Knowledge Engagement in Collaborative Water Governance:

A New Brunswick Example

by

Katherine VanTol

A thesis
presented to the University of Waterloo
in fulfillment of the
thesis requirement for the degree of
Master of Environmental Studies
in
Environment and Resource Studies

Waterloo, Ontario, Canada, 2012

Author's Declaration

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

I understand that my thesis may be made electronically available to the public.

ABSTRACT

Authoritative, top-down forms of environmental governance are presently giving way to more collaborative approaches in which decision making is an ongoing negotiation between government and non-government actors. There is growing consensus that critical environmental concerns—such as contamination of drinking water—relate as much to political, economic and social issues, as to technical and scientific issues. As the trend toward collaborative environmental governance continues, and as science-based knowledge increasingly shares a role in decision-making processes with more "local", non-scientific knowledge, questions arise concerning how diverse knowledge contributions are understood and engaged in these governance processes. This research explored the relationships between knowledge and collaborative environmental governance processes. The purpose of the research was to identify (1) types of knowledge that individual actors bring into collaborative governance pertaining to water resource protection, (2) uses of that knowledge, and (3) features of collaborative processes that affect the engagement of actor knowledge. Collaborative water governance in New Brunswick provided the context for the research. Most actors did not see a definitive distinction between "expert", scientific and "local", non-scientific knowledge; they considered both to be important contributions. Nonetheless, science-based knowledge, especially natural science, was found to be a predominant knowledge type among actors involved in collaborative water governance. Science-based, expert knowledge was more readily used than local knowledge types in the various stages of collaborative governance. Leadership and the definition of actor roles were considered paramount for engaging a wide range of knowledge types in collaborative governance processes.

ACKNOWLEDGEMENTS

First and foremost, this thesis could not have been completed without the masterful guidance of my supervisor Dr. Rob de Loë, and the sage direction of my co-supervisor Dr. Ryan Plummer. Dr. Rob de Loë and Dr. Ryan Plummer, thank you sincerely for taking me on as a student and lending your wisdom every step of the way. I will not forget your inspirational dedication and your motivation for your work and for the work of those in your charge.

Simon Mitchell of the St. John River Society and Meduxnekeag River Association, and Dr. Cynthia Stacey of the University of New Brunswick, I cannot thank you enough or sufficiently acknowledge your support to me and to this project. I loved the verdant green and river-riddled landscape of New Brunswick already, but your warm welcome and introductions to the people of the province were immeasurably helpful. Thank you also, Simon, for ongoing review, suggestions and comments, especially regarding the contents of Chapter Four. To you both, this project would not be in existence but for the selfless giving of your time and knowledge.

Hearty thanks also to the Canadian Water Network, to the generous research assistant positions with Dr. Rob de Loë and the teaching assistant positions within the Faculty of Environment for funding the project. Throughout these two years I have been keenly aware of the blessing that this funding has been. Each trip to New Brunswick, the translation of French text, the production of the map in Figure 1 and many more small details were made possible through this financial support.

To Marie Puddister, thank you so very much for your work on the map in Figure 1. I appreciated the time that you spent on various iterations of the map, your patience and the cheerful emails that we shared throughout the process.

To my colleagues at the University of Waterloo, and within the Water Policy and Governance Group, thank you all for friendly conversations, your encouragement and useful hints and tips at the most crucial moments. In particular, to Georgia Simms, Becky Swainson, Seanna Davidson, and Dan Murray, I owe you much for your technical help during the development and field research phases of this project. Chapter Three (and, consequently, the entire methodology of the project itself) would be a disaster without you! As well, thank you Katie Saunders for lending your valuable advice and for sharing your own master's experience.

Dear family and friends, you put up with me through it all and I am so grateful to you for that. Thank you for leaving me alone when the work was heavy, for lending your ears when the work was frustrating, and for providing healthy distraction when the work became too consuming. And to Art Smit, thank you for reminding me constantly that God has a plan for our lives, and that the plan extends beyond the limits of this thesis work!

> "Let the heavens rejoice, let the earth be glad; let the sea resound, and all that is in it; let the fields be jubilant, and everything in them. Then all the trees of the forest will sing for joy; they will sing before the Lord, for He comes" – Psalm 96: 11-13a

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER ONE:

INTRODUCTION

1.1 Problem Context

Top-down authority and scientific expertise no longer have a monopoly on decision making in environmental governance (Savan *et al.*, 2004; Failing *et al.*, 2007). Rather, policy and public administration studies in recent decades have shown that the inclusion of different types of knowledge in decision-making processes is one of the important, basic determinants of the effectiveness of governance (Feldman *et al.*, 2009; van Buuren, 2009). Additionally, a review of environmental governance literature suggests that including a range of actors and their different types of knowledge in collaborative processes can result in better environmental outcomes (Armitage *et al*., 2007; Berkes, 2009; Hahn *et al*., 2006; Kroon *et al*., 2009; Olsson *et al*., 2004; Pahl-Wostl & Hare, 2004; Plummer, 2009; Schultz *et al*., 2009).

Collaborative governance is a "governing arrangement in which a broad range of actors is directly engaged in a collective decision-making process that is formal, consensus-oriented and deliberative, and which aims to make or implement public policy or manage public programs" (Ansell & Gash, 2007: 545). Globally, there has been growing acceptance of the need for collaborative processes in environmental governance (Ansell & Gash, 2007; Margerum, 2008; Margerum & Whitall, 2004). As a result, governance that once mainly involved scientists and environmental professionals (Bryant & Wilson, 1998) now depends on the involvement of a wider range of actors.

According to research by Goucher and others (2007), the protection of water resources is an important environmental issue that should be approached collaboratively. It requires the knowledge contributions of people involved in regional and local governments as well as in

water utilities and watershed organizations. Protection of drinking water sources is an increasingly critical aspect of water resource protection. For example, the first decade of the 21st century saw a number of water contamination events that emphasized the need for better governance of water in Canada. Drinking water advisories were experienced in many communities across the country. Tragically, in Walkerton, Ontario, drinking water contamination resulted in illness and fatalities. This event initiated a new focus on drinking water safety and water governance (e.g., d'Ombrain, 2001; Hrudey *et al.*, 2003; Swain *et al.,* 2006). An influential document, published by Judge Dennis O'Connor, Commissioner of the Walkerton Inquiry, set out guidelines for a multi-barrier approach to ensuring uncontaminated water resources (O'Connor 2002). The first step of this multi-barrier approach is source water protection.

Source water protection (SWP) is an important step in maintaining healthy drinking water supplies. As all water resources are connected through the hydrologic cycle over time and space, it is necessary to think of SWP within the broader context of water resource protection. Source water is any surface water that is used, or may be used in the future, as drinking water. The policies, plans and activities undertaken to prevent or minimize the release of contaminants into surface or groundwater make up SWP (O'Connor 2002). Achieving effective SWP is a complex task that requires consideration of the many different uses of water (Simms *et al*., 2010). Agricultural, commercial, private and industrial activities along watercourses often have measurable effects on water quality. The knowledge that local actors bring to decision-making processes is thus critical. The effectiveness of SWP initiatives depends on the involvement of local actors (Hill, 2006) who live and work in the watershed, in addition to the involvement of water resource managers and scientists.

In the Canadian province of New Brunswick, surface water protection is an important matter. Roughly 40% of the province's population depends on water from surface water bodies, such as lakes and rivers, for drinking water (Environment Canada, 2004). A governance tool with the potential to promote the protection of surface water within the province was the Water Classification Regulation (2002)—a regulation under New Brunswick's *Clean Water Act* (1989). The program created under this regulation promoted a collaborative approach to water resource protection; importantly, the discontinuation of the program that implemented the Water Classification Regulation was formally announced several weeks before the publication of this thesis. Formerly, under the Regulation, community members were encouraged to work with government representatives and water experts to set goals for water quality protection along the rivers and streams in their local watershed (GNB 2011g). The vision behind the design of the Regulation was to involve a wide representation of stakeholder contributions early on, and continually throughout the process. Wide representation was encouraged so that there might be a greater understanding of how human actions affect water quality, and greater agreement on how water quality should be governed and protected (GNB 2011g). Thus, the approach underlying the program was an example of collaborative governance.

Collaborative watershed groups in the province have been engaged in carrying out the Regulation. Watershed groups in New Brunswick are often initiated through the interest of individual citizens, such as people sharing an interest in fish preservation or a broader environmental concern. Group member and staff composition within the groups is not regulated by an over-seeing body and thus each group is unique in its makeup. The reality that each collaborative watershed group is unique in its actor makeup allowed an opportunity to study the different types of knowledge that are engaged in the collaborative governance of water resources.

There was also the opportunity to study what the knowledge contributors are tasked to do and what factors of collaborative governance determine the ways in which different types of knowledge are engaged. A study investigating the characteristics of knowledge inclusion in collaborative decision making has the potential to contribute to the growing body of literature on collaborative environmental governance and the roles of different types of knowledge.

1.2 Purpose and Objectives

This research explores knowledge and collaborative environmental governance processes. The purpose of the research is to ascertain the types of knowledge used by individuals engaged in collaborative water governance, how the different types of knowledge are used in the governance processes, and what factors affect the inclusion of knowledge in collaborative governance processes. The Water Classification Regulation in New Brunswick provides a source water protection context for the work.

Two specific objectives follow from this overall purpose:

1. Draw from academic and empirical literature to develop a framework that can be used to identify the types of actor knowledge used in collaborative environmental governance, how that knowledge is used, and the factors that determine how the knowledge is engaged in collaborative environmental governance processes.
2. Use the framework to (a) explore the types of knowledge that individuals engaged in collaborative water governance in New Brunswick use, (b) investigate how the knowledge is used, and (c) examine what factors affect the inclusion of knowledge in collaborative water governance processes.

1.3 Organization of Thesis

This thesis consists of six chapters. Following the introduction, the second chapter presents an overview of literature that is pertinent to this study and its objectives. Chapter Three discusses the research design used to achieve the study's three objectives. A detailed explanation of the case study context is given in Chapter Four. The fifth chapter consists of a presentation of the results of the study. Finally, Chapter Six provides a discussion of the significance of the results and their practical and scholarly contributions.

CHAPTER TWO:

LITERATURE REVIEW

Environmental policy and governance, as well as public administration, were the main bodies of literature consulted to provide the theoretical foundation for this study of collaborative water governance. In this chapter, literature addressing collaborative governance and knowledge inclusion in governance is reviewed and presented.

2.1 Collaborative Environmental Governance

Within the environmental governance literature, governments are no longer considered the sole source of authority, and scientific knowledge is no longer considered the only valid way of knowing (de Loë *et al*., 2009; Failing *et al.*, 2007). Dryzek (2005) argues that the knowledge needed to deal with environmental complexities and uncertainties is dispersed among government and non-government actors at the local, regional and national levels. Indeed, studies have shown that the inclusion of different types of knowledge in decision-making processes is one of the important, basic determinants of effective governance (e.g., Blackler, 1995; Feldman *et al.*, 2006; Nonaka, 1994). Consequently, there has been growing acceptance of the necessity of collaborative processes in environmental governance (Ansell and Gash, 2007; Margerum, 2008; Margerum & Whitall, 2004), with the view that collaboration may be an effective way to involve a wide range of actors and their knowledge in environmental governance processes (Kroon *et al.*, 2009). It is generally accepted in the literature that collaboration is a key factor contributing to effective decision making (Beierle & Konisky, 2001; Crozier, 2008; Dryzek, 2005; Hempel, 1996; Koehler & Koontz, 2008). As a result, governments globally have begun to implement collaborative approaches to environmental governance (Crozier, 2008; Moore & Koontz, 2003).

A wide range of actors is typically involved in collaborative governance. This necessitates a process of deliberation between different actors in order for effective solutions to be found. With its focus on the importance of deliberation, literature on collaborative environmental governance draws heavily on the theory of deliberative democracy (Connick & Innes, 2003). Roberts (2004) states “deliberation is not 'the aggregation of interests.' It [is a process that] requires thoughtful examination of issues, listening to others' perspectives, and coming to a public judgment on what represents the common good” (Roberts, 2004: 332). In deliberative democracy theory, decisions are justified through reasoned deliberation (Gutmann & Thompson, 2004). The emphasis of the process is on deliberation—debate, personal reflection and informed public opinion (Parkins & Mitchell, 2005). In terms of practical application, however, Zwart (2003) points out that the theory of deliberative democracy has been unable to suggest what type of governance model will best foster deliberation.

Similarly, although collaborative approaches are typically offered as an appropriate way to foster deliberation, a consensus does not exist in the literature on the definition of collaborative governance. This is due to the fact that the range of government and non-government actors involved in collaborative forms of governance results in links across institutional, organization and personal levels and domains (Berkes, 2009). Among other forms, the structures of collaborative governance may be citizen-based, agency-based or mixed partnerships (Moore & Koontz, 2003) and can vary according to activity focus, institutional setting, population demographics, organization size, geographical scale and other aspects (Margerum, 2008). One well-cited definition of collaborative governance is from Ansell and Gash (2007). In their view, collaborative governance is considered to be a “governing arrangement in which a broad range of actors is directly engaged in a collective decision-making process that is formal, consensus-

oriented and deliberative, and which aims to make or implement public policy or manage public programs" (Ansell & Gash, 2007: 545). This perspective is well supported in literature. For example, Bryan (2004: 882) states that collaboration involves "processes [that] engage citizens and other participants in the development of alternatives that government agencies have the authority to adopt, modify, or reject based on scientific and formal public review, in compliance with existing laws, regulations and procedures". Collaborative governance, it is generally thought, increases the legitimacy of decision-making processes for a wide range of participants and affected citizens, and can result in more effective and efficient governance as well as better policy implementation (Feldman *et al*., 2006).

In a discussion of various forms of political discourse, Dryzek (2005)—a deliberative democracy theorist—asserts that an intelligent approach to environmental issues demands that political structures encourage the capacity of actors to facilitate and engage in collaborative deliberation. Strong deliberative participation takes time to establish but is beneficial. The benefits arise through challenging participants to think and act in new ways (Beierle & Konisky, 2001) through actively sharing knowledge via deliberation in decision-making processes. Several other key benefits of collaborative decision making, revealed in the literature, include improved relationships through conflict resolution among actors; increased capacity among non-government and government actors to understand environmental issues and coordinate action to address them; and outcomes that more often reflect local actor values, incorporate citizen knowledge and ultimately influence change (Beierle & Konisky, 2001; Hempel, 1996).

Despite the benefits attributed to collaboration, research shows that collaboration by a range of participants is not always beneficial to decision-making processes (e.g., Moore & Koontz, 2003; Murdoch & Abram, 1998). Indeed, the shift from top-down governance to more

collaborative forms of governance has resulted in a large number of questions. These questions relate to concerns such as the challenge of gaining legitimacy for the governance process through acknowledgement and acceptance by those subject to the governance actions (Priscoli, 2004); the challenge of determining the roles of the various actors in the collaboration (Cash *et al*., 2003; Failing *et al.,* 2007; Feldman *et al*., 2006; Feldman *et al*., 2009); the challenge of managing different understandings of the environment and of the society acting within it (Dewulf *et al*., 2011); the challenge of how to come to effective governance solutions that include all understandings of the issue (Olsson *et al.,* 2004); and, overall, the challenge of understanding what types of knowledge are important to environmental governance (Blackstock & Richards, 2007; Feldman *et al*., 2006; Sheikheldin *et al*., 2010) and how these knowledge types are used in governance (Beierle & Konisky, 2000; Kroon *et al*., 2009). Several of these questions relate directly to the inclusion of different types of knowledge in collaborative environmental governance, and are addressed in this research:

1. *Types of knowledge* - there is a need to understand what types of knowledge are important to collaborative environmental governance (Blackstock & Richards, 2007; Feldman *et al*., 2006; Sheikheldin *et al*., 2010).
2. *Use of knowledge* - it is important to understand how these knowledge types are used in collaborative governance (Beierle & Konisky, 2000; Kroon *et al*., 2009).
3. *Engagement of knowledge* – in the facilitation of collaborative governance, it is necessary to encourage recognition of the plurality of normative interpretations of issues, and to maintain an ability to coordinate multiple types of actor knowledge (van Buuren, 2009).

The collaborative environmental governance literature emphasizes that knowledge from various sources and actors is critical to the achievement of successful collective decision making (Innes & Booher, 2010). Collaboration occurs through deliberative processes, in which solutions are found through the communication of information, development of shared goals, and pursuit of a collective vision (Koontz & Johnson, 2004; Bidwell & Ryan 2006). There is a necessary and important focus on knowledge in collaborative governance literature. Collaboration emphasizes that different actors work and think together, and that the process of collaborating makes sense of knowledge from different sources and actors (Berkes, 2009).

2.2 Knowledge in Collaboration

A main challenge of collaborative environmental governance is that of understanding what types of knowledge are important to the governance processes (Blackstock & Richards, 2007; Feldman *et al*., 2006; Sheikheldin *et al*., 2010). Knowledge is a multifaceted concept with many layered meanings (Nonaka, 1994). Knowledge is not the same as "data" or even "information". "Data" can be both quantitative, or qualitative, and characterized according to four scales of measurement—suggested by Stanley Smith Stevens in 1946—which are nominal, ordinal, interval or ratio. The data used in this study took the form of responses to interview questions. While *data* are measurable variables (e.g., temperature in degrees), *information* is data put into context in order to be communicated (e.g., it is 27 degrees Celcius in Toronto today). Data alone carry no meaning, but must be interpreted in order to become information. *Knowledge* is information that has been evaluated and organized for further use to guide action (e.g., 27 degrees Celcius is unusually warm for this time of year in Toronto) (Michaels *et al.*, 2007).

Collaborative governance typically involves a multiplicity of actors with a wide range of backgrounds and knowledge. This necessitates a shift in the types of knowledge that are viewed as legitimate for decision making in governance processes (van Buuren, 2009). Traditionally, academically-trained scientists employed by the government, and the technical, scientific information they generated, were considered authoritative in solving issues of environmental concern (Bryant & Wilson, 1998). The focus of environmental governance was to understand human-environment interaction in terms of western positivist science, with emphasis on the procedures of natural science, the acquisition of quantitative data, statistical and modelling techniques and methodological analysis of the cause of issues and projected future trends (Bryant & Wilson, 1998). Edelenbos *et al*. (2004) have suggested, however, that local citizens and social groups are now less inclined to automatically accept academic research results and scientific lines of argument because of their own increased levels of education and the "democratisation" of knowledge. Along with the shift from top-down governance to collaborative governance that has been prompted by these changing social conditions, scientific and professional knowledge contributors have lost their monopoly on the supply of knowledge, and their perspective of environmental governance is no longer considered sufficient for dealing with complex environmental issues (Edelenbos *et al*., 2004; Lejano & Ingram, 2009). As a result, governance that once mainly involved scientists and environmental professionals (Bryant & Wilson, 1998) now depends on the involvement of a wider range of actors including those from institutions, the private sector, markets and civil society (Pahl-Wostl, *et al.*, 2007; Rogers & Hall, 2003). Because collaborative governance processes include a range of actors, there is access to a diverse range of knowledge—much more so than is the case in top-down modes of governance (Beierle & Konisky, 2001; Bryant & Wilson, 1998).

In order for collaborative forms of environmental governance to be effective, there is a need to encourage the inclusive participation of the various types of knowledge that individual actors bring into decision-making processes (Feldman *et al*., 2009; Hahn *et al*., 2006; van Buuren, 2009). In discussions regarding knowledge in collaborative environmental governance, authors such as Haller and Gerrie (2007) and Olsson *et al*. (2004) use a range of terms to describe actor knowledge. Two main categories of knowledge commonly identified in collaborative governance literature are "expert" and "local" types. "Expert" knowledge is often considered to be explicit, structured knowledge, such as professional (Edelenbos *et al.*, 2004), technocratic (Fischer, 1990), or objective facts (Pahl-Wostl *et al.*, 2007). "Local" knowledge, defined as informal knowledge, is described using terms such as tacit (Polanyi, 1997), implicit (Chomsky, 1980) or soft (Hildreth & Kimble, 2002).

Collaborative environmental governance is not simply an expert, scientific search for an optimal solution to issues. Instead, given the diverse range of government and non-government parties typically involved, it is an ongoing learning and negotiation process that seeks to fully integrate the knowledge of each of these actors (Berkes, 2009; de Loë *et al*., 2009; Pahl-Wostl & Hare, 2004). The nature of expert and local knowledge is a critical concern in this thesis. Therefore, these ideas are explored in more depth in the following subsections.

2.2.1 Expert Knowledge

Within literature concerned with traditional Western democratic environmental governance, knowledge types are often defined according to the significance they are thought to have to the issue at hand. This implies a focus on measurable, explicit knowledge (Hildreth and Kimble, 2002; Nonaka, 1994), particularly on scientific knowledge. Edelenbos *et al.* (2004) consider professional knowledge to be expert knowledge. Pahl-Wostl and Hare (2004) speak of expertise

in terms of objective fact, such as information that can be cognitively expressed. In contrast, Michaels *et al*. (2007) support the perspective that expert knowledge may be viewed not as the property of a given individual, but rather as something that must be validated by the others in collaborative processes. Similarly, Limoges (1993: 418) notes that "the expert status itself is at stake in collaborative forms of governance and needs to be re-established at each new development during the process".

What types of "expert" knowledge are used in collaborative environmental governance? Olsson *et al.* (2004) describe several types that are important, including ecosystem knowledge and knowledge related to human involvement on different ecological scales and levels of authority (e.g., environmental managers and policy makers at local and national levels). These knowledge types incorporate knowledge of the environment from a variety of perspectives. They also include knowledge of the different spatial and temporal factors that lead to complexity in environmental issues (Olsson *et al*., 2004). These types of "expert" knowledge may be very important in order for collaborative decision-making processes to be accepted as legitimate by the government agencies that have the authority to adopt or reject the proposed solutions. Beyond expert knowledge types however, Innes and Booher (2010) contend that expertise plays only a small part of the governance process. Environmental resilience requires a full range of knowledge types, including often lesser-heard-of "local" types of knowledge contributions (Innes & Booher, 2010).

2.2.2 Local Knowledge

"Local" knowledge is often cited as necessary for successful collaborative governance processes (see, for example, Alaerts & Dickinson, 2009; Blaikie *et al.,* 1997; Duffield *et al.,* 1998; Failing *et al.,* 2007; Gadgil *et al.,* 2003; Kroon *et al.,* 2009; Olsson & Folke, 2001). Failing *et al.* (2007:

48) refer to local knowledge as "the full variety of insights, observations and beliefs related to a particular decision that do not stem from conventional scientific expertise." Local knowledge may also be regarded as experiential (Edelenbos *et al.,* 2004; Pahl-Wostl *et al.,* 2007), and learned through time and experience living in a particular area. Indigenous knowledge (Berkes & Folke, 1998) and traditional ecological knowledge (Fischer, 1990) often are considered distinct from local knowledge in environmental governance because of the specialized historical and contextual environmental information that these knowledge systems contain (Mitchell, 2010). Other definitions of local knowledge include geographical and contextual (Corburn, 2003), as well as common sense and thoughtful speculation (Lindblom & Cohen, 1979).

In contrast to the idea of disparate "expert" and "local" knowledge types, and reflecting the ideological shift from top-down, authoritative governance to more collaborative governance ideals, Fischer (2000) states that the term "specialized citizen" might best reflect the distinction between local knowledge contributors and expert actors, contending that the reservation of the term "expert" for those who hold scientific knowledge may be inappropriate, because scientists might be much less expert in non-scientific areas than other actors.

There are many perspectives concerning both expert and local knowledge, particularly regarding how to define the terms and what the different forms can contribute to environmental governance processes. This thesis aims to discover, through case study research, what forms of expert and local knowledge participants involved in collaborative water governance acknowledge as important for decision making.

2.3 Use of knowledge

A second challenge of collaboration is that it is necessary to understand how a broad range of knowledge types is used in collaborative governance (Beierle & Konisky, 2000; Kroon *et al*., 2009). Innes and Booher (2010) point out that dialogue among the contributors of many knowledge types is critical at all stages of governance so that decision-making outcomes will be useful for effecting change. The literature on collaborative governance strategies identifies different phases that take place during collaborative processes (e.g., Ballard *et al.*, 2008; Stringer *et al*., 2006). These phases include important steps such as combining complementary actor knowledge, skills and capacities, in order to foster the ability to design locally appropriate governance strategies; goal-setting using the contributions of both scientific knowledge and local knowledge; planning or program design through joint deliberation about what is known and what is not known about the issue at hand, allowing actors to question the assumptions made by the various disciplines and perspectives involved in the collaborative process; and ongoing monitoring and interpretation of results, engaging a wide range of information from the various knowledge types.

Although most decision-making processes do not follow such a linear path (Ansell & Gash, 2007), these phases are relatively distinct and may involve different types of knowledge (Kroon *et al*., 2009). Hillman and Brierley (2002) suggest that the types of knowledge necessary for water governance include baseline information on the current state of the river, a scientific understanding of the links between various water data parameters and ecological functions, a basis for framing decisions within the broader social, economic, political, and cultural context, and technical information with which to implement the decisions.

Knowledge contributions such as those suggested by Hillman and Brierley (2002) can be from scientific or local knowledge sources within a collaborative organization. Additionally, the components and characteristics found within a collaborative group that facilitate the inclusion of different knowledge types, and the actions that the group takes within its own organization and among its members to engage and include different knowledge types are critical concerns for effective environmental governance. These issues will be addressed in the following section.

2.4 Factors Affecting Knowledge Engagement

A third challenge is that, after several decades of shifting from top-down to collaborative processes in environmental governance, questions remain concerning the relationship between collaborative processes and the many types of knowledge that are involved (Koehler & Koontz, 2008; Savan *et al*., 2004). A weakness perceived in the concept of collaboration is that, with a wide range of actors and knowledge types, cooperation within decision-making processes can be difficult (Berkes, 2009). Because knowledge contributors come from different contexts and have different understandings of the issues, it has been observed that there will be miscommunication, controversy and conflict (Koppenjan & Klijn, 2004; Dewulf *et al.*, 2011). Accordingly, an emerging literature examining collaborative methods of governance reveals that attention to individual actor knowledge and the interaction of the various actors' knowledge throughout decision-making processes can lead to positive environmental outcomes (Lejano & Ingram, 2009).

For example, studies of Ecomuseum Kristianstads Vattenrike (EKV) in Sweden show how an organization focused on collaboration can potentially play the critically important role of facilitation between "expert" scientific and "local" knowledge (Berkes, 2009). The case study

findings show *capacity* (see subsection 2.4.1 for definition of "capacity") in the building of moral, political, legal and financial support (Schultz *et al.*, 2009), as well as trust-building and conflict resolution, collaboration and value formation based on common fixed objectives, generation and communication of ecological knowledge (Hahn *et al*., 2006). The case study findings also reveal that EKV managers and members were able to *facilitate* (see subsection 2.4.2 for definition of "facilitation") the gathering of different types of ecological knowledge, and identify opportunities for local environmental governance (Schultz *et al.*, 2009). The study of the EKV case revealed that the elements of capacity and facilitation are necessary for communicating the necessary initiatives and components of environmental governance between government and non-government actors (Hahn *et al*., 2006). At the time of the study, Hahn *et al.* (2006) suggested that EKV had been successful in integrating individual actor knowledge into collaborative environmental decision-making processes, with resulting improvement of the human-environment relationships within its geographical area of influence.

Collaborative governance literature supports several factors that affect the relationship between knowledge and collaboration in collaborative processes. Two categories of factors will be investigated in this study: *capacity* factors that affect the gathering of knowledge types (e.g., Ansell & Gash, 2007; Berkes, 2009; Feldman *et al.*, 2009; Margerum & Whitall, 2004; Ryan & Klug, 2005), and factors that affect the *facilitation* of interaction between knowledge types (e.g., Berkes, 2009, Blackstock & Richards, 2007; Kroon *et al.*, 2009). Literature reveals that capacity is necessary in gathering a full representation of relevant knowledge types together and that facilitation is necessary for encouraging interaction between knowledge types in collaborative governance processes. The sub-sections below outline variables that affect the inclusion of knowledge in collaborative governance processes.

2.4.1 Capacity

Decades ago, Gargan (1981) recognized that the capacity of local organizations to do what is necessary to fulfil their roles was a critical concern, and that local capacity results from the interaction of community expectations, community resources, and community problems. A more recent study by Ivey *et al.* (2006) reveals similar conclusions concerning the concept of capacity. From these definitions, conclusions about the meaning of capacity have been drawn with regard to the collaborative water governance context of this study. In this study, the concept of capacity is determined to be the components and characteristics found within a collaborative group that facilitate the inclusion of different knowledge types.

Funding sources have been shown to play an influential role in the activities and goals of collaborative groups (Hardy, 2010). Notably, local organizations often have only small amounts of funding that must be spread over long timeframes (Ryan & Klug, 2005). Collaborative decision-making processes take time due to the necessity of deliberation, and the wide range of actors involved whose contributions must be fairly considered. Efficiency in the process is also important as many members of community environmental groups are volunteers, and have other jobs and commitments to attend to besides the environmental group's activities and meetings. Reducing the amount of time that activities take—in order to maintain actor involvement—introduces the question of whether or not efficiency limits the opportunity for communication between the knowledge contributors needed to solve environmental issues (Margerum & Whitall, 2004). In addition, Koehler and Koontz (2008) attest that the location of the group plays an important role in participation. Rural locations with stable populations are thought to be more conducive to community building and social capital, whereas urban areas experience challenges due to transient populations with diverse sets of perspectives (Koehler & Koontz, 2008).

A further concern is that the inclusion of a broad representation of participants in decision-making processes can generate ambiguity in roles and tensions within the collaboration, which may lead to weak governance (Blackstock & Richards, 2007). To illustrate, an important consideration is how authority is granted to non-government actors in the collaboration and how the individual knowledge of an actor is viewed by the other actors (Pahl-Wostl & Hare, 2004). In terms of role-definition, Ansell and Gash (2007) also argue that leadership is a critical factor that contributes to the success of collaboration. Leadership is influential in bringing actors together in deliberative problem solving (Pahl-Wostl & Hare, 2004), and in encouraging open debate among the multiple perspectives and knowledge types involved in the deliberation (Hahn *et al*., 2006).

These factors of capacity may affect the ability of collaborative governance actors to access relevant knowledge necessary for decision making. The issue of the capacity of collaborative organizations to bring together the diverse range of actors necessary for environmental governance highlights a subsequent need for facilitative processes that are effective in engaging multiple knowledge types.

2.4.2 Facilitation

Within a number of branches of collaborative governance literature, facilitating knowledge inclusion is recognized as an important concern (see, for example, Armitage *et al.*, 2007; Berkes, 2009). In this thesis, facilitation is considered to be the actions that the group takes within its own organization and among its members to engage and include different knowledge types. Raymond *et al*. (2010) suggest that knowledge integration must support deliberation among knowledge contributors. As discussed in Section 2.1, deliberation takes time, but is beneficial because it challenges non-government and government actors to think collaboratively and to act in new ways in order to ultimately influence change (Beierle & Konisky, 2001). More

pragmatically, the trend from top-down to more collaborative forms of environmental governance necessitates the use of local knowledge alongside science-based, expert knowledge (Koehler & Koontz, 2008). Integrating these knowledge types in collaborative processes is, however, not accomplished without challenges (Kroon *et al*., 2009).

Numerous issues arise in the literature concerning the inclusion of different knowledge types in collaborative governance processes, as mentioned in Section 2.1. Primarily, there is a need to understand what types of knowledge are important in environmental governance (Blackstock & Richards, 2007; Feldman *et al*., 2006; Sheikheldin *et al*., 2010). Research has shown that beneficial contributions to the identification and solution of environmental issues can be achieved by successfully combining both expert and local knowledge in decision making (Edelenbos *et al*., 2004). Despite the benefits of collaboration, expert knowledge, based on training and professionalism, and local knowledge, based on personal experience of the environment or of the context-specific case in question, are often at odds in environmental decision-making processes (Fischer, 1990). An important challenge is in connecting diverse understandings (Dewulf *et al.*, 2011; van Buuren, 2009). As noted in a recent study by Dewulf *et al.* (2011: 53) "confusion, misunderstanding, disagreement or even intractable controversy are likely when participants frame the issues in divergent ways". In addition, Cash *et al.* (2003) note that scientific information may be effective in collaborative governance decision making only to the extent that the relevant stakeholders perceive the information as credible and salient. Actors need to be able to consider all of the different types of knowledge being used in the process, and must make decisions about the validity and trustworthiness of each type (Blackstock & Richards, 2007). Different actors bring knowledge gathered from different cultures, communities, backgrounds and scales of environmental understanding (Berkes, 2009). For example, local

citizens can provide important information about local natural and socio-political systems (Koehler & Koontz, 2008), while trained professionals can offer a broader perspective based on disciplinary tools and methods (Corburn, 2003).

There are many considerations when integrating both "expert" and "local" knowledge types in collaborative processes. The literature presented thus far reveals three important challenges, and provides some detail regarding each set of concerns. In the following section the three challenges are outlined, along with the critical components of each, in the form of a table.

2.5 Research Framework

The three main challenges of collaborative governance explored in this chapter provided a focus for the research and allowed for the identification of three related research questions. The challenges, questions, and working assumptions derived from the literature are presented in the form of a research framework (Table 1). Insights and assumptions emerging from the literature review, presented in the third column of Table 1, provided the basis for investigation of knowledge, the use of knowledge and the factors that facilitated the use of knowledge in collaborative water governance in New Brunswick, Canada. The framework guided data collection (Chapter Three) and provided the basis for the analysis of results (Chapter Five).

Table 1: Research Framework

Research Challenge	Research Question	Insights and Assumptions Derived from the Literature	
Types of knowledge - there is a need to understand what types of knowledge are important to collaborative governance (Blackstock & Richards, 2007; Feldman *et al*., 2006; Sheikheldin *et al*., 2010).	1. What types of actor knowledge are used in collaborative environmental governance?	<u>Expert knowledge</u> was suggested to be explicit, hard, formal, information, easily articulated and measurable, characterized as: • Professional (Edelenbos *et al.*, 2004), • Technocratic (Fischer, 1990), • Objective fact (Pahl-Wostl *et al.*, 2007), • Ecological (Olsson *et al.*, 2004).	
		<u>Local knowledge</u> was suggested to be tacit, implicit and soft, characterized as: • Geographical and contextual (Corburn, 2003), • Historical (Fischer, 1990) • Experiential (Edelenbos *et al.*, 2004; Pahl-Wostl *et al.*, 2007), • Practical (Failing *et al.*, 2007), • Common sense and thoughtful speculation (Lindblom & Cohen, 1979).	
Use of knowledge - it is important to understand how these knowledge types are used in collaborative governance (Beierle & Konisky, 2000; Kroon *et al.*, 2009).	2. How is the knowledge used?	Stages	• Set goals, plan and monitor (Stringer *et al.*, 2006), • Gather knowledge contributors, collect data, design programs and interpret results (Ballard *et al.*, 2008).
		Necessary knowledge	• Baseline information on current state of the river, • Scientific understanding of linkages between water data parameters and ecological function, • Basis for framing decisions within the broad social, economic, political and cultural context, • Technical information for decision implementation (Hillman & Brierley, 2002).
Engagement of knowledge – in the facilitation of collaborative governance, it is necessary to encourage recognition of the plurality of normative interpretations of	3. What factors determine how the knowledge is engaged in collaborative environmental	Capacity	<u>Location</u> Rural locations with stable populations are thought to be more conducive to community building and social capital, whereas urban areas experience challenges due to transient populations with diverse sets of perspectives (Koehler & Koontz, 2008).

Research Challenge	Research Question	Insights and Assumptions Derived from the Literature	
issues, and to maintain an ability to coordinate multiple types of actor knowledge (van Buuren, 2009).	governance processes?		<u>Funding</u> Inadequate financial resources can be a barrier to the inclusion of multiple knowledge types in the collaborative process (Ryan & Klug, 2005).
			<u>Time</u> Specific timelines, meeting lengths and frequency of meetings can constrain the collaboration of multiple knowledge types in the collaborative process (Margerum & Whitall, 2004).
			<u>Roles and Leadership</u> Abroad representation of participants in decision-making processes can generate ambiguity in roles and tensions within the collaborative, which may lead to weak governance (Blackstock & Richards, 2007). A leader who is dedicated to the collaborative process may be beneficial to collaborative governance efforts (Ansell & Gash, 2007; Feldman *et al.*, 2009; Hahn *et al.*, 2006; Olsson *et al.*, 2004).
		Facilitation	<u>Representation</u> A broad range of knowledge types is beneficial for environmental governance (Berkes, 2009; Feldman *et al.*, 2009; Hahn *et al.*, 2006; Kroon *et al.*, 2009; Olsson *et al.*, 2004; Pahl-Wostl & Hare, 2004; Plummer, 2009; Schultz *et al.*, 2009).
			<u>Deliberation</u> Opportunities for deliberation between scientific and other actors are important to include at each stage of the collaborative process (Berkes, 2009; Blackstock & Richards, 2007).
			<u>Legitimacy and Value</u> There may be scepticism among some actors concerning the legitimacy and value of the different types of knowledge (Armitage *et al*. 2007; Lejano & Ingram, 2009).

2.6 Summary

The knowledge needed to deal with complex environmental problems is dispersed among local, regional and national agencies and groups and individuals (e.g., Armitage *et al.,* 2007; de Loë *et al.,* 2009; Dryzek, 2005). This diverse knowledge can grow through collaboration in environmental decision making (Singleton, 2002). However, despite several decades of experience in collaborative governance globally, it remains unclear how the knowledge of the many actors involved should be used or included in decision-making processes. Knowledge inclusion in decision-making processes has been shown to be one of the important, and most basic, factors that determine the effectiveness of governance (e.g., Blackler, 1995; Feldman *et al*., 2006; Nonaka, 1994). Highlighting the knowledge diversity in collaborative governance processes sheds light on the various challenges facing the achievement of knowledge inclusion in collaborative decision making (van Buuren, 2009). If effective collaborative environmental governance is to proceed in Canadian communities, fundamental questions must be addressed. These questions concern who is involved in the deliberative processes, how individual actor knowledge is used in environmental decision making and what factors of the governance processes foster desired collaborative outcomes.

CHAPTER THREE:

METHODOLOGY

The purpose of this research is to investigate knowledge as a component of collaborative water governance. Collaborative forms of environmental governance are increasingly common (Ansell & Gash, 2007). It has become clear that there is a great need to understand what types of knowledge are important in this form of environmental governance (Blackstock & Richards, 2007; Feldman *et al.*, 2006; Sheikheldin *et al.*, 2010) and how these types of knowledge can best be engaged and used in governance processes (Beierle & Konisky, 2000; Kroon *et al.*, 2009). The literature suggests that both "local" and "expert" knowledge are needed for environmental governance (Chapter Two). Additionally, the literature suggests a range of factors that influence how knowledge is engaged, and identifies different ways in which knowledge can be used in collaborative processes. This study investigates knowledge and the inclusion of knowledge in the governance processes of five collaborative watershed groups in the province of New Brunswick, Canada. Chapter Three discusses the methodology employed in carrying out this study.

3.1 Research Approach

A multiple case study research design is used. The multiple case study design used in this study follows a replication approach (Yin, 2003). Using replication logic, a theoretical research framework is constructed first in order to collect evidence from each individual case. The research framework used in this study is outlined in Section 2.5. The framework was constructed around three collaborative governance challenges from which emerged three main research questions. The literature review provided information regarding each research question; this information provided the basis for the specific questions that were posed during the collection

and analysis of the data from each of the five cases in the study (see Appendixes B and C). Following replication logic, after construction of the research framework, data were collected from individual case studies and the conclusions of each case were considered as information to be replicated by the data of the other cases.

According to Gerring and McDermott (2007: 688), "The case study is a form of analysis in which one or a few units are studied intensively with an aim to elucidate features of a broader class of—presumably similar but not identical—units". By providing the opportunity for comparison between units of analysis and a range of variables, the multiple-case study method allows a depth of analysis that a single case study might lack, as well as the preservation of the specific, unique details of each case (Yin, 2003; Gerring, 2007). Another valuable aspect of multiple case study is avoiding ambiguous findings, that may be statistically meaningful but not applicable to individual cases, thus increasing the transferability of the findings to other research studies (Guba & Lincoln, 1994).

Yin (2003) also observes that case study research is preferred over other methods of research when there are questions about a contemporary set of issues over which the researcher has little or no control. The intent of the research in New Brunswick (NB) was to identify the types of knowledge used and the variables in the relationship between knowledge and collaborative governance processes among five collaborative watershed groups in the province. Thus this study could be considered an instrumental case study which, according to Stake (1995), is one which aims to gain a general understanding of something and uses one or more cases to get insight into the research question.

3.2 Case Study Selection

Collaborative environmental governance in NB offers an opportunity for case study research that can give insight into how multiple types of actor knowledge are included in collaborative governance processes for water resource protection. As mentioned above, this study follows Yin's (2003) logic of replication wherein each case is selected in order to predict similar or contrasting results, through comparison among cases. Emphasis is placed on rigour in selecting cases, thus specific case study groups in NB were carefully chosen using the six key criteria outlined below.

The first criterion was that the organizations selected be focused on water resources at the scale of a watershed or drainage basin. Singleton (2002) notes that approaching environmental problems from a watershed scale, rather than from the perspective of a single resource or from within the delineations of a political jurisdiction, is desirable due to the presumed familiarity that members of the watershed community have with each other and with the local environment. Thus the watershed scale was considered an appropriate focus to gain an understanding of collaborative governance (see definition of collaboration in Chapter Two). A list of environmental groups and organizations was obtained from the NB Department of Environment's Provincial and Community Planning Section. Application of this criterion narrowed the list of suitable case study groups in New Brunswick from approximately 180 environmental organizations to 30 watershed organizations.

Second, organizations had to be involved in the NB Water Classification Program—either through having completed, or currently being engaged in, a water classification. For this study, the Water Classification Program was considered to be a tool for source water protection (subsection 4.2.2). As outlined in Chapter 1, source water protection is an important concern of

the study, and the inclusion of this second criterion permitted narrowing the focus to groups with an overt interest in this aspect of water governance. Through this criterion the list of potential cases was reduced to 19 organizations.

Third, the organizations had to have been in existence for more than one year, and actively functioning at the time of this research project, in order to be included in the study. They also had to have a coordinator and a board. This criterion helped to ensure comparability among the organizations in terms of administrative capacity. All 19 groups identified in the second criterion were retained following application of this criterion.

At this point in determining a set of watershed groups to include in the study it was necessary to be mindful of the geographical location of the possible groups. To ensure that experiences with collaborative environmental governance reflected a range of NB experiences, a mix of more urban versus more rural watershed groups was sought. As noted in subsection 2.4.1, watershed organizations in rural areas face different challenges than those in urban areas. NB is predominantly a rural province with several distinct urban centres. Thus, a fourth selection criterion was used to permit distinguishing between urban and rural experiences. "Urban" cases included geographical areas that contained at least one urban centre. "Urban centre" was defined in this study as a city with more than five thousand residents. Natural Resources Canada's 2006 Population Density statistics showed 11 NB communities that met the population requirements of an "urban centre". Five collaborative watershed groups were based in a geographic area containing an urban centre. Fourteen groups were located in predominantly rural areas. Thus, both rural and urban experiences were represented among the 19 organizations identified through application of the first three criteria.

A fifth selection criterion was included that also related to geographical location. An Ontario study of the capacity of local organizations undertaking activities to protect groundwater resources (Ivey *et al.*, 2002) revealed that the size of the watershed can be an important consideration that affects environmental governance outcomes. In NB, watershed groups work at a variety of watershed levels, and it was determined that a selection of both large and small watersheds should be considered. For this study, a "large" watershed was defined as an area of over 1000 km^2, while a "small" watershed had an area less than 1000 km^2. Both small and large watershed areas were represented among the 19 organizations identified through application of the first three criteria.

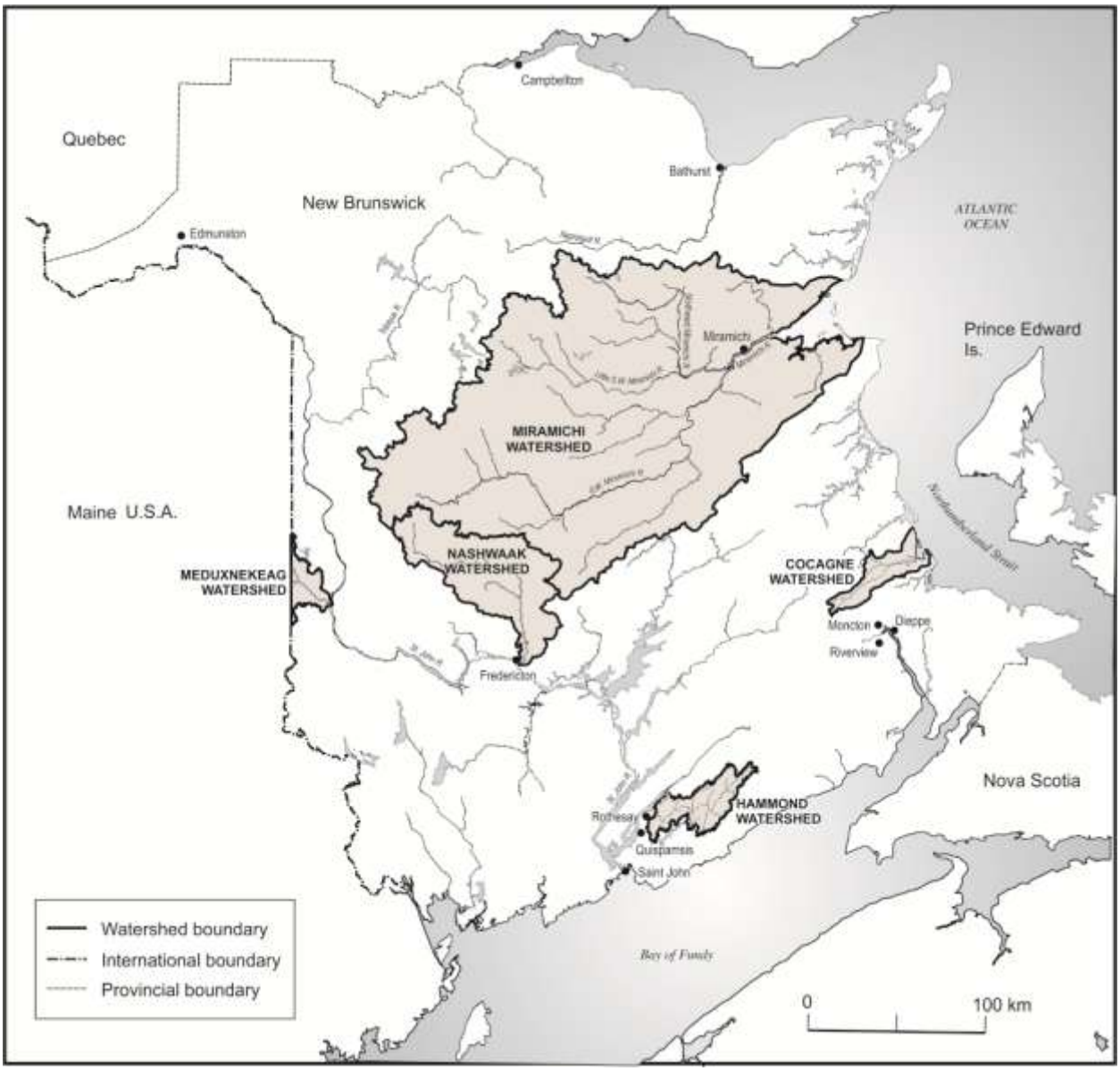
The sixth criterion related to two practical considerations: accessibility to the researcher and the ability of the group to participate in the study. This criterion was tested through an initial scoping visit to NB. Regarding accessibility to the researcher, access to information about the group on the internet was considered to be necessary. Groups were not considered for the project if there was no website for the organization available online. At the same time, groups were not considered for the project if the website and associated online documents were written entirely in French. Three groups were found to have no website and four groups were found to be predominantly French-speaking, thus removing them from the final list of potential groups. The ability of the group to participate in the study was also considered important in the context of the sixth criterion (practical considerations). Some of the groups were found to have a very small membership, and members were too busy or otherwise unavailable for contact. Also, the researcher decided, after initial contact, to avoid including groups that were in the midst of a significant reorganization. One group could not be contacted, and two groups had circumstances unfavourable to taking part in this study, thus removing them from the final list of potential

groups. The final criterion determined that five case study groups would be appropriate and able to be part of the study project. The five groups selected are listed in Table 2 and shown on the map in Figure 1. The groups are characterized in further detail in Chapter Four.

Table 2: Case Study Features

Case Study Group	Location	Small or large area	Watershed area	Rural or Urban	Urban Centre (population)
Groupe de Developpement Durable du Pays de Cocagne	East—Atlantic coast	Small	400 km^2	Rural	n/a
Hammond River Angling Association	South— inland	Small	433 km^2	Urban	Quispamsis (15,239), Rothesay (11,637)
Meduxnekeag River Association	West—Maine border	Small	400 km^2	Rural	n/a
Miramichi River Environmental Assessment Committee	North—inland and Atlantic coast	Large	13,465 km^2	Urban	Metropolitan Miramichi (18,129)
Nashwaak Watershed Association Inc.	Central—inland	Large	1700 km^2	Urban	Fredericton (50,535)

Figure 1: Case Study Locations in the Province of New Brunswick



3.3 Data Collection

Triangulation is recommended as an effective way to verify qualitative data through the convergence of information from multiple sources (Richards, 2006; Stake, 1995). Three data sources were used in the study: key informant interviews, documents, and personal observations.

Key informant interviews provided detailed and specific understanding of the knowledge and people involved in collaborative watershed governance in NB. Document review provided initial contextual information at the outset of the study, verified information given by the participants, and furthered the contextual understanding of knowledge in collaborative governance after the interviews were completed. Further empirical evidence was gathered through personal observations throughout the project. Richards (2006) points out the importance of careful planning before the project to ensure that the triangulation is useful. The framework presented in Chapter Two guided the collection of all sources of data for this project (see also Section 3.4).

3.3.1 Key Informant Interviews

Interviews, if completed sensitively and thoughtfully, can be very useful for gathering information for detailed review within the parameters of the study (Richards, 2006). Interviews were used as a primary source of data for this study. In total 28 people were interviewed. Six of the interviewees participated in a second interview, and nine of the interviews included more than one interviewee.

A purposeful sampling strategy was used to select interviewees. Participants were recruited based on their knowledge of and/or involvement in collaborative environmental governance processes. One of the watershed group members acted as the initial contact between the researcher and the study participants. This was in line with recommendations in qualitative research literature concerning gatekeepers. Gatekeepers are key informants who can either provide access to field data or close the gate of access for the researcher (Patton & Appelbaum, 2003). The assistance of the gatekeeper proved to be invaluable to this study as doors were opened and access to members of other groups was facilitated.

Permission to pursue this study was granted by the Office of Research Ethics at the University of Waterloo. A formal recruitment letter was sent out to the potential participants identified by the NB contact person. This recruitment letter included information detailing the research purpose of the project and the rights of the participants. Prior to each interview, a consent form was filled in by the participants, indicating approval of audio-recording during the interview, and the manner in which their statements could be cited should their insights be used in the final report. Following each interview, the audio-recording was transcribed verbatim. Transcripts were sent to each interviewee for review, or "member checking". Member checking is a method of data verification. In this process, participants are asked to review and respond to the researcher's transcription of information that was provided during interviews (Stake, 1995). In this project, completed interview transcripts were sent to participants prior to data analysis, and participants were asked to review the transcriptions and to provide feedback. While many of the participants were pleased with the transcription, several gave additional comments to clarify what they had said in the interview. This feedback was treated as additional data, as recommended by Richards (2006).

The interview process for the study took place in three separate trips to NB during the course of five months in the summer and fall of 2010. The purpose of the first trip, from July 12-19, 2010, was to learn about the watershed groups in the province, to determine the meaning of "collaboration" in NB water resource protection, and to gather data needed to apply the fifth criterion (above). Ten interviews were conducted during this trip. Six of the interviews were individual, three of the interviews involved two interviewees, and one of the interviews involved four participants. In total, 16 participants were interviewed during the initial visit to NB.

The purpose of the second trip to NB, from September 28 to October 5, 2010, was to interview members of the selected case study watershed groups (see selection process outlined in Section 3.2). In total, five interview sessions took place during this trip. Three involved one interviewee, while two involved two interviewees. In total, seven people were interviewed during the second visit to NB, with two of the participants having participated in previous interviews.

The purpose of the third trip, from October 31 to November 5, 2010, was to continue to interview members of case study watershed groups. Seven interviews were conducted during this trip. Four of the interviews were individual (two of these were phone interviews), two of the interviews involved two interviewees, and one of the interviews involved three interviewees. In total, 11 participants were interviewed during the final visit to NB, with four of the participants being interviewed a second time. Table 3 provides an overview of the involvement of the key informants. Appendix A provides a more detailed background description of the key informants.

Table 3: Involvement of Key Informants

Key Informants	**Case study groups[1]**					**Other[2]**
	GDDPC	**HRAA**	**MRA**	**MREAC**	**NWAI**	
Watershed group staff	1	3	2	3		3
Watershed group board	3		1	2	4	
Government						4
Academic						1
Environmental Institution						1

[1]See Chapter Four for full names of the case study groups as well as background information.

[2] Key informant was not directly involved with any of the five case study watershed groups, but was familiar with collaborative water governance in New Brunswick and/or the watershed group experience.

Interviewees often had multiple affiliations. However, Table 3 characterizes participants in the capacity of their role within one of the case study watershed groups or outside of the case study watershed groups. The other affiliations were occasionally discussed during the interviews but the interviewees strove to speak from their experience as indicated in the table. An example, to illustrate the complexity around affiliation, is a participant from one of the case study groups. The participant was employed by an environmental institution involved with salmon restoration, he was on multiple collaborative environmental group boards and was a past government employee. This individual, however, participated in the study as a board member of one of the case study groups and is characterized in Table 3 in his capacity as such.

Interviews ranged in length from 30 minutes to two hours, with most lasting about one hour. During the first trip, interviews were open-ended, and followed a semi-structured format. Questioning followed a defined path set by the interview guide, but participants were able to answer questions as they saw fit. Interviews conducted during the initial scoping trip were directed at determining participants' perceptions of "collaboration" in general, and the realities of water resource protection in the context of the NB Water Classification Program. During the second trip, an interview guide aligned with the research framework presented in Chapter Two was used (see Appendix B). The third trip used a revised, but fundamentally similar, interview guide. The interview guides, structured according to the research framework presented in Chapter Two, were designed to explore the second research objective of the project (see Section 1.2).

3.3.2 Document Review

Documents associated with water governance in New Brunswick were a second critical data source. Review of these documents allowed for cross-checking and verification of information

obtained from key informant interviews, and provided supplementary information not available through interviews. The literature review findings and research framework outlined in Section 2.5 provided the basis for document data collection guides that were designed to explore the second research objective of the project (see Appendix C). The document data collection guides sought to answer the questions posed by the research objectives, outlined in Section 3.4 below, in the same manner as the interview guides. Questions were intended to identify the existing knowledge types within the groups and the manner in which each type of knowledge was engaged and used in group activities. Thirty documents were reviewed that are not directly cited throughout this thesis document (see Appendix D). They include government documents, non-government reports, newsletters, meeting minutes, annual reports and press releases. Many of the documents were found online, while others were obtained from interviewees during the data collection period, or shared later through email. Other documents associated with New Brunswick water governance that are cited in this thesis are listed in the list of references.

3.3.3 Personal Observations

Personal observations were also made during the data collection period in NB. These observations were recorded in notebooks and emails and through digital photographs. During the first trip, from July 12-19, 2010, observations regarding environmental governance in NB were documented during the interviews, during a presentation by four NB Department of Environment employees in which the Water Classification Program was outlined, and during a renewable energy tour with members of Miramichi River Environmental Assessment Committee. A stop at the Salmon Museum in Doaktown, NB, reinforced the importance of salmon to the people of the province. Similarly, a car trip into the crown lands of NB's northern interior revealed the importance of forestry for the province's economy.

The second trip, from September 28-October 5, 2010, included attendance at the 2010 Atlantic Riparian Forum in Moncton, NB, during which several key observations were noted. A tour of several salmon monitoring projects and a hike along a Nashwaak River tributary with a member of one of the case study groups was an opportunity for verification of the governance of, and interest in salmon in NB.

During the third trip, from October 31-November 5, 2010, a personal tour of the Miramichi Salmon Association operation and grounds in Miramichi, NB, permitted observation of some of the activities in which watershed group members are engaged. Attendance at a monthly meeting of one of the watershed groups provided an opportunity to present this research project to members and to answer questions. Collectively, all of these experiences were instrumental in increasing understanding of the context in which the research took place.

3.4 Data Analysis

The types of knowledge used, and the relationships between actor knowledge and collaborative processes, were analyzed. Following the multiple-case study replication method recommended by Yin (2003), which suggests the importance of using a theoretical basis to guide data collection, a research framework was created (see Section 2.5). To reiterate, the three key research questions which guided the study were as follows:

1. What types of knowledge do individuals engaged in collaborative water governance in New Brunswick consider important for collaborative governance of water resources?
2. How are different types of knowledge used in governance processes of collaborative governance of water resources in New Brunswick?

3. What factors affect the inclusion of knowledge in collaborative water governance processes in New Brunswick?

In addition to relaying the importance of a theoretical framework, Yin's (2003) replication method emphasizes the importance of feedback loops throughout the study; "the loop represents the situation in which important discovery occurs during the conduct of one of the individual case studies [...] A second feedback loop could represent the situation in which the discovery led to reconsidering one or more of the study's original theoretical propositions" (Yin, 2003: 50). Thus, where appropriate, the research framework guided the analysis but insights were also drawn from the data themselves.

The analysis of interview transcripts, documents and personal observations was completed using a directed content analysis method. Directed content analysis is a method of data analysis in which a pre-existing coding framework is developed, with enough flexibility to allow for new themes to emerge as the data are coded, fitting well with Yin's replication approach. According to Hsieh and Shannon (2005: 1281), "the goal of a directed approach to content analysis is to validate or extend conceptually a theoretical framework or theory". In a directed content analysis, passages are highlighted and coded into pre-existing categories determined by the research framework. In the event that a number of similar instances emerge that cannot be categorized according to the pre-existing codes, the researcher will determine if a new category, or sub-category to an existing code, should be established. Directed content analysis allowed for the use of the research questions in the data analysis and also permitted additional themes to emerge from the data.

NVivo 8 software was used to complete an organized and comprehensive coding process in which the codes associated with each research question were checked for accuracy. All of the

data in this study were first deductively coded according to the research framework presented in Section 2.5, focusing on the three key research questions that came out of the review. Three main "parent" nodes were identified as 1) *knowledge*, 2) *use of knowledge* and 3) *factors effecting engagement of knowledge*. The parent nodes linked directly to research questions 1, 2 and 3 respectively. "Child" nodes were created within each parent node establishing categories for the various points that were expected to emerge in the data, following the issues that had come up in the literature review (see third column in Table 1). When a portion of data was found relevant to one of the parent or child nodes, it was highlighted and coded accordingly. Following this deductive coding process, and in light of the feedback loops suggested according to Yin's replication logic, the data coded within each category were analyzed and unexpected themes were revealed if present. In other words, data were highlighted that were not expected based on the research framework, but which emerged inductively from the data. In instances in which a significant amount of data followed an inductively recognized theme, the data were coded in a new category. The new category was inserted retroactively into the research framework and academic literature was reviewed in order to provide theoretical information about the emergent issue.

The process of data analysis followed several steps, in the method of "pattern-matching". "The pattern-matching technique is way of relating the data to the [theoretical] propositions" (Yin, 2003: 27). Using this technique, the collected data for each case were compared to the theoretical propositions set forth in the research framework. The patterns among cases were then compared in order to reveal results about the larger phenomena under study.

The first step of this method was to organize the data into tables. This step was completed three times, allowing for an analysis of the data to be completed from three distinct

perspectives—individual cases, rural vs. urban and small watersheds vs. large watersheds. The importance of analyzing the data according to the two particular sets of cross-case analysis was determined through the literature review and further emphasized in the case selection criteria (Section 3.2). The rural vs. urban analysis was considered interesting to analyze due to research by Koehler and Koontz (2008) that reveals that rural locations may be more conducive to collaborations, whereas urban areas experience challenges resulting from larger populations with diverse sets of perspectives (also see discussion in Chapter Two, subsection 2.4.1). Small area vs. large area was considered to be another important analysis due to research which revealed that the size of the watershed can be a factor that affects environmental management outcomes (Ivey *et al.*, 2002).

The first set of tables presented the data on a case-by-case basis. This formulation revealed the specific features of each individual case study watershed group. The second set of tables charted the data evidence by rural watershed groups and urban watershed groups. Watershed groups were classified as "urban" or "rural" based on whether or not there was an urban centre within the watershed (see Table 2). The third set of tables documented the data according to the size of watershed, allowing for a comparison of case study groups with a large area of land versus case study groups governing a smaller area of land. Watersheds were classified as "small" versus "large" based on their geographical size (see Table 2). Analyzing the data in this fashion permitted determining the extent to which findings were associated with specific case studies, with "rural" or "urban" cases, and with "small" or "large" cases.

With the data organized into the tables described above, the next step in the analysis involved comparison, searching for similarities and differences, and patterns and trends. Commonalities were highlighted between rural case study groups (GDDPC, MRA), between the

urban ones (HRAA, MREAC, NWAI), between the cases covering a large area (MREAC, NWAI) and between the cases covering a small area (GDDPC, HRAA, MRA). Several differences were revealed between cases, between rural and urban cases and between small area and large area cases. The details of these results are highlighted throughout Chapter Five. For the most part, however, the results proved to be relatively similar across all five cases. Hence, there were few instances where results could be distinguished clearly based on rural versus urban and large versus small case studies. It is for this reason that the results documented in Chapter Five are largely aggregate responses, except where key differences were revealed in the data.

CHAPTER FOUR:

CASE STUDY CONTEXT

This chapter provides descriptive contextual information regarding the location of the multiple case study. It is not intended to be an evaluative analysis of the context or of the five case study watershed groups. Two major elements are discussed: 1) the environmental, economic and social context of New Brunswick; and 2) the governance context, including the provincial legislative and policy context, an overview of the Water Classification Regulation, a brief outline of collaborative water governance in the province and details of the five case study watershed groups. Familiarity with place-specific information is crucial for gaining a broad understanding of the province, and is necessary for conducting an analysis of knowledge types involved in collaborative New Brunswick water governance. Each contextual element is described in detail.

4.1 Social, Environmental and Economic Context

4.1.1 Social Context

The province of New Brunswick (NB) is the only officially bilingual Canadian province, with approximately 33% of the population French-speaking (GNB 2011a). Most of the French-speaking citizens, people of Acadian descent, live on the coast and in the north of the province. Despite the fact that the focus of the project was on organizations that functioned primarily in English, this study includes groups in English, French and mixed linguistic communities. The total population of the province in 2010 was 751,755 citizens (GNB 2011f). Half of the citizens live in urban areas, areas which are concentrated along the coastline and rivers in the province, and mainly in the southern portion of the province. Saint John, Moncton and Fredericton, in the southern half of the province, are the largest cities. The northern parts of the province are largely

rural or unpopulated. The province is divided into 15 counties. The five case study watershed groups are in the counties of York, with the 2nd largest population density of the 15 counties, Kings, with the 5th densest population, Northumberland, with the 6th densest population, Kent, with the 9th densest population, and Carleton, with the second to last densest population (GNB 2011f).

4.1.2 Environmental and Economic Context

New Brunswick is largely a resource-based economy. The landscape is sparsely populated in the interior northern part of the province with approximately 50 percent of the province being Crown and Public Land (Prospectors & Developers Association of Canada 2011). Forests take up 85 percent of the land mass, and wood and wood products are a cornerstone of the economy (New Brunswick Forest Products Association 2011). The watershed of one case study group is largely forested, a matter which was evidenced in study data pertaining to the group. While forests take up a large percentage of the province, another major resource of the NB economy is farming.

Agriculture is concentrated in three main areas: the neighbouring counties of Carleton and Victoria, Kings county, and along the coast (GNB 2011b). This study includes a watershed group in both Carleton and Kings counties, as well as Kent county. While data from the case in Kings county revealed the influence of farming in the collaborative governance efforts of the group, data from the Carleton county watershed group did not clearly suggest an influence, and data from the Kent county case study group on the eastern coast of the province revealed a declining agriculture industry. The long coastline of NB, however, provides aquaculture and shipping opportunities.

Fishing is an important industry in NB, with more than 50 varieties of fish and shellfish caught for market (GNB 2011e). Citizens pursue sport fishing as a pastime on the countless

rivers and streams that crisscross the province. The combined GDP of agriculture, forestry, fishing and hunting in NB fell from $725,600,000 in 2003 to $644,200,000 in 2007 (GNB 2011c).

Mining has become a very important industry in the past decade. The GDP of mining in the province rose from $211,400,000 in 2003 to $905,500,000 in 2007 (GNB 2011c). The people of NB mine silver, bismuth, cadmium, coal, copper, natural gas, gold, oil, lead, potash, peat, tungsten, silica, salt and zinc (GNB 2011a). It is often mining operations that come into conflict with water resource governance in the province.

Three borders of the province of NB are coastlines: the Gulf of St. Lawrence and Northumberland Strait border the east of the province, and the Bay of Fundy and Passamaquoddy Bay line the south of the province. The St. John and the St. Croix Rivers are both Heritage Rivers within the Canadian Heritage Rivers System, and they form the international boundary between NB and Maine, USA, for portions of their length. The Restigouche River flows along the Quebec/NB border. There are also a number of cross border waterways, for example the St. John River, the Meduxnekeag River and the Presquille River.

The rivers of NB crisscross the province and historically provided the main means for transportation by the Maliseet, MicMac (MigMaw) and, at times, the Penobscot nations. To illustrate how thoroughly the rivers traverse the province, the Miramichi River flows through the northeast portion of the province and the St. John River crosses from northwest to southeast. There was also once an extensive portage network that facilitated transportation from large to smaller waterways on the river network, providing access to many areas of the province. The waterfalls of New Brunswick's rivers are still visited by many, whether they are found just off the main highway or at the end of a winding network of logging roads. Of additional note, the St.

John River system is 2nd largest on North America's Atlantic coastline (GNB 2011d) and three of the case study watershed groups work on its tributary watersheds.

4.2 Governance Context

The water resources of NB are controlled by the Provincial government (Living Water Policy Project 2011). Primary responsibility for water is with the Department of Environment, but departments such as the Natural Resources, Agriculture, Aquaculture and Fisheries and others are important because of responsibilities for certain crown lands and aquaculture operations.

There are several pieces of legislation that govern water resources in NB, such as the *Clean Environment Act* (1971), the *Public Health Act* (2009) and the *Clean Water Act* (1989). The *Clean Environment Act* (1971) contains the Water Quality Regulation. The *Public Health Act* contains important legislation for areas along the coast where active fisheries are located. A number of key regulations for water protection are enacted under the *Clean Water Act* (1989).

There are various regulations under the 1989 *Clean Water Act* that fit together to form a framework for SWP in the province. Under the Act, a Watershed Protected Area Designation Order outlines surface water supply protection for municipalities. A Wellfield Protected Area Designation Order provides guidelines for ground water supply protection within municipalities. A Watercourse and Wetland Alteration Regulation provides a governance tool for all surface watercourses and wetlands, in regard to specific land use activities. Lastly, until the summer of 2011 when the program was discontinued, the Water Classification Regulation outlined water quality goals on a watershed basis. The Department of Environment (DENV) administers both the *Clean Water Act* (1989) and the *Clean Environment Act* (1971).

4.2.1 New Brunswick Department of Environment

The mission statement of the DENV is to protect and enhance the environment in order to enable a sustainable future for all citizens of the province. The agency is dedicated to working cooperatively with citizens to achieve their vision of a province that values clean air, land and water and in which everyone contributes to a sustainable quality of life (NB DENV 2009). The DENV is divided into four main divisions. Collaborative water governance, according to the definition expounded in Chapter Two of this thesis, takes place within the Community Planning and Environmental Protection Division. Under this Division are five main Branches, each tasked with a slightly different focus. The Sustainable Development, Planning and Impact Evaluation Branch is subdivided into four Sections: *Provincial and Community Planning*, Drinking Water Source Protection, Environmental Assessment, and Surface Water Protection. It was under the Provincial and Community Planning Section of the Sustainable Development, Planning and Impact Evaluation Branch that the Water Classification Regulation was administered as a program among NB community groups. It was to the State of the Environment Branch—one of the five main branches—and through its Water Quality and Quantity Section that community groups engaged in the Water Classification Program sent their water data for review.

4.2.2 Water Classification Regulation

Several weeks before the publication of this thesis, the government of NB announced that the Water Classification Regulation would no longer be in effect. It is not clear as to what, if any, regulation will replace this regulation. Despite discontinuation, the Regulation is discussed here as it was an integral component of the study. The Regulation and related Water Classification Program provided the means with which to understand collaborative water governance in NB.

The Water Classification Regulation (New Brunswick Regulation 2002-13) was a regulation under the *Clean Water Act* (O.C. 2002-56) (GNB 2011g). The purpose of the Regulation was to set goals for surface water quality and to promote water governance on a watershed basis (GNB 2011g). Though it was not aimed expressly toward drinking water protection, the Regulation had the potential to be a key component of NB's SWP measures, as it worked to govern water quality. In that respect, the Regulation contributed to the protection of source waters.

The Water Classification Program placed the waters of lakes and rivers into categories based on water quality goals set according to the intended uses of the water (GNB 2002). Classification was encouraged for all water bodies within a common watershed, rather than single bodies of water (NB DENV 2002). Through the process of Classification, water quality classes and associated water quality standards were established for each river and body of water being focused on in the Classification (GNB 2011g). The Classification process could be initiated by the government or by any group or individual by sending a request to the Minister of Environment (NB DENV 2002). Nineteen watershed groups across the province have engaged in the program. The Classification process involved a number of steps: 1) request to Minister of the Environment by an initiator; 2) citizens in watershed informed through any means available; 3) water quality and land use data collected; 4) initiator proposed classifications; 5) public information sessions regarding proposed classifications advertised and hosted by classification initiator and government staff; 6) feedback from public encouraged and accepted; 7) initiator drew up Provisional Water Classification document and delivered it to Minister of Environment; 8) Minister of Environment considered the results of the consultations alongside the

recommended classifications drawn up by the initiator; 9) Minister made final decision and informed the public (NB DENV 2002).

At the time of this study, no watershed groups had moved beyond the Provisional Classification to the Regulation because the process of implementing the Regulation was stalled at the level of the Government of New Brunswick. Provisional classification documents were beneficial in establishing watershed governance goals and action plans for the groups, but data are getting old—some reaching back a full decade—and possibly becoming irrelevant. Groups are starting to take initiative in updating data, without the same funding as at the outset of the program. One case study group has taken the initiative in writing a revised watershed plan, based on the structure of the Provisional Water Classification document that they produced in collaboration with DENV a decade ago.

The vision behind the design of the Water Classification Regulation was to encourage collaboration among water managers and NB citizens and other water stakeholders. By involving stakeholders early in the process, it was hoped that there would be a better understanding about water quality among NB citizens. In addition, the program would educate citizens about the benefits for the water resource and the water resource users resulting from actions to maintain, protect, or restore the quality of the water. As described in an online document by Tims (1999):

> [Water Classification will] build stronger, more broadly based watershed management groups that will benefit from the inclusion of new ideas and other points of view long after the classification exercise is complete […] Water Classification leaves a legacy of knowledge and concrete tools such as land use maps and water quality data […] providing the group with focus and direction into the future.

At the outset of the Regulation, the Department of Environment and Local Government worked closely with watershed and community groups throughout the province to develop a watershed

focus and water classifications in their watersheds (GNB 2011g). Collaborative NB watershed groups are discussed in the subsection below.

4.2.3 Community Watershed Groups

This section first generally outlines the characteristics of watershed and environmental groups in NB, and then describes each of the five case study groups in more depth. Many of the details describing each of the case study groups were sought during the case study selection process, and are related to the selection criteria (Section 3.2).

Collaborative water governance—in the form of watershed and other environmental groups—takes place unevenly across NB. Generally, where concerned citizens have started up an organization, there is the chance for funding through programs promoted by the provincial government to complete the necessary water governance actions. In 1999 there were approximately 50 known collaborative watershed groups established in the province of New Brunswick (Tims, 1999), while in 2011 there were approximately 170 known collaborative environmental groups (personal communication with DENV representative). The community-level groups are often initiated through voluntary individual interest—such as fish or a broad environmental focus—and many of the groups are involved in water governance activities such as water monitoring and offering educational programs within NB communities. Some of the groups have been successful in securing outside funding to maintain their operation, but the reliance on voluntary contributions is still immense. Group member and staff composition is not mandated by any overarching governing body, and thus each group is unique in its makeup. This situation brings about the opportunity to study the different types of knowledge that are engaged in the collaborative governance of water resources, what the knowledge contributors are tasked to do and what factors of collaborative governance effect the involvement of different types of

knowledge. The following sub-subsections outline some basic elements of each of the five case study watershed groups selected for this study (see Figure 1 and Table 2).

Groupe de Developpement Durable du Pays de Cocagne (GDDPC)

This case was considered to be "rural" and in a small watershed, according to the criteria set out in Chapter Three. The GDDPC shares an office with two other organizations in the small village of Cocagne on the Acadian Atlantic coast in Kent County. This area is made up of small villages and summer residences, typical of the rural coastal region of the Southern Gulf of St. Lawrence (GDDPC 2011a). The group focuses on a 400 km^2 area of the county that includes the Cocagne River Watershed, the Cocagne Harbour and Bay, and several small watersheds to the north of the Cocagne River, all of which flow into the Northumberland Strait (GDDPC 2011a). The boundaries of the area are determined by the flow divide of the neighbouring watersheds of Bouctouche Bay to the north and Shediac Bay to the southeast (GDDPC 2011a).

The GDDPC was established in 2000 as a part of a sustainable community initiative. The group coordinates programs that aim for holistic sustainable development of the community and offer opportunities for citizens to take control of their environmental surroundings (GDDPC 2011b). In terms of group structure, there is an executive director, a secretary and a board of ten dedicated volunteers who meet monthly to discuss the activities and direction of the group (GDDPC 2011b).

This group is unique among the other NB watershed groups in that it acts in direct partnership with two other water-related groups—Coalition des bassins versants de Kent and Southeastern Anglers Association. The Coalition des bassins versants de Kent group compiled the water and land use data for the Cocagne Provisional Water Classification and wrote the reports for the DENV. The stakeholder engagement aspect of the Water Classification Program

was coordinated by the GDDPC. Four interviewees—one staff and three board members—took part in the study as GDDPC participants (see Appendix A for a detailed description of the key informants).

Hammond River Angling Association (HRAA)

The Hammond River Watershed is an inland watershed in the southern part of the Province. It lies just northeast of City of Saint John. The Hammond River is a tributary to the Kennebecasis River which flows into the St. John River (HRAA 2011). The watershed encompasses 433 km^2 of land used for rural and urban residences, agriculture, commerce and industry (HRAA 2011). According to the criteria for this study (see Chapter Three, Section 3.2) this case was considered to be an "urban" group within a small watershed.

The HRAA began in 1977 when a group of conservationists and anglers took an interest in the future of the Hammond River and its resources (HRAA 2008b: 2). Today the group is actively engaged in the community, with a highly visible building in Nauwigewauk and large property which is used for a large number of educational programs and community events. The group employs an executive director and one or two staff members. A Board of Directors guides the group activities. The group also maintains an active membership within the community. According to the executive director at the time of this study, the 2011 membership was approximately 300 people.

HRAA is dedicated to protecting and restoring the Hammond River Watershed and the Salmon populations that inhabit the Hammond River and its tributaries (HRAA 2011) and was one of the first watershed groups in NB to partner with the DENV in completing the Water Classification Program. The group's Provisional Water Classification document has guided the restoration, protection, education and public outreach activities of the group since that time. In

2008 the group developed a complete Hammond River Watershed Management Plan using their Provisional Water Classification document as a basis for water governance (HRAA 2011). Three interviewees took part in this study as HRAA participants (see Appendix A for a detailed description of the key informants).

Meduxnekeag River Association Inc. (MRA)

This group was considered to be a "rural" case within a small watershed, according to the study criteria. The office of the MRA is in the Town of Woodstock, near the NB-Maine border. The group serves approximately 400 km^2, or 1/3, of the Meduxnekeag River Watershed—which is the NB portion of the watershed—while the remaining upper 2/3 of the watershed lies within the State of Maine. The Meduxnekeag River is a tributary to the St. John River that originates in the State of Maine, USA. The watershed contains predominantly farms and forests, with several small remnants of Appalachian Hardwood Forest (MRA 2009). Historical industry along the Meduxnekeag River included sawmills and tanneries, while today the local economy centres around service industries, small and isolated industrial operations and residential development. Agriculture and forestry continue to expand in the area (MRA 2005).

The MRA was formed in 1995, incorporated in 1998 and received official charitable tax status in 2002 (MRA 2009). The purpose that the group has established for itself in regards to watershed governance is, generally, "to promote, encourage and assist in the protection, restoration and responsible use of the Meduxnekeag River Watershed, both flora and fauna, promote the conservation and enhancement of the fish populations that inhabit the River and its tributaries, preserve the remnant Appalachian Hardwood Forest, to work with landowners, and to promote public education and awareness" (MRA 2005: 5). The group maintains two part-time staff members, the equivalent of one paid full-time position, and is governed by a volunteer

board of approximately 15 members. The board is subdivided into committees that focus on certain activities and initiatives within the group (MRA 2005).

MRA completed a Provisional Water Classification document in 2005. The project was spearheaded by the staff members using data collected over the course of three years with the help of volunteers (MRA 2005). Three participants from MRA were interviewed for this study (see Appendix A for a detailed description of the key informants).

Miramichi River Environmental Assessment Committee (MREAC)

MREAC has an office in the City of Miramichi, and focuses on the Miramichi River Watershed. This case was considered as an "urban" group, within a large watershed, for the study. The watershed encompasses 13,465 km^2—approximately 23% of the Province's landmass—and is made up of diverse saltwater estuarine and freshwater environments. Most of the industrial and commercial activity happens in the estuarine area of the watershed. The highest percentage of the watershed's population also lives in the estuarine area. Though the watershed is very large, and mostly unpopulated, there is legitimacy in the case being considered "urban" because the population distribution results in the group's activities being concentrated in the estuarine portion of the watershed. The inland area of the watershed is predominantly forested, with the woodland being harvested for lumber, pulp or paper products. The fishery in the freshwater portion of the watershed is economically important for the province. The Miramichi River is 250 kilometres long and drains almost one quarter of the Province (MREAC 2011a).

Established in 1989 as a response to a community concern about a local pulp and paper mill expansion, MREAC became a member of the former Environment Canada-funded ACAP team in 1993. Today the group focuses on science-based research and projects that work to protect and manage the Miramichi River Watershed (MREAC 2011b). An executive director, office

administrator and one other staff member make up the core of the group. A committee of approximately 35 people directs the volunteer member and the staff activity (MREAC 2011b). This committee is called the Technical Advisory Committee (TAG) and is composed of "experts" in the area of environmental resources.

MREAC began the Water Classification process in 2008 and hoped that the process would be completed by 2018. At the time of this research project the group had completed a 1st Year Report on water quality in one portion of the Miramichi River Watershed. A Strategic Plan was created first, outlining the process that the classification project would follow. The watershed was divided into three sections for the project. The plan was for water quality and land use data to be collected for two years in each defined section of the watershed, and the final two years spent analysing the data and establishing classifications for the watercourses (MREAC 2011c). Five participants were interviewed from this group (see Appendix A for a detailed description of the key informants).

Nashwaak Watershed Association Inc. (NWAI)

NWAI works to protect the Nashwaak Watershed and its ecosystem. The watershed drains an area of 1700 km^2. The Nashwaak River flows from the Upper Nashwaak Lake to the Saint John River at Fredericton. The River is the largest salmon-producing tributary of the Saint John River below the Mactaquac hydroelectric dam (NWAI 2002). In 2002, 92 percent of the watershed was forested, three percent was agricultural and roughly one percent was residential. Most of the population density is near the confluence of the St. John River and the Nashwaak River (NWAI 2002).

The NWAI was founded in 1995 by a local engineer and business owner who had a concern for the river. Today the group is involved in activities such as raising salmon fry, gene banking,

riparian restoration, water sampling, salmon smolt assessment and smolt passage improvement on the Saint John River. The group structure is centred around a Board of Directors elected out of the members—president, vice-president, past president, treasurer and secretary, and at least two other members to a maximum of ten (NWAI 2008). Four interviewees took part in this study as participants from NWAI (see Appendix A for a detailed description of the key informants).

CHAPTER FIVE:

RESULTS

The results that emerged from the data analysis described in Chapter Three are presented in this chapter. Three sections are used to organize the results. Section 5.1 outlines the results that revealed the types of knowledge that individuals engaged in collaborative governance in New Brunswick used; it addresses research question 1. Section 5.2 outlines the results that revealed how the different types of knowledge were used; it addresses research question 2. Section 5.3 outlines the results that revealed what factors affect the inclusion of knowledge in collaborative governance processes; it addresses research question 3. Section 5.4 provides a summary and overall synthesis of the findings of the research. The results were analysed case-by-case, and between rural vs. urban and small area vs. large watershed area. During these analyses, several differences were revealed by case, by rural vs. urban case and by small watershed area vs. large watershed area. The details of these results are highlighted throughout this chapter. For the most part, however, the results proved to be relatively similar for all cases, resulting also in similar results among rural/urban and small/large. Thus, the results documented in this chapter are largely aggregate responses, except where key differences were revealed in the data.

5.1 Knowledge Used in Collaborative Water Governance

Detailing the types of knowledge actually used in collaborative water governance is useful for analyzing which types of knowledge are considered important for governance processes. Therefore, it is necessary to determine whether or not the different types of knowledge identified in Chapter Two are used in real-world processes, and to determine if there are other important types of knowledge used that are not identified in the literature. This section details what types of

knowledge individuals engaged in collaborative water governance in New Brunswick use. Results were gathered from all five of the case study groups, and analyzed individually, rural groups vs. urban groups, and small watershed areas vs. large watershed areas (see Section 3.4). Table 4 summarizes the results of the understanding of "expert" and "local" knowledge types on a case-by-case basis, between rural and urban cases, and between cases located in small watersheds versus cases located in large watersheds. Plus signs (+) indicate that data from a group was in agreement with the knowledge type listed in the left-hand column of the table (see Section 2.2 for further details on the knowledge types listed). Each plus sign represents one group. Thus, for example, two plus signs signify two groups, and three plus signs indicate that data from three cases were in agreement with the particular factor being tabulated.

Table 4: Results Summary of the Definitions of "Expert" and "Local" Knowledge

Knowledge Types	**Individual Cases**					**Rural/Urban[1]**		**Watershed Area[2]**	
Expert Knowledge	**GDDPC**	**HRAA**	**MRA**	**MREAC**	**NWAI**	**Rural**	**Urban**	**Small**	**Large**
Technical environmental expertise	+	+	+	+	+	++	+++	+++	++
Political expertise		+		+	+		+++	+	++
Academic expertise	+	+			+	+	++	++	+
Local Knowledge	**GDDPC**	**HRAA**	**MRA**	**MREAC**	**NWAI**	**Rural**	**Urban**	**Small**	**Large**
Knowledge of the watershed	+	+	+	+	+	++	+++	+++	++
Knowledge of the people and community	+		+	+	+	++	++	++	++
On-the-ground experience	+	+	+	+	+	++	+++	+++	++

Knowledge Types	Individual Cases					Rural/Urban[1]		Watershed Area[2]	
Historical knowledge			+		+	+	+	+	+
Story-telling					+		+		+

[1]Rural cases include GDDPC and MRA. Urban cases include HRAA, MREAC and NWAI.

[2]Small watersheds include GDDPC, HRAA and MRA. Large watersheds include MREAC and NWAI.

5.1.1 "Expert" Knowledge

Analyses of the data revealed strongly consistent perspectives regarding the question of "expert" knowledge. Thus, the results for this research question are presented here in aggregate form, with reference to specific highlights only where they add insight.

Academic training was cited by seven interviewees from GDDPC, HRAA and NWAI as an important aspect of "expert" knowledge for collaborative water governance. Time spent studying the theoretical and practical aspects of environmental governance, and related fields, was considered by participants in all five case study organizations to be an important aspect of "expert" knowledge, and critical to effective water governance. Academic knowledge was understood to be gained with time and training. The staff members of the five cases had varied academic backgrounds in natural and technical sciences (see Appendix A), which included four undergraduate degrees and a masters degree in biology, a diploma and a masters degree in ecology, one BSc in forestry, one BSc in geography, one advanced diploma in water quality, one degree in soil microbiology, and program minors in aquatic ecology and anthropology. The group board members also had varied academic backgrounds, with some case study groups having a greater degree of natural science-trained members within the board than other case study groups. Though interviewees from GDDPC, HRAA and NWAI suggested that academic

"expert" knowledge was important to water governance, only interviewees from HRAA and MREAC mentioned a high degree of natural science trained board members within the group. MRA claimed a more business sector orientation, and the GDDPC and NWAI interviewees did not mention a concentration of members in any particular area of expertise.

Technical scientific expertise was noted by fifteen interviewees, from all of the case study groups, as necessary for monitoring water correctly and determining if projects were feasible on the ground. Scientific and technical types of "expert" knowledge were described by one participant from MREAC in this way:

> Much of the technical [knowledge] is tidbits of information that have to do with some of the details of, say, methodologies or equipment or mechanical or technical science (geology, biology—this is how the cell works, this is how aquifers work, here's how you test them).

The knowledge of political systems and function was considered by five participants, from HRAA, MREAC and NWAI, to allow the group members to more effectively influence government bodies involved in water governance. This was a type of expert knowledge not suggested in the reviewed literature, yet identified as an important type of expertise by study participants.

The data showed that the case study groups turned to a wide range of knowledge holders in order to gain access to these "expert" knowledge types. For example, data from GDDPC, HRAA, MREAC and NWAI suggested that expert knowledge was brought in through consultation. Although two participants, one from MRA and one from NWAI, suggested that experts from outside of the watershed were removed from local issues, two other interviewees, one from GDDPC and one from an NB environmental advocacy group, acknowledged that these experts

were able to contribute useful in-depth knowledge of the broader issue. As one NWAI interviewee noted,

> 'Expert' [...] doesn't mean that they have an understanding of that particular river, and that particular community, or that particular brook feeding into the river. They may never have physically been there, but they understand the interactions of plant and aquatic life.

Five participants, one from each case study group, expressly noted that expert "skills" were called on by way of consultation when needed. This reality was echoed throughout the data, in documents such as the MRA Provisional Water Classification Report (MRA 2005), the NWAI 1st Year Water Classification document (NWAI 2002) and HRAA Strategic Plan (HRAA 2008a), and in personal observations throughout the research project, for all five case study watershed groups. As an interviewee from HRAA stated, "there's a variety of skill sets that we call on to make an organization like this a success". From the MRA, another interviewee agreed with the comment, "whatever one of us doesn't have we'll look for it, in terms of skills that are needed, or information".

The employees of government departments, such as the Department of Environment, Department of Natural Resources and Department of Fisheries and Oceans, were consulted regularly regarding environmental information and water resource data by all five of the case study groups, as suggested by three participants from the HRAA and NWAI and meeting minute documents of the GDDPC, MRA and MREAC. Consultation with federal government branches such as Environment Canada was mentioned by the participants of MREAC. Partnering with local municipal government as a consultant was mentioned by one interviewee from MRA as well as in meeting minute documents from the GDDPC and MREAC.

Other knowledge contributors were brought in for expertise by each of the case study groups, on a project-by-project basis. To illustrate, objective number seven of the HRAA Strategic Plan (HRAA 2008a) expressly addressed pursuing consulting opportunities within the Hammond River Watershed. Engaging independent professional consultants in particular projects was seen as important, as mentioned by four interviewees, from the GDDPC, HRAA and NWAI, and evidenced in one GDDPC meeting minute document. Information from environmental institutions such as NB Aquatic Resources Data Warehouse, Canadian Rivers Institute, Service NB, Water Survey of Canada, the US Geological Survey and other institutions was noted by two participants, from MRA and NWAI, and in four meeting minute documents from the GDDPC, MRA and MREAC. Knowledge from the employees of specific industries—such as mining and forestry—was mentioned in three meeting minute documents from MREAC. Bringing in knowledge from other local environmental groups was mentioned as something that was done by an interviewee from MRA and an interviewee from NWAI. Four interviews, with participants from the GDDPC, HRAA, MRA and MREAC, and two meeting minute documents from the MRA, also suggested that students were regularly hired through funding applications and brought in to help with environmental projects.

Study participants reserved high honour for "expert" knowledge contributors who lived locally within the watershed. One interviewee noted that these "expert" locals knew more about water and landscape governance, as well as the local history in the area, than the outside experts often did. In answering interview questions about local "expert" knowledge, a participant from GDDPC noted:

> We have a lot of experts in our community too. We can't forget that… we don't always have to go outside and to other provinces. We have an awful lot really close at home that are willing to share.

Five interviewees mentioned cases in which consulting "experts" from outside of the watershed could become attached to a particular area, and dedicate themselves to it. This was evidenced in the fact that both the MRA and MREAC had a natural science trained director who was originally from outside of the watershed, whereas most of the other case study group staff members interviewed were from the area in which their watershed group operated.

5.1.2 "Local" Knowledge

According to the literature presented in Chapter Two, in collaborative water governance the range of knowledge types involved should extend beyond "expert" knowledge to include other types. Another form of knowledge identified by the literature as necessary for water governance was "local" knowledge. This section outlines what the study revealed concerning "local" knowledge in the five cases.

The Volunteer's Guide to Water Quality Monitoring (GNB 2000) published by the NB DENV, as well as the MRA Provisional Water Classification Report (MRA 2005) and NWAI 1st Year Water Classification document (NWAI 2002), referred to "local" knowledge in a similar sense as the academic literature: history and familiarity with the local landscape and human interactions with the environment. When speaking to members of the case study watershed groups, however, the term *"local" knowledge* seemed to be a difficult one to define. One MRA participant commented:

> There's an accumulation of local knowledge of the [watershed] within the organization as well as within the community. I don't think we think about it much – it's just there.

As outlined in subsection 5.1.1, case study data showed that "local" knowledge was considered complex and entwined with other forms such as "expert" knowledge. A complexity suggested in

the study data, as pointed out by two interviewees, was that different types of "local" knowledge, such as knowledge contributed by First Nations peoples in comparison to knowledge contributed by a newly-immigrated farmer in the area, are set in different timeframes and supported by different value structures. Despite complexity and difficulty in defining "local" knowledge, the data revealed a number of important aspects of this form of knowledge in collaborative water governance.

Historical knowledge was identified as a characteristic of "local" knowledge by five participants from within the MRA and NWAI. The NB DENV Volunteer's Guide to Water Quality Monitoring document (GNB 2000) defines valuable local knowledge as knowledge of the history of the area, changes over time in habitat and wildlife, and old industrial operations, farms or dams that may once have been present in the area. A participant from NWAI listed a number of items that fit this description of local knowledge, which are local history, ancestry, lifestyles, people, ecology, land use, food production and harvesting, industry, politics. Literature suggests that traditional ecological knowledge (TEK) is necessary for collaborative environmental governance. Though there were First Nations peoples living in NB, the historical knowledge noted in the data was not defined in terms of TEK. Rather, the data focused on local knowledge gathered within a 50 or 100 year time-span of living in the watershed.

In addition to historical local knowledge, contextual geographical knowledge of the watershed was indicated to be an important type of local knowledge for water governance. Three participants, and the MRA Provisional Water Classification document (MRA 2005), noted that local knowledge supplies valuable information for the selection of sampling sites and for interpretation of data. This knowledge of the watershed was mentioned as an important form of local knowledge by eleven participants, from all five of the watershed groups. Contextual

knowledge of the watershed included knowledge contributions about local fish species, habits of the fish, nature of the river, when the ice runs, when the salmon spawn, etc.

A social component to "local" forms of knowledge was indicated in the case study data. Eight interviewees, from GDDPC, MRA, MREAC and NWAI, suggested that collaborative environmental governance required knowledge of the environment but also knowledge of the people who live in that environment. An interviewee from MRA suggested that even if all of the water quality data were collected, and then analyzed by outside experts, it would be difficult to write a management plan without some knowledge about the people in the area. This included knowledge of the local culture, knowledge of community relations and communications, and management of people. As a participant from an environmental advocacy group stated, "local knowledge includes a 'loved knowledge' of how things work and the quirks of the community. This is important for getting science to fly".

Both the environmental and social contexts of a community constantly change, and the local experiential knowledge associated with this was indicated to be another important aspect of "local" knowledge, as identified in the data from all five cases, and necessary for collaborative environmental governance at a watershed scale. Three participants expressly pointed to and provided evidence of the importance of the on-the-ground aspect of local knowledge. As an interviewee from MREAC stated, "[The expert knowledge] is often not as important as the rounded out experience that the people bring to the table". Documents such as the MRA Provisional Water Classification Report (MRA 2005) and several newsletter accounts of the MREAC River Watch program drew attention to the value of local contributors providing environmental information as environmental issues arose. An interviewee from GDDPC described this aspect of local knowledge this way:

> […] the developer needs to get a permit from all the agencies—Fisheries & Oceans, DENV, Planning Commission or whatever. And the evaluation of the file is, 'Well, okay yeah you can build there, it doesn't look like a marsh on my map, and the 100 year storm surges are going to be there so you can't build to here.' [So] the evaluation of this area is made by the scientific information that someone *out* of the community, which I'm sure is good information, but how recent and local is it is another story. So then the permit gets given and the development starts and then the local people say, 'Hmmm that land floods every other year.' 'No it doesn't, Fredericton said that it floods every 50 years!' 'Well, I don't know, last year it flooded and the year before it did too, but go ahead.'

The environment and its issues constantly change, and local knowledge was indicated in the data to be considered as most current. As noted in the MRA Provisional Water Classification Report (MRA 2005), anecdotal knowledge provides a necessary dimension to formally collected data, and anecdotal information verifies other anecdotal information, as well as "expert" knowledge, for a valuable record bank of information.

Five interviewees, including participants from MREAC and NWAI, spoke highly of "local experts" or "community champions". These knowledge contributors were distinguishable from the *local "experts"* defined in subsection 5.1.1. Study data suggested that the local knowledge contributors who were considered "local experts" often had lived in the watershed their entire life, had been with the group for a very long time and had been a very active part of group initiatives. An interviewee from MREAC noted "when you lose someone like that unfortunately you lose so much information […] you can't replace those guys". Observations showed that all groups considered themselves very fortunate to have local knowledge experts involved in group activities.

There was a variety of "local" knowledge types that were indicated in the study data to have necessary contributions for water governance in NB. According to the reviewed literature, in collaborative water governance situations these knowledge types interplay with other knowledge types, such as "expert" knowledge.

5.1.3 Summary

Evidence of the types of knowledge actually used in collaborative water governance is important for analyzing which types of knowledge are considered important for governance processes and for verifying the characteristics predicted in the collaborative governance literature. The implications of the findings will be discussed in detail in Chapter Six.

As discussed in Chapter Three, the evidence was compared and contrasted among each individual case, between rural cases versus urban cases, and between cases operating in small watersheds versus cases operating in large watersheds. In the analyses the interview data were considered to be of primary importance, and data from documents and personal observations were taken into account as secondary, supporting or refuting evidence. The data revealing the perceptions of "local" and "expert" knowledge contained several notable similarities when analyzed case-by-case. For example, whereas the academic literature reviewed for this study described "expert" knowledge generally as explicit, formal, information, easily articulated, measurable, objective fact, etc., the study data uniformly indicated a more practical understanding of "expert" knowledge. The data for each case also showed that specific scientific "expert" knowledge was considered necessary for collaborative water governance, and that it was often more readily sought in decision making than other knowledge types. Though data from all five cases emphasized the use of "expert" knowledge through consultation with contributors from outside of the local watershed, evidence from four of the cases revealed the importance of local experts and expert local knowledge contributors. To illustrate, while all analyses provided evidence for the value of technical environmental expertise in NB collaborative water governance, similarly uniform in the data was the emphasis on experience and knowledge of the watershed as two important forms of knowledge.

The case-by-case analysis revealed differences among cases as well. Evidence from only two cases indicated the importance of local historical knowledge. Data from one case, MREAC, indicated that expert consultation with federal government branches such as Environment Canada was an important part of their operation. This data may show the closer affiliation of this group with the federal government, compared to the others, due to the groups' association with the former federally-funded Atlantic Coastal Action Program. Additionally, results from MREAC revealed that consultation with the expert knowledge contributors of local resource sectors, such as the forestry industry, was important. This is likely due to the large, rural, forested area of the Miramichi River watershed, and the impact that the forestry sector has on the water quality of the rivers in the watershed.

Comparison of rural groups versus urban groups highlighted one distinct difference. Evidence from all urban cases indicated the importance of political expertise. Evidence from none of the rural cases suggested that political knowledge was an important form of expert knowledge within collaborative water governance.

5.2 Use of Knowledge in Collaborative Water Governance

As seen in Section 5.1, engaging several types of knowledge is considered to be valuable in collaborative water governance. The study of five watershed groups in NB revealed that although interview subjects found it difficult to define the distinction between "expert" and "local" knowledge types, as expressed in literature, both were considered important and actively engaged collaborative water governance. This section outlines the study evidence regarding how knowledge was used in NB collaborative water governance. As one NWAI participant noted:

> …Yes, it would be self-evident in some respects [that different types of knowledge are necessary]. Whether it's regular board activities or the Water Classification [project], there

> are process questions about how to collect the water samples and have them analyzed, there's the organizing of the stakeholder meetings and facilitating those meetings, communicating the information, there's managing the project. There are many different levels of knowledge. So they are essential. People rarely bring all of the skills that are necessary, and that's why group endeavours, however frustrating, are still necessary.

Results regarding the use of knowledge were gathered from all five of the case study groups, and analyzed individually, according to rural groups vs. urban groups, and small watershed areas vs. large watershed areas (see Section 3.4). Table 5 summarizes the results of the use of knowledge on a case-by-case basis, between rural and urban cases, and between cases located in small watersheds versus cases large watersheds. Plus signs (+) indicate that data from a particular group were in agreement with the particular knowledge type, used at a particular phase of governance, listed in the left-hand column of Table 5 (see Section 2.3 for further details on the listed items). Each plus sign represents one group thus, to illustrate, three plus signs indicate that data from three cases were in agreement with the particular factor being tabulated.

Table 5: Results Summary of the Use of Knowledge

Stages of Decision Making	**Individual Cases**					**Rural/Urban[1]**		**Watershed Area[2]**	
Goal Setting	**GDDPC**	**HRAA**	**MRA**	**MREAC**	**NWAI**	**Rural**	**Urban**	**Small**	**Large**
Academic knowledge and technical experience for leadership	+	+	+	+	+	++	+++	+++	++
Staff and board members use technical expertise for monitoring	+	+	+	+	+	++	+++	+++	++
Expert consultation		+	+		+	+	++	++	+
Local knowledge for observation		+	+	+		+	++	++	+
Planning	**GDDPC**	**HRAA**	**MRA**	**MREAC**	**NWAI**	**Rural**	**Urban**	**Small**	**Large**
Staff and board members deliberate on water governance planning			+	+	+	+	++	+	++

Expert consultation sought in drawing up plan documents		+					+	+	
Volunteer members encouraged to administer plan development	+	+				+	+	++	
Local knowledge engaged in discussion throughout W.C.*	+	+	+	+	+	++	+++	+++	++
Monitoring	**GDDPC**	**HRAA**	**MRA**	**MREAC**	**NWAI**	**Rural**	**Urban**	**Small**	**Large**
Staff technical experience provides leadership for volunteers	+	+	+	+	+	++	+++	+++	++
Staff technical expertise used in lab work for Environment Canada	+	+				+	+	++	
Expertise in data collection and data review sought from government departments	+	+	+	+	+	++	+++	+++	++
Expertise in data collection sought from environmental institution		+		+	+		+++	+	++
Expertise in data collection sought from local industry				+			+		+
Expertise in project implementation sought generally					+		+		+

[1]Rural cases include GDDPC and MRA. Urban cases include HRAA, MREAC and NWAI.

[2]Small watersheds include GDDPC, HRAA and MRA. Large watersheds include MREAC and NWAI.

*Water Classification program.

The literature review presented in Chapter Two indicated that it is essential to determine how knowledge is used within governance processes (Raymond *et al.,* 2010). Stringer *et al.* (2006) suggest that the stages of environmental governance can be identified as goal setting, planning and monitoring. The following sections outline the use of particular knowledge types in the various stages of the watershed group decision making.

5.2.1 Goal Setting

Goal setting was considered in this study to be the identification of environmental issues through the study of environmental trends and on-the-ground analysis (Section 2.3). The data showed that in NB it was mainly funding agencies that identified the water governance problem to be addressed. The funding agencies were often provincial government departments, through specific water governance programs or through the Wildlife or Environmental Trust Fund. Despite the fact that often the general problem identification for major projects was done by funding agencies, the groups took responsibility for determining what needed to be done within their own watershed. Expert skills and knowledge involved at this stage were in GIS, geology, land use and ecology. Participants from all of the case study groups indicated that the watershed group staff applied their academic knowledge and experience in the identification of water governance problems through taking the leadership role in setting up the course of action. This was also evidenced in the groups' Provisional Water Classification documents, the HRAA Watershed Management Plan (HRAA 2008b) and several newsletter and meeting minute documents. To illustrate, one MRA interviewee commented:

> A lot of it is driven by [the staff]. A lot of things that they do, that they come up with, we [the Board] haven't even thought of, because we're out working at something else. And, you know, they say "wouldn't this be good for our group?" and, you know, if they've researched it and think it is, 99 times out of 100 then we go with what they say … because they're the people that are on the ground all of the time.

In addition, data from all five of the cases—five interviewees, the HRAA Watershed Management Plan (HRAA 2008b) and MRA Provisional Water Classification Report (MRA 2005)—indicated that both staff and board members used their technical expertise directly in group problem identification activities. Data from three of the groups (MRA, MREAC and GDDPC) suggested that staff members were the main actors at the problem identification phase.

Interviewees from HRAA and NWAI, and personal observation of the activities in all five cases, indicated the use of local volunteers in monitoring. Volunteers came from within the group membership and board, or from outside of the group membership and board. The DENV Volunteer's Guide to Water Quality Monitoring states: "Activities that volunteers participate in for a baseline assessment project usually consist of collecting water samples, taking field measurements, making field and general observations, and gathering land use and other environmental information from the sample station" (GNB 2000: 5). This was shown to be true through evidence from four of the groups, and happened regularly or during particular projects. As one interviewee from MREAC had to say:

> Much of our work that we talk about and deal with through the [volunteer] membership really results in more technical work in the field. So it might be assisting with snowfall studies, or working with other groups (provincial, federal government) to proceed with the projects (say, e coli measurement in the river), and that requires expertise in terms of having somebody that can technically, actually do that […]. We've been able to keep some pretty high-quality people in those technical positions, to do that type of work. But definitely, if you send somebody out to sample e-coli, not everybody can do that.

"Local" knowledge was indicated by data from HRAA, MRA and MREAC to be engaged in observation through living in the watershed. For example, through a program set up by MREAC, water quality assessments happened continuously through local observation. A meeting minute document (September, 2010) from the group reported:

> Residents and pedestrians around Ritchie Wharf were coping with strong sewage smells around their residences, noticed also by MREAC staff on occasion. One resident called MREAC on this issue. MREAC contacted the city engineering section and they have reacted to the issue.

In the case of the MREAC group, "expert" members were separated from the general membership and asked to join a Technical Advisory Group. This committee of "experts" determined the direction that the group would go in terms of programs and activities. This was a

notable exception among the case study groups. In the other four cases the board was composed of a range of knowledge types and the influence of the board in general directed the group. A participant described the situation within the MRA:

> Occasionally there are big-picture, high-level issues or questions that go beyond [the staff] comfort zone, and really require a greater input and responsibility. Somebody other than [the staff] needs to assume the responsibility, or at least identify the responsibility, associated with the project or issue. In those cases that issue goes to the Board. There's a discussion and then it comes back down the chain, so to speak, and [the staff does] what [they're] instructed to do, or proceed as [they] should proceed. That's sort of a basic decision making model. Generally I would consider it a flat model. There is a hierarchy there—there's staff and directors and executive, but often the decision of either group or party is made with the input / guidance of the other ones.

Apart from the staff and members playing a key role in problem identification, five interviewees and several documents from HRAA, MRA and NWAI revealed that "expert" consultants were also integral knowledge contributors at this phase of governance. As an interviewee from HRAA shared, "the last time he [(a senior hydrologist)] spent a full day with us, we toured the watershed, and looked at some of what we thought of as being problem areas". Groups also indicated seeking expertise through partnership with NB government departments (see subsection 5.1.1) for data collection, advice and review on particular projects. For example, as indicated by all of the groups, during the Water Classification Program group staff compiled research, data and reports and sent it to the Department of Environment for review before the next steps were taken.

The types of problem identification work done in the groups involved water quality reading, such as benthic invertebrate testing—done routinely by all of the groups—as indicated in the groups' Provisional Water Classification documents, the HRAA Watershed Management Plan (HRAA 2008b), meeting minute documents and newsletters and the Volunteer's Guide to Water Quality Monitoring (GNB 2000), as well as by three interviewees. Fish population monitoring

was another activity evidenced in meeting minute documents, the NWAI Provisional Water Classification Report (NWAI 2004) and by two participants. Land use mapping and monitoring was indicated to be another important goal-setting activity by two interviewees, meeting minute documents and newsletters, as well as in the NWAI Provisional Water Classification Report (NWAI 2004) and Volunteer's Guide to Water Quality Monitoring (GNB 2000).

5.2.2 Planning

Planning was considered for the purposes of this research project to be the development of policies and projects within the collaborative watershed group context, such as management plans, community environmental programs or strategic goals (Section 2.3). There was not much evidence in support of planning work among the five case study groups. The groups took initiative in leading many community environmental programs and engaging in tasks such as community awareness and promotion, program design and acquiring necessary funding. The data having to do with the Water Classification Program pointed to how knowledge was included in deliberations during the development of the management plans—Provisional Water Classification documents and list of strategic water quality goals—that were a required part of the program. The groups' Provisional Water Classification documents pointed out that water resource stakeholders and residents were engaged in preliminary discussions before the Provisional Water Classification plan formulation and were in ongoing discussion with staff members throughout the process. It should be noted that the knowledge engagement was at the instigation of the government during the Water Classification Program. One interviewee from MRA stated:

> When we went through our Water Classification Program, we had a much more concerted effort to get out there and hear all of the comments—good, bad and otherwise. But that was a specific program and we're now well through it. We've got our provisional classification

> report, and our action plan and we're pursuing those action items. But that was driven by the program, and it was mandated by somebody else—the Province—[requiring us to] consult the stakeholders and listen to them, and we definitely heard it. We made some changes as a result, and that's fine! I think, in that case, we were trying to come to a consensus on water quality and how the [watershed] would be managed into the future. Yes, you do need buy-in, or at least acknowledgement of what the current state is, from all of the players before you can make headway with it.

Since the completion of the Water Classification Program, two case study groups, HRAA and GDDPC—both classified in this study as rural groups—still encouraged volunteer members to help administer plan development and programs. As one HRAA participant had to say: "one of our senior members has developed strategic plans for a variety of other NGOs and the government, so he can facilitate the process".

An interviewee from MREAC and an interviewee from NWAI mentioned that experience with developing strategic plans for NGOs and government was important, and expertise in drawing up plans was indicated to be sought through consultation in at least one group, HRAA. An excerpt from an HRAA newsletter (Fall, 2008) read:

> I'd particularly like to thank the efforts of [a contributor], who assisted the staff as a consultant for the past several months. Some great work was accomplished, particularly the finalization of the Strategic Plan.

Much like the results reported in subsection 5.2.1, however, staff of the watershed groups did much of the deliberating on water governance plans within the groups. This was heard from three of the cases—MRA, NWAI and MREAC. More detail about the difficulty in particular of engaging local knowledge in these processes will be outlined in subsection 5.3.2.

5.2.3 Monitoring

Monitoring was considered in this research to be the implementation of management plans and projects on the ground (Section 2.3). One participant noted that expert knowledge was required

in implementing and executing projects. Technical knowledge necessary for monitoring was considered to be in water quality determinants, nutrients and bacterial contaminants, temperature, dissolved oxygen and wildlife indicators. Technical, hands-on working knowledge within the staff members of the case study groups, for example, of building fish and water sampling tools, was observed during tours with interviewees from two of the case study groups, and evidenced in the meeting minutes as well as Provisional Water Classification documents and watershed management documents of all of the groups. In addition MREAC, GDDPC/Kent Coalition and HRAA had contracts from Environment Canada to do lab tests in their facilities, monitoring the water conditions across the province more broadly. This technical work was won through a bidding process and undertaken by staff.

Government employees played an important role in contributing "expert" knowledge to collaborative water monitoring in NB, as evidenced in data from all five of the case study groups—in one interview and in official group documents, such as the HRAA Watershed Management Plan (HRAA 2008b) and MRA Provisional Water Classification Report (MRA 2005). In terms of water monitoring, the groups reported working with, and getting feedback and expert advice from government departments (DENV mostly). In the analysis of rural vs. urban case study groups, it was noted that the data from the urban groups (MREAC, NWAI and HRAA) contained a greater level of detail about the involvement of government in environmental monitoring. To illustrate, an HRAA newsletter noted working closely with DENV, the federal Department of Fisheries and Oceans and the Department of Transportation in minimizing the impacts of development along the Hammond River. Seeking government advice included the development of sampling techniques for changing water conditions, as noted by HRAA, and fish research, as noted by NWAI and MREAC. According to the DENV Volunteer's

Guide to Water Quality Monitoring (GNB 2000), a government "Quality Assurance" technician was necessary to tabulate water quality data during the Water Classification program. The technician would then send the report back to the watershed group. All of the groups reported having followed these guidelines. For example, an excerpt from the NWAI Provisional Water Classification Report (NWAI 2004: 3) read:

> Volunteers collected water samples from 11 points on the main stem of the Nashwaak [... sample] bottles were kept on ice and immediately delivered to the DELG water quality lab in Marysville Place [...]. Once lab testing was done, results were entered into a database and water quality graphs for various parameters at various locations were generated.

In terms of "expert" knowledge from contributors outside of the watershed, expert consultants also played a role in solution-finding within the HRAA. Regarding the involvement of industry, a meeting minute document from MREAC (September 2010) stated:

> Field monitoring has been ongoing at 15 sites throughout the SW Miramichi. JD Irving Ltd. is assisting with the five furthest west as an in-kind contribution. This arrangement was orchestrated by [an employee] of DENV.

In addition, data from HRAA, MREAC and NWAI mentioned the involvement of an environmental institution (NB Museum, Canadian Rivers Institute) in providing aquatic monitoring advice and assistance.

Involvement of staff was seen in directing and providing guidance for volunteer members. Volunteers for monitoring came from the local community with a range of knowledge contributions, whether "expert", "local" or "local expertise," and were given training sessions in the activity being performed—such as collecting water samples. This was observed in the operations of all five of the case study groups. The HRAA Watershed Management Plan (HRAA 2008: 16) noted an example of how this took place in the watershed: "Green Teams also looked

at a variety of different physical characteristics of the water and recorded all their findings on a data sheet. Upon completion of the work, crews reported back to HRAA staff with their findings [...] and data was processed".

5.2.4 Summary

As discussed in Chapter Three, the evidence was compared and contrasted among each individual case, between rural cases versus urban cases, and between cases operating in small watersheds versus cases operating in large watersheds. In the analyses the interview data were considered to be of primary importance, and data from documents and personal observations were taken into account as secondary, supporting or refuting evidence. The data revealing the use of knowledge contained several notable results when analyzed. A key finding of the case-by-case analysis was that the use of local knowledge was not indicated strongly among the cases, with the exceptions of the use of local observation during the goal-setting phase and the use of local knowledge during the planning phase of the Water Classification Program (see Table 5). Evidence did not indicate that local knowledge was used during the monitoring phase. Various types of expert knowledge were suggested in the data as being used during all phases of collaborative water governance in NB. A highlight of the comparison of rural groups versus urban groups revealed that urban groups regarded specific types of expertise as an important contribution to the activities of the monitoring phase (see Table 5), whereas the importance of expert knowledge during monitoring was not as evident among the rural case data.

5.3 Engaging Knowledge in Collaborative Water Governance

Sections 5.1 and 5.2 presented how knowledge was differentiated and what types of knowledge were actually used during different phases of collaborative water governance in New Brunswick.

The data were analyzed based on the research framework (see Table 1), which outlined theoretical understanding of the types of knowledge necessary for collaborative governance processes and the use of knowledge in the processes. Gaining a greater perception of how different knowledge types are engaged in the processes of collaborative governance is crucial for increasing the understanding of how successful collaborative water governance takes place.

This section reviews the extent to which various collaborative governance process factors work to engage the different knowledge types that are necessary for collaborative water governance in the five New Brunswick watershed group cases. Results were gathered and analyzed individually, by rural groups vs. urban groups, and small watershed areas vs. large watershed areas (see Section 3.4). Table 6 and subsection 5.3.1 summarize the results of the *capacity-related* knowledge engagement factors on a case-by-case basis, between rural and urban cases, and between cases located in small watersheds versus cases large watersheds. *Facilitation-related* knowledge engagement factors were analyzed similarly, and are discussed in subsection 5.3.2 and summarized in Table 7. Plus signs (+) in Table 6 indicate that a group agreed with the capacity factor. Each plus sign represents one case study group thus, for example, two plus signs indicate that data from two cases were in agreement with the particular factor being tabulated.

Table 6: Results Summary of Capacity Factors effecting the Engagement of Knowledge

Capacity Factor	**Individual Cases**					**Rural/Urban[1]**		**Watershed Area[2]**	
	GDDPC	**HRAA**	**MRA**	**MREAC**	**NWAI**	**Rural**	**Urban**	**Small**	**Large**
Location				+	+		++		++
Funding	+	+	+	+		++	++	+++	
Time			+		+	+		+	

Leadership	+	+	+	+	+	++	+++	+++	++
Roles	+	+	+	+	+	++	+++	+++	++

[1]Rural cases include GDDPC and MRA. Urban cases include HRAA, MREAC and NWAI.

[2]Small watersheds include GDDPC, HRAA and MRA. Large watersheds include MREAC and NWAI.

The following subsections outline several factors considered to be influential to the inclusion of various knowledge types in collaborative environmental governance. "Capacity" factors are the contextual surroundings and structural makeup of the group that facilitate the inclusion of different types of knowledge in collaborative water governance. "Facilitation" factors are the components and characteristics within the group that facilitate the inclusion of different knowledge types (subsections 2.4.1 and 2.4.2).

5.3.1 Capacity

The data concerning the capacity factors that affect the engagement of knowledge in collaborative governance processes contained several differences when analyzed between rural groups versus urban groups and between small watersheds versus large watersheds. The results of the case-by-case analysis showed many similarities among groups, with notable differences regarding the opinions of time and location as important capacity factors. In this section, capacity factors that emerged in the literature review (Chapter Two), and were discussed in the data, will be presented in an aggregated format and the notable differences that arose from the analyses will be highlighted.

Location

Data from the two case study groups working within large watershed areas, MREAC and NWAI, suggested that location was a key factor affecting the types of knowledge available for

collaborative processes. An interviewee from the DENV indicated that groups that were closer to each other geographically were able to develop stronger relationships, and could share knowledge and resources more easily, because the members and staff would see each other at local events and phoning would not be long distance. In addition, the DENV interviewee noted that rural watersheds were less likely than urban ones to have people interested in joining the watershed groups, as there were fewer people living there, and so less of a network to draw on for membership in the group. A participant from MREAC noted:

> That awareness business is [a] challenge. We have a huge watershed. We have a bit of a presence around [the city of] Miramichi, almost like concentric rings, right. You have one in 10, maybe one in 20 knowing us in the city, and when you get out to Juniper you get one in 500 who'd have some sense of what we're doing. You know, so it's that kind of thing. But the awareness level is pretty abysmal in general. We have a fairly limited network of people who are aware and who we can effectively try to reach.

Funding

Although funding was suggested by four of the case study groups—all but NWAI—to be an important factor in engaging knowledge in collaborative governance processes, the details suggested by the various participants were not sufficiently agreed upon, so as to be highlighted in either the rural/urban or the small/large analyses, indicating that concerns about funding are particular to individual groups. Four interviewees indicated that funding limited staff salary, and thus it was considered a factor in determining involvement in the group. One participant described the situation of people leaving a community group: "You can get somebody who's finally at the point where they're really talented, they've got the expertise and they have the knowledge, but [the group gets] to the point where they can't pay enough to keep them anymore."

Lack of money necessitated the reliance on others. To illustrate, according to two interviewees, experts who had water monitoring equipment and expertise that they were willing to lend were highly valued as this saved time and resources that the group would have had to expend otherwise. This matter was commented on by an HRAA participant in this way:

> The development of a strategic plan is very important. The difficulty is most NGOs are poorly funded, and it's oftentimes an almost insurmountable task because of the very few staff that they have. So really, the best solution is if they are able to find an appropriate facilitator. A volunteer facilitator that is able to take that up is great, otherwise it will cost you huge amounts of staff time or huge amounts of scarce financial resources.

Partnerships with government bodies such as Environment Canada or the Province of New Brunswick, allowed for the funding of staff for particular projects. For example, evidence in the case groups' Provisional Water Classification documents, as well as meeting minutes and newsletters, indicated that the DENV Water Classification Program opened doors for funding for all of the case study groups. Similarly, NWAI fish research with the Department of Fisheries and Oceans allowed for funding, and HRAA sought to be funded by the Department of Agriculture for farm rehabilitation within the Hammond River watershed. As noted by one interviewee from the MRA: "[The Water Classification Program provided] funding to establish and maintain an office and pay part time staff. This in turn allowed us to improve our research base, gain a better understanding of watershed issues and plan—and carry out—work to remediate some of them". This point was backed up by an interviewee from the University of New Brunswick.

Despite the limitations and constraints of funding, interviewees from two of the case study groups, MRA and MREAC, indicated that the funding issue could be a positive challenge for collaborative water governance. For example, a participant from MREAC described:

> In the way of doing business, when you think of how government performs or how other organizations perform—[they] have all levels of bureaucracy or structure—a small sort of

> community group that's on the scene [is] able to respond quickly (unfortunately often VERY inexpensively because we don't get the funding levels we need). This is an excellent way to manage watersheds, and I can't think of a better model for watershed management. I think we're starting to get some begrudging acknowledgement of that at various levels of government and community as well.

The NB government also provided funding for students which, as discussed in subsection 5.1.1, was an important knowledge contribution source for the case study groups.

Time

One NWAI participant noted that rural watersheds had less money and rural citizens had less time than urban watershed citizens, and that this effected what the groups could achieve. Another NWAI interviewee commented, "I think that there's great opportunity to integrate and engage different types of knowledge in these kinds of processes. But it all comes down to capacity [...] money is always a big factor, because with money you can buy time, and that's mostly what you need - time. You need the expertise, but you need time". This concern was also noted by one participant from MRA.

The NWAI Water Class 1st Yr Report (NWAI 2002) noted that it was necessary to be cognizant of when community members had time to take part in governance activities, so as to be able to engage important knowledge contributions. For example, the document stated: "As the data generated in 2002/2003 will not be available [from the DENV] until near the end of next year's effort, it will not be possible to distribute that data until 2003/2004. As previously stated, meaningful stakeholder decision-making cannot be performed until this information is made available for public consideration" (NWAI 2002: 11).

Roles and Leadership

In the context of the engagement of knowledge, the importance of defined *roles* was brought up numerous times during the interviews. The definition of roles could potentially allow participants to find a task for themselves, according to their skills and interests, and could be an effective manner by which to engage different knowledge types in decision making. Data from three of the case study groups, GDDPC, HRAA and MREAC, emphasized the importance of establishing roles for staff, group members and board members. In the case of HRAA, for example, roles were formally defined in an employee handbook. Evidence from interviews, documents, meeting minutes and newsletters at GDDPC, HRAA and MRA indicated that a structured organization could allow for the definition of specific roles. To illustrate, a participant from GDDPC commented that, "the GDDPC has been expanding, so far it has been forming new committees, and new initiatives. So they expand that way, but the core group doesn't expand". A specific benefit of defined roles could be seen at MREAC in the Technical Advisory Group that was established to provide guidance for the group (see subsection 5.2.1).

Evidence from four of the case study groups, GDDPC, HRAA, MRA and MREAC, suggested that when there were multiple staff members, it was possible for each person to have a particular role. For example, HRAA had an executive director and two technical members on staff at the time of this research study. The executive director noted focusing on leadership roles, while the two other staff members spent more time monitoring and carrying out projects on the ground. The structure of MREAC was similar in that distinct administrative, technical and director roles were established. This was noted by all three of the MREAC staff as a favourable situation, allowing each member to focus on a specific set of tasks without hindrance from the other roles necessary in the collaboration. The NWAI Provisional Water Classification

documents indicated that a division of roles had been possible at the time during which the NWAI was involved in Water Classification, but there were no staff members at the time of this study. Indeed, participants from MRA and NWAI indicated that when there were fewer staff members, the roles are less well-defined. For example, an MRA interviewee remarked "[My colleague] and I did most of [the Water Classification Report]".

Evidence from all five of the case study groups showed that *leadership* was also considered an important factor in the engagement of knowledge in collaborative processes. Evidence from HRAA and MREAC suggested that a leader provided the liaison between staff, board members and executive. Three participants from NWAI mentioned that this was not always an ideal situation as, from time to time, a single individual could have too much influence on the decision-making process. Participants from HRAA and MRA noted that a leader was also responsible for outreach to local citizens, as well as for organizing publicity, promotion and volunteer activities that attract new members. As an HRAA participant made note:

> That's a significant responsibility here, to be sure that the members are involved as well as possible, update the websites, on occasion going up to them and letting them know that the door is open. If they have questions we make every effort to answer them and to describe our programs and our projects to them.

In regard to reaching out to involve members of the community, knowledge transfer was suggested to be a key component of leadership by an interviewee from MRA, and was evident in meeting minute documents and newsletters from all of the case study groups. Together the members shared in the governance and planning of the group and this often necessitated knowledge interpretation (see notes on *deliberation* in subsection 5.3.2). For example, an HRAA meeting minute document described how one of the staff members explained the science behind

salmon tagging to a group of members and local citizens. Another example of knowledge interpretation was noted by an NWAI interviewee:

> The information that comes from the proponent body is volumetric and technical. So they hand you 700 pages of typed data, basically. And you're expected to go through that and to, uh, I mean that's the theory, I don't know if that ever happens, but you go through that and then say "this is how I feel about it, and these are where my concerns are." Without the good fortune of having somebody with a background in that particular field, then you're at a considerable disadvantage in dealing with it.

In addition, speaking the language of the community was considered to be important by four other participants. One participant, a volunteer member of the GDDPC, commented:

> One thing that I say is, when you have things and you invite the community, don't use scientific terms. I have a big pet peeve about this. If you want people to come in, you don't head it as "climate change". They're totally going to ignore that. But if you put a word like "emergency", "ice storm" or "hurricane"—everyday words that people use—then you'll get them more. That's what I think.

5.3.2 Facilitation

The literature reviewed for this study suggested that the effectiveness of water governance could be enhanced by including many different types of knowledge in collaborative processes. Critics, however, described difficulties relating to the inclusion of multiple types of knowledge in governance activities (see Chapter Two). The data regarding the engagement of knowledge contained several notable results when analyzed between rural groups versus urban groups and between small watersheds versus large watersheds. The results of the case-by-case analysis showed many similarities among groups, with few notable differences. In this section, facilitation factors that emerged in the literature review, and were seen in the data, will be presented in an aggregated format and the notable differences that arose from the analyses will be highlighted.

Results were gathered from all five of the case study groups, and analyzed individually, between rural groups vs. urban groups, and small watershed areas vs. large watershed areas (Section 3.4). Table 7 summarizes the results of the knowledge engagement factors on a case-by-case basis, between rural and urban cases, and between cases located in small watersheds versus cases large watersheds. Plus signs (+) indicate that a group agreed with the facilitation factor. Each plus sign represents one case study group thus, for example, one plus sign indicates that data from one case were in agreement with the particular factor being tabulated.

Table 7: Results Summary of Facilitation Factors effecting the Engagement of Knowledge

Facilitation Factor	**Individual Cases**					**Rural/Urban[1]**		**Watershed Area[2]**	
Representation	**GDDPC**	**HRAA**	**MRA**	**MREAC**	**NWAI**	**Rural**	**Urban**	**Small**	**Large**
Staff and members	+	+	+	+	+	++	+++	+++	++
Local community	+	+	+	+	+	++	+++	+++	++
Local sectors	+			+	+	+	++	+	++
Multiple levels of management		+	+	+	+	+	+++	++	++
Youth	+	+	+		+	++	++	+++	
Deliberation	**GDDPC**	**HRAA**	**MRA**	**MREAC**	**NWAI**	**Rural**	**Urban**	**Small**	**Large**
Bring new ideas and interest into decision-making		+					+	+	
Bring knowledge into decision-making	+	+		+		+	++	++	+
Translate between knowledge types	+		+		+	++	+	++	+
Work towards consensus	+		+	+	+	++	++	++	++
Establish clear vision, goals, plan	+	+	+		+	++	++	+++	+
Legitimacy and Value	**GDDPC**	**HRAA**	**MRA**	**MREAC**	**NWAI**	**Rural**	**Urban**	**Small**	**Large**

Long term involvement	+	+	+	+	+	++	+++	+++	++
Training	+	+	+	+	+	++	+++	+++	++
Presence of scientific experts within the group	+	+		+	+	+	+++	++	++
Consultation	+	+	+	+	+	++	+++	+++	++
Verification through expert review			+	+	+	+	++	+	++
Perception of group work by local community	+	+	+		+	++	++	+++	+

[1]Rural cases include GDDPC and MRA. Urban cases include HRAA, MREAC and NWAI.

[2]Small watersheds include GDDPC, HRAA and MRA. Large watersheds include MREAC and NWAI.

Representation

Among the cases there was acknowledgement of the necessity of involving many levels of management in collaborative watershed governance, such as government, industry, developers, landowners, etc. This was mentioned in data from four of the cases—all but GDDPC (seven interviews, with participants from HRAA, MRA, MREAC and NWAI as well as in documents such as the HRAA Strategic Plan (HRAA 2008a), MRA Provisional Water Classification document (MRA 2005) and meeting minutes from MREAC). For example, the HRAA Strategic Plan stated that local respect for the river comes from working with all stakeholders along it (HRAA 2008a).

The representation of watershed group members was described by one participant from MREAC as a "mixed bag" that reflected the local watershed communities, which were also a mixed bag of people, vocations and interests. Similarly reported by another MREAC interviewee:

> In the general MREAC committee—anyone can go. We get people that walk in there that are only mildly interested in the environment but like to know what's going on. We have bird watchers, naturalists, and cross-section of the community. For example, people that are fish-oriented, or just care about the environment.

Board members of the groups were university professors, provincial government officials, federal government officials, retired people that had worked their careers in the environmental sector, people with fisheries backgrounds, water engineers, biologists, or people not at all engaged in water issues. As one interviewee from an NB environmental advocacy group stated, "[… the composition of the watershed group] depends completely on who's at the table and who is interested in your watershed". In this sense, the data pointed mainly to the necessity of involving a range of knowledge contributors, rather than a range of knowledge contributions (such as particular "expert" or "local" types) specifically. However, the skills and knowledge stemming from members' vocations and interests were tapped into in regards to water governance initiatives.

Five participants, from HRAA and MRA, noted that group membership often grew outward to the people that the case study group members knew through personal contact. For example, an interviewee from HRAA shared a story about a retired environmental educator from the States who spent his summers along the Hammond River, saw the activities of the group and wanted to share his expertise. An MRA participant commented: "Initially I think most people say "Yah, I'll be on that committee" and don't have a clue, they don't have ANY idea what's out there [...] but they think it's a good idea, and they want to help us [...]". Bringing personal contacts into group decision making also occurred in regard to consultants, wherein experts who were brought in were often people that a staff or board member knew. As one MRA participant noted, "[My colleague] and I, we know a lot of people. So it's a matter of a phone call to say 'Well look, we're thinking of doing this stream bank restoration, and we're thinking of doing it this way, what's your experience?'".

In addition to either an "expert" or "local" knowledge type being found within each individual seated around the decision-making table, the case study data indicated that both local and expert knowledge contributions may be found within the same person. A participant from MREAC commented:

> I think the technical may have specialized knowledge which might not be available to a lot of people, and vice versa. But it's more of an approach. I don't personally see the two as being disparate entities; they're one and the same, just approaches I guess. The way I look at it is that each side specializes. One side is the technical. To be effective you would *have* to have the other.

Seven participants, from GDDPC, MRA, MREAC and NWAI, observed that individuals engaged both formal training and local knowledge in water governance within NB watershed groups. As one interviewee from GDDPC expressed, "Both, it's both! You can't have one without the other. It won't be a complete picture". Speaking also from the perspective that humans hold both types of knowledge, and that both are fundamentally necessary for environmental governance, one participant from NWAI observed:

> There's a difference between expert knowledge and local knowledge in some respects, but I don't know if they're the purview of any particular group. So the one individual can have local and expert … for me it's the lived experience. Fundamentally, the literature is trying to separate "expert" and "local", and I would challenge that […]. Whether it's government or community or anywhere, people want specialized [knowledge] as opposed to looking at things holistically […]. Holistic thinking is the only thing that is going to get us anywhere.

Eight participants, from all of the case study groups, mentioned that staff and members of the groups tended to take on a lot of responsibility without seeking outside help. This evidence suggests that staff and group members engaged, within and of themselves, all of the knowledge necessary for the tasks within the group. While this unexpected finding did not emerge from the literature review, it was quite prevalent, being observed through personal observations during discussions with the interviewees and in reading documents, especially the watershed group

newsletters. Meetings, management plans and monitoring, in small board situations, tended to be done all by the same people, using the knowledge that they had or could find themselves. One interviewee from NWAI described the situation with the comment, "everybody needs to be an expert on everything". When extra funding was available (discussed in subsection 5.3.1) the groups hired "expert" consultants for specific tasks, in order to utilize the distinct types of knowledge specialized for that task.

Results revealed that all five case study groups considered local community relations to be important to the operations of the group. While data from all five case study groups indicated that local community relations were important for the operations of the group, a case-by-case analysis also revealed that seven interviewees, as well as documents and meeting minutes from all of the five case study groups, noted the difficulty of engaging potential local knowledge contributors in water governance processes. One participant from MRA described the experience this way:

> That generation (and I say "that generation" because it's often people that are quite a bit older than I am) don't quite understand why we're interested. They think there's an ulterior motive there because that's not something they're used to. Yes, family members, absolutely; the kids grow up and they eat, sleep and drink the farm or the woodlot or the sugar bush, or whatever it might be—the watershed, canoeing, the river, anything. But why would an outsider or somebody that's essentially not related to [them] be interested, and what are they up to?

Evidence from an NWAI interviewee reflected another difficulty in engaging local contributors:

> It's very difficult—boards—I think there's a psychology to board structures. I mean, they tend to be the same kinds of people, in small communities. They tend to be professional, they tend to be well-educated, they tend to be in the middle to upper income class - those are the people [involved]. A single mom dragging her groceries home on the bus, and hauling a kid with her, isn't going to go home and then go to a board meeting.

In the same vein, a MREAC participant pointed out that a true cross-section of the citizens of the watershed was unlikely to occur because people only involved themselves in watershed group activities if they had an interest. The topics of water and the environment would not interest everyone in the watershed. He stated it this way:

> You can't get a good representation if you only have 20 people show up at a meeting, right? Joe Citizen that doesn't care about the environment isn't going to be there. No one's getting paid to go there. You never get a cross-section of society because, if you don't care, you just don't show up! So the only people that you get there are the people that care. So you're only getting one segment of society.

In addition to the difficulty of engaging local citizens, four participants, from GDDPC, MREAC and NWAI, spoke about struggles with involving different sectors such as municipal government or industry. One interviewee from the DENV noted:

> Every watershed is different. They have different stakeholders. Some will have fishing communities, others will have a lot more agricultural stakeholders, and some will have a lot of industry. It just depends on where you're at in the province […] If you look at it on a broader scale, most of the major stakeholder groups, somewhere in the province there is a group that is involved with probably one watershed group. It's very specific, I find, and very different between territories—watershed group territories.

Though this was noted as a challenge by the DENV participant, it was not expressly noted as a challenge by any of the case study watershed group interviewees. Indications of this challenge were, however, drawn from the results of the case-by-case analysis. For instance, MRA reported having willing First Nations representation in decision making, whereas MREAC and NWAI shared experiences of unsuccessful attempts to gain First Nation involvement. GDDPC and HRAA did not mention First Nation activity at all, perhaps indicating that there was not a First Nation presence within those watersheds, or that the Fist Nation people in the watershed had watershed groups of their own (as is the case in at least one area of NB). While it seems evident that each watershed has a different composition of citizens, institutions, industry, etc., and

therefore each watershed group has a different array of members and external folks to tap into, most of the groups seemed to be similar in regards to external contacts (see subsection 5.1.1 regarding knowledge brought into group decision making).

Data from two of the case study groups, GDDPC and HRAA, suggested that ongoing recruitment was an important aspect of the everyday functioning of the watershed group. This result was shared by the groups located in a small watershed, and not evident in the large watersheds, urban or rural groups, when those comparison analyses were made. In the case of three of the groups, HRAA, MRA and GDDPC, reaching out to youth was a priority. This was also evident as a commonality between the groups located in small watersheds, but not in the large ones. However, the case-by-case analysis revealed that four of the groups considered school environmental programs and workshops to be an important aspect of ongoing recruitment and local outreach. The programs reached out to a wide selection of students and educators across the watershed and trained them on different aspects of water quality and monitoring. This was evident in all analyses except among the groups located in large watersheds. As one interviewee from GDDPC noted, "You have to start from young ones. Teach them well as they grow up". A statement in an HRAA newsletter echoed this with the words "It is our belief that educational programs are extremely valuable to the river system because, not only are the youth that they reach the future anglers of the [local river], but they are future land owners, land developers and recreational users of the river".

Deliberation

The literature reviewed for this thesis (Chapter Two) revealed that, when bringing different forms of knowledge together in decision making, it is important to have deliberation between scientific and other knowledge contributors during the various stages of governance in order to

reduce conflict. Analysis showed that the five case study groups agreed, through the comments of 11 interviewees, that chances for deliberation and working towards consensus were valuable to the decision making quality of the group. For example, ongoing general meetings were considered in data from HRAA to be important for bringing knowledge together in decision making and engaging new ideas and interest. Participants from four of the groups—GDDPC, HRAA, MRA and MREAC—suggested that decision making was positive within the group for the most part, because many of the contributors around the decision-making table held common interests. Several participants noted that crisis situations were not dealt with regularly, and that there was no real cause for disagreement among those involved. Data from only two cases, MRA and NWAI, indicated that formal processes for remediation between disparate knowledge contributors were in place. All of the groups, as suggested by six interviewees and document review, also contended that deliberation allowed the opportunity to establish a clear vision and goals and plan to get there. On a negative note, one participant from MREAC described:

> It gets a little sticky at times when the media show up at some of the presentations. They can run wild with some of the information, of course, and make it much more of an issue than it was in our meeting. And then they [MREAC members] feel a little blind-sided by that, but normally they know who's in the room. Media sometimes, actually, squelches the discussion sometimes, because you have to be aware that this is going to be sometimes on front page news when the following Leader [(local newspaper)] comes out.

A challenge related to bringing together a broad representation of knowledge types was that of knowledge translation between the various knowledge types. This concern was evident in the rural cases as well as the cases located in small watersheds. Six participants, at the GDDPC, MRA and NWAI, believed that while technical expertise was essential for water governance, in collaborations there also should be knowledge of how to translate the technical expertise into

everyday language. Deliberation created opportunities for people holding different knowledge to learn from each other, and come to a common understanding.

Legitimacy and Value

The literature suggests that there may be scepticism among some actors concerning the legitimacy and value of different types of knowledge (Armitage *et al.,* 2007; Legano & Ingram, 2009). As seen in subsections 5.1.1 and 5.1.2, different knowledge contributions may be valued differently and, as shown in the previous subsection regarding representation, there are actual difficulties in bringing different types of knowledge to the collaborative decision-making table. Data analysis using case-by-case, rural vs. urban and small watershed vs. large watershed comparisons, revealed several notable highlights that will be outlined in this subsection.

Nine interviewees, representing all five case study groups, agreed that ongoing involvement or work with collaborative groups increased the perception of legitimacy and value of disparate knowledge contributions. Analysis revealed, through six interviewees from all five of the case study groups, that the longer a person was known to the group, the more their knowledge contributions were perceived as legitimate and valuable by the group members.

Three interviewees, from the GDDPC, DENV and an environmental advocacy group, as well as personal observations at the Atlantic Riparian Forum in October 2011, however, indicated that "expert" knowledge still predominated in importance compared to local knowledge. For example, technical scientific presentations were the key focus at the Forum.

As described in subsection 5.1.1, "expert" scientific knowledge was important to collaborative water governance in NB, and data indicated that verification of other knowledge contributions might be achieved through review of knowledge inputs by "expert" knowledge

holders. This was noted in the MRA Provisional Water Classification Report (MRA 2005) and the NWAI Water Classification 1st Year Report (NWAI 2002), and heard in two interviews with participants from MRA and MREAC. This was further seen in the emphasis on the use of "expert" guidebooks, guidelines and certification to inform volunteers of how to do water governance activities correctly, as mentioned by one MREAC participant and evidenced in the five case study groups' water management documents and meeting minutes. An emphasis on the value of expert knowledge contributions was backed by more evidence within urban cases than rural cases.

Including "expert" knowledge contributions through bringing in consultants on specific projects—exemplified in six meeting minute documents and expressly noted by one participant from each of the case study groups (see subsection 5.1.1)—was suggested to be a way of increasing the legitimacy of the group decisions. The presence of expert knowledge among board members may also increase the legitimacy of group decisions, as suggested in five interviews with participants from HRAA, MREAC and NWAI.

According to literature, however, in collaborative governance the involvement of a broad representation of participants beyond "experts" is necessary (see Chapter Two). Among the five cases studied, the value of local contributions was evident in that local community volunteers were gratefully acknowledged. Noting this were the NWAI Provisional Water Classification Report (NWAI 2004) and the HRAA Watershed Management Plan (HRAA 2008b), the meeting minutes from GDDPC, HRAA and MRA and two interviewees from GDDPC and HRAA. Also, legitimacy of local contributions was shown in the MRA Provisional Water Classification Report (MRA 2005), which acknowledged that anecdotal information verified quantitatively collected data. This document did not go on, however, to suggest that local knowledge could contribute

beyond verification in such ways as challenging or contradicting expert data. Seven interviewees, from GDDPC, MRA, MREAC and NWAI, spoke highly of local "expert" and expert "local" knowledge contributors—people with experience in the environmental field and in the local community—suggesting that local experience, alongside expert knowledge, was an important aspect in making knowledge contributions legitimate and valuable.

Issues were found not only in how group staff valued the knowledge contributions of the group members or broader community, but also in how knowledge contributors and community members perceived the group. Four participants from GDDPC, MRA, NWAI and an environmental advocacy group, expressly stated that this issue was a concern for collaborative watershed groups. When speaking about "expert" knowledge contributions, one from GDDPC participant observed:

> …all I know—and I know a few words—is that I was lost myself. It's too abstract - it's okay for the scientific community - that's fine for them […]. So that's what I find. When you're dealing with things like [collaborative group activities and decision making], my thing is use simple words and use very concrete things so people can relate to it.

Knowledge translation might have increased the validity of both "expert" and "local" knowledge types in the eyes of the other. Two participants, one from MRA and one from an environmental advocacy, however, noted the particular difficulty in verifying knowledge contributions involving values—such as "local" types of knowledge—instead of more objective "expert" types of knowledge.

5.3.3 Summary

As discussed in Chapter Three, the evidence was compared and contrasted among each individual case, between rural organizations versus urban organizations, and between organizations operating in small watersheds versus those operating in large watersheds. In the

analyses the interview data were considered to be of primary importance, and data from documents and personal observations were taken into account as secondary, supporting or refuting evidence.

The case-by-case data analysis revealed that leadership and roles are viewed as highly important capacity factors affecting the engagement of knowledge. In terms of facilitative factors, the individual case analysis showed full support for the importance of representation within the group. Support included the necessity of a mix of staff, members and community members. Additionally, this analysis revealed that all groups fully agree that legitimacy and value of knowledge come through long-term commitment of the contributor to the group, as well as through expert training and a consultative role within the group.

When analyzed between rural groups versus urban groups and between small watersheds versus large watersheds, several differences came to light. For example, difficulties were noted with regard to representation—the involvement of knowledge from different sectors within the watersheds. This was revealed in the urban cases, but not evidenced as strongly among the rural groups. Similarly, the data for groups in small watersheds did not strongly suggest difficulty with sector engagement, though the evidence for groups in large watersheds did. Related to the challenge of involving a wide range of knowledge types from the sectors represented in the watershed, it was evident that representation of sectors and individual actors changed from watershed to watershed. Each watershed had a different composition of actors and the involvement of the actors varied from watershed to watershed.

CHAPTER SIX:

DISCUSSION AND CONCLUSIONS

The purpose of the research was to ascertain the types of knowledge used by individuals engaged in collaborative water governance, how the different types of knowledge are used in the governance processes, and what factors affect the inclusion of knowledge in collaborative water governance processes. This chapter summarizes and synthesizes the results presented in Chapter Five, and explores their relevance in the landscape of collaborative environmental governance. A summary of the key findings is presented, followed by a discussion of the implications for governance. Case-specific recommendations for New Brunswick are offered, and scholarly and practical research contributions are highlighted. Finally, the limitations of the study are outlined and future research opportunities are suggested.

6.1 Summary of Key Findings

As collaborative approaches to environmental governance become increasingly common research investigating what knowledge types are included (Blackstock & Richards, 2007; Feldman *et al*., 2006; Sheikheldin *et al*., 2010), how the knowledge is used (Beierle & Konisky, 2000; Kroon *et al*., 2009) and what factors affect the inclusion of knowledge in collaborative governance processes (van Buuren, 2009) is proliferating. This study contributes to the understanding of collaborative environmental governance by exploring five cases in which collaborative governance is used at a watershed level in the province of New Brunswick, Canada. The following subsections highlight the notable findings of the study.

6.1.1 Knowledge

The first research question, "What types of knowledge do individuals engaged in collaborative water governance in New Brunswick consider important for decision making?" was explored in order to clarify the types of knowledge that arose from the reviewed literature. Several key findings emerged.

The definition of the term "expert knowledge" by the study participants was analysed. Although some authors argued that the term "expert" must be revaluated within collaborative governance situations and redefined from its former understanding within top-down environmental governance (e.g., Limoges, 1993; Michaels *et al*., 2007), evidence from this study showed that expert knowledge was still considered to be an important contribution to collaborative water governance processes. Technical scientific knowledge, academic training and political expertise were considered necessary types of expert knowledge by study participants in all five cases, as can be seen by the results shown in Table 4. This evidence provides some support for the position of Olsson *et al*. (2004) who determined that knowledge related to different levels of authority is a necessary contribution to collaborative environmental governance. A notable result from an analysis of rural/urban cases revealed that, while data from neither of the rural groups suggested the importance of political expertise, evidence from all three of the urban cases noted the importance of this type of knowledge in collaborative environmental governance. This evidence adds some weight to the argument that the needs of collaborative groups are different in rural versus urban areas (e.g., Ivey *et al.*, 2002), and requirements for knowledge contributors will be unique to each particular situation.

The findings regarding the New Brunswick participants' views of "expert" knowledge are important as they highlight the continued relevance of expertise in environmental governance,

even as the changing landscape of governance introduces pressure on environmental practitioners to seek out other knowledge types such as "local" knowledge. This suggests that there should perhaps be more meaningful ways of incorporating local knowledge into governance processes. Though expert contributions are evidently important, in collaborations it is imperative that expert knowledge is not the only contribution sought.

Evidence from this study also helped to define the characteristics of "local" knowledge, a knowledge type widely considered in collaborative governance literature to be a necessary component of collaborative decision making. Analyses revealed that participants considered intimate knowledge of the watershed and on-the-ground experience in the watershed as critical; these are similar to the experiential characteristics of local knowledge that Olsson *et al.* (2004) identify. Knowledge of the people and the community within the watershed was another aspect of local knowledge noted in the data. This type of local knowledge was not emphasized in the literature. Nonetheless, it can be related to Corburn's (2003: 421) understanding that local knowledge can include "information pertaining to local contexts or settings, including knowledge of specific characteristics, circumstances, events, and relationships".

An interesting highlight is that there was not much support for the characteristic of historical knowledge. This finding may be important as it reveals a departure from traditional understandings of local knowledge and, rather, points expressly to the ongoing relevance of local knowledge. Indeed, Failing *et al.* (2007) contend that local knowledge is not static, as the term "historical" implies. Instead it is dynamic and thus should be viewed as being able to continually add knowledge and insights to governance processes. Indeed, the data regarding experiential knowledge and the lack of data regarding historical knowledge can be analysed concurrently to suggest that the value of local knowledge is in the day-to-day synthesis of local

environment/society workings, which includes observation over time. These findings suggest that fluid and changing local knowledge may be a suitable counterpart for more concrete and factual scientific expert knowledge.

The data showed that local knowledge was considered complex and entwined with other forms such as "expert" knowledge. Evidence revealed that members of the case study groups found knowledge contributors who were both local, and who had specific expertise, to be most beneficial to collaborative decision making. The importance of "local experts" was emphasized, which is consistent with literature that depicts holistic "ways of knowing" as a more appropriate lens through which to view knowledge (Feldman *et al.*, 2006; Feldman *et al.*, 2009; van Buuren 2009) (see subsection 6.2.1). These indications suggest that local knowledge may be an integral aspect of expert knowledge contributions.

The findings presented above are important because they point to a more holistic perspective of "knowledge" that is emerging as collaborative forms of governance become increasingly common. The evidence reveals that local knowledge contributors should be pursued in a manner that focuses less on distinct knowledge types, as has been done in the past, and more on the combined experience and knowledge of the actor. It also suggests that collaborative governance decision-making processes can perhaps provide more suitable tasks and roles for local knowledge contributors. Thus, the findings also have implications for how knowledge is used.

6.1.2 Use of Knowledge

After analyzing the different types of knowledge considered important for collaborative environmental governance, the study addressed the question "How are different types of knowledge used in collaborative water governance processes in New Brunswick?" The analysis

produced a number of findings that added detail to the process stages suggested in the literature. The findings are outlined below.

Evidence regarding the use of expert knowledge was seen in all phases of collaborative governance in NB. This was consistent with results revealing the perceived importance of expert knowledge contributions (see subsection 6.1.1). Expert knowledge was contributed both by staff and board members of the case study groups, and by consulting contributors from outside of the watersheds. Findings suggest that staff and board members used their academic knowledge and technical experience in goal-setting leadership. Data also indicated that often the expertise for the monitoring phase was found within the staff and board members of the group.

Evidence suggested that bringing in expert knowledge contributors from outside of the watershed was a component of the goal setting phase. Findings also supported that, during the monitoring phase, all of the cases had a close association with government departments for expertise during their monitoring work and for data review. The "urban" cases engaged NB environmental institutions for expertise as well, perhaps indicating the use of local expertise as institutions may more readily be located in populated areas. Data suggested that urban groups and groups in large watersheds more readily use the expert knowledge of staff and board members in planning, whereas the rural groups and groups in small watersheds more readily sought out volunteer members to administer plan development. This provides further evidence that collaborative group issues may vary depending on geographical location (e.g., Ivey *et al.*, 2002).

Notable evidence revealed that only two of the cases fully engaged both expert and local knowledge types together. In the stage of "planning", evidence revealed a lack of information about the use of local knowledge types, except during the Water Classification Program when

engaging local knowledge contributors was a required part of the process. This may indicate a limitation of the study, as interview questions were not directed towards the planning that occurs during ongoing projects and activities, other than activities resulting in management plans such as the activities of the Water Classification Program. Findings regarding the use of knowledge during the Water Classification Program indicated that both expert knowledge and local knowledge were engaged in determining which classes to identify the rivers within the local watershed. During the Water Classification Program, evidence also indicated that the case study groups had difficulty in gathering interested local citizens together.

Local knowledge was used in a much more limited sense than expert knowledge during all phases of collaborative water governance engaged in by the case study groups. For example, evidence from only three of the cases expressly suggested that local knowledge was used regularly in the goal-setting phase. Where it was used, it provided insights to the group decision-making process through observations gained from people living within the local watershed. The data did not reveal the input of local knowledge in the planning or monitoring phases of collaborative governance, while evidence suggested that technical expertise was essential for water governance. Nonetheless, evidence also revealed that members of the case study groups believed that in collaborations there should be knowledge of how to translate the technical expertise into everyday language. Thus, despite the evident lack of local actor contributions, the members of the case groups recognized the need to provide understandable and useful information to the local citizens. This is consistent with the assertion of Cash *et al.* (2003) that scientific information will be acceptable to citizens only to the extent that it is perceived as salient, credible and legitimate. While the case study groups engaged a broad representation of expert knowledge types, both from within and outside of the local watershed, there was little

evidence pointing to the involvement of local knowledge types. The literature, however, called for more knowledge-inclusive processes. For example, Cundill and Fabricius (2009) assert that combining knowledges can improve decision making and increase transparency and accountability among participants which is crucial within collaborative governance settings.

These findings are important in understanding the challenge of knowledge inclusion that faces organizations involved in collaborative governance. The fact that the findings reveal a much more overt reliance on expert knowledge than local types of knowledge provides weight to the argument of Stringer *et al.* (2006) that different mechanisms should be employed throughout decision-making processes in order to engage different knowledge types. However, when the evidence is analysed alongside the findings revealed in subsection 6.1.1, the issue is made more complex because of the holistic view of knowledge that was seen in the data as compared to in the literature. The issue is not one of learning how to engage distinct expert and local knowledge types in decision making. Rather, it is a complicated issue of how the holistic contributions of both local and expert knowledge holders can be included together in the pursuit of beneficial environmental solutions.

The reliance on the expert knowledge of local board members, rather than consulting experts outside of the watershed, may suggest an inherent use of local knowledge in decision making. Without consciously seeking local knowledge contributions, the groups have found local knowledge among their membership. Indeed, subsection 6.1.1 revealed that a most valuable knowledge type was the "local expert" type. A shift to a more holistic understanding of knowledge may relieve the pressure on collaborative environmental governance organizations to overtly seek local knowledge contributors, as much of the local knowledge necessary for environmental governance is readily available from the local experts within the group. The

factors effecting the inclusion of multiple knowledge types in collaborative governance will be outlined in more detail in the following subsection. The findings in subsection 6.1.3 reveal, again, the difficulties of engaging different knowledge contributors. The findings also indicate that, in collaborative governance decision making, there should be emphasis placed on engaging the holistic knowledge contributions of the actors who are part of each group.

6.1.3 Factors Affecting Knowledge Engagement

As a final analysis, the capacity and facilitation factors that affect the engagement of knowledge in collaborative governance processes were analysed to answer the question "What factors affect the inclusion of knowledge in collaborative water governance processes in New Brunswick?" The analysis revealed findings that added detail to the information in the reviewed literature, and which are highlighted in this subsection.

The evidence revealed a number of factors considered to be influential in engaging knowledge in collaborative governance processes. Funding was indicated to be a limiting factor in terms of knowledge inclusion, verifying literature which emphasizes the same point (Ryan & Klug, 2005). Findings noted that small budgets impeded groups from hiring staff with the necessary knowledge for collaborative environmental governance. Lack of funds to hire necessary staff members resulted in a reliance on volunteer efforts. Additionally, data indicated that lack of funding reduced the ability to define roles, and staff members took on tasks that they were not necessarily skilled at. Though there is a broad literature regarding the aspect of funding and actor involvement in collaborative processes (Brackbill, 1999; Bradshaw, 2003; Carmeli, 2002), there is a far smaller literature regarding the relationship between actor roles and actor knowledge contributions (see Lundqvist, 2000).

The definition of roles was indicated by the field data to be important for knowledge engagement within collaborative groups. With defined roles, each actor was more likely to be working within their area of expertise, skill and experience. Following the importance of defined roles in collaborations, leadership was a factor of capacity suggested in the results to be important. Though data revealed particularly case-specific aspects important for leadership, notably only one aspect was considered commonly across all five of the case study groups: the actor in the position of leadership within the group was responsible for knowledge interpretation and transfer between the different knowledge types involved. This finding was similar to the literature of other authors who contend that local citizens are more open to environmental solutions if the information is understandable to them (e.g., Cash *et al.,* 2003).

The findings regarding funding and roles were consistent with the reviewed literature, and provided additional evidence that despite the best intentions of the members of the collaborative group, certain factors of group capacity have influence on which knowledge contributors will or will not become engaged, such as lack of funds for hiring or the ability to determine distinct roles and tasks for members. Further details of the implications of the results concerning actor roles and leadership will be discussed in Section 6.2.

Regarding representation of knowledge types within collaborative groups, the data indicated that staff and members of the group engaged both expert and local types of knowledge, within each individual, and tended to complete projects often without seeking expertise or local knowledge from contributors outside of the collaborative group. This suggested a narrow representation of actors, while concurrently indicating a wide representation of knowledge types. At the same time as the evidence suggested a narrow representation of actors, however, results also suggested that local community relations were important, with much effort spent in being a

presence within the watershed. Despite the emphasis on community relations, findings noted that engaging local citizens in all stages of collaborative decision making was difficult. Other authors provide detailed reasons for this difficulty (e.g., Dorcey & McDaniels, 2001; Irvin & Stansbury, 2004; Koehler & Koontz, 2008; Warriner *et al.*, 1996). Though these reasons were beyond the study scope, they reach the heart of the intent of the research project, as the study aims to reveal details about knowledge in collaboration for the purpose of gaining an understanding about how to fully engage knowledge contributors of all types.

Evidence also indicated a similar difficulty in engaging knowledge contributions from different sectors within the watersheds. NB watershed groups noted difficulty in engaging the participation of local sectors such as First Nations, local government, business, and industry. This was a relatively case-specific finding. Local industries were particular to each watershed, some groups had the involvement of local government (local government levels varied depending on location within province), and the involvement of First Nations varied as well. Results revealed that these realities were largely based on relationships between the watershed group and the various sectors—mirroring results found by other authors (Berkes, 2009; Ferreyra & Beard, 2006; Innes & Booher, 2004)—and the level of local interest in specific projects that the watershed group carried out.

Local knowledge contributors were difficult to engage, and often interest in what the watershed group was doing was very limited among community members. Evidence showed that, for the knowledge contributors who did become involved, deliberation and consensus-building were considered to be necessary. Findings indicated that deliberation provided a clear vision, goals and a plan to reach the goals. This was consistent with other authors who describe the benefits of deliberation similarly (Koontz & Johnson, 2004; Bidwell & Ryan, 2006). Though

not quite as evident in the data, the importance of bringing multiple knowledge types into decision making through deliberation was suggested. The knowledge-engagement aspect of deliberation was highlighted in reviewed literature (e.g., Connick & Innes, 2003; Gutmann & Thompson, 2004; Roberts, 2004). Evidence also indicated that translation between different knowledge types was important for collaborative governance decision making. Some authors contend that knowledge translation takes place during deliberation (e.g., Roux *et al.,* 2006). Thus, when both sets of data regarding knowledge and deliberation were analysed together, there was strong evidence that the engagement of knowledge in collaborative processes was facilitated by deliberation.

In addition to the analyses of results concerning the facilitating factors of representation and deliberation, evidence regarding legitimacy and value was analysed. Data revealed that legitimacy and value were found in a knowledge contributor's long term experience and involvement with a collaborative group, as other authors have noted (e.g., van Buuren, 2009). This evidence also provided support for the emphasis on "local experts" among participants.

Legitimacy and value were indicated to be gained through training activities and guidelines for those involved, an aspect of collaboration encouraged by authors such as Innes and Booher (2004), as well as found in the knowledge contributions of expert consultants. In addition, evidence from three of the groups suggested that verification of knowledge contributions could be achieved through the review of knowledge inputs by expert knowledge, and data from three of the groups revealed the importance of the scientific experts—either staff or board members—within the group.

The importance of expert types of knowledge is continually acknowledged in literature alongside the acknowledgement that there are many untapped contributions within the realm of

local knowledge as well (e.g., Failing *et al.*, 2007). Highlighted in the small/large analysis was a difference between the cases in small watersheds compared to the cases in larger watersheds concerning this point, however. The data from the two groups in large watersheds indicated that more emphasis was placed legitimacy and value being gained through the review of knowledge contributions by scientific experts, whereas the data results from the three cases in smaller watersheds indicated that more importance was placed on legitimacy and value through the local community's perception of the group. Though the data revealed clear evidence that expert knowledge provided legitimacy and value to the decision making of the group, the perception of the group by the local community was indicated to be another necessary component of legitimacy and value for four of the cases. This finding reflects the work of Fischer (2000), which revealed that citizens expect transparency in decision-making processes, as well as access to issue-related information that they can understand. With openness and transparency, a collaborative watershed group may have better success at gathering local and expert knowledge contributors from within the community.

In summary, the case study analysis of five collaborative watershed groups in New Brunswick has provided insights relevant to the three research questions that underlie this thesis. The results of Research Question 1, 2 and 3 have broad implications for collaborative environmental governance, which will be outlined in detail in Section 6.2.

6.2 Implications for Governance

Collaborative forms of governance are increasingly common in the landscape of water resources. For example, hundreds of water collaborations exist in the United States, Canada and Australia (Leach & Pelkey, 2001). As was highlighted in Chapter Two, research into collaborative forms

of governance leaves many questions to be answered concerning how multiple types of knowledge should be incorporated into the governance processes. This study used a multiple case study approach to analyze knowledge inclusion in collaborative governance processes, and thus provides additional clarity to the literature on the topic. A number of knowledge types, uses and factors that contribute to successful knowledge-collaboration have been identified and explained. This section explores the implications of these findings for collaborative governance.

6.2.1 Holistic Knowledge

With the increasing utilization of collaborative forms of governance to manage environmental resources, there is continual need to understand the knowledge that is necessary for the collaborations. At the outset of the shift from top-down to more collaborative forms of environmental governance, there was a general acknowledgement that a more diverse range of knowledge types was necessary beyond scientific expert types (e.g., Blackler, 1995; Feldman *et al.,* 2006; Innes & Booher, 2010). In recent years authors have begun to turn their attention to more comprehensive ways of understanding knowledge. Knowledge is seen increasingly as complex and variant, rather than as "monolithic" entities such as expert and non-expert (Corburn, 2003). Clarity on the issue of how to view knowledge is crucial for gaining a greater understanding into effective collaborative governance.

In this study, for example, on-the-ground participants in the case study groups often had difficulty drawing distinctions between "expert" and "local" knowledge. Local contributors and expert contributors evidently input both scientific and local knowledge, depending on their personal background. Many members of the case watershed groups were retired or working career people employed in areas of expertise that continued to provide valuable contributions to the watershed group. Alternatively, experts brought into the group on specific contracts were

also sometimes previously affiliated with the group outside of the particular project contract, because of personal connections to the group, the cause or the area.

Recent studies in organizational and knowledge management delve into the concept of holistic knowledge, and recognize that participants of collaborative governance decision making each hold individual "ways of knowing" that encompass their training, context, background and belief systems (e.g. van Buuren, 2009). With regard to the understanding of "expert" and "local" knowledge types and the distinctions that have been drawn in the literature between tacit and explicit forms, outlined at the beginning of Section 2.2 in this thesis, Wolfe (2009) points out an alternative perspective in which tacit and explicit forms of knowledge are interdependent and co-existent. "Tacit knowledge provides the context—the meaning, priorities and values, or how we understand the world—while explicit knowledge provides the tools that we use to act upon that understanding" (Wolfe, 2009: 492). Less focus on distinct "expert" and "local" knowledge types, and more emphasis on how the holistic knowledge inputs of group members might best be utilised, is appropriate. However, a focus on holistic knowledge does have implications for collaborative governance processes; these are discussed below.

6.2.2 Stages of Collaborative Governance

The data revealed answers as well as questions concerning what knowledge types should and could be involved at each stage of governance. While collaborative governance literature suggests that both local and expert types of knowledge are necessary for all stages of collaborative governance initiatives, the findings in NB suggested that in reality this is a challenge to achieve. Even where programs such as the Water Classification Program required the involvement of a diversity of actors in all stages of the decision-making process, groups were faced with disinterest among community members who could provide local types of knowledge.

More often than not, in ongoing water governance activities, it was expert knowledge contributions and contributions from staff and dedicated board members that drove each phase of water governance as meaningful interest was difficult to engage among members of the public community. This is a major inhibitor to collaborative environmental governance. As Blackstock and Richards (2007: 497) point out, "small numbers may preclude having all interests present, resulting in trade-offs between representative legitimacy and deliberation".

Studies, such as by Raymond *et al*. (2010), attempt to provide a framework for knowledge integration, and offer advice on how to incorporate both local and expert knowledge at each phase of collaborative governance. Kroon *et al.* (2009) also recognize the issues of knowledge inclusion in collaborative governance, in particular the tensions between biases and uncertainty among different types of knowledge. Their study suggests the importance of the timing of knowledge contributions, in that timing affects how knowledge contributions can be debated and integrated into decision-making processes (Kroon *et al.,* 2009). While it is evident that different stages of governance require particular knowledge inputs, and that the timing of knowledge inputs is critical for the final outcomes of the decision making, it is less clear as to what knowledge contributions are needed at each stage of the governance process. In a 2009 study, van Buuren found that successful collaborative governance processes are realized through the informal and formal inclusion of several different components of knowledge—different frames, interpretations, or normative perceptions of reality. Thus, using a holistic view of knowledge, the author was able to determine that successful deliberation between actors can be possible. It is important to achieve successful deliberation among a broad variety of knowledge types during all phases of collaborative environmental governance.

6.2.3 Actor Roles and Leadership

The NB cases were all small groups of one to three staff and around ten voluntary board members. In the context of the use of knowledge, participants of all five cases commented on the effectiveness of roles. Data from the groups with two or fewer staff (MRA and NWAI) indicated that a distinction in roles and the tasks belonging to each role would be beneficial. The few staff within these cases was responsible for tasks beyond their time and training capacity. Data from the other groups indicated that the definition of roles and a structured organization were beneficial and provided clarity to the work of the group. Defining actor roles was not a collaborative governance challenge that came up in the literature review in regard to the question of how knowledge should be engaged and included. Although Blackstock and Richards (2007) contend that the inclusion of a broad diversity of participants can generate ambiguity in roles and result in tensions within the collaboration, the NB cases did not report any tension.

An essential role described in the data was that of leadership. A common view among the cases was that leadership has an essential task of translating and transferring knowledge between the different actors in the collaboration. This result is consistent with observations presented by other authors (Berkes, 2009; Hahn *et al.,* 2006). For example, Berkes (2009: 1696) suggests that leadership is a key factor that enables collaborative governance to "deal with knowledge issues, especially if local knowledge is based on a different epistemology and worldview than government science". Some authors contend that the interpretation, comparison and integration of expert and local types of knowledge are necessary to make judgments about which of these different forms of knowledge are valid and trustworthy (Blackstock & Richards, 2007).

6.3 Case-Specific Recommendations

The research reveals a number of implications for collaborations dealing with water governance in New Brunswick. First, a perspective of knowledge that is holistic would allow participants to better understand ways in which to engage the knowledge that is needed for collaboration. Currently, programs such as the Water Classification Program require local knowledge to be actively sought from among the public, in order that decision making might be a collaborative effort between experts and local contributors. The findings of the multiple-case study in NB suggest that engaging local knowledge is not easily or readily done. It is important to note that the data reveal that a comprehensive understanding of knowledge exists among the people who participated in this study. In their minds expert and local knowledge are not clearly separated. This creates opportunities to enhance collaboration. For example, while it may be difficult to engage the local community members in discussions about water quality, the group members with expert training may themselves have valuable knowledge about the local area. The data suggest the need for a greater recognition of holistic knowledge, rather than distinct "expert" and "local" knowledge types within collaborative governance. As one study participant stated: "[Natural science expertise] is often not as important as the rounded out experience that these people bring to the table. It's not necessarily their science as much as who they are—their life experiences".

Second, recognition that knowledge is holistic has implications on the governance processes of the NB watershed groups. Study results indicated that even during the Water Classification Program, in which the government stipulated that there be outreach to all watershed stakeholders, gaining representative involvement from local knowledge contributors was not an easy task. The goals of the Water Classification Program regarding stakeholder

involvement in the process were focused on participation, sharing points of view, dialogue, providing information and knowledge, acting for the good of the watershed, increasing community access to environmental issues and decision making and averting resistance to the objectives of the program (Tims, 1999). This set of goals was reflected in the Provisional Water Classification documents reviewed in this study project. Indeed, study data indicated that the Water Classification Program was successful in encouraging the inclusion of a broad representation of knowledge types. For example, data from three of the groups, GDDPC, HRAA and NWAI, indicated that the program was effective in deepening relationships with the local and broader community. Some of the groups had even adopted the collaborative goals into their ongoing work after the Water Classification process. For example, one interviewee from HRAA, a newsletter from NWAI and GDDPC meeting minutes spoke of engaging with other citizen groups, also those which were not water resource-related. However, actively inviting local community members to take part in group initiatives, such as watershed governance and restoration projects after the Water Classification Program had been completed, had a different tone than "engaging a representation of knowledge types". To illustrate, one case study group newsletter stated: "if you are looking for some great volunteer experience to boost a résumé or just to fill in some time helping the association and the environment, feel free to drop by or phone us and we will be more than willing to match you up with a suitable activity!" This did not suggest an acknowledgement for the need of specialized knowledge from the local community members, but rather pointed to the use of local volunteers for hands-on physical work.

While data indicated that the Water Classification Program was successful in engaging local knowledge, the engagement seemed to have been limited. As mentioned in the first point of this section, data indicated that it was difficult to engage local knowledge contributions. If the

focus was on the different aspects of holistic knowledge, as outlined by van Buuren (see subsection 6.2.1), perhaps the knowledge of the current group members would be more fully utilised, reducing the need for external sources of, for example, local knowledge. Fully utilising all aspects of the knowledge of the existing members might also reduce the time and effort that groups currently feel they have to put into gaining the interest of—often disinterested—local citizens.

6.4 Scholarly Contributions

The purpose of this research was to analyze key aspects of knowledge inclusion in collaborative water governance processes, in order to provide insights to policy makers. To accomplish this goal, the experiences of those involved in collaborative watershed groups in New Brunswick were used as a multiple-case study. The study was designed to provide both scholarly and practical contributions.

The findings have several implications for governance, as detailed in Section 6.2. After conducting an in-depth study of knowledge in collaborative water governance, findings were discussed in relation to the evidence found in academic literature. The results of this study supported major themes in the literature, but provided additional weight for several newer perspectives within collaborative governance research. Section 6.2 revealed a number of considerations for further study. These included developing a stronger understanding of knowledge, the stages of collaboration, actor roles and the necessity of leadership.

This study provided clarity to the terms "expert" and "local" knowledge types in water governance. Whereas authors presented broad definitions such as "professional" (Edelenbos *et al.*, 2004), "technocratic" (Fischer, 1990), "historical" (Fischer, 1990), "experiential" (Edelenbos

et al., 2004; Pahl-Wostl *et al.*, 2007), and "practical" (Failing *et al.*, 2007), the data gave practical descriptions such as knowledge of GIS or knowledge of the local culture. Also highlighted was the importance of "local expert" contributors. The strength of evidence for combined "local" and "expert" knowledge was significant and furthers the observations of "ways of knowing" as a holistic perspective of knowledge.

The stages of collaboration suggested in the literature were found to fit the activities of the case study groups, though the use of multiple knowledge types within each stage was not readily evident in the study data. Two conclusions were drawn from this finding: the lack of definition of knowledge types is due to a holistic understanding of knowledge, wherein the study participants could easily point out the technical knowledge while the inherent local knowledge was not deciphered, and; it is increasingly important to study ways in which multiple knowledge types can be engaged at each stage. The first conclusion supports further study into a holistic understanding of knowledge and how the inseparable components of knowledge might be engaged in collaborative governance initiatives. The second conclusion supports the study of knowledge integration tools and mechanisms for each distinct stage of collaborative governance.

This study also provided weight to the necessity of several capacity components that influence knowledge inclusion. These components were funding, leadership and actor roles. Aspects that did not receive much acknowledgement in the study data were location of the group and timing of meetings. Clarity was added to the understanding of leadership in the context of knowledge inclusion. Evidence strongly pointed to the essential task of the group leader in translating knowledge and understanding between different contributors.

Results from the study demonstrate support for the necessity of broad representation within collaborative governance, but highlight immense challenges in gaining local involvement. Again,

conclusions can be drawn concerning a holistic perspective of knowledge. A holistic perspective may reduce the stress on collaborative groups in terms of achieving local contributions. The expert members of the group tended to be local citizens as well, and their local knowledge contributions could be viewed similarly valuable to the local knowledge of potential contributors who were difficult to engage. This opens up further possibility for research into knowledge inclusion tools and mechanisms, beyond searching for optimal ways to engage far-flung and often disinterested local citizens. Tools and mechanisms may be employed to parse out the "expert" and "local" knowledge of collaborative participants. Or perhaps it is necessary to dispense with the understanding that expertise and experience are differentiable and, rather, determine which tools and mechanisms will best draw out the valuable holistic knowledge contributions of environmental governance actors. More energy spent on learning about these various tools may be warranted.

Lastly, the study findings revealed that the legitimacy and value of knowledge are gained with expert training as well as a close relationship with the group. Knowledge contributions are thus weighed according to two disparate measures; technical and social. Both considerations are practical and provide evidence for two conclusions. First of all there is ongoing necessity for "expert" knowledge types in collaborative governance, despite the emphasis placed on "local" and multiple other types of knowledge. Secondly, relationships are a key consideration in collaborative governance. Evidence not only pointed to relationships being a factor in the legitimacy of knowledge, but also to the importance of relationships in gathering together a representation of knowledge types. Critical components of collaboration evidently are strong relationships and networks, which can be built through open deliberation, through fully engaging the use of many knowledges in the various stages of governance, and through understanding the

unique and holistic contributions of the participants. There is a large body of literature regarding relationships and networks in collaborative governance, yet there is an opportunity for this literature to focus on how relationships affect the involvement of many knowledge types.

6.5 Limitations and Research Opportunities

Interpretation of the results and contributions of this study should be considered in light of several limitations. Understanding the limitations of the study also highlights opportunities for further research.

Despite the fact that attempts were made to access a full range of experiences within NB collaborative water governance, the representation could have been broadened further. For example, the second and third criteria narrowed the study cases to groups with a similar capacity (Section 3.2). This narrowing was intensified in the final criterion when groups without a website were removed from the list of potential cases. An opportunity for further research might be a study of differently sized groups, or of groups with a greater or lesser capacity to carry out collaborative water governance. This further research might provide much different evidence regarding the types of knowledge, the use of knowledge and the factors effecting the inclusion of knowledge.

Another limitation lies in the fact that results for each case were gathered using data from interviewees who were mainly staff or highly involved volunteer board members. This may have affected the resulting evidence of the study, as these participants also tended to be highly trained in environmental issues. The perspectives of untrained group members would likely have provided different evidence regarding the types of knowledge, the use of knowledge and the factors effecting the inclusion of knowledge. This provides yet another opportunity for research.

Further, two very important sets of the NB population were left out of the study. Though fully 1/3 of the citizens of NB are French-speaking, the study did not include groups that functioned only or primarily in French. This was due to the language limitations of the field researcher. Fortunately, the GDDPC was a French-speaking group and an integral case in this study. The group qualified under all six of the criteria, and afforded an Acadian (French culture) NB perspective, to greater or lesser extent, to the study. An opportunity for more research in this regard would be to focus keenly on the French culture of water governance, in order to gain a broader perspective on collaborative water governance issues within the diverse communities of Canada. Unintentionally, another sector of NB society that was not a voice in this study was that of the First Nations. There was at least one collaborative watershed group within a First Nations reserve in NB, but the group did not qualify for the study as it had not engaged in the Water Classification Program (criteria two). Additionally, there was no representation on the case study watershed group boards by First Nations. The lack of First Nation representation in this study is notable, but not unexpected, considering the challenges of gaining First Nation representation in collaborative water governance across Canada.

With a growing demand for collaborative approaches to environmental governance in many countries around the world, studies examining the numerous aspects of collaboration are warranted. Knowledge will always be an important consideration in governance collaborations, and full understanding of the types, uses and factors effecting its engagement has not yet been realized. Studies, such as by Raymond *et al*. (2010), attempt to provide a framework for knowledge integration, and offer advice on how to incorporate both local and expert knowledge at each phase of collaborative governance. However, based on the findings of the study, perhaps a concurrent focus might be on methods for fully realizing the potential of the knowledge

contributions of each group member—both the expert as well as the local contributions that the members are able to make. Studies in knowledge management strive to understand the components of actor knowledge more completely. For example, van Buuren's (2009) research depicts "ways of knowing" as an appropriate perspective to take on knowledge. Similarly, Dewulf *et al.* (2011) look into the different ways that actors frame problems and how uncertainty in decision making may be reduced by considering multiple frames. These types of research projects are increasingly important as we grow more aware of the complex nature of actor knowledge in collaborative governance. The various aspects of knowledge will likely be the subject of ongoing study, as long as collaborative forms of governance are investigated. This study contributes to a greater understanding of knowledge, and intends to encourage further research that promotes effective governance through collaborative and inclusive decision making.

REFERENCES

Alaerts, G. J. and N. L. Dickinson (Ed). 2009. *Water for a Changing World – Developing Local Knowledge and Capacity*. Leiden: CRC Press.

Ansell, C. and Gash, A. 2007. Collaborative governance in theory and practice. *Journal of Public Administration Research and Theory* 18(4): 543-571.

Armitage, D., Berkes, F. and Doubleday, N. (Eds). 2007. *Adaptive Co-Management: Collaboration, Learning and Multi-Level Governance*. Vancouver: University of British Columbia Press.

Ballard, H. L., Fernandez-Gimenez, M. E. and Sturtevant, V. E. 2008. Integration of local ecological knowledge and conventional science: a study of seven community-based forestry organizations in the USA. *Ecology and Society* 13(2): 37. [online] URL: http://www.ecologyandsociety.org/vol13/iss2/art37/

Beierle, T. C. and Konisky, D. M. 2000. Values, conflict, and trust in participatory environmental planning. *Journal of Policy Analysis and Management* 19(4): 587-602.

Beierle, T. C. And Konisky, D. M. 2001. What are we gaining from stakeholder involvement? Observations from environmental planning in the Great Lakes. *Environment and Planning C: Government and Policy* 19: 515-527.

Berkes, F. 2009. Evolution of co-management: role of knowledge generation, bridging organizations and social learning. *Journal of Environmental Management* 90(5): 1692-1702.

Berkes, F. and Folke, C. (Eds). 1998. *Linking Social and Ecological Systems: Management Practices and Social Mechanisms for Building Resilience*. Cambridge, UK: Cambridge University Press.

Bidwell, R. D. and Ryan, C. M. 2006. Collaborative partnership design: the implications of organizational affiliation for watershed partnerships. *Society and Natural Resources* 19(9): 827-843.

Blackler F. 1995. Knowledge, knowledge work and organizations: an overview and interpretation. *Organization Studies* 16(6): 1021-1046.

Blackstock, K. L. and Richards, C. 2007. Evaluating stakeholder involvement in river basin planning: a Scottish case study. *Water Policy* 9(5): 493-512.

Blaikie, P., Brown, K., Stocking, M., Tang, L., Dixon, P. and Sillitoe, P. 1997. Knowledge in action: local kowledge as a development resource and barriers to its incorporation in natural resource management and development. *Agricultural Systems* 55(2): 217-237.

Brackbill, C. E. 1999. Financial help for utilities along the US-Mexico border. Journal of the American Water Works Association 91(4): 129-136.

Bradshaw, B. 2003. Questioning the credibility and capacity of community-based resource management. *The Canadian Geographer* 47(2): 137-150.

Bryan, T. A. 2004. Tragedy averted: the promise of collaboration. *Society and Natural Resources* 17(10): 881-896.

Bryant, R. L. and Wilson, G. A. 1998. Rethinking environmental management. *Progress in Human Geography* 22(3): 321-343.

Carmeli, A. 2002. A conceptual and practical framework of measuring performance of local authorities in financial terms: analysing the case of Israel. *Local Government Studies* 28(1): 21-36.

Cash, D. W., Clark, W. C., Alcock, F., Dickson, N. M., Eckley, N., Guston, D. H., Jäger, J. and Mitchell, R. B. 2003. Knowledge systems for sustainable development. In *Proceedings of the National Academy of Sciences of the United States of America*. National Academy of Sciences 100(14): 8086-8091.

Chomsky, N. 1980. Rules and representations. *Behavioral and Brain Sciences* 3(1): 1-15.

Connick, S. and Innes, J. E. 2003. Outcomes of collaborative water policy making: applying complexity thinking to evaluation. *Journal of Environmental Planning and Management* 46(2): 177-197.

Corburn, J. 2003. Bringing local knowledge into environmental decision making – improving urban planning for communities at risk. *Journal of Planning Education and Research* 22(4): 420-433.

Crozier, M. 2008. Listening, learning, steering: new governance, communication and interactive policy formation. *Policy and Politics* 36(1): 3-19.

Cundill, G. And Fabricius, C. 2009. Monitoring in adaptive co-management: toward a learning based approach. Journal of Environmental Management 90: 3205-3211.

de Loë, R. C., Armitage, D., Plummer, R., Davidson, S. and Moraru, L. 2009. From Government to Governance: A State-of-the-Art Review of Environmental Governance. Final Report. Prepared for Alberta Environment, Environmental Stewardship, Environmental Relations. Guelph, ON: Rob de Loë Consulting Services.

Dewulf, A., Mancero, M., Cárdenas, G. and Sucozhañay, D. 2011. Fragmentation and connection of frames in collaborative water governance: a case study of river catchment management in Southern Ecuador. *International Review of Administrative Sciences* 77: 50-75.

d' Ombrain, N. 2001. Machinery of government for safe drinking water in Ontario. Draft Discussion Paper for the Walkerton Inquiry. Toronto, ON.

Dorcey, A. H. J. and McDaniels, T. L. 2001. Great expectations, mixed results: trends in citizen involvement in Canadian environmental governance, Chapter in *Governing the Environment: Persistent Challenges, Uncertain Innovations*. Ed. E. A. Parson, 1, 247-302. Toronto, Ontario: University of Toronto Press.

Dryzek, J. S. 2005. The Politics of the Earth: Environmental Discourses. Toronto: Oxford University Press.

Duffield, C., Gardner, J. S., Berkes, F. and Singh, R. B. 1998. Local knowledge in the assessment of resource sustainability: case studies in Himachal Pradesh, India, and British Columbia, Canada. *Mountain Research and Development* 18(1): 35-49.

Edelenbos, J., van Buuren, M. W. and Teisman, G. R. 2004. By-passing barriers in sustainable knowledge production. In *Proceedings of the 2002 Berlin Conference on the Human Dimensions of Global Environmental Change "Knowledge for the Sustainability Transition. The Challenge for Social Science"*. Amsterdam, Berlin, Potsdam and Oldenburg: Global Governance Project.

Environment Canada. 2004. Case Study: Edmunston, New Brunswick. Available at www.ec.gc.ca/eau-water/default.asp?lang=En&n=DFF500EF-1. Accessed July 8, 2011.

Failing, L., Gregory, R. and Harstone, M. 2007. Integrating science and local knowledge in environmental risk management: a decision-focused approach. *Ecological Economics* 64: 47-60.

Feldman, M. S., Khademian, A. M., Ingram, H., Schneider, A. S. 2006. Ways of knowing and inclusive management processes. *Public Administration Review* 66: 89-99.

Feldman, M. S., Khademian, A. M. and Quick, K. S. 2009. Ways of knowing, inclusive management, and promoting democratic engagement: introduction to the special issue. *International Public Management Journal* 12(2): 123-136.

Ferreyra, C. and Beard P. 2006. *Assessing Collaborative and Integrated Water Management in the Maitland River Watershed. Lessons Learned II: Outcome Evaluation*. Unpublished.

Fischer, F. 1990. *Technocracy and the Politics of Expertise*. New York: Sage.

Fischer, F. 2000. *Citizens, Experts, and the Environment: The Politics of Local Knowledge*. London: Duke University Press.

Gadgil, M., Olsson, P., Berkes, F., and Folke, C. 2003. Exploring the role of local

ecological knowledge in ecosystems management: three case studies, Chapter in *Navigating Social-Ecological Systems: Building Resilience for Complexity and Change*. Eds. F. Berkes, J. Colding, and C. Folke, 187-189. UK: Cambridge University Press.

Gargan, J. J. 1981. Consideration of local government capacity. *Public Administration Review* 41(6): 649-658.

GDDPC Groupe de Developpement Durable du Pays de Cocagne. 2011a. About Us. Available at www.ecopaysdecocagne.ca/index.php?option=com_content&view=article&id=15&Itemid=6&lang=en. Accessed March 13, 2011.

GDDPC Groupe de Developpement Durable du Pays de Cocagne. 2011b. Territory. Available at www.ecopaysdecocagne.ca/index.php?option=com_content&view=article&id=15&Itemid=6&lang=en. Accessed March 13, 2011.

Gerring, J. 2007. *Case Study Research: Principles and Practices*. New York: Cambridge University Press.

Gerring, J. J. and McDermott, R. 2007. An experimental template for case study research. *American Journal of Political Science* 51(3): 688-701.

Goucher, N. P., Lagacé, E., Michaels, S. and Schaefer, K. 2007. *Towards understanding the linkages between science and source water protection policies in Canada: a survey of provincial and territorial source water protection policies*. Unpublished research paper.

Government of New Brunswick. 2000. *Volunteer's Guide to Water Quality Monitoring*. Published by the Department of the Environment and Local Government.

Government of New Brunswick. 2002. *Clean Water Act – New Brunswick Regulation 2002-13 under the Clean Water Act*. Queen's Printer for New Brunswick.

Government of New Brunswick. 2011a. Basic Facts. Available at

www2.gnb.ca/content/gnb/en/gateways/about_nb/basic_facts.html. Accessed June 15, 2011.

Government of New Brunswick. 2011b. Counties. Available at www1.gnb.ca/cnb/imagebank/display-e.asp?imageID=1193&version=e. Accessed July 8, 2011.

Government of New Brunswick. 2011c. Department of Finance. Available at www.gnb.ca/0024/site-e.asp. Accessed June 24, 2011.

Government of New Brunswick. 2011d. Geography. Available at http://www2.gnb.ca/content/gnb/en/gateways/about_nb/geography.html. Accessed June 24, 2011.

Government of New Brunswick. 2011e. Natural Resources. Available at www.gnb.ca/0078/index-e.asp. Accessed June 24, 2011.

Government of New Brunswick. 2011f. Population Estimates. Available at www.gnb.ca/0160/Economics/PopulationEstimates1.htm. Accessed June 15, 2011.

Government of New Brunswick. 2011g. The Water Classification Regulation – Planning for Water Quality. Available at www.gnb.ca/0009/0371/0003/0001-e.asp. Accessed May 1, 2011.

Guba, E. G., and Lincoln, Y. S. 1994. Competing paradigms in qualitative research. Chapter in *Handbook of Qualitative Research.* Eds. Denzin N. K. and Lincoln Y. S. London: Sage.

Gutmann, A. and Thompson, D. 2004. *Why Deliberative Democracy?* Princeton, New Jersey: Princeton University Press.

Hahn, T., Olsson, P., Folke, C., and Johansson, K. 2006. Trust-building, knowledge generation and organizational innovations: the role of a bridging organization for adaptive co-management of a wetland landscape around Kristianstad Sweden. *Human Ecology* 34(4): 573-592.

Haller, S. F. and Gerrie, J. 2007. The role of science in public policy: higher reason, or reason for hire? *Journal of Agricultural and Environmental Ethics* 20: 139-165.

Hardy, S. D. 2010. Governments, group membership, and watershed partnerships. *Society and Natural Resources* 23: 587-603.

Hempel, L.C. 1996. *Environmental Governance: The Global Challenge*. Washington: Island Press.

Hildreth, P. and Kimble, C. 2002. The duality of knowledge. *Information Research* 8(1). [online] URL: http://InformationR.net/ir/8-1/paper142.html

Hill, C. 2006. Source water protection in Canada: local innovation and multi-level governance. Chapter in *Innovation, Science, Environment: Canadian Policies and Performance, 2006-2007*. Ed. G. B. Doern. Montreal, QC: McGill-Queens University Press.

Hillman, M. and Brierley, G. 2002. Information needs for environmental-flow allocation: a case study from the Lachlan River, New South Wales, Australia. *Annals of the Association of American Geographers*, 92(4): 617-630.

HRAA Hammond River Angling Association. 2008a. Strategic Plan 2008 - 2013. Nauwigewauk, New Brunswick: Hammond River Angling Association.

HRAA Hammond River Angling Association. 2008b. *Watershed Management Plan*. Nauwigewauk, New Brunswick: Hammond River Angling Association.

HRAA Hammond River Angling Association. 2011. Watershed Management. Available at www.hraa.ca/Watershed-Management-Plan.php. Accessed March 13, 2011.

Hrudey, S. E., Payment, P., Huck, P. M., Gillham, R. W. and Hrudey, E. J. 2003. A fatal waterborne disease epidemic in Walkerton, Ontario: comparison with other waterborne outbreaks in the developed world. *Water Science and Technology* 47(3): 7-14.

Hsieh, H. and Shannon, S. E. 2005. Three approaches to qualitative content analysis. *Qualitative Health Research* 15(9): 1277-1288.

Innes, J. E. and Booher, D. E. 2010. *Planning With Complexity: An Introduction to Collaborative Rationality for Public Policy*. New York: Routledge.

Irvin, R. and Stansbury, J. 2004. Citizen participation in decision making: is it worth the effort? *Public Administration Review* 64(1): 55-65.

Ivey, J. L., de Loë, R. C., and Kreutzwiser, R. D. 2002. Groundwater management by watershed agencies: an evaluation of the capacity of Ontario's conservation authorities. *Journal of Environmental Management* 64: 311-331.

Ivey, J. L., de Loë, R. C., and Kreutzwiser, R. D. 2006. Planning for source water protection in Ontario. *Applied Geography* 26: 192-209.

Koehler, B. and Koontz, T. M. 2008. Citizen participation in collaborative watershed partnerships. *Environmental Management* 41: 143-154.

Koontz, T. M. and Johnson, E. M. 2004. One size does not fit all: matching breadth of stakeholder participation to watershed group accomplishments. *Policy Sciences* 37: 185-204.

Koppenjan, J. F. M. and Klijn, E. H. 2004. *Managing Uncertainties in Networks*. London: Routledge.

Kroon, F. J., Robinson, C. J. and Dale, A. P. 2009. Integrating knowledge to inform water quality planning in the Tully-Murray basin, Australia. *Marine and Freshwater Research* 60: 1183-1188.

Leach, W. D. and Pelkey, N. 2001. Making watershed partnerships work: a review of the empirical literature. *Journal of Water Resources Planning and Management* 127(6): 378-385.

Lejano, R.P. and Ingram, H. 2009. Collaborative networks and new ways of knowing. *Environmental Science & Policy* 12(6): 653-662.

Limoges, C. 1993. Expert knowledge and decision-making in controversy contexts. *Public Understanding of Science* 2: 417-426.

Lindblom, C. E. and Cohen, D. K. 1979. *Usable Knowledge - Social Science and Social Problem Solving*. Yale Station: Yale University Press.

Living Water Policy Project. 2011. New Brunswick Water Policy Data. Available at www.waterpolicy.ca/new-brunswick-water-policy. Accessed March 13, 2011.

Lundqvist, J. 2000. Rules and roles in water policy and management need for clarification of rights and obligations. *Water International* 25(2): 194-201.

Margerum, R. D. 2008. A typology of collaboration efforts in environmental management. *Environmental Management* 41: 437-500.

Margerum, R. D. and Whitall, D. R. 2004. The challenges and implications of collaborative management on a river basin scale. *Journal of Environmental Planning and Management* 47(3): 407-427.

Michaels, S., McCarthy, D. and Goucher, N. P. 2007. Information management for water resources: concepts and practice, Chapter in *Integrated Resource and Environmental Management: Concepts and Practice*. Eds. K. S. Hanna and D. S. Slocombe, 220-235. Don Mills: Oxford.

Mitchell, B. (Ed). 2010. *Resource and Environmental Management in Canada. Fourth Edition*. Don Mills, Ontario: Oxford University Press.

Moore, E. A. and Koontz, T. M. 2003. A typology of collaborative watershed planning groups: citizen-based, agency-based and mixed partnerships. *Society and Natural Resources* (5): 451-460.

MRA Meduxnekeag River Association. 2005. *Provisional Water Classification Report*. Woodstock, New Brunswick: Meduxnekeag River Association.

MRA Meduxnekeag River Association. 2009. About Us. Available at www.meduxnekeag.org. Accessed March 13, 2011.

MREAC Miramichi River Environmental Assessment Committee. 2011a. Welcome. Available at www.mreac.org/index.html. Accessed March 13, 2011.

MREAC Miramichi River Environmental Assessment Committee. 2011b. Watershed. Available at www.mreac.org/watershed.html. Accessed March 13, 2011.

MREAC Miramichi River Environmental Assessment Committee. 2011c. Water Classification. Available at www.mreac.org/waterclass.html. Accessed March 13, 2011.

Murdoch, J. and Abram, S. 1998. Defining the limits of community governance. *Journal of Rural Studies* 14(1): 41-50.

New Brunswick Department of Environment. 2002. *Understanding the Law: A Guide to New Brunswick's Water Classification Regulation*. Fredericton, New Brunswick: Government of New Brunswick.

New Brunswick Department of Environment. 2009. *Department of Environment Strategic Plan: 2009 – 2014*. Fredericton, New Brunswick: Government of New Brunswick.

New Brunswick Forest Products Association. 2011. Forest Management. Available at www.nbforestry.com. Accessed June 24, 2011.

Nonaka, I. 1994. A dynamic theory of organizational knowledge creation. *Organization Science* 5(1): 14-37.

NWAI Nashwaak Watershed Association Inc. 2002. *Water Classification 1st Year Report: Report of Progress Towards Water Classification, 2001/2002, Nashwaak Watershed Drainage*. Stanley, New Brunswick: Nashwaak Watershed Association Inc.

NWAI Nashwaak Watershed Association Inc. 2004. *Provisional Water Classification Report 2003 – 2004*. Stanley: New Brunswick: Nashwaak Watershed Association Inc.

NWAI Nashwaak Watershed Association Inc. 2008. By-Laws of the Nashwaak Watershed Association Inc. Available at www.nashwaakwatershed.ca/NWAI_Constitution_-_approved_AGM_2008.pdf. Accessed March 13,2011.

O'Connor, D. 2002. *Report of the Walkerton Inquiry: A strategy for safe drinking water, Part Two*. Toronto: Queen's Printer for Ontario.

Olsson, P., Berkes, F. and Folke, C. 2004. Adaptive co-management for building resilience in social-ecological systems. *Environmental Management* 34(1): 75-90.

Olsson, P. and Folke, C. 2001. Local ecological knowledge and institutional dynamics for ecosystem management: a study of Lake Racken Watershed, Sweden. *Ecosystems* 4: 85-104.

Pahl-Wostl, C. and Hare. M. 2004. Processes of social learning in integrated resource management. *Journal of Community and Applied Social Psychology* 14: 154-165.

Pahl-Wostl, C., Craps, M., Dewulf, A., Mostert, E., Tabara, D. and Taillieu, T. 2007. Social learning and water resources management. *Ecology and Society* 12(2): 5. [online] URL: http://www.ecologyandsociety.org/vol12/iss2/art5/

Parkins, J. R. and Mitchell, R. E. 2005. Public participation as public debate: a deliberative turn in natural resource management. *Society & Natural Resources* 18(6): 529-540.

Patton, E. and Appelbaum, S. H. 2003. The case for case studies in management research.

Management Research News 26(5): 60-71.

Plummer, R. 2009. The Adaptive Co-Management Process: an Initial Synthesis of Representative Models and Influential Variables. *Ecology and Society* 14(2): 24. [online] URL: http://www.ecologyandsociety.org/vol14/iss2/art24/

Polanyi, M. 1966. *The Tacit Dimension*. Garden City, New York: Doubleday.

Priscoli, J. D. 2004. Public participation in water resources management and why is it important? *Water International* 29(2): 221–227.

Prospectors & Developers Association of Canada. 2011. New Brunswick: Lands and Regulations. Available at www.pdac.ca/pdac/advocacy/land-use/pa-new-brunswick.html. Accessed May 1, 2011.

Raymond, C. M., Fazey, J., Reed, M. S., Stringer, L. C., Robinson, G. M. and Evely, A. C. 2010. Integrating local and scientific knowledge for environmental management. *Journal of Environmental Management* 91: 1766-1777.

Richards, L. 2006. *Handling Qualitative Data: A Practical Guide*. London: Sage.

Roberts, N. 2004. Public deliberation in an age of direct citizen participation. *American Review of Public Administration* 34(4): 315-53.

Rogers, P. and Hall, A. W. 2003. *Effective Water Governance, TEC Background Papers No. 7, Global Water Partnership Technical Committee (TEC) Background Papers*. Stockholm, Sweden: Global Water Partnership.

Roux, D. J., Rogers, K. H., Biggs, H. C., Ashton, P. J. and Sergeant, A. 2006. Bridging the science-management divide: moving from unidirectional knowledge transfer to knowledge interfacing and sharing. *Ecology and Society* 11(1): [online] URL: http://www.ecologyandsociety.org/vol11/iss1/art4/

Ryan, C. M. and Klug, J. 2005. Collaborative watershed planning in Washington State:

implementing the watershed planning act. Journal of Environmental Planning and Management 48(4): 491-506.

Savan, B., Gore, C. and Morgan, A. J. 2004. Shifts in environmental governance in Canada: how are citizen environment groups to respond? *Environment and Planning C: Government and Policy* 22(4): 605-619.

Schultz, L., Duit, A. and Folke, C. 2009. Participation and management performance in the World Network of Biosphere Reserves. In *Nurturing Resilience in Social-Ecological Systems: Lessons Learned from Bridging Organizations*. Doctoral thesis, Schultz, L. Sweden: Stockholm University.

Sheikheldin, G., Krantzberg, G. and Schaefer, K. 2010. Science-seeking behaviour of conservation authorities in Ontario. Environmental Management 45: 912–921.

Simms, G., Lightman, D. and de Loë, R. 2010. *Tools and approaches for source water protection in Canada. Governance for Source Water Protection in Canada, Report No. 1*. Waterloo, ON: Water Policy and Governance Group.

Singleton, S. 2002. Collaborative environmental planning in the west: the good, the bad and the ugly. *Environmental Politics* 11(3): 54-75.

Stake, R. E. 1995. *The Art of Case Study Research*. Thousand Oaks, California: Sage Publications.

Stringer, L. C., Dougill, A. J. Fraser, E. Hubacek, K. Prell, C. and Reed, M. S. 2006. Unpacking "participation" in the adaptive management of social–ecological systems: a critical review. *Ecology and Society* 11(2): 39. [online] URL: http://www.ecologyandsociety.org/vol11/iss2/art39/

Swain, H., Louttit, S. and Hrudey, S. 2006. *Report of the Expert Panel on Safe Drinking Water for First Nations, Volume 1*. Ottawa: Minister of Indian Affairs and Northern Development and Federal Interlocutor for Métis and Non-Status Indians.

Tims, J. 1999. *Water Classification – A Tool for Managing Watersheds*. Available at

http://www.elements.nb.ca/theme/rivers/jane/jane.htm. Accessed July 8, 2010.

van Buuren, A. 2009. Knowledge for governance, governance of knowledge: inclusive knowledge management in collaborative governance processes. *International Public Management Journal* 12(2): 208-235.

Warriner, G. K., Madden, J. J., Lukasik, L. and McSpurren, K. 1996. Public participation in watershed management: a comparitive analysis. *Canadian Water Resources Journal* 21(3): 253-273.

Wolfe, S. E. 2009. What's your story? Practitioners' tacit knowledge and water demand management policies in southern Africa and Canada. *Water Policy*. 11(4): 489-503.

Yin, R. K. 2003. *Case Study Research: Design and Methods*. California: Sage.

Zwart, I. 2003. A greener alternative? Deliberative democracy meets local government. *Environmental Politics* 12(2): 23-48.

APPENDIX A: KEY INFORMANTS

Watershed Group Staff

In total, 12 key informants were paid staff members of a collaborative watershed group in NB. Six interviewees were executive directors, including the five case study watershed groups. Six of the interviewees were paid staff members of the five case study watershed groups. Table A1 outlines each informant's role, the organization from which they interviewed, as an employee, and select details of their personal background.

Table A1: Summary of Watershed Group Staff Involvement

Role	**Organization**	**Background***
Executive Director	Groupe de Developpement Durable du Pays de Cocagne (1 informant)	Founded the group a decade ago, is a long-time resident of the area and holds a bachelor degree in biology and a masters degree in ecology.
	Hammond River Angling Association (1 informant)	Long-time resident, committed environmentalist, fisherman, director of the Atlantic Salmon Federation and president of the NB Salmon Council.
	Miramichi River Environmental Assessment Committee (1 informant)	Past employment at Parks Canada, holds an undergraduate degree in geography and a masters degree in biology.
	St. Croix International Waterway Commission (1 informant)	N/A
	Eastern Charlotte Waterways Inc. (1 informant)	N/A
	Kennebecasis Watershed Restoration Committee (1 informant)	N/A
Employee	Hammond River Angling Association (2 informants)	1. Forestry and fishery technician and avid fisherman. 2. Long-time resident with a combined degree in zoology and biology.
	Meduxnekeag River Association (2 informants)	1. Freelance writer, editor, gardener and director of the provincial credit union risk management organization. 2. Program coordinator and community liaison, holds a BSc in forestry and is also staff at another NB water resource organization.

	Miramichi River Environmental Assessment Committee (2 informants)	1. Project coordinator within the group, holds BSc in biology and an advanced diploma in water quality. 2. Administrative staff person, with a college degree in office administration.

* Information provided only for key informants from the five case study groups.

Watershed Group Board

In total, 10 key informants were volunteer members on the five case study group's boards. Table A2 outlines each informant's role, the organization from which they interviewed, as a volunteer member, and select details of their personal background.

Table A2: Summary of Watershed Group Board Member Involvement

Role	**Organization**	**Background***
Board Member	Groupe de Developpement Durable du Pays de Cocagne (3 informants)	1. Long-time resident of the area, with a diploma in ecology, and sole staff member of Coalition des bassins versants de Kent. 2. Avid outdoors-person and long-time community citizen. 3. Recreational fisher and member of several other committees in areas such as fisheries management.
	Meduxnekeag River Association (1 informant)	Member of the land acquisitions committee of MRA and brick layer with interest in real estate, housing and land.
	Miramichi River Environmental Assessment Committee (2 informants)	1. Member of the Technical Advisory Committee of the group, past fisheries biologist with the federal government, vice president of another local watershed group, president of a local salmon preservation association and president of the NB Salmon Council. 2. Hydrologist and instructor of environmental technology at the local community college, holds a BSc in geology and a masters degree in adult environmental education, and is also self-employed as a hydrogeology and hydrology consultant.

	Nashwaak Watershed Association Inc. (4 informants)	1. President, a carpenter. 2. Past president, founder of the group, environmental and mechanical engineer and business owner. 3. Past president and retired research scientist in soil microbiology with the provincial government. 4. Past board member, a provincial government employee.

* Information provided only for key informants from the five case study groups.

Government

Four key informants were employees of the Government of New Brunswick Department of Environment:

- Manager of the Drinking Water Protection Section;
- Outreach and Partnering Coordinator from the Provincial and Community Planning Section;
- Program Manager of the Provincial and Community Planning Section;
- Program Manager of the Water Quality and Quantity Unit.

Academic

One key informant was a faculty member at the University of New Brunswick with a major research focus on collaborative forms of governance.

Environmental institution

One key informant was the Program Coordinator of the Freshwater Protection Program at a well-established environmental advocacy group in the province.

APPENDIX B: INTERVIEW QUESTIONS

The following interview guide was used during the second research trip to New Brunswick, from September 28 to October 5, 2010.

1. Identifying existing knowledge

How do members of the organization identify and define knowledge types?

- Occupation?
- Live/work in watershed; how long?
- Level of formal education?
- What forms of knowledge do you think are valid and useful for water management planning?
- What do you consider to be 'local knowledge' in water management planning? e.g., experiences.
- What do you consider to be 'expert knowledge' in water management planning? e.g., hydrology.
- Do you feel that there are there significant voices in the community that are/have been missing? Why do you feel that these voices are important? Why are they missing?

2. Analyzing different knowledges

How is the validity and reliability of the different knowledges evaluated?

- Has being a member of the group increased your level of respect and understanding of the perspectives and knowledge of other stakeholders in the area? How so?
- Are there processes/methods in place to check knowledge claims for reliability and validity? Do you think that this is necessary?
- How are differences handled when opposing views are presented?

3. Engaging and integrating the knowledges

To what extent are the knowledges being used at different stages of decision-making processes (e.g., problem identification, deliberation and solution-finding)? What opportunities are there for multiple actors to understand and learn from each other?

- Do you feel that different stages of activities (preliminary meetings, management plan formulation, ongoing monitoring) require the use of certain knowledge types? Explain.

- Do you think that members of the community are equally informed and engaged in discussions about technical information?
    - Is there a need for this? Is there interest in the community? Could it be improved?
- Do you feel there is ample opportunity for participants to discuss the technical information?
    - Is there effort to assure understanding and agreement on the information; reconcile different sources of evidence?
- In your opinion, are there particular people / a particular person involved in the group who help(s) facilitate the sharing and understanding of information that is discussed by participants?
    - e.g., help translate technical jargon into everyday terms.
- Are there any other aspects of the group decision making and activities that you'd like to comment on? Strengths, drawbacks, suggestions for improvement?

The following revised interview guide was used during the third research trip to New Brunswick, from October 31 to November 5, 2010.

1. Identifying existing knowledge - *How do members of the organization identify and define knowledge types?*

- How long have you lived/worked in the watershed?
- Occupation?
- Formal education?
- What forms of knowledge do you think are valid and useful for water management planning?
    - e.g., technical.
- What do you consider to be 'local knowledge' in water management planning?
    - e.g., experiences.
- What do you consider to be 'expert knowledge' in water management planning?
    - e.g., hydrology.

2. Analyzing different knowledges - *How is the validity and reliability of the different knowledges evaluated?*

- Has being a member of the group increased your level of respect and understanding of the perspectives and knowledge of other stakeholders in the area? How so?
- Do you feel that there are significant voices in the community that are / have been missing?
    - Why do you feel that these voices are important?
    - Why are they missing?
- How are differences handled when opposing views are presented?
    - Is there a formal process?

3. Engaging and integrating the knowledges - *To what extent are the knowledges being used at different stages of decision-making processes? What opportunities are there for multiple actors to understand and learn from each other?*

- Do you feel that different stages of activities (preliminary meetings, management plan formulation, ongoing monitoring) require the use of certain knowledge types? Explain.
- Can you identify any particular activities that you think help to build a more common understanding of water resources and issues amongst the community and technical experts?
- Are members of the community informed and engaged in discussions about technical information?
    - Is there a need for this?
    - Is there interest in the community?
- In your opinion, are there particular people / a particular person involved in the group who help(s) facilitate the sharing and understanding of information that is discussed by participants?
- Are there any other aspects of the group decision making and activities that you'd like to comment on?
    - Strengths, drawbacks, suggestions for improvement?

APPENDIX C: DOCUMENT DATA COLLECTION GUIDE

Table C1: Framework for interpreting the variable of "knowledge" and the use of knowledge in collaborative governance

Specific Concerns	Literature
What is "local knowledge"? What local knowledge is used (if any) by members of the group? How is it used? How important is it to have local knowledge represented in the group?	"Local" knowledge characteristics • Geographical, contextual (Corburn, 2003) • Historical (TEK) • Experiential (Edelenbos *et al.,* 2004; Pahl-Wostl *et al.*, 2007) • Practical (Failing *et al.,* 2007) • Common sense, thoughtful speculation and analysis (Lindblom & Cohen, 1979) • Ecological (Olsson *et al.,* 2004)
What is "expert knowledge"? What expert knowledge is used by members of the group? How is it used? How important is expert knowledge to the activities of the group?	"Expert" knowledge characteristics • Explicit, hard, formal, information, easily articulated, measurable • Professional (Edelenbos *et al.,* 2004) • Technocratic (Fisscher, 1990) • Objective fact (Pahl-Wostl *et al.,* 2007) • Technical • Ecological (Olsson *et al.,* 2004)?
Do different stages of activities (preliminary meetings, management plan formulation, ongoing monitoring) require the use of certain knowledge types? What barriers exist to *using* different kinds of knowledge effectively in environmental governance?	Different stages of the collaborative process may require the involvement of difference types of knowledge (Kroon *et al.*, 2009).

Table C2: Framework for analyzing collaborative governance process variables that determine how knowledge is used

Variable	Specific Concerns	Literature
Capacity	Where does the organization get funding? Does the source of funding effect what types of knowledge are involved in particular projects / activities?	Inadequate financial resources can be a barrier to the inclusion of multiple knowledge types in the collaborative process (Ryan & Klug, 2005).
	Does the timing, location, length or frequency of meetings and activities affect which members participate and how often they participate? Are there other barriers to *gathering* different types of knowledge in collaborative processes? Describe.	Time (specific timelines, meeting lengths and frequency) can constrain the collaboration of multiple knowledge types in the collaborative process (Margerum & Whitall, 2004).

	Does the leadership of a particular individual in your organization encourage trust between actors, to allow open debate between the multiple perspectives and knowledge types?	Leadership may be beneficial to collaborative governance efforts (Ansell & Gash, 2007; Berkes, 2009; Feldman *et al.,* 2009).
	Is [the leader] dedicated to maintaining collaboration among members, and in the decisions made by your organization?	A leader who is dedicated to the collaborative process may be beneficial to collaborative governance efforts (Feldman *et al.*, 2006; Feldman & Khademian, 2007; Hahn *et al.,* 2006; Olsson *et al.,* 2004; van Buuren, 2009).
Facilitation	Have participants been vocal about missing sources of knowledge, or over-representation of certain types of knowledge? What are common causes of misunderstanding between participants? Are differences between knowledge type, and understanding of the issue, a common cause of discord?	Evidence of opportunities for deliberation between scientific and other actors about the knowledge being used at different stages of the collaborative process (Berkes, 2009, Blackstock & Richards, 2007).
	Are the knowledges combined into a holistic "way of knowing"? Do the members of the group combine local and expert knowledge when providing input to decisions and activities?	A broad range of knowledge types is beneficial for environmental governance (Berkes, 2009; Feldman *et al*., 2009; Hahn *et al*., 2006; Kroon *et al*., 2009; Olsson *et al*., 2004; Pahl-Wostl & Hare, 2004; Plummer, 2009; Schultz *et al*., 2009; van Buuren, 2009).
	Is broad representation beneficial for environmental governance in the group? Are any particular sorts of knowledge given preference over others? If so, why? Are there certain types of knowledge that are not represented that would benefit the organization? If yes, what types of knowledge are not represented and why?	Actors may use their knowledge primarily to substantiate their own perspectives, rather than to search for knowledge that extends beyond individual interests (Edelenbos *et al.*, 2004).
	Are actors willing to use their knowledge to contribute positively to the collaborative decision making and activities?	There may be scepticism among some actors concerning the legitimacy and value of the different types of knowledge (Armitage *et al*. 2007; Lejano & Ingram, 2009).

APPENDIX D: DOCUMENTS REVIEWED

The following 30 documents were reviewed as part of the data analysis of this research project. They include government documents, non-government reports, meeting minutes, annual reports, watershed group environmental management plans and press releases.

1. Government of New Brunswick. 1992. A Water Classification System for New Brunswick: A Review of Water Classification Systems in Other Jurisdictions. Fredericton, New Brunswick: Department of Environment Environmental Planning and Sciences Branch Land and Water Use Planning Section.
2. Groupe de développement durable du Pays de Cocagne. 2010. *May Meeting Minutes*. Cocagne, New Brunswick: Groupe de développement durable du Pays de Cocagne.
3. Groupe de développement durable du Pays de Cocagne. 2010. *June Meeting Minutes*. Cocagne, New Brunswick: Groupe de développement durable du Pays de Cocagne.
4. Groupe de développement durable du Pays de Cocagne. 2010. *November Meeting Minutes*. Cocagne, New Brunswick: Groupe de développement durable du Pays de Cocagne.
5. Hammond River Angling Association. 2008. *Fall 2008 Newsletter*. Nauwigewauk, New Brunswick: Hammond River Angling Association.
6. Hammond River Angling Association. 2009. *Spring 2009 Newsletter*. Nauwigewauk, New Brunswick: Hammond River Angling Association.
7. Hammond River Angling Association. 2010. *Annual General Meeting Minutes*. Nauwigewauk, New Brunswick: Hammond River Angling Association.

8. Hammond River Angling Association. 2010. *October Board Meeting Minutes*. Nauwigewauk, New Brunswick: Hammond River Angling Association.
9. Hammond River Angling Association. 2010. *November Board Meeting Minutes*. Nauwigewauk, New Brunswick: Hammond River Angling Association.
10. Hammond River Angling Association. 2010. *December Board Meeting Minutes*. Nauwigewauk, New Brunswick: Hammond River Angling Association.
11. Hammond River Angling Association. 2011. *January Board Meeting Minutes*. Nauwigewauk, New Brunswick: Hammond River Angling Association.
12. Hammond River Angling Association. 2011. *February Board Meeting Minutes*. Nauwigewauk, New Brunswick: Hammond River Angling Association.
13. Hammond River Angling Association. 2011. *January Executive Meeting Minutes*. Nauwigewauk, New Brunswick: Hammond River Angling Association.
14. Meduxnekeag River Association. 2004. *January Board Meeting Minutes*. Woodstock, New Brunswick: Meduxnekeag River Association.
15. Meduxnekeag River Association. 2005. *January Board Meeting Minutes*. Woodstock, New Brunswick: Meduxnekeag River Association.
16. Meduxnekeag River Association. 2006. *November Board Meeting Minutes*. Woodstock, New Brunswick: Meduxnekeag River Association.
17. Meduxnekeag River Association. 2007. *May Board Meeting Minutes*. Woodstock, New Brunswick: Meduxnekeag River Association.
18. Meduxnekeag River Association. 2008. *February Board Meeting Minutes*. Woodstock, New Brunswick: Meduxnekeag River Association.

19. Meduxnekeag River Association. 2009. *February Board Meeting Minutes*. Woodstock, New Brunswick: Meduxnekeag River Association.
20. Meduxnekeag River Association. 2010. *May Board Meeting Minutes*. Woodstock, New Brunswick: Meduxnekeag River Association.
21. Miramichi River Environmental Assessment Committee. 2009. *Annual General Meeting Minutes*. Miramichi, New Brunswick: Miramichi River Environmental Assessment Committee.
22. Miramichi River Environmental Assessment Committee. 2009. *September Meeting Minutes*. Miramichi, New Brunswick: Miramichi River Environmental Assessment Committee.
23. Miramichi River Environmental Assessment Committee. 2010. *May Meeting Minutes*. Miramichi, New Brunswick: Miramichi River Environmental Assessment Committee.
24. Miramichi River Environmental Assessment Committee. 2010. *September Meeting Minutes*. Miramichi, New Brunswick: Miramichi River Environmental Assessment Committee.
25. Nashwaak Watershed Association Inc. 2001. *Fall 2001 Newsletter*. Stanley, New Brunswick: Nashwaak Watershed Association Inc.
26. Nashwaak Watershed Association Inc. 2002. *Fall 2002 Newsletter*. Stanley, New Brunswick: Nashwaak Watershed Association Inc.
27. Nashwaak Watershed Association Inc. 2003. *Fall 2003 Newsletter*. Stanley, New Brunswick: Nashwaak Watershed Association Inc.
28. Nashwaak Watershed Association Inc. 2004. *Winter 2004 Newsletter*. Stanley, New Brunswick: Nashwaak Watershed Association Inc.

29. Nashwaak Watershed Association Inc. 2003. *Water Classification Stakeholder Information Letter*. Stanley, New Brunswick: Nashwaak Watershed Association Inc.

30. Peabody, G. and Mitchell, S.J. 2005. Interim Progress Report Meduxnekeag Watershed. Woodstock, New Brunswick: Meduxnekeag River Association.