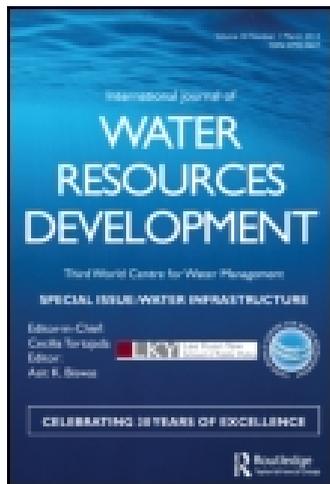


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Integrated water resource management: lessons from conservation authorities in Ontario, Canada

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The lessons and opportunities of integrated water resource management in Ontario are described by focusing attention on conservation authorities: watershed-based agencies formed between 1946 and 1979. Six foundational principles of the programme are explained: the watershed as the management unit; local initiative; provincial–municipal partnership; a healthy environment for a healthy economy; a comprehensive approach; and cooperation and coordination. Illustrative examples from the Grand River and Halton Region conservation authorities provide the basis for conclusions. The six principles have served the integrated water resource management programme well. In addition, the ability to make difficult budgetary decisions and adapt to changing public need has contributed to the conservation authorities' success

Keywords: IWRM; conservation authorities; Ontario; implementation lessons

Introduction

Integrated water resource management (IWRM) is an ecosystem approach in which at least: (1) the catchment or river basin¹ rather than an administrative or political unit is the management unit; (2) attention is directed to upstream–downstream, surface–groundwater and water quantity–quality interactions; (3) interconnections of water with other natural resources and the environment are considered; (4) environmental, economic and social aspects receive attention; and (5) stakeholders are actively engaged in planning, management and implementation to achieve an explicit vision, objectives and outcomes. Moving from the ideals of IWRM to successful implementation can be challenging (Beveridge & Monsees, 2012; Biswas, 2008; Blomquist & Schlager, 2005; Butterworth, Warner, Moriarity, Smits, & Batchelor, 2010; Molle, 2008).

In the light of IWRM, this study examines the performance of the conservation authorities in Ontario, Canada. Thirty-six river basin–based organizations are facilitated by provincial legislation passed in 1946 to be partnerships between the provincial and municipal governments related to 'integrated watershed management', or IWM. IWM is defined by Conservation Ontario (2013a) as

the process of managing human activities and natural resources on a watershed basis. The approach allows us to protect important water resources, while at the same time addressing critical issues such as the current and future impacts of rapid growth and climate change. . . .

This approach allows us to address multiple issues and objectives and enables us to plan within a very complex and uncertain environment.

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IWM is applied by the conservation authorities to achieve their mandate “to ensure the conservation, restoration and responsible management of Ontario’s water, land and natural habitats through programmes that balance human, environmental and economic needs” (Conservation Ontario, 2013b). The conservation authorities also have four core objectives: (1) to ensure that Ontario’s rivers, lakes and streams are properly safeguarded, managed and restored; (2) to protect, manage and restore Ontario’s woodlands, wetlands and natural habitat; (3) to develop and maintain programmes that will protect life and property from natural hazards such as flooding and erosion; and (4) to provide opportunities for the public to enjoy, learn from and respect Ontario’s natural environment (Conservation Ontario, 2013b).

Following passage of the [Conservation Authorities Act](#), many municipalities across Ontario banded together to form conservation authorities.² Because of variation in the size and nature of watersheds, many of the original conservation authorities formed in the late 1940s and 1950s later amalgamated to consolidate their programmes.³ Today, conservation authorities range in size from 490 km² (Catfish Creek Conservation Authority) to 6800 km² (Grand River Conservation Authority). In 2012, the number of full-time staff and expenditures ranged from 7 with annual expenses of CAD 1.1 million (Catfish Creek Conservation Authority) to 1204 with annual expenses of CAD 85.2 million (Toronto Region Conservation Authority) ([Canada Revenue Agency, n.d.](#)).

These differences are both an asset and a detriment to the delivery of IWRM. While each conservation authority has created and delivered programmes focused on the key watershed issues in its jurisdiction, they have been criticized for being unaccountable and for being unable to deliver consistent resource programmes across the province. To address such criticisms, Conservation Ontario⁴ has produced several discussion papers, including a *Brief on the Reform, Responsibilities and Funding of Ontario’s Conservation Authorities* (Association of Conservation Authorities of Ontario, 1986); *Blueprint for Success: Restructuring Resources Management in Ontario* (1993); and *Watershed Management Futures for Ontario* (2012). These papers acknowledge that watershed management in Ontario needs reform, reiterate the importance of IWM, and suggest opportunities to realign governance, funding and accountability frameworks in order to achieve more effective implementation of IWM. In addition, conservation authorities are working with their municipal and provincial partners to provide more consistent delivery of plan review and permitting programmes⁵ and have developed a template for watershed report cards. In 2013, watershed report cards were produced by 28 conservation authorities as a management and evaluation tool to enable conservation authorities, municipalities and other partners to target priorities and measure environmental change (Conservation Ontario, 2013c).

A record of almost seven decades allows examination of what has been learned in moving from the ideals to the practice of IWRM by the conservation authorities, which manage watersheds containing 90% of Ontario’s 11 million people (Pentland & Wood, 2013). This article’s purpose is to examine and reflect upon both the accomplishments and the challenges.

Context⁶

Two major considerations led to the Conservation Authorities Act in 1946. The first concerned the provision of jobs for returning World War II veterans. The second pertained to the degraded state of the province’s renewable natural resources. These two concerns stimulated two catalytic events. The first was the Guelph Conference in 1941, usually

considered as the impetus for the conservation authorities (Mitchell & Shrubsole, 1992). Its participants concluded that the most effective conservation strategy would be based on watersheds and that renewable resources needed to be treated in a holistic way. The second initiative was the Ganaraska Survey (Richardson, 1944), a study completed in 1944 by the provincial government regarding the state of renewable natural resources in that watershed. It advocated a new paradigm – river valley development – and recommended establishment of watershed-based conservation authorities.

A challenge in water resource management is to create effective governance arrangements, something well understood in the 1940s by the advocates of river valley development. Regarding the Ganaraska Survey, it was observed that leadership by an existing provincial agency

would be the most obvious solution ... but ... no one department is equipped at present with a staff of experts trained in all sciences represented. Even if a department were equipped, it is questionable whether the best interests of the community would be served by having a government department take absolute responsibility for such a programme (Richardson, 1944, p. 238).

Proponents of the conservation authority programme recognized that experience had been gained elsewhere. Thus, they systematically examined the Tennessee Valley Authority (USA), the Muskingham Watershed Conservancy District (Ohio, USA) and the Grand River Conservation Commission (Ontario) while designing the proposed new agencies for Ontario.

Principles

Six principles underlie river valley development and the conservation authority programme: (1) the watershed as the management unit; (2) local initiative; (3) provincial–municipal partnership; (4) a healthy environment for a healthy economy; (5) a comprehensive approach; and (6) cooperation and coordination.

The rationale for “the watershed as the management unit” reflected a conviction that a “comprehensive approach” was essential, with water being the principal variable or starting-point. Being able to examine water inputs and outputs, all water uses, upstream–downstream issues, and values of a watershed in supporting ecosystems and economies would prompt managers to adopt a holistic appreciation of the water resource. It also would promote effective decision making. The initial plans, referred to as ‘conservation reports’, completed for each conservation authority shortly after its initial formation, embraced both a watershed perspective and a comprehensive approach.⁷ These plans were prepared by an interdisciplinary team. They covered a range of topics, including physical and human geographies, hydrology, history, land use, wildlife, agriculture and urbanization. Their intent was to ensure attention to both economic development and environmental protection (“a healthy environment for a healthy economy”).

Each plan examined water and land-related resources and recommended a mix of dam construction and other structural adjustments, land acquisition, reforestation, park development, better agricultural practices and general public information and education (“comprehensive approach”). No visible public participation occurred during development of the initial plans, and recommended projects reflected their perceived desirability by the study team. Neither was there any impact analysis – economic, environmental or social. Until the mid-to-late 1970s, the major activities of many conservation authorities focused on selecting and implementing the most desirable

and feasible projects from the conservation reports. Local benefits were promoted, and often achieved, through the local municipal representatives on each conservation authority.

A key aspect of “provincial–municipal partnership” was an early 50-50 cost-sharing agreement between the provincial and municipal governments. Thus, neither the province nor local municipalities could impose projects viewed as undesirable by or beyond the capacity of local governments. Furthermore, because of their financial contribution, the municipal governments had commitment to and ownership of initiatives. This funding arrangement was used, in part, to make formation of a conservation authority attractive to municipalities. The rationale was that the provincial share of the funding for a range of programmes, including water management, reforestation and recreation, was available to municipalities only through conservation authorities. Thus, “local initiative” was required by municipal governments in a watershed to propose a conservation authority. Cost sharing among local communities was generally based on the benefits derived from a project or the share of the watershed’s tax base or population.

“Cooperation and coordination” was also fundamental. As previously noted regarding the Ganaraska Survey, in the early 1940s various provincial departments were involved in many aspects of water management. The formation of a conservation authority did not eliminate this fragmentation. However, a conservation authority was expected to foster greater cooperation and collaboration among provincial agencies, as well as between the province and local municipalities. This expectation was initially achieved through a multi-agency approval system requiring line provincial departments to approve, and sometimes fund, conservation authority projects related to their primary mandates (e.g. forestry, wildlife, or agriculture). This cumbersome approach was eliminated by 1953. Another early approach to achieving cooperation and coordination, used until the 1970s, was the participation of line provincial agency and municipal officials on many conservation authority advisory boards. These dealt with issues of forestry, agriculture and water management. However, this arrangement was eventually stopped because of the conflicts of interest it created.

Conservation reports also fostered cooperation and collaboration. Until the 1980s, provincial agencies did not conduct strategic planning, and their medium- and long-term intentions were not articulated to those outside the organization. In contrast, many conservation authorities’ long-term plans were provided in the conservation reports. This established a transparent basis for discussion among conservation authorities, provincial agencies and local municipalities.

Since 1946, water management paradigms have evolved in response to changing characteristics and conditions within the province of Ontario (e.g. new legislation, financial arrangements and challenges) as well to new ideas and events external to the province (e.g. the Stockholm Conference and the Dublin Statement). IWRM has influenced the values and strategic approaches of the government of Ontario, the municipalities and the conservation authorities. This article examines the initial six principles and their current relevance within the context of IWRM through examples from the Grand River (GRCA) and Halton Region (Conservation Halton, CH) conservation authorities.^{8,9} These two conservation authorities were selected because the GRCA has won an international award for its performance and CH provides an example of an authority functioning adjacent to major metropolitan areas. Though these 2 cannot represent all 36 conservation authorities, they do illustrate the experiences of many. Implications are addressed in the concluding section.

Provincial–municipal partnership and financial arrangements

A major impediment to effective IWRM is inadequate funding for activities. Traditional sources of funding for Ontario's conservation authorities have been provincial government agencies, municipalities and self-generated revenues (e.g. parks, timber sales, land rental and fundraising). Until the early 1990s, provincial transfer payments for administration, conservation, and recreation activities represented a significant and relatively stable source of funds for conservation authorities. With provincial funds matched by fees from municipal levies, financial arrangements reflected a reasonably reliable provincial–municipal partnership. In the early 1990s, provincial payments to the conservation authorities were nearly CAD 50 million annually.

In response to the province's changing fiscal circumstances, modifications to the financial arrangements began in the early 1990s. In 1991, provincial funding ceased for all non-core functions of the conservation authorities, including recreation and education. The most severe reductions in provincial funding occurred with a 70% decrease in conservation authorities' operations funding implemented over two years. This caused a decline in funding from CAD 33 million in 1995 to CAD 12 million in 1996 (Shrubsole, 1996). Provincial funding would continue to drop to less than CAD 8 million per fiscal year by 2002.

Not only was the amount of funding from the province reduced, but funds became available only for specific conservation authority functions: structural flood control and protection of significant lands through municipal tax coverage (Ivey, Smithers, de Loë, & Kreutzwiser, 2004; Shrubsole, Hammond, Kreutzwiser, & Woodley, 1997). Provincial funding was no longer available for non-structural watershed management, including commenting functions for provincial regulations such as the [Planning Act](#) and development controls supported by the Conservation Authorities Act (Shrubsole, 1996). Levies from municipalities were restricted to functions mandated for conservation authorities. Traditionally, discretionary levies were considered imbursements from municipal partners for any function that both parties considered beneficial (e.g. tree planting or research), even if they were not part of mandated functions, subject to provincial government approval.

To address the substantial funding cuts from the province, the conservation authorities focused on enhancing their partnerships with watershed municipalities. Rather than seeking to raise municipal levies, many conservation authorities worked collaboratively with their municipal partners, which also had been affected by changing financial arrangements, including decreased or frozen levies (Priddle, 2009).

Such an approach helped to maintain positive partnerships with municipal governments. However, it also resulted in conservation authorities often having to cut funding to programmes, decrease staff and other resources, and consider alternative funding sources such as land sales. As an example, overall programme funding at the GRCA dropped from CAD 18.4 million in 1995 to CAD 14.3 million in 1996 (Priddle, 2009). Similarly, revenue for the Nickel District Conservation Authority, one of the five northern authorities, fell from nearly CAD 1.5 million to CAD 800,000 during that same period (Bullock & Watelet, 2006). It would not be until the late 1990s and early 2000s that many conservation authorities began to contemplate increases to municipal levies. In 2000, for example, the GRCA increased the municipal levy by 7.85% (Priddle, 2009). For all of the conservation authorities, municipal levies began to increase in the 2000s, even without increases in provincial funding.

To address funding reductions from the provincial government, the conservation authorities have increasingly focused on involving themselves in innovative partnerships to obtain funding and obtain stature with the community, to undertake new ventures (e.g. hydropower generation), and to renew fundraising activities by their associated charitable foundations. Provincial partnerships are still an element for conservation authorities, although they are often made with non-traditional provincial partners such as the Ministry of Culture, Tourism and Recreation. Today, self-generated income represents a significant portion of conservation authorities' income, often near 50% of overall funding.

One example of partnerships that have adapted to changing institutional and financial arrangements is CH's experience with the Hamilton Harbour Remedial Action Plan (HHRAP). In the late 1980s, CH and the Hamilton Region Conservation Authority (then known as the Hamilton Conservation Authority) applied their knowledge of the local community and watersheds that drain into Hamilton Harbour as part of the Stakeholders Group and Writing Team for the HHRAP. When HHRAP reports were submitted in 1992 to the International Joint Commission, the Stakeholders Group was separated into the Bay Area Implementation Team (BAIT) and the Bay Area Restoration Council (BARC).

Responsible for implementation of the HHRAP, BAIT has 17 members. It includes representatives from CH and the adjacent Hamilton Region Conservation Authority who have technical expertise as well as knowledge of relevant planning processes and community stakeholders. In the mid-1990s, when the provincial premier removed funding for the HHRAP process, CH entered into an agreement with the federal government to provide a coordinating role for the HHRAP. Two employees of CH (one who has served as the HHRAP programme coordinator since 2000 and another who has worked entirely on the HHRAP programme from the HHRAP office) remain full-time employees of CH. Funding for these positions has been provided by Environment Canada, the Ontario Ministry of the Environment, and three watershed municipalities. BARC is separate from BAIT and represents a confederation of community citizen stakeholders. BARC realized the importance of upstream non-point pollution sources and supported the creation of a stewardship programme. Tasked with disseminating information and funds for environmental projects on private lands, the Hamilton-Halton Watershed Stewardship Program is now administered by and operated through a partnership between the two conservation authorities.

Since the early 1990s, CH has adapted its involvement within the HHRAP in response to changing institutional arrangements. Even though this involvement has not resulted in incremental direct funding, CH has contributed planning and project administration to the HHRAP. In return, it has expanded its scope of activity, increased its knowledge of the watershed and enhanced its stature within the community. This experience reflects an altruistic partnership for the betterment of the community's environment.

Despite severe funding cuts, conservation authorities have managed to maintain partnerships with provincial and municipal governments and to continue delivering a broad range of programmes and management functions. The ability to deliver varied programmes is facilitated by the Conservation Authorities Act, which allows conservation authorities to establish their own programmes, enter into innovative partnerships, and find creative new sources of revenue to deliver programmes. Since the mid-1990s, as a result of such adjustments, the conservation authorities have largely been able to address the challenges related to financial arrangements through a shift away from traditional funding sources, especially from the provincial government. The focus on innovative partnerships and new sources of funding highlights the necessity for watershed-based agencies to be adaptable as circumstances change.

Watershed as management unit; comprehensive approach; cooperation and coordination: Grand River Conservation Authority case study

During its early years of operation, the GRCA focused on water control through construction of multipurpose dams and channel works, as recommended in the reports completed by the provincial government in the 1950s (Ontario Department of Planning and Development, 1954). However, as communities in the watershed grew, debate arose regarding the efficacy of additional dams for water supply and effluent dilution versus constructing a pipeline to one of the Great Lakes. This debate precipitated an additional provincial study by the Ontario Treasury Board (1971). It recommended that a comprehensive plan for the Grand River watershed be developed and coordinated by a multidisciplinary government planning team.

The immediate concerns of water supply and pollution were overshadowed by a devastating flood in May 1974 in the Grand River basin (Grand River Disaster Relief Committee, 1975). The province established a royal commission to investigate the circumstances surrounding the flood. Immediate improvements to the water control system, including a new dam and reservoir, were recommended (Leach, 1975). In 1979, a comprehensive environmental assessment of water control structures concluded that, in addition to various ongoing water management and land use programmes, an additional multipurpose reservoir was needed on the Grand River, together with river channel and waste disposal improvements (Grand River Conservation Authority, 1979).

Concurrently (in 1977), the province initiated the Grand River Basin Water Management Study. This CAD 1.6 million study examined issues relating to water quality, water supply and flooding. It was directed by the Grand River Implementation Committee, which was composed of representatives from five provincial ministries and the GRCA. The technical work was led by a coordinator and undertaken by five multi-agency subcommittees. Using a 50-year planning horizon, the study generated and examined 26 different scenarios to deal with water issues. Public input was obtained through public meetings. A Public Involvement Program Advisory Committee also was formed. It created four public consultation groups, representing a wide range of interests and geographical areas of the watershed. These groups were involved in the formation, screening and evaluation of the water management scenarios.

In 1982, the Grand River Basin Water Management Study report was released. It recommended an option costing more than CAD 180 million (Grand River Implementation Committee, 1982). The study's 22 recommendations called for action by the GRCA and municipal and provincial governments and emphasized the need for a mix of structural and non-structural approaches. Most of the plan's recommendations were implemented, although the study was never formally approved by the province (Conservation Ontario, 2003, Appendix D). Implementation occurred because people with day-to-day responsibilities for addressing water issues in the watershed actively participated in the study and had a vested interest in pursuing anticipated outcomes.

In 1987, another multi-agency initiative reinforced cooperative and coordinated management. Requested by several municipalities, a multi-agency steering committee with representatives from Parks Canada, the Ontario Ministry of Natural Resources and the GRCA considered the Grand River for designation in the Canadian Heritage Rivers System.¹⁰ After background studies were completed (Nelson & O'Neill, 1989), extensive public participation produced a management plan (Grand River Conservation Authority, 1994). Embedded in the plan were the principles of consensus, community

involvement, cooperation and commitment. The overarching philosophy was that everyone sharing the resources of the Grand River watershed should be part of concerted and collective effort. “Share the resources – share the responsibility” became the motto. Early in the process, a shared vision and a set of values and principles were debated, modified and accepted. The plan provided a framework within which stakeholders could volunteer for specific actions to conserve, interpret and enhance river-related heritage resources in the watershed. The plan was accepted by the Canadian Heritage Rivers Board, followed in 1994 by the formal designation of the Grand River and its major tributaries.

The merits of an ongoing holistic and collaborative watershed management approach were recognized in 2000, when the GRCA received the Thiess International Riverprize for excellence in river management in Brisbane, Australia (Krause, Smith, Veale, & Murray, 2001).¹¹ This prestigious international award fostered a sense of pride among watershed residents and government decision makers. This positive view, in turn, benefitted the GRCA, when discussions were held with member municipalities regarding the need for increased funding support. For example, watershed municipalities supported annual increases in levy contributions, from CAD 3.6 million in 2000 to CAD 6.4 million in 2003, while the overall GRCA budget increased from CAD 15.3 million in 2000 to CAD 21.76 million in 2003.

The Grand River watershed is now experiencing challenges related to climate change, escalating population growth, and agricultural and urban intensification. Most of the drinking water for almost one million people comes from groundwater and rivers in the basin. The rivers assimilate effluent from 30 wastewater treatment plants and runoff from urban and rural non-point pollution sources. The cumulative impact of progressive water takings, increasing contaminant loads and climate change is adversely affecting the hydrology and ecology of the river system (Grand River Conservation Authority, 2010a).

In response to this challenge, an updated water management plan (WMP) for the Grand River watershed was launched in 2009. Building on earlier experiences with collaborative planning, the GRCA engaged partners from federal and provincial agencies, municipalities and First Nations. A project charter outlining the purpose, scope, goals, guiding principles and partner roles was crafted and signed by the partners to signify joint commitment and agreement (Grand River Conservation Authority, 2010b). A multi-agency steering committee oversees the WMP and is supported by a technical project team with representation from all partners. Several multi-agency working groups were formed to answer technical questions, synthesize data, share best practices and exchange perspectives. The GRCA provides administrative support and ensures that information is shared among and discussed by participants. Administrative support has been funded through the provincial Ministry of Environment’s Showcasing Water Innovation programme, with further in-kind funding from other partners.

The WMP is voluntary and non-regulatory. It builds on past and current knowledge, planned actions, commitments to meet shared goals, and an adaptive approach for continuous improvement. Knowledge assembly is encouraged through facilitated workshops, surveys, and meetings at which participants share their experiences, challenges and innovations. Communities of practices around water demand management, stormwater management and enhanced performance of wastewater treatment plants are forming among partners.

Twenty-three broad water objectives, supporting human uses, ecological needs and social and cultural values for water have been developed and agreed to by the partners. Indicators and targets describing when the broad objectives are met are being identified.

Monitoring will be performed to corroborate that the partners have done what they said they would do and measure progress toward meeting the targets. The insights from monitoring will be used to adjust implementation strategies and actions, as well as to revise the WMP (Grand River Conservation Authority, 2013).

Legislating IWM principles

Earlier, it was mentioned that the Guelph Conference and the Ganaraska Survey influenced the reshaping of water governance and institutions in Ontario. Nearly 60 years later, a tragedy became the impetus for further reform. In 2000, seven people died and thousands became ill in Walkerton, a community of about 5000 people in southern Ontario, as a result of drinking water contaminated with *E. coli* (Burke, 2001).

During the ensuing provincial inquiry, Chief Justice O'Connor specifically noted the importance of watershed management using multi-barrier protection. He recommended that the conservation authority model form the basis for developing source protection plans across Ontario watersheds. He endorsed a watershed-based approach (Recommendation 1) and conservation authorities being responsible for coordinating local initiatives and educating stakeholders about their responsibilities under source protection plans (Recommendation 8) (O'Connor, 2002b). The inquiry was followed by institutional and legislative reform in Ontario as the provincial government set out to implement the 121 recommendations in the *Report on the Walkerton Inquiry* (O'Connor, 2002a, 2002b). The subsequent Clean Water Act establishes a legislative foundation for some of the six initial principles of IWM and the five characteristics of IWRM. This section discussed how the legislative and regulatory changes support conservation authorities' capacity.

The Clean Water Act of 2006 and supporting regulations establish a new framework for the protection of drinking water and mandate the development and implementation of local, science-based source water protection plans. Grouping some of the 36 conservation authorities led to the creation of 19 source protection areas and regions across parts of the province.¹² The purpose of grouping two or more adjoining conservation authorities was to enhance capacity by sharing scientific, technical and administrative support for preparing source water protection plans. Within each region, one conservation authority takes the lead to foster cooperation and coordination among province, municipalities, stakeholders and First Nations (where applicable). Additionally, source water protection authorities coordinate the source protection process: assessment reporting and source protection planning, implementation, monitoring, reporting and updating. This is similar to the strategy introduced 67 years ago – conservation reports and recommendations, followed by implementation – but with the addition of monitoring, annual reporting and updating.

The specific contents of and methods for preparing comprehensive watershed-based assessment reports are set out in [Ontario Regulation 287/07](#). An advisory committee, led by the Ministry of the Environment, developed technical rules to guide the drafting of assessment reports (Ontario Government, 2004). This approach has standardized the reporting methods to ensure consistency. Assessment reports include: watershed characterizations; water budget; delineation of vulnerable areas; drinking-water issues and threats; and risk threat assessment. The threat assessment considers anticipated population growth and climate impacts over a 25-year period. Assessment reports do not contain recommendations. How to deal with significant drinking-water threats is the responsibility of individual source protection committees.

Members of source protection committees represent three main groups: municipal; economic (agriculture, business and industry); and environmental and health. Each group

receives a third of the seats (Ontario Regulation 288/07). First Nation communities within the source protection region or area receive up to three seats, depending on the size of the source protection committee. A source protection committee is responsible for guiding development of the source water protection plan for each watershed and for creating reasonable, science-based policies to protect current and future drinking-water sources. Policy options include: (1) establishing stewardship programmes; (2) specifying and promoting best management practices; (3) establishing pilot programmes; (4) commissioning research; and (5) specifying actions to implement the source protection plan or to achieve the plan's objectives (Clean Water Act, S.O., 2006, c. 22, s. 26(1)).

Ontario's Clean Water Act and supporting regulations establish source water protection committees and regions to integrate water protection and growth management through a watershed-based approach. Under the regulations, municipalities are responsible for developing and implementing risk-management strategies. Conservation authorities are responsible for coordinating planning efforts across source water protection regions. A conservation authority is required to assess threats to drinking-water quality through a process that emphasizes scientific knowledge. However, drinking-water quantity appears to be beyond the scope of the source protection committees' jurisdiction. All plans have been completed and are awaiting approval from the provincial government. Once approved, the plans will be implemented by various agencies, including municipalities, provincial ministries and conservation authorities.

Between 2004 and 2008, the provincial government committed CAD 120 million to technical studies to establish a scientific understanding of physical and human systems and their interaction in source protection areas and regions. Conservation authorities received financial support through the [Ontario Drinking Water Stewardship Program](#). From 2006 to 2011, the province spent CAD 21 million to assist landowners, businesses and others in reducing significant threats to drinking water, as well as to support source protection authorities in administering education, outreach and incentive programmes (Clean Water Act, 2006, c. 22, s. 97(2)). In 2010–2011, over CAD 500,000 was used to purchase land around municipal groundwater wells. The financial assistance has helped conservation authorities meet the objectives of the Clean Water Act. However, a long-term sustainable funding formula is uncertain. As noted earlier, declining funding during the 1990s has left some conservation authorities with little capacity to deliver the necessary education, outreach, incentive programmes, monitoring, reporting and updates.

Implications

The design and activities of the conservation authorities reflect the five principles of IWRM identified at the start of the paper. The general implications of this experience are considered below.

The experience of the conservation authorities highlights that IWRM is a means to serve identified ends. Since the early conservation reports, conservation authorities have explicitly identified their vision, objectives and desired outcomes. The governance model for conservation authorities embodies a blend of 'top-down' and 'bottom-up' approaches to enable dialogue and joint problem-solving at an appropriate scale and to address priority issues of concern to watershed stakeholders and to provincial and municipal governments. That two conservation authorities (GRCA in 2000; Lake Simcoe Region Conservation Authority in 2009) have received the Thiess International Riverprize confirms that each has a verified track record demonstrating a collaborative and coordinated, integrated, systems-based, science-informed and stakeholder-engaged approach and has delivered results relative to a vision, objectives and outcomes.

The record of the conservation authorities highlights a capacity to adapt, particularly with regard to changing priorities of the key provincial government partner, which led to significant financial challenges. In such circumstances, the conservation authorities sought new sources of income. Making such adjustments is rarely easy. It almost always involves a re-assessment of priorities, leading to some initiatives being cut back or eliminated, with negative consequences for some stakeholders. We believe that the capacity of the conservation authorities to make such adjustments has been one key to effectiveness. We also recognize that small conservation authorities find it difficult to make such adjustments because of smaller base budgets. Amalgamations have occurred in the more distant past (e.g. Conservation Halton), as well as more recently. For instance, the 1996 amalgamation of three conservation authorities (Moir River, Prince Edward Region and Napanee Region) to form Quinte Conservation was prompted by the provincial cuts of that era and enabled adequate economies of scale. These types of circumstances have also led other conservation authorities adjacent to one another to share scarce resources and thereby continue activities not sustainable for one on its own. Similarly, collaborations with local universities and colleges create unique learning and training opportunities, and thus students and faculty have helped supplement the efforts of conservation authorities.

The availability of provincial funding for specific programmes and cost-sharing arrangements favouring certain projects, such as the construction of small dams during the 1960s, influenced the nature and extent of activities. The watershed plans produced by conservation authorities in the late 1970s and early 1980s consisted largely of inventories of environmental attributes related to conservation authority programmes, such as acquisition of conservation lands or implementation of flood and erosion controls. Since the 1990s, conservation authorities have continued to coordinate watershed-planning activities, with an expanded role. While source protection regulations ensure financial support for administering and implementing plans, similar to earlier funding commitments, resources tend to fade along with community and political interests.

The value provided by conservation authorities through IWRM was recognized by Ontario's provincial government when it introduced the Clean Water Act and source protection regulations. The contents of assessment reports for source protection are similar to the earlier conservation reports. However, all of the reports are "comprehensive" only relative to their intended purpose and use. That is, the Clean Water Act is narrowly scoped to protect the quality of municipal drinking-water resources, with no provisions for protecting ecosystem health. The source protection committees' planning authority is restricted to addressing significant threats in the designated wellhead protection areas, surface water intake protection zone or vulnerable significant recharge areas. Consequently, assessment reports are narrowly scoped to identify and assign risk only to drinking-water threats. This is far less than what Justice O'Connor envisioned when he wrote that "source protection planning must be carried out on an ecologically meaningful scale – that is, at the watershed level" (O'Connor, 2002b, p. 89). The narrow scope of the legislation is a consequence of the Ministry of Environment's consultation with various advocacy groups during the regulation and policy-development process. However, conservation authorities address this weakness by undertaking broader watershed planning efforts. For example, the GRCA has been able to administer a parallel Watershed Management Planning programme along with the Source Protection Planning process by partnering with other agencies. The Ministry of Environment's Showcasing Water Innovation programme provided almost CAD 1 million to support the planning process. Without such funds, it would not have been able to coordinate the plan.

Conservation authorities have a long record of stakeholder engagement, especially because of their mandate to offer educational and incentive programmes and, more recently, the need to seek alternative funding strategies. Development of source protection regulations requires public consultation and stakeholder engagement throughout the source protection planning process. This process is both a strength and weakness in that it imposes a forced rather than voluntary type of collaboration within a regulatory framework. Stretch goals and voluntary partnerships cannot be considered. Moreover, by requiring the monitoring of threats and risks, submission of annual reports, and updating of source protection plans, the source protection committees can apply adaptive management strategies. However, funding is restricted to activities supporting the objectives of the Clean Water Act, not the entire mandate of conservation authorities.

Multi-agency collaboration and coordination have created various challenges. First, government representatives on conservation authorities change frequently, and decision makers, elected for a four-year term, tend to focus on immediate issues rather than taking a long-term view. Similarly, government funding programmes generally last only as long as they are supported by the current administration. Second, knowledge transfer within and among government bureaucracies and municipalities is often limited, leading to lack of awareness and assistance among other agency personnel not directly involved in the partnership. Third, other agency priorities can take precedence and result in inconsistent participation, disinterest, lack of support, and duplicative or conflicting actions. While conservation authorities play an important role in delivering IWRM by cultivating relationships that result in ongoing coordination and exchange of information among multiple agencies, their influence is limited.

Notwithstanding ongoing challenges, Ontario conservation authorities have accomplished much related to the application of IWRM. Despite the difficulties, Pentland and Wood (2013) concluded that conservation authorities represent models of watershed-based management and that their approach to source water protection has been innovative. In their view, conservation authorities have effectively taken a holistic approach to water and related natural resources and have engaged systematically with stakeholders. In particular, they observed that effectiveness has been a result of a collective mandate with measurable objectives, articulated roles and responsibilities for all participants, capacity to obtain financial and human resources, and capacity to influence initiatives with implications for water security.

Notes

1. In this paper, 'catchment', 'river basin' and 'watershed' are used interchangeably, reflecting the common practice in Ontario related to these three terms. It is understood that, technically, 'watershed' refers to the high point of land which divides two or more river basins or catchments.
2. A map of the 36 conservation authorities is available online (<http://conservationontario.ca/find/>).
3. For example, the Grand River Conservation Authority was formed in 1966 through the amalgamation of the Grand River Conservation Commission and the Grand Valley Conservation Authority (see Mitchell & Shrubsole, 1992, for details). The Halton Region Conservation Authority was formed in 1963 through the amalgamation of the Sixteen Mile Creek Conservation Authority and the Twelve Mile Creek Conservation Authority.
4. The Association of Conservation Authorities of Ontario was formed in 1981 to advise, support and assist all conservation authorities in Ontario in achieving their objectives and to act as a liaison with the government of Ontario. In 1997, the association changed its name to Conservation Ontario.

5. See *Policies and Procedures for Conservation Authority Plan Review and Permitting Activities* http://www.conservation-ontario.on.ca/planning_regulations/Policy&Procedure_CA_plan_review_permitting_Final_Apr23_2010.pdf
6. A more detailed discussion of the conservation authority programme is found in Mitchell and Shrubsole (1992). This section provides a synopsis of material in that publication.
7. Since the Grand River basin is very large, several conservation reports were written in its early years. The first was the Hydraulics Report, completed in 1954 (Ontario Department of Planning and Development, 1954). Subsequent conservation reports were completed for the four major subwatersheds; see Mitchell and Shrubsole (1992) for details. In the case of the Halton Region Conservation Authority, conservation reports were completed on Sixteen Mile Creek (Ontario Department of Planning and Development, 1958) and Twelve Mile Creek (Ontario Department of Commerce and Development, 1960).
8. The Halton Region Conservation Authority is informally known as Conservation Halton.
9. Barbara Veale, one of the authors, worked for the Grand River Conservation Authority from 1978 until 2013. In September 2013, she began working for Conservation Halton.
10. Other conservation authorities have also been involved in the designation and management of Canadian heritage rivers, including the Essex Region Conservation Authority (Detroit River); the Upper Thames River Conservation Authority and Lower Thames River Conservation Authority (Thames River); the Toronto Region Conservation Authority (Humber River); and the Sault Ste. Marie Conservation Authority (St. Marys River).
11. The Lake Simcoe Region Conservation Authority received the same prize in 2009.
12. A map of the 19 source water protection areas and regions is available online (http://www.conservation-ontario.on.ca/source_protection/files/SourceProtectionAreas_Map_sm.pdf).

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