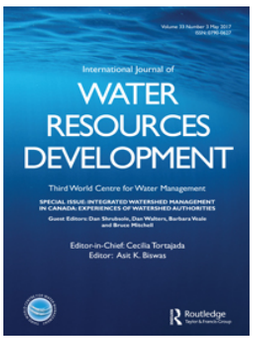

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Integrated Water Resources Management in Canada: the experience of watershed agencies

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ABSTRACT

Water agencies from 7 of the 10 Canadian provinces shared their experiences regarding history, successes, challenges and lessons learned with integrated watershed management. Based on these contributions, it is clear that an integrated approach does not mean 'all-encompassing'. Rather, it proposes desirable and feasible solutions through a systems approach based on sound technical information (e.g. biophysical and socio-economic), public engagement and monitoring. The roles of all participants must be clearly defined in order to promote success and facilitate implementation. Enduring and emerging challenges, such as adequate capacity and financing, engagement with Aboriginal communities and other stakeholders, and successful implementation, are identified.

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Integrated water management; Canada; watershed agencies; public participation; Aboriginal peoples; water planning; monitoring; implementation

Introduction

The idea for this special issue arose as a result of our 2014 article (co-authored with Charles Priddle) in the *International Journal of Water Resources Development*'s special issue on Revisiting Integrated Water Resources Management, which provided an overview of the 67-year history of Ontario's conservation authority programme (Mitchell, Priddle, Shrubsole, Veale, & Walters, 2014). As part of that research process, we invited water management practitioners from the conservation authority programme to present their experiences with river basin management to two special sessions at the June 2014 annual meeting of the Canadian Water Resources Association, in Hamilton, Ontario. Shortly after that meeting, we thought a more national perspective on the state of integrated water management (IWM) in Canada would be appropriate, and invited representatives of 13 water management agencies across Canada to reflect on and write about their experiences (i.e. history, structure, successes, challenges and lessons learned) with integrated water resource management (IWRM). While several contributions in this special issue are on the Ontario conservation authority programme, which reflects the focus of our 2014 article and the context outlined above, we are very pleased with the level of national coverage (7 of the 10 Canadian provinces) provided by this collection of manuscripts (Figure 1).

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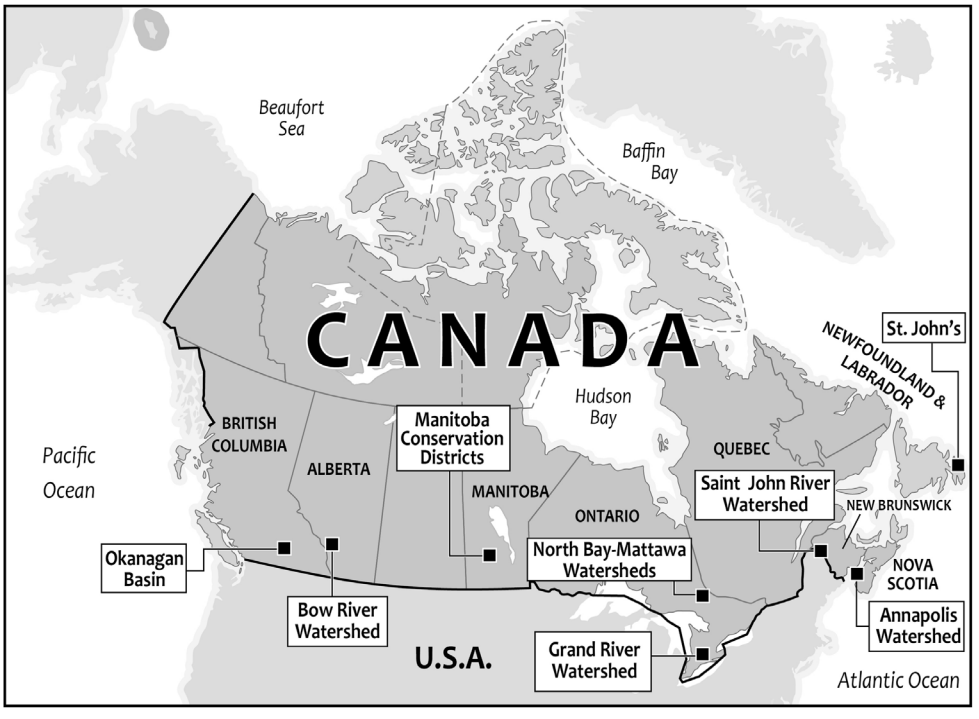

Figure 1. Location of Canadian water management case studies represented in this special issue.

In our 2014 article, we characterized IWRM as

> an ecosystem approach in which at least: (1) the catchment or river basin 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. (p. 460)

We also acknowledged that "moving from the ideals of IWRM to successful implementation can be challenging" (p. 460), a view shared by others (Beveridge & Monsees, 2012; Biswas, 2008; Blomquist & Schlager, 2005; Butterworth, Warner, Moriarity, Smits, & Batchelor, 2010; Molle, 2008). Addressing this gap prompted us to undertake this current special issue on the experience of watershed management agencies in Canada.

We believe that the Canadian experience can be instructive for many researchers and practitioners throughout the world. In common with practice in much of the world, the responsibility for implementing integrated watershed management in Canada is fragmented, and there is a need for water management agencies to foster partnerships, coordinate planning and management activities, engage stakeholders, secure funding, monitor and report on progress, and update and adapt plans when necessary. All the provinces and territories in Canada have developed unique approaches or governance models to guide decision making in that regard. Thus, this special issue will enable readers to gain insight on the best practices in Canada for achieving success or addressing barriers to implement IWM.

We recognize a variety of strategies for planning and managing water in Canada, and that much has been and can be learned from those on the 'front lines'. Although this approach of having front-line managers report has at least one potential limitation – it can be difficult to comment on one's own shortcomings and lessons learned – it has been used successfully in the past. Thirty-five years ago, various key front-line managers and practitioners had an opportunity to present their views in a symposium and subsequent publication. In 1981, a co-sponsored symposium on River Basin Management: Canadian Experiences led to a book with 27 chapters which reviewed regional, provincial and interprovincial approaches being used across the country (Mitchell & Gardner, 1983). At that time, five key challenges were identified:

- There did not appear to be any single correct or proper way to pursue river basin management.
- There was an urgent need to reduce the time to complete and implement plans.
- There was a need to broaden the focus from 'water' to include related land-based issues.
- While there was a recognition of the merits of public participation, the results had been disappointing.
- There was a need to improve communication between those involved in writing plans and those who must decide if, when and what specific recommended initiatives are to be implemented and funded. (Mitchell & Gardner, 1983, pp. 1–4).

Since that time, there have also been a book that provided an overview of federal and provincial/territorial initiatives to plan and implement 'sustainability' in water management, which had the essential characteristics of IWRM (Mitchell & Shrubsole, 1994), and two edited volumes that allowed practitioners and academics to provide insights on IWM in Canada, although neither provided complete national coverage (Shrubsole, 2004; Shrubsole & Mitchell, 1997). This current special issue provides an opportunity to identify progress related to the challenges identified at the 1981 symposium, as well as subsequent findings noted in the volumes above, and to identify emerging problems and solutions, as well as opportunities.

The following sections provide context for this volume of contributions by providing an overview of the concept of IWM, the context for water management in Canada, and general observations arising from the manuscripts.

The physical and human contexts that frame water management in Canada

At first glance, Canadians would appear to have few concerns over the management of water. The country's population of almost 36 million people is served by about 9% of the global runoff. Another water statistic is that about 20% of the world's total water supply is in Canada, while it has about 0.5% of the world's population (Environment Canada, 2012). Although these types of data suggest that the country should have an abundance of water, it has long been recognized that this is a myth (Foster & Sewell, 1981).

Canada is tied for third with Indonesia, the United States and China in receiving nearly 6.5% of the global renewable supply of freshwater annually (Sprague, 2007, p. 24). Over 60% of the renewable water supply in Canada drains into the Arctic and sub-Arctic regions, while 90% of the population lives within 300 km of its southern border with the United States. The annual precipitation is variable, ranging from over 2000 mm on the west coast to less than

500 mm in Saskatchewan. Parts of the nation have experienced water shortages and drought. McBean (2015) observed that there also has been an increase in the frequency of major flood events, particularly over the past 60 years, which reflects a complex interplay between global climate change, and increasing occupancy and flood damage potential on flood plains. Some of the major recent floods include Winnipeg, Manitoba (1997), Peterborough, Ontario (2004), and Calgary, Alberta (2014).

In general terms, the Conference Board of Canada (2014) ranked Canada as having the fourth-best water quality among the 17 OECD countries. Three major risks to Canada's water quality are: inadequate treatment of sewage waste; industrial effluent; and runoff of fertilizers from agricultural areas. Three relatively recent events in Canada have prompted governments to realize how quickly water problems can have tragic impacts on people. The first two were the contamination of water supply systems in Walkerton, Ontario (2000), and North Battleford, Saskatchewan (2001). Seven people died and over 2300 people became sick in Walkerton from the bacteria *Escherichia coli* O157:H7, and many thousands of residents in North Battleford became ill as a result of a parasite, *Cryptosporidium*. The general response from all governments has been to increase the scope (e.g. source water protection) and depth of water quality regulations. Cyanobacteria is a recent problem that is triggering the call for more integrated approaches to water management. A mix of drought, flooding and water quality concerns underlies all the watershed organizations. Some of the articles in this theme issue provide more details on the nature of the integrated water management responses.

The third event reflects, in large part, the nature and history of relations between Canada's Aboriginal peoples and Europeans and Canadian governments. In the context of water, the 'tip of the iceberg' occurred in 2005, when unacceptable levels of bacteria were found in the drinking water of the community of Kashechewan (on western James Bay in Ontario) and residents were not informed in a timely manner (there was a delay of over two days). Subsequent studies found that the quality of the drinking water in many Aboriginal communities was much more degraded than in other locations. For instance, a 2008 study by the Canadian Medical Association found that of over 1700 boil water advisories issued in Canada, the vast majority were in Aboriginal communities (Eggerton, 2008). This event further raised the public's awareness of the need to protect water supply. The federal government recently pledged to eliminate the need for boil water advisories in Aboriginal communities across Canada. This special issue reveals that there is further need to integrate Aboriginal peoples and their perspectives in watershed decisions, which may help the federal government achieve its goal regarding boil water advisories.

Aboriginal peoples, who comprise just over 4% of Canada's population, have lived in North America since at least 17,000 BP (and possibly as early as 50,000 BP) and often settled close to Canada's ocean and freshwater coasts, as well as its many rivers and streams (Mulrennan, 2015). The historical relationship between European settlers and Aboriginal people is complex and often associated with conflict, displacement, attempts at assimilation, and a preponderance of negative outcomes for Canada's first peoples. The tardiness in notifying the residents of Kashechewan of water contamination, while the unfortunate result of the failure to hook up a back-up chlorinator and the absence of an emergency paging system for local water operators (a standard amenity in most Canadian communities), illustrates in a modest manner some aspects of this relationship. This event, combined with more recent initiatives, such as formation of the Idle No More movement (http://www.idlenomore.ca/) and the findings and recommendations arising from the Truth and Reconciliation Commission

(http://www.trc.ca/websites/trcinstitution/index.php?p=905), has made the public of Canada more aware of the need to improve relationships with Aboriginal peoples across a wide range of issues, including the management of water and related land resources.

The Canadian Constitution Act (1982) supports a federal approach to government and divides responsibilities for water and other resource management between federal and provincial governments. The federal government has responsibility for Aboriginal people, and, as noted above, it has been playing a more significant role, and there is a desire to significantly change and improve past arrangements. Provincial governments have substantial influence over water management because (1) they own most of the water resources in their provinces, (2) they have ownership of land, mineral and forest resources that impact water, (3) they have responsibility for civil and property rights, and (4) they control the formation and responsibilities of local governments, which recently have been playing a more significant role in water management (Cairns, 1987; Pearce, 1986). With these four legal realities, provinces have enacted legislation pertaining to matters of water supply and quality, irrigation, drainage, recreation and power. As will be seen in this special issue, it is the actions of the provinces (and often local government) that have legitimized and focused many of the activities of watershed management agencies.

While the provinces derive their major powers by exercising proprietary and legislative rights, federal water management responsibilities have exclusive legislative jurisdiction over navigation, inland and ocean fisheries, interprovincial works, trade and commerce, and international relations. The federal government also has sole jurisdiction over federal lands and water north of 60° latitude, until and unless agreements are negotiated with the territorial governments. The federal government has influenced the activities of provincial and local governments through its spending powers, and in this volume, this is seen to arise in the federal government's direct funding of watershed management agencies in Newfoundland and Labrador, and in Nova Scotia (Burke, 2016; Cliché & Freeman, 2016).

Commentary

In common with a conclusion arising from the 1981 River Basin Management: Canadian Experiences symposium, the contributions in this special issue indicate that "there remains no consensus as [to] the 'best' way to approach river basin management" (Mitchell & Gardner, 1983, p. 2). However, the principles of IWM appear to be a common element guiding watershed management in Canada. The special issue illustrates the diverse contexts, situations and experiences of implementing IWM across Canada, which we believe should make it of interest to a wide range of readers. In this section we use insights from these authors to provide some comments on the current state of IWM in Canada.

First, while there is a realization of the value in recognizing and understanding 'the big picture', there continues to be a need to focus on the most important water and related land resource problems confronting the residents of a watershed in order that adequate attention and resources (e.g. human, political, or financial) can be directed towards implementing custom-designed solutions. An integrated approach does not mean all-encompassing; several front-line workers suggest that prioritizing local issues helps reduce the time to complete plans and garner local support and involvement (e.g. Cliché & Freeman, 2016; Cuvelier & Greenfield, 2016). This is essential as citizens are increasingly being asked to play a role in the planning, implementation and monitoring stages (Burke, 2016; Veale & Cooke, 2016).

The data and information generated by professionals and citizens play a fundamental role in guiding the ranking of priorities and the identification and assessment of alternatives.

Second, monitoring the outcomes of implemented programmes and projects has become a common practice for Canadian watershed agencies, although this can be resource-intensive. Water monitoring programmes are resource-intensive activities often beyond the capacity of watershed authorities. Partnerships with other agencies and post-secondary institutions have, in some instances, provided funds and expertise to monitor conditions (Melnychuk, Jatel, & Warwick Sears, 2016). In other situations, standardized protocols allow citizen volunteers with sufficient training to fill this need (Cliché & Freeman, 2016; Veale & Cooke, 2016). The emphasis on monitoring and partnerships, particularly with the voluntary sector, is a new element to integrated water management since the 1981 conference. Although database management and GIS can support data collection and analysis, effectively and efficiently coordinating the monitoring activities of multiple sources can be a logistical challenge. It will also be interesting to observe how agencies continue to engage citizens in monitoring activities over the long term.

Third, the practice of integrated water management in Canada often involves developing a holistic perspective, and applying a systems approach that focuses attention on answering the central questions of what needs to be done, by whom, and with whom paying for planning and implementation. At least three levels or types of integration, particularly at the watershed scale, are considered:

- Integration of the linkages among environment, economy and society (e.g. sustainable development)
- Understanding resource interactions and how humans have affected or may in the future affect natural processes, often as they relate to one or more of the following: water quality and quantity; surface water and groundwater; water and related land resources; and how human activities have contributed or may contribute to degradation
- Coordinating the responses in the context of a programme and/or project(s) that involve decisions about the mix of means (e.g. information and education, technical assistance, financial incentives, regulations, taxation, property acquisition) to solve the problem(s), and division of costs and benefits.

A systematic planning process often guides this three-level integration process. The watershed organizations often play a coordinating and integrating role that is crucial for maintaining momentum to achieve established milestones or goals (Cuvelier & Greenfield, 2016; Veale & Cooke, 2016). The responsibility for maintaining this cyclical process is being devolved to local watershed authorities, under the direction of boards of directors, and reflects a significant change since the 1981 symposium.

Fourth, the watershed-based agencies are continuously striving to clearly define their role in (contributions to) solving water problems, and to maintain and ideally increase the level of confidence from the public as well as key decision makers (Worte, 2016; Leclerc & Grégoire, 2016). This represents a shift since the early 1980s. Communication between the planners and practitioners is better aligned through multi-stakeholder planning and implementation oversight (e.g. Cliché & Freeman, 2016; Stewart & Bennett, 2016). The watershed organizations often play a coordinating and integrating role. Developing effective partnerships with other relevant public agencies is now a common practice. This can include inviting

representatives from these other agencies to participate in planning exercises. In this way, implementation can be fostered because there has been engagement from all participants about the nature of the problem(s), the need for action and who is best suited to implement solutions in a coordinated manner (Veale & Cooke, 2016). There is now more emphasis on sharing resources and responsibility for completing certain tasks in watershed plans. The emerging information can be used to form part of the budget process of public agencies.

Fifth, relative to the experience reported in 1981, the planning process is now relatively less complex and more appropriate in length relative to the nature of the problem to be solved. There is acute awareness of the need for planning to be able to transition quickly to implementation, and there is often a conscious effort to achieve short-term, visible gains that can be seen as a product of the process (Veale & Cooke, 2016). The previously mentioned monitoring programmes aid in communicating to the public and decision makers the outputs, outcomes and impacts of implementation. Watershed organizations' websites and government data portals make information more readily available to the public.

Sixth, public participation/engagement remains a crucial undertaking during planning and implementation with continuing devolution of responsibility to local government or groups to plan, implement, monitor and update watershed plans. In addition, since there is reasonable public support for the IWM activities described in this special issue, there appears to be more attention devoted to designing governance arrangements that are effective, efficient and fair. Public participation is now mandated in some jurisdictions, for example Ontario and Manitoba (Cuvelier & Greenfield, 2016; Worte, 2016). In other jurisdictions, such as Alberta and Quebec, the voluntary nature of the programme encourages public involvement and initiatives (Leclerc & Grégoire, 2016; Stewart & Bennett, 2016). Public involvement is also sought because strategies for resolving water problems involve soft solutions or behaviour changes. Education and outreach programmes are a key feature of many IWRM strategies (e.g. Scott, Tayler, & Walters, 2016; Veale & Cooke, 2016). While there has been progress since the 1981 symposium (better engagement and partnering with Aboriginal communities), it is one aspect of IWM that requires greater attention (MeInychuk et al., 2016; Scott et al., 2016).

Seventh, a variety of financial arrangements support all the activities of the watershed agencies. In Atlantic Canada, the federal government's Atlantic Coastal Action Program was and is fundamental to the activities occurring in the Avalon Peninsula and Annapolis Valley (Burke, 2016; Cliché & Freeman, 2016). Most other agencies report a mix of funding from provincial government agencies and self-generated revenue (e.g. Leclerc & Grégoire, 2016; Worte, 2016). None has the ability to tax individual property owners or levy income taxes. The level of funding varies considerably, reflecting the nature of responsibilities, and ability and willingness to pay. As evident in the special issue, all local watershed authorities must be prepared and able to adapt to the shifting priorities of senior levels of government. This is one of the continuing challenges.

Key current challenges

The Canadian experience in the past 35 years has addressed a number of the challenges identified at the 1981 symposium. The time to complete watershed management plans has improved, and there is more emphasis on implementation. There also is more emphasis on sharing resources and responsibility for certain tasks related to watershed plans (Stewart &

Bennett, 2016; Veale & Cooke, 2016). It is generally appreciated that an integrated approach is about building and maintaining relationships, and creating a sense of responsibility and accountability among partners. However, there also are enduring and emerging challenges.

First, droughts, floods and/or water quality concerns are what normally triggered the formation of each watershed organization featured in this special issue. Agricultural, urban and industrial intensification are making it difficult to manage these threats. A changing and uncertain future climate further complicates the task of watershed managers. Monitoring and reporting will be essential to track trends and identify emerging threats. The responsibility for monitoring is shared among different groups, such as government departments, citizen volunteers and post-secondary institutions. Ensuring quality control and quality assurance will require clear and explicit sampling protocols and training sessions (Burke, 2016). Solutions should be both science-based and socially accepted. However, integration of such data and information into decision making has often been slow or limited.

Second, capacity issues seem ubiquitous. While the full-time staff complement of the watershed organizations in this special issue ranges in size from two to over one hundred, they all cite financial, human, political and information challenges as limiting their capacity to tackle the complex socio-ecological issues. This concern is based on the desire and need to do more, and not an indication of limited success. Watershed organizations without stable core funding often seek project-based funding from a mix of sources to improve the health of the watershed. This need to be opportunistic and seek available funding from various sources often limits their ability to undertake long-term planning initiatives (Scott et al., 2016). Nevertheless, specific project-based initiatives contribute to the cumulative improvement of watershed conditions.

Third, there appears to be better recognition of the need to fund all aspects of the watershed planning process. However, implementation is challenging when the watershed organization has no legislative authority or legitimacy (Leclerc & Grégoire, 2016; Stewart & Bennett, 2016). In many instances, watershed authorities' programmes are subject to periodic review. For instance, a review of Ontario's Conservation Authority Act is currently underway to "improve the legislative, regulatory and policy framework that currently governs the operation and activities of the conservation authorities" (Ontario Environmental Registry, 2016). The provincial government sought broad public feedback on three central questions: (1) How well is the governance model working? (2) How are the programmes and services delivered by conservation authorities best financed? (3) What should be the role of conservation authorities in Ontario? There does not appear to be a direct effort to seek comments on how well programmes and services are being delivered. There were nearly 250 submissions from various interest groups, such as municipal, conservation authority, developer, environmental sector, public and Aboriginal representatives. These interest groups identified areas of improvement that were consistent with issues identified by the practitioners in this special issue, such as clarifying the mandate and regulatory authority of conservation authorities, encouraging sharing of information among partners, and updating and reviewing funding mechanisms. Based on an analysis of public responses, the provincial government identified five priorities for updating the Conservation Authority Act: "stronger oversight and accountability, clarity and consistency, updated funding mechanisms, collaboration and engagement, and future flexibility" (Ontario Environmental Registry, 2016).

How the provincial government chooses to address these five broadly defined priorities could present future opportunities for or challenges to implementing IWM.

Fourth, Aboriginal communities are often still not adequately consulted – for free and prior informed consent – across Canada. While there may be seats available at or invitations to meetings, Aboriginal perspectives are often not part of the planning, implementation, monitoring or adaptation processes. The problem is not one-way, however, because in some situations Aboriginal groups may decline to engage with a watershed authority, arguing that they should only interact directly with senior officials of the relevant provincial government. The jurisdictional issues are complex, and some continue to be resolved by court decisions. Aboriginal communities may not participate due to the uncertain legal implications of subsequent legislation or infringement of rights. However, there is much that can be done that does not require resolution of jurisdictional questions. The Truth and Reconciliation Commission calls upon all Canadian society to "renew or establish Treaty relationships based on principles of mutual recognition, mutual respect, and shared responsibility for maintaining those relationships into the future" (Truth & Reconciliation Canada, 2015, p. 326). IWM provides the opportunity for watershed authorities and Aboriginal communities to jointly develop new relations. Partnerships and collaborations thus underlie the ideal of integration.

There always will be scope and opportunity to improve capacity for integrated watershed management or IWRM, and it is unlikely that one standardized approach will ever be suitable in all situations. However, notwithstanding the reality of some significant challenges which need attention, experience with an integrated approach across Canada highlights that learning continues, and that improvements are steadily being made. Thus, perhaps the most basic lesson is that we need to maintain a willingness to monitor what we do, acknowledge when things do not work as anticipated or hoped for, continue to learn, and be willing to adapt and adjust from experience and new understanding. In that spirit, we hope that what has been learned from applying an integrated approach to water management in Canada over the last 35 years will be of interest and value to managers and researchers working in other countries across the world.

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