First Nation capacity in Québec to practise integrated water resources management

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Abstract: Integrated Water Resources Management (IWRM) has been identified by the United Nations as a critical component of effective and sustainable water resources management in the future. This research examined the extent to which IWRM is practised among First Nations (FN) in Canada. This study also developed and applied an analytical framework to assess the overall capacity of two FN communities in Québec to practise IWRM. The FN communities of Kitigan Zibi and Kahnawà:ke were evaluated with respect to capacity to support actor network, information management, human resources and technical, financial and institutional dimensions. This study recommends that future Québec IWRM initiatives with FN collaboration be directed towards strengthening actor network capacities and understanding the complexity of FN perspectives. In addition, the results of this study indicate that FNs with limited financial capacity will experience reduced actor network, information management, human resources and technical capacity.

Keywords: First nations; indigenous; capacity; IWRM; integrated water resources management; Québec; Canada.

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1 Introduction

A majority of the world's Indigenous peoples within nation–states are rarely involved as collaborators in meaningful discussions of water policies (United Nations, 2009). A correlation has been suggested to exist between ethnic indigenous identity and limited access to water (Macisaac, 1996; Gracey et al., 1997; Bailie et al., 2004; United Nations, 2009). Integrated Water Resources Management (IWRM), a paradigm shift in the management of water resources, could potentially reduce water inequities between users and increase Indigenous participation. IWRM embraces principles of stakeholder participation in decision-making, equity of water allocation, efficient and balanced water use and recognition of linkages and interactions among human and physical systems (Global Water Partnership, 2000). Canada is in the process of evolving from traditional approaches to water management, which can be characterised as fragmented, engineering-based, supply-oriented, sectoral, reactive and top-down, to more integrated and collaborative approaches (Ramin, 2004; Mitchell, 2006).

Canada's progress in IWRM is expanding: several provinces, including Québec, have developed comprehensive provincial water policies. Stakeholder participation is often seen as an essential vehicle to achieve short and long-term goals in integrated and collaborative water management (Dalton, 2006; Watson, 2007; Morin and Cantin, 2009; Roy et al., 2009). In 2002, Québec developed a comprehensive strategy to formalise IWRM and stakeholder participation (MDDEP, 2002a): the Québec Water Policy (QWP). This strategy began by identifying 33 watershed organisations (ROBVQ, 2010), whose mandates were to develop a watershed management plan and act as regional round tables to which any and all water resource stakeholders were invited (ROBVQ, 2010). In March 2009, the QWP expanded to cover 40 watershed zones with a focus on southern Québec (MDDEP, 2002a, ROBVQ, 2010).[1] Given the QWP's recognition of water as a "valuable asset of Québec society and an integral part of its collective heritage," water governance reforms include strengthening Québec's partnerships and ensuring all water

management players, particularly aboriginals, are involved in achieving the province's water management goals (MDDEP, 2002b).[2]

While the importance of capacity is widely acknowledged in IWRM, more attention needs to be drawn to holistic evaluations of indigenous communities' ability to practise IWRM. The existing literature mainly evaluates capacity for implementation of specific aspects of IWRM, including:

- source water protection or management (De Loë et al., 2002; De Loë and Lukovich, 2004; Carter et al., 2005; Ivey et al., 2006; Timmer et al., 2007)
- desalination (Al-Jayyousi, 2000)
- IWRM implementation at the national level (Mkandawire and Mulwafu, 2006)
- urban water management (Brown, 2008)
- drought (Hundertmark, 2008)
- rain water harvesting (Farahbakhsh et al., 2009)
- institutional capacity (Lamoree and Harlin, 2002).

Although studies specific to the capacity of Canada's indigenous people to implement IWRM exist (Smith et al., 2006; Lebel and Reed, 2010), there remains insufficient discussion on the capacity of indigenous communities to holistically practise IWRM in Canada. To date, Lebel and Reed (2010) evaluated the capacity of a Saskatchewan First Nation (FN) community to provide safe drinking water in terms of financial and human resources and institutional, socio-political and technical aspects, while Smith et al. (2006) investigated 56 FN drinking water systems in Alberta with regard to technical and human resources. Indigenous indicators have yet to be created in the literature. It is hoped that future research will explore indigenous indicators in IWRM. At present, there is an abundance of literature that examines capacity as it relates to small water systems and which discusses financial, technical and other capacity areas.

The purpose of this study was to develop and apply an analytical framework and then report findings for Kitigan Zibi and Kahnawà:ke FNs to practise IWRM in the province of Québec, particularly in the areas of actor network, information management, human resources and technical, financial and institutional capacities.

2 Study areas

Selection of participant communities was based on:

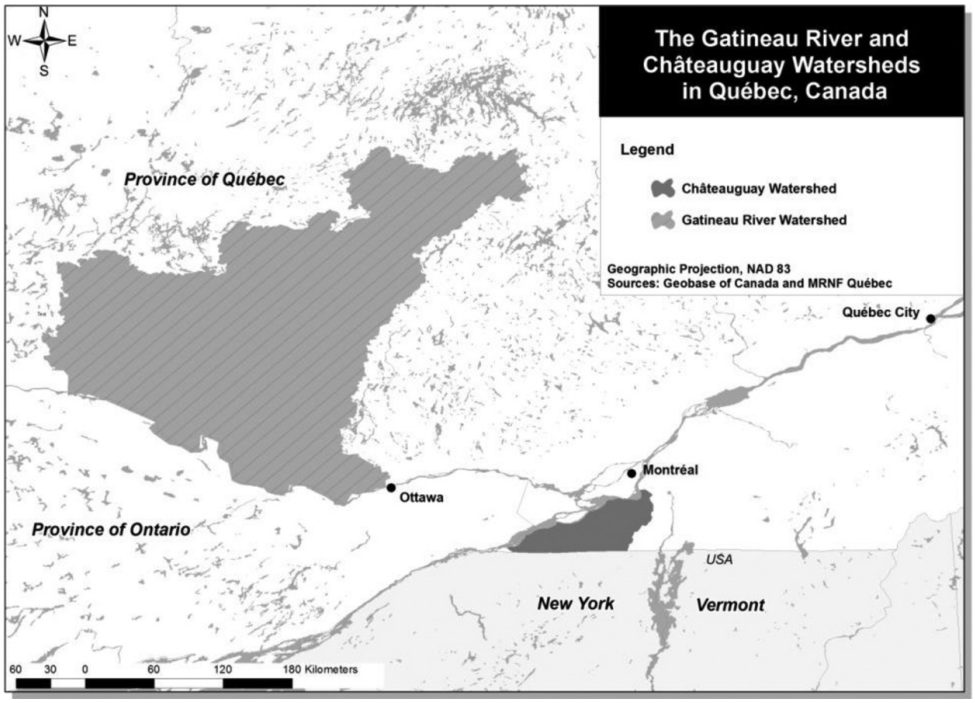
- geographical representation of rural and urban regions
- situated within the province of Québec
- agreement on study objectives and research processes from Band Chief or representatives
- having a FN designation as defined by the Government of Canada.

2.1 Kitigan Zibi FN

Kitigan Zibi is a rural community of 1,557 Algonquin residents, located 130 km north of Gatineau, Québec. It is bound on the north by Rivière de l'Aigle and Rivière Désert

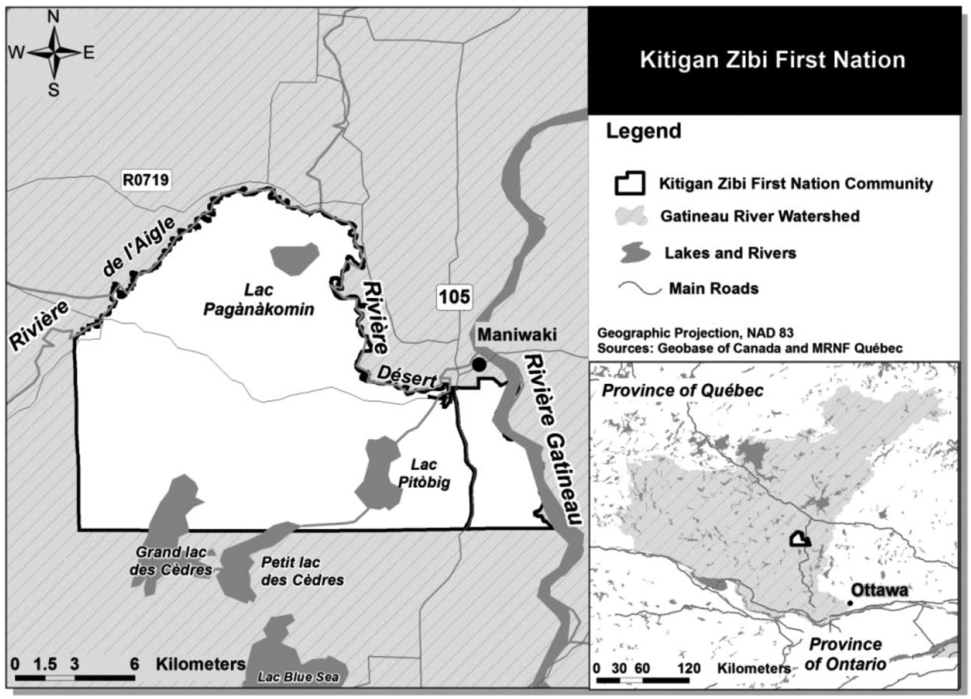
(Figure 1). The community covers 18,438 hectares (45,559 acres) and is part of the Gatineau River Watershed (Figures 1 and 2). Based on the geographical 'remoteness factor', there is year-round road access and it is located less than 50 km from the nearest service centre (INAC, 2010b). There are about 25 small businesses in Kitigan Zibi (INAC, 2010b).

Figure 1 The Gatineau river and Châteauguay watersheds in Quebec, Canada



At the time of the study, some 88 Kitigan Zibi households (or 17% of total households) were connected to the piped water distribution and wastewater system of Maniwaki, a neighbouring non-aboriginal municipality. Maniwaki's piped water distribution relies on groundwater. The 437 remaining homes (or 83% of total households) used well-distribution systems for non-drinking purposes, relied on INAC-supplied bottled water for drinking and had their own sewage fields (Kitigan Zibi FN, personal communication, 30 April, 2010). Groundwater areas as well as water quantity and quality are known based on previous hydrological studies. The average Kitigan Zibi household has approximately five occupants (Kitigan Zibi FN, personal communication, 5 April, 2012). The province of Québec recommends a well-water quantity of 750–885 litres per hour for a household of this size (MDDEP, 2002c). Although individual wells produce approximately 568–758 litres per house per hour, water quantity is adequate for household use (Kitigan Zibi FN, personal communication, 30 April, 2010). However, water quality is a concern (Kitigan Zibi FN, personal communication, 30 April, 2010). In 1999, a Health Canada study found high levels of uranium, a toxic heavy metal, present in groundwater and issued a 'do not consume' drinking water advisory for well water users (Harden and Levalliant, 2008).

Figure 2 Location of the Kitigan Zibi First Nation in the Gatineau River Watershed



2.2 Kahnawà:ke First Nation

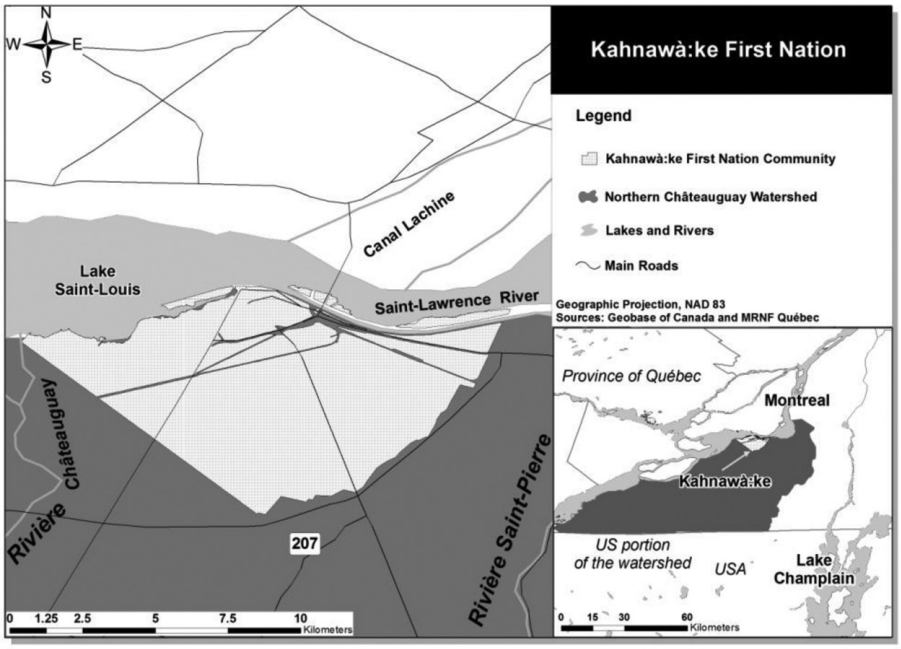
Kahnawà:ke is an urban community of 7,556 Mohawk residents, located 10 km southwest of Montréal on the south shore of Lake Saint-Louis (Fig. 1). The community covers 4,811 hectares (11,888 acres) and is part of the Châteauguay River Watershed (Figures 1 and 3; INAC, 2010a). There is year-round road access and it is located less than 50 km from the nearest service centre (INAC, 2010a).

Kahnawà:ke relies on surface water from the St. Lawrence for the larger part of its drinking water needs, and the community has over 60 years of experience in drinking water management. Piped water distribution was installed in the 1950s to core homes and now the piped water distribution network extends to 2,200 households and 114 businesses (Kahnawà:ke FN, personal communication, 5 October, 2010). Some 300 households and 49 businesses rely on well water for non-drinking purposes and individual wells are not monitored frequently (Kahnawà:ke FN, personal communication, 25 May, 2010). Three to four individual wells per week are monitored, which means an individual well may be tested only once every two years (Kahnawà:ke FN, personal communication, 30 April, 2010).

3 Capacity in Integrated Water Resources Management

The United Nations Development Program (UNDP) (1997) defines capacity as the "ability of individuals, institutions and societies to perform functions, solve problems and set and achieve objectives." Since the early 1990s, capacity in the context of water management has

Figure 3 Location of the Kahnawà:ke First Nation in the Châteauguay Watershed



been viewed as critical (Hartvelt and Okun, 1991; Franks, 1999). The nature of an integrated approach to water resources management also requires capacity across various areas and recognises interdependencies (Franks, 1999; Cap-Net, 2006). The UNDP recognises that capacity building is a long-term, continuing process and is a strategic element for the sustainable management of the water sector (Biswas, 1996; Franks, 1999).

The UN-Water Decade Program on Capacity Development (UNW-DPC) prioritises capacity development activities and requires capacity needs assessment and gap analysis, as well as the implementation of innovative capacity development methodologies (UN Water, 2009). *A Handbook for IWRM in Basins* suggests a successful basin management strategy anticipates the need to strengthen capacity and fund capacity building, and basin organisations are encouraged to develop programmes to build capacity (GWP, 2009). Furthermore, it is suggested that capacity development is necessary for disenfranchised groups to ensure their involvement in planning and implementation (GWP, 2009). Essentially, capacity is an enabler and driver of IWRM (Van der Zaag, 2005) and the water sector is highly dependent on individual and institutional capacities (Blokland et al., 2009). Strengthening capacity is an integral component of IWRM.

4 First Nation capacity challenges in Canada

FNs in Canada experience a wide spectrum of capacity challenges related to water resources management. With respect to human resources capacity, FN water treatment operators are critical to the delivery of safe drinking water (O'Connor, 2002; Swain et al., 2006); however, FN communities often lack certified or qualified personnel to operate water treatment facilities, which results in considerable risk and problems (INAC, 2003; Smith et al., 2006). Despite

the fact that water treatment operators are critical for the delivery of safe drinking water, operator training certification and retention of qualified individuals are also major issues in FN communities (OAG, 2005; Smith et al., 2006).

Financial capacity is another area of concern. FN communities rely heavily on Indian and Northern Affairs Canada (INAC) for capital and operational funding and Health Canada's FNs and Inuit Health Branch for monitoring drinking water quality (Smith et al., 2006). Despite substantial funding aimed at addressing water quality in FN communities, the efforts of the federal government have yielded limited improvement in drinking water (OAG, 2005). In addition to a community's level of poverty, the overall direct impact of a community's ability to finance the operation and maintenance (O & M) of water treatment facilities is limited. FNs are responsible for 20% of O & M costs for water systems, a heavy financial burden in communities with high unemployment and little likelihood of recovering costs from the community (Chiefs of Ontario, 2001; OAG, 2005; Swain et al., 2006). In addition, communities can seldom afford operator-training expenses when presented with financial constraints (Swain et al., 2006). Despite FN financial challenges, communities are required to meet the same health-based water quality standards as larger drinking water systems, even if they lack resources and economies of scale that larger systems enjoy (Smith et al., 2006). Limited financial resources place a major risk on O & M objectives, thereby jeopardising safe drinking water in FN communities.

Technical capacity in more remote or smaller FN communities is a problem, as these communities have greater difficulty than non-remote or larger communities in coping with technical and managerial challenges specific to water-related activities (Morris et al., 2007; Hrudey, 2008)[3]. Some 43% of aboriginal people live in remote communities or settlements and comprise 30% of Northern Canada's population (MacLeod et al., 1998). Smaller systems can contribute to marginalised water infrastructures, and in situations where there is a complete absence of water infrastructure, this can lead to the transmission of diseases (Health Canada, 2005). Among 61 FN communities in Manitoba, those without wells or running water accounted for 89% of the *Shigella* cases in the early 1990s (Clarke et al., 2002). The reported incidence of *Shigella* among FNs communities (74.1 per 100,000 individuals) was 26 times greater than that of their non-aboriginal Canadian counterparts (2.8 per 100,000 individuals) (Clarke et al., 2002).

The 2001 National Assessment of Water and Wastewater Systems in FN communities conducted by INAC was based on an on-site inspection of all FN water systems and included an evaluation of system performance, associated risk levels and operating practises (INAC, 2003). Of 740 community water systems, 46% were classified as posing a medium water quality risk and 29% were classified as posing potentially high risks (INAC, 2003). High and medium water quality risk assessments occurred as a result of a failure to meet one or more Maximum Acceptable Concentration (MAC) parameters[4]. Failure to meet MAC parameters can occur due to a lack of: regular testing procedures, records maintenance, operator knowledge in how to run the water system, emergency procedures, safety equipment and operating manuals in the facilities. Poor raw water sources, inadequate treatment, equipment failure and absence of backup equipment or power sources can also result in a failure to meet MAC standards (INAC, 2003). In 2003, the federal government responded to these poor results with the FNs Water Management Strategy (FNWMS), which was afforded a $600 million budget to improve water and wastewater systems in FN communities (INAC, 2004; OAG, 2005). In 2005, the Office of the Auditor General audited the FNWMS and concluded that residents of FN communities did not benefit from the same level of drinking water protection as other Canadian communities (OAG, 2005).

In 2006, the Plan of Action for Drinking Water in FN communities yielded the *Protocol for Safe Drinking Water for FN Communities*. On-going training of 875 operators through the Circuit Rider Training Program and 24-hour access to a support hotline, led to a decrease in high-risk drinking water systems from 193 to 97 (INAC, 2007). Building on progress under the Plan of Action for Drinking Water in FN Communities, the 2008 FNs Water and Wastewater Action Plan (FNWWAP) received $330 million in funding. There were 49 high-risk drinking water systems identified, significantly below the 193 identified in 2006 (INAC, 2010d). In 2009, the Economic Action Plan (EAP) targeted $165 million for water and wastewater infrastructure projects in 18 FNs communities across the country (INAC, 2010c).

Institutional capacity refers to a water regulatory regime that provides rules and standards to ensure water quality and safety. This type of capacity is generally absent in Canadian FN communities. Currently, drinking water safety in FN communities is managed through a series of guidelines, protocols and contracts between Indian and Northern Affairs Canada (INAC) and FN communities (OAG, 2005; Swain et al., 2006; Duncan and Bowden, 2009; MacIntosh, 2009). There is a general consensus among senate committees, independent commissions and political representatives like the Assembly of FNs (AFN), that the current institutional situation produces unacceptable levels of risk to public health and that a regulatory framework is needed for FNs (OAG, 2005; Swain et al., 2006; Duncan and Bowden, 2009; MacIntosh, 2009). The Office of the Auditor General (2005) report concluded that the federal government's passing fiduciary and water provisioning responsibilities to FNs creates confusion in regards to where the ultimate responsibility falls. In 2005, when over 800 members of Kashechewan FNs were evacuated after *E. coli* was discovered in their water supply, responsibility shifted amongst the federal, provincial governments and Kashechewan FNs. When water pathogens are detected, there is no clear protocol on how to proceed or who to assign responsibility to.

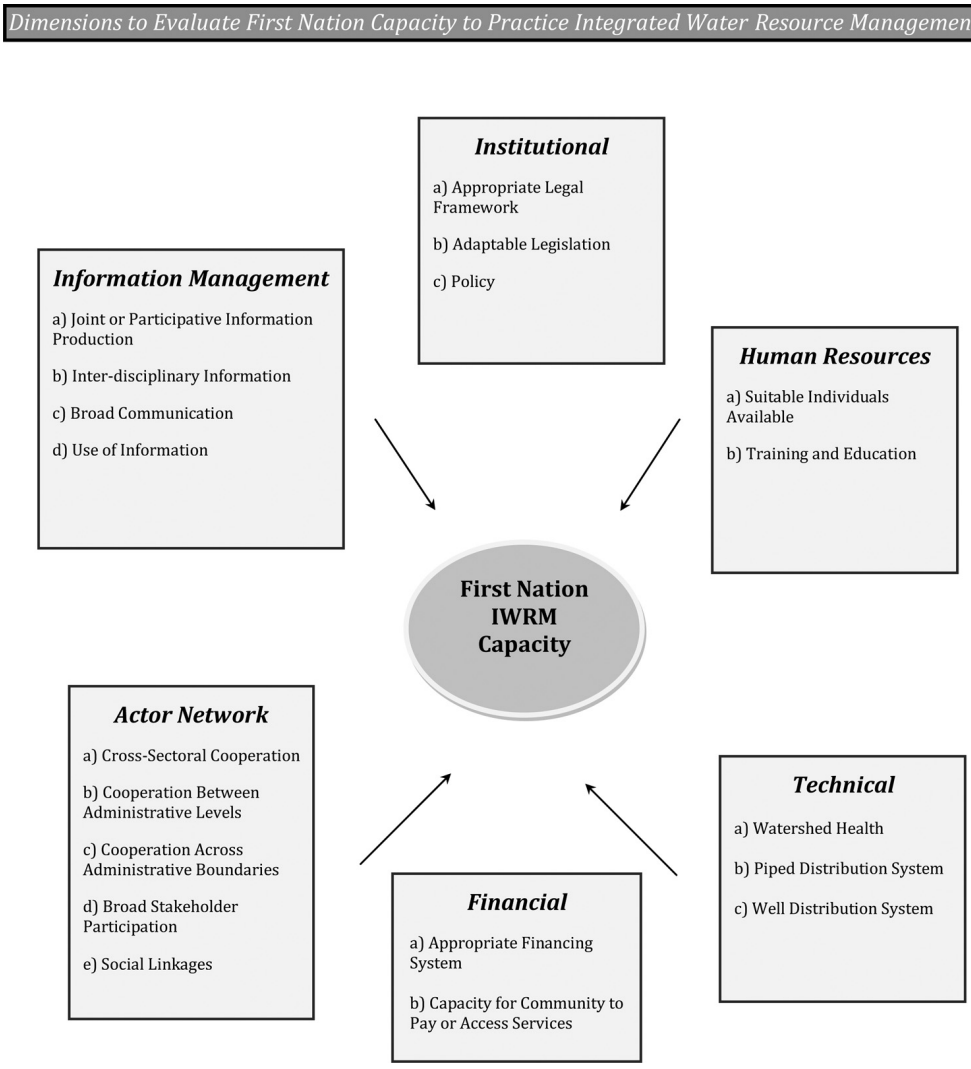
Another aspect of institutional capacity is jurisdiction. The limits and powers of a territory are of great concern in integrated water management processes. A watershed protection report submitted to the Ministry of Environment of Ontario cited three non-aboriginal municipalities that clearly lacked municipal authority "to address threats to vulnerable drinking water sources in existing built-up areas and from existing activities" (Hill at al., 2009). Commissioner O'Connor's Report on the Walkerton Inquiry recommended working toward intergovernmental coordination, particularly with representatives of Fisheries and Oceans Canada, Environment Canada, Indian and Northern Affairs Canada and Agriculture and Agri-Food Canada. However, O'Connor (2002) cautioned that this is complex "in an area where constitutional jurisdiction is not always clear." If non-aboriginal municipalities are subject to a lack of authority as it relates to watershed management, then FN communities will likely be subject to even greater governance complexities. Another aspect of institutional capacity relates to customary water rights. Aboriginal peoples have water rights, unless limited or properly extinguished (Phare, 2006). Section 35 of the *Canadian Constitution Act of 1982* affirms and protects aboriginal rights to occupy land, fish, hunt, trap and generally use goods produced by the land and water (Craig, 2003; Kempton, 2005; Phare, 2006). Prior to 1982, only the federal government (and not provincial governments) could extinguish aboriginal and treaty rights, whereas today, neither government can extinguish water rights (Kempton, 2005).

5 Applying an analytical framework to evaluate community capacity to practise IWRM

For the purpose of this study, six dimensions and a number of sub-dimensions were employed in evaluating capacity (Figure 4). Each sub-dimension is composed of various capacity

indicators that characterise the dimension. The selection of capacity dimensions was based on previous research in the literature that demonstrated the necessity of a given capacity as it related to an aspect of IWRM. The capacity dimensions employed include: actor network, information management, human resources, technical, financial and institutional capacity. Capacity indicators provided a metric for identifying trends toward or away from an intended objective. To achieve the study's objectives, 79 indicators were drawn from the literature specifically related to watershed management, source water protection, drinking water management and community capacity (Pahl-Wostl et al., 2007; Timmer et al., 2007; Cap-Net, 2008; De Carvalho et al., 2008; Raadgever et al., 2008). As IWRM continues to evolve, future efforts need to include indicators identified and developed by Indigenous communities, particularly of community-based knowledge specific to environmental resources more commonly referred to as 'Traditional Ecological Knowledge' (TEK).

Figure 4 Conceptual framework to evaluate First Nation capacity to practise IWRM



A four-level rating scheme was adapted from a *'Summary Indicator Table'* developed by the Environmental Finance Center's (2005) assessment of drinking water safety as it relates to financial capacity. Based on qualitative data derived from interviews, response content was evaluated as either positive or negative. Each capacity indicator was evaluated as having an 'absence' of capacity if it did not meet or partially met the requirements, or a 'presence' of capacity if it met or would meet the requirements in the future. In the assessment of each capacity dimension, all indicators were weighted equally, as suggested by McGuire et al. (1994). Subsequently, an overall designation for each capacity dimension was denoted as either having a capacity 'presence', or 'absence', while a 'partial' capacity indicated a dimension that partly meets the criteria.

Primary data for this study were derived from one-on-one interviews in the two participant FN communities. In total, five interviews were conducted in Kitigan Zibi and three in Kahnawà:ke FN. Interviews were conducted with employees and leaders with expertise and experience in natural resources management, water system operations, water testing, engineering, finance and governance. Individuals included Chiefs, forest and civil engineers, water treatment operators, public work directors and environmental health and safety technicians, as well as environmental and financial administrators. The names, training and jobs of interviewees were not disclosed in any part of this research. Total anonymity was necessary to build an enabling environment where all interviewees felt there were no consequences for their opinions, observations and experiences. This is particularly important in smaller communities where identifying participants by profession easily identifies the interviewee. Qualitative data were gathered by using both structured interviews, consisting of predetermined questions, with the same question order and wording (Kumar, 2005), as well as questions modified to incorporate flexibility and allow exploration of emerging information (Kumar, 2005). The presence and absence of capacity indicators for each dimension were recorded, based on interviews, in the *FN Capacity to Practise IWRM Indicator Ratings Table* (Tables 1 to 7). At a later time, the results were shared with each interviewee for verification that their input was correctly evaluated to reduce research error.

Table 1 Summary of capacity results for Kitigan Zibi and Kahnawà:ke First Nations

		Capacity indicators (*Present:total*)	
Capacity type	*Total indices*	*Kitigan Zibi*	*Kahnawà:ke*
Actor network	18	2:18	6:18
Information management	10	4:6	4:6
Human resources	4	2:4	3:4
Technical	26	14:26	12:26
Financial	12	4:12	3:12
Institutional	9	6:9	8:9

6 Results and discussion

The results represent findings for case studies of two FN communities in the province of Québec and should not be generalised to all FN communities in Canada. Rather, the findings of this research are an initial discussion on FN capacity along with an identification of capacity preconditions required for their participation in IWRM.

Table 2 Actor network capacity indicator ratings, showing whether a particular capacity is not met, partially met, met, or met and expected to be met in the future

	Capacity met							
	Kitigan Zibi				*Kahnawà:ke*			
Elements of capacity	*No*	*In part*	*Yes*	*Yes + future*	*No*	*In part*	*Yes*	*Yes + future*
Cross-Sectoral Cooperation								
• Partnerships with different communities & stakeholders	•						•	
• Conflicts with other parties (communities, stakeholders) dealt with constructively, resulting in inclusive agreements to which the parties are committed	•					•		
• Use of cross-sectoral analysis to identify emergent problems and for policy implementation	•					•		
Cooperation Between Administrative Levels								
• FN governments involved in decision-making processes with the federal departments (vertical linkages)		•				•		
• Conflicts dealt with constructively, resulting in inclusive agreements to which the parties are committed		•				•		
Cooperation Across Administrative Boundaries								
• Downstream communities involved in decision making by upstream communities	•				•			
• FN community part of a cooperation structure (e.g., watershed associations)	•				•			
• Conflicts dealt with constructively, resulting in inclusive agreements to which the parties are committed	•					•		
Broad Stakeholder Participation								
• Legal provisions concerning access to information, participation in decision-making (e.g., consultation requirements)	•				•			

Table 2 Actor network capacity indicator ratings, showing whether a particular capacity is not met, partially met, met, or met and expected to be met in the future (continued)

	Capacity met							
	Kitigan Zibi				*Kahnawà:ke*			
Elements of capacity	*No*	*In part*	*Yes*	*Yes + future*	*No*	*In part*	*Yes*	*Yes + future*
• Community includes cooperation structures from non-government groups	•				•			
• Community contributes to agenda setting, analysing problems, developing solutions and making decisions at the watershed scale		•				•		
• Community undertakes parts of watershed management themselves, e.g., through watershed associations	•				•			
• Federal Government takes community input seriously		•					•	
• Provincial Government takes community input seriously		•					•	
• Tribal Council or Environmental department takes community input seriously				•			•	
Social Linkages								
• Clear leadership for water protection at the watershed level exists	•					•		
• Community members have awareness and support for watershed protection				•			•	
• Community members regularly involved in decisions as it pertains to drinking water management and environmental protection		•					•	

6.1 Actor network capacity

This type of capacity requires cooperation, communication and exchange of information. Hence, the need for partnerships is essential in collaborative water management efforts (Yillia et al., 2003). Capacity is improved when stakeholders coordinate, facilitate and maintain active linkages to provide vision and direction (De Loë et al., 2002) and ultimately, partnerships can help overcome the 'silo' effect (Mitchell, 2006).

Table 3 Information management capacity indicator ratings, showing whether a particular capacity is not met, partially met, met, or met and expected to be met in the future

	Capacity met							
	Kitigan Zibi				*Kahnawà:ke*			
Elements of capacity	*No*	*In part*	*Yes*	*Yes + future*	*No*	*In part*	*Yes*	*Yes + future*
Joint or Participative Information Production								
• Community is involved in setting the terms of reference and supervising the research, or is at least consulted (interviews, surveys, etc.) at the watershed scale		•					•	
Interdisciplinary								
• Different disciplines involved in defining and executing research, in addition to technical and engineering sciences, also include ecology, social sciences, etc.				•			•	
Broad Communication								
• Different levels of governments exchange information and data with other governments (federal, tribal councils, band councils)				•			•	
• Community actively disseminates information and data to the public (internet, literature, brochures, media, etc.)		•				•		
Use of Information								
• New information used in public debates				•		•		
• New information influences federal policy		•				•		
• Data needed to manage water supplies, delineate watersheds and aquifers and develop source protection plans available				•			•	
• Community monitors and collects data (e.g., produces quality data)				•			•	

Table 3 Information management capacity indicator ratings, showing whether a particular capacity is not met, partially met, met, or met and expected to be met in the future (continued)

	Capacity met							
	Kitigan Zibi				*Kahnawà:ke*			
Elements of capacity	*No*	*In part*	*Yes*	*Yes + future*	*No*	*In part*	*Yes*	*Yes + future*
• Water management information available to managers and other stakeholders if requested			•				•	
• Comprehensive understanding achieved with open, shared information sources that fill gaps and facilitate integration at the watershed level		•				•		

In this study, 18 actor network capacity indicators were employed (Tables 1, 2), including vertical and horizontal linkages that encompass cross-sectoral cooperation, cooperation between administrative levels, across administrative boundaries and broad stakeholder participation, as adopted in the study by Raadgever et al. (2008) on water management regimes. Another important indicator included in this study is cross-sectoral analysis to identify emerging problems and integrate policy implementation (Pahl-Wostl et al., 2007). Social linkages, a vital element of actor network, include indicators identified as specific to clear leadership for water protection at the watershed level, in addition to community awareness and support for watershed protection (Timmer et al., 2007). Another key aspect of social linkages was developed by Lebel (2008) and evaluates community members' involvement in decisions pertaining to drinking water management and environmental protection. The actor network capacity indicators selected for this study were chosen to reflect the diverse vertical and horizontal linkages that exist in drinking water management, environmental protection and watershed participation.

A clear absence of actor network capacity was apparent for the Kitigan Zibi FN (Tables 1, 2). The reasons were two-fold:

- a lack of partnerships with neighbouring communities
- a lack of participation in watershed associations.

In the first instance, interviewees indicated a non-aboriginal community was situated illegally on Algonquin territory. FNs territorial claims are problematic in Quebec, as Quebec's identity comes with a "profound sense of belonging to the territory traditionally recognized by cartographers" (Salée, 1995). However, FN identity to ancestral land is profound and is in direct conflict with Quebec's identity (Kitigan Zibi FN, personal communication, 30 April, 2010). Furthermore, an interviewee suggested the neighbouring municipality is *"threatened by the economic rise of Kitigan Zibi"* and that socio-political tensions exist as a result. In the second instance, a lack of participation in watershed associations can be attributed to this Nation's strong preference to be recognised as an independent nation with government status and not just as another ordinary stakeholder (Kitigan Zibi FN, personal communication,

Table 4 Human resources capacity indicator ratings, showing whether a particular capacity is not met, partially met, met, or met and expected to be met in the future

	Capacity met							
	Kitigan Zibi				*Kahnawà:ke*			
Elements of capacity	*No*	*In part*	*Yes*	*Yes + future*	*No*	*In part*	*Yes*	*Yes + future*
• *Availability of Suitable Employees*								
• Sufficient number of employees dedicated to water management, environmental protection or rights-holder participation		•				•	•	
• Access to individuals with the appropriate level of education and expertise to adequately support water management, environmental protection or rights-holder participation				•			•	
Training and Education								
• Education and training opportunities available to staff members to participate in, helping them to contribute to water management, environmental protection or rights-holder participation activities			•				•	
• Education and training opportunities regularly taken up by staff members from various departments to participate and contribute to water management, environmental protection or rights-holder participation activities		•					•	

30 April, 2010). In Canada, aboriginal people's customary right to water ensures a rights-holder status, thereby placing them in a unique position unlike that of any other stakeholder (Phare, 2006). There is dissatisfaction with forestry and mining industry consultations, which are viewed as documents outlining decisions that have already been made either without their input or which ignore the concerns they have voiced (Kitigan Zibi FN, personal communication, 30 April, 2010). As such, the potential opportunity for collaboration with other actors in a watershed association may produce the same dissatisfaction experienced with government or industry (Kitigan Zibi FN, personal communication, 30 April, 2010).

A similar absence of actor network capacity in the Kahnawà:ke FN is attributable to multiple factors. An absence is due to previous political conflict in Oka, a preference

Table 5 Technical capacity indicator ratings, showing whether a particular capacity is not met, partially met, met, or met and expected to be met in the future

	Capacity met							
	Kitigan Zibi				*Kahnawà:ke*			
Elements of capacity	*No*	*In part*	*Yes*	*Yes + future*	*No*	*In part*	*Yes*	*Yes + future*
Watershed Health								
• Community drinking water quality monitored (throughout the watershed) regularly (daily tests)	•				•			
• Community drinking water quality monitored (throughout the watershed) regularly (weekly and quarterly tests)	•				•			
• Community drinking water quality monitored (throughout the watershed) regularly (annual tests)	•						•	
• Community groundwater recharge areas are identified			•				•	
• Community source water areas incorporated into official plans			•				•	
• Potential water supply contaminant sources (point & non-point) identified		•				•		
Piped Distribution System								
• Community drinking water quality meets established drinking water standards			•				•	
• Community drinking water quality monitored (within the water distribution system) regularly (daily tests)			•				•	
• Community drinking water quality monitored (within the water distribution system) regularly (weekly and quarterly tests)			•				•	
• Community drinking water quality monitored (within the water distribution system) regularly (annual tests)			•				•	
• Community groundwater recharge areas are identified			•		•			
• Community source water areas incorporated in official plans			•		•			

Table 5 Technical capacity indicator ratings, showing whether a particular capacity is not met, partially met, met, or met and expected to be met in the future (continued)

	Capacity met							
	Kitigan Zibi				*Kahnawà:ke*			
Elements of capacity	*No*	*In part*	*Yes*	*Yes + future*	*No*	*In part*	*Yes*	*Yes + future*
• Potential water supply contaminant sources (point & non-point) identified			•			•		
• Physical infrastructure adequate to produce safe drinking water for community residents			•				•	
• Physical infrastructure adequate to distribute safe drinking water for community residents			•				•	
• Source water adequate in terms of quantity			•				•	
• Source water adequate in terms of quality	•					•		
Well Distribution System								
• Community drinking water quality meets established drinking water standards		•				•		
• Community drinking water quality monitored (within the water supply and distribution system) regularly (daily tests)	•				•			
• Community drinking water quality monitored (within the water supply and distribution system) regularly (weekly and quarterly tests)		•				•		
• Community drinking water quality monitored (within the water supply and distribution system) regularly (annual tests)			•				•	
• Potential water supply contaminant sources (point & non-point) identified		•				•		
• Physical infrastructure adequate to produce safe drinking water for the community's residents		•				•		
• Physical infrastructure adequate to distribute safe drinking water for the community's residents		•				•		

Table 5 Technical capacity indicator ratings, showing whether a particular capacity is not met, partially met, met, or met and expected to be met in the future (continued)

	Capacity met							
	Kitigan Zibi				*Kahnawà:ke*			
Elements of capacity	*No*	*In part*	*Yes*	*Yes + future*	*No*	*In part*	*Yes*	*Yes + future*
• Source water adequate in terms of quantity			•				•	
• Source water adequate in terms of quality	•					•		

for aboriginal sovereignty and a lack of participation in local watershed associations (Tables 1, 2). However, it was suggested that previous political conflicts have led the federal government to be more sensitive to ensuring conflicts are resolved (Kahnawà:ke FN, personal communication, 25 May, 2010). In addition, Kahnawà:ke has rejected opportunities to integrate with the province and prefers to promote aboriginal sovereignty (Alfred, 1995). French, the operative language for the local watershed association, is considered a barrier for the participation of Kahnawà:ke, as, in general, residents speak only English and Mohawk. An interviewee thought "*their participation [in the francophone watershed association] required more time for translations"* and this limited their role in local watershed meetings, thereby hindering their participation (Kahnawà:ke FN, personal communication, 26 May, 2010). Overall, the socio-political realities of each community greatly determine its ability to work collaboratively to identify common water resource concerns.

6.2 Information management capacity

This capacity, as it relates to integrated water management, requires that information be shared and generated collaboratively. Cooperation in information management helps develop trust and collaboration amongst stakeholders. Information has to be accessible, shared and integrated to enable decision-making (Kennedy et al., 2009). Information management fosters greater technical capacity, mutual understanding and shared insights (Mostert et al., 1999; Van der Zaag and Savenije, 2000).

In Kitigan Zibi, FN there exists a partial information management capacity (Tables 1, 3). Although the community has expertise (or the ability to locate a third party) in producing information at the local level, there is a clear lack of joint or participative information produced with partners at the watershed scale. In IWRM, it is the sharing of information that is imperative to developing information management capacity (Mostert et al., 1999; Van der Zaag and Savenije, 2000; Raadgever et al., 2008; Kennedy et al., 2009). This lack of information management is primarily due to Kitigan Zibi's lack of participation in the watershed association, poor regional partnerships with other municipalities and dissatisfaction with consultation processes with government or private industries.

In the Kahnawà:ke FN there is a presence of information management capacity (Tables 1, 3). Kahnawà:ke can produce information on a joint or participative-basis, use

Table 6 Financial capacity indicator ratings, showing whether a particular capacity is not met, partially met, met, or met and expected to be met in the future

	Capacity met							
	Kitigan Zibi				*Kahnawà:ke*			
Elements of capacity	*No*	*In part*	*Yes*	*Yes + future*	*No*	*In part*	*Yes*	*Yes + future*
Appropriate Financing System								
• Sufficient (public and private) resources available for water management initiatives (e.g. source water protection, watershed participation, infrastructure, water system projects)	•					•		
• Costs recovered from the users by public and private financial instruments to maintain a balanced budget			•			•		
• Decision-making and financial control under the same leadership			•				•	
• Water rates reflect the cost of protecting and providing drinking water (including treatment, distribution, maintenance and source water protection)	•				•			
• Able to obtain funding from outside the community		•				•		
• Able to obtain funding from inside the community		•				•		
• Stable funding	•				•			
• Funding surpluses saved for future water projects			•			•		
Capacity for a Community to Pay or Access Services								
• What level of education do most community members have		•				•		
• Unemployment rate		•					•	
• Average income level		•				•		
• Work days lost per annum due to water related diseases			•				•	

different disciplines in research, share information and they have water management data and the ability to monitor and collect data (Kahnawà:ke FN, personal communication, 26 May, 2010). Since Kahnawà:ke does not participate in watershed associations, a comprehensive understanding could not be achieved because information was not shared to fill gaps and facilitate integration as required for watershed management in a collaborative setting.

Table 7 Institutional capacity indicator ratings

	Capacity met							
	Kitigan Zibi				*Kahnawà:ke*			
Elements of capacity	*No*	*In part*	*Yes*	*Yes + future*	*No*	*In part*	*Yes*	*Yes + future*
Legal Aspects								
— Appropriate Legal Framework —								
• There are complete and clear legal frameworks for water management (with sufficient detail)		•					•	
— Adaptable Legislation —								
• Federal laws and regulations easily changed *Policy*	•					•		
— Actual Implementation of Policies —								
• Plans and policies actually implemented			•				•	
• Local policies reviewed and changed periodically		•					•	
• Policies are flexible and not rigid when there are good reasons not to implement them (e.g., new and unforeseen circumstances and new insights)			•				•	
— Planning —								
• There are community planning strategies and by-laws that protect current drinking water supplies			•				•	
• Land use activities controlled in community				•			•	
• well fields, recharge and watershed water supply areas								
— Long Term Horizon —								
• Solutions for short-term problems which do not cause more problems in the (far) future (20 years or more)			•				•	
• Preparations being made for the (far) future (20 years or more)			•				•	

Both participant communities indicate a high level of capacity as it relates to producing quality water data. However, a lack of participation in watershed associations hinders the distribution of information to other stakeholders. It is apparent from this study that information management capacity has a direct relationship with actor network capacity. If

there is a presence of an actor network capacity, there is a greater likelihood of information management capacity as it relates to sharing information. Trust and cooperation are necessary components to ensure information is accessible, shared and integrated to enable decision-making at the watershed level.

6.3 Human resources capacity

This capacity refers to the education and training individuals currently possess in water management, protection or rights-holder participation activities and also includes opportunities for continued professional growth. Human resources capacity is necessary for competent water management (Forster, 1997) and essentially, links education, training and the abilities of individuals to achieve sustainable water stewardship. Regional capacity and human resources development are important elements in IWRM (Forster, 1997; Van Der Zaag, 2003; Gumbo et al., 2005).

In Kitigan Zibi FN there exists a partial human resources capacity (Tables 1, 4). Although Kitigan Zibi has a sufficient number of employees for O & M, interviewees indicated a dedicated staff person to exclusively manage watershed health, environmental protection where rights-holder participation was required (Kitigan Zibi FN, personal communication, 30 April, 2010). Limited financial resources are a concern when trying to ensure there is a dedicated staff person to manage watershed issues. Although there are education and training opportunities available to staff members to participate in and later contribute to water management, environmental protection or rights-holder participation, the onus is on the individual to take these opportunities (Kitigan Zibi FN, personal communication, 30 April, 2010). Furthermore, these opportunities are only available if additional funding is located, which is not an easy endeavour, particularly in the case of Kitigan Zibi, which operates on a zero debt policy (Kitigan Zibi FN, personal communication, 25 May, 2010).

In the Kahnawà:ke FN, human resources capacity is present (Tables 1, 4). In regards to a sufficient number of employees, the interviewees again voiced the same concerns and preferred a dedicated staff person to exclusively manage watershed health, environmental protection and rights-holder participation. An interviewee in Kahnawà:ke thought financial resources have become more constrained in recent years and that this hinders the possibility of hiring a staff person exclusively for watershed-related activities (Kahnawà:ke FN, personal communication, 25 May, 2010). Financial capacity has a direct impact on human resources capacity. Without adequate funds, staff to support drinking water management and environmental protection is not possible. If financial resources are limited, then priority is directed to drinking water management, which thereby takes precedence over activities associated with watershed health.

Based on this study, limited financial resources have been found to greatly hinder the ability to hire staff to exclusively manage watershed matters. Current staff cannot be expected to adequately manage watershed responsibilities, in addition to their present responsibilities. A staff person to support integrated water management matters would directly benefit information management, actor network and technical capacity.

6.4 Technical capacity

This capacity encompasses watershed health, as well as piped and well water distribution systems. Kitigan Zibi FN showed partial technical capacity (Tables 1 and 5). With

respect to watershed health, there exists an absence of capacity, primarily due to lack of monitoring of water quality throughout the watershed and to not knowing where potential water supply contaminant sources are. Limited human and financial resources impact overall watershed health activities (Kitigan Zibi FN, personal communication, 30 April, 2010).

With respect to the piped distribution system, there exists a technical capacity, reflected by water quality meeting established drinking water standards, regular water monitoring, knowledge of groundwater recharge areas and potential water supply contaminants (point and non-point source), adequate physical infrastructure to distribute and produce safe drinking water, incorporation of water sources into plans and adequate source water quantity. In 2010, Kitigan Zibi had their first water and wastewater system approved, at a cost of $10 million obtained from the EAP. It was completed in March 2011, and presently 195 households (or 37% of households) are connected to a piped water distribution system (INAC, 2009b, INAC, 2011). Currently, Kitigan Zibi is self-sufficient in providing water and wastewater services to 236 households (or 45% of households) (Kitigan Zibi FN, personal communication, 30 April, 2010). The Band Council hopes to deliver piped water to the remaining 289 households within the next 5–10 years (Kitigan Zibi FN, personal communication, 30 April, 2010). Interviewees were highly in favour of piped distribution as a means of self-sufficiency and this installation is another step towards achieving this goal. It should be noted that EAP funds were distributed to only 18 FN communities across Canada, including three in Québec, which include both Kitigan Zibi and Kahnawà:ke.

With respect to well distribution systems, the results clearly indicate an absence of capacity. Groundwater sources contain uranium, which contributes to poor water quality. In addition, the monitoring of wells is time-intensive and the number of wells to be monitored greater than available human resources can handle.

The Kahnawà:ke FN shows partial technical capacity (Tables 1, 5). In terms of watershed health there is an absence of capacity primarily due to lack of water quality monitoring throughout the watershed and lack of knowledge about where potential water supply contaminant sources are (point and non-point source). In a manner similar to Kitigan Zibi, limited human and financial resources to support watershed health activities are a reason for this capacity deficiency.

In terms of piped distribution systems, there is a presence of capacity. The following indicators support piped distribution capacity: the presence of water quality that meets established drinking water standards, regular water monitoring, adequate physical infrastructure to distribute and produce safe drinking water and adequate source water quantity.

In terms of well distribution systems, there is an absence of capacity. The following indicators do not support well distribution system capacity: drinking water does not meet established standards, monitoring of wells is not done regularly, there is poor physical infrastructure to distribute or produce safe drinking water and the source water is inadequate in quality.

In summary, both communities showed a partial capacity with regard to watershed health, a presence of capacity in piped distribution systems and an absence of capacity for well distribution systems. It should be noted that a lack of information or knowledge results in an absence of capacity indicators, which in turn contributes to information gaps related to problem solving within an IWRM context and with regards to achieving safe drinking water or environmental sustainability.

6.5 Financial capacity

This capacity represents the ability to access, generate and save funds for drinking water and environmental stewardship.

Results for the Kitigan Zibi FN indicate an absence of financial capacity (Tables 1, 6). Vulnerabilities in internal and external funding sources contribute to overall poor financial capacity. FNs rely heavily on INAC for external funds. In January 2009, the federal government administrated funds of $165 million for water and wastewater projects for aboriginal peoples under the EAP (INAC, 2009a; INAC, 2009b). The 2010 EAP approval of Kitigan Zibi's first water and wastewater system initially did not include a wastewater system. The community encouraged the installation of both systems and did not sign the agreement until provisions were made to include a wastewater system (Kitigan Zibi FN, personal communication, 30 April, 2010). An interviewee noted that there was a constant struggle to secure external funds from INAC and that funds were not always accessible (Kitigan Zibi FN, personal communication, 30 April, 2010).

In addition, the community's inability to pay or access services produces internal financial vulnerabilities. In general, community members find seasonal employment in the forestry and mining industries, but experience challenges in securing long-term employment (for those not employed by the Band office) (Kitigan Zibi FN, Personal Communication, 30 April, 2010). The economic implications of these community employment trends do not support a healthy base for the Band office to rely on for financing water-related activities.

The Kitigan Zibi community indicated that residents do not pay what is required to fund drinking water services, as current fees for water services are substantially lower than the real cost of operating and maintaining water facilities and services, particularly when taking into account rising input costs. This low capacity for communities to financially contribute exerts great financial strain on limited Band resources. In Kitigan Zibi, the Band Office offers insurance to households for maintenance and repairs for well distribution and septic systems. The sum of $85/household insures an individual well and an additional $85/household insures septic systems (Kitigan Zibi FN, Personal Communication, 17 September, 2010). This is voluntary and only 60% of the community pays it.

An absence of financial capacity heavily impacts activities associated with watershed health. There is a heavy dependence on external funding and there are no financial sources generated from the community or secured with external government funding specified for watershed health. An interviewee specified financial resources are required to attend meetings and to collect and maintain data necessary for participation and without financial resources, watershed participation is not a viable option (Kitigan Zibi FN, personal communication, 30 April, 2010).

In the case of the Kahnawà:ke FN, there is an absence of financial capacity (Tables 1 and 6). Internal funding opportunities are limited. As one interviewee noted, the Indian Act (Section 89) is a significant economic barrier in stimulating the local economy and explained that

> *"assets on reserves cannot be seized from outside entities ... a bank that finances a company [located on FN land] cannot seize assets, so companies are hesitant to do business with Kahnawà:ke because a bank cannot recover assets"*

(Kahnawà:ke FN, Personal Communication, 25 May, 2010). A healthy local economy would be sustained by business investments to generate taxes, which could then be directed to financing watershed health, source water protection and drinking water management activities.

External funding for infrastructure depends on the availability of federal funds beyond the scope of funds made available for O & M. Although Kahnawà:ke's need for a reservoir was identified as early as 2003 and for a new water line in 2002, there was a lack of funds to support water infrastructure needs until a financial opportunity was provided by EAP (Kahnawà:ke FN, personal communication, 3 September, 2010). Due to the rare opportunity provided by the EAP, Kahnawà:ke's plan to improve their water treatment and reservoir was approved and received $13 million in funding (INAC, 2009a). Kahnawà:ke's reservoir capacity will be increased significantly to meet health and safety requirements (INAC, 2009a). However, had this rare funding opportunity not presented itself, Kahnawà:ke could not have financed this endeavour.

In terms of internal capacity for the community to pay for or access services, there is an absence of capacity. Kahnawà:ke charges a mandatory $59 per annum per household for both water and wastewater services. However this fee has not changed in 20 years and does not reflect the rise in input costs (Kahnawà:ke FN, Personal Communication, 20 September, 2010). Water management costs are $1.2 million annually, of which the community of 2,000 residents generates only $118,000 (Kahnawà:ke FN, Personal Communication, 25 May, 2010).

In summary, financial capacity supports a wide spectrum of aspects related to integrated water management. A major misunderstanding is that FNs acquire most or all of their funds from governments with ease and therefore, should exhibit the presence of financial capacity. However, interviewees revealed the difficulty in acquiring funding, as witnessed in both participating communities. This coincides with the financial burden encountered in communities with high unemployment and the inability to depend on internal financial resources as a prospective source to ensure financial capacity (OAG, 2005; Smith et al., 2006; Swain et al., 2006). As noted previously, Kitigan Zibi and Kahnawà:ke acknowledge financial resources as a key limiting factor to employing a staff person exclusively for watershed matters, to participate in watershed associations, to monitor watershed health and to generate and collect watershed data. The absence of financial capacity impacts actor networks, information management, human resources and technical capacity. This finding is similar to that of Leach and Pelkey's (2001) study of 37 watersheds, which cited adequate funding as the most important factor for successful watershed management. A lack of financial resources hinders the capacity of stakeholders to plan and achieve watershed goals (Litke and Day, 1998).

6.6 Institutional capacity

This capacity encompasses the regulation, legislation, protocols and plans surrounding watershed management. Institutional capacity incorporates appropriate institutional frameworks and policies to support integrated water initiatives (GWP, 2003). Van der Zaag (2003) suggests that since IWRM is based on relationships amongst water users and between water users and the government, it requires good governance.

In the case of the Kitigan Zibi FN, institutional capacity is present (Tables 1, 7). This capacity relates to locally-initiated environmental policies that are flexible and implementable and have cognizance of long-term benefits (20 years or more), despite federal policies critiqued as neither often reviewed, nor changed periodically due to the bureaucratic nature of the federal government (Kitigan Zibi FN, personal communication, 30 April, 2010). Furthermore, Kitigan Zibi has implemented policies to protect drinking water supplies, particularly in determining the location of community landfills and restricting development near water supplies (Kitigan Zibi FN, personal communication, 30 April, 2010). An observation is that locally directed

efforts have benefitted the protection of drinking water and control of land use activities in community well fields, recharge and watershed water supply areas.

In the case of the Kahnawà:ke FN, there is a presence of institutional capacity (Tables 1, 7). Although interviewees indicated the legal framework set out by INAC was complete and clear, they felt federal legislation was not adaptable due to the nature of government bureaucracy. The presence of the existing capacity is due to Kahnawà:ke's ability to implement policies that are responsive to identified environmental priorities. Kahnawà:ke has implemented policies to protect drinking water supplies, particularly in determining the location of on-community landfills and restricting development near water supplies (Kahnawà:ke FN, personal communication, 25 May, 2010). Kahnawà:ke has the ability to adjust regulations within six weeks, indicating a rapid response time for local environmental concerns (Kahnawà:ke FN, personal communication, 25 May, 2010).

Both participant communities indicated a strong presence of institutional capacity. This is largely due to many indicators being focused on local institutional capacity (e.g., FN implementation of by-laws) rather than institutional capacity at a national level (e.g., review and periodic change of federal policies). It is important to note that at the local scale, FNs experience strong institutional capacity when decision-making and control are within their jurisdiction. Based on Day and Cantwell's (1998) case study, governance was identified as being of the greatest significance for FNs involved in the implementation of integrated land and resource planning.

7 Conclusions

Based on this study, both participant FN communities demonstrate an overall partial capacity to practise IWRM. Kitigan Zibi had a presence of 34 out of a total 79 capacity indicators (43% of overall capacity), while Kahnawà:ke had 38 out of a total of 79 capacity indicators (48% of overall capacity). To achieve sustainable, equitable and collaborative integrated water resources partnerships with FNs as key players, it is important that FNs be engaged in capacity development. However, FN capacities to practise IWRM undoubtedly encounter challenges not common to their non-aboriginal Canadian counterparts, particularly in generating financial resources.

The findings of this study suggest that financial resources are necessary to support FN watershed activities as they relate to technical capacity (e.g., to monitor water quality throughout the watershed), human resources capacity (e.g., to employ personnel that have exclusive responsibility for watershed activities, participation, monitoring and collecting data) and information management capacity (e.g., to generate quality water data). Capacity dimensions are interconnected and tend to overlap. As previously noted, in the case of FNs, the presence of financial capacity plays a significant role in contributing to other capacities. However, the presence of each capacity dimension is necessary for a FN community's overall capacity to practise IWRM.

An additional important finding of this study is the necessity of an actor network capacity. The presence of an actor network capacity serves as a precursor for FNs to participate on a collaborative basis with other stakeholders. FN partnerships, cooperation and communication are critical for participation in IWRM in Québec. However, the absence of an actor network capacity, as demonstrated in this study, is connected with the complexity of the socio-political setting in Québec. Although the processes of addressing language,

cultural identity and political tension are not easily resolved and are beyond the scope of this study, alternatives are necessary to ensure the development of FN capacities to practise watershed management and simultaneously address socio-political concerns.

FN-led watershed councils as suggested by Wilson (2004), FN capacity building partners, customary rights education in watershed associations and addressing jurisdictional complexities while recognising aboriginal self-governance could all serve as a means to address language, cultural identity and political tension issues, thus bridging a colonial past and moving forward with progressive and equitable water management systems inclusive of FN perspectives.

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Notes

[1]Watershed zones are river basins identified by the Government of Québec.

[2]The term aboriginal is used here to refer to a person who identifies with, or is a member of a political or cultural entity comprising persons indigenous in Canada (i.e., FNs, Métis, Inuit and Indian), but may or may not be member of an Indian Band or FN (Statistics Canada, 2010a).

[3]Remote areas are places with a population of less than 1,000 and a density of less than 400 persons per square kilometre (Statistics Canada, 2009).

[4]Health Canada (2008) defines maximum acceptable concentrations as established limits for certain substances that are known or suspected to cause adverse effects on health.