At a Watershed

Ecological Governance and Sustainable Water Management in Canada

Urban
Water
Demand
Management

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BUILDING ON CANADA'S STRENGTHS

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Selected Summary

Full Report Available at: www.waterdsm.org

At a Watershed:

Ecological Governance and Sustainable Water Management in Canada

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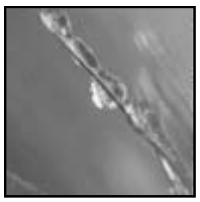
I do not know much about gods; but I think that the river
Is a strong brown god-sullen, untamed and intractable,
Patient to some degree, at first recognised as a frontier;
Useful, untrustworthy, as a conveyor of commerce;
Then only a problem confronting the builder of bridges.
The problem once solved, the brown god is almost forgotten
By the dwellers in cities—ever, however, implacable.
Keeping his seasons and rages, destroyer, reminder
Of what men choose to forget. Unhonoured, unpropitiated
By worshippers of the machine, but waiting, watching and waiting.
.....
The river is within us, the sea is all about us...

T.S. Eliot, *The Dry Salvages, 1941*

Executive Summary



Critical to life in all its diversity, water is the lifeblood of society and a foundation of civilization. In addition to drinking water, freshwater ecosystems provide other fundamental "ecosystem services" such as irrigation water, habitat for wildlife, reserves for biodiversity, flood control and drought mitigation, mechanisms for environmental purification, and sites for recreation. All these functions are essential to the ongoing health and development of society.

As cities grow and environmental problems escalate, managing human demand for fresh water presents an immediate challenge. In Canada's cities, scarcity of supply, wasteful use, pollution, climate change and other factors combine to increase the stress on aquatic ecosystems and water supply systems. The habits of a profligate past are colliding with ecological and economic limits—the need for innovative water management is acute.

Water is *the* strategic resource of the 21st century. As we write this report, Canada stands "at a watershed" in freshwater management. Attitudes, institutions and policies are changing, but an outdated supply-oriented paradigm still dominates. This paradigm treats fresh water as a virtually limitless resource; forecast demands are met by endlessly seeking additional sources of supply. A new approach is needed.

Demand management: The new water paradigm

Demand-side management uses less water to meet the same human benefits, through conservation and a dramatic increase in water use efficiency. Demand-side practices include conservation pricing, smart technologies, public education, and regulation that forces innovation by promoting efficiency, conservation and recycling.

Comprehensive demand management programs integrate diverse activities such as consumer behaviour, water provision, waste disposal, energy use, and land use to redirect social development onto a new "soft path." This path focuses on meeting underlying human *needs*, for example, for sanitation and agriculture, instead of supplying more water. It requires water planners to satisfy demands for water-based *services*, rather than simply delivering more water as the *product*.

A "soft path" for water moves away from "forecasting" the future by simply extrapolating from the past. Instead it relies on "backcasting"—a planning approach based on a future scenario that integrates human needs within ecological limits. After determining what water might be available (ecologically), planners then work *backwards* to find feasible paths to meet long-term social and economic needs. To reach a sustainable future, the soft path relies on policies and programs that change behavior and promote greater water productivity. At the core of this process are structural changes that embed conservation, complemented by technologies and practices that increase efficiency.

Water in Canada

The myth of abundance is firmly entrenched. This myth impedes Canada's ability to change water use habits. Water prices in Canada are the lowest in the industrialized world, which encourages our pattern of excessive use and waste. Lack of consumer awareness and conservation incentives, a dearth of effective policies and innovative regulations, and limited strategic planning all reinforce the supply-side paradigm. Profligate water use not only causes environmental damage, but also inflicts huge and unnecessary infrastructure costs on already overburdened municipalities and taxpayers.

Structurally, myriad public agencies share authority in "a bewilderingly complex administrative galaxy" that fails to address the underlying problems. From coast to coast, Canada's water management is in need of sober reform. The ultimate solutions are local in nature, yet those solutions are unlikely to be widely implemented unless situated within a broad national strategy.

Ecological governance to address water scarcity

At a Watershed focuses on the enabling environment that ensures holistic water management is institutionally embedded. Ultimately, the goal is "ecological governance," where natural ecosystem processes are carefully considered at all levels of decision making, up and down the watershed. All three pillars of governance—government, business and civil society—must participate to fully incorporate sustainability into the very nature of our government, our industry and our civil society.

Developing Sustainability

By definition, sustainability respects biophysical limits. However, while *sustainable development* merely imposes constraints on traditional economic development, *developing sustainability* seeks to liberate new processes for social and economic transformation.

Developing water sustainability requires a shift that embeds ecosystem integrity in the fundamental basis of all planning. This approach limits the expansion of supply-oriented infrastructure, addresses cumulative effects at the watershed, and unleashes the full potential of conservation-oriented innovation. The best source of "new" water is not actually new water at all. It is better use of the water we already withdraw.

Key Concepts

To develop sustainability, four key concepts must guide water planning and management:

1. Prevention and Precaution

To maintain ecosystem integrity, prevention of harm is better than subsequent compensation or remediation. A precautionary approach is the best hedge against an uncertain future.

2. Ecosystem-based management

Ecosystem-based management adapts economic, political and social processes to fit within the ecosystem, instead of the reverse. Rather than managing a watershed as an adjunct to human needs, ecosystem integrity sets the context for management decisions.

3. Matching authority to jurisdiction

Watershed governance recognizes that local people and institutions are best situated to monitor environmental feedback and respond with tailored solutions. However, local powers must also be "nested" within higher level institutions that hold them accountable, coordinate with other local institutions, and participate in broader collective actions.

4. Adaptive management

Plans and policies should be continually modified to respond to ecological, economic and social feedback through an ongoing process of informed "trial and error." Decisions that are provisional and reversible can create and apply critical knowledge to refine decision making in an uncertain world.

Part II: Key Components of a national water strategy

Working together, federal and provincial governments can promote the tools and institutions to allow all local interests—suppliers, businesses, consumers and local governments—to take effective action in developing water sustainability. Real world experiences in many jurisdictions can provide signposts for Canadian authorities along the path to a sustainable water future.

The attached table summarizes these opportunities, experiences and best practices from around the globe (with reference to additional details in the full report).

Allocating water in the 21st Century

Ecosystem-based management starts at the source to protect ecological function and ecosystems. Only after ecological needs are met can water then be accessed for human activities. Once the ecological limit of an aquifer, river basin or watershed is reached, future water demands must be met through increased water "productivity." This liberates the full potential of demand management.

Enabling local water planning and conservation

Senior governments can uniquely address the institutional inertia of the supply-side paradigm that now prevents the long-term planning and decision making needed to implement DSM. They can ensure local governments have a sustainability strategy based on long-term water conservation planning and an integrated approach to water management.

Patterns of supply and demand, ground and storm water use, energy and land use decisions can all be shaped and transformed. Specific tools and practices to foster such transformation include funding, guidelines, data and information, building and sharing technical knowledge, increasing staff resources, providing incentives for innovative management and ensuring widespread public education.

Facilitating urban water demand management

Demand management programs can reduce infrastructure costs and ecological impacts. However, water conservation does not just happen. Success requires coordinated efforts from all stakeholders and an environment where demand management is the primary focus of water managers.

Senior governments can facilitate a demand-oriented focus through the creation of model bylaws and standardized Best Management Practices (BMPs). They can act as a central clearinghouse of information and undertake research, pilot projects and educational programs. They can also move forward specific DSM opportunities such as product labelling, social marketing, conservation-based pricing and reuse and recycling technologies.

Thinking like a watershed

Sustainable water management requires managers, in effect, to "think like a watershed"—to consider the complex interaction of human activities and natural processes in planning and decision-making. Ecological governance is only possible where management focus shifts away from manipulating the watershed and toward managing human activities within the watershed.

Demand management is a foundational tool for watershed managers. When applied not only within the urban sector but in all sectors—including power generation, industry, manufacturing and agriculture—up and down the watershed a broader social process of ecological governance begins to take root.

Learning from other places

The strength of this report lies in the rich mosaic of experiences and examples from around the world where theory and concept inform practice. For example, experiences in ***Australia*** and ***South Africa*** reveal opportunities to integrate ecological considerations into water allocation systems and demonstrate how watershed-based management institutions can protect ecosystems. In these jurisdictions, nature is recognized as a legitimate "user" of water.

In ***California*** and some other parts of the United States, urban water management and innovation go hand in hand. Conservation planning, increasing water efficiency and improving water reuse and recycling are fundamental aspects of water management. Dedicated government divisions for water efficiency, specific conservation laws and codes, targets and reporting requirements, and processes linking infrastructure funding to best practices ensure continual innovation and improvement.

In the ***European Union***, integration at the watershed level is an important part of a "nested" planning approach promoted through the EU Water Directive. For many European countries the watershed is viewed as the staring point for sustainable water management. For example, ***France*** has created a water parliament system where government has modified its water management role from central controller to facilitator of local decisions in the context of river basins and watersheds. A management authority for the basin develops policies and plans that address basin-wide problems. These provide guidance to the management bodies of smaller, nested watersheds, which develop detailed action plans tailored to local conditions.

Similar efforts to integrate water resource management at the watershed level are occurring in ***Washington State*** where growing recognition of a need to shift away from centrally-driven efforts towards more collaborative watershed-based approaches is creating a dynamic adaptive management framework.

Future directions

A future different from the past is possible for Canada. Financial, technological, legal and social tools are available to grapple with water issues before they reach crisis proportions. But the long-term solution requires a fundamental shift to watershed governance—an institutional shift towards ecologically-based water allocation, innovation in planning, managing water use with a "soft path" approach, and ecosystem-based management at the watershed scale.

The challenge now is to ensure that these new approaches, resources and institutional arrangements are implemented across the country. Senior government must provide the leadership to make this happen, taking steps to ensure water agencies at all levels of government have the ability and the incentives to implement comprehensive solutions and programs. The opportunity is here, and the time for action is now.

Key elements of a national water strategy for Canada

	Practice (BMP)	Purpose(s)	Key enabling requirement(s)
Ecosystem-based water allocations Chapter 5	**Water allocations that ensure watershed health**	Allocate water to sustain ecosystem integrity	Provincial action on fundamental reform of water licensing and allocation systems
	Adaptive withdrawal permitting	Avoid future over-allocation of water sources by allowing permitted withdrawals to be adjusted over time in response to water availability	Change water licenses and entitlements; and demand detailed hydrological and human water use monitoring
	Market-based instruments for water sustainability	Provide incentives (financial rewards) for desired behaviour or impose fees on undesirable behaviour to reduce water use and provide potential revenue to subsidize conservation and restoration	Pricing - attention to distributive effects (i.e. political economy of water) Trading - property rights with clear ecological water allocations and significant government regulation Liability - public access to legal system
Innovative Urban Water Management Chapter 6 and 7	**Long-term conservation planning**	Overcome short-term decision making that increases long-term impacts/costs	Water conservation planning guidelines and incentives that require their use (conditional funding, legislation)
	Environmental management systems	Embed planning in an adaptive management framework, ensuring regular assessment of business practices and consequential environmental impacts	Overcome upfront costs for management process (e.g. plan, do, check, act) and ensure availability of detailed information
	Utility Full-Cost Accounting	May eliminate perverse subsidies by promoting a truer value of water to end users, ensuring long-term financial stability for the utility	Local political will or provincial legislation as in Ontario. Citizen/end-user education
	Developing conservation capacity	Develop professionals that create and run effective long-term DSM programs	Sufficient financial resources and recognition that DSM professionals are critical to any water supply team
	Best practices clearinghouse	Disseminate information and opportunities to improve water management and promote innovation	Create one central and credible resource in collaboration with key stakeholders
	Promote market in DSM planning/implementation	Ensure ongoing innovation and continual integration of conservation technologies	Commitment by local government to link development with conservation incentives
Key DSM measures Chapter 7	**Labelling**	Allow purchasers to identify and select the most water-efficient products to meet their needs, facilitating a market for conservation technologies	Credible oversight and enforcement of standards
	Social Marketing	Promote behavioural change at community level	Specific training and direct public contact and involvement
	Conservation-based pricing	Provide incentives to reduce water use and signal the value of water	Universal metering and public and political buy-in
	Reuse and recycling	Cascade water use to reduce wastewater and water use	Dual plumbing, enabling regulation, pilot projects, national guidelines for reused water and health regulations
Watershed Governance Chapter 8	**Water parliaments**	Ensure holistic planning and decision making at the watershed scale by bodies aware of local needs and circumstances	Collaboration by key stakeholders and senior governments; sufficient resources and delegated decision-making authority

Impact/implications	Governance principle	Leading example(s)
Water allocated for ecosystems and basic human needs first; the remainder allocated to maximize social and economic benefits	Ecosystem-based management	• South Africa National Water Act (Sec 5.3) • Australia, COAG reforms (Sec 5.3)
May challenge expected long-term specific volume requirements for fresh water	Adaptive management	• Time-limited withdrawal permits in the UK, South Africa and Florida (Sec 5.4.1) • A consumptive pool - Australia (Sec 5.4.2)
Tax shifting and green taxes may impact costs and individual company/industry competitiveness	Ecological modernization; full-cost accounting and user pay	• Europe (Sec 5.6.1) • South Africa (Sec 5.6.1)
Commodification of water resources and potential corporate influence requires careful government oversight		• Australia (Sec 5.6.2) • Alberta (Sec 5.6.2) • California (Sec 5.6.2)
Cost recovery facilitated by environmental bond requirements		• Sweden (Sec 5.6.3) • Columbia (Sec 5.6.3)
Senior government must provide support (finances and information) to assist in preparation of plans, and must enforce penalties if plans are not implemented	Matching principle and deliberative democracy	• EPA guidelines (Box 39) • California's Urban Water Management Planning Act (Box 40)
Requires industry or government action to develop specific EMS frameworks for water utilities and providers, and requires establishment of indicators	Adaptive management	• ISO 14001 (Box 41) • North East Water in the State of Victoria Australia (Sec 6.3.1) • Sydney Water Corp., Australia (Box 42)
Concern that privatization may result; requires strong public oversight	Subsidiarity and ecological modernization	• CRD Victoria (Box 45) • Ontario's Sustainable Water and Sewers Systems Act (Box 44)
Changing utility focus from water supplier to service provider	Ecological modernization	• California - dedicated government division for water efficiency (Box 40) • Some Canadian cities have hired full-time DSM staff (Sec 6.6)
Compliance with practices can be part of criteria for linking funds for infrastructure expansion or DSM programs	Ecological modernization and subsidiarity	• WaterWiser Clearinghouse Web (Sec 7.2.2) • California MOU Regarding Urban Water Conservation (Sec 7.2.1, Box 47)
May increase developer costs leading to focused resistance	Ecological modernization	• WASCOs (private entities contracted to plan and implement DSM program (Sec 6.2.3) • Arizona Active Management Areas requires developers to reduce water use before new building permits are given (Sec 6.4.1)
Can help local water providers select models/brands for rebate and giveaway programs	Deliberative democracy and ecological modernization	• WaterStar (Sec 7.3) • EcoLabel (Sec 7.3) • WELS (Australia) (Box 49)
Requires detailed planning, pilot projects and evaluation	Ecological modernization	• The Region of Durham, Ontario (Sec 7.1.5, Box 19)
May effect municipal water revenue predictability	Ecological modernization; full cost and user pay	• Irvine Ranch Water District (Box 50) • EU Water Framework Agreement (Sec 7.4)
Requires additional technologies and technical expertise	Ecological Modernization	• California Water Code (Sec 7.5.2) • Florida Reuse Coordinating C'ttee (Sec 7.5.2) • Vernon, BC (Sec 7.5)
Changing role of government from central control to facilitator of local decisions	Matching authority and subsidiary	• France's Water Parliaments (Box 56) • COAG and the Murray-Darling Basin Initiative, Australia (Box 58) • Washington State, US (Sec 8.2, Box 57)

Box 1: Services provided by freshwater ecosystems

Service	Benefits
Provision of water supplies	Greater than 99% of industrial, irrigation and residential water supplies worldwide come from natural freshwater systems
Regulation of ecosystem function	Ensures essential ecological processes and fundamental life support systems continue
Flood mitigation	Functionally intact freshwater systems buffer stormwater flows, reducing flood damage
Drought mitigation	Functionally intact freshwater systems absorb rainwater, slow runoff and help recharge groundwater
Maintenance of coastal zones	Freshwater flows maintain the salinity gradients that are critical to the biological diversity and productivity of deltas and coastal marine environments
Recreational opportunities	Freshwater ecosystems are sites for swimming, fishing, hunting, boating, wildlife viewing, and so on
Hydropower generation	Flowing freshwater ecosystems provide opportunities for both conventional hydropower generation and more environmentally sensitive micro-hydro options
Provision of habitat	Rivers, streams, floodplains and wetlands provide habitat and breeding sites for numerous aquatic, avian and terrestrial species
Biodiversity conservation	Freshwater and riparian ecosystems harbour diverse assemblages of species that support many of the services in this table and also conserve genetic diversity for future generations
Provision of food	Fish, shellfish and waterfowl are important food sources for people and wildlife
Sink services	Healthy freshwater systems possess an ability to absorb and neutralize pollution. For example, micro-organisms play a critical role in groundwater purification breaking down organic wastes, including petroleum hydrocarbons and synthetic halogenated organic compounds
Water purification	Wetlands filter and break down pollutants, enhancing water quality
Nutrient delivery	Freshwater systems store and transport nutrients within the watershed
Soil fertility maintenance	Functional river-floodplain systems constantly renew the fertility of surrounding soils
Land subsidence prevention	Groundwater stored in aquifers prevents land subsidence and reduces erosion through absorption of runoff
Aesthetic, cultural and spiritual values	Natural freshwater systems are sources of inspiration and deep cultural and spiritual values

Adapted from: (Postel and Richter, 2003; Moss et al. 2003)

Box 12: Threats to freshwater ecosystem services from human activities

Human activity	Impact on ecosystems	Services/benefits at risk
High or increasing water consumption	Increases pressure to dam and divert more water and to drain wetlands; increases water pollution, aquifer overpumping, and contributes to climate change	Virtually all aquatic ecosystem values
Dam construction	Alters timing and quantity of river flows, water temperature, nutrients and sediment transport, delta replenishment; blocks fish migrations	Habitat for native species, impacting recreational and commercial fisheries Deltas and estuarine fisheries
Dike and levee construction	Destroys hydrologic connection between river and floodplain habitat	Habitat, sport and commercial fisheries, natural floodplain fertility, natural flood control
Excessive river diversion	Depletes streamflows to damaging levels	Habitat, sport and commercial fisheries, recreation, pollution dilution, hydropower, transportation
Interbasin transfers	Alters timing and quantity of river flows, water temperature, nutrients and sediment transport, delta replenishment; destroys hydrologic regime; alters production and nutrient cycling; introduces exotic species and eliminates native species	Habitat, recreational and commercial fisheries, maintenance of deltas, productivity of estuarine fisheries
Deforestation/poor land use	Alters runoff patterns, inhibits natural recharge, fills water bodies with silt	Water supply quantity and quality, fish and wildlife habitat, transportation, flood control
Pollution - water and air	Diminishes water quality, alters chemistry of rivers and lakes	Water supply, habitat, commercial fisheries, recreation, human health
Overharvesting	Depletes species populations	Sport and commercial fisheries, waterfowl, other biotic populations
Introduction of exotic species	Eliminates native species, alters production and nutrient cycling	Sport and commercial fisheries, waterfowl, water quality, fish and wildlife habitat, transportation
Draining of wetlands	Eliminates key component of aquatic environment	Natural flood control, habitat for fish and water fowl, recreation, natural water purification
Climate-altering activities and pollutants	Potential for dramatic changes in runoff patterns from increases in temperature and changes in rainfall	Water supply, hydropower, transportation, fish and wildlife habitat, pollution dilution, recreation, fisheries, flood control

Adapted from (Postel and Richter 2003: 14-15)

Chapter 8
Thinking like a watershed

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

John Muir, 1911

A watershed is a complex ecosystem. Soil, vegetation, animals, humans, water and climate are all integral and interacting parts. Water extraction, land use changes, urban developments, and industrial, forestry and agricultural operations all impact the watershed. The cumulative impacts of these human activities often lead to problems with water quantity and timing of surface flows, as well as with water quality, groundwater recharge, and floodplain maintenance. Only by addressing these concerns in an integrated management approach can we ensure watershed and ecosystem health, as well as adequate water supplies.

It is now widely accepted that management of water should be accomplished at a full watershed level. Watershed-based management requires water managers to account for the complex interactions in the watershed, and encourages them to, in effect, "think like a watershed" especially where interactions between naturally occurring and human activities are involved. Recognition of the watershed's importance to society is not new; integrated public management on a watershed basis is.

Opportunities for such management are the major theme of this report. These include integration of water supply and conservation planning, surface and ground water management, waste and storm water management, and urban design. The watershed is the logical context for a holistic integration that moves away from end-of-pipe treatment toward watershed-specific identification of water quality and quantity problems and solutions (Gabor 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 entire watershed. Demand management is a foundational tool for watershed managers that must be applied not only in the urban sector but also to other water users, such as power generation, industry and agriculture.

Watershed management is not an end point. Quite the opposite. This report concludes by considering how the watershed is the *starting point* for sustainable water management. By examining all actions in the context of the watershed, we begin to move towards an *ecosystem governance* regime. The focus moves to managing people within the watershed, not trying to control the watershed itself. The ecosystem is the physical foundation and long-term, sustainable *ecological governance* of society is the goal.

Box 55: Watershed management

> "While water managers generally understand and advocate the inherent powers of the concept of a watershed as a unit of management, where surface and groundwater quantity and quality are inexorably connected, the institutions which have developed to manage the resource have historically followed these tenets only in the exception."
>
> (Wolf 2003: 168)

8.1 Finding the proper scale for management

Many problems at the watershed level are the result of wasteful water use, widespread non-point pollution and other dispersed activities throughout the area. Involvement and "buy-in" by the various groups in the watershed is fundamentally required to solve such problems.

Watersheds are generally selected as the proper scale of management based on the idea that water management organizations should reflect the physical unity of water bodies to account for potential sources of conflicts. The river basin—comprised of many watersheds—is a logical administrative unit to handle the regional externalities linked to water pollution and conflicts of use. Such institutions can bring relevant groups together to work on problems collaboratively and—provided sufficient management authority is devolved to them—

Box 56: Water parliaments

French River Basin Committees (RBC), described as local "water parliaments," serve as consultative bodies responsible for analyzing any subject relevant to the river basin. Various parties concerned with the water management are represented such as communities, water users and the central administration (which comprises less than half of the representatives). On this decentralized committee, stakeholders resolve conflicts related to water quality and water availability. By assembling the interested parties in the river basin, RBC decisions are expected to reflect the general interest of all users and stakeholders.

Water Agencies (WAs) are the executive branch of the RBCs. Financially autonomous, they are in charge of collecting the water charges that finance their activities. Through loans and subsidies, they finance private and municipal investment projects intended to reduce pollution and increase water availability. Financial assistance is aimed at giving polluting firms and communities incentives to reduce pollution and at water-saving investments. Eligible investment must be in accordance with the priorities defined by the WA (and later approved by the RBC) in the multi-year working plan, established for a five-year period. The plans are supposed to reconcile demands for multiple water users and set priorities for the most important pollution reduction actions and water availability measures to be taken in the river basin during the period.

Source: (da Motta et al. 2004: 37)

implement solutions (EPA 1997; EPA 2002; Ruhl et al. 2003; Schoefield et al. 2003: 35).

France has embraced this approach with its water parliament system. Water Agencies and River Basin Committees exist in each of the six French river basins. The water agencies perform executive functions and the River Basin Committees act as the central clearinghouse and consultative bodies, as discussed in Box 56 (da Motta et al. 2004: 4).

Australia is also managing activities on a watershed scale. The Australian focus has shifted from government as the administrator of policy on behalf of industry and the community as passive recipients to government as "enabler" and "facilitator." This way, government supports an empowered industry-community alliance to articulate catchment strategies. This brings together the three pillars of governance outlined in Chapter 2.

In the United States, a number of state governments also use the watershed as the unit for water management. To deal with pollution discharge permits and ambient water quality monitoring, the State is split into a number of watershed management units. For any particular unit, state management activities are spread over a five-year, five-step process: 1) data collection and monitoring, 2) assessment and prioritization, 3) strategy development, 4) basin plan review and approval, and 5) implementation (EPA 2002).

Once the first "round" of activities for a management unit is complete, the cycle is repeated, in recognition that watershed management is not a one-time planning process but an ongoing, adaptive one. To help distribute government resources effectively, these five steps are staggered between watersheds. Thus in any one year, different management activities are undertaken for different management units. Mechanisms for agency-to-agency coordination (such as a multi-agency steering committee) can attempt to integrate different sectors. Processes to increase public involvement are often included.[67]

8.1.1 Watershed management in Canada

The importance of a watershed focus has certainly been recognized in Canada. The 1987 Federal Water Policy (Environment Canada 1987) states: "Increasingly, watersheds are becoming the preferred spatial unit for water resource planning. It is an approach that makes sense at any scale of planning." In Ontario, as far back as 1946, the creation of Conservation Authorities embodied a watershed approach.

Other more recent initiatives that embrace a watershed approach include the Saskatchewan Watershed Authority, Manitoba Water Strategy, Alberta Water for Life Strategy, source water protection reforms in Ontario and the Quebec Water Policy. Canadian policymakers increasingly recognize that sound management practices implemented at the watershed level will protect ecosystem functions, and protect water resources as well. This evolution in thinking puts watersheds at the centre of environmental decision making. The challenge is translating this understanding into an appropriate, effective and collaborative governance regime.

[67]Successful integration and participation in mainly government-run watershed management schemes such as those in the United States have, however, been limited. The management of different sectors in the watershed remains fundamentally split between government agencies with varying mandates. "Turf battles" between agencies are common. And experience in a number of states has shown that attendance by NGOs and citizens at government-led basin meetings is poor, likely because many perceive the government agency to be simply "going through the motions" (EPA 2002: 26).

8.2 Collaborative governance at the watershed level

The U.S. Environmental Protection Agency (EPA 2002: 26), in a review of state-wide watershed management experiences, noted: "[s]tates often describe their most notable successes as occurring in watersheds with strong stakeholder groups supported by state and other resources. While it may be difficult in some cases for states to devolve agenda-setting and priority-establishing powers—and the associated funding—to local entities, such an approach enhances the prospect for local buy-in, support, and action."

Similarly, *Washington State's Watershed Management Act* states: "the local development of watershed plans for managing water resources and for protecting existing water rights is vital to both state and local interests. The local development of these plans serves vital local interests by placing it in the hands of people who have the greatest knowledge of both the resources and the aspirations of those who live and work in the watershed, and who have the greatest stake in the proper, long-term management of the resources. (Revised Code of Washington §90.82.010).

The evolution of watershed management in Washington State provides an example of the growing recognition of a need to shift away from centrally-driven efforts towards more collaborative watershed-based approaches that embody an "experimentalist" ethic (see Box 57). Australia has become a world leader in state-wide "integrated catchment management" (ICM)—the Australian term for watershed management—under the leadership of COAG and the Murray-Darling Basin Initiative. A number of Australian states have also expressly legislated the devolution of powers to the catchment level (see Box 58).

For large watershed basins, a "nested scale" approach is often appropriate, as illustrated in the French Water Parliament example discussed above. A management authority for the basin develops policies and plans that address basin-wide problems. These provide guidance to the management bodies of smaller, nested watersheds, which develop detailed action plans tailored to local problems. This approach is used in the Chesapeake Bay and the Great Lakes programs, as well as in the Murray-Darling Basin in Australia (EPA 1997: 27; Karkkainen 2002: 209).

Watershed management institutions must include broad participation from the watershed community. Local people and businesses should be invited to participate in various ways, including representation and consultation during planning, and direct involvement in implementation and monitoring (Webler and Tuler 2001; Chess et al. 2000). Participation by non-local interests may also be included, such as representatives from higher level governments or national NGOs, to ensure these watershed bodies do not become too heavily weighted toward local economic or political interests at the expense of broader ecological goals (EPA 2002: 27).

Raising public awareness of watershed management issues is also critical. Significant transformative potential exists by ensuring meaningful public participation in watershed management, shifting how citizens and institutions relate to one another and to their watersheds and providing a broad-based societal sense of place (Cannon 2000: 419-425). A volunteer program in Oregon's McKenzie Watershed, for example, engages students throughout the watershed in the evaluation and monitoring of water quality parameters. This program allows for monitoring of activities at a number of diverse sites on a weekly basis, and has proved an effective outreach tool, helping citizens link their personal actions with watershed problems (EPA 1997: 30).

Watershed management bodies require adequate and secure long-term funding. A common frustration is the lack of resources for implementation after so much effort has gone into the planning process. Options for funding include state grants, watershed levies, and dedicated water withdrawal revenues for watershed management.

8.2.1 Government role in nested watershed management

The multi-tiered governance structure discussed above embodies the experimentalist principle of *subsidiarity*, with each level of governance addressing those issues that are most appropriately handled at its scale of management. Watershed management bodies must be given sufficient authority to plan and ensure their plans are implemented. However, such devolution must also ensure sufficient higher (senior government) and lower (municipal and regional bodies) level government involvement.

A hierarchy of plans and policies is usually created by the various governing bodies, starting with international and inter-provincial water sharing agreements, moving down through provincial land and water use policies, individual basin and watershed plans, and finally to local/municipal DSM and land-use plans.

Vertical integration between these levels of governance is important. Legislation can require lower level plans and policies to be consistent with higher-level

Box 57: Evolving watershed management in Washington State, U.S.

Washington State's first state-wide watershed management framework splits the State into 23 Water Quality Management Areas (WQMAs), with each WQMA assigned to a Regional Office of the State Department of Ecology. A five-step, five-year rotating management process establishes a point-source pollution permitting (NPDES) procedure and a Total Maximum Daily Load (TMDL) program, two requirements of the federal *Clean Water Act*.

Watershed Management Act (WMA), enacted in 1998, initiated a second, more locally-led and collaborative state-wide watershed management program. Under this program, the State was split into 62 Water Resource Inventory Areas (WRIAs) based on watershed boundaries. Local citizens, NGOs, governments and native tribes can voluntary form a Planning Unit for one or more WRIAs. State agencies, such as the Department of Ecology, provide grants, technical assistance, training and if requested can serve on Planning Units.

The only legislated requirement of a Planning Unit is a water quantity plan to address the competing demands for water. Planning Units may choose to address a number of other issues, including water quality, aquatic and riparian habitat, and in-stream flows. The planning process proceeds in four phases.

1) ***Start-up.*** Initiating governments (counties, the largest city, tribes, or the highest volume water utility within a WRIA) can apply for an organizing grant of up to $50,000.

2) ***Assessment.*** Planning Units may apply for up to $200,000 per WRIA to fund watershed assessments, which gather information on surface and ground water availability, current human use, and recharge rates of aquifers and surface waters. An additional $300,000 is available to Planning Units that pursue the optional (non-quantity) issues.

3) ***Plan development.*** Up to $250,000 per WRIA is available for development of a Watershed Management Plan. If the Planning Unit approves the Plan by consensus, governments at the table are obligated to implement the plan, which is then submitted to each county government in the WRIA for ratification. If the Planning Unit develops instream flow recommendations, they can be adopted as binding State rules that limit subsequent water withdrawal permits.

4) ***Implementation.*** Once a Plan has been approved, an implementation grant of up to $100,000 per year for the first three years, and $50,000 for the next two years, is available per WRIA.

As of March 2003, 42 of the 62 WRIAs were represented by 33 Planning Units, a number of which have recently completed their Watershed Management Plans. For example, the Elwha-Dungeness Planning Unit recently completed its draft plan after five years of work. The Planning Unit chose to address all the optional issues, and the resulting draft plan includes recommendations on water quantity and quality, habitat, instream flows, stormwater, land use and management, education and outreach.

As for water conservation, the Elwha-Dungeness draft plan includes a detailed examination of water quantity issues, including urban DSM efforts within the WRIA. Some of its innovative recommendations include: a conservation plan developed by all water suppliers, annual maintenance shut-downs scheduled by industry during low water flow periods, reduction targets established for water utility system leakage, and the elimination of taxes on conservation materials and equipment.

Source: (Elwha-Dungeness Watershed Plan; EPA 2002: 25,64,65)

ones. This creates accountability mechanisms up through the hierarchy, and ensures that higher-level bodies provide guidance and assistance to lower level ones. Efforts in various Australian states, including South Australia and Victoria provide fine examples of such nested integration.

Horizontal integration between governance entities at the same level is also important, such as coordinating actions between watershed management bodies and helping them learn from one another. For example, a Common Implementation Strategy (CIS), discussed in Chapter 4, consists of a number of work groups and expert advisory bodies to develop practical guidelines and tools to promote information sharing as part of the European Union Water Framework Directive (WFD) to adopt river basin management (EU Directive 2000/60/EC; Ast and Boot 2003; Rijswick 2004).

In the United States, the EPA has provided significant assistance to state watershed management efforts over the past decade (EPA 1997; EPA 2002). This has included training for state personnel, organization of a National Watershed Forum and regional roundtables, comprehensive Internet training tools, and funding and awards programs.

Box 58: The Murray-Darling Basin Initiative in Australia

The Murray-Darling Basin covers most of inland south-east Australia. It is over one million square kilometres, and spans five states/territories. Intense development pressures led to rising salinity levels, reduced instream flows and endangered native fish populations. Federal, state and territorial governments responded by creating the Murray-Darling Basin Initiative, the largest integrated catchment management program in the world, and a model for governance. Three key governance bodies have been created.

• The **Murray-Darling Basin Ministerial Council (MDBMC)** determines major basin-wide policy for the Initiative. It consists of ministers responsible for land, water and environmental resources from each of the collaborating governments, and acts by unanimous votes so that decisions reflect government consensus across the basin.

• The autonomous **Murray-Darling Basin Commission (MDBC)** provides assistance and advice to the Ministerial Council, and coordinates implementation of Council measures. It consists of senior public servants from each signatory government, and is assisted by a Strategic Investigations and Education (SI&E) program to fund scientific research for policy development.

• The **Community Advisory Committee (CAC)** advises the Ministerial Council, participates in basin-wide policy development, and disseminates Council decisions to basin communities. Its 21 members include a representative from each of the catchments across the basin, five from national special-interest stakeholder groups, and two Indigenous representatives.

These governing bodies have initiated a broad range of programs.

• In 1990, the Ministerial Council called for integrated catchment management (ICM) and community-government partnerships across the basin. Since then, 19 catchment management organizations have been created under state ICM programs.

• In 1993, the Ministerial Council initiated an Audit on Water Use in the Basin, which led to the Council placing a cap on diversions. This limits collaborating states to the volume of water that would have been diverted under 1993/94 levels of development.

• In 2000, the Ministerial Council initiated the Sustainable Rivers Audit, an ambitious assessment of river health and ecological conditions to obtain consistent, basin-wide information.

• In 2001, the Ministerial Council initiated the Living Murray Initiative, aimed at restoring instream flows of the River Murray. In 2003, the collaborating governments agreed to provide $500 million over five years to address water over-allocation in the basin.

• In 2001, a new Integrated Catchment Management (ICM) Policy Statement was released. Jointly developed by the Ministerial Council and the Community Advisory Committee, it commits the Commission to setting and achieving resource condition targets for water quality, consumptive uses and environmental flows, the re-establishment of native aquatic species, etc. Recognizing its ambitious agenda, the ICM Policy concludes: "Significant costs will be incurred in establishing the arrangements outlined in this document and in managing the basin's catchments into the future. However, these costs are dwarfed when compared with the inevitable costs-economic, environmental and social-if current management practices are not changed."

Source: (MDBC 2004; COAG 2004; Bellamy 2002: 42; Purdie 2003)

In Canada, provincial and federal governments will need to collaborate to provide an effective legislative framework and suitable assistance to facilitate cross-Canada watershed management. A national strategy on water sustainability is key. Local governments also have important roles to play, both as planning partners on watershed bodies and in the implementation of watershed strategies and plans, such as urban water DSM. Australia has devoted considerable efforts to improving such catchment-municipal linkages. For example, the Australian National Heritage Trust (NHT) has undertaken a project entitled "Incorporating integrated catchment management into local government planning."

8.3 From reactive to proactive watershed management

A number of high profile watershed management initiatives have been undertaken in response to mounting ecological crises or lack of existing controls. These include:

- **New York City's Watershed Protection Program.** In an attempt to avoid building an expensive water filtration plant, a Memorandum of Agreement (MOA) was signed in 1997 by the City, the State, the federal EPA, five environmental groups, seven counties, and 71 watershed towns and villages. Under the MOA, watershed management is being

implemented on a scale unprecedented in the United States. It includes an acquisition program to buy water-sensitive lands, a set of rules controlling activities close to bodies of water, funds for environmentally conscious development, and a set of best practices for agriculture and forestry to reduce water impacts. The initiative is expected to cost the City $1.5 billion over 10 years (NRC 2000; Kimmerling et al. 2000-2001; Yaggi 2000-2001).

- **The Murray-Darling Initiative in Australia.** Under this initiative, the federal and five state/territorial governments cooperate to address the over-demand for and degradation of water and land resources in the Murray-Darling Basin (see Box 58).
- **The CALFED Bay-Delta Program in California.** Under this program, the state and federal governments cooperate to address poor water quality, the water needs for endangered aquatic species, and the competing and increasing water demands of the Bay-Delta area. Water conservation plays a significant role in CALFED. $1.8 billion was proposed for urban and agricultural conservation, including water recycling, with a baseline level of water use efficiency a condition for permitting new surface storage projects (Dyballa 1999: 45; Adler and Straube 2000-2001).

These initiatives have achieved notable successes, and provide many important lessons in designing ongoing, dynamic, collaborative management processes, especially in inter-jurisdictional contexts. They are, however, "reactive" responses to existing or mounting problems and are applied on an ad hoc basis. Such an approach allows problems to grow until they are difficult and costly to remedy, not only because of the significant ecological damage that has occurred, but also because of the deeply entrenched and conflicting positions that have often formed.

One of the main lessons to be learned from these three examples is that the crises and lack of controls that necessitated them should (and could) be avoided with a proactive approach. Province-wide collaborative watershed management is required to achieve this, ideally as a central component of a national water sustainability strategy.

Chapter 9
Conclusion and future directions

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 center on 'getting institutions right.'

(Saleth and Dinar 2004: 23)

The Commissioner of the Environment and Sustainable Development (2001) declared that "water is becoming the world's most sought after resource…The availability and management of fresh water is becoming one of the greatest environmental, political, and social challenges of the 21st century." Even for Canada, a nation relatively rich in freshwater resources, achieving sustainable freshwater management poses a significant challenge.

Canada is indeed at a watershed as it moves from a situation of historic abundance of water, to a future of freshwater scarcity. Yet, Dr. David B. Brooks (2003a: 42), Canada's foremost water conservation specialist, warns that "[o]ur management systems for fresh water in Canada are becoming less, not more, sustainable…"

The question is not about whether Canada must use water more efficiently. It is to what extent Canada will go beyond increasing efficiency to a more fundamental change—a paradigm shift in water management.

Political and institutional constraints are considerable. Institutions that will creatively manage and accelerate the adoption of sustainable solutions are needed. *At a Watershed* demonstrates that change is possible and that long-term solutions to water scarcity exist.

Canada has the opportunity to break from its historical pattern of wasting water. A future different from the past is possible. Financial, technological, legal and social tools are available to grapple with water issues before they reach crisis proportions. But the long-term solution requires a fundamental shift to *watershed or ecosystem governance*. It requires an institutional shift towards ecologically-based water allocations, the soft path for water, ecosystem-based management, and innovative urban water management.

The challenge now is to ensure that these new approaches, resources and institutional arrangements are implemented across the country. Senior government must provide the leadership to make this happen and take steps to ensure water agencies have the capacity and incentives to implement comprehensive solutions at the local level.

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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 extractive, linear and unsustainable systems that continue to level ancient forests, displace indigenous and local communities and clog and choke our global cities. Instead ecological governance 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 supply 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, revitalization or overhauling national environmental laws, the thrust of all of our research is guided and informed by the concept of ecological governance.

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