reclaimed water, and of protocols for research, validation and commercialization of onsite reuse technologies (Vassos, 2003: PC; Ellison, 2003: PC).

4.3 Summary

Although discussed separately here, behavioural and physical changes are closely related. Behavioural change can be a long and difficult process when faced with deeply entrenched values and habits. In many cases, physical changes, particularly the application of technology, make it possible to achieve substantial water reductions despite these values and habits. Ultimately, however, the two should work in a complementary fashion to achieve the greatest reduction in water demand without sacrificing economic productivity or social welfare.

Experts indicate that, where not already resolved, the technical barriers to increasing water efficiency are surmountable. As Brooks (2003: 33) notes, "though there is ample scope for technical research and information, technology is not the big problem." The greater obstacle to widespread adoption of DSM is the lack of motivating factors to encourage the necessary physical and behavioural changes.

5. Policy instruments for urban water DSM

Identifying and developing the means to support DSM goals does not ensure that the necessary changes will come about. Water users often require motivating factors to encourage or mandate behavioural and physical changes. Similarly, the agencies and institutions responsible for water management generally lack the stimuli to shift from supply to demand management.

Figure 1 grouped the policy instruments for motivating behavioural and physical change into three categories: education, economic incentives and mandatory mechanisms. This chapter discusses a number of specific instruments in each of these categories, as well as barriers impeding their use. The discussion focuses on the policy instruments emphasized by the experts and is not a comprehensive discussion of all policy instruments applicable to urban water demand management. See Brandes and Ferguson (2004) for a more comprehensive discussion of policy instruments.

5.1 Education

Raising awareness of the importance of water conservation and associated techniques is a key component of urban water demand management. According to de Loë (2003: PC), "the general level of awareness regarding water issues is highly variable across the country." The culture of urban water use in Canada has evolved such that unlimited access to high quality water is an expectation. As a result, water users, water managers and political leaders simply may not be cognizant of the levels of inefficiency associated with common technologies and practices, or that more efficient alternatives exist.

"the general level of awareness regarding water issues is highly variable across the country"

Access to educational and promotional materials should not be a barrier to encouraging physical and behavioural change. Materials prepared by organizations such as Environment Canada and the CWWA are readily available to water managers, often at little or no expense. While the quality of these materials is excellent, program design and delivery are major problems affecting the success of many educational initiatives.

Educational programs fall into two broad categories: information-based approaches and social marketing. Information-based programs are the more common approach. These programs rely primarily on large-scale dissemination of promotional materials to induce social change. Common techniques include bill inserts, media campaigns, conservation awards and school-based programs (Shrubsole, 2001: 44).

According to McKenzie-Mohr (2003: PC), although these programs may be effective in raising awareness and changing attitude, studies indicate that behavioural change, and thus increased water use efficiency, rarely occur. Social marketing offers an alternative and relatively unexplored approach. Shrubsole (2001: 45) suggests that the essence of social marketing is to first understand the barriers limiting certain desired behaviours, and second, to develop specific strategies to overcome these barriers.

Conventional education programs tend to focus on information dissemination without developing a sound understanding of the barriers to desired behavioural changes. Social marketing differs from conventional approaches because more time and effort is invested 'up-front' to understand the barriers to desired behavioural changes prior to program design and implementation.

McKenzie-Mohr has developed an approach to social marketing based on the recognition that behavioural change is most effectively achieved at the community level involving direct contact with citizens. Community-based social marketing (CBSM) has been used in a number of communities seeking to encourage behavioural change that supports sustainability initiatives (McKenzie-Mohr, 2003: PC).

The Region of Durham in Ontario has adopted this approach into its outdoor water efficiency program with notable success. In 1997, the regional municipality began employing summer students in a CBSM program to work with homeowners to reduce residential lawn watering. Students visit each homeowner three to four times over the summer to provide information and advice on effective and water-efficient lawn care.

In 2000, the municipality instigated a study utilizing CBSM techniques to reduce lawn watering in a neighbourhood. Zone metering was used to compare water use in the study area to that in a control area where the CBSM approach was not applied. From this data it was determined that the CBSM approach resulted in a 32% reduction in peak water demand (Pleasance, 2003: PC). The key to the success of this program, and the CBSM approach in general, is direct contact between end-users and those delivering the program.

While approaches such as CBSM have successfully increased awareness of water conservation and changed water use behaviour among end-users, education is still considered by many to be the least effective DSM instrument. A number of experts suggest that one of the major barriers to effective educational programs is a lack of expertise and experience in program delivery.

Given that urban water management has traditionally focused on large physical structures, engineering experts tend to dominate the field. Many interviewees note that the design and delivery of educational programs is often uncomfortable territory for water managers, so they are commonly overlooked or undervalued as effective management instruments.

"one of the major challenges with moving forward on water reuse may not be public health, but public perceptions regarding health risks"

Educational barriers are also prominent impediments to water reuse. According to Rowse (2003: PC), "one of the major challenges with moving forward on water reuse may not be public health, but public perceptions regarding health risks." Many interviewees note that public education is critical both to alleviating such perceptions and to ensuring that consumers are aware of safe practices for the use of reclaimed water.

While many interviewees anticipate that reuse may indeed become an accepted practice in Canada, it is widely held that a lack of knowledge at the management and political levels is a major impediment to progress. Brooks (2003: PC) suggests that education of politicians and planners is critical as they are largely unaware of the extent of the opportunity that exists to reduce urban water demand through reuse.

Many indicate that conducting and sharing the results of demonstration projects is also vital to increasing social awareness and raising the profile of water reuse as a viable management tool. For example, the CMHC has produced a number of publications and maintains an extensive website on the Toronto Healthy House to share information and experiences on this project (CMHC, 2003).

Public education is often the first instrument adopted by communities embarking on a DSM program – primarily because it is relatively inexpensive and easy to administer. While many interviewees stress the importance of education in promoting DSM, education alone is not sufficient. As de Loë (2003: PC) notes, "public education and communication will only get you so far; other measures are needed to get people change their water use behaviour."

Educational programs rely solely on voluntary adoption of DSM practices. Many note that policies relying on voluntary change, for example those encouraging voluntary reduction of greenhouse gas emissions, have been ineffective. It is widely held among interviewees that without the influence of economic incentives and/or mandatory mechanisms, the behaviour and decisions of politicians, managers and water users will continue to focus on supply-side solutions to urban water challenges.

5.2 Economic incentives

The vast majority of those interviewed consider a general lack of economic incentives as the most significant impediment to DSM in Canada. Economic instruments for motivating behavioural and physical change include conditional infrastructure funding programs and water pricing schemes.

5.2.1 Conditional infrastructure funding

In Canada, major infrastructure works and improvements are funded primarily through grants and transfers from provincial and federal governments to municipalities. Many interviewees suggest that these arrangements should be leveraged to encourage DSM at the municipal level by making water efficiency a requirement for the approval of funding.

In certain regions, this mechanism is already being used to some degree. For example, to be considered for provincial infrastructure funding, municipalities in BC are required to submit water conservation plans with grant applications for water and wastewater infrastructure. Tying infrastructure funding to water conservation plans not only raises the profile of DSM in municipalities, but also encourages the integration of water efficiency into longer-term water planning.

A number of interviewees question the effectiveness of this mechanism as currently applied. Agencies that provide and administer funding for major infrastructure seldom enforce conditional water conservation plans, and there is no mechanism for withdrawing issued funds. Therefore, once municipalities are issued funds, little or no incentive exists to follow through on proposed water efficiency plans.

Interviewees suggest a number of ways that federal and provincial governments can better leverage infrastructure-funding programs to promote water efficiency. Enforcement of conditional conservation plans is an important first step. A number of the experts note that plans should be much more comprehensive, requiring that municipalities explore all opportunities to reduce demand as a condition of infrastructure funding. Ultimately, funding transfers should be for DSM, not contingent on it, thereby shifting financial priorities away from supply-side infrastructure toward development and implementation of DSM programs.

"until we get the prices right, we will continue to have water supply problems"

5.2.2 Water pricing

Water pricing schemes are often considered the most effective economic incentive to encourage water use efficiency. There are two elements to municipal water pricing: prices and rate structures. Currently, both elements pose barriers to furthering DSM in Canada.

The need for water metering

Consideration of volume-based water pricing requires that some form of metering be in place. A widespread lack of metering is a major barrier to the use of water pricing in Canada. Shrubsole (2001: 31) reports that only 55 percent of single-family homes in Canada are metered for water services. By contrast, many countries with similar levels of wealth, including the United Sates, Finland and France, report levels of water metering at 90 to 100 percent. Most of the experts interviewed advocate universal metering as a critical first step toward the use of pricing instruments in urban water management.

From a technical perspective, metering should not pose a significant barrier. According to Blease (2003: PC), the technical capacity exists to monitor water flow across the entire scale of municipal water networks, from distribution systems to households to specific household fixtures.

It has been suggested that metering alone, without any change in pricing levels, may reduce water use. Tate (1990: 17) references several studies that support this observation, asserting "that metering alone could reduce municipal water use by 15 - 20 percent over pre-metering values." Brooks and Peters (1988: 20) report that installation of meters without any increase in price has resulted in permanent reductions in municipal water use of 10 to 40 percent. However, many suggest that metering on its own is generally unreliable, as water use often rebounds to pre-metering levels in the absence of a price incentive.

Lack of sufficient price signals

Canadian municipal water prices rank second lowest among OECD nations while per capita water use is among the highest (Shrubsole, 2001: 37). The OECD (1999) has gone as far as calling Canadian water "cheaper than dirt." In fact, Canadians pay more for a beer or a coffee than we pay for 1,000 litres of treated drinking water (Boyd, 2003: 47).

The influence of these low prices is reflected in our profligate water use, and has in part led to the infrastructure deficit observed in many communities across the country. According to Tate (2003: PC), "until we get the prices right, we will continue to have water supply problems."

The vast majority of interviewees agree that Canada's water pricing regime is a major impediment to sustainable urban water management. Effective water pricing schemes send signals to both users and suppliers of the limit and value of the resource, and encourage them to engage in the behavioural and physical changes that reduce waste and increase efficiency (Tate, 1990: 5). According to Brooks and Peters (1988: 17), there is "overwhelming evidence that higher prices for water do lead to reductions in use."

The experts agree that, in most regions, no economic incentives exist to encourage water users to apply water-efficient technologies and techniques. Ellison (2003: PC) suggests that to date we have failed to make the 'water-efficient home' as appealing an investment as we have done with energy. In comparing typical energy bills at $200 per month to water costs at $40 monthly, he notes, "we still don't have the [economic] trigger."

Many of the experts observe that the progress of water reuse is also limited by current water pricing. While some contend that wastewater can be cost-effectively treated for reuse applications under current pricing arrangements, others maintain that significant increases in the price of water and wastewater services will be required to stimulate widespread adoption of reuse in urban water management. Regardless of these contrasting views, it is widely held that if Canadian water prices better reflected costs, water reuse would become a more appealing management option.

Average vs. marginal cost pricing

Water prices in Canada do not reflect the 'true' value of the resource and seldom even recover the complete costs of treatment and distribution. To be economically efficient, water prices should account for all of the costs of providing water and sanitation services to users. This should include opportunity costs of urban water use where alternative uses of the resources or aquatic ecosystems exist. Examples of alternative uses include agriculture, industrial uses and ecological services such as habitat maintenance and pollution assimilation. A long history of subsidies and narrow definitions of 'cost' have resulted in low retail prices that undervalue the resource; these issues persist across the country today.

Renzetti (2003: PC) suggests that problems exist with the overall economic approach to developing water prices in Canada. The most common approach is average cost pricing. Under this approach, the current operating costs of a utility are determined from labour, material (e.g. chemicals for treatment), and maintenance expenses, and the cost of servicing existing debt. Retail prices are then set to recover these costs.

There are three major problems with this approach. First, much of the information used in these calculations is based on historical data – for example, the cost of infrastructure when it was constructed 20 or 30 years ago. Second, the costs of future upgrades, maintenance and expansion of infrastructure are seldom considered. Finally, the process does not include the external costs to society of water and sanitation services, such as pollution from wastewater treatment facilities (if they even exist), and the negative impacts of dams and diversions on aquatic ecosystems.

Average cost pricing results in low prices that do not signal the 'true' cost of urban water services to end-users. According to Renzetti (2003: PC), from an economic perspective, marginal cost pricing is the preferred approach. In contrast to average cost approaches, pricing based on marginal cost theory attempts to look forward by considering the costs of each additional unit of water.

"because we don't price according to distance and/or peak demands, utilities have extended their services too far and built capacity too large"

Under a marginal cost approach, the future costs of providing water and sanitation services are estimated (e.g. over the next 10 years) and current prices are set accordingly. Future costs typically include changes in operating costs resulting from increased use of existing infrastructure and the cost of expanding infrastructure to meet additional demand. In some cases, attempts are even made to include environmental costs.

Time and distance are also considerations for marginal cost pricing. Time is of concern because the marginal cost of supplying water often varies seasonally or at different times of day (i.e. peak demand). Distance should also be considered since it is more expensive to supply areas further from water sources due to increased pumping and infrastructure costs (Renzetti, 2003: PC).

Not only does average cost pricing misrepresent the 'true' costs of water services, it also encourages over-development of municipal water infrastructure. According to Renzetti (2003: PC), "because we don't price according to distance and/or peak demands, utilities have extended their services too far and built capacity too large." In essence, existing pricing approaches reinforce a negative cycle of infrastructure expansion and persistent over-consumption.

By better signalling the 'true' costs of water services, individual water use will be optimized. Providing more accurate pricing signals can reduce water use and defer infrastructure expansions. Marginal cost pricing sends signals to users that better inform them of the consequences of increasing water use, such as the need for future infrastructure developments and the negative impacts of excessive water use on aquatic ecosystems.

Rate structures

Rate structures are the second element of water pricing. Two general categories of rate structures are common in municipal water operations: flat and volume-based rates. Flat rate systems charge users a fixed amount in each billing period regardless of the volume of water used. In contrast, volume-based systems charge users for the actual amount used in each billing period.

"Rate structures are as important to the DSM approach as the actual prices charged" (Brooks 2003: PC). By charging a fixed fee for unlimited water use, flat-rate structures provide no incentive to increase water use efficiency. Indeed, Canadian households billed on flat rate schedules use 70 percent more water than those under volume-based schedules (Environment Canada, 2001).

"Rate structures are as important to the DSM approach as the actual prices charged"

Despite this evidence and existence of alternative approaches, flat rates continue to predominate in Canada. Shrubsole (2001: 35) indicates that in 1996, 56 percent of over 1400 Canadian municipalities surveyed were using flat rate structures for water billing.

Economic theory suggests that goods and services that are not appropriately priced will be over-consumed. By linking the cost of water to the amount used, volume-based rate structures signal to consumers the costs of increasing water use, or conversely, the financial benefits of using water more efficiently. Despite ample information and expertise on the design of pricing regimes to encourage demand reductions, there has been little progress on reform of water pricing policies in Canada.

The issue of water pricing transcends simple economic solutions. Water pricing reform is a component of larger policy issues concerning the way in which urban water systems are financed, and the way in which efficiency and equity are defined. Many interviewees note that reform of water pricing policy requires consideration of social equity, and related to this, must consider contentious issues such as the socio-economic definition of water and the privatization of water utilities.

The equity challenge

In Canada, water pricing policy has traditionally involved recovering operating costs for water systems at the municipal level through some sort of user-pay mechanism. Funding for major infrastructure, however, is typically subsidized through general taxation, primarily from higher levels of governments.

From an equity perspective, this is considered by many to be a progressive social policy because it ensures 'sufficient' water is supplied to all citizens regardless of ability to pay. Historically, this social policy has overshadowed the need for efficient water management, as subsidized water prices do not signal to consumers the 'true' cost of providing the service.

Shifting policy objectives to require complete financing of water systems (infrastructure and operations) through user-pay mechanisms will require significant increases in municipal water prices. Some are concerned that doing so will undermine social policy objectives that seek to ensure universal access to potable water. This, in essence, is 'the equity challenge': balancing the 'human right' to clean, safe water with the ability to pay for the water 'commodity' services that are suitably priced to encourage less wasteful patterns of use.

It is often argued that flat-rate systems are inequitable because low volume users subsidize wasteful users. As Bakker (2003: PC) notes, "it is unfair that in a society such as ours with large differences in income that all members pay the same amount for water services regardless of the volume used." However, she also suggests that pricing based solely on consumption rather than ability to pay may penalize low-income users. Therefore, the challenge to urban water managers is to implement a pricing system that ensures social equity, cost recovery and conservation objectives are achieved.

Many experts suggest that increasing block rate structures can be designed to achieve these goals. Basic water needs can be met by providing an initial block to all users at minimal cost. This initial block, commonly referred to as a 'lifeline', reflects typical household needs for potable water (e.g. cooking, sanitation, drinking). By charging successively higher prices for additional blocks, high water users have the choice to either pay more for their profligate use or engage in water conservation. Although in theory this appears to be a simple solution, many low-income households have high occupancies and inefficient water fixtures. Therefore, equity is still of concern because household water use may exceed the lifeline volume, and income constraints restrict the move to high efficiency fixtures.

Commons or commodity? Public or private?

Underlying the equity debate in water pricing is the socio-economic definition of water. Is water to be viewed as a commons (public good) or a commodity (economic good) for management purposes?

"water pricing is about sustainable resource management and social equity, not about privatization"

Proponents of the commons view assert that as water is essential to life, it is a human right that should be collectively managed (either by communities or the state) with social equity the primary goal of policy and management. In contrast, the commodity view regards water as an economic good, not markedly different from other essential goods or utility services. Proponents of this view hold that economic efficiency should be the primary goal of policy and management, and therefore promote the use of market or market-simulating mechanisms (Bakker, 2002: 12-1).

A number of interviewees suggest that the debate around the socio-economic definition of water impedes the use of pricing instruments in water management. Some suggest that the use of economic instruments, such as marginal cost pricing or 'full' cost recovery, is a prelude to privatization. The argument is based on concerns that the use of economic concepts to increase water use efficiency in a sense commercializes water, and that calls to further commercialize it by shifting responsibility for its provision into the private sector will not be far behind.

According to Bakker (2003: PC), this discussion confuses privatization and commercialization, which are two different issues. Privatization entails involvement of the private sector (to varying degrees) in water management, but does not necessarily imply commercialization. On the other hand, commercialization applies the principles of private sector management and neoclassical economics (i.e. marginal cost pricing and full cost recovery) to water management, but does not necessarily involve participation of the private sector. For example, a public utility may take a commercialized approach to operating water systems to recover costs and increase water use efficiency, but not relinquish management or ownership to the private sector.

Bakker (2003: PC) also suggests that the debate over the socio-economic definition of water is seldom an issue at the level of municipal and regional governments where water-pricing regimes are implemented. She asserts, "water pricing is about sustainable resource management and social equity, not about privatization," and goes on to note, "even if water is viewed as a public good, when it is processed and distributed, pricing must be considered because there are considerable costs associated with supplying treated water" (Bakker, 2003: PC).

Some suggest that, given the potential political repercussions of increasing water prices, the private sector has far greater liberty than do public utilities to operate water systems in an economically efficient manner. However, many feel that, unless regulated to do so, private corporations possess little incentive to engage in water conservation or pricing regimes that incorporate social and environmental values. One interviewee suggests, "If we ultimately negotiated a contract for the public good, there may not be a worthwhile private venture."

5.3 Mandatory mechanisms

Mandatory or 'command and control' mechanisms may be used to prescribe specific behavioural and physical changes that promote efficient water use. Typical examples include plumbing and building codes and regulatory instruments.

In Canada, current regulatory instruments fail to effectively promote the adoption of DSM. Given that most aspects of water management in Canada are under provincial authority, many suggest that the major impediments exist at this level of government. A number of unique regulatory instruments that support demand-side solutions have been developed over the past decade, for example the BC Municipal Sewage Regulation and the Sustainable Water and Sewage Systems Act in Ontario. However, the general consensus is that these examples remain the exception, not the norm.

5.3.1 Plumbing and building codes

Current building and plumbing codes were identified by many of the experts as significant impediments to the DSM approach. The Canadian Commission on Building and Fire Codes (CCBFC), a component of the National Research Council, is responsible for the development of national building and plumbing codes. These national codes serve only as guidelines. Plumbing and building regulation is the responsibility of provincial and territorial governments, which adopt or adapt national codes and enforce their requirements.

The City of Toronto estimates that total water demand for the period of 1996 to 2011 will be reduced by 62 million litres per day based on these building code changes

Currently, national and provincial codes fail to promote the use of water-efficient fixtures. Ontario is the sole province in which the building code has been updated to mandate the use of water conserving fixtures. The impacts of this code change are expected to reduce urban water consumption significantly. The City of Toronto estimates that total water demand for the period of 1996 to 2011 will be reduced by 62 million litres per day based on these building code changes alone (City of Toronto, 2002: 37).

Ellison (2003: PC) indicates that the next revision of the national code is expected to prescribe the installation of high efficiency fixtures for all new buildings. However, the onus will remain on provincial and territorial authorities to adopt and enforce these changes. As noted previously, there may be resistance because of performance issues with a number of water-efficient toilet technologies. Provincial and territorial authorities may be unwilling to adopt the mandatory use of water-efficient fixtures to avoid future problems if these issues are not resolved.

Existing plumbing codes are unclear on the use of reclaimed water. While the current National Plumbing Code (1995) does not prohibit water reuse outright, it does pose barriers to the use of reclaimed water. The code does allow for dual water distribution systems to accommodate the use of both potable and reclaimed water. At the same time, it prohibits the discharge of non-potable water through outlets such as faucets or toilets, and prescribes that every water distribution system be connected to a potable water supply (CMHC, 1998).

A number of experts suggest that the national code, and provincial and territorial equivalents, must be strengthened to promote the use of reclaimed water. For example, altering codes to require dual plumbing is seen as an essential step toward greater use of reclaimed water. Some assert such changes are not currently a priority in Canada, suggesting that widespread use of reclaimed water is unlikely to occur in the near future. Yet it is simpler and less costly to incorporate dual plumbing into new construction than to retrofit completed buildings. Therefore, many experts suggest that appropriate code changes be made now to allow for the incorporation of dual plumbing into all new buildings as a 'future proofing' measure.

5.3.2 Regulatory instruments

In most Canadian provinces, water and wastewater regulations limit wastewater reclamation and reuse. Only Alberta and BC have developed regulatory instruments and guidelines that permit the use of reclaimed wastewater; other provinces may allow individual projects on an experimental basis.

In BC the Municipal Sewage Regulation (1999) and associated Code of Practice for the Use of Reclaimed Water (2001) permit large-scale water reclamation projects. The regulation is applicable to projects dealing with flows greater than 22.7 cubic meters (5000 gallons) per day. According to Vassos (2003: PC) "this regulation is far ahead of the rest of Canada in facilitating water reuse."

The regulation takes a 'performance-based' approach by prescribing outcomes (e.g. water quality criteria) rather than specific processes or techniques to achieve those outcomes. The regulatory framework includes water quality standards and detailed guidelines on appropriate end-uses for reclaimed water.

Water quality standards and allowable end-uses are founded on the basic principle of public health protection (BC MELP, 2001: 3; CCME, 2002: 9). Examples of allowable end-uses include (but are not limited to): irrigation of agricultural and recreational lands, fire fighting, toilet and urinal flushing, snow- and ice-making, and a variety of industrial applications (BC MELP, 2001).

In many areas, water reuse projects fall under the jurisdiction of public health authorities. This is particularly true of smaller-scale or 'onsite' household and institutional systems, the majority of which are still in experimental phases. For example, the BC Ministry of Health Services is responsible for proposed water reuse projects with flows less than 22.7 cubic meters per day. In most cases, onsite reuse projects are administered through permitting processes, which tend to be administratively intensive and therefore much more time consuming than performance-based regulations.

A number of interviewees note that public health authorities are often reluctant to issue permits for reuse systems. According to Ellison, (2003: PC), "public health ministries in Canada soundly argue that water systems are essentially risk-free at the moment. Why would they consciously make moves to increase this risk to save a bit of water without assurance that such systems will be safe?" Some suggest that the conservative approach taken by public health authorities and the administratively intensive nature of permit-based regulation are major impediments to water reuse in Canada.

Under the Sustainable Water and Sewage Systems Act, Ontario has made it mandatory for municipalities to assess and recover the full cost of providing water and sewer services

5.3.3 Water quality criteria for reuse

While specific water reclamation and reuse regulations typically include water quality criteria for a range of end-uses, currently no national guidelines exist for water reuse in Canada. A number of interviewees note that the development of water quality standards for reuse is being considered at the national level. Groups such as the CWWA and CMHC, as well as provincial and federal public health authorities, are involved in the discussions.

Some debate exists among those interviewed regarding water quality criteria for reuse, particularly concerning indoor applications such as toilet flushing. Some suggest the potential for human contact in these circumstances warrants a conservative approach, and propose that guidelines for harmful microorganisms in reclaimed water should be equivalent to those for potable water. While setting such strict criteria may minimize public health concerns, it often translates to increased treatment costs, which in turn diminish the feasibility of water reuse.

A number of interviewees suggest that recreational water quality guidelines are a more appropriate benchmark for reclaimed water. Recreational standards allow for slightly higher levels of microorganisms given that the risk of human infection is far less than for potable water. It is argued that the risk of human infection in water reuse applications is also far less than for potable water, and that guidelines similar to those for recreational waters are sufficient to protect public health.

5.3.4 Pricing regulations

As discussed above, Ontario is the only province to have adopted full cost pricing principles into its regulatory framework for water supplies. The province undertook this initiative based on recommendations from the Walkerton Inquiry. Under the Sustainable Water and Sewage Systems Act (2002), the province has made it mandatory for municipalities to assess and recover the full cost of providing water and sewer services.

Many interviewees suggest that this legislation is an important step forward in the use of pricing instruments for managing urban water demand. They also note that long-term success will be contingent on clear guidelines for determining full costs, and on proper oversight of financial accounting procedures to ensure compliance with the new regulation. To date, the Ontario government has not published guidelines in support of the Act and many remain sceptical of the legislation, noting that without guidelines, the full potential of this legislation to promote water efficiency will not be realized.

5.4 Summary

It is widely held among the experts interviewed that the lack of a strong pricing stimulus is the most prominent barrier to encouraging the physical and behavioural changes that will reduce urban water demand. Many note, however, that pricing reform is not a 'silver bullet' solution, but that integration of the available policy instruments is key to the success of the DSM approach.

Many interviewees stress the importance of education as a vital complement to the development and implementation of pricing instruments to influence water demand. Shifting policy away from highly subsidized water rates toward user-pay approaches is a highly charged political issue. Education is seen as critical to ensuring that water users understand why this shift is taking place, and informing them of the physical and behaviour changes that can increase water use efficiency and mitigate the financial impacts of rising water prices.

The majority of the experts interviewed consider the lack of political leadership as the most significant barrier to the use of pricing as a water management tool. Municipal politicians avoid the politically contentious issue of water pricing reform. To alleviate some of the political obstacles at municipal and regional levels, many experts suggest that water metering and full cost pricing principles should be incorporated into provincial and territorial water regulations.

The discussion in Chapters 4 and 5 suggest that both the means for reducing water demands and the instruments for stimulating behavioural and physical change are for the most part well developed. Despite this fact, the progress of DSM in Canada is stalled – limited primarily to the use of voluntary programs and short-term conservation measures. A number of over-arching obstacles emerged from discussions that shed light on the limited application of DSM, and the persistence of unsustainable urban water management practices.

. . . pricing reform is not a 'silver bullet' solution, integration of the available policy instruments is key to the success of the DSM approach

6. Overarching obstacles

Discussions with the experts concentrated primarily on the means and policy instruments that comprise the process of DSM. Nevertheless, the consensus among interviewees is that moving forward on DSM will require future efforts to shift from ‘how to do it’ (the means and policy instruments), to promoting the higher level changes needed to make it happen. As Bocking (2003: PC) suggests, “we have so much knowledge about water that we are not using; we know what we should be doing, it’s just a matter of getting on with it.”

This chapter introduces a number of overarching administrative and institutional obstacles to the progress of DSM: entrenched engineering approaches, fragmented administration, and a lack of political leadership. Other obstacles are not included here; Brandes and Ferguson (2004) provide a more complete discussion of many obstacles.

6.1 Entrenched engineering approaches

The predominance of the supply-side paradigm is in part a product of a bias toward engineering practices and expertise in the field of water resource management. The influence of this bias is apparent in both public and private sector participants in urban water management.

“we have so much knowledge about water that we are not using; we know what we should be doing, it’s just a matter of getting on with it”

Municipal water utilities are usually managed and operated by water supply engineers who are comfortable with traditional ‘big pipe’ solutions (de Loë, 2003: PC). Many note that this is a major barrier to the DSM approach because of its different emphasis on socio-political and economic techniques, which require very different skill sets than those found in the engineering profession. As de Loë (2003: PC) notes, “venturing into the institutional and educational realm is often difficult for managers who have been trained exclusively in engineering aspects of municipal water supply.”

The engineering bias also plays a significant role in water planning. According to Tate (2003: PC), “the wrong people are making the decisions and influencing politicians and financiers; engineers typically don’t understand the complete dynamics of the problem.” In essence, the background and experience of many current utility managers and water planners are not well suited to DSM and instill significant institutional resistance to change.

A bias toward large engineering solutions is also dominant in the private sector. As Vassos (2003: PC) notes, “large engineering firms that are typically more familiar with supply-side approaches continue to do most of the thinking and planning with respect to urban water systems.” It is uncommon for major engineering firms to consider even physical DSM solutions such as low flow water fixtures and decentralized waste treatment systems, let alone educational and economic tools. As a result, many opportunities to increase water use efficiency, particularly through water reclamation and reuse, are being lost. Once a large capacity centralized system is installed, there is little incentive to examine decentralized or onsite reuse initiatives (Vassos, 2003: PC).

The DSM approach does not propose a wholesale movement away from physical engineering solutions, but seeks to focus efforts on existing infrastructure and to reorient the scale of physical solutions toward smaller scale, decentralized projects. For example, ample opportunity exists for the design, development and operation of water reclamation and reuse systems as integral components of current water supply infrastructure.

Diversifying the expertise of current water management institutions is necessary to facilitate the shift from supply to demand-side management. Many of the experts note that greater emphasis must be placed on the social and economic aspects of water use, and that doing so requires education and diversification of existing staff in order to realize the full potential of the DSM approach.

6.2 Fragmented administration

Water resource management in Canada has been described as a “bewilderingly complex administrative galaxy”. Regulatory and administrative responsibilities for water management are fragmented among multiple levels of government, and various agencies within these levels. This fragmentation poses significant barriers to the progress of DSM.

In Canada, development and administration of water management policies are distributed among federal, provincial/territorial, and regional/municipal governments. Within each level of government, administrative responsibilities are also fragmented among a number of agencies concerned with economic, environmental and health issues. On average, three to four agencies of government may be involved in water efficiency initiatives. Poor communication and coordination among these groups often impedes efforts to integrate DSM into water management.

A number of interviewees note particular difficulties in areas where two-tiered municipalities exist (i.e. a regional authority supplying water wholesale to member municipalities). The internal structures, information systems and policies of regional and local bureaucracies are often very different. These differences frequently impede communication and information sharing, which in turn pose significant barriers to concerted efforts on water efficiency projects.

Two-tiered municipal structures also impose barriers to pricing reform. In these cases, the regional districts responsible for providing treated water and maintaining the related infrastructure have no control over retail prices. Lower tiers are reluctant to increase prices due to political concerns.

A lack of cooperation between municipal and provincial levels of government is also an issue. For example, in an effort to strengthen local water conservation programs, a number of municipal and regional water agencies have requested building code changes to mandate the use of water-efficient fixtures, but such requests have not been given priority by the responsible provincial agencies.

Many interviewees note that the lack of inter-agency integration within provincial and territorial governments is a major barrier. The vertical organization typical of provincial bureaucracies is such that there is little communication among the ministries accountable for municipal funding programs, environmental quality and public health, all of which play important roles in water management.

Addressing the barriers to DSM imposed by the fragmented nature of water resource management in Canada is no simple task, but possibilities for reform are apparent. For example, opening the lines of communication among the many agencies and levels of government involved in water management would help promote cooperative efforts on water efficiency initiatives. At the provincial and territorial level, multi-agency task forces could be set up with clear mandates and the authority to make changes. Ultimately, addressing the many social, economic and environmental aspects of water management may require restructuring of existing agencies and decision-making processes to promote more comprehensive, integrated and innovative solutions to growing water problems.

Box 1: Quayside Village - A Case in Point

The residents and developers of Quayside Village, a multiunit co-housing project located in North Vancouver, BC, have experienced first hand many of the challenges of DSM. Their experiences demonstrate the need for an integrated approach that combines technical innovation and effective incentive programs.

The 19 unit residential complex includes an experimental greywater reuse system funded by the CMHC. All water from sinks and showers is collected and treated for reuse in toilet flushing. The ‘village’ has also been double plumbed to permit future reuse of greywater in showers.

By reusing greywater, water demand and wastewater flows are reduced by 40%; the associated savings in water bills are expected to offset the costs of the reuse system. However, this innovative approach to urban water management has not been without its challenges.

Health authorities required over a year of testing to demonstrate system reliability before approving it for use. The systems operators also experienced difficulties finding professionals willing and capable of taking on the maintenance contract - the system is too complex for most plumbers, but too small for most engineering firms to be interested.

Through patience, persistence and the ongoing support of the CMHC, appropriate maintenance expertise has been identified and all permits are in place. However, new challenges have arisen.

Since the project’s inception, local water suppliers have changed billing structures for multi-unit dwellings from a volume-based to a flat-rate system. The new billing system is a counter-incentive for water conservation.

The message to residents? - Conserve water, but pay the same as the people who don’t!

6.3 Lack of political leadership

Many interviewees suggest that a general lack of political leadership on water issues is the most challenging obstacle to furthering the progress of DSM. Despite the primacy of water to the social, economic and ecological health of Canadian communities, water management issues generally receive little political attention at any level of government.

At the municipal level, water systems are largely absent from political agendas unless serious drought, water quality or infrastructure capacity issues arise. When such issues do arise, they are commonly dealt with on a reactive basis using politically benign measures. When water quantity issues arise, the typical response is to impose short-term conservation efforts until additional supply can be secured.

A number of interviewees suggest that this neglect arises because water and wastewater services rely on 'sunk' infrastructure. As water infrastructure is not readily visible to the public, water issues are not viewed as major political concerns. In an era of limited budgets, municipal politicians are more likely to invest in highly visible services such as roads and policing to maintain or win support among voters.

. . . a general lack of political leadership on water issues is the most challenging obstacle to furthering the progress of DSM.

Water pricing and metering are contentious political issues. Pricing reform is particularly sensitive because Canadian prices have been maintained at low levels for so long; as a result, large increases in price will be required to realize any impact on demand. Municipal politicians are for the most part unwilling (or unable) to substantially increase water prices, as doing so would jeopardize their political careers. Indeed, asking constituents to spend more money for a low visibility service that has historically been inexpensive and unregulated invites confusion and hostile reactions among the citizenry.

The major criticisms concerning the lack of political support for DSM is targeted at the provincial level. As noted previously, many interviewees suggest that provincial leaders should be taking a far greater leadership role on water pricing to get around political challenges at the municipal level. Action at this level is far easier politically.

Significant potential also exists for provincial and territorial authorities to promote DSM by leveraging their authority in areas such as pollution control, infrastructure funding, and building regulation. Measures such as expediting changes to building and plumbing codes, developing enabling regulations that promote water reuse, and shifting funding priorities to demand-side solutions are among the many ways provincial authorities can accelerate the progress of DSM.

Many interviewees also note that there is no longer a concerted leadership effort with respect to water issues within the federal government. Indeed, in discussing the state of federal leadership one interviewee suggests, "they are for the most part irrelevant at this point." While water management does not constitutionally fall within federal jurisdiction, interviewees suggest that federal authorities should be playing a much stronger supporting role by identifying best practices, funding applied research, and collecting, analyzing and disseminating data in support of water efficiency initiatives.

A number of interviewees note that data collection initiatives by the federal government have been minimized in recent years. This information is critical to understanding patterns of water use across the country, and is an important input to long-term water planning and policy. Many are critical of existing data collection initiatives and recommend that efforts in this area should be strengthened, not diminished.

6.4 Summary

Entrenched engineering practices and values, fragmented administration of water management, and a general lack of political leadership on water issues are examples of the numerous overarching obstacles limiting the progress of DSM. Many of these obstacles are not specific to the DSM approach, or even the field of water resource management, but are symptoms of the broader decision-making processes and misplaced priorities of many political and administrative institutions. These obstacles make the shift from supply to demand-side management difficult and complex.

Although the experts stress the need to shift efforts away from the means and policy instruments of DSM toward addressing these overarching obstacles, few solutions were proposed in the interviewing process. As such, further research and action is clearly needed in this area.

7. Future directions

This report discusses some of the major technical means, policy instruments and overarching obstacles identified by experts in the field of urban water management. It provides an up-to-date background of the discussion occurring within the water policy community on what is required to stimulate a shift from supply to demand-side management.

At present, DSM is viewed as a stopgap measure to deal with water shortages until additional supply can be developed, and the financial capital to do so can be secured. Many interviewees stress that the potential for DSM extends far beyond mitigating the impacts of seasonal water shortages. It is widely held that DSM must be recognized as a long-term community-planning tool that is both economically and ecologically superior to traditional supply-side developments.

One of the primary benefits of DSM is that it can be implemented on an incremental and iterative basis. It is an effective strategy for dealing with short-term water shortages, and is instrumental to long-term planning for sustainable water management. The many tools and diffuse nature of DSM increases the flexibility for water managers to deal with future changes in climate, hydrological conditions, and water use patterns. DSM programs are more adaptable than supply-side measures to uncertain economic conditions, since investments are diversified, and financial and technical risks are generally smaller.

> ***. . . effective governance is central to addressing and resolving many of the major barriers to the progress of DSM***

Moving from supply to demand-side management is complex. The challenge is multidimensional, involving change in all sectors of society – government, economic institutions and water users. A significant shift in the paradigm of water management is required – from centralized structures, such as dams and new treatment facilities, to smaller-scale and more diffuse solutions, such as water-efficient fixtures; from high throughput water and wastewater systems, to water reuse, which seeks to maximize the use of water withdrawals; and from a focus on large engineering projects that satisfy demand, to social and economic instruments that reduce it.

Based on discussions with the experts, facilitating the shift to DSM is not an issue of can demand be reduced, or even how to stimulate demand reductions, but rather will society choose to do so. Many of the means for reducing water demand and the policy instruments to encourage the adoption of these means already exist. According to Brooks (2003: 33), efforts now need to focus on the institutions that can creatively manage and accelerate the adoption of DSM practices and policies – on governance of demand management.

The majority of the experts interviewed did not explicitly discuss governance, and it is therefore not directly addressed in this report. However, this report recognizes that effective governance is central to addressing and resolving many of the major barriers to the progress of DSM.

Education Developing institutional capacity in water management to design, implement, and administer effective DSM programs is critical. This requires diversification beyond the present engineering focus to incorporate knowledge and expertise in education and the economics of water management. Education of water managers, community planners and politicians on the potential for demand-side solutions is required to ensure that DSM is given full consideration in water planning, and to facilitate a movement away from status quo supply-side solutions.

Investing in long-term and more effective approaches to education will instil a lasting 'water ethic' in Canadians. A better understanding of water issues and the benefits of water efficiency are needed throughout Canadian society – by school children, water users, municipal leaders and government decision-makers. Advancing this understanding can be accomplished in a variety of ways; by changing school curricula, promoting professional seminars and workshops, and formally recognizing the importance of DSM in provincial and federal policy and strategic documents. For example, community-based social marketing, an educational approach that directly engages the public in learning, is effective in changing water use behaviours, and may begin to dispel the 'myth of water abundance' that continues to influence Canadian water use habits.

Economic Incentives Economic incentives that stimulate water use efficiency are central to DSM. Establishing water prices that better reflect true costs of the resource and implementing rate structures that ensure both equitable access to potable water and water conservation are policy priorities.

Regulatory Mechanisms Water pricing regulations, such as Ontario's Sustainable Water and Sewage Systems Act, that require a better indication of the full economic and environmental costs of supplying water, and that deal with the concomitant wastewater, are an important first step. The success of such regulations will be contingent on clear guidelines for determining 'full' costs and oversight of financial accounting procedures to ensure compliance. Making such changes to provincial policy and regulations also insulates local leaders from the political backlash of water pricing reform.

Beyond these pricing reforms, provincial governments should consider additional regulatory changes. Building and plumbing codes must be revised to mandate the use of water-efficient fixtures in new construction and renovations. Product standards and sound certification procedures for water-efficient technologies are needed to ensure that the full impact of these code changes will be realized.

"water laws and policies must evolve to reflect the ecological realities of limited water supplies, limited capacity to absorb pollutants, and the needs of aquatic ecosystems."

Leadership Senior governments must provide leadership on water reuse to ensure it is incorporated into future water management strategies. National guidelines for reclaimed water quality and appropriate practices for its use are required to guide provinces in developing sound regulatory instruments that enable water reuse and at the same time ensure that public health is not compromised. The BC Municipal Sewage Regulation is an excellent benchmark for developing national guidelines and water reuse regulations in other jurisdictions.

Funding Funding transfers from federal and provincial governments to municipalities must shift from the traditional priority given to supply-side solutions to promoting DSM. A good first step is to make public subsidies contingent on implementing water conservation programs. Ultimately, federal and provincial governments should provide direct incentives by designating funding specifically for DSM programs.

These policy and regulatory changes can influence water use efficiency in a number of ways. They will encourage the use of water-efficient technologies, influence water use behaviours, accelerate the adoption of water reuse as a viable source of supply, and stimulate innovation in sustainable technologies for water management.

Planning New approaches to planning and decision-making concerning urban water management should also be examined. Conventionally, cities delegate responsibility for future water planning to engineering firms with little public consultation – a process that commonly results in supply-side solutions.

Robinson (2003: PC) suggests that greater public engagement in water planning is needed. Communities should be informed of the economics, technical constraints, and ecological impacts of both supply-side and demand-side scenarios for meeting future water demands. By informing and engaging the public, future water plans and developments will better reflect community values and concerns.

Social Commitment Firm commitment to water efficiency in long-term community plans is important to ensure lasting change. For example, the city of Melbourne, Australia has decided that for the next 50 years all additional water supply will come through DSM programs. Robinson (2003: PC) suggests that many cities in Canada could do the same and would, in fact, find that doing so costs less than developing new sources of supply.

... to an Ecosystem Approach The growing water demands of Canada's urban centres must be managed to maintain the ecological integrity of local watersheds. To accomplish this, urban water management and policy must look beyond its current anthropocentric focus and recognize that maintaining the underlying ecological processes that provide this vital resource is critical to sustainable water management. Boyd (2003: 52) asserts, "water laws and policies must evolve to reflect the ecological realities of limited water supplies, limited capacity to absorb pollutants, and the needs of aquatic ecosystems."

The shift from supply to demand-side management will require strong political leadership at all levels of government. An important role exists for Canadian water experts to influence political decision-making and ensure that the necessary regulatory and policy changes are made to facilitate this shift.

Appendix A

Directory of Water DSM Practitioners

Directory of Associations and Organizations

Directory of Water DSM Practitioners

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Diana Allen's research interests include groundwater resource evaluation, impacts of climate change on groundwater, and aquifer thermal energy storage.

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Karen Bakker's research interests include water supply privitization, private sector participation in water supply management, and community participation in water management.

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Maude Barlow and the non-governmental organization The Council of Canadians are working to protect Canada's public fresh water resources from privitization and bulk export.

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Author of The Restoration of the Great Lakes

Contact: email: sproulem@mcmaster.ca
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Dorie St. Jean

Water Conservation, Water and Waste Department,
City of Winnipeg

Dorie St. Jean works with the City of Winnipeg's water conservation program.

Contact: 510 Main St.
Winnipeg, MB R3B 1B9
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Directory of Water DSM Practitioners

Troy Vassos

President, NovaTec Consultants Inc.

Troy Vassos is a professional environmental engineer and process specialist currently developing national water quality standards and technology verification protocols for water reuse technologies on behalf of the Canada Mortgage and Housing Corporation.

Contact: 224 West 8th Ave.
Vancouver, BC V5Y 1N5
web: www.novatec.ca
email: troy@novatec.ca
tel: (604) 873-9262

Craig Walker

Utility Manager,
Charlottown Water and Sewer Utility

Craig Walker is a civil engineer who manages the City of Charlottetown's water and sewer utility.

Contact: 199 Queen St., PO Box 98
Charlottetown, PE C1A 7K2
email: cwalker@city.charlottetown.pe.ca
tel: (902) 629-4014

Deborah Walker

Water Demand Management Coordinator,
Capital Regional District

Deborah Walker develops and implements water demand management programs for the Capital Regional District surrounding Victoria.

Contact: 479 Island Highway
Victoria, BC V9B 1H7
email: dwalker@crd.bc.ca
tel: (250) 474-9684

Carl Yates

General Manager,
Halifax Regional Water Commission

Carl Yates oversees the municipal water utility for the Halifax Regional Municipality, which provides potable water to Halifax's urban core and operates small systems throughout the rural parts of the municipality.

Contact: PO Box 8388, Stn A,
6380 Lady Hammond Rd.
Halifax, NS B3K 5M1
email: general_manager@hrwc.ns.ca
tel: (902) 490-4820

Sherman Yee

Engineer, Waterworks Design Branch,
Engineering Services, City of Vancouver

Sherman Yee oversees water conservation and quality for the City of Vancouver.

Contact: 453 W. 12th Ave.
Vancouver, BC V5Y 1V4
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tel: (604) 871-6189

Wayne Zhan

Senior Engineer, Policy and Research Team,

Demand Side Management Division,

Greater Vancouver Regional District

Wayne Zhan is a professional engineer whose experience includes water conservation, water and wastewater planning and design, regulatory compliance issues and long-term capital planning.

Contact: 4330 Kingsway
Burnaby, BC V5H 4G8
email: wayne.zhan@gvrd.bc.ca
tel: (604) 436-6814

Directory of Associations and Organizations

Atlantic Canada Waterworks Association

Dedicated to assisting water purveyors in the provision of adequate quantities of safe drinking water.

Contact: Box 74
Porter's Lake, Nova Scotia B3E 1M1
www.acwwa.ns.ca

Agricultural Groups Concerned About Resources and the Environment

The Farm Environmental Agenda outlines the strong commitment of farmers, through Environmental Farm Plans, to document present environmental conditions on their farms, develop a strategy for making appropriate changes, document actual farm practices and use those data for the development of new farm environmental initiatives. Jointly administers Ontario Pesticide Education Program with OMAFRA.

Contact: 40 Eglinton Ave. West, 5th Floor
Toronto, Ontario M4P 3B1
www.agcare.org

American Water Resources Association

Advances research, planning and management of water and provides forum for communication of ideas and best practices.

Contact: #300, 950 Herndon Pkwy
Herndon VI 20170-5531 USA
www.uwin.siu.edu/~awra/

American Water Works Association

Promotes public health and welfare in the provision of drinking water of unquestionable quality and sufficient quantity. Affiliated with the Canadian Water and Wastewater Association and other groups.

Contact: 6666 West Quincy Ave.
Denver, CO 80235 USA
www.awwa.org

Assembly of First Nations

The focus of AFN is to gain constitutional recognition of Natives as distinct peoples both legally and politically. Has committee on the Environment, Conservation and Sustainable Development and Great Lakes environmental health impacts.

Contact: One Nichol St., 10th Floor
Ottawa, Ontario K1N 7B7
www.afn.ca

Association of Municipalities of Ontario

The purpose of AMO is to unite Ontario's municipalities, to promote and enhance effective municipal government, and to provide strategic leadership by developing quality policy to educate governments, the media and the public. Has an Environmental Committee.

Contact: #1701, 393 University Ave.
Toronto, Ontario M5G 1E6
www.amo.on.ca

British Columbia Water and Waste Association

Safeguards public health and the environment through the sharing of skills, knowledge and experience in the water and wastewater industry.

Contact: #221 - 8678 Greenall Avenue
Burnaby, British Columbia V5J 3M4
www.bcwwa.org

Canada Mortgage and Housing Corporation

CMHC is the Government of Canada's national housing agency. Improves housing and supports the housing market by being the key Canadian source of reliable and objective housing information. Active in water conservation policy and research including projects on water efficient fixtures and water reuse.

Contact: 700 Montreal Road
Ottawa, Ontario K1A 0P7
www.cmhc-schl.gc.ca

Directory of Associations and Organizations

Canadian Association of Energy Service Companies

Represents companies involved in providing energy efficiency and conservation goods and services. Seeks to attain national and provincial energy efficiency, conservation and alternative energy objectives in an environmentally responsible manner.

Contact: 9 Village Squire Lane
Thornhill, Ontario L3T 1Z8

Canadian Council of Ministers of the Environment

Establishes and maintains an intergovernmental forum for discussion and joint action on environmental issues; harmonizes environmental legislation, policies, procedures and programs; develops nationally consistent environmental objectives, standards and databases, complimentary strategies, accords and agreements.

Contact: #360, 123 Main Street
Winnipeg, Manitoba R3C 1A3
www.ccme.ca

Canadian Environment Industry Association, Ontario Branch

Comprised of Ontario-based companies that provide technologies and services to protect the environment and help achieve sustainable development.

Contact: #102, 23 Lesmill Road
Toronto, Ontario M3B 3P6
www.ceia.on.ca

Canadian Environmental Auditing Association

Comprised of practitioners of environmental auditing. Encourages the discipline of environmental auditing and its development.

Contact: 6519B Mississauga Road
Mississauga, Ontario L5N 1A6
www.mgmt14k.com/ceaa

Canadian Environmental Network

Comprised of NGOs with focused on environmental concerns and which share the objectives of CEN. The CEN is an independent, non-partisan organization. It does not take positions on environmental issues. Rather, the CEN actively encourages and supports those who take part in public consultation processes, participate in working groups, or who are delegates to national and international conferences.

Contact: 300-945 Wellington St.
Ottawa, Ontario K1Y 2X5
www.cen-rce.org

Canadian Institute for Environmental Law and Policy

Analyzes current environmental issues in Canada and provides leadership in developing environmental law and policy. Affiliations include Canadian Environmental Network and Great Lakes United.

Contact: #400, 517 College Street
Toronto, Ontario M6G 4A2
www.cielap.org

Canadian Institute of Planners

Comprised of professional community and regional planners in the public and private sectors. Promotes discussion on sustainable human settlements. Publishes Plan Canada journal.

Contact: #801, 116 Albert Street
Ottawa, Ontario K1P 5G3
www.cip-icu.ca

Canadian Institute of Resources Law

Has completed studies related to mining, forestry and the environment.

Contact: PF-B 3330, University of Calgary
2500 University Drive NW
Calgary, Alberta T2N 1N4
www.ucalgary.ca/~cirl

Directory of Associations and Organizations

Canadian Ground Water Association

Comprised of members who belong to a provincial Ground Water or Water Well Association. Encourages the management and protection of ground water by creating partnerships for public awareness and utilization, serves as a recognized steward of the groundwater resource in Canada, promotes the development of ground water guidelines and strategies.

Contact: PO Box 60
Lousana, Alberta T0M 1K0
www.cgwa.org

Canadian Homebuilders Association

Comprised of members involved in the residential construction industry. Involved in the development of an Energy Building Code and an Environmental Code of Practice.

Contact: #200, 150 Laurier Ave. West
Ottawa, Ontario K1P 6M7

Canadian Public Works Association

Aims to create a forum for public works professionals in Canada to exchange information, develop ideas, and share skills, knowledge and technologies on issues unique to Canada.

Contact: 253 College Street, Suite 191
Toronto, Ontario M5T 1R5
www.apwa.on.ca

Canadian Sanitation Supply Association

Comprised of manufactures or distributors of sanitation products and services. Promotes discussion and public awareness about the sanitation industry.

Contact: #G10, 300 Mill Road
Toronto, Ontario M9C 4W7
www.cssa.com

Canadian Standards Association

The CSA is a not-for-profit membership-based association serving business, industry, government and consumers in Canada and the global marketplace. It is comprised of 7000 volunteers who contribute to standards writing committees. In Canada and around the world, the CSA works to develop standards that address public safety and health, advance quality of life, help to preserve the environment, and facilitate trade.

Contact: 5060 Spectrum Way
Mississauga, Ontario L4W 5N6
www.csa.ca

Canadian Urban Institute

Brings together private, public and not-for profit sectors to address the challenges facing large cities in Canada and abroad.

Contact: 10 St. Patrick Street, 6th floor
Toronto, Ontario M3T 3A3
www.canurb.com

Canadian Water Quality Association

Promotes individual rights to quality water, educates water professionals, promotes the growth of the water quality improvement industry, serves as a unified voice in government and public relations, provides a role in consumer education.

Contact: #330, 295 The West Mall
Toronto, Ontario M9C 4Z4
www.cwqa.com

Directory of Associations and Organizations

Canadian Water Resources Association

Stimulates public awareness and understanding of Canada's water resources, and encourages recognition by all governments of the high priority of water as a resource. Encourages the formulation of appropriate water policies, provides a forum for the exchange of information related to management of Canada's water resources, and participates with appropriate agencies in international water resource activities. Has branches in eight Canadian provinces.

Contact: PO Box 1329
Cambridge, Ontario N1R 7G6
www.cwra.org

Canadian Water and Wastewater Association

Comprised of 131 corporate, 18 institutional members and others. Represents the common national interests of Canadian water and wastewater systems, particularly related to the management, legislative and regulatory issues and especially in respect to the actions of the federal government. Has regional association members in Atlantic Canada, Quebec, Ontario, Western Canada, British Columbia, and the Northern Territories (contact information for these at www.cwwa.ca/membdir/regional.htm). Also maintains the online Water Efficiency Experiences Database, which encourages the exchange of information and best practices in water efficiency (access at www.cwwa.ca/WEED/index.asp).

Contact: #402, 45 Rideau Street
Ottawa, Ontario K1N 5W8
www.cwwa.ca

Conservation Council of Ontario

Committed to the conservation of the environment and natural resources for the common good and sustainable future of Ontario.

Contact: #600, 3 Church Street
Toronto, Ontario M3E 1M2
www.greenontario.org

Conservation Ontario

Coordinates the activities of the province's conservation authorities.

Contact: Box 11, 120 Bayview Parkway
Newmarket, Ontario L3R 4W3
www.conservationontario.org

Environment Probe

Restores strong property rights in order to empower Canadians with the means to protect the environment; promotes full-cost water pricing to protect the quality of Canadian waters.

Contact: 225 Brunswick Avenue
Toronto, Ontario M5S 2M6
www.nextcity.com/environmentprobe/

Federation of Canadian Municipalities

The Federation of Canadian Municipalities (FCM) has been the national voice of municipal government since 1901. FCM is dedicated to improving the quality of life in all communities by promoting strong, effective and accountable municipal government. Has a standing committee on Environmental Issues.

Contact: 24 Clarence Street, 2nd Floor
Ottawa, Ontario K1N 5P3
www.fcm.ca

Federation of Northern Ontario Municipalities

Liaises with the provincial government in support of Northern Ontario municipalities.

Contact: 81 St. Brendon Street
Sudbury Ontario P3E 1K4

Great Lakes United

US-Canada organization that promotes the conservation and protection of the Great Lakes-St. Lawrence ecosystem.

Contact: #307, 2360 rue Notre Dame Ouest
Montreal, Quebec H3J 1N4

Directory of Associations and Organizations

Greenpeace Canada

Conducts peaceful public protest to protect the environment, as well as scientific, economic and policy research.

Contact: 605, 250 Dundas Street West
Toronto, Ontario M5T 2Z5
www.greenpeacecanada.org

IRC International Water and Sanitation Centre

Facilitates the sharing, promotion and use of knowledge so that governments, professionals and organizations can better support poor men, women and children in developing countries to obtain water and sanitation services they will use and maintain.

Contact: PO Box 2869, 2601 CW
Delft, The Netherlands
www.irc.nl

Lifewater Canada

Christian organization dedicated to helping the rural poor obtain safe water.

Contact: PO Box 44
Kakabeka Falls, Ontario P0T 1W0
www.lifewater.ca

Municipal Engineers Association

Association of public sector Professional Engineers in the full time employment of municipalities performing the various functions that comprise the field of municipal engineering

Contact: #2, 530 Otto Road
Mississauga, Ontario L5T 2L5
www.municipalengineers.on.ca

Northern Territories Water and Waste Association

Advances knowledge in the design, construction, operation, and management of water works, wastewater treatment and disposal works, and solid waste site works. Encourages friendly exchange of information amongst its members, improves the professional status of all personnel engaged in any aspect of the provision of water and sanitation services to the public.

Contact: #201 - 4817 49th Street
Yellowknife, NWT X1A 3S7
www.ntwwa.com

Ontario Association of Landscape Architects

Promotes and improves the profession and supports improvement and/or conservation of the natural, cultural, social and built environment.

Contact: #101, 2842 Bloor Street West
Toronto, Ontario M8X 1B1
www.oala.on.ca

Ontario Federation of Agriculture

Has developed "Our Farm Environmental Agenda" (in cooperation with AgCare, Christian Farmers' Federation, and Ontario Farm Animal Council) that outlines a commitment to environmental management on farms.

Contact: 40 Eglington Avenue, 5th Floor
Toronto, Ontario M4P 3A2
www.ofa.on.ca

Ontario Ground Water Association

The Ontario Ground Water Association was created in 1952 as a not-for-profit organization to facilitate the various sectors of the groundwater industry coming together for the delivery of safe and clean water supplies throughout the Province.

Contact: 7522 Aberfeldy Line, R. R. #2
Bothwell, Ontario N0P 1C0

Directory of Associations and Organizations

Ontario Municipal Administrators' Association

The members of the OMAA are dedicated to the concept of effective, democratic local government by responsible elected officials. They strive to enhance the value of the municipal order of government by promoting continuous improvement in municipal government administration and leadership excellence in local public service throughout Ontario.

Contact: 101-49 Emma Street
Guelph, Ontario N1E 6X1
www.omaa.on.ca

Ontario Municipal Management Institute

Facilitates and promotes management development programs for municipal personnel.

Contact: PO Box 58009
Oshawa, Ontario L1J 8L6
www.ommi.on.ca

Ontario Municipal Water Association

The OMWA is a spokesperson for the municipal water supply authorities in Ontario, and works to improves municipal water supply. An affiliate of the AWWA.

Contact: #69, 225 Benjamin Road
Waterloo, Ontario N2J 3Z4
www.omwa.org

Ontario Sewer and Watermain Construction Association

Represents sewer and watermain construction contractors. Has Clean Water Action Committee.

Contact: #300, 5045 Orbitor Drive, Unit 12
Mississauga, Ontario L4W 4Y4
www.oswca.org

Ontario Water Works Association

Primary objective is to promote the protection of public health and the environment, in the interest of providing safe drinking water to the consuming public, through the efficient management and operation of water supply facilities and resources.

Contact: 45-23rd Street
Toronto, Ontario M8V 3M6
www.owwa.com

POLIS Project on Ecological Governance

A research team that investigates new strategies for developing sustainability, and pursues ecological alternatives in economic and constitutional policy. The Urban Water Demand Management (UWDM) Project at POLIS seeks to understand the structure and dynamics of urban water use, and to provide mechanisms to help reorient Canadian water management from supply to demand-side approaches.

Contact: PO Box 3060, University of Victoria
Victoria, British Columbia V8W 3R4
www.polisproject.org
www.waterdsm.org

Pollution Probe Foundation

Defines environmental problems through research, promotes understanding through education, and presses for practical solutions through advocacy.

Contact: 12 Madison Avenue
Toronto, Ontario M5R 2S1
www.pollutionprobe.org

RÉSEAU environnement

Ensures the development of technologies and science, the promotion of expertise and the support of activities in the environment field.

Contact: 911, rue Jean-Talon est, bureau 220
Montréal, Québec H2R 1V5

Directory of Associations and Organizations

Soil and Water Conservation Society

Fosters the science and the art of soil, water and related natural resource management to achieve sustainability. Promotes and practices an ethic recognizing the interdependence of people and the environment.

Contact: 945 SW Ankeny Road
Ankeny, Iowa 50021-9764
www.swcs.org

Stockholm Environment Institute

Supports decision-making and induces change towards sustainable development around the world by providing integrative knowledge that bridges science and policy in the field of environment and development.

Contact: Box 2142
S-103 14 Stockholm, Sweden
www.sei.se

Water Environment Association of Ontario

Organization of technical and professional individuals dedicated to the preservation and enhancement of Ontario's water environment.

Contact: PO Box 176
Milton, Ontario L9T 4N9
www.weao.org

Water Environment Federation

Informs the general public about water quality issues, including household hazardous waste, biosolids recycling, and watershed management. Offers workshops and seminars to wastewater professionals. Produces technical publications on water quality topics ranging from prevention and control of sewer overflows to water reuse.

Contact: 601 Wythe Street
Alexandria, VA 22314-1994 USA
www.wef.org

WaterCan

Organizes World Water Day and clean water projects. Raises awareness of the need to manage water resources responsibly and effectively.

Contact: 323 Chapel Street
Ottawa, Ontario K1N 7Z2
www.watercan.com

Western Canada Water and Wastewater Association

Promotes and advances knowledge, design, construction, operation and management of water and wastewater systems.

Contact: #203, 301 - 14 St. NW
Calgary, Alberta T2N 2A1
www.wcwwa.ca

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POLIS Project on Ecological Governance:
An Organization for Transformative Solutions

Created in 2000, The POLIS Project on Ecological Governance, seeks to discover and implement solutions to pressing issues that can build healthy and sustainable communities. Among the many research centres investigating and promoting sustainability world-wide. POLIS is unique in its focus on multidisciplinary research and action and in that its work strives to blend academic research with community engagement.

The concept of ecological governance is exciting in that it offers an alternative to extrative, linear and un-sustainable systems that continue to level anciant forests, displace indigenous and local communities and clog and choke our global cities. Instead ecologicalgovernance asks how we might foster circular systems in which we reduce our demands on distant (and local) ecological systems.

Whether it be through investigating the shift from suppy to demand management in our use of minerals or water, re-imagining new forms of urban 'smart growth' such as the eco-innovative university campus, or reforming local land tenures for indigenous and local community, re-vitalization or overhauling national environmental laws, the the thrust of all of our research is guided and informed by the concept of ecological governance.

How to contact us:
The POLIS Project on Ecological Governance
PO Box 3060, University of Victoria
Victoria, BC
V8W 3R4

email: polis@uvic.ca
www.polisproject.org

POLIS Project on Ecological Governance
University of Victoria