What we govern and what governs us:

Developing sustainability in Canadian water management

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ABSTRACT

The era of unlimited water supply is ending. Aquatic ecosystem degradation, climate change, regional water scarcity and increasing water demands driven by population and economic growth are all factors contributing to the demand for water security. Ecological limits to human water use exist and are increasingly apparent. In Canada, water scarcity is primarily a social dilemma – one that requires attention to the social contexts that shape decision making, attitudes and behavior.

Ecological governance addresses the need for institutional reforms that enable and embed ecologically sustainable solutions. Our paper applies this concept to water governance in Canada, exploring the complexities inherent in facilitating change in social institutions and decision making. Such change necessitates focused attention on addressing conflicting values, interests and priorities for water and ecosystems, and requires that water governance progress beyond managing watersheds toward managing how people live as watershed citizens.

We focus our attention "at the source" and investigate why and how current approaches to water allocation must evolve to address scarcity and protect ecosystems. Under a system of ecological governance, only after basic human and ecological needs are met, can water be used for additional human activities. This requires, at a minimum, an institutional commitment to increasing water productivity.

Establishing limits and recognizing ecosystems as legitimate "users" of finite water resources are critical steps toward sustainable water management. While grounded in the science of eco-hydrology, sustainable water management is inevitably a problem of social decision making. Going beyond a theoretical experiment in governance we hope to provide specific direction for Canadian water planners and policy makers. We conclude the discussion by exploring how the water challenge demonstrates the need for a broader dialogue on *developing sustainability* – the process through which ecological principles become embedded in institutions and decision making.

Introduction: Canada at a watershed

"The water crisis is essentially a crisis of governance."
UNDP World Water Report 2003

During much of the 20th century, Canadian legal frameworks and social policy encouraged rapid economic growth to develop livelihoods for a growing population. For the nation's freshwater systems, this mode of development resulted in substantial withdrawals and large-scale modification of aquatic ecosystems. While critical to the social and economic security we have come to expect, as we emerge into the 21st century, Canadian water policy is at a watershed.

For scientists and policy makers alike, freshwater management has expanded in scope. The tradition of social and economic development premised on seemingly endless supplies of high quality fresh water has all but run its course. Cumulative and anticipated implications of 20th century water development combined with uncertainties related to global climate change are increasing social demand for water security and aquatic ecosystem protection. Solutions to water scarcity are no longer considered the exclusive domain of engineers and technicians. Fostering the transition toward sustainable freshwater management is now recognized as largely a social challenge.

Fresh water is emerging as the strategic resource of the 21st century. In a recent poll, 200 leading scientists from 50 countries ranked a lack of fresh water as an environmental priority second only to global climate change (Praxis Inc., 2001; United Nations, 2000). Despite our relatively abundant supplies, Canada is not immune to water security concerns. For example, Schindler & Donahue (2006) warn of impending water crises for Canada's western prairie provinces. In southern Ontario, regional concerns are such that "Development pressures … existing hydrological variability, and possible future increases in the incidence and duration of droughts will make balancing human and ecological water needs increasingly difficult" (Ivey, Smithers, de Loë, & Kreutzwiser, 2001: 9). And in British Columbia, a decision that embodies a precautionary approach by the Environmental Appeal Board (EAB), imposed limits on water withdrawals in

response to the absence of suitable water planning.[3] This growth in concern across the country supports Schindler's (2001: 26) assertion that "unless there is a quick reversal in recent trends in water management, fresh water will become Canada's foremost ecological crisis early this century."

Many Canadians still believe that our water resources are boundless. This so called "myth of abundance" must be shaken if we are to develop a more sustainable relationship with our freshwater systems. Water is a finite resource, hydrologic and ecological limits to withdrawals and ecosystem modification exist. However, given our economic wealth, and our capacity for policy innovation and technical ingenuity, water scarcity in Canada is primarily a social dilemma. Indeed, the challenge we face is much more a crisis of governance than resource scarcity – one that requires focused attention to the social conditions that shape decision making, attitudes and behavior.

Toward a paradigm shift

"Old-think" – Water as a limitless resource

Supply-side water developments typified 20th century water policy, planning and management in industrialized countries, including Canada. The product of this tradition is a vast stock of large, centralized and technical infrastructure – the dams, reservoirs, pipelines and treatment technologies critical to our social security and economic prosperity. This same infrastructure – and the supply-side mode of development – has also disrupted hydrological processes and damaged aquatic ecosystems. Continuing down this path is at odds with a transition toward an ecologically sustainable society (Brandes & Ferguson, 2004; Brooks, 2005; Gleick, 2000, 2002; Maas, 2003; Postel & Carpenter, 1997).

In its failure to acknowledge water as a limiting factor to economic growth, the supply-side paradigm reflects a philosophical stance that Dryzek (1997) refers to as a

[3] The August 9, 2005 decision of the BC Environmental Appeal Board in McClusky and Mulligan v Assistant Water Managers is available at www.eab.gov.bc.ca.

"Promethean" perspective on environmental problems. Despite broadly accepted notions of ecological limits to economic growth, the Promethean perspective asserts that human ingenuity will allow us to escape the limits of a finite biosphere (Dale, 2001; Dryzek, 1997; Meadows, Meadows, Randers, & Behrens, 1972; Wackernagel & Rees, 1996). In the water context, this perspective is apparent in the supply-side paradigm, which holds that the only real constraints on economic growth are the technological developments and financial resources required to harness, store and transport more water. Under the supply-side perspective, plans for future water needs are developed by extrapolating past and current water use and consumption patterns into the future. This in turn instigates infrastructure projects deemed necessary to meet projected water needs. The product is "more of the same" with little regard for changing water use behaviours, economic conditions, social preferences, environmental health or ecological constraints (Postel, 2003; Wolff & Gleick, 2002).

Conservation and efficiency – A new source and a new paradigm

Consensus is building that further supply-side development is, in most cases, simply unsustainable. Increasingly, conservation and efficiency[4] are viewed as the best "new" sources of water for Canadian communities and for water-dependant activities up and down the watershed. This changing view marks the emergence of a new paradigm of water management – one driven by a multitude of confounding factors, including climate change, rapid urbanization, conflicting priorities for public funds, and increased environmental consciousness. Not only is reducing water demand through conservation and efficiency often a cheaper alternative to almost any supply-side option, it can be implemented more rapidly, adaptively[5], and with less environmental damage than supply-side options.

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[4] Efficiency is a *means* and conservation an *end*. Efficiency results in some conservation, but may also serve as permission to consume (Brandes & Brooks, 2006).

[5] The decentralized and small-scale nature of demand-side solutions can be implemented incrementally in response to changing social values, economic trends, ecological conditions and scientific information.

While water conservation and efficiency still depend on existing supply-side infrastructure, the primary focus shifts to managing demand for water rather than continually increasing supply to meet projected future needs.[6] The overarching goal is to delay – or ideally to eliminate – the need for additional supply-side developments by maximizing the productivity of existing infrastructure and by using less water more efficiently.[7] Despite its potential, as demand management is currently applied, its full potential remains unrealized.

An ecological paradigm of water governance

Water demand management does not just happen. To effectively meet its goals, this new approach must better integrate disparate demand management measures into comprehensive, long-term strategies through innovative water planning (e.g. The "soft path" for water – see Box 1). However, planning and implementation are impeded by a complex interplay of financial, informational and administrative barriers resulting in a policy gridlock (Brandes & Ferguson, 2004; Maas, 2003). The problem is systemic. Implementing individual demand management measures appears relatively straightforward; however, a comprehensive strategy cannot be achieved with the fragmented approach characteristic of contemporary demand management efforts. Effectively addressing and overcoming this policy gridlock requires an integrated and long-term approach that transcends isolated strategies to tackle a number of barriers simultaneously and strategically.

Box 1: The "soft path" for water

The "soft path" is a comprehensive management and planning approach that takes its name from the energy soft path of the 1970s (Lovins, 1977). The water soft path emphasizes increased efficiency in end use, avoiding system losses or leakage and most fundamentally changing behaviour to promote a water conservation paradigm (Brandes & Brooks, 2005; Brooks, 2003; Gleick, 2002).

[6] As Wolff & Gleick (2002: 29) point out, projections of future water use often overestimate demand because they rarely consider changes in technology, prices, social values and market forces.

[7] Options that improve water efficiency abound. See Vickers (2001) and The POLIS Project on Ecological Governance Water Sustainability Project at www.waterdsm.org.

It is critical to develop a clear understanding of the contextual constraints within which such planning and implementation must proceed. Along with a shift from supply-side developments to conservation and efficiency, water must be secured *in situ* to sustain ecosystem integrity. In contrast to conventional supply-side approaches that accept incremental damage to ecosystem health as an unfortunate by-product of development, this new paradigm explicitly acknowledges – and plans within – eco-hydrological limits to economic growth. Placing limits on human water use establishes the context within which water-dependant elements of an economy must function, and provides a broad incentive for increasingly "hydro-efficient" human activities.

Establishing limits and shifting from supply- to demand-oriented planning and management are core elements of what we refer to as an ecological paradigm of water governance. More broadly, this emerging ecological paradigm recognizes the need to develop resilient socio-ecological systems[8] as a fundamental requirement of a sustainable society (Gibson, Forthcoming; Gunderson & Holling, 2002; Holling, 1995). This shifts the aim of policy, planning and management from controlling change to building the capacity to tolerate and adapt to it while recognizing the inevitable uncertainty inherent in complex systems (Berkes, Colding, & Folke, 2003; Gunderson & Holling, 2002; Mitchell, 2002). Decentralized solutions, a focus on efficiency and conservation, softer approaches (i.e. social and economic vs. technological) and an overarching aim to preserve or restore ecological integrity are integral to this ecological paradigm of water governance.

The ensuing discussion situates the need for water governance reform in the context of the broader initiative known as *ecological governance* – a regime that seeks to embed the concept of ecological sustainability into social institutions and decision-making processes (Brandes, Ferguson, M'Gonigle, & Sandborn, 2005). Water allocation systems that reflect eco-hydrological limits and nested decision-making structures are two critical elements of such reform. These are key components of the institutional environment

[8] A system's resilience is defined by its ability to cope with, adapt to, and ideally benefit from, change (Gunderson & Holling, 2002; Holling, 1995; Mitchell, 2002).

necessary to overcome current policy gridlock and enable a transition toward ecologically sustainable water use.

Embedding ecology in governance

Governance

Broadly defined, governance encompasses the structures, dynamics and outcomes of social coordination and collective decision making. A key feature of governance is the extension of social decision making beyond the state to include non-governmental actors – private interests and "civil society" (e.g. business, NGOs) – as legitimate and desirable actors in public decision making. It recognizes the complex interconnections among institutions, including both formal constraints on behaviour such as rules, laws and constitutions, as well as informal constraints such as social norms, conventions and self-imposed codes of conduct (Berkes & Folke, 1988). Governance is inherently political, involving bargaining, negotiation and compromise as it evolves over time.

Governance brings attention to both means and ends – connecting the structural and dynamic elements of social decision making to particular outcomes or trajectories of development. This connection is apparent in Francis' (1996: 303) assertion that governance involves "the collective *results* from the exercise of authority and control through multiple governmental and other organizations, each following their own decision-making processes" [emphasis added].

Sustainability and ecological governance

Sustainability demands that society create new forms of equitable development that support a high quality of life, now and into the future – development that is cognizant of, and progresses within, the constraints imposed by the finite resilience of ecological systems (Gibson, Forthcoming). However, extending social decision making beyond the state toward a more distributed mode of governance does not, on its own, imply better outcomes in terms of sustainability. As Stoker (1998) stresses, the value of the governance concept lies not in its ability to explain causal relationships but rather in its value as an organizing framework, directing attention to the many forces influencing social decision making.

Current development practices and the governance systems guiding them are ineffective in addressing the scientific, political and institutional imperatives demanded by sustainability. The notion of ecological governance responds to this concern. It stresses the need for decision-making processes and structures better synchronized with the ecological processes and structures that underpin social and economic development (Francis, 1988; Gunderson & Holling, 2002; Holling, 1995; Kay & Schneider, 1994). Tacking minor reforms on to existing systems – as is often the case with contemporary responses to sustainable development – is simply insufficient. Rather, society must actively *develop sustainability* (M'Gonigle, 1989; M'Gonigle & Ramsay, 2004)[9] to create new public and private arrangements with ecological principles integrated at all levels of decision making (Brandes et al., 2005).

"Practising" ecological governance engages society to create the systemic reforms required to develop sustainability. By actively seeking opportunities to integrate ecosystem values and principles in decision-making structures and processes (i.e. markets, law and policy, planning and management), the intent is to develop governance systems that embed the notion of ecological sustainability into the very fabric of government, industry and civil society. Taken to its full conclusion, ecological governance not only *re-embeds*[10] ecology in our governance systems, the very nature of governance structures and processes "become" ecological. This conception of ecological governance then provides a useful framework for analysis when considering efforts aimed at sustainably managing water resources in Canada.

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[9] ***S**ustainable development* is generally seen as imposing constraints on traditional development, whereas *developing sustainability* goes beyond shallow reforms, seeking to liberate transformative economic practices and the potential for innovation associated with an ecosystem-based approach (M'Gonigle, 1989). In a similar vein, Taylor (2001) advocates a shift from "the law of nations with respect to biosphere" to "the law of biosphere with respect to nations."

[10] Certain cultures and historical resource management regimes include ecological considerations in a much more integrated fashion (M'Gonigle, 2000).

Box 2: Elements of ecological governance

Ecological governance entails:

- integrating governance structures and processes in the context of ecologically relevant spatial dimensions (i.e. watersheds, ecozones) to form nested decision-making units functioning as co-evolving socio-ecological systems
- embedding ecosystem values and considerations within decision-making processes by government, business and the public, including economic calculations;
- taking uncertainty seriously by developing flexible decision-making structures and processes capable of responding to uncertain future conditions;
- extending decision making beyond the temporal confines of the electoral cycle, calculations based on short-term returns on investment, and personal values over just isolated consumption-oriented preferences;
- experimenting with new approaches to legal regulation, resource management regimes, and jurisdictional designs that can inculcate ecological thinking into decision making; and
- enhancing local capacity to enable socio-political choices consistent with sustainable production and sustainable consumption.

(Brandes et al., 2005; Lundqvist, 2004)

Emerging trends in water governance

Canadian water governance has always included government – federal, provincial, regional and municipal, as well as First Nations – as important actors. The roles of government in managing our water resources, which include: controlling pollution, regulating water use and allocation, source protection and supply, managing trans-boundary and international water issues, data collection and guiding development, are well established. Despite these generally defined and accepted roles for existing institutions of government, Canadians are currently witnessing a period of fundamental change in the dynamics of water governance – both in the form and scale of planning and management, and in the role of stakeholders.

Governments, represented by various ministries and agencies sharing responsibility for water management, are recognizing that they are only one actor of many. Citizens, communities and non-government groups – civil-society – are taking a greater role in

decision making and program implementation. With growing tensions among water management, ecosystem health and economic development, stakeholders from sectors including agriculture, conservation groups and industry are increasingly active in water governance. Dale (2001), for example, suggests the role of government is shifting from the command and control of social activities, to that of catalyst and enabler of more broadly distributed decision making. So, although governments may no longer *exclusively* set the water management agenda, they remain critical to effective water governance.

Two specific areas of water governance remain as important spheres of influence for senior government:

1. water use planning and allocation; and

2. the character and scale of decision-making institutions.

The following two sections elaborate on these areas and highlight emerging opportunities for government to begin the institutional reforms necessary to promote a more sustainable approach to water management in Canada.

Freshwater allocation & sustainable water use

"When we try to pick out anything by itself,
we find it hitched to everything else in the universe."

John Muir, 1911

Water allocation systems in many industrialized nations remain mired in 20th century philosophy that favours economically productive human uses over ecosystem integrity. Despite increasing attention to ecological considerations at the policy level,[11] maintaining the integrity of aquatic ecosystems often remains an afterthought in water allocation decisions. As a result, only residual amounts of water remain *in situ* to sustain the integrity of freshwater ecosystems (Postel, 2003; Postel & Richter, 2003; Richter, Matthews, Harrison, & Wigington, 2003).

Allocating surface water in Canada – current approaches

Riparian rights and eastern Canada

Riparian rights for surface water were developed from English common law. They are not ownership rights, but rights of access to water for "reasonable" domestic uses, such as drinking and bathing, and some irrigation.[12] A key constraint on these rights is that a landowner must not infringe on the rights of other users either by diminishing the water quality or decreasing the quantity available downstream. Riparian rights still form the basis for water allocation in eastern Canada; however, they have undergone significant modification by statute law and their associated permitting regimes. In Ontario and the

[11] For example, The United Nations World Water Development Report (2003) *Water for People, Water for Life;* EUROPA Water Framework Directive (2004), or more locally Quebec's *Water Policy* (2002), Saskatchewan's *Water Management Framework* (1999), and Alberta's *Water for Life* strategy (2003).

[12] Historically, only riparian landowners (those adjacent to the water) had rights – not a guaranteed amount of water, but a relative right. Non-riparian landowners had no right to surface waters, except through easements.

Atlantic provinces, administrative licensing systems are superimposed on the common law riparian system; in Quebec a similar hybrid system has been adapted to its civil law tradition. Under these current systems of granting rights to use water preservation of environmental values is entirely dependent upon administrative policy and bureaucratic discretion (Nowlan, 2005).

This system is outdated. It was designed and adapted during a period when human water demands were less significant and the understanding of ecological processes less sophisticated. Increasing demand for water and improved understanding of ecosystem function has exposed the shortcomings of this system in ensuring sustainable water use and protecting ecosystem health. In some cases, new institutional arrangements, such as Ontario's Low Water Response system (Government of Ontario, 2003), have evolved to address the increasingly apparent shortcomings of the permitting system – both in terms of institutional design and administrative outcomes.

First in time, first in right in western Canada

In Canada's western provinces and northern territories, water laws and institutions evolved differently from those in the East. This difference was primarily due to water scarcity, geography and a commitment during the latter half of the 1800s to facilitate settlement and promote particular land uses, such as irrigated agriculture and gold mining. In these regions, statutory modifications have virtually displaced the common law riparian rights rules (Percy, 1988). [13]

Over time the western model has become increasingly complex as a result of adjustments and amendments developed in reaction to drought and inefficient water use. Despite major modification, such as water rights that were granted for an indefinite period are

[13] Percy (1988) and Lucas (1990) suggest that limited riparian rights continue to exist notwithstanding the statutory vesting of water rights in the Crown. The continued existence of these rights follows from "the basic presumption that Legislature does not, in the absence of clear and specific language, intend to abrogate exiting rights" (Lucas, 1990: 48). It is generally assumed that these rights cannot be asserted against licensed appropriators; however, Percy's (1988) analysis indicates that at least a possibility exists that domestic use rights could be enforced.

now being granted for a specific term, three features of the basic western model have remained relatively unchanged in all western jurisdictions (Percy, 2004):

1) Crown ownership of water;
2) Crown distributed rights to water on a first come, first served basis; and
3) competition among licensees for available water governed in law, but not always in practice, by the principle of prior allocation.[14]

Licenses for surface water withdrawals in the western provinces are based on the principle of prior allocation. This first-in-time-first-in-right system ensures the earliest granted licensee (i.e. the senior rights holder) is entitled to receive the entire amount stipulated in their licence before the next junior licensee can receive any water at all (Percy, 1988; Thompson, 1991). Initially, permanent water rights were granted; however, more recently, rights are granted only for a limited time – usually long enough to protect the licensee's investments (Percy, 1988).

The western system has been further modified to free up water for new users and direct limited resources to the most socially valuable ends (Lucas, 1990; Percy, 1988). Statutory preferences list the main uses in priority, usually listing domestic uses first, followed by municipal, industrial, irrigation and finally, other uses. A new user who requires water for a higher priority purpose can, in some cases, apply to the Minister for the cancellation of an existing licence issued for an inferior purpose. Under some legislative schemes (e.g. Alberta), the holder of the cancelled licence is entitled to compensation. Although governments do have some discretion to reserve unallocated water for the public interest, this has generally only been exercised to make water rights available for large irrigation and hydroelectric projects and not ecosystem needs (Percy, 1988).

[14] In Canada governments *allocate* first-in-time-first-in-right water entitlements under the respective statutory authority of their water legislation (a matter of public law). Priority is therefore based on date of completion of application, while in the western United States early users *appropriated* rights (a matter of private law), with priority based on date of appropriation for a beneficial use.

Problems with this system are most severe in areas where water shortages are common, such as southern Alberta, where some streams are now over-allocated, meaning licensed takings exceed the volume of water actually available. Recent efforts to address such problems include Alberta's 1999 *Water Act* amendments, which include provisions for voluntary trading of water licences within a watershed. Under these provisions, all trades are subject to a hold back of up to 10 per cent of the transfer to meet stated water conservation objectives (Alberta Environment, 2003). However, as in the eastern model, the decision to hold back water for instream needs and ecosystem protection is highly discretionary and subject to political influence. As Percy (1988: 34) states, "all versions of the basic western model continue to entrust that task [of protecting environmental and other public values] to the benevolent exercise of administrative discretion."

Systemic weaknesses of current allocation systems

For the most part, Canadian water allocation systems are not designed to protect and restore of aquatic ecosystems. Current surface water allocation schemes are primarily designed to license human water use with only minimal attention to securing instream flows for ecosystems, wildlife habitat, fisheries, or navigation (Percy, 1988; Thompson, 1991). Groundwater licensing schemes are also deficient; in particular, little effort has gone into developing institutions for planning and management that reflect interconnections between surface and ground waters (Environment Canada, 2003). Three particular shortcomings of current allocation systems stand out: unclear priorities in allocation and use; limited promotion of water conservation and efficiency; and rigidity in the face of uncertainty and change.

Unclear priorities in water allocation and use

Canadian water policy is unclear on priorities in allocation and use. For example, based on stakeholder perspectives, Kreutzwiser, de Loe, & Benninghoff (1999) identified unclear priorities as the most frequent criticism of Ontario's water permitting system. This issue is particularly true with respect to securing water for instream ecological water needs and ensuring sustainable groundwater use.

Contemporary ecosystem science suggests that significant ecological impacts to river systems can occur even at low levels of withdrawals (Schofield, Burt, & Connell, 2003), and significant uncertainty exists with respect to groundwater quantities, use, recharge and surface water interaction (Nowlan, 2005). Despite such claims, these considerations are rarely integrated into water planning and allocation. Schindler & Donahue (2006) assert that in the Prairie provinces, limited attention to integrated planning and poor representation of science in planning processes means that ecological instream flow needs are ignored.

In many parts of the country, ecosystem needs for water and sustainable groundwater use now garner significant attention at the policy level; however, implementation remains a key challenge for planners and managers. While many provincial policies[15] recognize the benefits of viable ecosystems and the importance of maintaining ecosystem integrity, they remain unclear as to when ecosystem purposes have priority over extractive human uses (Matthews, Gibson, & Mitchell, Forthcoming). Furthermore, they do not recommend processes, criteria or rules for establishing trade-offs among conflicting interests (Brandes et al., 2005: 35; Kreutzwiser, de Loe, Durley, & Priddle, 2004; Matthews et al., Forthcoming). Valiante (2004) illustrates this concern, citing recent changes to Ontario's permit to take water (PTTW) program, which now places ecosystem function as the "highest priority." Yet, in source water protection initiatives, which are closely linked to changes in the PTTW program, drinking water is given "highest priority." With current water allocation systems in Canada relying to varying degrees on administrative discretion to protect ecological integrity, the lack of clear priorities remains a major obstacle to sustainable water management.

Limited promotion of water conservation and efficiency

Under existing allocation systems, promotion of water conservation and efficiency is limited and ad hoc. But as supply-side developments become more costly and local

[15] For example, Nova Scotia's (2000) *Water Resources Protection Act*, Quebec's (2002) *Water Policy*, Saskatchewan's (1999) *Water Management Framework*, and, Alberta's 2003 *Water for Life* policy.

water scarcity more prevalent, the need to integrate water allocation systems with water efficiency and conservation planning is increasingly apparent.

The current failures of existing allocation systems to reflect the true economic and social value of water undermine opportunities to encourage efficiency and conservation. Typically, permitting and licensing systems involve only minimal administrative fees that do not reflect the value of water, and in many cases do not even cover the full costs of administering the allocation system. This fee arrangement may in fact create a perverse subsidy that leads to over-consumption; as Renzetti & Dupont (2002: 495) suggest, "the inefficient price of the resource becomes embedded in the stock of industrial capital and in the design of municipal water utility systems."

Recommendations for attaching volume-based levies to water permits and licenses are increasingly common within the Canadian water policy discourse (Brandes et al., 2005; Kreutzwiser et al., 2004; Renzetti & Dupont, 2002). The Province of Ontario's White Paper on Source Protection Planning (Government of Ontario, 2004) recommends user fees for some water takings; however, moving toward such fee-based water takings is politically difficult. In the continued absence of strong economic incentives, attaching conditions to permits and licences – or in some cases refusing licences – remains the primary mechanism for integrating allocation systems with water use efficiency and conservation efforts. Such mechanisms remain highly discretionary and ad hoc, and are only effective if infractions are detected and penalties imposed (Dinar, Rosegrant, & Meinzen-Dick, 1997). This is an increasingly difficult task given trends toward smaller, less interventionist governments typical of contemporary liberal democracies.

Rigidity in the face of uncertainty

Complexity and uncertainty are key elements of 21st century water policy, planning and management. As Slocombe (2004: 437) suggests, these forces emerge from many sources, "some in the natural environment, some in the human, and more in the interaction of the two." The foundations of Canadian allocation systems – riparian rights, statutory regulation and prior allocation – have proven ineffective in the face of mounting complexity and uncertainty. Current systems are generally too rigid to adapt to changing

social priorities, ecological and climatic conditions, and scientific understanding. In response to these challenges – *unclear priorities, limited conservation and rigidity* – governments have begun to modify or supplement their allocation systems. Two specific examples of this evolution are the Ontario Low Water Response (OLWR) (Government of Ontario, 2003) plan and limits on water takings in the West.

The OLWR is a prime example of a supplemental policy established to compensate for the limitations of a riparian rights system. This "response policy" is designed to enhance the flexibility of the water allocation system (PTTW) in the event of drought, first through voluntary water conservation efforts and, when required, by restricting particular water uses based on priority guidelines. While the OLWR provides more flexibility, it does little to clarify priorities in the case of extreme low water conditions, and in its current form, remains largely a reactionary approach (Kreutzwiser et al., 2004).

In the West, continued growth of urban demand, agricultural and industrial uses, and climate change impacts on water resources suggest that the primary concern for water allocation systems in the 21st century will not be permitting extraction of more water, but rather directing available water to its most socially valuable uses. Accordingly, Janmaat (2005: 209) describes the current state as the "Era of Reallocation" resulting from *over*-allocation of water resources. In response, policy makers and water users in regions such as the Okanagan Basin and southern portions of the Prairies are responding to the shortcomings of the prior allocation system by limiting further extractions and applying water use restrictions to some sources.

Ecological water management – the next evolution

In their historical context, Canada's water allocation systems were well-developed to tackle the challenges of the day: creating a sense of certainty and promoting development. Their evolution was (and continues to be) dependent on social and ecological contexts. The western prior appropriation model, for example, addressed the shortcomings of riparian rights common law in dealing with scarcity and economic development objectives. This system evolved during a period of rapid development during which certainty, or at least a perception of certainty, was required to promote

investment. In the West, water was needed for agriculture and mining and was in short supply at the turn of the century. Therefore a system emerged that enabled developers to mobilize capital – a system that addressed the underlying needs of promoting development and creating a more certain climate for investors.

Society, however, is now entering an era of new requirements and new values for water. As such, we should expect continued evolution of water allocation systems to address the challenges of the 21st century. Signs of this evolution are already apparent in places like Australia, South Africa, New Zealand and parts of Europe where scarcity and the demand for water security are driving policy and legal reforms that more formally recognize ecosystem needs.

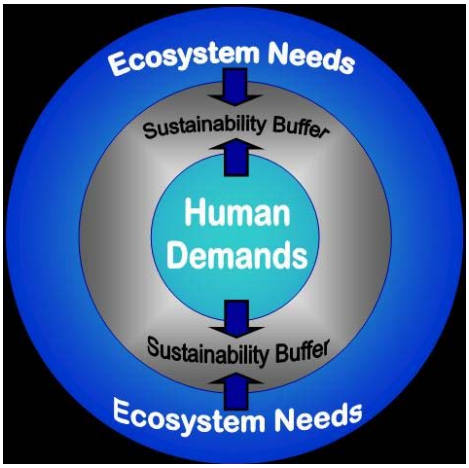
The key driver of this evolution is the need to address biophysical limits on economic growth, and to establish mechanisms that will limit human water use. It may be time to seriously consider if existing water allocation systems are the most appropriate mechanism for integration of human water use with ecological needs. Continued reliance on the administrative approaches that have led us to our current predicament may result in further sub-optimal ecological and social outcomes. And while market mechanisms hold potential for increasing the efficiency of water use, on their own they are unlikely to ensure sustainable outcomes either. Bjornlund (2005: 7) warns that without a process for setting limits on human water use, "water markets are likely to produce socially and ecologically undesirable outcomes."

Establishing limits on human water use – or addressing ecosystem needs for water – is a growing challenge for water governance. Recently, Postel & Richter (Postel, 2003; Postel & Richter, 2003) introduced the notion of *sustainability boundaries* to bring attention to the immutable truth that the human water economy is nested within – and therefore inextricably dependant upon – nature's water economy. The concept is based on the understanding that the quantity of water available in a given watershed or aquifer is limited, as is the extent to which human activities can alter freshwater ecosystems before impairing the production of the goods and service they provide.

While useful as a conception of the problem, the sustainability boundary appears to set limits on human water use as static points; yet, we are dealing with complex, dynamic, co-dependant social and ecological systems. This static perspective has served – and in many cases continues to serve – as the basis for addressing ecosystem needs for water. This typically results in the prescription of minimum river flows or levels in lakes and aquifers. However, it is now widely acknowledged that maintaining or enhancing the health and productivity of freshwater ecosystems requires more than merely allocating a minimum volume of water to an ecological sector. The natural flow regime is now considered by aquatic ecologists as a "master variable" controlling ecosystem structure and function (Richter et al., 2003: 207).

To reflect this thinking, (Maas, Forthcoming) has adapted Postel & Richter's sustainability boundary concept to better reflect the dynamics and uncertainty of complex social-ecological systems by replacing the "static" boundary with a *sustainability buffer*, illustrated in Box 3. [16] This in turn suggests new objectives for water management – not the prescription of a static boundary, but rather the development of resilient socio-ecological systems capable of flourishing within the sustainability buffer. But this acknowledgement takes us only so far in addressing the challenge. It says nothing of the fact that establishing a sustainability buffer requires integration of scientific knowledge and social values in a decision-making arena fraught with conflicting priorities and interests. The challenge must be recognized as a social dilemma, not solely a scientific problem. Indeed, while science will play an important role in decision making, it cannot answer what are essentially value questions (Cortner & Moote, 1999).

Box 3: The sustainability buffer



[16] Black (1995) also discusses the concept of a resource "buffer."

The first step toward addressing the problem is to recast water allocation for sustainability as a planning problem rather than a need to modify current allocation mechanisms. Traditional administrative approaches and the introduction of market mechanisms may be suitable for apportioning water among competing human demands – the area in the centre of Box 3; however, neither holds much potential for locating the sustainability buffer in relation to the total available water. Locating the buffer itself can only be done through scientifically informed decision making guided by an open, democratic planning process. Addressing decisions about proper use and stewardship of water resources via planning processes engages broader society in the challenge. By opening the process and engaging citizens, water governance can minimizes dependence on administrative and political discretion or the inherent weakness associated with standard economic valuation techniques due to incomplete information or the challenges of static marginal analysis on dynamic systems (Bjornlund, 2005).

Watershed governance

"Laws and institutions must go hand in hand with the progress of the human mind."

Thomas Jefferson, 1786

Canada is witnessing a period of rapid change as new regimes of water governance begin to take shape. Despite this change and mounting evidence that the supply-focused paradigm has run its course, existing institutional arrangements often continue to limit progress and entrench the status quo.

The challenge is to accept that Canada's emerging "water crisis" cannot be resolved via engineering solutions or more and better science alone. It is what Trist (1980) refers to as a "messy problem" – one where multiple values, perspectives and visions are at odds. Complex problems require complex solutions. While science and engineering will continue to play important roles in the future of water management, a new perspective on water governance requires that we address the social dimensions of the challenge – entrenched values and behaviour, and outmoded decision-making mechanisms. During this period of change, leadership by senior government is urgently needed.

Integrating within the watershed

The watershed is the *starting* point for sustainable water management. It is the logical context for a holistic integration (Lundqvist, 2004; Mitchell, 1990) that moves away from end-of-pipe treatment toward watershed-specific approaches to water quality and quantity problems and solutions (Gaovr et al., 2005:7). To maintain reliable future water supplies, healthy aquatic ecosystems, adequate instream flows and groundwater balance, all actions will have to be considered for their cumulative impact on the watersheds. This moves demand management from being an "add-on" solution to becoming a foundational tool for watershed managers, water planners and all water users up and down the watershed (Brandes et al., 2005).

Commitments to watershed approaches are emerging – and, in some cases, are well-established – in Canada. Ontario's Conservation Authorities and commitments in the Federal Water Policy (1987) provide good starting points for institutional and policy examples. More recent institutional experimentation, such as the Fraser Basin Council and progress on provincial water strategies, such as components of those in Alberta and Quebec, also demonstrate clear commitments to watershed-based management.

These initial institutional shifts suggest a broader potential for transformation of water governance in Canada. But, if this type of approach is to take root and flourish, a more serious commitment is needed. Integrated approaches to water governance – those that foster decision making and institutional design within the river basin or watershed scale, offer significant benefits that cannot be captured by functionally specialized sectoral organizations (Mitchell, 1990, 2002). Ad hoc efforts to promote integration of water governance at the river basin or watershed scale are not sufficient to reap the full range of potential benefits. Organizations and new decision-making processes must evolve (or be created) specifically to fill the role, which requires active engagement from senior government. Lessons learned from places such as Australia, South Africa, New Zealand and Europe emphasize the need for coordination, capacity and resources to ensure an effective transition toward watershed-based integration. Greater emphasis on re-scaling of governance is critical in any effort to move toward water sustainability in Canada.

Managing humans, not watersheds

To sustainably manage human interaction with the hydrologic cycle and aquatic ecosystems requires specific attention to:

- the ***flow*** of the resource that knows only Nature's contoured boundaries rather than lines on a map;

- the role of water as the ***grand integrator***, linking terrestrial and aquatic ecosystems, and natural and human systems – across both space and time; and,

- the challenge of ***reconciling water's value to humans*** – having a unique life-giving quality, a distinctly economic value as an input to production, and a role as

"service" provider (providing, for example, the green lawns, sanitation, industrial production and cooling and recreation that we seek).

By examining all actions in the context of the watershed, we begin the move toward *ecological governance*, or "watershed governance" in this context. Watershed governance encompasses the institutional shift toward ecosystem-based management, including ecologically based water allocation, comprehensive water demand management and strategic "soft path" planning.

Watershed governance thus begins the process of *developing sustainability* by embedding a new paradigm of water management – one focused on water conservation – in all aspects of decision making and management throughout the watershed. This governance regime moves beyond water management toward managing how people live as watershed citizens.

Conclusions & recommendations

"…you don't get wet by talking about water,
you get wet by doing something –
action is what is needed to move
us toward water sustainability…"

Ted van der Gulik – Water Sustainability Committee
BCWWA – March 30, 2005

Although water is finite, water scarcity – as indicated by per capita resource availability – is not the principle challenge in most parts of Canada. Indeed, Canada's looming water crisis is one of our own making, and is largely a social dilemma. Canadians have the economic wealth, technical ingenuity and capacity for policy innovation necessary to begin addressing this challenge. Avoiding this crisis requires a serious commitment to change the social conditions shaping decision making, attitudes and behavior.

We conclude by applying the principles developed in our discussion of watershed governance as a guide for government to begin *developing sustainability* – embedding ecological principles and considerations in institutions and decision making. The following four themes represent broad, but critical, elements required to begin this process:

- ***Enable and promote conservation as the core of water management and planning***. The question is not about whether Canada must use water more efficiently, but rather to what extent Canada will go beyond merely increasing efficiency to embrace a more fundamental change – a paradigm shift in water management founded on ecologically-based water allocation and innovation in how we manage water at the community level.

- ***Strengthen existing efforts to continue the evolution of water allocation.*** Use emerging legal and institutional tools complemented by ecosystem-based planning to better address issues of human interaction with water resources.

- ***Recognize watersheds as the appropriate scale for water governance***. Given water's central role in the human-environment nexus, the watershed provides the "natural" context for managing humans and our activities within ecological systems.

- ***Acknowledge that governance matters***. How we arrive at decisions and what influences those decisions have significant impacts on outcomes. In an ecological governance regime, governments take on a dramatically different role as they move from "top down" water managers to facilitators of community engagement, acknowledging ecological limits and seeking to manage human activities rather than ecosystem structure and function.

The challenge for water is, as Saleth & Dinar (2004: 23) frame in the context of natural resource management, "…with all its many forms of externalities, neither the price mechanism nor the creation of property rights can provide a durable solution. Therefore, policy prescriptions, which have moved from 'getting the prices right' to 'getting the property rights right', now centre on 'getting institutions right'."

The challenge is to promote the paradigm shift in water management by ensuring that these new approaches, resources and institutional arrangements are implemented across the country. Governments at all levels must provide the leadership to make this happen.

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