Assessing the Influence and Effectiveness of Watershed Report Cards on Watershed Management: A Study of Watershed Organizations in Canada

by

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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

The concept and practice of watershed management have evolved since the early twentieth century and continue to change. Contemporary watershed management, as a means to improve environmental, social, and economic well-being, is generally accepted world-wide and is gaining popularity. Recognition of the ever-changing, complex, conflicting, and unpredictable nature of the forces that influence ecological and human systems has given rise to concepts and principles related to ecological or watershed health, sustainability, and good governance. Numerous terms have emerged to describe and explain contemporary watershed management processes that incorporate these concepts and principles, including 'integrated' and 'sustainable' watershed management. While there is growing consensus that integrated or sustainable watershed management should be practiced, there is little agreement on what these two terms mean and how they differ.

The rational comprehensive or synoptic model is a widely-accepted normative framework to guide watershed management processes. This model presumes a 'top-down' linear, systematic, and logical sequence of steps characterized by complete knowledge of the issues and consequences of actions and dominated by rational decision making – circumstances that rarely happen in real life. Implementation gaps between theory and practice exist because of persistent and common challenges relating to complexity, conflict, uncertainty, and change in human and ecological systems. Failure to account for these factors has restricted the utility of this model for guiding watershed management processes, prompting questions about how the model might be adjusted to incorporate concepts and principles associated with watershed health, sustainability, and good governance.

In response to the need to demonstrate progress towards watershed health and sustainability, a growing number of watershed organizations in Canada are pioneering the development of indicator-based assessment reports. The actual versus anticipated outcomes of watershed indicator reports and their existing and potential role in the watershed management process have not been systematically assessed or compared.

A review of academic and professional literature and a mixed methods research approach comparing 13 case studies from 7 provinces across Canada were used to explore these knowledge gaps. A more in-depth investigation of two of the case studies, the Fraser Basin Council and the Humber Watershed Alliance, was also completed. Contextual factors influencing the practice of watershed management and the process used for developing watershed report cards are identified through an analysis of available documents. This information is supplemented with opinions gathered from 109 in-depth and semi-structured interviews/questionnaires. In addition, informants

provided viewpoints regarding the usefulness, effectiveness, benefits, and value of watershed report cards, along with ideas about how they can be improved.

This study concludes that while sustainable watershed management (SWM) and integrated watershed management (IWM) are closely aligned concepts, the distinguishing factor is scope. The primary goal of SWM is environmental, social, and economic sustainability within a watershed unit, whereas the central focus of IWM is the protection and/or restoration of water and land resources within a watershed to sustain human well-being. In Canada, IWM rather than SWM is generally pursued. Nevertheless, sustainability is an ultimate goal of IWM. Sustainability principles are acknowledged, valued, and applied. This study concludes that IWM can play a significant role in supporting a broad sustainability agenda.

This study contributes to a growing body of knowledge seeking to enrich the theory of watershed management and improve and streamline practice. To improve the utility of the rational comprehensive model for guiding contemporary watershed management, modifications are presented which include separate phases for visioning and learning and couch the process within an overall conceptual framework that balances management, research, and monitoring activities. These adjustments reflect the concepts of integration, collaboration, and shared learning and acknowledge the shift away from 'command and control' bureaucratic processes to collaborative 'middle ground' polycentric governance structures. Rather than focusing strictly on a sequence of steps and a prescribed process, the consideration of a series of context-specific questions is advocated to help scope and streamline processes to match stakeholder capacity, address issues of greatest concern, and sustain interest and enthusiasm. However, concerted effort is required to counteract competing and entrenched socio-political and economic doctrines and traditions.

Monitoring, evaluating, and reporting are key components in the IWM process. Study findings reveal that watershed report cards in Canada are a fledgling tool and no standard approach exists. Each case-study watershed organization has a unique approach to selecting, organizing, and presenting indicators. As a result, report card styles and formats vary. Despite a general consensus that watershed report cards are worthwhile, expectations often exceed outcomes, and common traits which challenge their effectiveness exist. The usefulness and effectiveness of watershed report cards are hampered by several common shortfalls: (1) universal lack of consistent, spatially-specific, and timely data, (2) inconsistent measures and indicators between successive watershed reports, (3) ambiguous or non-existent goals, objectives, targets, and benchmarks, and (4) messages that are unclear, difficult to understand, or fail to resonate with the target audiences.

The ‘lessons learned’ from an assessment of the attributes and perceived benefits of watershed report cards parallel those discovered for community indicator initiatives. Building on this research, recommendations for improvement include (1) focus on stakeholder issues of prime concern, (2) use consistent measures and indicators, (3) limit the number of indicators and simplify report card styles and formats, (4) select spatially explicit, temporally relevant, and science-based indicators and measures, (5) explain and illustrate major cause-effect linkages, (6) use the report card process to build a constituency of support, (7) incorporate marketing and outreach activities, and (8) introduce performance measures to assess efficiency and how well collective practice demonstrates sustainability principles. This study concludes that opportunities exist for improving watershed report cards and boosting their multi-purpose role as a predominant planning, assessment, advocacy, communication, learning, and research tool in support of IWM, and ultimately, sustainability.

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My research relied extensively on the voluntary participation of senior staff and Board members from 13 case-study watershed organizations and other individuals associated with municipalities, government agencies, and NGOs from 7 provinces across Canada. To those who participated, thank you for your willingness to take time from your busy schedules and provide candid opinions and keen insights, and for cooperating beyond my wildest expectations and with great enthusiasm. Your input provided me with a rich and extensive qualitative database. In particular, special thanks are extended to David Marshall and Gary Wilkins. David and Gary, your endorsement, interest, and assistance in setting up interviews with senior staff and directors of the Fraser Basin Council and members of the Humber Watershed Alliance helped lend credibility to my research and, I suspect, increased my chances for securing input from key individuals.

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Dedication

This thesis is dedicated to the memory of my father and mother, Willis and Eileen Young, who always believed in me and urged me to pursue my dreams, and to the memory of my dear son Adam, who inspired me every day with his wonderful smile, big hugs, and boundless capacity to love.

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List of Acronyms

AB: Alberta
AWC: Alberta Water Council
BBWMP: Bow Basin Watershed Management Plan
BC: British Columbia
BRBC: Bow River Basin Council
CA: Census Agglomeration
CARP: Clean Annapolis River Project
CEMP: Comprehensive Environmental Management Plan
CMA: Census Metropolitan Area
CMVVR: Comité de mise en valeur de la vallée du Richelieu
COA: Canada-Ontario Agreement
COVABAR: Comité de concertation et de valorisation du bassin de la rivière Richelieu
CRWMSU: Credit River Water Management Strategy Update
CSD: Commission on Sustainable Development
CVC: Credit Valley Conservation
CWN: Canadian Water Network
DPSIR: Driving Forces-Pressures-State-Impacts-Responses
DWRC: Don Watershed Regeneration Council
EPCOR: EPCOR Utilities Inc.
EPI: Environmental Performance Index
ESI: Environmental Sustainability Index
EWI: Ecosystem Well-being Index
FBC: Fraser Basin Council
FBMP: Fraser Basin Management Program
FEEM: Fondazione Eni Enrico Mattei
FRAP: Fraser River Action Plan
GIS: Geographic Information System
GLWQA: Great Lakes Water Quality Agreement
GOMC: Gulf of Maine Council on the Marine Environment
GPI: Genuine Progress Index
GRBWMS: Grand River Basin Water Management Study
GRCA: Grand River Conservation Authority
HDI: Human Development Index
HWA: Humber Watershed Alliance
HWI: Human Well-being Index
IBI: Index of Biotic Integrity
ICI: Invertebrate Community Index
ICM: Integrated Catchment Management
ICWE: International Conference on Water and the Environment
IISD: International Institute for Sustainable Development
INRM: Integrated Natural Resource Management
IRBM: Integrated River Basin Management
IUCN: World Conservation Union
IWI: Index of Watershed Indicators
IWM: Integrated Watershed Management
IWMP: Integrated Watershed Management Plan
IWRM: Integrated Water Resources Management
LPI: Living Planet Index
LRVCA: Lower Thames Valley Conservation Authority
MAA: Master Agreement on Apportionment

MDGs: Millennium Development Goals
Montérégie CRE: Conseil régional de l'environnement de la Montérégie
MPW: Master Plan for Water
MRBB: Mackenzie River Basin Board
MREAC: Miramichi River Environmental Assessment Committee
MVA: Meewasin Valley Authority
MWC: Muskoka Watershed Council
NB: New Brunswick
NEPA: National Environment and Planning Agency
NGO: Non-Governmental Organization
NRTEE: National Round Table on the Environment and Economy
NS: Nova Scotia
NSRB: North Saskatchewan River Basin Group
NSWA: North Saskatchewan Watershed Alliance
OCSWO: Other Case-Study Watershed Organizations
OECD: Organisation for Economic Co-operation and Development
ON: Ontario
PSR: Pressure-State-Response
QC: Quebec
QHEI: Qualitative Habitat Evaluation Index
RAP: Remedial Action Plan
SEEA: System of Integrated Environmental and Economic Accounting
SOLEC: State of the Great Lakes Ecosystem
SWM: Sustainable Watershed Management
TBI: Triple Bottom Line
TRCA: Toronto and Region Conservation Authority
TVA: Tennessee Valley Authority
UN: United Nations
UNCED: United Nations Conference on Environment and Development
UNESCO: United Nations Educational, Scientific and Cultural Organization
UTRCA: Upper Thames River Conservation Authority
WAC: Watershed Advisory Committee
WATER: Watershed Approach To Environmental Responsibility
WMO: World Meteorological Organization
WPAC: Watershed Planning and Advisory Committee
WQI: Water Quality Index

Chapter 1: Introduction

1.1 Problem Statement

The concept and practice of watershed management have evolved since the early twentieth century and continue to change (Ffolliott et al. 2002; Molle 2009). The framework underpinning watershed management is the rational comprehensive or synoptic approach – a sequence of logical, linear steps that presumes complete knowledge of all management options and impartial assessment of all social, political, and economic costs and benefits, leading to best decisions. However, implementation gaps between theory and practice exist because of persistent and common challenges relating to the *complexity* of the systems being managed (both ecological and human), *conflicts* among stakeholders, *uncertainty* about how natural systems work, and *change* because ecological and human systems continually adjust (Mitchell 2009). In response, the framework has evolved to acknowledge the concepts and principles associated with ecosystem dynamics and ecological health, sustainability, and good governance. This modified framework embraces a cyclical process through which a plan is developed, implementation occurs according to the plan, and results are monitored and evaluated against the goals and objectives of the plan, culminating in the revision of the plan (Heathcote 2009; Conservation Ontario 2010). Numerous terms have emerged to describe and explain these contemporary watershed management processes, including 'integrated' and 'sustainable' watershed management.

During the past two decades, watershed management has been aggressively pursued in both developed and developing countries (e.g., Mekong River Commission (Southeast Asia), Murray-Darling Basin Authority (Australia), Ruhr Basin Water Association (Germany), Mersey Basin Campaign (England)) (Goldstein and Huber-Lee 2004). In Canada, a watershed approach for addressing environmental, social, and economic conditions is gaining popularity among the federal, provincial, and territorial governments and among non-government, community-based organizations (Soil and Water Conservation Society 2007). While there is growing consensus that 'integrated' or 'sustainable' watershed management should be practiced, there is little agreement on what these two terms mean. In addition, implementation approaches vary, influenced by context-specific factors and the degree to which various concepts and principles are subscribed to, and requisite outcomes are often elusive or the connection between the actions taken and the outcomes is indeterminate.

Concurrently, increasing emphasis is being placed on assessing the effectiveness of watershed management in achieving on-the-ground results. Since the call to develop indicators to inform decision making at the international and national levels by the United Nations in 1992 (Agenda 21,

Chapter 40), many indicator studies and reports aimed at measuring progress towards watershed health and/or sustainability at the local to international levels have been undertaken. Since 2000, several watershed management organizations in Canada have formulated indicator reports. However, few comparative studies, in Canada or elsewhere, assess these indicator reports regarding how well they provide: (1) a useful assessment tool for evaluating the effectiveness of watershed management, (2) a strong feedback mechanism for influencing watershed planning and decision making and promoting adaptation (i.e., adaptive management), and (3) increased public awareness and motivation for undertaking community action.

This study focuses on three distinct, but related knowledge gaps. First, the meaning and interrelatedness of the terms 'integrated' and 'sustainable' watershed management are fuzzy. Second, the degree to which the concepts and principles associated with contemporary watershed management are accepted and incorporated into the practice of watershed management in Canada, including the design and application of indicator tools, is unclear. Third, the actual versus anticipated value and benefits of watershed indicator reports have not been systematically assessed and compared. These core knowledge gaps are the focus of my research.

1.2 Research Goal and Questions

The goals of my research are to (1) advance the theory and improve the practice of watershed management in Canada, and (2) identify opportunities to increase the usefulness and effectiveness of watershed indicator reports. These goals relate specifically to the knowledge gaps identified in Section 1.1.

In order to accomplish these two goals, my research aims to answer the following six primary research questions:

1. What key principles are associated with contemporary watershed management and has consensus been reached among watershed organizations in Canada regarding their applicability?
2. What are the similarities, differences, and gaps among the theories, concepts, and methods ascribed to contemporary watershed management in the literature and the practice of watershed management in Canada?
3. How do the processes and methods used to develop watershed indicator reports in Canada compare to and contrast with key indicator models identified in the literature?
4. What styles of watershed indicator reports and types of indicators are used by watershed organizations in Canada to measure, evaluate, and report on the effectiveness of watershed management, what are their perceived benefits and shortfalls, and how well do they match the principles?
5. To what extent do watershed indicator reports influence the practice of watershed management and what practical changes can be made to make them a more effective governance tool?

6. What challenges and opportunities exist in Canada to improve the practice of watershed management and what roles should watershed indicator reports play?

According to Saunders et al. (2007), research can be *exploratory*, *descriptive*, or *explanatory*. *Exploratory* studies investigate phenomena about which very little is known. *Descriptive* studies provide an accurate portrayal of persons, events, or situations. *Explanatory* studies try to establish causal relationship between variables. To address the six research questions, my research objectives span these three research modes and include:

1. To determine the key definitions, goals, objectives, and principles associated with 'integrated' and 'sustainable' watershed management in the literature and to identify the degree to which either is actively pursued by watershed organizations in Canada.
2. To identify the methods used by watershed organizations in Canada for developing watershed indicator reports, including:
   (a) determining which criteria, indicators, and targets are used to monitor, measure, and assess progress towards watershed health and/or sustainability and the rationale and process for selecting them;
   (b) identifying how these methods compare and contrast with other key indicator models identified in the literature;
   (c) pinpointing the gaps, overlaps, strengths, and limitations related to the suite of indicators used to measure: (1) progress towards stated goals, objectives, and targets (directional change), and (2) performance (efficiency, effectiveness, and equity of management arrangements);
   (d) identifying the nature and extent of the direct and indirect impacts of watershed indicator reports; and,
   (e) determining the strengths and limitations of current methods and the opportunities and constraints associated with using indicator reports as feedback mechanisms to inform stages of the watershed management process.
3. To compare and contrast methods for selecting indicators and developing, formatting, and disseminating sustainability reports at the watershed and community scales in Canada, including:
   (a) assessing the feasibility and validity of developing a core set of indicators, or generic categories of indicators, that could be transferred across river basins;
   (b) determining challenges with and opportunities for linking watershed reporting initiatives with community reporting initiatives, recognizing that human activities and impacts are nested within a hierarchy of geographic scales from the community to the sub-watershed and watershed levels;
   (c) determining 'best practices' and 'lessons learned'; and,
   (d) identifying options for increasing the usefulness and effectiveness of watershed indicator reports and strengthening their role as a governance tool for watershed management.

4. To compare and contrast planning and decision-making processes for watershed management in Canada with contemporary planning theories and concepts, including:
   (a) determining the nature and extent to which planning theories and concepts are incorporated into current planning and decision-making structures for watershed management; and,
   (b) identifying opportunities for improving watershed management.

1.3 Research Contribution

This research contributes to a growing body of knowledge seeking to enrich the theory of watershed management and understand the forces that guide and influence watershed management practices and outcomes. The use of indicators is widely championed as a promising assessment tool to link more clearly actions to results and lead the way to a more sustainable future. However, the usefulness of current methods is uncertain. By exploring the experiences of organizations and stakeholders that have embarked on the arduous process of defining, selecting, and interpreting indicators, an array of strengths, weaknesses, opportunities, and threats is revealed. This knowledge is critical for constructing more useful theories as well as consistent and less complicated frameworks and methods that can be used at different watershed scales to measure and assess progress and performance.

Watershed management plays and will continue to play a critical role with respect to the availability, use, and health of vital natural resources into the future. In the face of population growth, climate change, and continued resource exploitation, it is imperative that illustrative, understandable, credible, and uncomplicated tools be developed that will permit researchers and practitioners to convey key messages about potential consequences and possible futures associated with management alternatives.

1.4 Overview of the Thesis

This thesis is structured to answer the research questions and meet research objectives through a review of academic and professional literature and the use of a mixed methods approach through comparative case studies. Thirteen case-study watershed organizations were selected for study, two of which were targeted for more in-depth investigation. Chapter 2 presents a review of the relevant theoretical and applied knowledge pertinent to (1) watershed health and ecosystem dynamics, (2) sustainability and good governance concepts, and (3) planning theory, and explores how these three factors should collectively guide and inform the practice of watershed management. Chapter 3 examines the role of indicators in watershed assessments and looks at the key characteristics, models, and methods associated with them. Chapter 4 describes the methodological approach and detailed methods chosen for this study. Chapter 5 provides an overview of the administrative, legal, and political setting for watershed management in Canada. Chapter 6 then describes the geographic

context and specific conditions under which each case-study watershed organization operates. Chapter 7 identifies the key characteristics and attributes of the various watershed indicator reports produced by each case-study organization. Chapter 8 describes the perceptions of key informants with respect to the usefulness and effectiveness of these reports. Finally, Chapter 9 assesses study findings and revisits the research questions, further develops the theory of watershed management, assesses how well indicator reporting matches the theories presented in Chapters 2 and 3, recommends tactics for improving the usefulness and effectiveness of watershed indicator reports, examines how the results contribute to academic literature and management approaches, and suggests aspects for future research.

Chapter 2: The Theory and Practice of Watershed Management

2.1 Introduction

The history of watershed management illustrates a gradual transition from engineering-oriented 'top-down' solutions designed to resolve single resource issues to adaptive and multi-faceted participatory processes to tackle multiple and complex resource problems. Not surprisingly, the theories and concepts associated with contemporary watershed management draw from a range of disciplines and relate ostensibly to complex systems, ecosystem health, sustainability, governance, and planning.

Sections 2.2 to 2.10 present a brief overview of the evolution of watershed management and describe and compare associated theories and concepts. Section 2.11 summarizes the preceding sections, providing a basis for discerning the degree of alignment between the theory and practice of watershed management. This analysis relates directly to the first two research questions in Chapter 1.

2.2 The Evolution of Watershed Management

A watershed is a distinctive, biophysical unit and refers to an area of land draining into a common water body such as a river or lake. The terms 'watershed', 'river basin', and 'catchment' are often used interchangeably, although 'catchment' is a more customary term used in Australia, Britain, New Zealand, and South Africa. Some researchers distinguish river basins from watersheds, depending on size. For example, the term 'river basin' is used to describe the entire area of land drained by a large river system, while the term 'watershed' denotes the area of land drained by a major tributary (Molle 2009).[1]

Watershed management has its roots in the history of human civilization (Brooks and Eckman 2000). Since ancient times, humans have adapted to, and manipulated the environment. Typically, the focus was not on the whole watershed or river basin, but on the river itself, and how it could be used and controlled to support human development in adjacent floodplains and farmlands (Molle 2009).[2] Rivers provided routes for transportation and water for consumption, irrigation, waste assimilation, and power. While people discovered that river flows are unpredictable forces and fluctuate in response to the vagaries of nature, they could be altered, diverted, and stored to meet human needs. With the advent of industrial development and expanding knowledge in the sciences, efforts to control water became more prevalent and widespread. Molle (2009: 486) states that

[1] 'Sub-basin' and 'sub-watershed' are terms used to describe an area of land drained by a smaller river tributary.

[2] The concept of a river drainage area as a natural entity was probably first put forth by Philippe Buache, a French cartographer. The idea was popularized by cartographers, although it was contested vehemently by geologists, who proposed other natural units based on geological features (Molle 2009).

"subduing nature and marshalling water became part of the mission of western countries, inebriated by their colonial adventures and by the scientism of the time."

By the turn of the 20th century, management activities in North America were focused on controlling river flood and erosion hazards and protecting water as a commodity (Adams, Noonan, and Newton 2000; Neary 2000; Ffolliott et al. 2002). For example, the definition endorsed by the American Society of Foresters in 1944, considered watershed management to be, "…the administration and regulation of the aggregate resources of a drainage basin for the production of water and the control of erosion" (Ffolliott et al. 2002: 38). The preferred approach was top-down, limited-purpose, reactive management of land and water resources with very little public input into decision making (Born and Genskow 1999). In fact, the International Glossary of Hydrology still defines watershed management as the, "…controlled use of drainage basins in accordance with predetermined objectives" (UNESCO and WMO n.d.).

As natural resource consumption rose to meet the demands of an increasing human population, with higher material standards of living, dramatic alterations in the hydrological, ecological, and biochemical functions of watersheds occurred (Folke et al. 2004; Karageorgis et al. 2005; Pirrone et al. 2005; Molle 2009). Extraction and exploitation of natural resources changed the natural landscape. Impacts such as degraded water quality, excessive erosion, fluctuating river flows (flooding and drought), desertification and salinization of soils, decreasing species diversity, and contaminated fish negatively affected human health, quality of life, and economic well-being (Loucks 2000; Loucks, Stakhiv, and Martin 2000; Lorenz, Gilbert, and Vellinga 2001; Wagner et al. 2002; Pittock, Madgwick, and Tickner 2003).

Observing some of these trends, Aldo Leopold challenged water managers in the mid-1900s to shift their thinking beyond a purely economic, commodity paradigm to one of holistic ecosystem management and to view conservation as a state of harmony between men and land (Leopold 1949). Despite his efforts, the theory and practice of watershed management did not evolve significantly until the early 1970s.[3] During the next two decades, a number of comprehensive basin plans were

[3] There are some examples where a more comprehensive watershed management approach was promoted through river basin organizations such as the Grand River Conservation Commission (1932), Muskingum Watershed Conservancy District (1933), and Tennessee Valley Authority (1933) (Mitchell and Shrubsole 1992). The Province of Ontario was a forerunner of the watershed approach in Canada. In 1946, the Conservation Authorities Act was passed, allowing watershed municipalities to establish conservation authorities. Through conservation authorities, watershed municipalities work in partnership with the Province which provides technical advice and financial assistance for locally established projects. Between 1946 and 1979, 36 conservation authorities were formed in watersheds inhabited by 90 percent of Ontario's population (Conservation Ontario 2001).

prepared to address multiple issues and resource demands (Downs, Gregory, and Brookes 1991; Mitchell 2008).

The first world-scale intergovernmental conference on water, the United Nations (UN) Conference on Water, marked a shift in global thinking regarding water. Held in Mar del Plata, Argentina in 1977, the conference aimed to assess global water resources, water use and efficiency, and to promote a level of national and international preparedness to help avoid a world water crisis. The conference approved an approach called the Mar del Plata Action Plan. The plan contained recommendations to deal with all aspects of water management and included 12 resolutions on a wide range of specific subject areas. Most importantly, it advocated a comprehensive and holistic approach to water management (Biswas 2004).

Fifteen years later, the International Conference on Water and the Environment (ICWE) was held in Dublin, Ireland. This conference focused on the necessity of integrated water management and the active participation of all stakeholders (Rahaman and Varis 2005). Four key principles were developed, including: (1) freshwater is a finite and valuable resource that is essential to sustain life, the environment, and development, (2) the development and management of our water resources should be based on a participatory approach, involving users, planners, and policy makers at all levels, (3) women play a central role in the provision, management, and safeguarding of water resources, and (4) water has an economic value and should therefore be seen as an economic good.

The recommendations of the Dublin conference were consolidated into Agenda 21 (Chapter 18) adopted at the UN Conference on Environment and Development (UNCED), in Rio de Janeiro, 1992. Through the *Programme for the Further Implementation of Agenda 21*, the General Assembly of the UN recognized an urgent need to formulate and implement national policies of integrated watershed management (IWM) in a fully participatory manner aimed at achieving and integrating economic, social, and environmental objectives of sustainable development (United Nations General Assembly 1997). In 1998, the UN Commission on Sustainable Development strongly urged governments around the world to endorse watershed management as a means to manage freshwater (Commission on Sustainable Development 1998). This position was first endorsed in the European Union's 2001 *Water Framework Directive* (Griffiths 2002) and subsequently supported by both the 2002 World Summit on Sustainable Development in Johannesburg (United Nations 2002) and the third World Water Forum in Kyoto in 2003.

In December 2000, a new *European Water Policy* came into force to rationalize water legislation among member countries of the European Union. Developed through an open consultation process,

the operational tool called the *Water Framework Directive* is based on the concept of IWM. The implementation of this Directive includes the development, monitoring, and assessment of watershed plans every six years to guide the implementation of activities aimed at improving water quality (Lorenz, Gilbert, and Cofino 2001; Veale 2003).

A decade ago, Born and Genskow (1999: 6) reported that in the United States, "there is now widespread recognition of the need to move "… to an approach which addresses the complexity and interdependence of environmental systems and resource uses and which involves those affected in the decision-making processes." This continuing trend is, in part, perceived to be the result of the collective inadequacy of government programs in dealing with diffuse issues such as non-point source pollution and habitat degradation (Imperial and Hennessey 2000; Lubell et al. 2002; de Carli, Massarutto, and Paccagnan 2004). Fragmentation of responsibilities and program delivery is also seen as an incentive to pursue partnerships since no one agency has the ability to adequately address resource issues independently (Imperial 1999; Veale 2003; Imperial 2004). In addition, Sabatier et al. (2005) indicate that the traditional top-down approach suffered problems of legitimacy because citizens were divorced from decisions that affected them.

While watershed management in the United States has existed in one form or another for decades, its widespread acceptance is a relatively new phenomenon. Troy (2007: 62) reports that in 1999, at least 17 federal resource agencies had officially adopted a watershed management approach to some extent. Lubell et al. (2002) analyzed the emergence of 958 watershed partnerships and discovered that 4 per cent began prior to 1970, 5 per cent between 1970 and 1979, 15 per cent between 1980 and 1989, and more than three-quarters (75.8 per cent) between 1990 and 1997. By 2002, it was estimated that more than 3,000 multi-stakeholder watershed groups had formed in the United States (National Policy Consensus Center 2002; Clark, Burkardt, and King 2005).

Internationally, watershed management is widely endorsed and ensconced in government rhetoric. Watershed agencies have been set up specifically around water and other environmental issues in France (Water Agencies); United Kingdom (Environment Agency – Planning Areas); Australia (Integrated Catchment Management); South Africa (Catchment Management Agencies); and New Zealand (Regional Councils). Other international agencies have been formed around the management of river basins such as the Rhine (International Commission for the Protection of the Rhine), the Nile (The Nile Basin Initiative), and the Mekong (Mekong River Commission) (Veale 2003). These watershed management agencies have been created using a variety of administrative and institutional arrangements and have differing levels of influence, responsibility, and accountability. Hooper (2006) identifies nine types of river basin organizations (Table 2.1).

Table 2.1. Types of River Basin Governance Models

Type of Organization	Description
Advisory	A formalized or quasi-formal organization in which individuals take responsibility for undertaking action planning and provide advice; governments 'hand over' strategic planning to such organizations; they frequently have no or limited legal jurisdiction.
Authority	An organization which makes planning decisions at a central/regional government level; may set and enact regulations, or have development consent authority; authorities are founded on democratic principles and a framework of law to which all relevant individuals and institutions are subject in a basin setting.
Association	An organization of like-minded individuals and groups with a common interest. In a river basin they have varying roles: providing advice, stimulating basin awareness, education and ownership of basin natural resources management issues; educational functions and information exchange.
Commission	An organization which is delegated to consider natural resources management matters and/or takes action on those matters. A basin commission's powers vary, and include advisory/education roles, monitoring roles, undertaking works, fulfilling goals of a specific government's charter or an international agreement.
Council	A formal group of experts, government ministers, politicians, NGOs, and lay people brought together on a regular basis to debate matters within their sphere of basin management expertise, and with advisory powers to government.
Corporation	A legal entity, created by legislation, which permits a group of people, as shareholders (for-profit companies) or members (non-profit companies), to create an organization, which can then focus on pursuing set objectives, and empowered with legal rights which are usually only reserved for individuals, such as to sue and be sued, own property, hire employees or loan and borrow money.
Tribunal	A basin entity which has formalized procedures and quasi-judicial powers; a heavy emphasis on bureaucratic decision making; stakeholders may formally participate through hearings; major decisions are taken by independent bodies, like a water pricing tribunal. These entities have limited traditional powers of civil government and do not report to other government agencies, except where a local government body may oversee entities.
Trust	A trust is legal device used to set aside money or property of one person for the benefit of one or more persons or organizations. It is an organization which undertakes river basin works; develops and implements a strategic plan; its mandate is to be the river basin 'advocate'; it co-ordinates local programs through Memoranda of Understanding or other agreements; it raises local levies (funds) for its works and programs. A Trust keeps monies raised in 'trust' for the benefits of its citizens.
Federation	A collaboration of organizations or departments within one government or between state and national governments to establish and undertake actions for river basin management.

Source: After Hooper (2006)

Canada has mirrored the burgeoning trend in the United States towards the establishment of new collaborative watershed groups. While the provinces of Ontario and Manitoba were early adopters of watershed management, other Canadian provinces have been actively encouraging the formation of watershed organizations under strategic initiatives such as Alberta's Water for Life Strategy, 2003 and Québec's Water Policy, 2002 (Veale 2003). The governance models used vary and represent all types of organizations identified by Hooper (2006), except tribunal and federation.[4] Chapter 5 provides a brief overview of watershed management initiatives in Canada.

[4] Hooper (2006) does not compare or assess the relative effectiveness or implications of these governance models.

2.3 The Concept of Integrated Watershed Management (IWM)

Many terms and definitions apply to watershed management in the late twentieth and early twenty-first centuries (Brooks et al. 1994; Born and Sonzogni 1995; Burton 1995; Bellamy et al. 1999; Adams, Noonan, and Newton 2000; Gelt 2000; Loucks, Stakhiv, and Martin 2000; Jaspers 2003; Global Water Partnership 2005; Hooper 2005; Heathcote 2009). In addition to IWM, the terms integrated river basin management (IRBM), integrated catchment management (ICM), and the 'new' watershed approach, proliferate in the literature and are used synonymously. IWM is considered to be a subset or derivative of integrated water resources management (IWRM) which implies implementation at a watershed scale (Savenije and van der Zaag 2000; Hooper 2005, 2006; Molle 2009).[5]

The most frequently used definition of IWRM is the one by the Global Water Partnership (2000: 22) which asserts that "IWRM is a process which promotes the coordinated development and management of water, land and related resources in order to maximize the resultant economic and social welfare, paving the way towards sustainable development, in an equitable manner without compromising the sustainability of vital ecosystems." Similar ideas are reflected in the World Wildlife Foundation's definition, which states that IRBM is, "the process of coordinating conservation, management and development of water, land and related resources across sectors within a given river basin, in order to maximise the economic and social benefits derived from water resources in an equitable manner while preserving and, where necessary, restoring freshwater ecosystems" (Pittock, Madgwick, and Tickner 2003: 5). In a review of several IWRM definitions, Cardwell et al. (2006: 15-16) conclude that,

> The concepts [definitions] refer to diverse water needs, the perception of water as a social and economic good, and maximizing economic and social welfare in an equitable manner. Many mandate specific ways to achieve integration, such as participatory planning and conflict resolution. Most of the definitions reflect the new consensus that the process of water resources management needs to consider social, economic and environmental aspects of water resource systems.

[5] Petry and Dombrowsky (2007: 12) claim that the difference between river basin management and integrated water resources management is that the former calls for the management of water resources at the watershed level and "mainly refers to spatial or natural system integration of water management functions" while the latter "mainly focuses on a sectoral or social system integration among the various water using sectors, while it leaves the spatial organization of water management open." However, this distinction is not apparent in the concept as presented by the United Nations or in the definitions cited. Other similar terms include integrated environmental management, adaptive environmental management, integrated resources management, and ecosystem management. While these terms may differ in their spatial context, they share many of the same underlying concepts (Margerum and Born 1995; Margerum 1997).

Integration is a central theme associated with IWRM. However, there are countless perspectives on what needs to be integrated.[6] Integration is suggested within and among (1) resource issues, goals, and outcomes, (2) research disciplines and scientific methods, (3) geographic or political boundaries, (4) institutions (both from an organizational and an operational perspective), (5) public and private funding, (6) social or sectoral systems, (7) spatial and temporal scales, and (8) a wide array of stakeholders (Margerum 1999; Bellamy and Johnson 2000; Gilman, Abell, and Williams 2004; Dovers 2005; O'Neill 2005; van Kerkhoff 2005; Cardwell et al. 2006; Petry and Dombrowsky 2007).

IWRM also encompasses the concepts of health, well-being, and sustainability and is being increasingly adopted as means to improve 'ecosystem health' and remedy an increasing array of environmental, social, and economic ills. The Global Water Partnership has developed an on-line toolbox for integrated water resource management and encourages its broad application among jurisdictions as a means to achieve sustainability (Global Water Partnership n.d.). To underscore this thrust, many authors use the term 'sustainable watershed management' or 'sustainable river basin management' (Cruz 1999; Jaspers 2003; Bruneau 2005; Hedelin 2008).

The definition offered by the World Wildlife Foundation is eco-centric, stressing the protection and enhancement of ecosystem functions, while that presented by the Global Water Partnership is more human-centric, emphasizing social-economic perspectives and benefits of environmental management. Nevertheless, these definitions share three common themes. First, IWRM is a dynamic process that involves balancing and making trade-offs between goals and interests, not an end state. Second, the complexity and interconnectedness of ecosystems, including humans, must be respected and considered. Third, sustainability and good governance principles need to be embedded in institutional, decision-making, and management processes. The main aspect that distinguishes IWM from IWRM is the watershed boundary as a logical management unit (Savenije and van der Zaag 2000; Hooper 2005; Molle 2009). The following sections outline the theories and concepts associated with IWM and identify widespread barriers that impede implementation, as well as lessons learned.

[6] In an analysis of existing literature, Biswas (2004: 10-11) collated the number of issues that researchers considered should be integrated. His list identifies 35 sets of issues for which, in his opinion, integration "even at the conceptual level…simply cannot be achieved". Sheng (2001) recommends that integration needs to be limited to a certain extent because the notion of integration creates problems from an institutional (too many agencies to coordinate), financial (funds are limited), and stakeholder perspective when demands of upstream and downstream users differ.

2.4 The Watershed as a Logical Management Unit

The watershed as a management unit for water and related land resources has been widely accepted (Brooks et al. 1994; Grumbine 1994; Slocombe 1998; Adams, Noonan, and Newton 2000; Cortner and Moote 2000; Gelt 2000; Towns 2000; Beak International 2001; Gilman, Abell, and Williams 2004; Goldstein and Huber-Lee 2004; Sieker et al. 2006; Randhir 2007; Heathcote 2009; Saravanan, McDonald, and Mollinga 2009). Primary reasons stated for this concurrence are (1) watersheds are defined by natural, hydrologic boundaries that permit the application of a systems approach, (2) watersheds integrate biophysical processes and exhibit cumulative effects, (3) watershed boundaries are generally easily recognizable and relatively stable, and (4) watersheds have a nested, hierarchical structure that allows 'scaling up' to large basins or 'scaling down' to small, local sub-basins. Addressing resource problems at a watershed scale rather than a single location or portion within it "allows all relevant factors contributing to the problem to be included in the planning process thereby increasing the number of potential solutions to the problem or threat" (Shaver et al. 2007: 295-296). Clark, Burkardt, and King (2005: 297) observe that,

> Increasingly, the watershed has come to be viewed as a place based and ecological entity, as well as a socioeconomic and political unit to be utilized for management planning, conservation strategies, and implementation purposes.

However, the natural features and physical extent of a watershed combined with the degree of anthropogenic landscape change are often proportionally linked to the complexity and magnitude of resource issues and management options. Matters of context, scale, and scope make each watershed distinct, requiring specific management strategies to appropriately address a particular mix of resource concerns and the values, perspectives, and expectations of interested stakeholders. There is no 'one size fits all' approach.

While watersheds provide a logical context within which to consider management options, their application as a management unit does not eliminate boundary or 'edge' issues. Boundary issues can arise when governments, agencies, organizations, or other stakeholders[7] hold divergent viewpoints and agendas or when there is an uneven distribution of power, wealth, or influence among

[7] There are many interpretations for the term 'stakeholder' (Mitchell, Agle, and Wood 1997; Friedman and Miles 2006). In the broadest sense, a stakeholder is "any group or individual who can affect or is affected by the achievement of the organization's objectives" (Freeman 1984: 46). According to Mitchell, Agle, and Wood (1997), a stakeholder possesses one or a combination of three attributes: (1) power (i.e., can influence decision makers), legitimacy (i.e., holds a legal or vested interest), and/or urgency (i.e., has a time-sensitive issue or calls for immediate attention to an issue). This interpretation is very corporate-centric. I support a broader perspective and define a stakeholder as any individual, group, government agency, or corporation that (1) has an interest (legal or otherwise) or investment (social, economic, and/or environmental) in the watershed, (2) can undertake actions that affect outcomes, and/or (3) could be affected by a decision.

stakeholders. Boundary issues also occur at the physical boundary of a watershed because natural ecosystems are not mutually exclusive and intersect, and because external environmental factors such as climate change and air quality cannot be managed within the context of a watershed. Butterworth et al. (2010: 71) point out that watershed management may not always be "administratively possible or ecologically sensible." For example, the management of large river basins that cross several administrative boundaries is complex and problematic. In areas that lack surface water resources, groundwater aquifers may provide a more logical management unit. Similarly, a management focus on shared headwater areas on heights of land may be considered more appropriate (e.g., Algonquin Provincial Park, Oak Ridges Moraine). Cardwell et al. (2006: 16) advise that, "the watershed concept is neither universally applicable or comprehensive enough to incorporate all of the necessary considerations for effective water resources management."

Physical, socio-economic, institutional, and political boundary issues and influences need to be acknowledged and factored into the watershed management process (Omernik and Bailey 1997; Wolf et al. 1999; Blomquist and Schlager 2005). Mitchell (1994: 134) concludes that one of the challenges for watershed managers is "to devise a management system which will function effectively in the presence of such boundary or edge problems." The strengths and weaknesses associated with the watershed as a management unit are summarized in Table 2.2.

2.5 The Watershed as a Complex Ecosystem

A key theme underpinning the definition of IWM is the ecosystem as both a natural entity and a mental construct to guide the management of natural resources. The loss of ecosystem diversity and the apparent declining health of ecosystems are two predominant concerns identified by the global scientific community. This situation has sparked further research to better understand complex ecosystem dynamics and responses to natural and anthropogenic stresses. The following sections provide an overview of the main tenets associated with the concepts of ecosystem and ecosystem health as they relate to watersheds.

2.5.1 The Ecosystem

First described by Arthur Tansley in 1935, the term 'ecosystem' was originally used to focus attention on organisms and their interactions and limiting factors.[8] Early views of ecosystem organization were dominated by the theory of balance in nature, assumptions of equilibrium, predictability, and permanence, and the idea that humans are separate from nature and that nature is best without human intervention (Botkin 1990).

[8] The term ecosystem first appeared in a publication by Tansley in 1935, but the term had been coined by Tansley's colleague Roy Clapham in the early 1930s (Willis 1997: 268).

Table 2.2. Strengths and Weaknesses of the Watershed as a Management Unit

Strengths	Weaknesses
Water integrates and catalyzes other biophysical processes in air, land and water environments and is a logical geographic unit for technical analysis.	In large complex areas or in regions of continental glaciation, deep sand, karst topography, flat plains and extremely dry climates, watershed boundaries are difficult to ascertain.
Watersheds define a nested hierarchy of distinct biophysical units that are tangible, understandable landscape units for managing at different scales.	Watershed boundaries are not static and may change due to natural forces such as avalanches, floods, storms, earthquakes, and gradual erosion.
The health of rivers and streams is both influenced by and illustrative of the health of the lands through which they flow.	Management of large-scale watersheds is problematic, particularly when drainage basins cross multi-jurisdictional boundaries.
Water systems demonstrate the cumulative effects of environmental stresses.	Groundwater and surface water are connected through the hydrological cycle. However, groundwater regimes may straddle watershed boundaries.
Quality of life is directly linked to water quality in watersheds.	Since terrestrial ecosystem components (flora and fauna) often extend beyond watershed boundaries, spatial differences in ecosystem health, integrity and quality may not be reflected or accounted for.
A watershed focus provides a mechanism to bridge barriers between management agencies - most management actions can be integrated using the watershed, at some scale, as a common monitoring and planning unit.	External influences on the watershed health such as climate change and atmospheric pollution cannot be managed within the bounds of a watershed.
A watershed is a logical, tangible landscape for engaging the public – human communities can relate to their landscapes and there is strong and growing public support for implementation at the local watershed level.	Socio-economic and political factors influence decision making beyond the confines of the watershed, which in turn, sway decisions about resource use within the watershed.
	Policy networks at a meaningful scale for collaboration and integration and stakeholder interests and perspectives may not coincide with watershed boundaries.

Source: After Corn (1993); Wolf et al. (1999); Cortner and Moot (2000); Gelt (2000); Beak International (2001); Gilman, Abell, and Williams (2004); Blomquist and Schlager (2005); Flint (2006); Randhir (2007); Ferreyra, de Loë, and Kreutzwiser (2008); Merrey (2008); Saravanan, McDonald and Mollinga (2009).

Slocombe (2010: 411) states that in a strict natural science usage, "an ecosystem is a locally distinct and coherent ecological community of organisms and the physical environment in which they interact." O'Keefe et al. (2002: 2) espouse that an ecosystem is "a functioning natural unit with interacting biotic and abiotic components in a system whose boundaries are determined by the cycles and flux of energy, materials and organisms." Different ecosystems may have overlapping boundaries within the same geographic area (e.g., forest and wetland ecosystems). In addition, ecosystems can be multi-scale or nested, from specific sites to global regions (Omernik and Bailey 1997; Berkes, Colding, and Folke 2003). Kay and Schneider (1994) demonstrate that ecosystems are not static but rather are inherently complex, dynamic, and self-organizing, continuously adjusting to a changing environment in different ways, including:

- the system can continue to operate as before, even though its operations may be initially and temporarily unsettled;
- the system can operate at a different level using the same structure it originally had;
- some new structures can emerge in the system that replace or augment existing structures;
- a new ecosystem, made up of quite different structures, can emerge; and,
- the ecosystem can collapse completely and no regeneration occurs.

Ecosystems often have multiple potential stable states (Kay et al. 1999; Scheffer et al. 2001; Folke et al. 2004; Groffman et al. 2006). The thresholds for change move and are unpredictable. A perturbation in the system, triggered by natural or anthropogenic causes, can lead to dramatic shifts, gradual shifts, or a return to the pre-disturbance state. When conditions exist where more than one stable state could occur, resilience can be measured by the magnitude of disturbance that can be absorbed before the system redefines its structure (ecological resilience). Individual disturbances to the system may not result in shifts but as resilience declines, the ecosystem becomes more vulnerable (less resistant), and progressively smaller disturbances can cause shifts (Ross et al. 1997; Rapport, Costanza, and McMichael 1998). Sharp regime shifts may more easily occur as a gradual cumulative result of anthropogenic acts. Human activities can reduce resilience over time by removing functional groups of species and their response diversity, contributing to pollution and climate change, and/or altering the magnitude, frequency, and duration of disturbance regimes to which the biota are adapted (Folke et al. 2004).

In recognition of these observations and to better understand ecosystem dynamics, a holistic approach, which acknowledges the structure, organization, and interrelationships among the components and explores system behaviour, is now advocated by some researchers. This shift has taken analysis from a reductionist view of the world to a more integrated or systems view in an attempt to understand the interactions among humans and Nature (Odum 1964; Van Dyne 1969; Slocombe 1999; Berkes, Colding, and Folke 2003).

For some researchers, the term ‘ecosystem’ has evolved from a focus on biota to the inclusion of humans as part of the ecosystem (O'Neill 2001). Others acknowledge the interconnections among natural and social systems and suggest that complex systems thinking can be used to examine this interplay. Berkes et al. (2003: 3) hold the view that “social and ecological systems are in fact linked, and that the delineation between social and natural systems is artificial and arbitrary.” They define social systems as those dealing with governance (e.g., property rights and access to resources) and different systems of knowledge pertinent to the dynamics of environment and resource use and world

views and ethics concerning human-nature relationships. Ecological systems (ecosystems) refer to self-regulating communities for organisms interacting with one another and their environment.

However, this shift in thinking has caused considerable debate (Jax 2007). Some researchers believe that the term 'ecosystem' has evolved to have multiple and inconsistent, conflicting meanings (Grumbine 1994; Omernik and Bailey 1997; Fitzsimmons 1999; O'Neill 2001). Limburg et al. (2002) draw attention to the fact that what constitutes an ecosystem is arbitrary and based on the boundaries drawn by the observer. These boundaries can be set depending on the scientific, management, or policy issue being examined. In fact, the usefulness of the concept has been questioned because "as spatial units, ecosystems represent a geographic free-for-all" (Fitzsimmons 1999:4). Ross et al. (1997) note that the term 'ecosystem' is viewed by different researchers as: (1) an identifiable natural region (entity), (2) a means of organizing our thinking about the natural world (an abstract concept), or (3) a particular approach.

As an identifiable natural entity, a watershed may be considered an ecosystem with complex interacting natural components influenced by natural processes and the impacts of human activities (O'sullivan 1979; Lotspeich 1980; Imhof et al. 1991; Hornbeck and Swank 1992; Margerum 1995; Margerum and Born 1995; Conservation Ontario 2001; O'Neill 2001). By shifting focus from the part to the whole, complex systems theory acknowledges the linkages between natural and cultural systems and recognizes that individual systems operate in and are affected by activities at multiple interacting scales, and is therefore relevant to the study of watersheds and how they are managed.

2.5.2 Ecosystem Health

Associated, but distinct from the discourse on ecosystems, is ongoing debate about the meaning and attributes of ecosystem health. Most definitions of ecosystem health emphasize three key features: (1) *organization* (diversity and number of interactions among biological, social, and cultural components), (2) *vitality* (ecological, economic, and cultural productivity), and (3) *resilience* (degree to which ecosystems can withstand change while retaining the same controls on function and structure) (McGlade 2002; Muñoz-Erickson and Aguilar-Gonzalez 2003; Rapport 2010). In the context of landscapes, some researchers claim that health is achieved when the cycling of energy and nutrients is not impaired, when the key ecological components are preserved, when the system is resistant and resilient to long-term effects of natural perturbations, and when the system requires minimal management interventions (Rolston III 1994; Covich et al. 1995).

Generally, ecosystem health research is focused on maintaining, enhancing, or restoring the natural system. When humans are added as an inextricable component of the ecosystem or coupled to

the natural ecosystem, the concept of health becomes even more complex and requires consideration of human-nature relationships. Society identifies and values certain 'ecosystem' services that are perceived as beneficial, but rarely recognizes or values intrinsic properties inherent in an ecosystem that help maintain its functions. The impact of human activities has impaired many ecosystems and there is mounting evidence that human-dominated ecosystems have become dysfunctional (Vitousek et al. 1997). The degradation of ecological services within an ecosystem requires extensive and expensive restorative measures, engineering interventions, or the import of ecological services from other ecosystems because natural systems under stress cannot always be repaired or replaced (Brooks et al. 1994; Karr 1995; Scheffer et al. 2001). Therefore, ecosystem assessments require the analysis of linkages among human pressures on ecosystems, altered ecosystem structure and function, alteration in ecosystem services, and societal response (Rapport, Costanza, and McMichael 1998).[9]

Some researchers propose the 'ecosystem approach' as a framework within which resource management decisions should be made, calling for a shift away from anthropocentric approaches (especially the domination of nature version of anthropocentrism) to eco-centric and symbiotic approaches (respect for nature and its associate goods, services, and intrinsic values). Others call for a move away from the 'science of parts' to the 'science of integration' (Walters and Holling 1990; United Nations Development Programme et al. 2000). Jope and Dunstan (1996: 53) associate complex systems theory with the ecosystem approach and state that "it is imperative that an ecosystem-based approach incorporates concepts of systems theory, including an awareness of emergent properties and implications of self-organization, disturbance and boundaries."

Since watersheds are considered one type of ecosystem, ecosystem health, in its broadest sense, is a term that is sometimes considered synonymous with watershed health. Every watershed can be described in terms of specific biophysical, socio-cultural, and economic characteristics. Biophysical components are a watershed's elements and functions (processes), while socio-cultural and economic components are both the values and benefits provided by healthy, functioning watersheds, and the stresses placed on the ecosystem. An awareness and understanding of system dynamics, the concepts of ecological health, the interplay between human and ecological systems, and the drivers that shape human behaviour can assist practitioners in designing more effective management strategies that consider the impacts and implications of human-nature interrelationships. The concepts associated

[9] Rapport et al. (1998) differentiate between ecological integrity and ecosystem health. Ecosystem health implies 'well-functioning' whereas ecological integrity is characterized with respect to species composition, biodiversity and functional organization relative to a naturally evolved system in the absence of significant human effects. According to Grumbine (1997), ecological integrity can only be maintained if human use is accommodated within these constraints.

with ecosystem functions and health (systems theory) form the building blocks of the ecosystem approach to watershed management described in Section 2.7.

2.6 The Role of Sustainability and Good Governance in IWM

Sustainability and good governance combine to represent a second theme associated with definitions of IWM described in Section 2.2. These concepts, which imply that coordinated, collaborative processes should be embedded in institutional, decision-making, and management processes that uphold sustainability principles, are discussed in the following sections.

2.6.1 Sustainable Development and Sustainability

The World Commission on Environmental and Development (WCED) published its report *Our Common Future*, more commonly known as the Brundtland Report, in 1987. It stated that development is sustainable when it meets "the needs of the present without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development 1987: 43). While sustainable development is generally accepted as a laudable goal, interpretations about what it means differ greatly (Jaeger 1995; Thompson 1997; Lackey 1998; Sneddon 2000; Hecht 2004; Ozkaynak, Devine, and Rigby 2004; Welker 2005).

Some argue that sustainable development is an oxymoron – that we cannot continue to develop in perpetuity without changing social values and priorities and using innovative technologies to stretch our capacity to meet needs (Lackey 1998; Ehrenfeld 2005). Some practitioners differentiate between 'sustainable growth' and 'sustainable development' by looking at issues of 'quantity versus quality'. Growth is viewed as an increase in physical size through quantitative material increases whereas development is a qualitative change, a realization of potentialities, and a transition to a fuller or better state (Kuhre 1998).

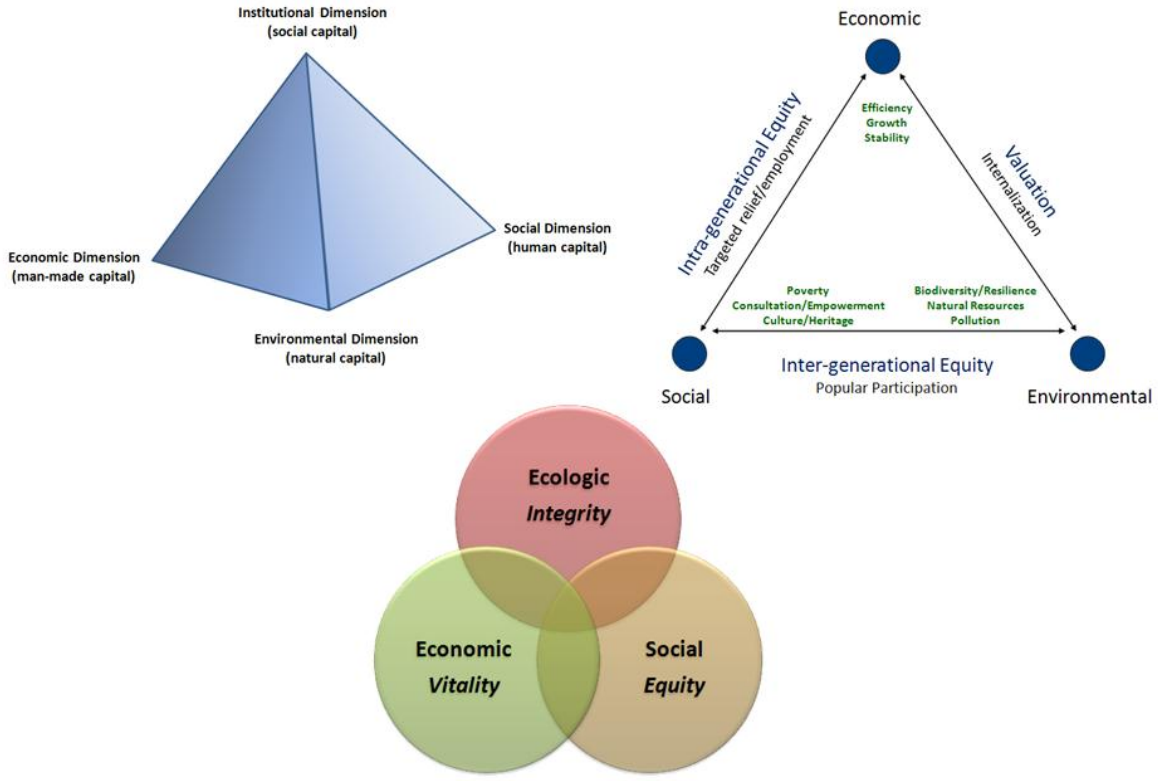
Likewise, the concept of sustainability is controversial and widely disputed. The complexities and changing dynamics of environmental, economic, and social interactions (e.g., ecosystems evolve, technologies advance, consumption patterns shift, social values, norms, and priorities change, and natural resources are either used up or degraded) give rise to diverging points of view. These perspectives vary depending on whether one believes in strong sustainability or weak sustainability.[10] Viewpoints also differ depending on whether one perceives sustainability as an end product or a

[10] Those who advocate 'strong sustainability' believe that the existing stock of natural capital must be maintained and enhanced because the functions it performs cannot be duplicated by manufactured capital, whereas those who support the idea of 'weak' sustainability believe that manufactured capital of equal value can take the place of natural capital (Hopwood, Mellor, and O'Brien 2005).

'journey' or both. However, most views of sustainability are highly anthropocentric and do not account for the intrinsic value of natural systems (Thompson 1997).

Hueting and Riejnders (2004) believe that the concept of sustainability implies that natural, human, and economic capital can be maintained in an equilibrium relationship between human activities and the physical environment. Many researchers and practitioners conceptualize this balance as the 'three pillars' (Annan 2002), a 'three-legged stool' (Just 2002; Dawe and Ryan 2002), an intersecting Venn diagram (Flint 2004), or an equilateral triangle (Munasinghe 1993). These three aspects of sustainability have sparked research that covers a broad range of disciplines. The economic approach is generally based on the concept of the maximum flow of income that could be generated while at least maintaining the stock of capital that yields those benefits. The social notion relates to intergeneration equity or the right of future generations to inherit a healthy environment. The environmental view focuses on preserving or re-establishing ecosystem health. Another model is the 'prism of sustainable development' which includes an economic dimension (human-made capital), an environmental dimension (natural capital), a social dimension (human capital), and an institutional dimension (social capital) (Keiner 2004) (Figure 2.1).

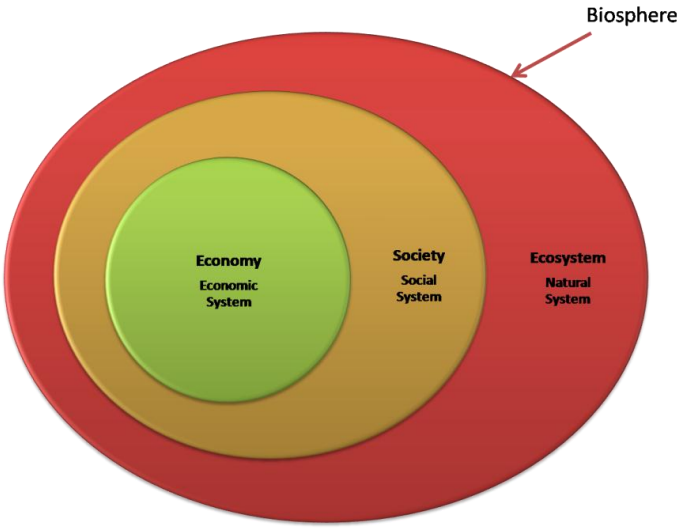
Figure 2.1. Alternative Models of Sustainability



Keiner (2004) offers an additional consideration to the concept, which he calls ‘evolutionability’. He contends that the principle of ‘good heritage’ should prevail in order to guide sustainability in the right direction. Good heritage means that next generations should not find equal, but better living conditions. Dawe and Ryan (2002: 1459) argue “that the environment must be considered at a different, more significant level than either the economy or our social well-being because it is the source of both these necessities to humanity.”

Some analysts have addressed this dichotomy in thinking by promoting the idea of ‘directionality’ to each element’s dependence on the other (Thompson 1997; Bossel 1999; Peart 2001; Flint 2004; Kranz et al. 2004). In this model, society and economy are nested within the broader ecosystem (Figure 2.2). A derivation of this model is the ‘egg of sustainability’ where the ‘white’ is the ecosystem and the ‘yolk’ is society (Guijt, Moiseev, and Prescott-Allen 2001). The key notion is integration rather than ‘balancing’. Gibson et al. (2005) point out that balancing implies sacrifices and may involve further loss of ecosystem health and integrity and, while trade-offs are inevitable, certain rules should pertain including achieving maximum net gains, putting the burden of argument on the trade-off proponent, avoiding significant adverse effects, protecting the future, providing explicit justification, and applying an open public process.

Figure 2.2. The 'Directionality' of Sustainability



Despite differences in the philosophical view of sustainability, many models of sustainability suggest several key ideas: (1) living within limits, (2) understanding the interconnections among economy, society, and the environment, (3) equitable distribution of resources and opportunities for existing and future generations, (4) recognition of uncertainty, and (5) anticipation of surprise.

Sections 2.2 and 2.3 illustrate that IWM is promoted globally as a means of remedying environmental, social, and economic problems and achieving sustainability. Incorporation of these ideas into watershed management requires institutional processes and rules of engagement that (1) clarify, manage, and reconcile intersecting and disparate environmental, social, and economic dimensions, (2) identify a mix of alternative management scenarios that distinguish probable trade-offs, opportunities, and anticipated outcomes (both positive and negative), and (3) facilitate decisions which consider particular contextual factors and support optimal solutions for protecting and improving ecosystem health, enhancing social well-being in a fair and equitable manner, and supporting economic vitality.[11]

2.6.2 Good Governance

The concepts of 'sustainability' and 'good governance' are closely linked. As global environmental, social, and economic issues continue to escalate, particularly in developing countries, many international development agencies, corporations, governments, and civil societies are supporting good governance to address pressing concerns such as poverty, environmental degradation, injustice, corruption, inequity, and inequality.

Although governance is a relatively new term, it has prompted a profusion of literature (Francis 2003). While there are many differing interpretations, this concept is generally used to refer to decision-making processes that involve government, civil society, and business. Collaboration is required because no single actor, public or private, has the competence to unilaterally address complex problems (Stoker 1998). According to Chess, Hance and Gibson (2000: 251), effective collaboration must have the 'right participation' and 'get the participation right' and requires an adaptive approach, incorporating explicit experimentation and adjustment because "the variables…tied to participation are…complex, uncertain, and poorly characterized." The Commission on Global Governance (1995: 2) defines governance as,

> The sum of the many ways individuals and institutions, public and private, manage their common affairs. It is a continuing process through which conflicting or diverse interests may be accommodated and co-operative action may be taken. It includes formal institutions and regimes empowered to enforce compliance, as well as informal arrangements that people and institutions either have agreed to or perceive to be in their interest.

[11] Optimal or "best" solutions allow for mutually-reinforcing ways to simultaneously meet ecological, social, and economic objectives and incorporate uncertainty and redundancy. This contrasts considerably with the goal to 'maximize' solutions, which implies actions that achieve the greatest return, usually over the short term, without full regard for long-term or multiple consequences.

Imperial (2004: 6) sees governance as "the means for achieving direction, control and coordination of individuals and organizations with varying degrees of autonomy." Using a mix of tools such as statutes, organizational and financial resources, programmatic structures and administrative rules, formal and informal rules, social norms and structures to govern the relationships between organizations, governance seeks to (1) engage a wide range of stakeholders (including state, private, and civil society), (2) share power in decision making, (3) encourage autonomy and independence in citizens, (4) rely on informal mechanisms of coordination, and (5) provide a process for developing the common good through civic engagement (Pierre 1999; Jun 2002).

Governance is inherently political and involves bargaining, negotiation, and compromise (Imperial 2004). It represents a networked practice, engaging interconnected stakeholders who hold power and whose knowledge and resources are recognized (Kemp, Parto, and Gibson 2005). Movement towards multiple centres of interaction and away from a single centre of power has been recognized in terms such as integration, decentralization, and devolution (Blomquist and Schlager 2005). These networks operate at different scales and sites (Himley 2008), and create a governance landscape which is highly dynamic, multi-sectored, and multi-level (Brunckhorst and Reeve 2006).

Research is increasingly focused on governance regimes that are polycentric in structure and that reflect a "political order in which multiple authorities serve overlapping jurisdictions" (McGinnis 2000: 2). Emphasis has shifted from local-scale considerations to 'multi-level' governance perspectives in recognition of the broader social, economic, and political processes that affect local issues (Bulkeley and Betsill 2005; Lankford and Hepworth 2010).

Governance is related to, but distinct from, management. Olsson (2007: 269) suggests that "governance is the process of resolving trade-offs and providing a vision and direction for sustainability, management is the realization of this vision, and monitoring provides feedback and synthesizes the observations to a narrative of how the situation has emerged and might unfold in the future." Bakker (2007: 16) also differentiates governance from management and notes that "governance refers to how we make decisions and who gets to decide; management refers to the models, principles and information we use to make those decisions. Obviously the two are interrelated; however, management is often the focus of debate, whereas governance is often overlooked."

The idea of 'good governance' relates to the quality of governance. It received world-wide support at the Millennium Summit General Assembly of the United Nations in September 2000. At

that time, world leaders committed to the Millennium Declaration of the United Nations that set key objectives for the twenty-first century. The Declaration outlines a common vision of peace and security, poverty eradication, protecting environment, and human rights, democracy, and good governance (United Nations 2000). Good governance encompasses a broad agenda that supports effective government policies and administration, respect for the rule of law, protection of human rights, and an engaged and effective civil society that cuts across social, political, economic, and environmental issues. According to the United Nations Economic and Social Commission for Asia and the Pacific (n.d.), good governance is,

> …participatory, consensus oriented, accountable, transparent, responsive, effective and efficient, equitable and inclusive and follows the rule of law. It assures that corruption is minimized, the views of minorities are taken into account and that the voices of the most vulnerable in society are heard in decision-making. It is also responsive to the present and future needs of society.

In 1997, the United Nations Development Program articulated nine characteristics of good governance that include the state, private sector, and civil society (Table 2.3). While many concede that those characteristics represent ideals that are elusive, complicated, and inherently conflicting, the desirability of striving towards good governance is widely acknowledged.

Table 2.3. The Characteristics of Good Governance

United Nations Development Program Characteristics of Good Governance
Participation – all men and women should have a voice in decision making, either directly or through legitimate intermediate institutions that represent their intention. Such broad participation is built on freedom of association and speech, as well as capacities to participate constructively.
Consensus orientation – good governance mediates differing interests to reach a broad consensus on what is in the best interest of the group and, where possible, on policies and procedures.
Strategic vision – leaders and the public have a broad and long-term perspective on good governance and human development, along with a sense of what is needed for such development. There is also an understanding of the historical, cultural and social complexities in which that perspective is grounded.
Responsiveness – institutions and processes try to serve all stakeholders within a reasonable time frame.
Accountability – decision makers in government, the private sector and civil society organizations are accountable to the public, as well as to institutional stakeholders. This accountability differs depending on the organizations and whether the decision is internal or external.
Transparency – transparency is built on the free flow of information. Processes, institutions and information are directly accessible to those concerned with them, and enough information is provided to understand and monitor them.
Equity – all men and women have opportunities to improve or maintain their wellbeing.
Effectiveness and efficiency - Processes and institutions produce results that meet needs while making the best use of resources.
Rule of Law – legal frameworks should be fair and enforced impartially, particularly the laws on human rights.

Source: United Nations Development Program (1997)

Dietz et al (2003) claim that, in the absence of effective governance institutions at the appropriate scale, natural resources and the environment are in peril from increasing human population, consumption, and deployment of advanced technologies for resource use, all of which have reached unprecedented levels. IWM, as defined in Section 2.3, is fundamentally about making decisions to address human interactions with and responses to the natural environment and to ensure that the nature and extent of the ecosystem goods and services are sustained for future generations. Therefore, the characteristics of 'good governance' have particular relevancy to this study.

2.7 Alternate Management Principles for IWM

While the dialogue evoked by the terms 'ecosystems', 'sustainability' and 'good governance' will continue to evolve, several researchers have suggested general principles for managing natural resources based on their particular conceptual and theoretical viewpoints and inclinations. Table 2.4 presents key principles associated with five complementary alternative management approaches that stem from these deliberations and debates: (1) ecosystem approach, (2) sustainability requirements, (3) sustainable governance, (4) new watershed approach, and (5) good governance. A more detailed description is provided in Appendix D.1. Many of these principles embrace similar concepts and are mutually supportive.

The ecosystem approach or ecosystem-based approach reflects many of the tenets of complex systems theory and offers a holistic approach to management which embodies human-nature relationships.[12] Yaffee (1999: 714) states that there is "remarkable consensus" among analysts regarding the fundamental aspects of this approach. These include systems thinking, deeper understanding of the complexity and dynamism of ecological and social systems, more extensive consideration of different spatial and temporal scales, ecologically-derived boundaries, adaptive management to deal with uncertainty, and collaborative decision making. An ecosystem-based approach ''integrates scientific knowledge of ecological relationships within a complex socio-political and values framework toward the general goal of protecting native ecosystem integrity over the long term'' (Grumbine 1994: 31).

[12] The differences among the terms ecosystem management, ecosystem-based management, and the ecosystem approach are indistinct. Slocombe (1998) contends that there is a difference between the terms ecosystem-based management and ecosystem-management. The former emphasizes the management of activities within an ecosystem from an ecosystem perspective whereas the later is conducted at smaller spatial scales and is the domain of ecological science (Slocombe 1998: 32). Yaffee (1999) suggests that ecosystem management can have multiple meanings including, ecoregional management which emphasizes landscape-scale management, ecosystem-based approaches to resource management which recognize interconnectedness but use the ecosystem as a mental construct, and environmentally sensitive, multiple-use management which is human-centric but more sensitive to the limits of ecological systems.

The ecosystem approach was formally accepted by the Convention on Biological Diversity (2000) during The Conference of the Parties in Nairobi, Kenya. Decision V/6 defines the ecosystem approach more broadly as "a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way. Thus, the application of the ecosystem approach will help to reach a balance of the three objectives of the Convention: conservation, sustainable use and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources."

Table 2.4. Principles Underpinning Alternative Management Approaches

Alternative Approaches / Principles	Ecosystem Approach (Slocombe 2010)	Sustainability Requirements (Gibson et al. 2005)	Principles for Sustainable Governance (Costanza et al. 1998)	New Watershed Approach (Born and Genskow 2000)	Good Governance (Graham, Amos and Plumptre 2003)
Adoption of the watershed for planning and managing natural resources	✓		✓	✓	
Recognition of human-ecological relations	✓	✓		✓	
Focus on protecting critical ecosystem components, functions and structures	✓	✓			
Focus on human activities to ensure lasting livelihood sufficiently and opportunity		✓			
Adaptive	✓	✓	✓	✓	
Precautionary		✓	✓		
Holistic	✓	✓			✓
Results-based (multiple benefits and gains)		✓			
Collaborative (interdisciplinary; multi-jurisdictional; multi-agency)		✓	✓	✓	✓
Consensus-based	✓	✓		✓	✓
Accountable and Responsive Decision Making	✓	✓	✓	✓	✓
Intergenerational Equity		✓	✓		
Intragenerational Equity	✓	✓	✓		✓

Grumbine (1994, 1997) suggests ten dominant themes inherent in the ecosystem approach. These are (1) hierarchical context (systems perspective), (2) ecological boundaries rather than political/administrative units, (3) ecological integrity, (4) increased data collection and improved data management (5) monitoring, (6) interagency cooperation, (7) humans embedded in nature, (8) adaptive management, (9) organizational change, and (10) human values. Key aspects of the ecosystem approach are summarized by Slocombe (2010) and presented in Table 2.4. The ecosystem approach and IWRM are considered complementary concepts. In fact, some researchers view IWRM as one type of broader ecosystem approach (Mitchell 2007). Often the two terms are used interchangeably when the management unit or study area is a watershed.[13]

Constanza et al. (1998) propose six sustainable governance principles, which they argue need to be applied to the use of all environmental resources. These principles are based on the paradigm of 'adaptive management' whereby policy making is an iterative experiment acknowledging uncertainty, rather than a static 'answer'. C.S. Holling (1978) introduced the concept of adaptive management. Johnson (1999) indicates that the goal of adaptive management is not to maintain an optimal state of the resource, but to develop an optimal management capacity. Maintaining flexibility in the management system allows managers to react when conditions change and manage issues within a range of acceptable outcomes, while avoiding catastrophes and irreversible negative effects.

Adaptive management can be active or passive. Passive management plans use the information available to choose options and specify future decision points where feedback and new information are analyzed to make decisions on future actions. Active management plans are considered experiments over a specified period of time, after which the best management options are widely applied (Anderson et al. 2003; Noble 2010).

The process of adaptive management requires 'adaptive learning' or the ability of people "to learn from their experiences and respond more effectively to new uncertainties, enabling them to change old ways of doing things and allowing them to make better decisions in managing the natural resource base" (Cadiz and Dagli 2010: 55). McLain and Lee (1996: 437) identify three prerequisites for adaptive learning: (1) rapid knowledge acquisition, (2) effective information flow, and (3) processes for creating shared understandings, and conclude that adaptive management suffers from "an overreliance on rational comprehensive planning models, a tendency to discount non-scientific forms

[13] In recent years, watershed management in Ontario has been promoted as an integrated ecosystem approach within which human and environmental interactions in a river basin are managed and management decisions shared by government, business, and civil society (Conservation Ontario, 2003).

of knowledge, and an inattention to policy processes that promote the development of shared understandings among diverse stakeholders." While the aims of adaptive management are to improve environmental management through 'learning by doing' and to understand the impact of incomplete knowledge, Schreiber et al. (2004) observe that in reality, it often consists of ad hoc changes in the absence of adequate planning and monitoring. Adaptive management is either severely constrained or impossible to achieve without adaptive design.

Sustainable governance principles stress: (1) civic responsibility to use resources in an ecologically sustainable, economically efficient, and socially fair manner, and (2) matching scale to decision making where relevant information is available, responses are quick and efficient, and integration can be achieved across scale boundaries. Additional key elements included in this framework include the notions of both intragenerational and intergenerational equity.[14]

Gibson et al. (2005) suggest an enhanced model for management which supports the principles of sustainable governance identified by Costanza et al. (1998), but adds important socio-economic and institutional dimensions. These include (1) providing universal access to opportunities for seeking self-improvement and a decent life without compromising future generations, (2) building participatory capacity among individuals, communities, and other decision-making bodies to apply sustainability requirements, foster reciprocal awareness and collective responsibility, and encourage integrated decision making, and (3) applying and integrating all principles of sustainability, now and in the future.

The concepts of sustainability and good governance share many similar ideas, including stakeholder collaboration. Stakeholder collaboration recognizes a need to shift from reliance on representative democracy in which decisions are made on behalf of the populace, to an open, inclusive decision-making process in which ample opportunity is provided for all voices to be heard. Good governance and sustainability also infer end goals and a shared process for achieving them.

Since about 1990, the creation of partnerships for watershed governance has increased dramatically in North America and elsewhere (Veale 2003). Born and Genskow (2000, 2001) refer to this phenomenon as the 'new watershed approach'. This approach borrows from the ecosystem approach and is also closely aligned with sustainability and good governance principles. In particular, this approach: (1) embraces principles that have an express focus on the watershed and collaborative decision-making processes, (2) supports a 'bottom up' or 'grassroots' approach, and (3)

[14] Intergenerational equity refers to the fair and just distribution of resources from one generation to the next, while intragenerational equity refers to the fair distribution of resource costs and benefits among people living now (Farrell and Hart 1998).

tends to be more strategic and reduced in scope, more action-oriented, and more adaptive than the traditional 'top-down' approach (Born and Genskow 1999).

The nine characteristics ascribed to good governance by the United Nations Development Program convey a series of defining features which relate to an inclusive, participatory process for decision making. These features are collapsed into five principles by Graham, Amos, and Plumtre (2003) and emphasize the need for a collective strategic vision, accountability and transparency in decision making across public and private sectors, equity, fairness, and equal opportunities for participation in the decision-making process between genders, and responsive institutional processes which serve all stakeholders and make effective and efficient use of resources (Table 2.4).

In summary, the principles described in this section describe desired outcomes (healthy ecosystems and enhanced social and economic well-being) and governance attributes required to achieve them. The relevance and applicability of these principles for guiding and assessing the practice of IWM are discussed in more detail in Section 2.8.2.

2.8 Planning Theory

The prescribed process for undertaking IWM has strong roots in planning theory. The following sections review the evolution of planning theory and describe its pertinence to IWM.

2.8.1 Planning Theory and the Role of Planners

Planning theory draws upon a wide range of theories and practices from different disciplines (Alexander 1992; Allmendinger 2002) and is shaped by divergent perspectives regarding the nature and role of planning. This has led to a diversity of viewpoints regarding the role of planners, the tasks of planning, and the theories that guide them. As a consequence, planning theory is not easy to define; "the subject is slippery, and explanations are often frustratingly tautological or disappointingly pedestrian" (Campbell and Fainstein 2003: 1). Lack of cohesive planning theory is manifest in the many definitions in the literature.

Definitions range from "planning is forethought" to "planning is a process of determining future action through a sequence of choice" to a simple pragmatic view that "planning is what planners do" (Alexander 1992: 86). Friedmann (2003: 75) suggests that planning is "that professional practice that specifically seeks to connect forms of knowledge with forms of action in the public domain." Knowledge is either derived from the top down through the central authority of the state (societal guidance) or it flows from the bottom up, emerging from the community and its members (social transformation). Actions can either be conservative, radical, or a combination of both. Conservative

actions are incremental, originating with and respectful of the existing system. Radical actions challenge the status quo and are activities or events that stem from outside of the existing system.

Rather than focusing on procedure, Friedmann (1987) suggests a range of political interpretations regarding the appropriate place for planning by combining forms of knowledge with forms of action and categorizes planning as social reform, policy analysis, social learning, and social mobilization. Social reform focuses on the role of the state in guiding societal progress through the application of scientific knowledge to public affairs. Policy analysis refers to planned change based on the belief that models of social problems or situations can be constructed, and scientific analysis of data can lead to 'best' solutions. Social learning emphasizes knowledge and action that stem from 'learning by doing' together. These three traditions focus on the state. The fourth tradition is rooted in civil society. Social mobilization stems from grassroots efforts to liberate and reform by confronting those in positions of power. Aspects of these four planning traditions are reflected in the various theories to explain and guide planning practice.

The predominant framework for planning until the early 1980s was the rational comprehensive or synoptic model. This framework was originally conceived as a top-down approach based on complete knowledge of the issues and the consequences of a range of actions – simplistic in its design but, in the strictest sense, usually unachievable due to its demands on resources and expertise (Lane, 2005). This approach assumes that planning occurs where problems and objectives are well-defined, extensive data sets are accessible, a full array of options is identified and the consequences understood, and sufficient time, skills, and resources are available to address the problems. While it was acknowledged that full knowledge was unattainable, the rational comprehensive approach as a normative framework for planners was endorsed by several influential planning scholars (Meyerson 1956; Banfield 1959; Branch 1959; Faludi 1973).

Other writers perceived this stance as limiting and unrealistic because planners operate within an ever-changing, complex, unpredictable milieu of interacting social and political forces where time, skills, and resources are limited (Forester 1989). An upsurge of alternative viewpoints ensued, creating a 'hyperactive state' for the generation of new planning theories and perspectives (Allmendinger 2002). In the past 30 years, theorists have espoused a wide range of alternative viewpoints on planning which represent "either modifications of synoptic rationality or reactions against it" (Hudson 1979: 388). These include how decisions are made (e.g., incrementalism, mixed scanning, satisficing), how planning can be made more equitable (e.g., transactive planning, advocacy planning, radical planning), how planning can be made more inclusive (e.g., communicative theory, participatory theory) (Mäntysalo 2005) and how policy can be more effectively influenced (e.g.,

evidence-based theory) (Davoudi 2006). Hudson (1979: 396) questions whether or not any planning style can be effective without parallel inputs from other complementary and countervailing traditions.

Many analysts of planning theory disagree with the notion that decision making is rational, believing instead that human intellectual capability is insufficient to understand and solve contemporary planning or 'wicked' problems.[15] Incrementalism, satisficing, and mixed scanning represent alternative views regarding the decision-making process and bring new insights to the rational comprehensive perspective.

Political scientist Charles Lindblom originated the concept of incrementalism. He suggested that policy decisions are often made incrementally because stakeholders hold divergent views on how goals should be pursued and agreement is "possible only to the extent that values are agreed upon" (Lindblom 1959: 83). As a result of the various views about ends and means, incrementalism alleges that actors use their political power to negotiate what and how something should be done in a series of small steps that are acceptable to others. The main problem associated with incrementalism is the often unintended and unconscious 'large decisions' that emerge from the series of 'small' incremental decisions taken by many actors (Odum 1982).

Satificing or 'bounded rationality' is a concept born from the ideas of Herbert Simon in the context of economic decision making. Simon believed that rather than trying to maximize solutions, firms opt for good solutions that are not necessarily the best. According to Simon (1992: 4),

> Bounded rationality, can be characterized as selective search though large spaces of possibilities. The selectivity of the search, hence its feasibility, is obtained by applying rules of thumb, or heuristics, to determine what paths should be traced and what ones can be ignored. The search halts when a satisfactory solution has been found, almost always long before all alternatives have been examined.

Mixed scanning is described by Amitai Etzioni as "a hierarchical mode of decision making that combines higher order, fundamental decision making with lower order, incremental decisions that work out and/or prepare for the higher order ones" (Etzioni 1986: 8). Mixed scanning entails a mixture of shallow and deep examination or scanning of data. The initial scan uses a generalized consideration of facts and choices followed by detailed examination of a selected subset (Etzioni 1989).

[15] Planning problems by their nature are wicked problems (Rittel and Webber 1973). Wicked problems (planning issues) have no definitive problem statement, divergent and alternative solutions based on multiple stakeholder perspectives and agendas, complex and shifting problem-solving processes influenced by social and political factors, and constantly changing rules of engagement as interested parties come and go, change their minds, fail to communicate, or otherwise change the rules by which the problem must be solved (Conklin and Weil 1997).

Other schools of thought, developed in opposition to the confines of synoptic rationality and purporting that planning should engage civil society and promote more democratic decision making, are labelled by Healey (1997) as 'the communicative turn'. Planning discourse has given rise to advocacy, transactive, communicative (collaborative), and radical planning approaches, among many others.

Advocacy planning was championed by Paul Davidoff who contended that the interests of the disadvantaged and disenfranchised were being ignored and that planners should intervene to ensure that their voices were heard in order to offset the powers of business and government. Advocacy planning rejects the notion of an objective and rational non-political view and calls for full inclusion of public interests through the development of plural plans rather than a unitary plan (Davidoff 1965).

Transactive planning espouses planning as a decentralized function based on face-to-face contacts, interpersonal dialogues, and mutual learning between planners and the people affected by planning (Friedmann 1973). Radical theory builds on transactivism by taking it to a level where planning for collective action is undertaken by civic groups to solve local problems in opposition to the perceived elitist, centralizing, and change-resistant of mainstream planning. Radical theory embraces systems change, decentralization, communal society, facilitation of human development, and consideration of ecology (Grabow and Heskin 1973). The role of the planner as an agent of change is inherent to radical planning. Radical planning requires "not settling for needs identification without altering the very mechanisms that exist to respond to those needs, which is often seen as maintaining the status quo that allows oppression to continue" (Netting, O'Connor, and Fauri 2008: 20). For this reason, radical planning is difficult to achieve in government bureaucracies that are typically resistant to change.

The roles of the planner as a conduit between technical and political information and the driving force for consensus building among diverse interest groups form the basic tenets of communicative planning theory (Forester 1989). Communicative planning theory builds on two strands of thought. Anthony Giddens' theory of structuration forms the first element, which emphasizes that individuals are reflective beings whose interests are not fixed and independent but constructed through interaction with others through space and time. The second aspect is influenced by Jürgen Habermas' ideas regarding communicative action. Habermas argues for a public realm where unfettered communication is possible. Communicative planning prescribes an active role for the planner in mediating disparate perspectives among a diversity of stakeholders and presupposes substantial public participation (Lane 2005). Relationships are formed among stakeholders by encouraging them to negotiate, debate, and share life histories and common experiences (Sager 1994; Healey 1997; Innes

and Booher 1999). This in turn, encourages mutual learning, joint problem construction, and stimulates stakeholders to make decisions and alter behaviours to pursue collective, rather than individual goals.

No discussion about participatory approaches to planning is complete without an overview of Arnstein's 'ladder of participation' (Arnstein 1969). The ladder is a metaphor that represents a continuum between top-down and bottom-up planning approaches. At the lower level, the public has limited access to decision making (non-participation). At the mid levels, the general public is informed, consulted, and placated (tokenism). At the highest levels, the general public has influence and control through partnerships, delegation, and citizen control (citizen power).

Since 1999, there has been a growing emphasis on evidence-based policy and user-relevant research and a shift towards a linear, utilitarian, or instrumental view of policy and practice (Davoudi 2006). Research either leads policy (evidence-driven) or follows policy (policy-driven). In contrast, another view (enlightenment model) emphasizes an 'evidence-informed' policy approach which suggests that "although research does and should play an important role in policy making, the role is less one of problem solving, than of clarifying the context and informing the wider public debate (Davoudi 2006: 16). Current interest in evidence-based theory is dominated by the former view that favours synoptic rationality by assuming that (1) policy making is a logical process, (2) evidence can only be generated through positive or 'good' science, and (3) experts are apolitical, objective, and know best.

Many planning theories put forward over the past 40 years overlap directly with the ideas and concepts articulated for ecosystem health and sustainability and good governance. Recognition of uncertainty, risk, and complexity within planning processes has led theorists to seek new theories to acknowledge these elements. The call for planners to engage civil society and promote decentralized decision making is particularly relevant to the practice of watershed management, as noted in Sections 2.2 to 2.4.

2.9 Concepts and Theories Associated with IWM

The basic implementation framework for IWM is a modified rational comprehensive or synoptic model that includes monitoring and evaluation as essential steps. It is illustrated as a straightforward, cyclical, and sequential process (Table 2.5). This process includes: (1) data collection and analysis necessary for identifying issues and developing a plan to resolve them, (2) a variety of mechanisms for implementing the plan, (3) ongoing monitoring of the plan's effectiveness, and (4) a process for

updating the plan (Blumenthal and Jannink 2000; Doppelt 2000; Gelt 2000; Ludwig 2001; Westmacott 2002; Conservation Ontario 2003; Schreiber et al. 2004). [16]

Table 2.5. Stages and Steps in the Watershed Management Process

Watershed Management Stages	Watershed Planning Steps	
Trigger	A watershed management plan is usually spurred by one or more environmental triggers such as flooding, drought, water shortage, soil erosion and sedimentation, contaminated drinking water, or degraded water quality.	
Plan and Research	• Identify decision structure • Scope the issue(s) • Characterize the biophysical and related socio-economic system (collate available scientific, traditional, and local knowledge) • Determine priorities at the community and watershed, provincial, and federal levels • Set common vision, goals, objectives, targets, and monitoring and assessment criteria • Identify broad plan alternatives, barriers and opportunities • Re-scope the issues • Identify gaps in knowledge • Identify barriers to and opportunities for research	• Develop research needs and their priority for funding • Develop strategies for eliminating barriers to research • Develop plan and management alternatives • Evaluate plan and management alternatives using precautionary principles, scenario testing, cost-benefit analysis, sustainability assessment, cumulative impact assessment, stakeholder analysis • Select preferred plan and management alternatives • Finalize targets • Develop implementation and data collection and monitoring plans
Implement	• Develop an implementation committee • Identify the implementation requirements and consider the options available • Develop a work plan for implementation which allows for long-term phased implementation with short-term project delivery	• Allocate resources to the work plan • Assign priorities and responsibilities for implementation • Develop a schedule • Carry out the plan
Monitor and Report	• Analyze the issues • Develop specific objectives and questions • Define impact models, indicators, protocols, sites • Establish an information management system	• Establish rigorous quality assurance program • Prepare and implement program • Analyze data and prepare reports • Practice adaptive management to promote a continuous process of adaptation to changing technologies, issues, and societal attitudes and deal with unexpected problems and opportunities
Review and Evaluate	Review should be done when the natural system has had enough time to respond to management actions and outcomes. It is an opportunity to review the effectiveness, efficiency, and equity of implementation and to adjust the plan based on new technologies and approaches and emergent issues and needs.	

Source: After Syme, Butterworth, and Nancarrow (1994); Conservation Ontario (2003); Ledoux et al. (2005).

[16] In Australia, this process is known as PRIME (Plan, Research, Implement, Monitor and Evaluate) (Syme, Butterworth, and Nancarrow 1994).

While these basic implementation steps are widely accepted in the literature, many analysts advocate planning processes that (1) build on mixed scanning, transactive, and communicative planning theories, (2) enable citizen power, and (3) are fully participatory, iterative, and adaptive, taking into consideration the social, political, economic, and institutional factors operating within the watershed (Dixon and Easter 1991; Lessard 1998; Bellamy et al. 1999; Conservation Ontario 2003; Hedelin 2008; Heathcote 2009). For this to occur, the conventional top-down planning processes need to be adjusted to foster adaptive governance. Innovative institutional arrangements and organizational frameworks that can cope with complexity and change and foster adaptation and collaborative learning are required (Moote et al. 1994; Wallace et al. 1996; Grumbine 1997; Cortner et al. 1998; Gunderson 1999; Johnson 1999; Loucks 2000; Clark and Richards 2002; Armitage 2005; Saravanan, McDonald, and Mollinga 2009).[17] In order to make a transition to adaptive governance, Pahl-Wostl et al. (2007: 38) contend that,

> … there must be widespread dissatisfaction with the current or anticipated performance of existing management strategies, those involved must have the ability to detect and monitor potential gaps between the achieved and desired goals of the current management system, and those involved must be willing to change.

Lee (1992: 73) suggests that, "small, flexible institutional units may be best suited for adaptive learning necessary to achieve sustainable resource management." However, instead of creating new institutional structures, some researchers believe that reforms should focus on existing mechanisms for decision making and participation, and build on local and sectoral realities (Goldfarb 1994; Butterworth et al. 2010). While a flexible, 'bottom-up' consensus-building approach is generally favoured over the universal, standardized 'top-down' approach (Goldfarb 1994; Diplas 2002; Brouwer, Georgiou, and Turner 2003; Sabatier et al. 2005; Butterworth et al. 2010), adaptive co-management has emerged as an alternative governance model. Adaptive co-management relies on collaboration and voluntary coordination of actions and is understood as ''a process by which institutional arrangements and ecological knowledge are tested and revised in a dynamic, ongoing, self-organizing process of trial-and-error'' (Folke et al. 2002: 20).

Decentralized and polycentric (middle ground or hybrid) governance occurs when individuals, organizations, agencies, and institutions are connected at multiple levels and actions "are coordinated voluntarily by individuals and organizations with self-organizing and self-enforcing capabilities" (Folke et al. 2005: 449). These networks incorporate horizontal and vertical relationships within which dialogue, debate, and joint actions can occur (Blomquist and Schlager 2005). The emphasis is

[17] Institutional arrangements are defined as the rules that govern the activities and transactions of participants working to achieve specific results (Michaels 2001).

on the processes and interactions required for achieving collective goals and outcomes (Joseph, Gunton, and Day 2008). This middle ground can entail a continuum of approaches, providing opportunities for harmonizing benefits and minimizing drawbacks inherent to both bottom-up and top-down management (Adger et al. 2003). Hooper (2003: 14) asserts that IWM,

> …provides mechanisms for meeting top-down with bottom-up management. In any geographical setting, "entry points" for success in IWRM need to be crafted, primarily through either improved human and organizational capacity; dedicated and sustained funding that employs cost sharing; water visioning, not just ownership of the "commons" problem but also covenants of mutual responsibility and self responsibility; or building leadership skills. What works in one location may not work elsewhere.

In contrast to Habermasian communicative rationality,[18] such an approach must take into account "power and knowledge differences" and recognize that decision making for water resources "sometimes involves sharing and collaboration and sometimes the use of differences in information and power" (Butterworth et al. 2010: 74). Steyaert and Jiggins (2007: 579) point out that stakeholders "do not all hold the same social position with regard to measures proposed or taken to resolve the issues involved and they do not necessarily share the same view about what is desirable or what constitutes the purposes of resources." Mitchell (2006) also observes that stakeholders often hold parochial viewpoints and are more concerned about their own interests or jurisdictional responsibilities than with complex and abstract ideals such as watershed health.

Given the diversity of contextual factors within individual watersheds, analysts advise that the planning process needs to be "tailored, with the involvement of main stakeholders, to local and river basin conditions…" (Chéné 2009: 3). This approach requires consensus and collaboration among stakeholders. An essential prerequisite for developing collaboration is creating a shared vision and goals and building connections and consensus among key stakeholders. However, Born and Genshow (2006: 62) caution that "inflexible prescriptive approaches to develop collaboration" should be avoided. Loucks (2000: 7) advises that,

> Any motivation to consider the future depends on the ability and willingness to understand the interactions of processes on very different spatial and temporal scales. It also depends on an informed and supportive public. Those who are managing natural resources need to ensure that the public as well as their representatives who make decisions are aware of the short and long term temporal as well as spatial impacts and tradeoffs.

[18] Saravanan, McDonald, and Mollinga (2009: 81) state that "this approach is driven by rational individuals, bounded communities, stable social relations ad identities, and singular conceptions of state power." Critics argue that this stance is contrary to reality and that struggles over power among diverse stakeholders drive social interaction, create conflict, and yield social inequities.

Clearly, the normative framework for IWM mirrors many of the theories and principles associated with ecosystem health and dynamics, sustainability, and good governance. It suggests that the practice of watershed management should be guided by planning processes that engage key stakeholders, foster adaptive learning, create innovative governance structures, and achieve a common vision and multiple, mutually-reinforcing goals. Section 2.10 examines how closely these ideals match the actual practice of watershed management.

2.10 Challenges and Opportunities

Watershed management is not a static concept or practice. Attendant ideas and concepts are constantly evolving in response to the perpetual interplay between theory and practice. The challenges and opportunities associated with implementing IWM in an ever-changing political, institutional, and socio-economic milieu are described briefly in Sections 2.10.1 and 2.10.2.

2.10.1 Governance, Institutional, Administrative, and Legal Barriers

Despite growing consensus around the notions of IWM, implementation is difficult and progress has been modest (Chéné 2009; Medema, McIntosh, and Jeffrey 2008; Butterworth et al. 2010). Van der Zaag (2005: 870) states that while the concept is relevant, it is also "elusive and fuzzy." The problem is exacerbated by inconsistent concept definitions (Cardwell et al. 2006). Butterworth et al. (2010: 70) hypothesize that, "maybe we have been expecting too much, too soon."

Detractors of IWM claim that the concept is filled with vagueness and ambiguities and is not universally implementable in all watershed contexts. Common criticisms include the following: (1) IWM is a normative concept – a rare ideal that has little practical value, if the specifics of local realities are disregarded, (2) too often, a prescriptive top-down approach that watershed organizations have a limited capacity to deliver is adopted, (3) investments and efforts in IWM typically do not build on existing administrative and institutional arrangements, (4) IWM is being applied at inappropriate scales without sufficient data to understand the overriding resource issues (e.g., in developing countries, the focus is on large river basins), (5) the scale at which policy making takes place is mismatched with the scale at which implementation occurs, (6) participation strategies fail to take into account the inequities in stakeholder information, power, and influence, resulting in tokenism, patronisation, or disenfranchisement of certain citizens (e.g., minorities, financially disadvantaged), and (7) IWM fails to recognize water politics as a reality (Butterworth et al. 2010). Biswas (2008: 21) argues that,

> … the proponents of this concept have already spent so much time, energy and resources that they are mostly very reluctant to consider, let alone admit, at least in public, that the emperor may not have any clothes.

Molle (2008) suggests that IWM is a "nirvana concept" and cautions that its usefulness may have more to do with politics than with trying to solve resource problems. As such, nirvana concepts are "invested in, and reappropriated by, various constituencies as a means of forwarding their agendas or as a smokescreen for business-as-usual strategies" (Molle 2008:150). Biswas (2008: 20-21) claims that "that integrated water resources management has become a popular concept in recent years, but its track record in terms of application to more efficiently manage macro- and meso-scale water policies, programmes and projects has been dismal."

Other researchers acknowledge a significant gap between theory and implementation (Margerum and Born 1995; Bellamy and Johnson 2000; Lorenz, Gilbert, and Vellinga 2001; Walmsley 2002; Biswas 2004; Rahaman and Varis 2005; Molle 2008; Mitchell 2009). In practice, the watershed management process is complicated and rarely linear. Several tasks may occur simultaneously (Heathcote 2009). Often plans are implemented and revised with limited monitoring or evaluation to inform the next generation of plans. The feedback loop is between the planning and implementation phases of the process, or external factors such as institutional capacity or availability of resources for implementation influence decisions. Moreover, each resource issue may involve a different and sometimes discrete set of stakeholders with disparate agendas.

Sometimes there are 'plans within plans' where the feedback loops are between planning processes, not within (Syme, Butterworth, and Nancarrow 1994).[19] In addition, watershed planning occurs at different spatial scales – from the basin to the small sub-watershed or site level. Ideally, these plans are nested and integrated so that planning can occur progressively across scales and one level can guide and inform the next lower level. In practice, this sequence rarely occurs and sub-watershed plans are frequently prepared prior to basin plans (Mitchell 2006). Occasionally, watershed plans 'sit on the shelf' with little or no action and no feedback loops to inform subsequent plans.

Mitchell (2008) points out that the comprehensive river basin plans undertaken in Canada in the 1970s are prime examples of expensive studies that produced limited results. Led by the federal government, watershed plans were undertaken in five large river basins including the Okanagan River basin in British Columbia, the Qu'Appelle River basin in Saskatchewan, St. John River basin in New Brunswick, the Souris River basin in Saskatchewan and Manitoba and the Shubenacadie-Stewiake rivers in Nova Scotia. Criticisms of the planning process included the following concerns: (1) the

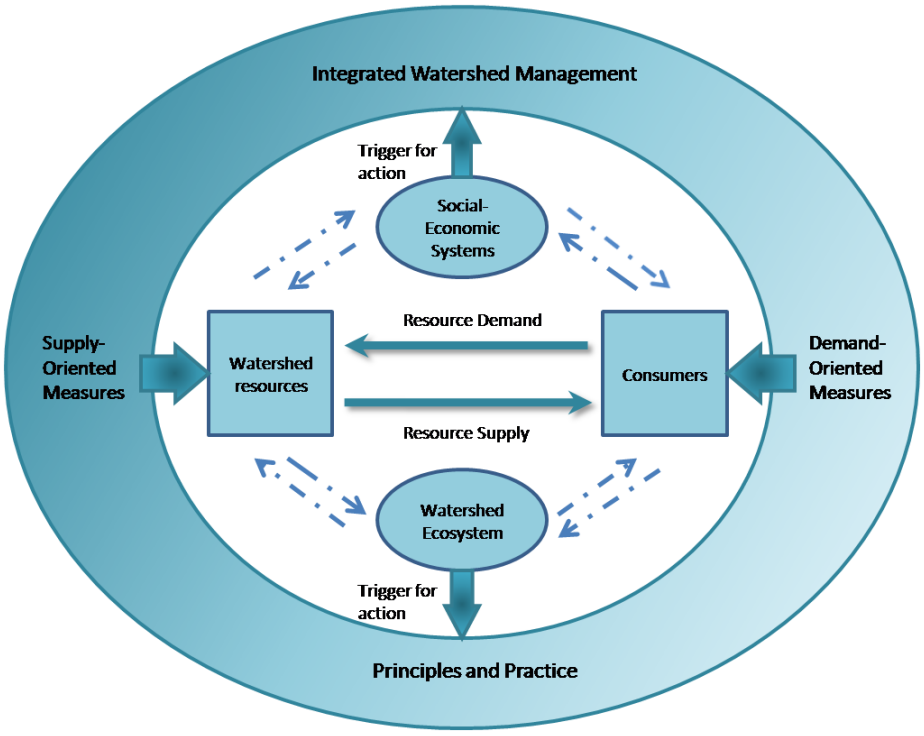
[19] For example, the Grand River Conservation Authority in Ontario has a watershed planning process called The Grand Strategy. Within the overall approach, a number of parallel and loosely connected planning initiatives have evolved such as the Grand River Fisheries Management Plan and the Grand River Watershed Forest Plan (Veale 2004).

process was too lengthy and focused on the collection of copious amounts of superfluous data, (2) recommendations for action were unclear and unprioritized, and (3) persons involved in planning did not communicate well with the implementers. These three perceptions led to the conclusion that comprehensive river basin management had limited incremental value as it was being interpreted and applied at that time.

Numerous studies have been carried out to investigate factors which contribute to the observed disconnect between theory and practice. Institutional and administrative factors confound the process of watershed management. For example, Butterworth et al. (2010) note that stakeholder participation is often limited, constrained by lack of capacity and/or reluctance to share power in decision making. According to Brunckhorst and Reeve (2006), the literature is dominated by accounts of limited success in achieving participatory frameworks. A summary of common institutional, administrative, and legal barriers to IWM documented through empirical research is presented in Table 2.6.

In addition to institutional, administrative, and legal challenges, IWM is influenced by the interplay of economic, social, and biophysical forces (Heathcote 2009; Butterworth et al. 2010). These forces are depicted in Figure 2.3.

Figure 2.3. Forces Affecting Integrated Watershed Management



Source: After Heathcote (2009: 389)

Table 2.6. Key Governance, Institutional, Administrative, and Legal Barriers

Barrier	Description
Politics, competing interests and societal inequalities	Sound decisions based on science are difficult in the face of vested interests, political motivation, and inequalities of power. Commitment to the watershed management process across multiple decision-making levels is generally weak.
Weak legislation / ever-emerging legislation	The absence of strong enabling legislation undermines implementation of watershed management (e.g., inadequate penalties for environmental violations, lack of national water quality standards and guidelines for industry). The proliferation of new single-issue legislation creates duplication and conflict.
Excessive bureaucracy/horizontal and vertical fragmentation and boundary issues	Unclear mandates, duplication of responsibilities, poor interagency cooperation, and conflicting missions among agencies lead to interagency battles making it difficult to share data, secure funding and partnerships, coordinate activities and respond quickly to issues. Most watersheds have overlapping political boundaries.
Risk aversion/reluctance to share power	In hierarchical decision-making structures, agencies are reluctant to shift from a known top-down, linear approach (safe) to an unknown participatory approach (risky) and are unwilling to share decision-making control and power.
Accountability concerns	Clear lines of responsibility are often obscured in collaborative watershed partnerships and mechanisms to ensure accountability are often lacking, hindering watershed management processes.
Preference for a standardized approach	There is a tendency to ignore differences in the biophysical and socio-economic contexts by applying the same approach to problem solving.
Resistance to change	Water resources practices typically focus on a single use rather than on multiple uses that require a holistic perspective combined with interdisciplinary or transdisciplinary approaches. The well-established status quo, steeped in a tradition of 'rational' domination, is difficult to change.
Lack of useful data, practical decision-support tools and technical expertise	There is either a lack of baseline data or inconsistent formats for data collection, storing and reporting across agencies. Basic and applied research and technical expertise are typically not adequate to provide the appropriate data, information and tools necessary to make informed decisions about key issues.
Lack of monitoring and evaluation procedures	The expense of data collection has caused governments to reduce monitoring sites thereby affecting the quality and quantity of available water data. Evaluations to assess the effectiveness of actions are inconclusive or absent; the state of science around the selection of appropriate indicators to measure success is in its infancy.
Lack of sustainable funding and human resources	There is often a lack of dedicated, sustained resources for coordination and few cost-sharing mechanisms are available on a long-term basis.
Lack of incentives /disincentives to spur change	An alternative mix of incentives and disincentives such as tax rebates, cost sharing and stricter regulations and penalties is necessary to effect change.
Unrealistic expectations /conflicting time horizons	Some recently established watershed agencies are expected by other government agencies and the public to show immediate results even though water issues develop over a number of years or decades and are cumulative; there is a need for practical procedures that consider risk and uncertainty so that expectations regarding research and decision-making are reasonable.
Diverse and competing stakeholder Interests	Stakeholders are numerous, and have overlapping roles and divergent interests that create competition and conflict.
Heavy reliance on community-based initiatives	Without support from different government levels, community-based initiatives have limited capacity to deliver outcomes and face volunteer burnout.

Source: After U.S. Environmental Protection Agency (1997); Conservation Ontario (2001); Bellamy et al. (2002); Veale (2003); Goldstein and Huber-Lee (2004); Veale (2006); Mitchell (2009); Saravanan, McDonald, and Mollinga (2009); Conservation Ontario (2010).

Supply- or demand-oriented actions affect the horizontal axis while environmental quality and resource use affect the vertical axis. This interchange dictates how resources are extracted, altered, consumed, used, and discarded. Heathcote (2009) states these interactions create a 'dynamic tension' that can trigger changes in watershed management practices. She concludes that watershed management must be dynamic and flexible to respond to resource issues in a timely manner. As more issues and relationships are considered in the management process, distinguishing the interplay of forces among them is likely to become more difficult.

2.10.2 Future Prospects for IWM

Given the complexities inherent to IWM, it is not surprising that watershed management outcomes vary based on the distinguishing mix of factors at play in individual watersheds. While it is important to acknowledge implementation flaws, Butterworth et al. (2010: 78) emphasize that the overall principles of IWM are generally sound and that discarding IWM for its faults "carries a risk of throwing out the baby with the bathwater." Moreover, many challenges and barriers are not exclusive to IWM, and are prevalent in many decision-making settings.

Rather than focusing on barriers that inhibit the watershed management process, researchers have undertaken empirical research to detect 'lessons learned' and factors for success (Schramm 1980; van Ast 1999; U.S. Environmental Protection Agency 1997; Veale 2003; Goldstein and Huber-Lee 2004; Joseph, Gunton, and Day 2008; Genskow 2009; Mitchell 2009; Butterworth et al. 2010). These traits generally underscore the 'flip side' of the barriers and accentuate prerequisite conditions that support a responsive, iterative, and inclusive participatory approach: (1) legitimacy or credibility that fosters ongoing commitment, political will, and sufficient resources (2) a common vision, goals and objectives and a long-term perspective, (3) a clear decision-making framework and a willingness to share or redistribute power, (4) best scientific and technical information combined with local knowledge, (5) dynamic leaders, (6) decentralized (local) and shared decision making among stakeholders and actions at the lowest appropriate level, (7) capacity for flexibility, resilience, and adaptability, (7) a mix of legal, economic, social, and communications tools, and (8) the demonstration, sharing, and celebration of accomplishments.

Some researchers have interpreted IWM to mean 'comprehensive' and have criticized the concept as an attempt to "cover all the possible linkages and stakeholder interests," which has diverted attention from highest priority actions and led to paralysis (Merrey 2008: 902). In Canada, one of the lessons learned from trying to complete 'comprehensive' basin plans was that understanding and describing every component and relationship "was not significant in accounting for variability in the system" (Mitchell 2006: 52). A strategic 'systems' approach focused on the main components and

relationships accounting for the greatest variability in systems behaviour may be sufficient to prioritize and guide relevant actions (Mitchell 2006). Perhaps the most significant lesson learned is that resolving watershed issues is not a prescriptive exercise that adheres to a strict regimen, rather it requires flexible, context-specific, inclusive, and responsive institutional and governance processes and creative 'made-in-the-watershed' solutions.

2.10.3 Towards Sustainable Watershed Management

The literature suggests that the focus of IWM is the coordinated management of land and water resources to achieve equitable and maximum societal benefits while maintaining or restoring ecosystems. In fact, van Heezik (2008: 77) believes there is general agreement that ecological objectives must "occupy a far more important place in river policy than ever before." It is generally acknowledged that IWM plays a vital, supporting role in advancing sustainability. However, as noted by Cardwell et al. (2006: 11), the goal of sustainable development "is unevenly acknowledged among agencies and its relationship to IWM is unclear." To further complicate matters, the literature often uses the term 'sustainable watershed management' (SWM) to describe contemporary watershed management, especially in developing countries (Cruz 1999; Wagner et al. 2002).

Definitions for SWM are scant and a broad spectrum of overlapping positions is advocated, depending on how sustainability is interpreted. Vishnudas, Savenije and Van Der Zaag (2005) define SWM as "the management of a watershed system with sustainable technological options, which may ensure the sustainability of land, agriculture and forestry or its combinations to conserve natural resources, with adequate institutional and economic options." This definition emphasizes the use of management technologies to achieve social and economic benefits while conserving natural resources, but does not fully incorporate social factors. Loucks (2000: 8) contends that sustainable water resource systems are "designed and managed to fully contribute to the objectives of society, now and in the future, while maintaining their ecological, environmental, and hydrological integrity." Hedelin (2007: 151) asserts that sustainable watershed management is "the sustainable management of water resources" and emphasizes the importance of integration and stakeholder participation. Clark and Richards (2002) concur, but stress holistic decision-making processes that are transparent, accountable and consistent. Wagner et al. (2002) suggest that SWM is "... integrated water-resources management, taking into account social, economic, and environmental factors and focussing on surface water, groundwater, and the ecosystems through which they flow." Menon (2007: 1) offers a broader view and suggests that the goals of sustainable watershed management are "to ensure the preservation, conservation and sustainability of all land based resources and for improving the living conditions of the people," particularly in developing countries.

Undoubtedly, IWM and SWM are parallel concepts and are terms that are used interchangeably. The literature suggests that a synthesis of the key (and often overlapping and mutually supporting) principles discussed in the preceding sections are relevant to the implementation of or by: (1) a naturally-defined ecosystem – the watershed, (2) a focus on protecting and restoring critical ecosystem components, functions and structures and managing human activities as part of maintaining a healthy ecosystem over time, (3) a holistic[20], interdisciplinary, multi-jurisdictional, multi-agency and participatory (consensual and collaborative) approach, (4) decision makers who are accountable and responsive, (5) decision making that is adaptive, precautionary, and matches actions to the scale of the problem, (6) decisions that result in fair distribution of opportunities, reduced per capita consumption of natural resources, and intergenerational and intragenerational equity, and (7) decisions that seek mutually supportive benefits and multiple gains.

Are there any specific attributes that differentiate IWM from SWM? Clearly, the river basin is a common focus for both IWM and SWM, and the principles ascribed to the concepts of ecosystem management, sustainability, and good governance apply. However, I believe that to reduce ambiguity and confusion regarding these two terms, differences need to be distinguished and debated. Based on my review of the characteristics of IWM, I propose its central focus is the protection and/or restoration of water and land resources to sustain human well-being. Sustainability is a related, but ensuing goal.

In contrast, I suggest that SWM acknowledges, understands, integrates, and manages a broader spectrum of social, economic, and environmental factors. It represents a concerted and deliberate effort by government, private business, and civil society to drive the collective sustainability agenda forward. Human well-being is central to SWM, including eradication of poverty and corruption and protection of human rights. In this regard, I contend that sustainable watershed management integrates the principles of good governance more fully than IWM and wholly incorporates the principles associated with the 'sustainability requirements' identified in Table 2.4. Consistent with this interpretation, I have defined SWM as "a participatory ongoing process of managing water and related land resources and human activities across sectors and jurisdictions within a given river basin to retain, enhance, or restore watershed health and optimize associated economic and social benefits in an equitable manner for existing and future generations." Implementation challenges for SWM mirror those for IWM. However, the nature and scope of these challenges are potentially broader and

[20] Mitchell (2005) notes that 'integrated' has been interpreted to mean comprehensive where the goal is to identify and understand all variables and relationships or integrative, where a relatively few key variables are considered within a systems context. Where problems are relatively straightforward, Hooper et al. (1999) argue that an integrated approach may not be the best approach.

even more difficult to overcome, given the innate complexities associated with the wider range of environmental, social, and economic issues and interrelationships that must be considered.[21] Nonetheless, these obstacles should not preclude the pursuit of sustainability as an ultimate goal for watershed management. In this regard, I concur with Loucks (2000: 8) who states that,

> Sustainability is an integrating process. It encompasses technology, ecology and the social and political infrastructure of society. It is probably not a state that may ever be reached completely, but it is one for which we should continually strive.

2.11 Chapter Summary

Watershed management is a global phenomenon, universally promoted to address burgeoning environmental, social, and economic issues. The interplay between theory and practice has provoked dissention, debate, and enquiry about (1) the viability of the watershed as a cohesive and applicable unit for problem-solving and management, (2) the relevance of associated principles and concepts, (3) scale, scope, and boundary considerations, (4) alternative governance and decision-making processes, and (5) correlated benefits and outcomes. The literature reveals an astonishing breadth and depth of divergent scholarly opinion. This rich discourse provides both the backdrop and starting point for addressing my research questions about what theories, concepts, and empirical research findings are accepted and incorporated into the practice of watershed management in Canada and determining whether IWM or SWM is being pursued. The ensuing analysis and discussion are presented in Chapter 9.

In order to respond to the criticisms of and prospects for contemporary watershed management and to guide future management decisions, criteria, and methodologies for assessing the effectiveness of water management processes, new decision-support tools are being explored and developed (Clark and Richards 2002; Hedelin 2007). Heathcote (2009: 12) observes that, "recent literature demonstrates that water managers, acutely aware of this challenge, are now attempting to measure and record their successes – and their failures." Assessment tools range from new analytical tools and technologies to indicator reports. Chapter 3 provides an overview of these assessment tools, with a particular emphasis on indicator reports.

[21] A focused application of SWM that combines general comprehensiveness and respect for interactive effects with practical emphasis on key factors relevant to the watershed and the prevailing context may be the next logical step in transforming IWM processes and moving towards SWM.

Chapter 3: Measuring Effectiveness

3.1 Introduction

Monitoring and evaluation are integral components of the adaptive management cycle and are normally embedded within the framework adopted for IWM (i.e., rational comprehensive model). In order to gauge the effectiveness of watershed management and to develop appropriate strategies to achieve sustainability goals, assessment tools are required at all junctures of the management process. Indicators are a common assessment tool used to measure progress (Lorenz, Gilbert, and Cofino 2001; Hezri 2005; Fredericksen and Kristensen 2008).

This chapter provides an overview of the history and use of indicators, highlights key characteristics and methodologies suggested for selecting, categorizing, interpreting, and presenting indicators, and summarizes the strengths and weaknesses associated with indicator initiatives described in the literature. This analysis provides insights for (1) classifying the types of indicators used to measure, evaluate, and report on the effectiveness of watershed management in Canada, (2) comparing and contrasting the value and use of the indicator reports generated by watershed organizations, and (3) offering feasible suggestions for enhancing the effectiveness of indicator reports. These three facets are fundamental to addressing the research questions linked to indicators and watershed indicator reports identified in Chapter 1.

3.2 The Role of Monitoring and Evaluation in the Adaptive Management Cycle

The adaptive approach acknowledges uncertainty about the outcomes of planning and management decisions. Mitchell (2010: 9) suggests four types of uncertainty: (1) *risk* (if the behaviour of the system is understood, the probability of various outcomes can be defined and quantified), (2) *uncertainty* (if the behaviour of a system is unknown, the probability of a given outcome is indeterminate), (3) *ignorance* (if a problem escapes recognition, it is not considered), and (4) *indeterminancy* (lack of understanding complex causal relationships). Adaptive management deals with risk and uncertainty by treating management activities as opportunities for learning. This allows managers to increase their understanding of the system being managed, modify decisions in response to changing objectives and circumstances, and adjust management activities accordingly.[22]

Monitoring and evaluation are essential to facilitate adaptive management (Cundill and Fabricius 2009; Williams, Szaro, and Shapiro 2009). While monitoring is undertaken by most organizations

[22] The implementation of adaptive management requires that managers be prepared to acknowledge mistakes or failures and "to examine openly the lessons to be gained from them so that future initiatives can be improved" (Mitchell 2004: 400).

and agencies, it is often an afterthought or resourced as an afterthought (Beasley and Wright 2001). This has resulted in data inconsistencies because monitoring programs are often discontinued before long-term trends are detected, data collection methodologies shift over time, and/or the data are not relevant to the management decisions that must be made. Grumbine (1997) distinguishes between data collection and monitoring. In his view, data collection is gathering primary information whereas monitoring tests the data against management activities or experiences. He suggests because "traditional resource management primarily concentrated on output, little interest was shown in designing monitoring programs to determine if production goals were sustainable" (Grumbine 1997: 44). In addition, there is often a tendency for organizations and agencies to collect data but then allocate few resources for actual analysis and synthesis.

3.3 History of Indicators as an Assessment Tool

The role of monitoring and evaluation has been extensively discussed in planning literature since the late 1960s. Early advocates called for "highly structured, quantitative, and technical analyses of planning goals and proposals, often supported by elaborate computer modeling exercises" (Seasons 2003: 431). However, the application of sophisticated analyses was problematic for reasons of cost, time, interpretive capacity, and data management. Interest waned as a result.

Support for monitoring and evaluation re-emerged in the mid-1990s. This coincided with a general acceptance that monitoring and evaluation were vital to inform decision making at all levels and to advance the global sustainable development agenda. In 1992, the UN Conference on Environment and Development through Agenda 21 (Chapter 40) called for improved data collection and use of indicators (United Nations 2007). In addition, Agenda 21 (Chapter 28) promoted a participatory, long-term, strategic planning process to help local municipalities identify local sustainability priorities and implement and monitor long-term action plans through the creation of a 'local Agenda 21'. As an outcome, the development of sustainability indicators has occurred at a 'macro' scale (e.g., national or global level) and at a 'micro' scale (e.g., community level).

Concurrently, the advent of decision support tools driven by more powerful and affordable computers, environmental assessment legislation, participatory democracy, and wide-ranging agreement that adaptive management was integral to the planning and management cycle also contributed to this increased appeal. The focus on quantitative indicators also shifted to a more 'holistic' approach which emphasized a mix of quantitative and qualitative indicators in light of

public concerns regarding accountability of decision makers,[23] sustainability, and the socio-economic factors influencing public health (Holden 2001; Maclaren 2001; Statistics Canada 2005).

In Canada, this interest was mirrored at the federal, provincial, regional, and local levels. In 1988, a National Round Table on the Environment and Economy (NRTEE) was formed, and by 1990, all provinces and territories and many local and regional governments had established round tables. According to Statistics Canada (2005: 10), "both the provincial and national round tables have played an important role in developing and promoting indicators of sustainability in Canada…" After producing three large 'state of the environment' reports, the federal government commenced an annual Canadian Environmental Sustainability Indicators report in 2005, which tracks national performance for air quality, water quality, greenhouse gases, and protected areas (Environment Canada 2010).

A systematic review of freshwater indicators in Canada, undertaken in 2008-2009, demonstrates their use is widespread. For example, approximately 365 indicators and indices have been developed to measure and assess water security in Canada.[24] This includes approximately 40 indices at the national level, 143 at the provincial level, and 112 at the regional (large-scale watershed) level. In addition, a selected sample of 70 indicators at the community (small-scale watershed) level was included in the study (Dunn and Bakker 2009).

Since 2001, initiatives to develop state of the watershed reports linked to indicators have grown. In Ontario, 22 of the 36 conservation authorities produce watershed report cards (Conservation Ontario n.d.). At the community level,[25] there has been growing interest in producing indicator reports since the 1990s (Maclaren 2001). Community health and quality of life concerns have prompted interest in defining a broad range of environment, social, and economic indicators. The use of indicator reports at the community and watershed levels is discussed in more detail in Section 3.7.

3.4 The Nature and Scope of Indicators

While there is agreement among disciplines and communities of practice that indicators are important assessment tools, the term 'indicator' is ambiguous and is used in different contexts. There is no common definition of the term or agreement about what it entails. After undertaking a definitional

[23] Holden (2001) maintains that assessing the effectiveness of government projects significantly changes the role of the planner or expert, empowers the public to demand accountability from decision makers, and consequently devolves institutional power.

[24] Water security is defined as "sustainable access on a watershed basis to adequate quantities of water, of acceptable quality, to ensure human and ecosystem health (Dunn and Bakker 2009: 1).

[25] A community can include areas within political boundaries, watersheds, or local neighbourhoods (Maclaren 2001).

analysis of the term 'indicator' used in the fields of ecology and environmental management, Heink and Kowarik (2010: 591) conclude that "it is not possible to reduce different indicator definitions to a common attribute that is shared by all definitions. Indicators cover a huge field of application and thus claim a diffuse and nearly meaningless universality." They stress that to avoid the risk of misinterpretation, the indicator term should always be clarified within the context of its use.

A key problem with the indicator term is the many qualities and functions it embraces. For example, an indicator can be used to measure a property of a phenomenon, body, or substance to which a magnitude can be assigned, or it can be a feature (a component or species) that is affected by the phenomenon of interest. Indicators can describe elements of a system or its state and distinguish changes over time. They can be normative to stipulate future conditions or to test whether a desired condition has been achieved (Heink and Kowarik 2010).

The European Environment Agency defines an indicator as "an observed value representative of a phenomenon of study" (Gabrielsen and Bosch 2003: 5). Other broad characteristics identified in the literature suggest that an indicator can generally be viewed as a variable used to track or reveal certain phenomenon of interest over time (Indicators for Evaluation Task Force of the International Joint Commission 1996; Dalal-Clayton and Bass 2002; Tilbury and Janousek 2006; Hák, Moldan, and Dahl 2007). Hák, Molden and Dahl (2007: 1) define indicators as "symbolic representations (e.g., numbers, symbols, graphics, colors) designed to communicate a property or trend." Indicators can be quantitative or qualitative,[26] objective or subjective (Lee and Marans 1980; Jacob and Willits 1994; Diener and Suh 1997). They can also be numeric or non-numeric. One key attribute of an indicator is that it provides a means to illustrate and communicate complex phenomena (World Water Assessment Programme 2003; European Environment Agency 2005)

The UN World Water Assessment Programme (2003) describes the roles of indicators under five categories: (1) descriptive, (2) showing trends, (3) communication, (4) assessment, and (5) predicting the future. The most common use of indicators is to describe the state of the resource (condition). Over time, regular measure of indicators provides time-series data which reveal trends. Indicators are used to show complicated issues and relationships to the public in order to motivate interest and action. In fact, Hoerning and Seasons (Hoerning and Seasons 2005) (2005: 5) include 'simplification' and 'catalyst for action' as additional functions for indicators. Assessing progress towards a desired state is done by comparing indicator values with the reference condition (target,

[26] The choice between the use of quantitative and qualitative indicators depends mostly on their purpose, although there is a general propensity to use quantitative indicators (Gallopin 1997; Roessner 2000).

goal, or objective) (Geniaux et al. 2009). By linking models to indicators, time-series data can be established and alternative scenarios can be assessed.

Based on these roles, indicators can be used to (1) track progress towards sustainability objectives and targets, (2) report on current conditions and key social, economic, environmental, and decision-making trends, (3) identify information gaps and research priorities, (4) anticipate undesired conditions before they happen, (5) identify causative agents, (6) demonstrate interdependence between indicators to make the assessment process more cost-effective, (7) promote public awareness and dialogue that will improve decision making, guide policy, and increase the transparency of possible trade-offs, (8) facilitate action and community empowerment, and (9) create a shared vision for the future of the watershed (Chilson 1998; Gustavson, Longeran, and Ruitenbeek 1999; Bossel 2001; Dale and Beyeler 2001; Anielski and Winfield 2002; Ledoux et al. 2005; Fraser et al. 2006).

Kranz et al. (2004) identify three distinct sets of functions for indicators: (1) assessment, diagnosis, prognosis, prescription, treatment, and reassessment, (2) policy making, forecasting, evaluation and management, and (3) research and education. Other researchers and practitioners have grouped indicator functions differently. The European Environmental Agency classifies indicators into five categories: (1) descriptive, (2) performance, (2) efficiency, (4) policy-effectiveness, and (5) total welfare (Gabrielsen and Bosch 2003).

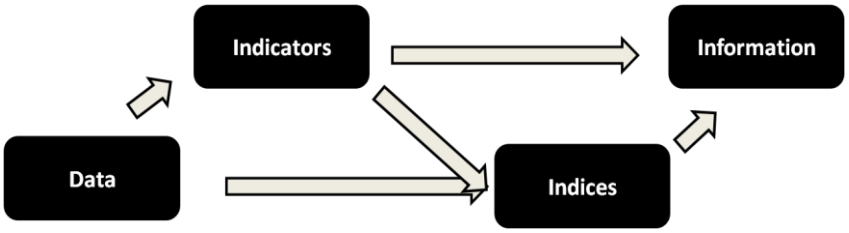
Hoernig and Seasons (2004) refer to three sets of indicators: (1) *conventional* (single-sector and often single-disciplinary), (2) *integrative* (holistic, multi-sectoral and multi- and inter-disciplinary), and (3) *performance* (accountability, competency, and efficiency). In the context of education for sustainable development, Tilbury and Janousek (2006) categorize indicators as either: (1) *status* (condition), (2) *facilitative* (assist, support, or encourage engagement), (3) *effect* (assess achievements), or (4) *communicative* (facilitate access and communication with stakeholders). Wicks et al. (2010) recommend that indicators be differentiated in a hierarchical context. They are either: (1) *overarching* (e.g., indicators that are aggregated to synthesize science and simplify messages), (2) *reporting/headline/key* (e.g., simple indicators that communicate key messages and issues and are limited in number), or (3) *diagnostic* (e.g., complex indicators that are used to support reporting indicators and are larger in number).

With many typologies in the literature to describe and explain indicators for different purposes and audiences, a universal approach and consensus about the meaning of various terms used in indicator studies is elusive. However, these categories provide a useful guide for reviewing and identifying the various types and roles of indicators used in watershed indicator reports. The terms

and meanings associated with monitoring and evaluation are typically nested within a broad, hierarchical context. The terms used for this study and their meaning and interrelationship with each other, are defined in Table 3.1.

The most basic component of an indicator is data. Indicators are derived from data. Aspects such as data collection and data availability play a critical role in shaping what kinds of indicators can be crafted for tracking or revealing phenomenon. Data are analyzed and aggregated to create indicators (variables) or indices which in turn allow for meaningful interpretations about the phenomena of study. Indicators are variables used to track or reveal certain phenomenon of interest over time. They are often aggregated to create indices that convey simple messages to the public and are described in Section 3.6. The interrelationship of data, indicators, indices, and information is shown in Figure 3.1.

Figure 3.1. From Data to Information



Source: Segnestam (2003).

3.5 Properties of Good Indicators

While there is no common typology for categorizing indicators, the literature is remarkably consistent when identifying properties of good indicators (Cairns, McCormick, and Niederlehner 1993; Rapport, Costanza, and McMichael 1998; Winograd et al. 1999; Seager 2001; Swisher, Rezola, and Sterns 2003; Smith 2004; Smith and Zhang 2004).[27] The main properties identified in the literature are summarized in Table 3.2. Gudmundsson, Tennøy, and Journard (2010: 107-108) group these properties into four categories: (1) methodological (e.g., timeliness, cost effectiveness) (2) statistical (e.g. data quality, reliability), (3) scientific (e.g., scientific soundness), and (4) policy (e.g., relevance). Based on the characteristics outlined in Table 3.2, another category should be added – indicators should be explicable and understandable to the intended audience.[28] Roche (1999) acknowledges that a suite of desirable indicators depends on the approach adopted and the nature of phenomena being assessed.

[27] Roche (1999: 47-48) provides two acronyms to describe indicator properties: SMART (specific, measurable, attainable, relevant, timebound) and SPICED (subjective, participatory, interpreted and communicable, cross-checked and compared, empowering, diverse and disaggregated). These concepts are integrated into Table 3.2.

[28] These criteria do not consider performance (legitimacy) relative to the sustainability principles presented in Table 2.4.

Table 3.1. Hierarchy of Terms Associated with Monitoring and Evaluation

Term	Meaning
Vision	A general description of a desired state.
Principle	A fundamental truth or law as the basis of reasoning or action.
Goal ▪ **Substantive** ▪ **Procedural**	Broad statement of intent, direction, and purpose. ▪ desired states or characteristics of the ecosystem being managed. ▪ preferred means to achieve or implement substantive goals.
Objective	Specific, clear statement that describes desired condition for a specific area, activity, or species. May be qualitative or quantitative.
Strategy/Plan	Explicit description of what actions will/should be undertaken to achieve objectives.
Task/Action	Specific step, practice or procedure to get the job done, usually organized sequentially with timelines and assignments – what and when.
Criterion	A standard or rule on which a judgment can be based.
Indicator ▪ **Stressor** ▪ **Input/Process** ▪ **Output** ▪ **Performance** ▪ **Impact / Outcome**	A variable used to track or reveal certain phenomenon of interest overtime. ▪ stress inputs into the system (emissions, contaminants). ▪ management effort (time, human and/or financial resources). ▪ level of activity (participation, activities, reactions). ▪ efficiency (meeting or exceeding operational goals, on time and on budget) and legitimacy (complying with sustainability principles) ▪ effect due to changes over the short- and long-term (learning, action and environmental and socio-economic impact).
Variable	A characteristic of a certain phenomenon which can take on different values.
Data	Actual measurements or observations of the values of variables at different times, locations, populations, or combinations of these. A collection of quantitative data is usually referred to as statistics.
Measure	A specific description of the way an indicator is measured i.e., the unit of measure, method, timeline.
Index or Indices	A compound or aggregated set of indicators combining several lower-level indicators (e.g., Human Development Index, Water Quality Index, Air Quality Index).
Composite Index	A combined set of components that are not indicators in themselves (e.g., Ecological Footprint, Consumer Price Index).
Model	A hypothetical description of a complex entity or process.
Target	A specific attainable endpoint for indicators that determine the achievement of objectives.
Benchmark/ Standard	A reference value against which a measure is assessed. Benchmarks can be set by legislation, certification standards, desired future conditions, or known values for the natural range of variation.
Threshold	Levels beyond which a system undergoes significant change; points at which stimuli provoke response.

Source: After Gallopin (1997); Horsch (1997); Slocombe (1998); Beasley and Wright (2001); Lorenz et al. (2001); Dalal-Clayton and Bass (2002).

Table 3.2. Properties of Good Indicators

Properties	Description
Specific / Valid	Relevant to the scale of phenomenon, sensitive to incremental changes or stressors in the system, pertinent to the stated goals or outcomes being measured, not redundant with other indicators, and not subject to external influences.
Accurate	Accurately measures the phenomenon in an effective, clear, and scientifically defensible way.
Reliable / Verifiable	Underlying data are consistent regardless of who collects them or when they are collected.
Attainable	Underlying data are affordable, available within a reasonable time-scale and at intervals that are appropriate, useful, and obtainable with reasonable effort; data collection uses the same measurement instrument or protocol.
Comparable	Changes can be compared and aggregated spatially and/or temporally.
Responsive / Timebound	Detects change in a timely manner (early warning and gradual) and anticipates future change over the long-term (25-50 years).
Relevant	Provides pertinent information about the phenomenon being tracked, reflects stakeholders' concerns, and is useful and important to them.
Integrative/Information Richness	Demonstrates linkages among the environmental, social, and economic systems and reflects a spectrum of conditions ranging from living systems back through the chemical and physical environments back to the sources of stress.
Flexible	Easy to update as conditions change, new issues arise, and responses to some problems begin to work.
Interpretable	Can be interpreted against a baseline condition, can facilitate an analysis of trends and is based on data collected over time using a standard method of collection. Capable of distinguishing acceptable from unacceptable conditions in a scientifically and legally defensible manner.
Sufficient	Can assess the scope of change, address the issue of carrying capacity and suggest a course of action.
Participatory	Developed and accepted by the people in the watershed. The process of setting and assessing indicators should be empowering.
Understandable	Understandable to non-technical audiences including decision makers and the public.
Attractive to the Media	Can be used to monitor, analyze, and communicate local trends to the general public.

Source: After Cairns et al. (1993); Indicators for Evaluation Task Force of the International Joint Commission (1996); Horsch (1997); Chilson (1998); Rapport et al. (1998); Winograd et al. (1999); Seager (2001); Conservation Ontario (2003); Muskoka Watershed Council (2003); Swisher et al. (2003); Flint (2004); Smith (2004); Smith and Zhang (2004); Franceschini, Maurizio and Maisano (2007).

Despite general agreement on the desirable properties of indicators, many approaches for identifying, organizing, and using indicators exist, making the task of defining an appropriate set of indicators difficult (Seager 2001; Anielski and Winfield 2002; Dalal-Clayton and Bass 2002; Dow 2003; Flint 2004; Smith 2004; Becker 2005; Wallis et al. 2007). Gustavson et al. (1999: 118) remark that many indicator exercises often degenerate into "…a collection of long 'laundry lists' of variables

or into compendiums of historical statistical data." If too few indicators are selected, critically important issues and trends may be overlooked (Smith and Zhang 2007). If too many indicators are selected, the process of data acquisition and analysis becomes expensive and time-consuming (Bossel 2001).

The choice of indicators also varies depending on the value judgments. Flint (2006) argues that "importance cannot be judged on purely scientific grounds, so if one has no idea what values to protect, one cannot determine which dynamics to monitor, what to study, and what indicators to emphasize in management goals." The values inherent in any indicator selection process, then depend on who is involved. As cautioned by Conley and Moote (2003: 376), "…evaluation is inherently normative, and inevitably political…"

Finding suitable indicators is hampered by scientific, temporal, spatial, and institutional factors. Major problems relate to the uncertainty of the linkages between an indicator and the criterion that it is meant to address, the lack of suitable and consistent data sets, the difficulty in matching indicators to the scale of the issue, unknown benchmarks, and the lack of long-term commitment by stakeholders to accept monitoring feedback (Beasley and Wright 2001). Seager (2001) notes that the identification of appropriate indicators should not be constrained by lack of data and that where data gaps exist, focused monitoring should be undertaken to move away from best available information to best needed information. Lorenz et al. (2001: 124) concur, noting that "dependence of indicator development on data can lead to the situation that data availability drives the selection of indicators, which, in turn, reinforces the collection of the same data."

The main barriers that impede the selection and use of appropriate indicators as identified in the literature are as follows:

- lack of clear management goals, objectives, benchmarks, or thresholds from which to measure meaningful results (The World Bank Group, Programme, and Organization 1999; Beasley and Wright 2001);
- shifting spatial and temporal factors (e.g., land use changes, population increases, technological advances, and external factors such as climate change) (Beasley and Wright 2001);
- relationships among factors and trends that differ substantially or disappear across spatial scales (Beasley and Wright 2001; Wallis et al. 2007);
- lack of knowledge about the nature and extent of causal and nested relationships, cumulative impacts of multiple human actions, and how ecosystems will respond to increasing levels of human activity (Cairns, McCormick, and Niederlehner 1993; Lorenz, Gilbert, and Vellinga 2001; Wallis et al. 2007);
- difficulty in distinguishing the effects of natural processes from the effects of humans (Berger and Hodge 1998);

- the lack of relevant data (both qualitative and quantitative) at the appropriate temporal and spatial scales as a result of monitoring gaps and discontinuities, prohibitive costs for obtaining data, length of time required to gather data, inconsistent data sets, and inaccessibility (Maclaren 2001; Wallis et al. 2007);
- the nonlinearity of linkages among planning, implementation, and monitoring, which affect the time and cost required to undertake actions since these vary depending on the nature, scope, and magnitude of the activities required and the complexity of the issue or issues being dealt with (Imperial and Hennessey 2000; Beasley and Wright 2001; Heathcote 2009);
- the often slow rate of change in human-environment systems, which makes detection possible only over several years or even decades (Bellamy and Johnson 2000); and,
- the evolving political and social context within which indicator selection and use are undertaken (e.g., shifts in social value systems, perceptions of different communities of practice, political agendas, funding arrangements, management philosophy and practice) (Manring and Pearsall 2004; Wallis et al. 2007; Holden 2009).

While there is no 'easy fix' to these challenges, several indicator frameworks have been proposed to address some of these shortcomings. Commonly-used indicator frameworks and their characteristics are described in Section 3.6.

3.6 Indicator Frameworks

Numerous theoretical, conceptual, and methodological frameworks for selecting, organizing, developing, and presenting sustainability indicators have been proposed (Bossel 1999; Conley and Moote 2003; Fredericksen and Kristensen 2008). Differences among them relate to the "ways in which they conceptualize the key dimensions of sustainable development, the inter-linkages among these dimensions, the way they group the issues to be measured, and the concepts by which they justify the selection and aggregation of indicators" (United Nations 2007: 39). In a review of methodologies for evaluating collaborative efforts around natural resources management, Conley and Moote (2003) note that assessments can be structured around how well efforts meet the stated goals and objectives or how different management processes in similar settings result in divergent outcomes. Additionally, evaluative criteria have been developed to validate theory, test theory, or construct theory.

To provide a context for assessment, the Bellagio Principles were developed in 1996 by the International Institute for Sustainable Development (IISD). These 'principles' are actually guidelines that combine many of the characteristics of good indicators with sustainability principles and deal with four main aspects of assessing progress towards sustainability. These are (1) the importance of establishing a vision and clear goals which resonate with the pertinent decision makers, (2) the nature and scope of assessment and the need to merge a sense of the overall system with a practical focus on the priority issues, (3) the process of assessment, and (4) the method for building continuing capacity

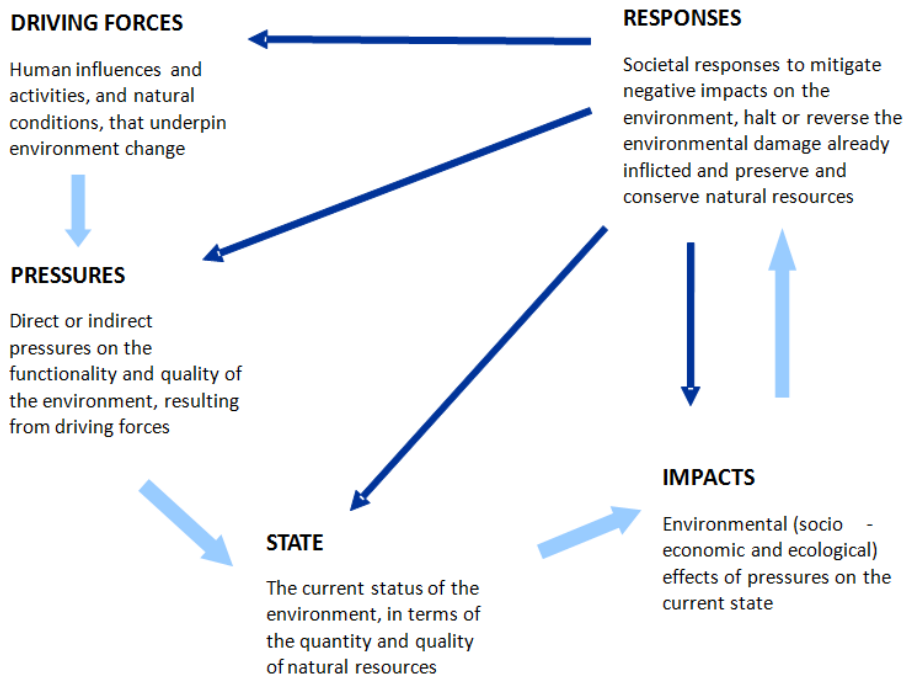
of ongoing assessment. These are presented under the general headings of vision, goals, holistic perspective, scope, openness, effective communication, broad participation, ongoing assessment, and institutional capacity (Bossel 1999).

To ensure that essential sustainability indicators are not missed, the Orientor Framework has been proposed by Bossel (1999, 2001). According to orientation theory, essential indicators provide a complete description of the state of satisfaction of the fundamental interests of six basic orientors including existence, effectiveness, freedom of action, security, adaptability, coexistence, and psychological needs (for humans and for systems with humans as components). It is asserted that this approach is useful at any spatial scale and helps to provide focus for the development of a limited set of indicators that provide information about all essential aspects of viability, sustainability, and performance.

Widely-used frameworks include the Pressure-State-Response Model and derivations thereof. Developed by the Organisation for Economic Co-operation and Development (OECD) based on the Stress-Response framework originally developed by Statistics Canada in the late 1970s, the Pressure-State-Response (PSR) is a popular framework that helps to describe cause-effect relationships (Carr et al. 2007). It is being used to guide the selection of indicators based on the fact that human activities exert pressures (such as pollution emissions or land use changes) on the environment, which can induce changes in the state of the environment (for example, changes in ambient pollutant levels, habitat diversity, water flows, etc.). Society then responds to changes in pressures or state with environmental and economic policies and programs intended to prevent, reduce, or mitigate pressures and/or environmental damage. This framework has been used by Environment Canada and the U.S. Environmental Protection Agency to develop the State of the Great Lakes Reports (Governments of Canada and The United States of America 2009).

An extension of this model has been adopted by the European Environment Agency to identify the interactions between society and the environment by including driving forces, pressures, states, impacts, and responses (DPSIR). The DPSIR model is shown in Figure 3.2 and was applied as an analytical tool to identify the complex set of environmental and socio-economic interrelationships and feedbacks in seven European catchment-coastal systems. These case studies were undertaken under the auspices of the EUROCAT project (European catchments, catchments changes and their impact on the coast), which ran from 2001-2004. The project focused primarily on the benefits to coastal environments of nutrient abatement in catchments and involved 23 research institutes and more than 70 scientists (Salomons 2005).

Figure 3.2. The DPSIR Framework



Source: Walmsley (2010).

One of the criticisms directed towards the PSR and DPSIR frameworks is that they do not acknowledge the complexities inherent in causal relationships because the linkages between cause and effect are assumed to be singular and linear, rather than multiple, reflective, ambiguous, and uncertain (Bossel 1999). In this regard, Berger and Hodge (1998: 261) ask, "in a system where each process and situation influences and is, in turn, influenced by many others, how can one separate out condition, stress and response?" They also note that this framework cannot account for simultaneous negative and positive system responses and is reactive rather than anticipatory. Carr et al. (2007) further caution that the DPSIR framework, when used in the context of development initiatives, is not inclusive. They contend that the DPSIR framework favours top-down, elitist worldviews and inadvertently disenfranchises local stakeholders, especially women. This weakness was also noted by Svarstad et al. (2008) who argue that conservationists' views are favoured to the neglect of other positions.

Despite these criticisms, variations of the pressure-state-response framework continue to be used for environmentally-oriented indicator sets. For example, a pressure-vector-condition framework has been adopted for the Stream and Estuary Assessment program in Queensland, Australia. Pressure refers to natural and human influences which cause disturbance (Browne et al. 2007). Vectors

represent the mechanisms of influence (e.g., water quality, hydrology), and condition relates to biological health (e.g., fish, macro invertebrates) (Negus and Marsh 2006).

In 1996, the Commission on Sustainable Development (CSD) drafted the first set of sustainable development indicators based on a driving force, state, and response causal framework. In 2001, this approach was discontinued because it "was not suited to address complex interlinkages among issues; the classification of indicators into driving force, state or response was often ambiguous; there were uncertainties over causal linkages; and it did not adequately highlight the relationship between the indicators and policy issues" (United Nations 2007: 40). In addition, there are "multiple pressures for most states, and multiple states arising from most pressures," making it difficult to identify indicators (Pintér, Hardi, and Bartelmus 2005: 6). A second set of CSD indicators is now embedded in a more flexible theme/sub-theme framework. Theme-focused frameworks typically bring together social, economic, and environmental objectives (Seager 2001; Vishnudas, Savenije, and Van Der Zaag 2005).

Numerous other examples of indicator frameworks focus primarily on environmental aspects. Kranz et al. (2004) suggest a framework based on systems and information concepts and apply it to operational models that describe ecological, social, and economic processes associated with water management. This creates a hierarchy of information in which a selected criterion provides the basis for a range of indicators quantified by single or multiple measures. Becker (2005) provides a framework loosely based on Capra's 'web of life'[29] and the ecological concepts of resilience, collaboration, and auto-sufficiency. Lopez-Ridaura et al. (2005) are currently testing a framework for assessing natural resource management systems which organizes indicators around five sustainability attributes including productivity, stability, resilience, reliability, and adaptability.

Capital frameworks calculate national wealth as a function of the sum of and interaction among four different kinds of capital: natural, human, social, and institutional. Substitutability among different types of capital is explicit in this approach (e.g., machines for human labour; renewable for non-renewable sources of energy) (Joint UNECE/OECD/Eurostat Working Group on Statistics for Sustainable Development 2008). While technological advances and human ingenuity may expand the scope of this approach, it has been acknowledged that there is capital for which no substitution is possible. There is also disagreement about how to express all forms of capital in monetary terms and the focus on 'weak sustainability',[30] problems with data availability, divergence on whether weak or

[29] Capra proposes an 'web of life' framework based on ecology and systems thinking with three essential components: (1) pattern, (2) structure, and (3) process (Capra 1996).

[30] 'Weak' sustainability is a concept promoted by some who believe that natural capital can be substituted for manufactured capital of equal value. This stance is subject to extensive debate (Chapter 2).

strong sustainability should prevail, and integration of intragenerational equity concerns (United Nations 2007).

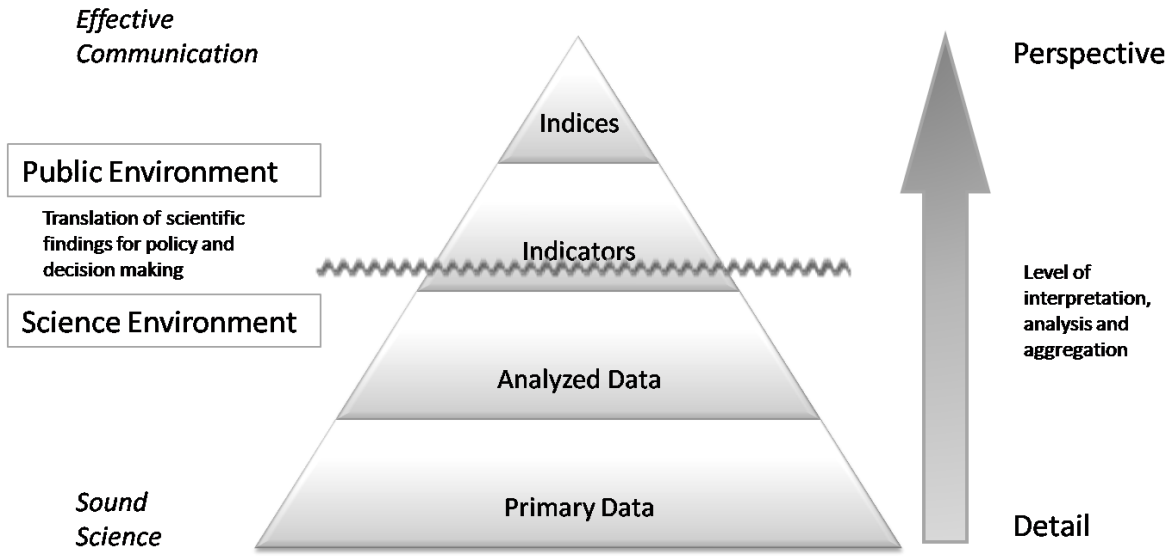
Bottom-up frameworks include accounting frameworks and aggregated indices. Accounting frameworks such as the System of Integrated Environmental and Economic Accounting (SEEA), pioneered by the United Nations Statistical Commission with the International Monetary Fund, the World Bank, the European Commission and OECD, draws indicators from a single database, allows for sectoral aggregation, and uses a consistent classification system. While SEEA was not specifically set up to address sustainability, it can be expanded to include social and institutional aspects through links with other frameworks (United Nations 2007).

Aggregated indices attempt to draw on a broad range of variables in order to convey a message easy to understand for both decision makers and civil society (Figure 3.3). Indices can be either a compound indicator, which combines several lower-level indicators, or a composite indicator made up of many components that are not indicators in themselves such as the Ecological Footprint[31] (Dalal-Clayton and Bass 2002). By combining the information contained in two or more indicators, aggregated indices can convey simple messages about complex environmental issues. Some examples of indices used at the global or national levels are the Millennium Development Goals (MDGs), Environmental Sustainability Index (ESI), Environmental Performance Index (EPI) Ecosystem Well-being Index (EWI), Living Planet Index (LPI), Genuine Progress Indicator (GPI), Human Development Index (HDI), and the Human Well-being Index (HWI) (Pintér, Hardi, and Bartelmus 2005; United Nations 2007).

One performance scale designed to measure human and ecosystem well being together, without submerging one in the other, is the Barometer of Sustainability. Its two axes - one for human well being (HWI) and the other for ecosystem well being (EWI) - enable socio-economic and environmental indicators to be combined independently (IUCN 1997). The Well-being Index is where the two intersect. Other tools for aggregating indicators in a more understandable visual format are the 'Dashboard of Sustainability' (Hardi and Semple 2000) and the 'Compass of Sustainability' (Atkisson and Hatcher 2001).

[31] The Ecological Footprint is defined as "the area of land and water ecosystems required to produce the resources that the population consumes, and to assimilate (some of) the wastes that the population produces, wherever on Earth the relevant land/water may be located" (Rees 2004: 3). Calculations include estimating the per capita land area appropriated for the production of each major consumption item and summing them. The Ecological Footprint is the collective per capita land area multiplied by the population. The model reflects the draw on Nature from a given lifestyle but does not attempt to include the social and economic dimensions of sustainability (Barrett, Birch, and Cherrett 2004).

Figure 3.3. Information Pyramid



Source: After Braat (1991); Hammond et al. (1995); Walmsley (2002).

Several watershed indices have been developed to assess water quality conditions and trends. Examples include the Water Quality Index (WQI), Index of Watershed Indicators (IWI), Index of Biotic Integrity (IBI), Invertebrate Community Index (ICI), and Qualitative Habitat Evaluation Index (QHEI).[32] The U.S. Environmental Protection Agency through its Ecosystem Services Research Program, is developing and testing Landscape Quality and Ecosystem Services Indices for watersheds in the U.S. Midwest as part of an environmental decision toolkit (Smith 2010).

While indices are useful communication tools, they can also be distorted by data gaps and easily misinterpreted because the underlying methodologies and assumptions are unclear or problematic. For example, weighting individual measures in an index reflects an arbitrary process based on a set of value judgments (Cairns, McCormick, and Niederlehner 1993; Diener and Suh 1997; Innes and Booher 2000; Dalal-Clayton and Bass 2002; Lopez-Ridaura et al. 2005; Tanguay et al. 2010). Highly aggregated information may also mask local information that would assist in identifying future

[32] The WQI is endorsed by the Canadian Council of Environment Ministers to provide consistent procedures for reporting water quality conditions across Canada. The U.S. Environmental Protection Agency developed the IWI to characterize the condition and vulnerability of aquatic systems. The IBI, developed by Karr (1981), is a measure of fish species diversity and populations used to assess the health of aquatic ecosystems. The ICI, developed by the U.S. Environmental Protection Agency in Ohio, is similar to the IBI, and measures the health of the aquatic macro-invertebrate community (DeShon 1995). The QHEI, also developed by the U.S. Environmental Protection Agency in Ohio, represents a measure of instream geography and provides a quantitative assessment of the physical characteristics of a given stream reach (macro-habitat quality).

problems and also may fail to reveal causal relationships between actions and outcomes (Schultz 2001; Dietz, Ostrom, and Stern 2003).

This overview of indicator frameworks shows that they are shaped generally by four approaches: (1) *the bottom-up approach* (primary data are aggregated through several hierarchical levels (information pyramid) into indicators), (2) *the top-down approach* (the logic flows from a vision to themes to actions to indicators), (3) *the systems approach* (the logic entails a comprehensive analysis of system inflows and outputs before defining indicators), and (4) *the cause-effect approach* (the logic of indicators denoting various causes and effects) (World Water Assessment Programme 2003). These approaches and examples of associated frameworks are summarized in Table 3.3.

Blending aspects of one indicator framework with another and/or linking frameworks to other measurement tools can reduce some of the inherent weaknesses and limitations of one approach and capture the inherent complexities of economic, social, environmental, and institutional complexities (Maclaren 1996). For example, linking the System of Integrated Environmental and Economic Accounting (SEEA) with social accounting matrices is being explored. Researchers are also developing new indices that focus on the linkages among indicators. One example is the Fondazione Eni Enrico Mattei (FEEM) Sustainability Index which employs an aggregation methodology and a dynamic computable general equilibrium model that projects different scenarios (Carraro et al. 2009).

To counter the weaknesses inherent to the Pressure-State-Response model and its derivations, Niemeijer and de Groot (2008) propose an enhanced DPSIR framework that incorporates a systems approach to show the interaction and interconnections inherent in the 'real world' among various causal chains. In this way, they contend that the criteria for indicator selection can be applied to structure the interrelationships among individual indicators around key nodes of the causal network, making them more relevant and meaningful.

Anielski and Winfield (2002: 9) examined a number of conceptual and existing reporting frameworks proposed or used in Canada to measure sustainability at different scales, to determine which might be relevant at the community level. They concluded that there were "disparate initiatives and data sets that are currently in a state of random disarray, scattered across the country with no consistent protocols for information gathering or reporting." By reviewing the strengths and weaknesses of various frameworks, they posited a conceptual 'Community Capital and Accounting and Measurement Framework' based on a combination of elements from different frameworks for monitoring sustainability and environmental quality at the community level. This combined

framework is an attempt to allow for integration of available data sets at the national level while maintaining flexibility in developing customized profiling at the community level.

Table 3.3. Advantages and Disadvantages of Four Indicator Framework Approaches

Approach	Description	Examples	Key Advantages	Key Disadvantages
Bottom-up	Primary data are aggregated along hierarchical levels into indicators and indices using intuitive and mathematical approaches.	Human Development Index Ecological Footprint System of Integrated Environmental and Economic Accounting (SEEA)	Simplifies large amounts of data; can be participatory; serves policy-oriented thinking.	Reductionist; details are lost; problems can be masked; improvements can be diluted.
Top-down (Logic Framework)	Uses the Logic Framework (log frame); follows a generalized structure where the goal of an intervention is structured according to its purpose, outputs and specific activities; indicators are set at all levels and are based on achievement.	Indicators of Sustainable Development (UN DESA) The Millennium Development Goals; World Wide Fund for Nature Living Planet Report	Identifies key areas of concern; includes all aspects of sustainability; can be used with other frameworks; ensures stakeholder and expert input.	Difficult to decide on themes; difficult to address cross-cutting issues; not suitable for solving new problems because only discovered problems are considered.
Systems Approach (Capital Framework)	Analyzes the inflows, stock, and outflows of an issue and their interrelationships before defining indicators. It draws from the concept of system dynamics.	Wealth of Nations, World Bank Four-Capitals Model Natural Capital Index	Systematic; major emphasis on links; takes into account dynamic nature of the system; future-oriented, deals with trends; has clear policy relevance.	Complex; technical; focuses on monetized values; not transparent; favours 'weak sustainability'; often used at a stage of development where it still is 'too academic' to address real-world problems.
Cause-Effect	The cause-effect approach is one of the most widely used approaches to indicator development. It enables trade-offs and the linking of environmental, economic and social indicators.	Driving Force-Pressure-State-Impact-Response (DPSIR) Driving Force-State-Response (DSR) Pressure-State-Impact-Response (PSIR) Driving Force-Pressure-State-Exposure-Effects-Action (DPSEEA)	Causal chains are easy to understand; serves policy-orienting thinking and institutional dimensions.	Assumes linear, interactions; links to socio-economic-institutional conditions are weak/ missing; difficult to differentiate indicators in each category of the causal chain; may favour elitist views and be gender biased.

Source: After Hardi (2001); Segnestam (2003); World Water Assessment Programme (2003) Ekins and Medhurst (2006); Carr et al. (2007); United Nations (2007); Johnston and Memon (2008); Mayer (2008).

Another example of a blended approach for both developing and evaluating indicators in the community context is the Urban Sustainability Evaluation Matrix, based on a typology which combines domain-based, goal-based, sectoral, issue-based, and causal (pressure-state-response) frameworks (Maclaren 1996).

Regardless of the approach, Dalal-Clayton and Bass (2002) suggest that a well-designed indicators framework should be (1) *systematic* (the parts are organized to facilitate analysis of key properties of the system and the relationship between subsystems and major features), (2) *hierarchical* (the parts are organized into a series of levels narrower in scope and more specific at lower levels), and (3) *logical* (the levels form a series of ends and means (what we measure and why)).

Perhaps one of the reasons why so many indicator frameworks have emerged is that contextual factors, which drive concerns, priorities, possibilities, and relationships, play an overarching role in determining what indicators will be used for what purpose. This creates a dynamic tension between the desirability of a standard indicator framework for comparison and aggregation, and the reality that different communities have unique circumstances that favour self-determining approaches.

3.7 Indicator Links to Policy

This section examines connections at the indicator-policy interface and how information influences policy decisions. The relationships among awareness, information, and action are complex, indirect, and subtle. Even when information is clear and compelling, people may deliberately choose to ignore it or the links between information and decisions are difficult to ascertain because of other intermingled factors (Bauler 2007). Innes (1998: 55-56) observes,

> When information is most influential, it is also most invisible. That is, it influences most when it is part of policy participants' assumptions and their problem definitions, which they rarely examine...Information acts more as a lens than as a bottom-line finding.

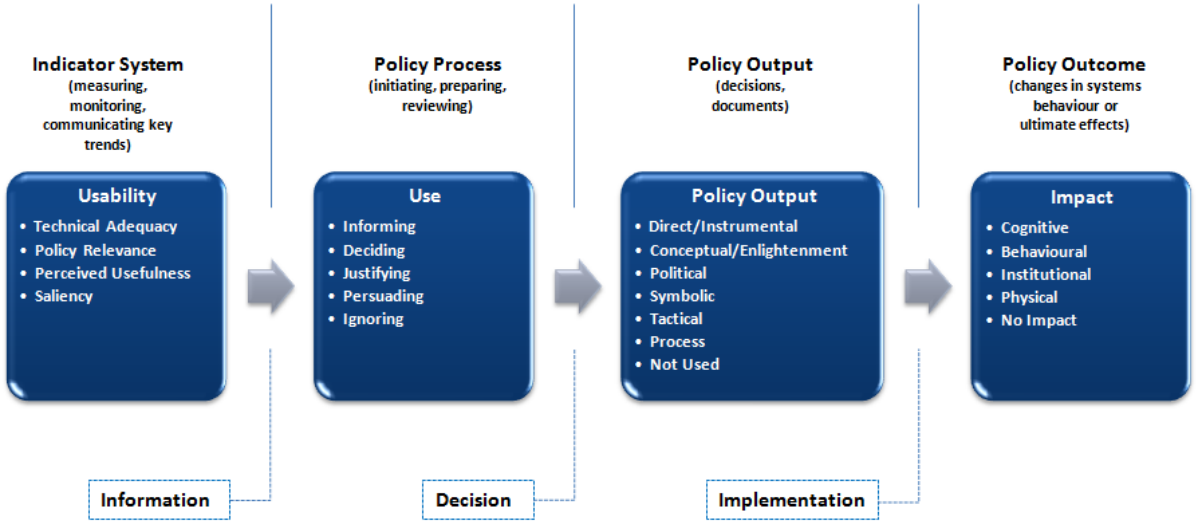
Indicators, as information, fulfil multiple policy functions. As such, they can have several uses (Figure 3.4). Depending on their use, therefore, indicators have varying functions or policy outputs. Journard and Gudnundssson (2010: 28) assert that,

> ...an indicator can be good with regard to one function, such as to stimulate debate, but less so for another, such as to diagnose underlying causes of observed change. Moreover, some functions of indicators are intended, such as detecting whether an environmental condition is present or not, while others may not be so, such as accidentally suppressing knowledge about problems that are not easily quantifiable.

Several researchers have examined indicator theory and the evaluation research literature, and conclude that policy roles for indicators depend on the motivations driving the policy process (Gudmundsson 2003; Hezri and Hasan 2004; Hezri and Dovers 2006; Bauler 2007; Gudmundsson et al. 2010). These roles can be (1) *direct/instrumental*, (2) *conceptual/enlightenment*, (3) *political*, (4) *symbolic*, (5) *tactical*, (6) *process*, or (7) *not used*. Indicators are sometimes used as a *direct* or

instrumental conduit to shape or modify strategies, actions or policies. *Conceptual* or *enlightenment* use happens when an individual's level of awareness and understanding of a problem or situation is altered. The *political* use of indicators occurs when they are relied on to confirm decisions already made or courses of action already taken, whereas the *symbolic* use of indicators prevails when the indicator selection process is used to reassure stakeholders and demonstrate the objectivity of decisions. When indicators are used by decision makers to postpone, avoid, or justify a decision, they are *tactical*. Indicators may also play a *process* role when the method used to identify and select shapes policy development, rather than the indicators themselves. Finally, indicators may be totally overlooked and therefore, *not used* at all, rendering them an insignificant factor in the policy and decision-making process.

Figure 3.4. Indicator Links to Policy Outcomes



Source: After Gudmundsson (2003); Hezri and Hasan (2004); Bauler (2007); Gudmundsson et al. (2010).

The degree of impact and influence that indicators have on policies and decisions is contingent on the functions assigned to them. Indicators can generate cognitive (e.g., increase awareness and understanding), behavioural, institutional (e.g., policy or governance), and/or physical changes (e.g., on-the-ground) or fail to trigger any change, if they are not used or disregarded. Section 3.8 explores the influence of community indicator reports on policy and decision making.

3.8 Community Indicator Reports

Across North America, numerous indicator initiatives to measure sustainability, community health, or quality of life at the community level have been undertaken since the mid-1980s (Besleme, Maser, and Silverstein 1999; Innes and Booher 2000; Gahin and Paterson 2001; Swain and Hollar 2003; Kates, Parris, and Leiserowitz 2005; Dluhy and Swartz 2006). During the 1990s, over 200

community indicator projects were launched in the United States and at least 24 were initiated in Canada (Maclaren 2001). Many local initiatives were spurred by local Agenda 21 processes and developed through 'grassroots' participation (Gray and Wiedemann 1999; Holden 2001; Mitra 2003).

Typically, communities have approached indicator projects from four alternative starting points: (1) quality-of-life, (2) sustainability, (3) healthy-community ,[33] or (4) benchmarking or performance (Swain and Hollar 2003).[34] These approaches are described in Table 3.4.

Table 3.4. Approaches to Community Indicator Initiatives in Canada and the United States

Approach	Description
Quality of Life	• Select a broadly defined and balanced set of indicators. • Focus advocacy on improvements which the community has identified as important and around which some degree of consensus already has been established. ***Typical Sponsors:*** Chambers of commerce, community-based organizations, or other non-governmental organizations. ***Examples:*** Jacksonville, Florida (1985); Trucklee Meadows Region, Nevada (1992).
Sustainability	• Select a set of indicators with greater emphasis on environmental measures. • Focus advocacy on community improvements consistent with the principles of sustainability as a means of changing perceptions and creating consensus on the desirability, even necessity, of these improvements. ***Typical Sponsors:*** Community-based organizations or other non-governmental organizations. ***Examples:*** Sustainable Seattle (1990); Sustainable San Francisco (1993); Sustainable Calgary (1996); Hamilton Vision 2020 (1998).
Healthy-community	• Select a set of indicators with a greater emphasis on health issues. • Focus advocacy on improvements which the community identified as important and around which some degree of consensus already has been established. ***Typical Sponsors:*** Health-care institutions, public health agencies; community-based non-profit organizations or a combination of these. ***Examples:*** Canadian Healthy Communities Project (1986); Pasadena, California (1992); Woolwich Healthy Communities (1991) – part of the Ontario Healthy Communities Coalition.
Benchmarking and Performance Measurement	• Select a set of indicators that measure outcomes related to public services. • Focus advocacy on guiding public policy decisions that determine or at least influence public service outcomes. ***Typical Sponsors:*** Government agencies or municipalities. ***Examples:*** State of Oregon (1989); King County Benchmarks, Washington State (1991).

Source: After Guy and Kibert (1998); Besleme, Maser, and Silverstein (1999); Swain and Hollar (2003); Dluhy and Swartz (2006).

[33] Canada played a leadership role in initiating the healthy-communities movement. In 1986, the First International Conference on Health Promotion sponsored by the World Health Organization produced the Ottawa Charter on Health Promotion. In the same year, the Canadian government produced a document entitled Achieving Health for All: A Framework for Health Promotion. The Canadian Healthy Communities Project was instituted in 1988 by the Canadian Institute of Planners, the Federation of Canadian Municipalities, and the Canadian Public Health Association (Hancock 1993). Active between 1988 and1991, this program promoted several provincial initiatives, which included a network of over 200 communities. Québec's Villes et Villages en Santé, Ontario's Health Communities Coalition and British Columbia's Healthy Communities initiative "take a broad approach that links environmental, social and economic factors together and they all facilitate and support collaborative action within communities" (Hancock 2009: B-7).

[34] In the United States, Sustainable Seattle, led by a non-profit organization dedicated to enhancing the long-term quality of life in the Seattle area, is held up as an exemplary example, as is Hamilton's Vision 2020 project begun in 1998 (Bossel 1999).

Dluhy and Swartz (2006: 1) note that the "purpose and focus of these projects vary considerably because communities are not using a common structure or template." Considerable effort, time, and resources have been invested in initiating and supporting indicator projects at the community level with the assumption that "information drives policy" (Innes and Booher 2000: 174).

The early literature focused primarily on how to design and develop scientifically-defensible community indicators, not on the nature and extent of the influence of indicator reports on policy, decision making, and on-the-ground actions (Innes and Booher 2000; Rydin, Holman, and Wolff 2003). However, the contention that indicator reports are 'little used' and gather dust has prompted a new research agenda to (1) examine the linkages among indicator initiatives and decision making, policy, and action, (2) understand the nature and extent of their influence in the community, and (3) identify opportunities for improving their effectiveness as a tool to promote sustainability (Innes and Booher 2000; Gahin, Veleva, and Hart 2003; Rydin, Holman, and Wolff 2003). Besleme, Maser and Silverstein (1999) argue that,

> ... if community indicators projects are to reach their potential for improving communities, they must play an increasingly direct role in – and taking increasing responsibility for – the use of information to promote change. The question now is how to more effectively translate knowledge and commitment into action.

A review of selected literature, published between 2005 and 2008, reveals that the focus of research shifted from the design of community indicators as decision-making tools to the effects of indicators on decision making and the explicit outcomes derived from indicator projects (Holman 2009). Some of the key findings from this research are outlined in Section 3.8.1.

3.8.1 The Value of Community Indicator Reports

Empirical studies investigating the nature, extent, and influence of community indicator projects suggest that key outcomes are the direct result of either: (1) the process of developing the indicators, (2) publishing and distributing the indicator reports, or (3) the action-oriented steps undertaken following the release of the report. Outcomes can be *intangible* (raised awareness, new connections and working relationships, better understanding of community issues, increased community dialogue), *concrete* (changes in decision-making processes and resource allocation), or *measurable* (on-the-ground progress) (Gahin, Veleva, and Hart 2003). *Intangible* outcomes provide potential building blocks for change. *Concrete* outcomes include the creation, modification, or implementation of particular actions in response to indicator feedback. *Measurable* outcomes track movement towards a target (Besleme, Maser, and Silverstein 1999). Several challenges associated with each of these three stages have been identified in the literature (Table 3.5).

Table 3.5. Challenges Identified with Community Indicator Reports

Indicator Stage	Key Challenges
Development of Indicators	***The definition of sustainability is problematic.*** • Multiple interpretations of sustainability make consensus and goal-setting difficult.
	There is a gap between the 'ideal' set of indicators and the data to support them. • Data may not be collected, collected sporadically, or at insufficient locations; available data at the local level favours use of socio-economic indicators. • Data may be collected but not available because fees are prohibitive, data are confidential, or resources are lacking to collate it properly. Insufficient time, resources, expertise, or connections with other agencies may hinder exploration of a full range of data sources. • There is no central depository for data so each provider needs to be contacted separately. • Continuity of the data may be a problem because of inconsistent monitoring and methods and lack of funding.
	There is a wide choice of indicator frameworks to use and no standard and universal classification of methods or approaches for selecting indicators. • Comparison with other communities is difficult; the development of individual frameworks is time-consuming and expensive.
	The choice of indicator frameworks for selecting indicators must be carefully considered. • The use of standardized indicator frameworks may omit aspects of the community valued locally and result in lack of credibility and support. The use of aggregated indices may mask issues. • Response to issues and priorities becomes opportunistic if there is no cohesive normative framework to guide indicator selection.
	It is difficult to engage the public and meet their expectations. • Public input may produce a long list of potential indicators for which data are unavailable or priorities are difficult to discern; the public may lack knowledge needed to choose appropriate indicators. • Indicator development processes do not generate as much excitement as visioning processes and may be considered burdensome by the participants. • Not all stakeholders are represented in the process; increasing the broadness and diversity of participation is problematic.
	Political agendas, not issues, drive indicator selection. • Indicator selection is influenced by the interplay of interests, priorities, and knowledge levels among participants, especially influential ones (e.g., local politicians, financial backers, report writers). • Indicators may be rejected if negative results are shown or if results identify poor social-economic conditions which may stigmatize residents.
	Key messages may be influenced by how indicators are presented. • Messages can vary depending on how indicators are presented (e.g., absolute or relative change; total or per capita values, aggregated) and what context is used (e.g., comparisons among communities may reveal insights about the phenomenon being measured).
	Continuity of approach over time may be problematic. • Changes in issues, availability of data, and people involved in the process of indicator reports may result in discontinuities over time.
Publishing and Distributing the Indicator Report	***The key messages may be obscured***. • Attention may focus on the views of a high-profile spokesperson rather than on the key messages. • Simplification may dilute key messages or result in an incomplete representation of the community. • Messages that do not resonate with the intended audience will be ignored.
Action-Oriented Steps	***Outreach and education are often the weakest aspect of indicator initiatives***. • Effort and energy are generally focused on creating the indicator report; indicator reports typically do not reach a wide audience and are not deliberately designed to inform community planning, enhance adaptive capacity, or respond to problems identified by the community.

Source: After Maclaren (2001); Sawicki (2002); Gahin, Veleva and Hart (2003); Dluhy and Swartz (2006); Smith et al. (2008); Holden (2009); Tanguay et al. (2010).

Research findings across a range of studies suggest that community indicators do not cause change independently or drive policy (Besleme, Maser, and Silverstein 1999; Innes and Booher 2000; Swain and Hollar 2003; Catasús et al. 2007; Holman 2009). In fact, there is historical evidence that many attempts to measure well being have not had a demonstrable impact on improving conditions (Sawicki 2002). The literature suggests that in the last decade, community indicators may foster change over a period of time. Most community indicator outcomes are intangible and contribute towards enriching social knowledge, building connections among people, and ultimately inspiring actions (e.g., concrete and measurable outcomes). Catasús et al. (2007: 516) state that, "we cannot minimize the impact of measurements when used as indicators because indicators support the relationship between mobilizing and acting."

Less frequently, indicator initiatives motivate change because results resonate strongly with decision makers or concerted outreach efforts are successful in spurring action. There is some evidence that indicators create a platform for meaningful dialogue about sustainability among different policy actors (Holden 2006). This, in turn, influences governance structure so that indicators become "embedded institutionally over time" and motivate new relationships and "networks of trust" (Holman 2009: 373-374). Researchers examining community indicator processes, in retrospect, identify several factors that can strengthen the nature and extent of outcomes. Some key 'lessons learned' from these studies are described in Table 3.6.

However, a better understanding of how reporting processes work and the forms, formats, and approaches that make indicators most effective in fostering progress is needed (Rydin et al. 2003). Holden (2009: 431) asserts that "by failing to investigate the range of perspectives that inform the development, application and dissemination of indicators in local governance, we lose the critical edge of our understanding of indicators, how they operate in communities, and how research might help them operate better." Actual change attributed to inspired action is harder to quantify because it takes time to detect, cause-effect linkages are complex, non-linear and difficult to ascribe, and solutions require collective effort from multiple parties (Gahin, Veleva, and Hart 2003).

Detecting and addressing these complexities as assessment is 'scaled-up' to the regional landscape, ecosystem, and watershed scales are even more problematic. The opportunities and challenges associated with watershed assessments and indicator reports are addressed in Section 3.9.

Table 3.6. Community Indicator Initiatives - Lessons Learned

Indicator Stage	Lessons Learned
Development of Indicators	A clearly defined, persistent vision helps define goals, foster commitment, and engage people.
	A participatory process for developing indicators is valuable and worthwhile. It can raise awareness about a problem, foster community discussion, mutual learning and ownership, build connections and coalitions among people, and broaden networks. This creates a political environment that provides a foundation for change over time and embeds sustainability into the policy culture.
	Sound project management is required to keep the process moving forward.
	Indicators should be meaningful and useful, recognizing that there are several 'communities of interest'. The inclusion of subjective data enhances objective data. A mix of quantitative and qualitative indicators should be considered and made explicit.
	A range of implementers must be involved in indicator development because responsibility for and solutions to complex issues are shared.
	New indicator frameworks that blend expert-driven and community-based approaches need to be developed and tested in order to better understand environmental, social, and economic system interactions and to formulate more relevant indicators.
	Data deficiencies can be addressed by acknowledging gaps or seeking additional data. Changes in data or analysis methods can be addressed by recalculating data according to the new methods.
	Important linkages among indicators over time and space should be identified. This requires investment in research, planning, and analysis, a diversity of perspectives, and an interdisciplinary approach.
Publishing and Distributing the Report Card	Indicator reports need to be easily understood by the intended audience and the indicators used must produce information that resonates with them.
	Effective dissemination strategies are required to ensure that target audiences are aware of and have easy, convenient access to indicator reports.
	Prominent community leaders (champions) who actively promote the indicator report give it visibility, credibility, and status in the community.
Action-Oriented Steps	Marketing indicator initiatives is critical to broaden community awareness, understanding, and support. A marketing strategy to focus the work directly with local media, general public, business leaders, and key organizations will ensure that they are aware of and regularly refer to the indicators information.
	Indicator initiatives should be closely integrated with other community planning initiatives.
	Outreach and follow-up actions after the release of an indicator report help to broaden implementation beyond the frontline of participants (e.g., adopt-an-indicator program, advocacy task forces, media campaigns, grant proposals).
	Efforts to increase community visibility to significant indicator trends are important to motivate positive trends (e.g., commending organizations that positively influence the direction of certain indicator trend lines).
	The process of developing indicators should not drain all of the available energy and resources. Resources, enthusiasm, and focus are needed for follow-up activities.
Other Findings	On- the-ground experience tends to carry more weight with the public and decision makers than information.
	Lack of sustained funding to produce successive indicator reports undermines the initiative.
	A focus on and celebration of small, incremental successes will keep participants engaged.
	The lead organization needs to be credible and respected and/or regarded as a neutral convener.

Source: After Besleme, Maser, and Silverstein (1999); Holden (2001); Gahin, Veleva, and Hart (2003); Swain and Hollar (2003); Dluhy and Swartz (2006); Reed, Fraser, and Dougill (2006); Holman (2009).

3.9 Watershed Assessment

Watershed assessments typically focus on two aspects: (1) natural processes and watershed conditions, and (2) institutional arrangements for watershed management. In addition, new assessment tools and techniques are being developed to model natural processes and predict potential on-site, incremental, and cumulative impacts of changing land uses and climate conditions or major projects.

Watershed studies examining the 'state of the watershed' usually capture current knowledge about the status of natural resources, how natural systems function, and the socio-economic forces which act as stressors on the environment. These kinds of reports are sometimes called watershed 'characterization' reports or watershed profiles. These studies are usually prerequisites for watershed planning exercises (Chapter 2).

Much of the research dealing with watershed management processes explores facets of collaborative decision making.[35] Several comparative analyses have been undertaken using interviews, surveys, and in-depth case studies to understand stakeholder perspectives and motivations and the factors that influence collaborative processes and social learning within watershed initiatives. A growing body of knowledge is being developed from empirical studies that centre on 'lessons learned' (Schramm 1980; van Ast 1999; U.S. Environmental Protection Agency 1997; Born and Genskow 2000; Goldstein and Huber-Lee 2004; Imperial 2005)

Assessments to ascertain the influence of management interventions in achieving on-the-ground results are rare (e.g., impacts) (Bellamy et al. 1999; Hooper, McDonald, and Mitchell 1999; Koontz and Moore Johnson 2004). Yet assessing the effectiveness of on-the-ground actions is critical to guide adaptive management strategies, justify additional financial and human expenditure, build knowledge and expertise around best management practices, motivate further effort, and attract new participants. In the opinion of several researchers, the emphasis for assessment should be to stimulate change in the decision-making process so that policies, strategies, priorities, and actions can ultimately affect on-the-ground results (Farrell and Hart 1998; Winograd et al. 1999; Johnson 1999; Kenney 1999; Kurtz, Jackson, and Fisher 2001; Wallis et al. 2007).

While the consequences of management decisions and actions are often indistinct, an ever-growing mix of tools and techniques designed to identify ecological linkages and predict the cumulative impacts are being tested. Examples are Cumulative Effect Assessment (CEA)

[35] Examples include Leach and Pelkey (2001), Lubell et al. (2002), Moore and Koontz (2003) and Hedelin (2007).

methodologies using checklists and matrices (Sonntag et al. 1987), spatial analysis, network and systems analysis, modeling, carrying capacity and threshold assessment, consultations and questionnaires, and expert judgment.[36] Methods to identify cause-effect relationships and models to simulate cause-effect relationships and predict future environment responses to changing land use activities have been designed (Fulcher, Prato, and Barnett 1999; He et al. 2000; Patil et al. 2001; Leitão and Ahern 2002; Conway and Lathrop 2005; Duinker and Greig 2007).[37] Guertin, Miller and Goodrich (2000) contend that the use of emerging technologies such as Global Positioning Systems, remote sensing, Geographical Information Systems (GIS), and related models and tools will assist significantly in the discovery of the nature and extent of causal relationships and in scenario testing to predict the implications of alternative water management regimes and land use changes across landscapes.

In a study of 19 watershed organizations from around the world conducted in 2001, only 5 organizations had developed indicators of sustainability and only one had developed a comprehensive set (Walmsley et al. 2001). Although less advanced than community-based exercises, watershed indicator initiatives to assess progress towards watershed health have been started in growing numbers across North America and elsewhere.

Many of the challenges experienced in developing indicator reports at the community level are applicable at the watershed scale. Some are more pronounced. For example, the issue of spatial scale poses significant challenges where "trends at one scale may lose their meaning at another scale because the basic relationships responsible for the trend may change across different spatial scales" (Wallis et al. 2007: 195). Watersheds tend to drain large areas that cross political boundaries and include multiple municipalities and agencies with specific management responsibilities. Watersheds can also include a diversity of distinct landscapes, natural features, ecosystems, and climate zones. Wallis et al. (2007: 202) point out that "no area, sector or community begins from the same base or has the same mix of environmental, social and economic issues and priorities and, therefore, most initiatives will require a unique set of indicators to assess sustainability." Another dilemma related to spatial scale relates to how integration between community and watershed scales occurs – should one scale up or scale down?

[36] In 1995, cumulative effects assessment (CEA) became mandatory under the Canadian Environmental Assessment Act. Duinker and Greig (2006) contend that CEA methodologies are deficient and need to be modified to address project-specific and region-scale effects.

[37] For examples of models that are used across the Great Lakes Basin, see U.S. Army Corps of Engineers, (2005).

In a review of approaches to developing ecosystem report cards, Browne et al. (2007) note that the issue of variability across regions (regionalism) must be considered within three broad contexts: (1) determining sampling design, (2) identification of reference conditions, and (3) reporting on conditions and trends. Defining appropriate regions can be based on aggregating areas with similar landscapes or grouping areas where similar biological characteristics prevail. Techniques such as pattern analysis and expert opinion to identify areas of common characteristics have been used to identify distinct regions. The availability of specific data in defined regions is essential to account for differing spatial, biological, or environmental factors that drive conditions and trends. Regionalism is also used to identify site reference conditions,[38] as "values for a particular indicator in one region may be quite different in another" (Browne et al. 2007: 15). For reporting, regionalism should be considered to ensure that findings are presented at a scale meaningful to stakeholders.

In the case of watersheds, presumably the appropriate unit of analysis and reporting would be the drainage area. However, the matter of scale and scope also must be considered to ensure that regional issues are not obscured and that reporting represents a level at which stakeholder and community groups can be engaged. This is particularly the case in large watersheds. To address issues and engage stakeholders, monitoring and reporting can be scaled down to sub-watersheds.

To integrate and apply science effectively, Longstaff et al. (2010) believe that four factors need to be considered: (1) balanced effort and strong communication (to foster unity among partners), (2) conceptual diagrams (to depict key attributes and processes of natural systems and capture increased understanding), (3) balancing complexity and explanatory power (to increase understanding while maintaining scientific credibility), and (4) spatial-temporal challenges (Longstaff et al. 2010). The scope and scale of the assessment can be broadened in stages.

Dennison and Wicks (2010: 13) suggest that a balance is essential among research, monitoring, and management and advise that,

> An imbalance toward too much management to the exclusion of research and monitoring means that decisions are too often not based on solid footing – knee jerk reactions result. An imbalance toward too much research to the exclusion of management and monitoring leads to an academic exercise in which research priorities are entirely curiosity driven…An imbalance toward too much monitoring to the exclusion of management and research results in a well-documented and sometimes inexplicable environmental decline.

[38] Reference condition refers to sites that have been subjected to minimal anthropogenic impact. Reference conditions are important to establish benchmarks. The magnitude of the deviation of the site from the reference condition is a measure of how healthy or unhealthy the ecosystem is (Bailey, Norris, and Reynoldson 2004).

Critical to this balanced approach is a shared vision which reflects community values and aspirations, developed through a participatory process. The fundamental reasons for producing a report card or indicator report then, are to enhance monitoring, research, and management.

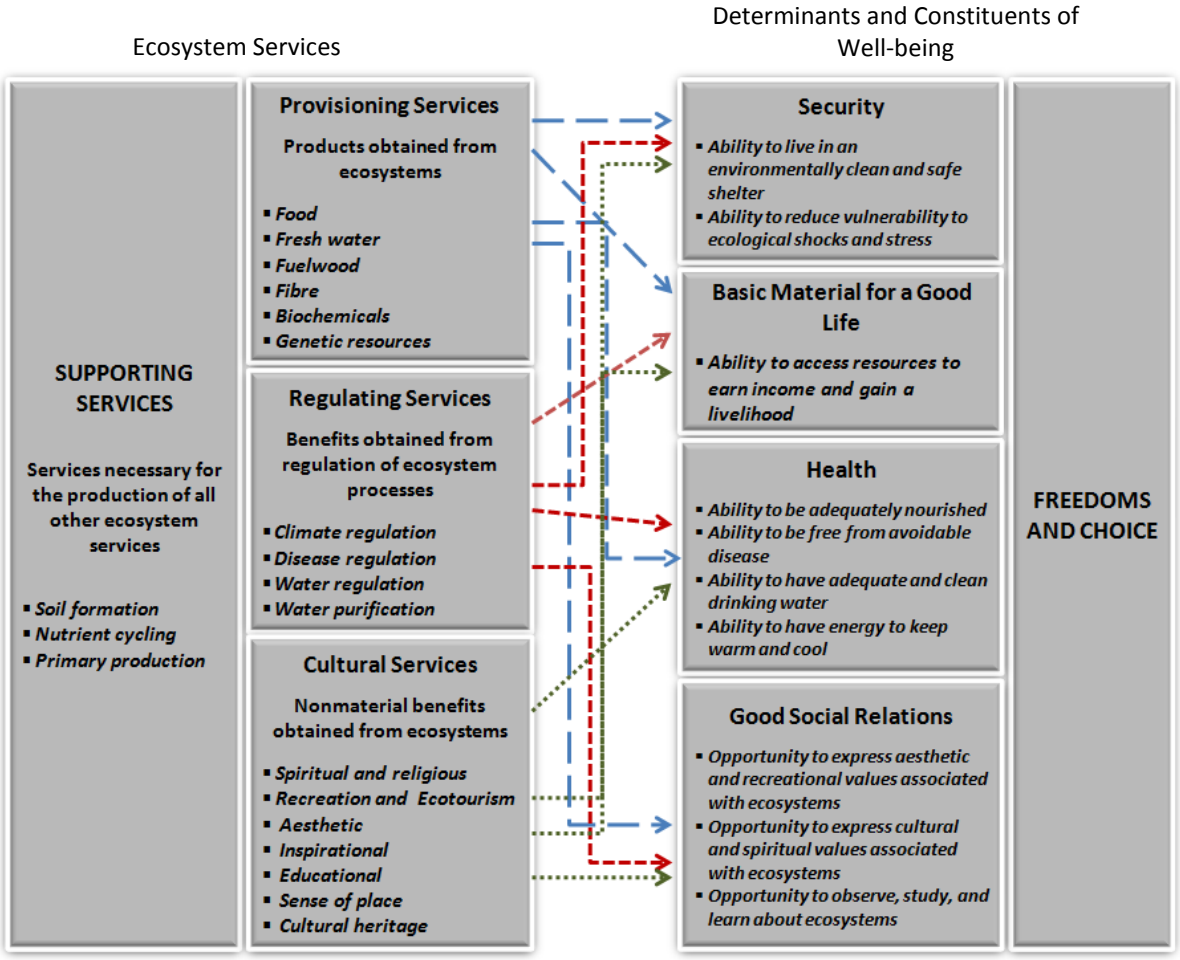
Several frameworks to assess watersheds have been or are being tested. The North East Catchment Management Authority in Victoria, Australia was selected as a pilot project to develop Triple Bottom Line (TBL) indicators[39] based on the Millennium Assessment Framework (Tiller and Fitzsimmons 2007). The Millennium Ecosystem Assessment (ME Assessment) was an international initiative established with the involvement of governments, the private sector, nongovernmental organizations, and scientists "to provide an integrated assessment of the consequences of ecosystem change for human well-being and to analyze options available to enhance the conservation of ecosystems and their contributions to meeting human need" (World Resources Institute 2003: 2). The ME Assessment recognizes four major categories of ecosystem services: (1) *provisioning* (product obtained from ecosystems), (2) *regulating* (benefits obtained from regulating ecosystem processes), (3) *cultural* (non-material benefits obtained from ecosystems), and (4) *supporting* (services necessary for the production of all other ecosystem services), and examines the tradeoffs among individual ecosystem services and the four services ecosystems provide. This framework allows for assessment at multiple scales and offers a conceptual model that places human well-being as the central focus for assessment, while acknowledging the interplay between people and ecosystems (e.g., the human condition drives indirect and direct change in ecosystems, and ecosystem alteration affects human well-being). The conceptual model used to describe these interrelationships is presented in Figure 3.5.

Another approach to track changes in the Florida Everglades was developed by Harwell et al. (1999). This method is driven by societal goals for ecosystem integrity as defined by stakeholders through a participatory process and based on the best available science. The involvement of stakeholders declines in direct proportion to the level of science needed to translate the goals into ecological meaning. The determination of essential ecosystem characteristics provides the interface where societal goals are translated by scientists and resource managers into endpoints which relate to the desired conditions. Endpoints are defined as ecosystem attributes of ecological or societal importance which describe the ecosystem in sufficient detail to characterize what ecosystem integrity ought to preserve. The lowest tier defines the field measurements required to determine the status or trends of the endpoints and their associated essential ecosystem characteristics. In this way "scientists

[39] Triple Bottom Line (TBL) indicators are variables that provide concurrent baseline information on economic, social, and environmental conditions and trends (Tiller and Fitzsimmons 2007: 2).

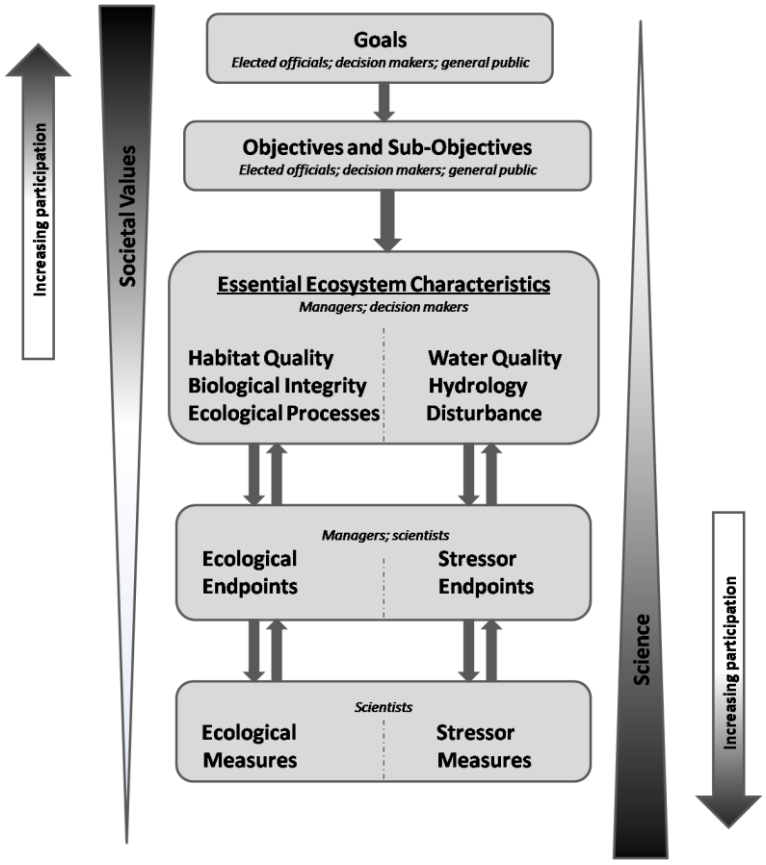
provide clarity and specificity to what society wants" (Harwell et al. 1999: 548). The measurements generated at the lower levels can be progressively condensed or aggregated as one moves up the tiers. This approach is shown in Figure 3.6. The report card is generated based on a subset of the endpoints that focus on the essential ecosystem characteristics. Harwell et al. (1999) recommend that the scientific basis for assigning grades should be included in the report card as well as a conceptual model that describes the causal relationships and linkages among societal drivers (i.e., human activity), stressors (i.e., changes in the system due to human activity) and ecological effects (i.e., the ecological changes caused by the stressors).

Figure 3.5. Ecosystem Services and Their Links to Human Well-being



Source: World Resources Institute (2003: 5).

Figure 3.6. Proposed Ecosystem Integrity Report Card Framework



Source: After Harwell et al. (1999).

The use of aggregated indices to report on the health of ecosystems at a regional scale is yet another approach used for watershed assessment. For example, report cards have been generated for 19 freshwater catchments emptying into Moreton Bay, on the east coast of Australia, as well as 18 estuaries and 9 marine zones within the bay. Produced since 1999 by Australia's South East Queensland Healthy Waterways Partnership,[40] the report cards use a single aggregated A to F rating to portray the health of each catchment, estuary, and marine zone. The ratings are based on data collected from 135 freshwater sites monitored twice a year (in spring and autumn), and 254 estuarine and marine sites monitored on a monthly basis. Data for freshwater sites are combined into 18 indices, which are aggregated and scored according to a prescribed methodology based on the percentage of sites and samples that exceed defined criteria levels. A similar report card is produced for Chesapeake Bay on the U.S. eastern seaboard. An annual Bay Health Index score is calculated for the Chesapeake Bay. This overarching score is calculated by combining a Water Quality Index and

[40] Healthy Waterways is a collaboration among the Queensland Government, local governments, industries, research organizations and community groups (South East Queensland Healthy Waterways Partnership 2009).

Biotic Index and data from 144 sites. The Water Quality Index aggregates three indicators (chlorophyll *a*, water clarity, and dissolved oxygen) as does the Biotic Index (aquatic grasses, Benthic Index of Biotic Integrity, and Phytoplankton Index of Biotic Integrity) (Integration and Application Network University of Maryland Center for Environmental Science and Ecocheck (NOAA-UMCES Partnership) 2009). In addition, separate ratings based on the same approach are calculated for 12 regions draining into the bay and for the upper, middle, and lower sections of the bay. Both the Moreton Bay and Chesapeake Bay examples rely heavily on the input of scientific experts and the use of conceptual models of specific biophysical dynamics to better understand and map the key linkages among human activities and ecosystem processes. This technique is used to drive study design and the selection of indicators. Both report cards are supported by an interactive website which provides detailed background information and data used to calculate results.

A different approach, using the DPSIR model, is being taken to report on the health of the Gulf of Maine. This model is being used to guide development of the State of the Gulf of Maine report under the auspices of the Gulf of Maine Council on the Marine Environment (GOMC) (Walmsley 2010). The GOMC was created in 1989 by the governments of New Brunswick, Nova Scotia, Maine, New Hampshire, and Massachusetts and is a bilateral, co-operative initiative between the U.S. and Canada. Members of GOMC represent government agencies, academic institutions, non-government organizations, and private sector organizations throughout the Gulf of Maine cross-border ecosystem area. In June 2009, the GOMC formed an ad hoc task group to develop a work plan and a first version of a State of the Environment report by June 2010 (GOMC Ad Hoc Task Group for State of the Environment Reporting 2009).

In Canada, interest in developing indicators of watershed health is strong. Most report cards are developed independently by individual watershed organizations. One of the most recognized efforts in Canada associated with watershed sustainability is the work of the Fraser Basin Council (FBC), a not-for-profit launched in 1997 to implement a Charter for Sustainability. In 2000, the FBC initiated a participatory process to develop sustainability indicators. The first sustainability report was published in 2003. Reports are produced biennially. In 2009, the fourth report was released, covering 18 key themes and incorporating social, economic, and environmental indicators (Fraser Basin Council 2009).

Conservation Ontario, an umbrella organization representing 36 conservation authorities in Ontario, released a guide to watershed reports in 2003 (Conservation Ontario 2003). This guide suggests that conservation authorities develop state of the watershed reports every five years to serve as a management and evaluation tool and as a means to communicate results to the public. Three

priority areas for measurement are identified as minimum reporting requirements: forest conditions, surface water conditions, and groundwater quality. The guide provides a step-by-step manual for data collection, assessment, and scoring of these three indicators, but acknowledges that comprehensive state of the watershed reporting should include other environmental aspects such as air quality as well as indicators of social and economic health. The guide also mentions the value of identifying stressors and management targets. Despite the upsurge in indicator initiatives among conservation authorities[41] and the availability of an umbrella guidance manual, approaches to developing report cards vary considerably (Dunn and Bakker 2009).

The Government of Saskatchewan rates the health of the province's 29 watersheds using a pressure-state-response (stress-condition-response) framework. The resultant State of the Watershed Report is a "benchmark tool for assessing watershed health, and is intended to provide governments, decision-makers, industry and the community with the scientifically-defensible information needed to manage the province's water resources in an integrated fashion" (Davies and Hanley 2010: ii). The second State of the Watershed Report was released in 2010.[42] Watersheds were ranked with respect to 6 condition indicators, 22 stressor indicators and 9 response indicators. Data to support all 37 indicators were available only for two watersheds. The condition of each watershed was ranked using the lowest health rating from the six condition indicators. The stressor level in a watershed was determined by the number of stressor indicators exhibiting a high intensity rating (i.e., the fewer the number of stressor indicators having a high intensity rating, the lower the stress intensity rating). Response ratings were based on the level of management initiatives adopted to mitigate stress and improve health (i.e., the response rating was calculated based on the percentage of response indicators active/present within the watershed) (Davies and Hanley 2010).

Dunn and Bakker (2009) report, that in Canada, there is an absence of a consistent reporting framework for water security among the various levels of governments and at various watershed scales. As a result, "environmental indicators currently have little or no impact on policy development" (Dunn and Bakker 2009: 2). Their research indicates that (1) there are few 'integrated' indicators that measure surface and groundwater interactions, (2) water quality indicators are more prevalent than water quantity indicators, (3) ecosystem health indicators are more commonly used than human health indicators, (4) surface water indicators prevail over groundwater indicators, (5) governance indicators are sparse and poorly developed, and (6) infrastructure indicators are limited in number and scope. They recommend a centralized repository for indicators and associated data to

[41] Twenty-two conservation authorities produce watershed report cards or watershed reports.

[42] The first State of the Watershed Report Card was issued in 2007 (Saskatchewan Watershed Authority 2007).

facilitate timely and effective reporting, a harmonized reporting framework, and consistent set of indicators and indices at the federal and provincial levels, and greater collaboration and engagement among end users.[43]

3.10 Chapter Summary

Indicators are widely used at global, national, regional, and community scales as a decision support tool. Their specific roles, functions, and linkages to policy outcomes vary depending on their purpose, the nature of the phenomena being assessed, and the intended audience. As a result, disparate methodologies, conceptual frameworks, and typologies for selecting, organizing, developing, and presenting indicators abound. To avoid misinterpretation, terms should always be clarified within the context of their use.

Data influence the nature and scope of indicator initiatives and tend to drive indicator selection. To be meaningful, data need to be collected, analyzed, and synthesized at a geographic scale suitable to fit the magnitude and scope of the decision context. This approach is typically obstructed by lack of comprehensive monitoring programs, shifting spatial, temporal, political, and social factors, and the usually slow rate of change in human-environment systems.

Cause-effect linkages and the interplay among the environmental, social, and/or economic systems are often difficult to distinguish. While data play a primary role in the development of indicators, the selection of indicators is sometimes guided by the use of a conceptual model or framework, which can assist in defining key linkages and interrelationships among indicators. However, no single model can accurately portray the nature, extent, and influence of interactions among phenomena. Inherent weaknesses and limitations can be lessened by blending aspects of one indicator framework with another or by linking frameworks to other measurement tools.

Indicator projects at the global, national, or state/provincial levels tend to use aggregated or composite indices to measure relative performance and are expert-driven, with limited public input. In contrast, community-based indicator projects are characterized by 'grassroots' participation, driven by local concerns, and often presented in a report card format. The process of bringing people together to debate sustainability issues has intangible value by fostering community discussion and mutual learning and 'buy-in', building rapport and trust among participants, and broadening social networks and coalitions. This helps encourage a political penchant for transformation and affirmative action and entrenches sustainability precepts into policy culture.

[43] The call for consistent indicator frameworks and indicator sets overlooks the reality that economic, social, and biophysical forces in watersheds vary, producing different priority concerns, possibilities, and interrelationships which should guide the design and development of monitoring and reporting initiatives.

Efforts to make indicator reports understandable, credible, and appealing to diverse target audiences are paramount to ensure that they reflect societal values, attract attention, and spur dialogue, debate, and action. The use of innovative graphics and indices, 'stoplight' symbols to indicate relative condition, simple conceptual diagrams, and other visual techniques are recommended for improving uptake. Outreach and follow-up activities after the launch of a report card are important to increase stakeholder awareness about indicator conditions, trends, and progress.

State of the watershed reports incorporating environmental, social, and/or economic indicators and watershed report cards are increasing in popularity, not only in North America, but internationally. Watershed indicator reports typically focus on measuring existing river or ecosystem health, developing targets, and identifying trends. A variety of approaches for creating watershed report cards is being used globally, borrowing from the methods and formats found in community-based report cards and larger-scale reporting initiatives. In Canada, watershed report cards typically organize and present indicators according to broad themes, individual indicators, or the pressure-state-response framework or derivations thereof. Efforts are currently underway to harmonize some indicator initiatives (e.g., Ontario's conservation authorities); however, the practicability of developing a meaningful and consistent watershed indicator framework is suspect, given the challenges and complexities identified in Section 3.5.

The literature reveals a paucity of research exploring (1) the effectiveness of the watershed management process in achieving on-the-ground results, (2) watershed reports cards and the nature and extent of their influence on decision making and their role in adaptive management, and (3) specific outcomes derived from indicator projects. In addressing these knowledge gaps, attention needs to be paid to links and discrepancies between the theories and concepts reviewed in Chapters 2 and 3 and the practice of watershed management and reporting. Issues relating to process are particularly salient and spark a number of questions. What is the management focus (human-nature interrelationship or human well-being)? Is the management process top-down (prescriptive), bottom-up (radical or communicative) or middle ground (collaborative)? Are indicators selected to measure conditions, trends, outputs, outcomes, impacts, performance (efficiency and legitimacy) and/or to demonstrate human-ecological relations (holistic)? Have decision makers demonstrated a willingness to learn (adaptive) and/or are there other socio-political forces that prevail? What role does the watershed management organization have in the decision-making process? Is inter and intragenerational equity considered? The next chapter will present the methodological approach and rationale used for this study.

Chapter 4: Research Design and Methods

4.1 Introduction

This chapter presents the methodological approach and associated rationale underpinning this study. A description of the overall research design as well as the methods utilized for data collection and analysis, including the attendant underlying assumptions, biases, strengths, and limitations, is provided.

4.2 Research Approaches

In designing research studies, researchers typically use one of three methods: (1) qualitative, (2) quantitative, or (3) mixed. They can also choose to study a whole population (e.g., people or objects), a random sample of the population, or purposively chosen case studies. A description of these research design choices is outlined in this section. The research design chosen for this study and the related rationale are provided in Section 4.3.

Qualitative research is rooted in the social sciences (Strauss and Corbin 1990; Merriam 2009). While differing opinions and interpretations exist in the literature,[44] qualitative research generally refers to the "what, how, when, and where of a thing – its essence and ambience" (Berg 2001: 3). Denzin and Lincoln (2003: 3) state that "qualitative researchers study things in their natural settings, attempting to make sense of or interpret phenomenon in terms of the meanings people bring to them." Merriam (2009: 13) claims that "…qualitative researchers are interested in *understanding the meaning people have constructed*, that is, how people make sense of their world and the experiences they have in the world." As a category of research method, qualitative research has been increasingly used by geographers since the 1980s (Winchester 2000).

Various writers have emphasized different characteristics of qualitative research (Berg 2001; Patton 2002; Kumar 2005; Bogdan and Biklen 2007; Chesebro and Borisoff 2007; Gay, Mills, and Airasian 2008; Creswell 2009; Merriam 2009). Merriam (2009) presents four common characteristics shared by most writers as key to understanding the nature of qualitative research: (1) the focus is on process, understanding, and meaning, (2) the researcher is the primary instrument of data collection and analysis, (3) the process is inductive, and (4) the product is richly descriptive. Strauss and Corbin (1990) further suggest that qualitative methods are appropriate for gaining understanding about little-known phenomena, revealing new dimensions about well-known entities, or accessing more in-depth

[44] The discourse pertaining to qualitative research over the past 30 years has resulted in a plethora of distinct perspectives and opinions resulting in "a family of terms, concepts, and assumptions" (Denzin and Lincoln 2008: 3).

information that may be difficult to convey quantitatively. According to Hoepfl (1997: 49), "qualitative methods are appropriate in situations where one needs to first identify the variables that might later be tested quantitatively, or where the researcher has determined that quantitative measures cannot adequately describe or interpret a situation."

Qualitative research is often portrayed as diametrically opposed to quantitative research, which stresses 'objectivity', measurability, and predictability and leads to generalizations about how specific variables interact within a given context (e.g., co-relations, relationships, causality). Quantitative research has its heredity in natural sciences (Bryman 1988). The focus is on (1) the analysis of numerical data to explain what is observed, (2) using tools to collect numerical data under controlled conditions, (3) an experimental and deductive process, and (4) a statistical and replicable product.

Data collection techniques differ between qualitative and quantitative methods. Data for qualitative research are most often derived from open-ended interviews, focus groups, direct observation, and word, text, and image analysis**.** Quantitative data collection relies heavily on controlled experiments, structured surveys that yield quantitative or numeric descriptions, and statistical analysis (Creswell 2009). According to Creswell and Plano-Clark (2007: 6), "the open- versus closed-ended nature of the data differentiates between the two types better than the sources of data." Typically presented as a series of dualisms, some of the key differences between the two research methods are highlighted in Table 4.1.

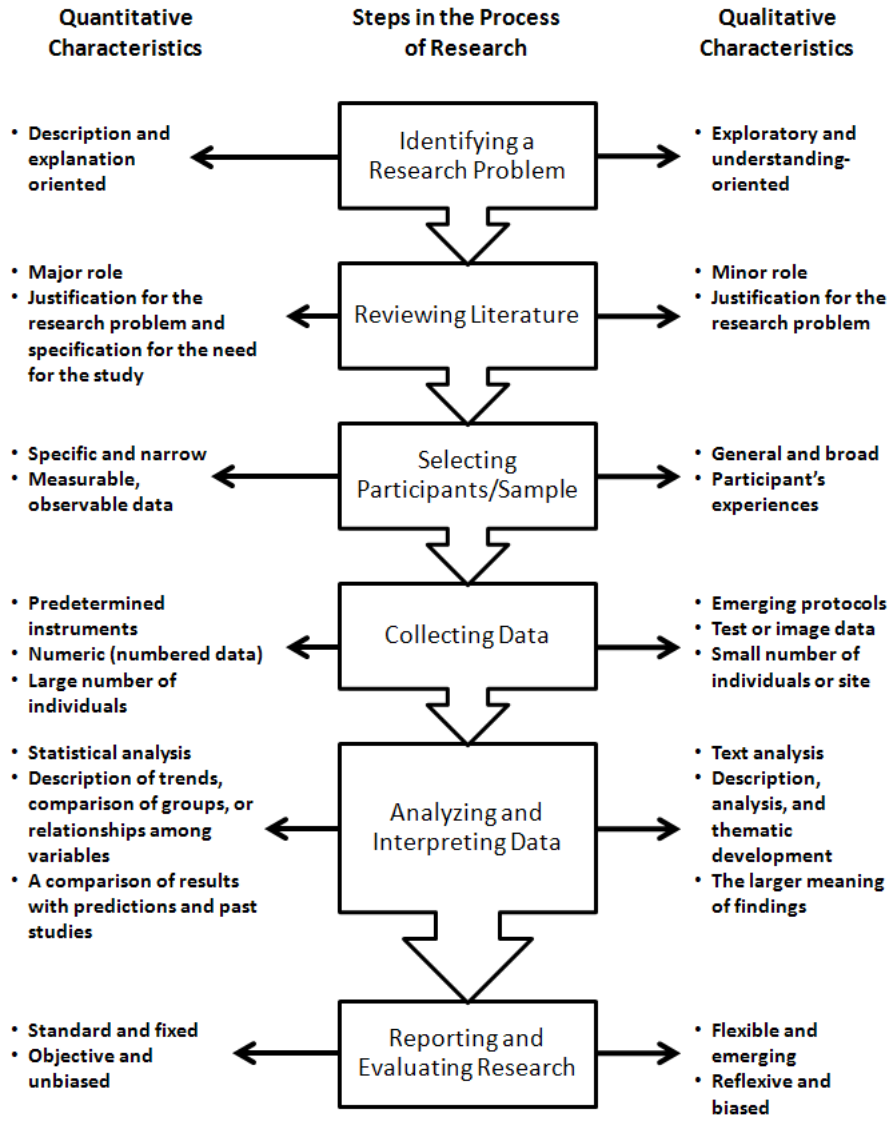
Generally, quantitative research methods are associated with the positivist perspective and qualitative methods with the constructivist or interpretivist perspective (Guba and Lincoln 1989; Wildemuth 1993; Hoepfl 1997; Johnson and Onwuegbuzie 2004). This difference leads not only to contrasting methods of data collection, but also to distinctions among their respective knowledge claims, strategies of inquiry, and methods of data analysis (Creswell et al. 2003). Creswell (2002) compares qualitative and quantitative approaches using a six-step model of research (Figure 4.1). Strategies of inquiry vary depending on which method is used. Creswell (2009:12-13) notes that quantitative strategies typically entail experimental research and structured instruments focused on a population or a random sample.

Table 4.1. A Comparison of Qualitative and Quantitative Research Elements

Point of Comparison	Elements of Qualitative Research	Elements of Quantitative Research
Focus of research	Quality (nature, essence)	Quantity (how much, how many)
Goal/intent of investigation	Understanding, description, exploratory, generating hypothesis/theory	Prediction, confirmation, hypothesis/theory testing, conclusive
Context of research	Natural setting (process oriented)	Laboratory or controlled setting (outcome oriented)
Philosophical roots	Phenomenology, symbolic interactionism, constructivism, interpretivism, naturalism	Positivism, logical empiricism, realism, objectivism
Ontological stance (nature of reality)	Reality is a product of human imagination/socially constructed; multiple realities	Reality as a concrete structure or process waiting to be discovered
Epistemic stance (nature of knowledge)	Knowledge for revelation and understanding social construction	Knowledge for construction of scientific laws
Role of researcher	Involved, reports bias	Detached, tries to remove bias
Associated phrases	Fieldwork, ethnographic, naturalistic, grounded, constructivist	Experimental, empirical, statistical
Design characteristics	Flexible, evolving, emergent, open-ended, value-laden	Predetermined, structured, standard, close-ended, value-free
Nature of data	Thematic, impressionistic, generalized	Numeric, measurable
Primary mode of analysis	Inductive (by researcher)	Deductive (by statistical methods),
Findings	Comprehensive, holistic, expansive, richly descriptive, applied	Replicable, strives to identify and isolate specific variables to determine correlations, relationships, causality
Validation of Data	Relies on participants, researcher or reader	Relies on external standards such as judges, past research, statistics
Challenges	Findings unique and non-transferrable, predictions difficult to make, investigation so broad that it is difficult to reconcile differences or assess representativeness, subjectivity reduces credibility, time-consuming, expensive, outcomes easily influenced by researcher bias and idiosyncrasies	Categories and theories not reflective of local constituencies, knowledge too abstract and general for practical use

Source: After Moran and Smircich (1980); Winchester (2000); Johnson and Onwuegbuzie (2004); Kumar (2005); Chesebro and Borisoff (2007); Creswell and Plano Clark (2007); Creswell (2009); Merriam (2009).

Figure 4.1. Characteristics of Qualitative and Quantitative Research Methods



Source: Creswell (2002).

In contrast, common qualitative strategies include (1) *ethnography* (the researcher studies an intact cultural group in a natural setting over time), (2) *grounded theory* (the researcher derives a general, abstract theory of process, action or interaction grounded in the views of participants), (3) *case studies* (the researcher explores in depth a program, event, activity, process or one or more individuals), (4) *phenomenological research* (the researcher identifies the essence of human experiences about a phenomenon or set of phenomena as described by participants), and (5) *narrative research* (the researcher studies the lives of individuals and asks one or more individuals to provide stories about their lives).

Quality of research is typically judged based on the validity and reliability of the work. Valid measurements are those which are accurate and measure what they were intended to measure. Reliable results are those that are replicable and consistent (Giannatasio 1999; Golafshani 2003). Internal and external factors that prevent the researcher from measuring what was intended to be measured or that obscure the relationship between dependent and independent variables pose threats to validity. Internal validity seeks to establish causal relationships and relies on the constancy of data collected or the data collection tool used in order to interpret the data accurately. External validity refers to the generalizability or representativeness of the data (Giannatasio 1999).

Given the philosophical, ontological, and epistemological differences between qualitative and quantitative methods, the application of the concepts of reliability and validity to qualitative research has been the subject of considerable debate. Qualitative research is sometimes considered a "soft" science and has been criticized because validity and reliability are purportedly lacking (Harper and Kuh 2007; Schwandt, Lincoln, and Guba 2007). For example, Stenbacka (2001) argues that since reliability deals with measurement, it has little applicability to qualitative research. Similarly, external validity is contested because generalizability is not a primary focus of qualitative research. Conversely, qualitative researchers argue that reliability and validity[45] are essential components of qualitative research. They agree that their research must have specific attributes to gain legitimacy, demonstrate "quality," and counter critics who contend that qualitative researchers write "fiction, not science" and that they have no way of verifying their truth statements (Denzin and Lincoln 2008: 11). Morse (1999: 717) states that, "science is concerned with rigor, and by definition, good research must be reliable and valid."

Responding to this challenge, Lincoln and Guba (1985) propose that the "trustworthiness" of the inquiry, including the notions of credibility, transferability, dependability, and confirmability, can be used to assess rigour[46] and better suits the qualitative approach (Table 4.2). These criteria run parallel to those used to assess the rigour of quantitative studies (Morse et al. 2002: 4). The aim of trustworthiness in a qualitative inquiry is to support the argument that the inquiry's findings are

[45] In qualitative research, validity generally refers to (1) the degree to which a finding is judged to have been interpreted in a correct way, or (2) gaining knowledge and understanding of the nature (i.e., the meaning, attributes, and characteristics) of the phenomenon under study (Krefting 1991; Golafshani 2003). Reliability refers to the ability of different researchers to make the same observations of a given phenomena if and when the observation is conducted using the same method(s) and procedure(s) (Krefting 1991).

[46] Rigour is a term used to denote thoroughness and accuracy (Oxford Dictionaries 2009: 801). The tests for rigour in qualitative research according to Lincoln and Guba (Schwandt, Lincoln, and Guba 2007: 15) include "exploring the truth value of the inquiry or evaluation (internal validity), its applicability (external validity or generalizability), its consistency (reliability or replicability), and its neutrality (objectivity)."

"worth paying attention to" (Lincoln and Guba 1985: 290). Trustworthiness applies to all stages of the research process, including research design, data collection and analysis, and data interpretation.

Table 4.2. Assessment of Trustworthiness (Rigour)

Criterion	Qualitative Approach	Quantitative Approach
Truth value	Credibility	Internal Validity
Applicability	Transferability	External Validity
Consistency	Dependability	Reliability
Neutrality	Confirmability	Objectivity

Source: Lincoln and Guba (1985).

Credibility in qualitative research parallels the notion of internal validity and provides assurances of the fit between participants' views of their experiences and understanding and the researcher's reconstructions and representations. Patton (2002) argues that credibility depends on the richness of the information gathered (thick description) and on the analytical abilities of the researcher. Strategies to enhance credibility include triangulation of data and the use of 'member' checks[47] (Lincoln and Guba 1985; Hoepfl 1997). Triangulation uses multiple data sources, methods, observations, and/or theoretical perspectives to achieve or demonstrate credibility.

Transferability is similar to external validity in quantitative studies and refers to the extent that research findings can be transferred to other contexts or settings. Lincoln and Guba (1985) maintain that the researcher cannot specify the transferability of the findings. However, by describing the research context and clearly stating key assumptions, the researcher can provide sufficient information to the person who wishes to transfer the findings to a different context. The person conveying the results is responsible for making the judgment of how sensible the transfer is. Schofield (2002: 185) notes transferability can be increased if numerous heterogeneous sites are studied, although she cautions that there is "typically a trade-off to be made between the increased potential for generalizability flowing from studying a large number of sites and the increased depth and breadth of description and understanding made possible by a focus on a small number of sites."[48] In fact, Onwuegbuzie and Leech (2007) advise that only when relatively large representative samples are utilized should qualitative researchers attempt to generalize findings across populations, locations, settings, contexts, and/or times.

[47] Member checks involve opportunities for people with a specific interest in the research to comment on the interpretations made (Thomas 2006; Schwandt, Lincoln, and Guba 2007).

[48] Yin (2009) notes that while research including multiple case studies or 'sites' is becoming more prevalent, it is often expensive and time-consuming to conduct.

Dependability refers to the replicability and consistency of research findings. Dependability means that (1) different researchers reach similar interpretations, (2) repeated examinations yield similar observations, and/or (3) multiple researchers produce similar interpretations of the same data (Franklin, Cody, and Ballan 2010). Marshall and Rossman (2010: 253) contend that "…the social world is always being constructed and the concept of replication is itself problematic." This reality does not negate the need for a researcher to accurately document the ever-changing context within which the research occurs and how this affects the way in which the research is conducted (Mackey and Gass 2005). The idea of dependability in qualitative research "recognizes that the research context is evolving and that it cannot be completely understood a priori as a singular moment in time" (Given 2008: 207). Rather than focusing on the ability of others to replicate results, the intent is to have others concur that the results are sensible and consistent with the collected data (Merriam 2009). However, Given (2008: 208) cautions that a research structure that cannot be replicated "will have limited impact beyond the context of the study".

Confirmability refers to the degree to which the researcher can demonstrate the neutrality of the research interpretations and minimize the effects of researcher bias, motivation, or interest. Well documented data collection and analysis procedures and peer review provide an "audit trail" that can help establish confirmability and dependability.

These four criteria of trustworthiness relate to methodological dimensions.[49] However, many factors can influence them (Onwuegbuzie and Leech 2007). The knowledge, skills, and perspectives of the researcher play a crucial role in determining the degree to which the research attains rigour (Morse et al. 2002). Some of the tactics to ensure the rigour and trustworthiness in qualitative study are outlined in Table 4.3. Many of these tactics address more than one quality criterion. Morse et al. (2002: 10) argue that these methods do not ensure rigour and that "research is only as good as the investigator." They suggest that qualitative researchers have done themselves a disservice in two ways: (1) using criteria and terminology not used in mainsteam science, and (2) focusing on evaluating qualitative research rather than ensuring rigour in qualitative research design. They recommend five verification strategies to ensure reliability and validity: (1) methodological coherence

[49] Lincoln and Guba (1986) suggest that these parallel criteria are incomplete and cannot wholly address trustworthiness because (1) they refer only to methodology and ignore the influence of context, and (2) they are philosophically misaligned with the perspectives inherent in qualitative research. To address this concern, they present an alternate set of "authenticity criteria" to address trustworthiness that support assumptions about interpretations as socially constructed undertakings. These criteria include fairness (a balanced view that presents all constructions and the values that undergird them), ontological authentication (improvement in the individual's (and group's) conscious experiencing of the world), educative authentication (increased understanding of the whats and whys of various expressed constructions), and catalytic authentication (facilitation and stimulation of action).

(the research questions match the research methods), (2) appropriate sample size, (3) concurrent data collection and analysis to facilitate mutual interaction between what is known and what one needs to know, (4) thinking theoretically/conceptually by building new ideas based on an iterative process of data confirmation and reconfirmation, and (5) theory development, moving between a micro perspective of the data and a macro theoretical/conceptual understanding. Morse et al (2002) call for a refocused agenda on ensuring rigour in the research process and placing responsibility for addressing reliability and validity issues with the researcher rather than concentrating on tactics to establish trustworthiness through external evaluation at the end of a study.

Table 4.3. Strategies to Improve Trustworthiness

Quality Criterion	Possible Provision Made by Researcher
Credibility	Adoption of appropriate, well recognized research methods
	Prolonged engagement
	Development of early familiarity with culture of participating organizations to establish authority of researcher
	Appropriate sampling of individuals serving as informants (e.g., random or purposive)
	Triangulation using different methods, different types of informants and different sites
	Interview techniques and tactics to help ensure honesty in informants
	Iterative questioning in data collection dialogues
	Negative case analysis (refining an analysis until it can explain or account for all or a majority of cases)
	Peer debriefing
	Peer scrutiny of project
	Reflexivity (use of 'reflective commentary' to identify and acknowledge how personal values and experiences shape the research)
	Description of background, qualifications and experience of researcher
	Weighting of evidence (putting more weight on 'quality' data)
	Informant feedback; member checks of data collected and interpretations/theories formed
	Thick description of phenomenon under scrutiny
	Examination of previous research and documentation to frame findings
Transferability	Provision of background data to establish context of study and detailed description of phenomenon in question to allow comparisons to be made
Dependability	Employment of 'overlapping or multiple methods'
	In-depth methodological description to allow study to be repeated
	Code-recode procedures; data quantitization
Confirmability	Triangulation to reduce effect of investigator bias
	Admission of researcher's beliefs and assumptions
	Recognition of shortcomings in study's methods and their potential effects
	In-depth methodological description to allow integrity of research results to be scrutinized
	Use of diagrams to demonstrate 'audit trail'

Source: After Lincoln and Guba (1986); Krefting (1991); Shenton (2004); Onwegbuzie and Leech (2007).

Both qualitative and quantitative methods are subjective. Winchester (2000) notes that, "if the subjectivity and value-laden nature of all research methods is admitted, then the apparent gap between the two groups of methods is dramatically reduced." Rather than attempting to totally eliminate researcher bias, the "rule of thumb" for qualitative researchers is to declare possible sources of bias and subjectivity and acknowledge these may influence research design and outcomes (Winchester 2000; Merriam 2009).

While many writers have contributed to the "qualitative – quantitative" discourse, some acknowledge that the differences between the two approaches are falsely dichotomous (Crotty 1998; Winchester 2000; Denscombe 2008; Merriam 2009). Denscombe (2008: 273) notes that distinction between the two approaches "hardly does justice to the variety of epistemological and ontological assumptions that underpin the terms." Winchester (2000: 18, 20) asserts that much of the qualitative work undertaken in human geography cannot be categorized into schools of thought but "is concerned with the broad questions of elucidating human environments and human experiences within a variety of conceptual frameworks" and that "qualitative methods have very frequently been used in conjunction with other methods." Hence, in the conduct of research, a mixed methods approach is increasingly used and appropriate. If qualitative and quantitative methods are seen as representing different ends on a continuum, according to Creswell (2009: 3) "mixed methods research resides in the middle of the continuum because it incorporates elements of both…"

Sometimes called pluralistic or multi-method research, the mixed methods approach is viewed as a 'third wave' or third research movement with its own worldview, vocabulary and techniques (Tashakkori and Teddlie 2003; Johnson, Onwuegbuzie, and Turner 2007; Denscombe 2008). Mixed methods research attempts to synthesize elements of qualitative and quantitative research and can be broadly defined as "research in which the investigator collects and analyzes data, integrates the findings, and draws inferences using both qualitative and quantitative approaches or methods in a single study or program of inquiry" (Tashakkori and Creswell 2007).

As the mixed methods approach evolves, it has been gradually accepted and applied by more researchers. The main defining characteristics of the mixed methods approach are as follows: (1) the use of quantitative and qualitative methods within the same research project, (2) a research design that clearly specifies the sequencing and priority given to the quantitative and qualitative data collection and analysis components, (3) an explicit account of how the quantitative and qualitative aspects of the research link to each other, emphasizing the manner in which triangulation is used, and (4) pragmatism as the philosophical underpinning for the research (Denscombe 2008).

Morgan (2007) contends that pragmatism complements the mixed methods approach. Pragmatism asserts that experiences or practical consequences are vital components of meaning and truth. This viewpoint is appealing in that it "offers an immediate and useful middle position philosophically and methodologically; it offers a practical and outcome-oriented method of inquiry that is based on actions and leads, iteratively to further action and the elimination of doubt; and it offers a method for selected methodological mixes that can help researchers better answer many of their research questions" (Johnson and Onwuegbuzie 2004: 17).

Morgan (2007) rejects the need to choose between qualitative and quantitative research methods. He offers the pragmatic approach, with its focus on choosing approaches geared towards understanding the research, as a practical means to acknowledge and connect these two approaches (Table 4.4). In fact, according to Creswell (2009: 10) "pragmatism is not committed to any one system of philosophy and reality. This applies to mixed methods research in that inquirers draw liberally from both quantitative and qualitative assumptions when they engage in their research."

Table 4.4. A Pragmatic Alternative to the Key Issues in Social Science Research Methodology

Purpose	Qualitative Approach	Quantitative Approach	Pragmatic Approach
Construction of theory and data	Induction	Deduction	Abduction
Relationship to research process	Subjectivity	Objectivity	Intersubjectivity
Inference from data	Context	Generality	Transferability

Source: Morgan (2007).

Using Morgan's typology, *abduction* refers to reasoning that moves back and forth between inductive and deductive approaches — first converting observations into theories and then assessing those theories through action. *Intersubjectivity* recognizes that research can be neither totally subjective nor objective and focuses on processes of communication and shared meaning. It represents a 'reflexive' orientation in response to issues of incommensurability (multiple world views) and treats them as key elements of social life. *Transferability* refers to the extent to which the knowledge gained can be transferred beyond the study context or generalizations to other settings. These three concepts provide an attractive and compelling rationale for the design of an overall research approach.

Some researchers claim that using mixed methods allows them to improve the validity, interpretability, and scope of research through research design. In a study of 57 mixed-method

evaluation studies, Green et al. (1989) discovered five main purposes for using mixed method research. Those main purposes and their rationale are outlined in Table 4.5.

In mixed methods research, qualitative and quantitative methods can be blended using *sequential*, *concurrent*, or *transformative* processes. The *sequential* process uses one method to elaborate or expand on the findings of the other method. The *concurrent* process denotes the collection of both quantitative and qualitative data at the same time to provide a more comprehensive analysis of the research problem. The *transformative* procedure uses a theoretical or conceptual lens as an overarching perspective within a design that contains both quantitative and qualitative data.

Table 4.5. Research Designs for Mixed Method Research

Purpose	Rationale
Triangulation seeks convergence, corroboration, correspondence of results from different methods.	To increase the validity of constructs and inquiry results by counteracting or maximizing the heterogeneity or irrelevant sources or variance attributable especially to inherent method bias but also to inquirer bias, bias of substantive theory, biases of inquiry context.
Complementarity seeks elaboration, enhancement, illustration, clarification of the results from one method with the results from the other method.	To increase the interpretability, meaningfulness, and validity of construct and inquiry results by both capitalizing on inherent method strengths and counteracting inherent biases in methods and other sources.
Development seeks to use the results from one method, where development is broadly construed to include sampling and implementation, as well as measured decisions.	To increase the validity of construct and inquiry results by capitalizing on inherent method strengths.
Initiation seeks the discovery of paradox and contradiction, new perspectives of frameworks, the recasting of questions or results from one method with questions or results from the other method.	To increase the breadth and depth of inquiry results and interpretations by analyzing them from the different perspectives of different methods and paradigms.
Expansion seeks to extend the breadth and range of inquiry by using different methods for different inquiry components.	To increase the scope of inquiry by selecting the methods most appropriate for multiple inquiry components.

Source: Greene et al (1989).

These processes can be triangulated or nested. Triangulation refers to the designed use of multiple methods with offsetting or counteracting biases to strengthen the validity of study findings of the same phenomena (Greene, Caracelli, and Graham 1989). Triangulation uses both quantitative and qualitative methods to confirm, cross validate, or corroborate findings within a single study. Qualitative and quantitative methods can carry equal weight or one method can predominate. One

example of a research design where one method predominates is the nested approach which embeds one method within the context of the other.

4.3 Research Design

The research design provides a study framework for focusing on research questions and goals, determining the best way to achieve them, and exercising maximum control over factors that could hinder the validity of the research results (Babbie 2010).

The choice of research methodology, study design, and methods[50] ultimately depends on four considerations. First, a researcher's theoretical perspective, world views, values, beliefs and skills will guide the choice of research methods (Olson 1995; Creswell 2009). A summary of the four major research paradigms[51] which underpin much contemporary research is provided in Table 4.6. Second, the nature and scope of the research questions often dictate how the research should be carried out (Creswell 2009). To address appropriately a range of research questions, the researcher may craft a study design and methods drawn from all four research paradigms[52]. Third, logistics (time and funds) may prescribe the scope of the research and methods used. Fourth, the intended audience and its experiences may shape the researcher's choice (Creswell 2009). Moreover, there is no explicit framework to guide research design. Denzin and Lincoln (2008: 27-28) contend that "researchers have never before had so many paradigms, strategies of inquiry and methods of analysis to draw upon and utilize."

Given this background, I chose a mixed methods approach for several reasons. First, to understand the geographic, political, and administrative context and basis for watershed management in Canada, a descriptive analysis of watershed organizations engaged in creating watershed report cards or state of the watershed reports across various watershed scales and governance structures is required. Second, to identify the nature and extent of the socio-economic and political forces that shape watershed management, day-to-day experiences and observations from practitioners are important. Third, to ascertain connections among sustainability reports at the community, regional,

[50] Methodology differs from methods. Methodology refers to the means by which a researcher gains knowledge about the world. Methods are the procedures and tools used to gather, synthesize and analyze information. The methods chosen should complement the supporting methodology (Denzin and Lincoln 2008).

[51] Thomas Kuhn (1970) popularized the term "paradigm" in 1962 as a way to summarize researchers' beliefs about their efforts to create knowledge but used the term very broadly. Morgan (2007) identifies four basic versions of the paradigm concept: (1) paradigms as worldviews, (2) paradigms as epistemological stances, (3) paradigms as examples, and (4) paradigms as shared beliefs in a research field. Johnson et al. (2007) use the term to denote what it means to conduct research and how it is undertaken (i.e., methodological paradigm). This is the context within which I use the term.

[52] Johnson et al. (2007) emphasize that the dividing lines among paradigms are much fuzzier than typically suggested in the literature.

and watershed levels and to find out the relevance and value of watershed report cards to other groups and agencies, the input of a broad range of personal perspectives obtained through qualitative methods is essential. Fourth, a quantitative analysis of report cards to identify their characteristics (e.g., methodologies, indicator types and foci, ranking rationale) is needed in order to connect these traits with user application and perceived effectiveness. Fifth, a range of research methods and data sources is advantageous to validate and confirm research findings. The breadth and depth of information gained using a mixed methods approach are valuable for identifying and explaining links and gaps between normative theories and the practice of contemporary watershed management and therefore, essential for addressing my research questions.

Table 4.6. Alternative Research Paradigms

Postpostivisim	Constructivism
• Determination • Reductionism • Empirical observation and measurement • Theory verification	• Understanding • Multiple participant meanings • Social and historical construction • Theory generation
Advocacy / Participatory	**Pragmatism**
• Political • Empowerment issue-oriented • Collaborative • Change-oriented	• Consequences of actions • Problem-centred • Pluralistic • Real-world practice oriented

Source: Cresswell (2009: 6).

Based on the focus of my research and the need for both qualitative and quantitative data, I chose a concurrent nested triangulation approach for my research design because it allows for qualitative and quantitative data to be collected simultaneously from different sources. Since the primary goals of my research are to describe, understand, and infer meaning, the predominant epistemological perspective which underpins my research is interpretivism/constructivism, typically associated with the qualitative research paradigm. Accordingly, my research design nests the quantitative method within the qualitative method. This approach, also known as qualitative dominant mixed methods research is defined as, "the type of mixed research in which one relies on a qualitative, constructivist-poststructuralist-critical view of the research process, while concurrently recognizing that the addition of quantitative data and approaches are likely to benefit most research projects" (Johnson, Onwuegbuzie, and Turner 2007: 124).

The qualitative orientation to my research design broadens the breadth and depth of my research for two primary reasons. First, a statistical analysis of the characteristics and contents of watershed report cards would limit my study to a listing of contents and traits and reduce the richness and depth of my inquiry. However, when combined with qualitative data and analysis, it provides an important basis from which to better understand peoples' interpretations and perceptions. Second, an overarching qualitative orientation allows me to discover contextual variations among watershed organizations. I believe that context plays an essential role in shaping opinions. Each watershed has a unique mix of contextual factors which influences how watershed planning, management, and reporting are done. Qualitative research to investigate how these factors intersect and sway outcomes is required to address my specific research questions.

4.4 Methods

To frame the study, I chose a case study design. Yin (2009: 18) defines a case study as "an empirical inquiry that investigates a contemporary phenomenon in depth within its real-life context, especially when the boundaries between phenomena and context are not clearly evident." Other technical characteristics including data collection and analysis strategies form a second part of Yin's definition because phenomenon and context are not always distinguishable. Since there will be many more variables than data points, the use of multiple sources of data which converge in a triangulating fashion and theoretical propositions to guide data collection and analysis also is essential.

Case studies can be *exploratory*, *descriptive*, and/or *explanatory*. An *exploratory* case study is used to gather information to gain an understanding of an under-researched problem or context. A *descriptive* case study is used to describe a problem, context or situation. An *explanatory* case study focuses on identifying and explaining a causal relationship among phenomena (Yin 2009). According to Yin (2009), the use of case studies depends on the research questions being posed. The case study approach is best applied when research addresses descriptive (what happened?) or explanatory (how or why did something happen?) facets and aims to produce a firsthand understanding of people and events (Yin 2006). Case studies can also be single or multiple. These designs can be based on a single unit of analysis or multiple units of analysis as shown in Table 4.7.

Table 4.7. Case Study Design Choices

	Single-case designs	Multiple-case designs
Holistic (single unit of analysis)	Type 1	Type 3
Embedded (multiple units of analysis)	Type 2	Type 4

Source: Yin (2009).

When case studies are multiple, they can also be predictive through the use of careful replication procedures. Yin (2009: 54) indicates that multiple case studies can either predict similar results across a population (a literal replication) or predict contrasting results but for anticipated reasons (theoretical replication), creating a "rich, theoretical framework." In the case of the former, it is possible to state conditions under which a particular phenomenon is likely to occur, where in case of the latter, it is possible to state when conditions are not likely to occur.

An embedded study may include the investigation of main and smaller units on different levels such as program, projects, and activities (Yin 2009). Grünbaum (2007) asserts that the term 'embedded' is ambiguous and inconsistently used in the literature. He demonstrates that many writers use the term interchangeably with 'case study' and posits an alternative conceptual approach where the 'case' is separated into layers that surround the unit of analysis. The unit of analysis is on a lower abstraction level than the case layers and consists of specific information required to illuminate the research questions. Thus, the study purpose plays a critical role in determining the unit of analysis and how it can be understood. Conversely, the unit of analysis is linked closely with the knowledge provided by key informants and tied to study protocol and purpose.

Based on this review of case study design, I selected a comparative multiple or collective case study design consisting of multiple embedded cases[53] (Type 4) for the following reasons: (1) representativeness of available case studies can be attained since there are a limited number of cases to choose from, (2) the inclusion of several case studies is appropriate to address my research questions, (3) the study focus cannot be separated from the overall context, (4) the study approach allows for a holistic view of the subject, (5) the study context cannot be controlled, (6) both comparative and longitudinal studies are viable options, (7) literal and theoretical replication are feasible, and (8) sufficient evidence can be acquired to contribute to theory development (generalizability).

4.4.1 Selection of Case Studies

I based my selection of watershed organizations in Canada on criteria that provide opportunity to secure meaningful insights into the key research questions. Criteria for selecting prospective watershed organizations for study are outlined in Table 4.8.

Three essential criteria for choosing candidate watershed organizations were identified. First, only those watershed organizations that have prepared at least one watershed report card (or a state of the watershed report incorporating indicators or an 'indicator' report) were considered as candidate

[53] Grübaum (2007) calls this approach a second-level summation design.

case studies. Second, only those agencies for which there was a realistic expectation of cooperation were pursued.[54] Third, preference was given to watershed organizations that have existed for at least 10 years – long enough for a process for watershed planning, management, and reporting to be established (Innes and Booher 2000).

Table 4.8. Selection Criteria for Case Study Watershed Organizations in Canada

Criteria for Selecting Case Studies
The organization is watershed-based or a member of an umbrella watershed organization.
The watershed organization has been established for at least 10 years.
Partnerships are part of the watershed governance model.
A watershed plan or strategic plan has been completed.
At least one report card / state of the watershed (with indicators) / indicator report has been completed.
At least one organization from provinces that have a provincial watershed strategy or water policy administered by watershed organizations.
More than one progress report has been completed.
The vision and / or mission statement of the watershed organization reflects sustainability principles (either explicitly or implicitly; in whole or in part).
There is a realistic expectation of agency cooperation.
The selected watershed organizations represent watersheds of different sizes, locations and governance structures.[a]
The selection of watershed organizations represents watersheds geographically distributed across Canada.

[a] This approach provides for maximum variation sampling to reveal any differences among watershed organizations in response to varying geographic, social, and political contexts and to ascertain any common patterns that span these variations (Bradshaw and Stratford 2000). It also offers a representative range of case studies within a diverse spectrum rather than 'all' possible case studies.

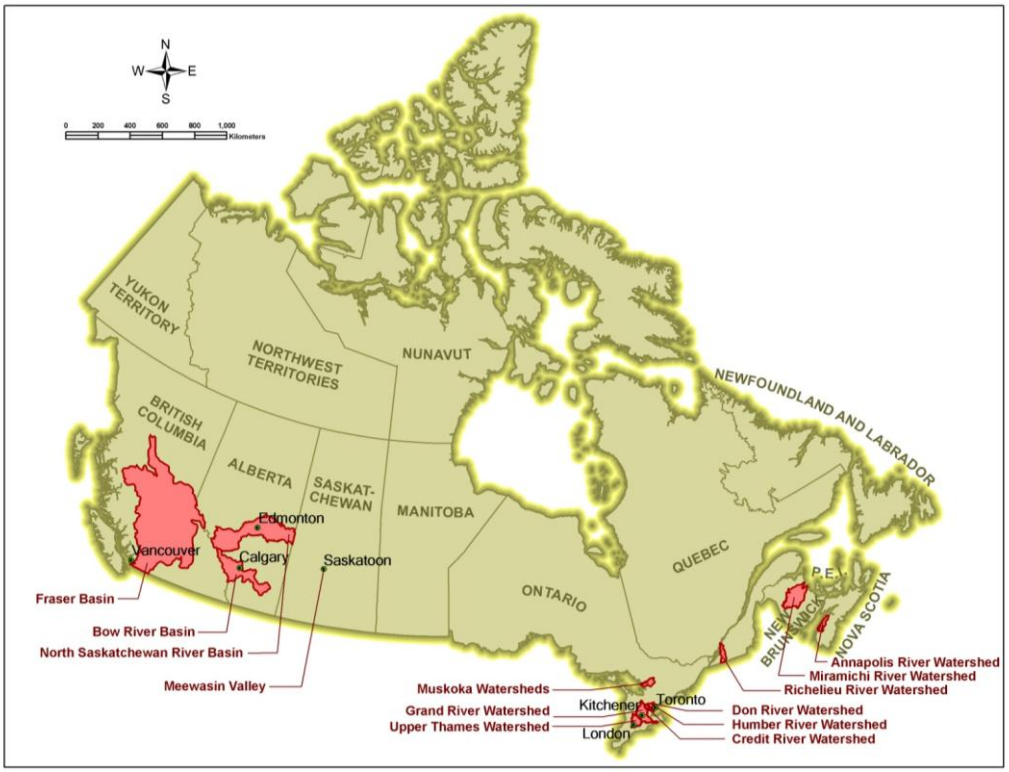
The requirement to have a least one case study from each province that has a provincial watershed strategy or water policy administered through watershed organizations was problematic in Québec and Manitoba. In Québec, two issues surfaced. First, while there are 33 watersheds that have been identified as administrative units for the implementation of the provincial water policy, only a limited number have been established for longer than five years. Second, finding a willing watershed organization from the limited number of samples, which fulfilled the selection criteria and who had staff members conversant in English was a challenge. In Manitoba, the provincial government is committed to delivering IWM through its Department of Water Stewardship (Manitoba Water Stewardship). With assistance from the 18 conservation districts, watershed management plans and watershed report cards are in progress, but none have been produced as yet.

[54] The importance of selecting case studies based on access and practicality is emphasized by Bradshaw and Stratford (2000) and Yin (2009).

The final screening resulted in identification of eleven candidate watershed organizations: Fraser Basin Council (FBC) in British Columbia; North Saskatchewan Watershed Alliance (NSWA) and Bow River Basin Council (BRBC) in Alberta; Meewasin Valley Authority (MVA) in Saskatchewan; Muskoka Watershed Council (MWC), Grand River Conservation Authority (GRCA), Credit Valley Conservation Authority (CVC), Humber Watershed Alliance (HWA), and Don Watershed Regeneration Council (DWRC) in Ontario; Miramichi River Environmental Assessment Committee (MREAC) in New Brunswick; and, Clean Annapolis River Project (CARP) in Nova Scotia.

An opportunity to include two additional watershed organizations arose, subsequent to the commencement of the research. These were the Upper Thames River Conservation Authority (UTRCA) in Ontario and Comité de concertation et de valorisation du bassin de la rivière Richelieu (COVABAR) in Québec, bringing the total case studies to 13.[55] The location and geographic area of interest for each case-study watershed organization is shown in Figure 4.2 and is described in more detail in Chapter 6.

Figure 4.2. Location and Geographic Area of Interest of 13 Case-Study Watershed Organizations



[55] I had the advantage of obtaining widespread cooperation for participation in my study because of my long association with an internationally respected watershed organization in Canada (GRCA) and because I was professionally or personally acquainted with key individuals within candidate organizations. I believe that these connections were instrumental helping me obtain candid opinions from participants which may not have otherwise been offered to other researchers.

In addition, two in-depth case studies were selected from the above suite of 13 case studies. The in-depth case studies were the Fraser Basin Council (FBC) in British Columbia and the Humber Watershed Alliance (HWA) in Ontario. These watershed organizations were chosen for four principal reasons. First, both watershed organizations have produced multiple, successive watershed report cards which include a range of measures to gauge the condition and progress of social, economic, and environmental indicators. Second, both the FBC and the HWA specifically cite sustainability as a chief motivation for reporting. Third, the cities of Vancouver and Toronto lie within the two watersheds, providing unique opportunities to explore the relationships among urban, regional, and watershed planning processes and the approaches and measures used to report on sustainability. Fourth, the addition of two in-depth studies provides an additional richness of data and increases the depth and breadth of description and understanding of the phenomena being researched.

4.4.2 Data Sources

Data were collected from written documentation available directly from case-study watershed organizations or from their respective websites, secondary sources of information, and interviews/questionnaires conducted with key informants. Information was extracted specifically from:

- Watershed report cards, state of the watershed or valley reports, other 'indicator reports', watershed plans, and associated background reports;
- Other documents including annual reports, meeting minutes, newsletters, planning documents and reports, and correspondence;
- Secondary sources of information such as government policy statements and planning documents, journal articles, newspaper articles, and other media coverage;
- Semi-structured interviews with, and questionnaires[56] completed by, key informants in eleven watershed organizations; and
- Semi-structured interviews with, and questionnaires completed by, key informants from the two in-depth case studies.

The following sections detail the methods used for collecting and analyzing data.

4.4.3 Document Analysis

Prior to conducting interviews/questionnaires, detailed baseline information about the case-study watershed organizations was collected, including: (1) administrative and governance structures, (2) stated mandate, vision, mission, and objectives, (3) planning and management functions, and (4) programs and services. This information was obtained from agency documents available either in

[56] Interviews refer to face-to-face or telephone conversations undertaken by the researcher with informants while questionnaires refer to the set of standardized questions answered by informants with no interaction with the researcher (Winchester 2000).

digital or hard copy from the organization and from secondary sources of information such as journal articles and other agency websites (e.g., Canada Revenue Agency, Natural Resources Canada).

In addition to eliciting facts, this exercise provided useful insights about the geographic, administrative, social, and political milieu within which each watershed organization operates. This provided me with a preliminary impression of how watershed organizations across Canada define, practice, and measure sustainability in the context of watershed management.

4.4.4 Report Card Analysis

In order to identify watershed report card characteristics among the 13 case studies, an in-depth examination and analysis of each report card generated by respective watershed organizations was done.[57] A total of 39 reports was reviewed and analyzed.

To identify the similarities and differences among successive watershed report cards produced by a watershed organization and among watershed report cards generated by all watershed organizations included in this study, each report card was examined and categorized according to a broad array of characteristics. These traits, outlined in more detail in Appendix B.1, relate to specific aspects associated with (1) general report card attributes, (2) themes, indicators, and measures, (3) ratings, trends, and targets, (4) data sources, (5) previous reports, and (6) implementation of actions. The report card analysis was undertaken simultaneously with an analysis of interview and questionnaire results.

4.4.5 Interview and Questionnaire Analysis

To confirm and supplement the insights from my review of watershed report cards and other documents and to collect and compare motivations, opinions, and experiences, I chose to conduct semi-structured interviews and structured questionnaires with key informants in all case-study watersheds (Appendix A.1).[58] The overall approach and proposed questions were reviewed and approved by the Office of Research Ethics at the University of Waterloo prior to conducting the interviews/questionnaires.

Initial contact with the chief of staff of prospective watershed organizations was initiated in person or by telephone. If interest was shown, email correspondence was sent explaining the purpose

[57] Watershed report cards refer to watershed report cards, state of the watershed reports and other 'indicator' reports that incorporate indicators and assessments of watershed conditions and/or trends. In the case of the Meewasin Valley Authority, the state of the valley report was included in the analysis.

[58] Purposive sampling techniques, such as the one I used, are primarily used in qualitative research where "particular settings, persons, or events are deliberately selected for the important information they can provide that cannot be gotten as well from other choices" (Maxwell 2008: 235). This sampling technique is appropriate where sampling is done to achieve representativeness or comparability (Teddlie and Yu 2007).

of the study with the interview questions and a consent form attached, followed by a telephone call to confirm interest in participating in the study. Face-to-face or telephone interviews were preferred because a responsive format allowed me to interact with informants and tailor the sequence and wording of the questions to elicit a thorough response and to clarify comments from them. However, I recognized that not all informants would be available for interviews and therefore, gave them a choice regarding how they wanted to respond to the interview questions (e.g., face-to-face interview, telephone interview, or written response).

Given time and budget constraints, I decided to conduct two series of interviews/questionnaires. The first series was limited to the chief of staff or senior manager for the selected watershed organizations, staff members involved in developing the watershed report card, and the chair and/or a past chair of the Board of Directors.[59] The purpose was to (1) confirm the principles, goals, objectives, and approach currently in effect to guide watershed planning and management, (2) identify the methodologies and processes used to develop the watershed report card/state of the watershed report and to solicit opinions regarding opportunities and limitations relative to indicator selection and report publication, and (3) determine the nature and extent of the perceived influence of report cards on plans, policies, programs, and projects of the watershed organization, associated partners and others.

According to Dunn (2000), several primary question types can be used to draw out a mix of responses. *Descriptive* questions refer to details on events, places, people, and experiences. They are easy-to-answer questions which are useful for initiating interviews because they are factual, non-threatening, and non-judgmental. *Storytelling* questions are open-ended and help the researcher to identify a series of players or an ordering of events or causative links. *Opinion-based* questions encourage the informant to express impressions, feelings, assertions, and guesses. *Structural* questions tap into an individual's ideology and assumptions and encourage reflection on how events and experience may have influenced opinions and perspectives. To elicit a broad range of responses, I used a combination of descriptive, storytelling, opinion, and structural questions. Each interview/questionnaire was designed to start with a few easy questions about the individual's professional and educational backgrounds. This allowed me to develop a rapport with interviewees and create informant profiles.

[59] The Board of Directors for the North Saskatchewan Watershed Alliance, Comité de concertation et de valorisation du bassin de la rivière Richelieu, and Clean Annapolis River Project refer to the head of the Board of Directors as the president, rather than chair.

Almost 80 questions were directed to the chief of staff (e.g., executive director or chief administrative officer) or senior manager (e.g., director or watershed specialist). These questions are included in Appendix A.2. To reduce the effort required to answer the questions and to facilitate responses, I completed the answers to descriptive or factual questions based on my review of the available documentation to facilitate replies. The questions and my responses were then circulated to informants who were asked to confirm the accuracy of the answers provided and to supply answers for the remainder of the questions during the interview or when completing the questionnaire. While the chief of staff was encouraged to confer with colleagues to answer descriptive or factual questions, I requested that responses to opinion questions be derived independently.

Staff members, involved in developing the watershed report cards, were asked to respond to a subset of questions posed to the chief of staff. Questions to staff focused on the impetus for and methods used in developing, formatting, and distributing the watershed report cards, how watershed report cards are used, and how they can be improved (Appendix A.3).

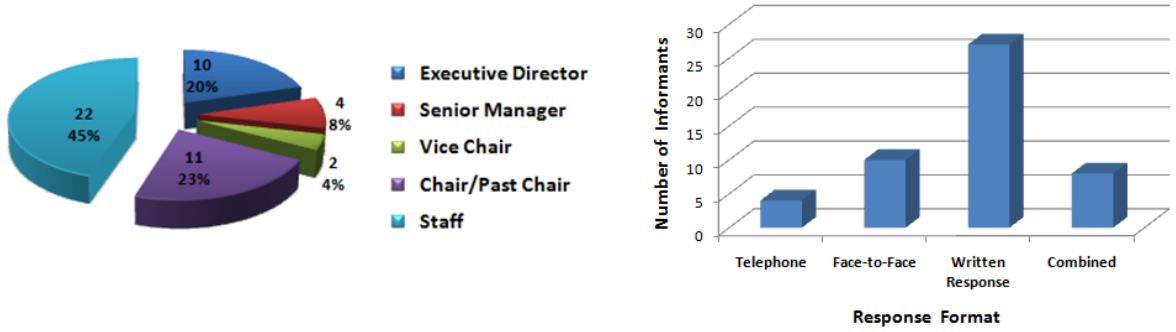
The questions put forward to the chair, past chair, or vice chair of the Board of Directors were also a subset of the questions posed to the chief of staff. However, unlike the questions addressed to the staff members, these informants were asked to respond to a series of queries focused on the vision, mission, and decision-making processes of the watershed organization and their views about the usefulness and effectiveness of the watershed report cards (Appendix A.4).

Prior to soliciting and obtaining responses, the intent, design, and specific questions included in the questionnaire were discussed with senior officials at the FBC in June 2008. Some questions were modified to suit the individual circumstances of respective watershed organizations (e.g., references to the appropriate documents and watershed planning, management, and reporting processes). In the case of the Grand River watershed, a series of questions specific to the reasons why a formal watershed report card had not been produced and designed to encourage insights about preferred approaches for enhancing future watershed reporting were added. The first series of interviews/questionnaires started in July 2008 and were conducted specifically with the chief of staff and senior staff of each case-study watershed organization and were completed in July 2009.

Forty-nine interviews/questionnaires were completed with senior staff and officials from the 13 case-study watershed organizations from across Canada. The breakdown of informants by affiliation and response format is shown in Figure 4.3. In order to clarify, confirm, or gather further information about the answers provided by informants, I relied on a combination of response formats (e.g., a

written response followed by a telephone interview or a face-to-face interview supplemented by a subsequent telephone interview) or a follow-up interview.

Figure 4.3. Breakdown of Informants by Position and Response Format



To further explore the influence of watershed report cards on decision making, a second series of interviews/questionnaires was conducted with a broader range of individuals in the Fraser River basin and the Humber River watershed. In addition to the chief of staff, staff members, and the chair/past chair/vice chair, a larger cross-section of directors/members was interviewed.

While face-to-face interviews with all directors or members of each watershed organization were preferred, I recognized that not all would be available or willing to be interviewed and some would not have served long enough to provide insightful comments. To ensure that the questions were appropriate, meaningful, and understandable, I conducted six pilot interviews with members of the HWA in September 2008. Questions that were deemed vague, unclear, redundant, or irrelevant were identified and adjustments to those questions were made for subsequent interviews and questionnaires.[60]

With 36 FBC directors and approximately 40 HWA members, I concluded that an attempt to interview all members was impractical. Instead, I selected potential informants to ensure geographic, sectoral, and political representation (including First Nations' representatives on the Fraser Basin Council). In addition, people who had been associated with the watershed organization for the development of at least one report card were approached for interviews. Board members identified as candidate informants were either recommended to me by the chief of staff or senior manager or I

[60] Dunn (2000) differentiates between interview guides and interview schedules. An interview guide is a list of general issues that a researcher wants to cover in an interview. An interview schedule is a list of carefully worded questions which are posed verbatim in the interview. For my research, I developed a list of questions which were used as an interview schedule during the face-to-face and telephone interviews. The structured questionnaire posed the same questions.

approached them directly with an interview request.[61] The questions presented to Board members were similar to those posed to the chair (Appendix A.5).

Interviews with key representatives from watershed municipalities and non-government organizations within the two in-depth case study watersheds were also sought (Appendix A.7). Potential interviewees were identified in several ways. First, staff members from the two watershed organizations suggested appropriate municipal staff to contact. Second, I identified individuals and organizations who participated in the report card process through a review of available documents. Third, several additional individuals thought to be appropriate candidates to interview were recommended by participants. To ascertain links with other community sustainability reporting processes, I also targeted key individuals at the Vancouver Foundation and the Toronto Community Foundation for interviews. Questions to these groups were specifically crafted to obtain insights into the methods used to develop the Vital Signs community report cards produced by these two foundations and to discover linkages, if any, between the community and watershed reporting processes (Appendix A.8).

In addition, since the Fraser River watershed represents almost one-quarter of the land area of British Columbia, contains over one-half of the total population of the province, and contributes about 80 per cent of the province's economic output, the Fraser Basin Council works closely with both provincial and federal agencies. For this reason, a further set of interviews was undertaken with representatives from both those levels of government. Potential interviewees were identified by Fraser Basin Council staff members and other informants (Appendix A.6). Where a broader range of perspectives was appropriate, I identified senior civil servants in relevant provincial and federal government agencies. These persons were contacted by telephone or email and invited to participate in the study, or alternatively, asked to recommend colleagues who could provide pertinent insights.

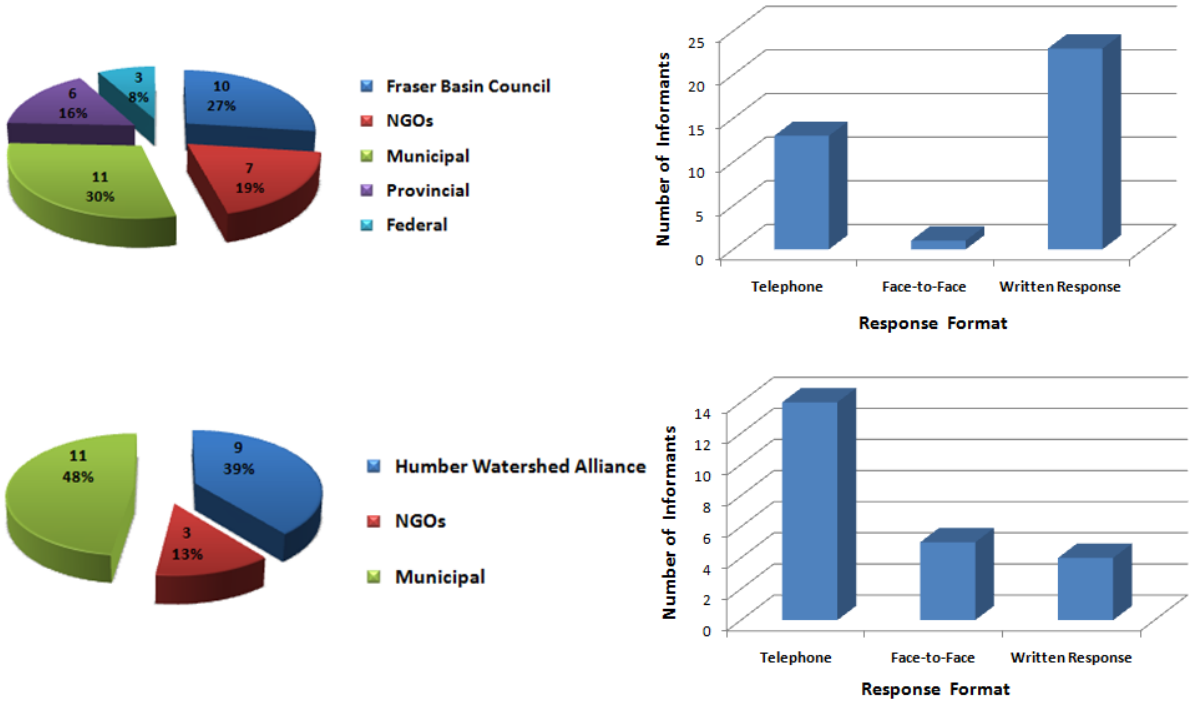
The purpose of interviewing people external to the watershed organization was to (1) determine the nature and extent of the influence of watershed report cards on decision making at local to watershed scales, (2) identify the nature and extent of relationships between and among watershed, regional, and urban planning and reporting processes, and (3) identify similarities, differences, and linkages (indicators and approaches) among report cards at the community, municipal, and watershed

[61] I attended a Fraser Basin Council Board Meeting in October 2008 in New Westminster, British Colombia and the 2009 State of the Fraser Basin Conference, "The Many Faces of Sustainability," held in Vancouver, British Columbia on February 19-20, 2009. These two events provided me with opportunities to approach various Board members to solicit their participation in this study. The Toronto and Region Conservation Authority assisted by directly contacting Humber Watershed Alliance members and scheduling face-to-face or telephone interviews with me.

levels. Interview questions were customized for representatives of municipalities and government agencies and non-governmental groups.

Logistical and timing considerations constrained the number of interviews possible. Thirty-seven people within the Fraser Basin and 23 people in the Humber River watershed participated in interviews or completed questionnaires between September 2008 and October 2009. I solicited input from more people in the Fraser Basin to ensure that I had representation from all sectors and sub-basins. I consider the number of interviews and questionnaires completed to be adequate to provide a representative cross section of informed perspectives and appropriate to facilitate comparative analysis. Figure 4.4 provides a breakdown of informants by affiliation and response format.

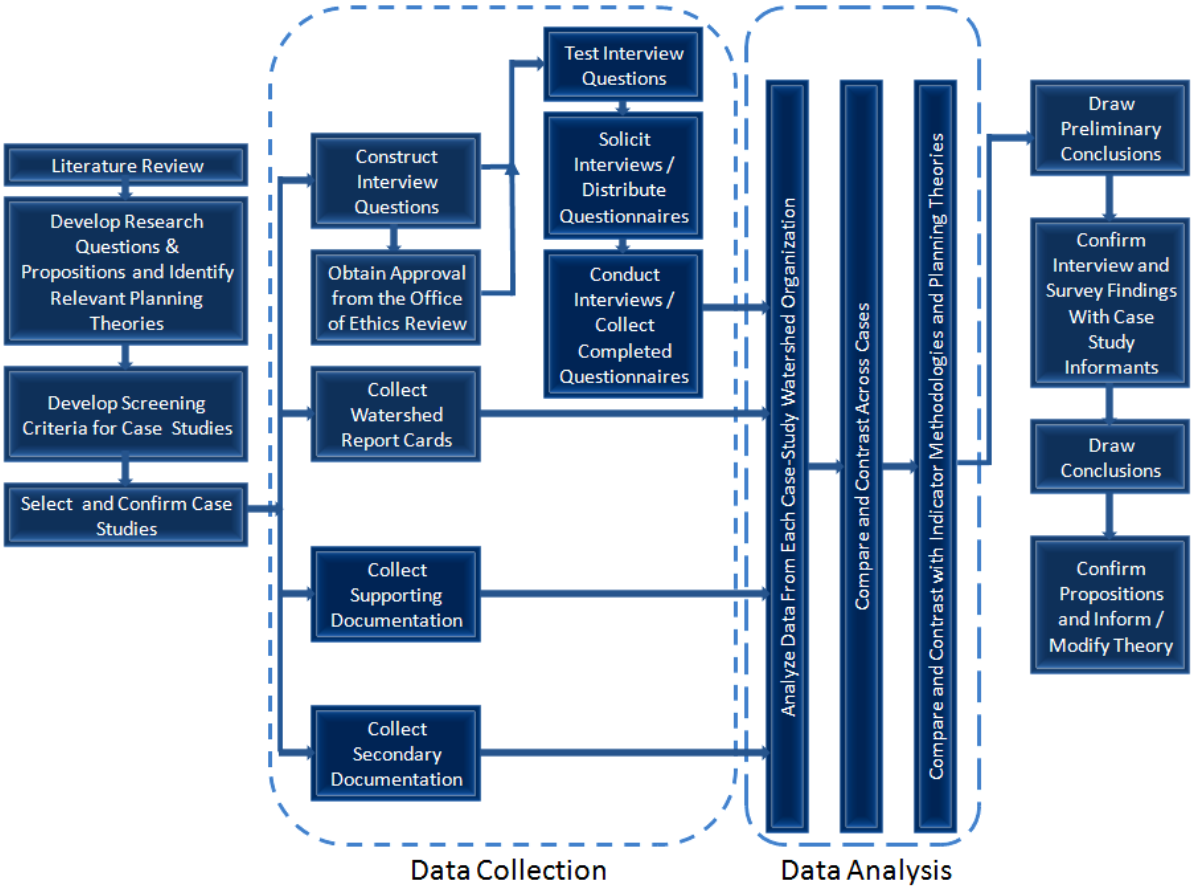
Figure 4.4. Breakdown of Fraser Basin and Humber River Watershed Informants by Affiliation and Response Format



A total of 55 interviews[62] were conducted and 54 questionnaires completed (n=109), after which I analyzed and coded the responses according to common themes and perspectives. The process of categorizing themes and perspectives was iterative. This technique was applied to ensure that the process of aggregation reflected the richness and diversity of the data collected and also retained the variety and integrity of opinions expressed by the informants. Figure 4.5 summarizes the research methods and sequence of research steps used for this study.

[62] This number includes eight structured questionnaire responses that were supplemented by face-to-face or telephone interviews.

Figure 4.5. Research Design



4.5 Strengths and Weaknesses of Chosen Methods

I believe that my choice of using a case study approach to address my research questions was appropriate to obtain details about context and complexity, but it was also extremely ambitious. The watersheds included in the study represented a broad range of watershed planning and management approaches in Canada at different geographic scales and within unique social, economic, and environmental contexts. While this suite of cases was deemed necessary and fitting, it precipitated several challenges. First, the number of case studies selected greatly increased the complexity of the research. Second, the time and effort required for data collection and analysis increased proportionately to the number of case studies chosen. I identified these issues early in the study and made a cautious but conscious decision to proceed, anticipating that the extra effort required would be offset by the richness of the data procured. In addition, my work was facilitated and supported by key individuals from the watershed organizations who were keen to participate in the research and believed they would benefit from the study outcomes.

Another set of challenges related to the amount of time it takes for watershed organizations to develop consistent measures for reporting change. A related issue is the length of time it takes for some changes to occur or be detected. Since the development of report cards to measure environmental, social, and/or economic change in watersheds is a relatively recent phenomenon in Canada, organizations are still 'muddling through' the process by re-evaluating approaches and data requirements, amending themes and measures, shifting reporting priorities, and adjusting reporting intervals. This added another level of complexity to the analysis of report cards. The analysis was further complicated because there is no standard template for developing watershed report cards and each watershed organization approaches the project differently, making comparison difficult.

There were also several unexpected peculiarities associated with undertaking the interviews. First, it took much longer than expected to contact potential interviewees and arrange either a face-to-face or telephone interview. In many instances, participants preferred to answer questions at their leisure and return a completed questionnaire to me. While most questionnaires were completed in a timely fashion, I needed to follow up with others on several occasions to remind them to respond. This process took time. Second, I discovered that although people were willing to complete a questionnaire, not all of the questions were answered, or the informant deferred to others who were participating in the study. This meant that my sample size varied, depending on what question was posed, to whom, and the response rate for that particular question. When an answer was deferred to another person, I assumed no response from the informant. Third, there were several informants who provided answers from more than one perspective because their role within the watershed organization had changed (e.g., former board member to staff member) or they had switched jobs (e.g., former staff member to NGO representative). For these interviews, I asked informants to match answers and perspectives. If the informant provided answers from more than one distinct perspective, I considered each set of answers as a separate interview.

Another interesting factor surfaced during the interviews. While many welcomed the opportunity to speak with me, they expressed unease with being recorded. I therefore opted to take notes rather than record the interviews. This manner of conducting the interviews turned out to be very informal and gave informants a lot of latitude in providing answers. When asked specific questions, people tended to offer more indirect, rambling answers and tell stories. This resulted in longer interviews. Furthermore, it was more difficult to accurately record and analyze comments using this style of interviewing, but this problem was offset because this tactic yielded many interesting and salient details that would not likely have surfaced otherwise. To ensure that the interviews were recorded as accurately as possible, I reviewed my notes and digitized them immediately following the interview.

Where clarification was needed, I arranged a follow-up conversation or asked for clarification of specific answers by email.

In addition, I had to contend with issues associated with researcher bias and intervention while administering face-to-face and telephone interviews for two reasons. First, some informants sought advice and insights from my experiences as a professional in the field of watershed management. Second, some interviewees were professional colleagues who were anxious to question me about preliminary research results. When confronted with questions related to my personal perspectives or research findings, I attempted to defer discussion until all of the interview questions had been answered.[63]

One specific issue relevant to the two in-depth case studies was the difficulty in finding willing participants from agencies and non-government organizations not directly associated or partnered with the case-study watershed organization. The reason most often cited by individuals for not participating in the study was because they were unfamiliar with the watershed report card (either because it was not accessed by their agency or because they were relatively new to their position and did not have the history or background to provide meaningful insights). Others who were willing to participate in the study, but who did not use the watershed report cards, were often unable to answer the full roster of questions.

Despite the challenges involved in data collection and analysis, the co-operation, support, and insights provided by participants gave me a wealth of information from a wide range of perspectives to draw on for answering my specific research questions. The results of my analysis are detailed in the subsequent chapters.

[63] Merriam (2009) points out that it is important for qualitative researchers to not only identify and monitor their personal biases or 'subjectivities' but to recognize how these qualities might shape the collection and interpretation of data.

Chapter 5: New Horizons for Watershed Management in Canada

5.1 Introduction

The legal, institutional, and administrative arrangements for managing land and water resources in Canada vary across provincial and territorial jurisdictions. These factors pervasively influence the practice of IWM. To understand the context in which watershed organizations operate, this chapter offers a general overview of the frameworks that guide IWM activities in Canada. Chapter 6 provides specific information about the case-study watershed organizations.

5.2 Setting the Stage for IWM in Canada

Canada consists of a federation of 10 provinces and 3 territories. Management of natural resources is complex and split between the federal and provincial governments. The Constitution Act (1867) defines the distribution of these responsibilities; however, neither water nor the environment is specifically mentioned (Côté 2004). While jurisdiction varies depending on specific issues or the defined area of responsibility, the main authorities for managing land and water resources are the provinces and territories (Muldoon and McClenaghan 2007; Morin and Cantin 2009).

The federal government can play a significant management role through its powers over coastal and inland fisheries, navigation, boundary and transboundary waters, and water on federal lands, in national parks, and on First Nations reserves. Parliament's authority to legislate for peace, order, and good government may be used to deal with environmental emergencies. It can also support national measures beyond the provinces' capabilities, such as the control of pollution (Veale 2004).

Shared federal-provincial responsibilities include agriculture, health, interprovincial water issues, and significant national water issues. The provinces have the primary responsibility for managing land and water resources (surface and groundwater) within their area of jurisdiction (Côté 2004). The Canada Water Act (Department of Justice Canada 1985) provides a framework for joint federal-provincial management of Canada's water resources. It underlies the consultative arrangements and co-operative agreements required to develop and implement plans for the management of water resources, such as the Great Lakes Water Quality and Canada-Ontario Agreements (International Joint Commission United States and Canada 1989; Environment Canada and the Ontario Ministry of the Environment 2007).

In 1988, the Canadian Environmental Protection Act (Department of Justice Canada 1999) was passed, providing for federal powers with respect to human, environmental, atmospheric, aquatic, and terrestrial health. The stated intent was to address pollution problems at the source, before they occur,

by applying such principles as integration, collaboration, pollution prevention, polluter pays, the ecosystem approach, the precautionary principle, among others. This legislation also recognized the role of science and traditional aboriginal knowledge in decision making and authorized the federal environment minister to enter into agreements with provincial governments in order to reduce duplication of efforts.

The Fisheries Act, (Department of Justice Canada 1985), one of the oldest federal statutes, first passed in 1868, provides for the conservation and protection of fish habitat, including provisions that prohibit the discharge of deleterious substances into waters that would harm fish. It is considered one of the strongest pieces of legislation to protect aquatic ecosystems (Langer, Hietkamp, and Farrell 2000).

Through specific cooperative arrangements, the federal government participates actively in watershed management throughout Canada. The Atlantic Coastal Action Program and the Canada-Ontario Agreement Respecting the Great Lakes Basin are two such programs.

The Atlantic Coastal Action Program operates in the Maritime Provinces, where federal technical and funding support is crucial to the viability of 16 incorporated, non-profit, community-based watershed management organizations. Launched in 1991 as part of the federal Green Plan, the program was initiated in response to the need to restore degraded or polluted coastal estuaries and to create a means of mobilizing local communities to address their local environmental and community development challenges. Since that time, the program has been transformed to incorporate community interests in watershed issues (Robinson 1997).

The Canada-Ontario Agreement (COA), a federal-provincial agreement, supports the restoration and protection of the Great Lakes basin ecosystem and contributes to meeting Canada's obligations under the Canada-United States Great Lakes Water Quality Agreement (GLWQA), first signed in 1972. The agreement outlines how the two governments will cooperate and coordinate their efforts. The COA, updated in 2007, commits both governments to "…the watershed approach to protecting the sources of drinking water in the Great Lakes Basin" and identifies impaired 'Areas of Concern' in the Great Lakes - St. Lawrence Basin. Remedial Action Plans (RAPs) are required to guide remediation in these areas (Environment Canada and the Ontario Ministry of the Environment 2007).

The federal government also participates in cooperative federal/provincial/territorial drainage basin boards created in large inter-provincial drainage basins to manage designated water issues. Examples include the Mackenzie River Basin Board and the Prairie Provinces Water Board.

The Mackenzie River Basin Board (MRBB) was created in 1997 to provide a forum for discussing water issues and exchanging information among First Nations, the federal government, and provincial/territorial governments having jurisdiction in the river basin. The primary goal of the MRBB is to maintain the ecological integrity of the river basin (Mackenzie River Basin Board 2006).

In 1948, the Prairie Provinces Water Board Agreement was signed by the federal government and three Prairie Provinces to ensure fair allocation of interprovincial water resources. In 1969, the agreement was updated to apportion water and to protect water quality and groundwater aquifers through a Master Agreement on Apportionment (MAA). Under the agreement, Alberta must ensure that 50 per cent of the water that originates in Alberta as natural flow is delivered to Saskatchewan. Saskatchewan, in turn, must ensure that it delivers 50 per cent of the water it receives from Alberta to Manitoba, along with 50 per cent of the natural flow that originates in Saskatchewan (Environment Canada 2004).

A commitment to monitoring and reporting underpins these cooperative arrangements and agreements, but not necessarily in the form of a watershed report card. ACAP organizations report regularly to the community through their individual websites, community events, state of the watershed reports, watershed report cards, and newsletters (Mcneil, Rousseau, and Hildebrand 2006). The State of the Lakes Ecosystem Conference (SOLEC) is hosted biennially by Environment Canada and the U.S. Environmental Protection Agency in response to a reporting requirement under the Great Lakes Water Quality Agreement. The State of the Great Lakes reports are discussed at the conference. The 2009 report assesses 62 indicators by 9 themes and 5 status categories (e.g., good, fair, poor, mixed, undetermined). It also denotes trends in each Great Lake (e.g., improving, unchanging, deteriorating, undetermined) (Governments of Canada and The United States of America 2009). In 2011, the reporting cycle will shift to every three years.

Under the terms of the Mackenzie River Basin Transboundary Water Master Agreement, the MRBB is required to submit a report on the state of the aquatic ecosystem every five years. In 2004, the MRBB released its first report which provides a mostly descriptive assessment of the state of the basin's six major sub-watersheds (Mackenzie River Basin Board 2004). The Prairie Provinces Water Board oversees the Master Agreement on Apportionment in partnership with the federal and provincial jurisdictions. For this purpose, Environment Canada monitors flow in 15 locations along the Alberta-Saskatchewan and Saskatchewan-Manitoba borders and accesses flow and meteorological data from 118 other stations maintained by Environment Canada, provincial governments, municipalities, and industries (Williamson 2010).

In 1987, following an extensive inquiry, a Federal Water Policy was developed to protect and enhance the quality of Canada's water resources and to promote the wise and efficient management and use of water. Five strategies based on water pricing, leadership in science, integrated planning, renewed and consolidated legislation, and public awareness were proposed (Environment Canada 1987). The federal government sanctioned an integrated approach to planning and development of water resources and stated, "increasingly, watersheds are becoming the preferred spatial unit for water resource planning. It is an approach that makes sense at any scale of planning…" (Environment Canada 1987: 7). At that time, the federal government, with very broad public support, was keen on playing a leading role in dealing with the big issues in water management – conservation, efficient use, environmental protection, and coordination across jurisdictions. A state of the environment reporting system to assess the extent and health of water resources in Canada was a key commitment.[64]

Although federally endorsed, the Federal Water Policy was not deemed to be a national water policy. de Loë (2008: 3) observes that, "momentum built up during the 1980s dissipated during the 1990s when water management ceased to be a major concern of governments across Canada." The federal dollars available for cooperative agreements declined sharply. Federal downsizing in 1995 led to a loss of staff and expertise in water management (Pearse 1998). In her 2001 Report on the Environment and Sustainable Development, Canada's Environmental Commissioner, Johanne Gélinas, stated that "the policy was set adrift because funds and specific departmental responsibilities were not allocated…Through the years, the government has lacked a consistent and clear strategy for updating the Federal Water Policy…The federal government needs to decide its priorities for fresh water and clarify its commitments to achieving them" (Commissioner of the Environment and Sustainable Development 2001: 99). Gélinas is not alone in her opinion. Similar sentiments have been expressed by Gordon Water Group of Concerned Scientists and Citizens (Morris et al. 2007), Canadian Water Resources Association (de Loë 2008), and Pollution Probe (2008).

Despite the lack of a national water focus, popular support for watershed management in Canada is growing, as evidenced by the number of watershed organizations and groups that have been established in the last 20 years (Soil and Water Conservation Society 2007). Since 2000, a resurgence of interest around water management and an ostensible commitment to IWM has

[64] In 2004, Environment Canada launched the Canadian Environmental Sustainability Indicators (CESI) initiative, in collaboration with Health Canada and Statistics Canada, to track Canada's performance on key environmental sustainability issues of concern including air quality, water quality, greenhouse gas emissions, and protected areas. This initiative was prompted by a recommendation made by Canada's Round Table on the Environment and the Economy (Environment Canada 2010).

occurred, in part, triggered by incidents of drinking water contamination in Ontario and Saskatchewan.[65] Many provincial and territorial water strategies containing statements that profile IWM have been launched, although some are narrowly scoped to address specific water issues (Province of Québec 2002; Manitoba Conservation 2003; North Saskatchewan Watershed Alliance 2005; Infrastructure Canada 2007; Prince Edward Island Department of Environment 2007; British Columbia Ministry of Environment 2008; Government of the Northwest Territories 2010). Table 5.1 provides an overview of key initiatives, associated principles, and management mechanisms supporting IWM in Canada.

5.3 Chapter Summary

Many of the broad goals underlying resource management strategies inaugurated in the past 10 years are similar. The acceptance of the watershed as a management unit and the protection of ecosystem and human health are pervasive themes. Stakeholder participation is another ubiquitous notion. Other accepted values include collaborative or co- management, shared funding, and scientific understanding. Contrasting approaches to IWM stem from the diversity and complexity of watershed issues, the confusing and disparate mix of institutional arrangements, and the unique socio-economic and biophysical factors in each province and territory. Governance modes vary from government agencies (e.g., Saskatchewan Watershed Authority) to quasi-governmental watershed entities (e.g., Ontario's conservation authorities), planning and advisory groups (e.g. Alberta's WPACs, Saskatchewan's Watershed Advisory Committees), and community-based, volunteer watershed groups.

The traditional top-down, single-purpose management approach adopted in the past has shifted towards a more collaborative, holistic, middle-ground approach. This mirrors the shifts in planning theory, away from strict synoptic rationality to communicative planning techniques that engage civil society and democratize decision making. It also generally reflects the concept of integrated watershed management embodied in the definitions put forward by the Global Water Partnership and the World Wildlife Foundation (Section 2.3, Chapter 2).

Chapter 6 describes the influence of these provincial strategies on watershed management in the 13 case-study watersheds and reviews the geographic context and institutional and administrative arrangements specific to each.

[65] In 2000, an *E. coli* outbreak associated with contaminated drinking water caused illness in over 2,500 people and claimed the lives of 7 people in Walkerton, Ontario (O'Connor 2002). The following year, between 5,800-7,100 people from the North Battleford area in Saskatchewan, not counting visitors, were sick after drinking water was contaminated with the *Cryptosporidium parvum* protozoan (Laing 2002).

Table 5.1. Legislative/Strategic Goals and Management Mechanisms for IWM in Canada

Province	Legislative / Strategic Goals
British Columbia	**Living Water Smart: British Columbia's Water Plan, 2008**
• Protect groundwater, ecosystems, ecological health and habitats; decommission dams • Ensure sufficient water for irrigating agricultural lands • Pursue water efficiency and water demand management; safe drinking water • Support to communities for watershed management in priority areas • Report on water use a required for large extractors	
Key Management Mechanisms: Watershed-Based Community Groups	
Alberta	**Water for Life, 2003 - Renewed 2008**
• Pursue water efficiency; water use/reuse; safe, secure drinking water; protect and enhance ecosystem health • Ensure water supply for a sustainable economy; retain rights for "first-in-time, first-in right" for existing water allocations, but allow transfers to support ecosystem needs • Undertake watershed management as a shared responsibility • Protect surface and groundwater quality while pursuing economic and community development • Participate in cooperative management to meet transboundary agreements with neighbouring jurisdictions. • Jointly manage water infrastructure for long-term sustainability • Use best available practices and market-based tools to maintain flexible and adaptive water management. • Integrate policies and plans, such as Land-Use Framework planning; improve knowledge for decision making	
Key Management Mechanisms: Alberta Water Council, 10 Watershed Planning and Advisory Committees (1 WPAC pending)	
Saskatchewan	**Water Management Framework, 1999**
• Renew and protect the health of aquatic and riparian ecosystems • Protect surface and groundwater quality; protect drinking water sources; ensure safe, reliable drinking water • Plan for multiple benefits; use innovative approaches for financing water infrastructure needs • Integrate agency mandates for water; manage water on a integrated, watershed basis • Promote sustainable water and related land use for economic diversity and stability; monitor and research • Plan developments in consideration of the potential effects of flood, drought and climate change • Enhance public awareness and participation in planning and decision making • Recognize the intrinsic and economic value of water and associated management costs.	
Key Management Mechanisms: Saskatchewan Watershed Authority, 19 Watershed Advisory Committees (Planning Team and Technical Committee support) formed in 2005 in six priority watersheds ***Monitoring Mechanism:*** State of the Watershed Reporting, 2007 and 2010	
Manitoba	**Water Strategy, 2003; Manitoba Conservation Districts, 1972**
• Protect/enhance aquatic ecosystems; conserve natural features to protect ecosystem benefits for future generations • Ensure adequate surface and groundwater quality for designated uses and ecosystem needs • Ensure long term sustainability of surface and groundwater – use and allocation • Manage water resources to meet priority needs and support economic development / environmental quality • Alleviate impacts caused by flooding; develop a comprehensive drainage plan to enhance economic viability	
Key Management Mechanisms: **Department of Water Stewardship, 18 Conservation Districts**	
Ontario	**Conservation Authorities Act, 1946 (CAA); Clean Water Act, 2006 (CWA)**
• Establish and undertake, in the area over which it has jurisdiction, a program designed to further the conservation, restoration, development and management of natural resources other than gas, oil, coal and minerals (CAA) • Protect existing and future drinking water sources within defined watersheds (CWA)	
Key Management Mechanisms**:** 36 Conservation Authorities, 19 Source Protection Authorities led by conservation authorities	

Table 5.1 (cont'd). Legislative/Strategic Goals and Management Mechanisms for IWM in Canada

Province	Legislative / Strategic Goals
Québec	**Water Policy, 2002**
• Recognize water as a collective heritage • Protect public health, water quality and aquatic ecosystems; promote water-related tourism activities • Clean up water and improve management of water services • Undertake integrated, sustainable, and coordinated watershed management; reform water governance	
Key Management Mechanisms: 33 Watershed Organizations	
New Brunswick	**Clean Water Act, 1989 – Water Classification Regulation, 2002; Watershed Protected Area Designation Order, 2001**
• Protect water quality; drinking water; involve stakeholders; manage water on a watershed basis	
Key Management Mechanisms: Watershed-Based Community Groups; Watershed Protected Area Designation Order applies to 30 watersheds	
Nova Scotia	**Drinking Water Strategy, 2002; Water Strategy (in progress)**
• Shift from self-motivated, single-purpose management decisions to an integrated framework for drinking water management on a broad watershed basis • Protect drinking water sources; ensure water systems are managed, optimized and upgraded, and monitored and tested to ensure secure and safe drinking water • Broaden drinking water strategy to a provincial-wide water strategy (announced as a 3-year process in 2007)	
Key Management Mechanisms: Watershed-Based Community Groups	
Newfoundland and Labrador	**Multi-barrier Strategic Action Plan, 2001**
• Protect public water supply areas through regulatory tools, operator training, monitoring and public reporting • Acknowledge watersheds as a management unit; stakeholder participation	
Key Management Mechanisms: 244 designated protected water supply areas; watershed monitoring committees	
Prince Edward Island	**Watershed Management Fund; A Guide to Watershed Planning on Prince Edward Island, 2007**
• Provide funding support to community-based watershed organizations for IWM and habitat enhancement • Foster the formation of community-based watershed organizations as incorporated entities with broad-based representation from stakeholders	
Key Management Mechanisms: 30 Watershed-Based Community Groups (as of April 2009)	
Northwest Territories	**Water Stewardship Strategy, 2010**
• Apply integrated watershed management and ecosystem-based management practices. • Apply concepts of water valuation and sustainability accounting. • Use decision-making processes that consider the effects of all past, present and future activities on the watershed and all interests in the water resource. • Base decisions that may affect water on the best available scientific, traditional and local knowledge.	
Key Management Mechanisms: Collaborative watershed management among The Government of the Northwest Territories (GNWT), Indian and Northern Affairs Canada (INAC) and Aboriginal Governments; Action Plan for implementation due in fall 2010.	
Canada's Territories	**Co-Management Agreements**
• Increase interaction among water partners. • Provide for shared management of aspects of integrated watershed management established under Land Claims Agreements with First Nations peoples	
Key Management Mechanisms: Water Boards	

Chapter 6: Case-Study Watershed Organizations: An Overview and Comparison

6.1 Introduction

This chapter provides an institutional and administrative overview and comparison of the 13 case-study watershed organizations, as well as a description of their geographic areas of interest. This synopsis is based on (1) written documentation produced by case-study watershed organizations, (2) secondary sources of information, and (3) facts provided by senior officials with each organization. Given the number of case studies included in this study, these descriptions are brief and emphasize key similarities and differences to provide a contextual basis for analysis.

6.2 Impetus for the Formation of Case-Study Watershed Organizations

The geographic context and institutional arrangements specific to individual watershed organizations selected for this study vary considerably. Nonetheless, all 13 case-study watershed organizations were formed when concerns respecting environmental degradation coalesced and spurred action on a watershed or river reach basis.

In Ontario, recognition of the need to adopt a province-wide, coordinated, and comprehensive watershed approach to deal with severe water issues including flooding, drought, and degraded water quality prompted the creation of the Conservation Authorities Act in 1946. This legislation was modeled after the Tennessee Valley Authority (TVA) and the Ohio Conservancy Districts in the United States. It provided a framework for municipalities voluntarily to establish watershed partnerships for managing land and water resources and created a governance model that has not been replicated in Canada or elsewhere.[66] The Act was based on six key principles:

- *Watershed as the Management Unit*: The best unit for coordinating natural resource conservation work was deemed to be the watershed.
- *Local Initiative*: If all watershed municipalities agreed to address resource problems jointly, the provincial government would establish a conservation authority having power to carry out conservation works.
- *Provincial-Municipal Partnership*: Once the conservation authority was established, the province would provide the authority with technical expertise and financial assistance based on a cost-sharing agreement.
- *Managing Resources for a Healthy Economy*: Tackling resource problems through conservation works (both structural and non-structural) was recognized as necessary to bolster the local economy.

[66] The conservation authority model has been recognized internationally as an exemplar for watershed governance. Both the Grand River Conservation Authority and the Lake Simcoe Region Conservation Authority have been awarded the prestigious International Thiess Riverprize for excellence in river management in Brisbane, Australia – the former in 2000 and the latter in 2009.

- *Comprehensive Approach*: Lessons from the TVA and Ohio Conservancy Districts demonstrated that land and water resources were closely connected and should be managed as a holistic system.
- *Cooperation and Coordination*: The new watershed governance model facilitated dialogue between and among provincial agencies, watershed municipalities, and non-government organizations, a factor considered essential for successful implementation (Fitzgibbon, Mitchell, and Veale 2006).

Three of the case-study watershed organizations were formed under the terms of Ontario's Conservation Authorities Act, and have a lengthy tradition of watershed management. These include the Grand River Conservation Authority (GRCA), Credit Valley Conservation Authority (CVC), and the Upper Thames River Conservation Authority (UTRCA). The Humber Watershed Alliance (HWA) and the Don Watershed Regeneration Council (DWRC) are not watershed management agencies, but stakeholder committees that operate under the auspices of the Toronto and Region Conservation Authority, formed to assist in implementing on-the-ground actions.[67]

Other watershed organizations included in the study were created in late 1980s and early 1990s. In Atlantic Canada, the Miramichi River Environmental Assessment Committee (MREAC) in New Brunswick and Clean Annapolis River Project (CARP) in Nova Scotia began prior to the commencement of the federal Atlantic Coastal Action Program (ACAP) in 1991. CARP joined the ACAP initiative upon its debut, while MREAC joined the following year.

Concerns in the Miramichi River watershed arose as a result of the expansion of a pulp and paper mill without a proper Environmental Impact Assessment. Citizens were uneasy about the project's potential for detrimental water quality impacts. A collaborative committee called the Committee on Public Information and Public Concerns was created with support from the Province of New Brunswick in 1989, to review the circumstances. The committee put forward four recommendations, including the undertaking of a two-year study to assess the health of the Miramichi River and the continuance of the committee to monitor related to the two-year study. The committee evolved to become a more formal and completely independent body operating as MREAC (Miramichi River Environmental Assessment Committee 1992).

The Clean Annapolis River Project formed as an outcome of two inter-related incidents. First, the nomination by the Annapolis Valley Affiliated Boards of Trade to have the Annapolis River as a candidate Canadian Heritage River was rejected because of its degraded state. Second, the Annapolis Valley was selected by the scientific community (the Atlantic Estuaries Cooperative Venture) as a

[67] TRCA predecessors include the Metropolitan Toronto and Region Conservation Authority (1957-1997) and the Don Valley Conservation Authority (1946-1957), both formed under the Ontario Conservation Authorities Act.

demonstration site to promote innovative community-based and collaborative environmental management initiatives and improve the riverine area, leading directly to the founding of CARP (Clean Annapolis River Project 1996; Robinson 1997).

In Alberta, water quality concerns were the catalyst for the creation of both the Bow River Basin Council (BRBC) and the North Saskatchewan Watershed Alliance (NSWA). The BRBC was created in 2000, by a union between the Bow River Basin Water Council and the Bow River Basin Water Quality Foundation. Predecessors to the BRBC date back to 1991. They include the Bow River Water Quality Task Force (1991), the Bow River Basin Water Quality Council (1992), the Bow River Basin Water Quality Foundation (1995), and the Bow River Basin Water Council (1996) which was formed through the re-organization of the Bow River Basin Water Quality Council (Alberta Environmental Protection 1996; Bow River Basin Council 2003). The BRBC became a Watershed Planning Advisory Council (WPAC) under the Alberta Water for Life Strategy in 2004.

The NSWA was formed in 1999, as a merger between two initiatives led by EPCOR Utilities Inc. and Trout Unlimited Canada. EPCOR Utilities Inc. made three observations that prompted its support for a watershed-wide organization. First, the anticipatory protection of water resources was more economical than reactive mitigation of damage and treatment of contaminated water. Second, co-operation and buy-in from stakeholders were essential for watershed protection. Third, the downsizing of Alberta Environment reduced its capabilities to undertake river basin planning. Consequently, EPCOR initiated the North Saskatchewan River Basin Group (NSRB) in 1997. Concurrently, Trout Unlimited Canada was concerned about cumulative impacts in the North Saskatchewan River and initiated the Watershed Approach To Environmental Responsibility (WATER) project to promote public awareness and community stewardship. Funding partners in this initiative included the Prairie Farm Rehabilitation Administration (PFRA), TransAlta (the largest investor-owned generator of energy in Canada) and the City of Edmonton Drainage Branch.[68]

By 1999, it was apparent these two groups were attempting to develop a collaborative approach to river basin stewardship and management. The NSWA was formed when they joined together to increase efficiencies, expand stakeholder networks, and decrease overlapping efforts (North Saskatchewan Watershed Alliance 2000; Primeau 2005). In 2005, NSWA attained status as a WPAC.

[68] The Prairie Farm Rehabilitation Administration (PFRA) was formed in 1935 to assist western farmers dealing with prolonged drought. It operates under the Agri-Environment Services Branch of Agriculture and Agri-Food Canada. Its mission is to provide expertise and services to producers and stakeholders for the sustainable use of agricultural land and water resources. Since the North Saskatchewan River drains the Prairie Provinces (i.e., Alberta, Saskatchewan, and Manitoba), PFRA had a vested interest in promoting upstream water stewardship and funding WATER.

In Québec, the Comité de concertation et de valorisation du bassin de la rivière Richelieu (COVABAR) (Committee for the Protection of the Richelieu River Watershed) evolved from its original roots as a tourism promotion association. It began in 1988 as the Comité de mise en valeur de la vallée du Richelieu (CMVVR) (The Richelieu Valley Development Committee). At a workshop organized by the Conseil régional de l'environnement de la Montérégie (Montérégie CRE) in 1998, participants agreed that critical issues such as degraded water quality needed to be addressed on a watershed basis. In response, the CMVVR was realigned and changed its name to COVABAR to promote integrated watershed management from Lake Champlain to Lake Saint-Pierre on the St. Lawrence River. Through a Memorandum of Understanding with the Province of Québec, COVABAR is recognized as a Watershed Organization under the Québec Water Policy, 2002 (Comité de mise en valeur de la Vallée du Richelieu 1999; Comité de concertation et de valorisation du bassin de la rivière Richelieu 2004).

The remaining three watershed case-study organizations, the Meewasin Valley Authority (MVA), the Muskoka Watershed Council (MWC), and the Fraser Basin Council (FBC) are voluntary partnerships. However, specific mandates, goals, and administrative arrangements for these organizations are stipulated by legislation or formal agreements.

The Meewasin Valley Authority (MVA) in Saskatchewan was founded under the terms of The Meewasin Valley Act, 1979 (Statutes of Saskatchewan 1979) in response to concerns about major residential encroachment in the river valley and loss of public access to the river (Hodge and Robinson 2001). The Act ensconces a tri-party understanding between the City of Saskatoon, Province of Saskatchewan, and the University of Saskatchewan for the management of primarily public lands within a defined corridor area adjacent to the two sides of the South Saskatchewan River within the City of Saskatoon and the Rural Municipality of Corman Park (Tomalty et al. 1994).[69]

The Muskoka Watershed Council (MWC) in Ontario was established in 2001, as a two-way partnership between the District Municipality of Muskoka and the Muskoka Heritage Foundation to promote watershed health in the areas drained by river systems that fall partially or wholly within the jurisdiction of the municipality. The MWC was the 'brainchild' of former Member of Provincial Parliament for Muskoka-Georgian Bay, Ken Black, who was "struck by the fact that Muskoka has never had a conservation authority. We had no official way of protecting the environment" (Cottage Country Communications 2009: 12).

[69] The Rural Municipality of Corman Park was an original founding partner in the MVA but withdrew from the partnership in 1981 (Tomalty et al. 1994).

The Fraser Basin Council, in British Columbia was launched by federal, provincial, and local governments and First Nations in 1997. The establishment of the FBC resulted from the culmination of events that started in the 1980s with a broad recognition of major resource issues in British Columbia. These issues included declining fish stocks, unacceptable pulp mill effluent discharges, limited sewage treatment, and uncoordinated planning and management (Calbick et al. 2004).

In 1990, the Government of Canada identified the Fraser River Basin as a major freshwater system requiring priority action because of environmental contamination and degradation. The Fraser River Action Plan (FRAP), a $90 million, six-year initiative under Canada's Green Plan, was developed with Environment Canada as the lead federal agency, to improve inter-agency cooperation and to establish targets to reduce pollution and restore ecosystem health on a watershed basis (Pomeroy 1995). The plan encouraged collective stewardship and cooperative partnerships. In 1992, a five-year Fraser Basin Management Program (FBMB) was established, bringing together four orders of government (federal, provincial, local, and First Nations), the private sector, and the public to address the key issues identified in the Action Plan (Hodge and Robinson 2001; Calbick et al. 2004; Watson 2004).

FBMB was responsible for the publication of the first 'State-of-the Basin' report for Canada in 1995. The report contained information on eight key issues in the basin and was accompanied by a briefer 'Report Card' grading progress in the basin on selected critical issues. This was a first attempt in Canada at assessing progress towards watershed sustainability (Calbick et al. 2004). A second report card was issued in 1996. Grades were assigned subjectively, based on results of programs and the input of stakeholders (Fraser Basin Management Board 1995, 1996).

The strategic plan resulting from the FRMB collaboration was the Charter for Sustainability (Fraser Basin Council 1997). The Fraser Basin Council, the FRMB's successor, was established to implement the Charter. The Fraser Basin Council Society is a not-for-profit that provides the legal foundation for the FBC and acts as custodian of the society's constitution and bylaws. Its seven members meet once annually and are empowered to elect officers of the society who are also officers of the FBC (Marshall 1998).[70]

The impetuses and mechanisms for establishing each case-study watershed organization are summarized in Table 6.1. Many are also Canadian registered charities.

[70] Members of the society elect the officers of the society (i.e., president, vice president, and secretary-treasurer) who, in turn, become the officers of the FBC (i.e., chair, vice chair, and executive director) (Calbick et al. 2004).

Table 6.1. Triggers and Mechanisms for Establishing Case-Study Watershed Organizations

Watershed Organization	Year Established	Trigger	Mechanism for Establishment	Status	Governance Model (after Hooper 2006)
FBC	1997	Issue	Society Act of British Columbia (Fraser Basin Council Society) Canadian Registered Charity (1998)	Incorporated Society	Council
NSWA	1999	Issue	Societies Act of Alberta (2000)	Incorporated Society	Advisory / Association
BRBC	2000	Issue	Societies Act of Alberta Canadian Registered Charity (2000)	Incorporated Society	Advisory / Association
MVA	1979	Issue	Saskatchewan Meewasin Valley Authority Act Canadian Registered Charity (1979)	Legislation (Corporate Body)	Authority / Corporation
MWC	2001	Idea	Partnership between the Muskoka Heritage Foundation and The District Municipality of Muskoka	Formal Partnership	Council
UTRCA	1947	Issue	Ontario Conservation Authorities Act Canadian Registered Charity (1973)	Legislation (Corporate Body)	Authority / Corporation
GRCA	1966	Issue	Ontario Conservation Authorities Act Canadian Registered Charity (1977)	Legislation (Corporate Body)	Authority / Corporation
CVC	1954	Issue	Ontario Conservation Authorities Act	Legislation (Corporate Body)	Authority / Corporation
HWA	1997	Management Action	Resolution of the Toronto and Region Conservation Authority (TRCA) Canadian Registered Charity (1976)	Subcommittee	Advisory
DWRC	1994	Management Action	Resolution of the Toronto and Region Conservation Authority (TRCA) Canadian Registered Charity (1976)	Subcommittee	Advisory
COVABAR	1988	Event	Québec Companies Act	Incorporated Society	Advisory / Association
MREAC	1989	Issue	Companies Act of New Brunswick Canadian Registered Charity (1993)	Incorporated Society	Association
CARP	1990	Event	Nova Scotia Societies Act Canadian Registered Charity (1990)	Incorporated Society	Association

6.3 Geographic Context and Areas of Interest

The selected watershed organizations have geographic areas of interest which vary in size. Within these geographic limits, biophysical, demographic, and economic factors combine to generate distinct resource issues and management challenges. Table 6.2 describes the geographic areas of interest for each and identifies the main population centres and the total number of people living within the area. Sections 6.3.1-6.3.13 then present overviews of the geographic context, associated demographic and

land use characteristics, and key resource issues pertinent to each case study. Appendix C.1 provides a breakdown of the resource issues identified by staff and officials in the interviews/questionnaires.

Table 6.2. Geographic Context for Case-Study Watershed Organizations

Watershed Organization	Geographic Area of Interest	Drainage Area (km^2)	Length (km)	Major Tributaries	Population (000s)	Main Population Centres
FBC	Fraser River watershed and adjacent areas, BC	233 100 (800 in U.S.)	1 370	Thompson River; Shuswap River; Nechako River; Stuart River; Chilcotin River; Quesnel River; Harrison River; and Bridge River	2,730	Vanderhoof; Prince George; McBride; Williams Lake; Kamloops; Chilliwack; Metro Vancouver[a]
NSWA	North Saskatchewan River watershed, excluding the Battle River watershed, AB	57 000	1 000 (in Alberta)	Ram River; Clearwater River; and Brazeau River	1,180	Edmonton
BRBC	Bow River watershed, AB	25 123	645	Cascade River; Spray River; Ghost River; Kananaskis River; Elbow River; Highwood River; and Nose Creek	1,300	Banff; Canmore; Calgary
MVA	South Saskatchewan River corridor through Saskatoon, Saskatchewan and Environs	65	80	South Saskatchewan River	210	Saskatoon, Corman Park
MWC	Muskoka River watershed and the Black/Severn River watersheds within the District Municipality of Muskoka, ON	7 198	210	North and South Branches; Lower Muskoka River; Black River; and Severn River	150	Huntsville; Bracebridge; Gravenhurst (Muskoka River); Vankoughnet (Black River); Severn Bridge (Severn River)
UTRCA	Upper Thames River watershed upstream from Delaware, ON	3 412	80	North Thames River; Middle Branch; and South Branch	485	London, Stratford; Woodstock
GRCA	Grand River watershed, ON	6 800	290	Conestogo River; Nith River; Speed River; and Eramosa River	925	Waterloo; Kitchener; Cambridge; Guelph; Brantford
CVC	Credit River watershed and adjacent small watersheds, ON	1 000	90	Black/Silver Creek; West Credit; Shaws Creek; East Credit; and Caledon Creek	750	Mississauga; Brampton; Orangeville
HWA	Humber River watershed, ON	903	126	East Humber River; West Humber River; and Black Creek	732	Vaughan; Richmond Hill; Caledon; Aurora; Mississauga; Toronto
DWRC	Don River watershed, ON	360	38	East Don River; German Mills Creek; Taylor Massey Creek; and West Don River	1,200	Vaughan; Richmond Hill; Toronto
COVABAR	Richelieu River watershed, QC	2 506	124	Acadia River; Huron River; South River; and Lacolle River	435	St.-Jean-Sur-Richelieu; Saint Luc; Chambly; Sorel
MREAC	Miramichi River watershed and adjacent small watersheds, NB	13 465	250	Northwest Miramichi River; Southwest Miramichi River; numerous other tributaries	50 - 55	City of Miramichi
CARP	Annapolis River watershed and adjacent small watersheds, NS	2 250	130	Numerous small tributaries	50	Annapolis Royal; Middleton; Kingston; Greenwood; Aylesford

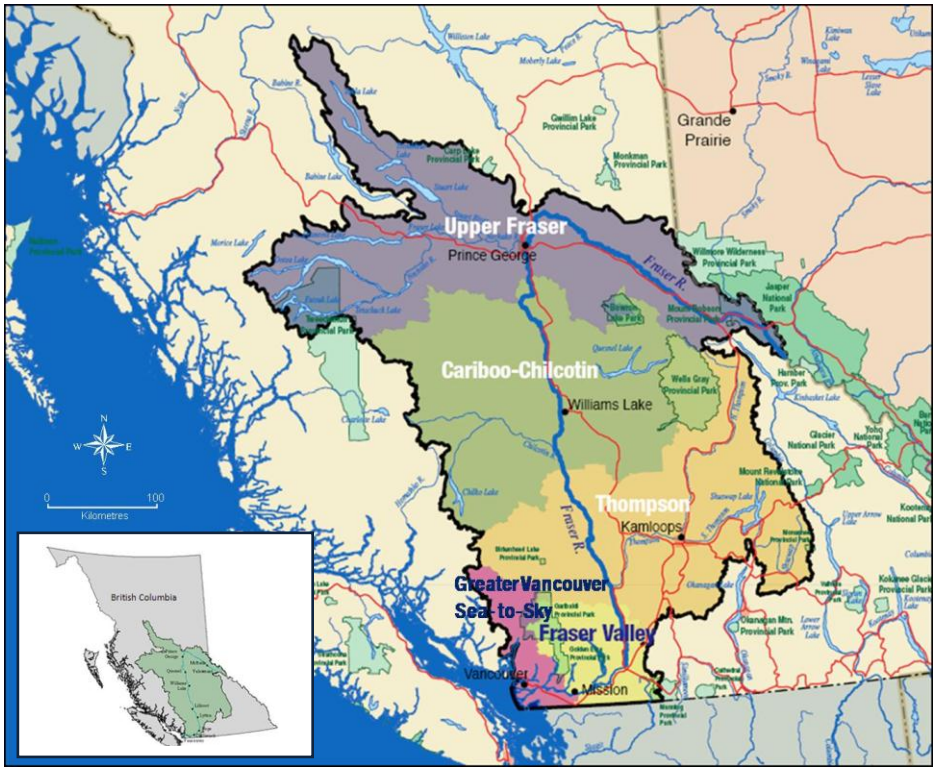
[a] Metro Vancouver consists of 22 municipalities including Vancouver, one electoral area, and one treaty First Nation.

6.3.1 Fraser Basin Council (FBC)

The Fraser River basin accounts for more than 25 per cent of all the land in British Columbia, 66 per cent of the population and 80 per cent of the gross provincial product (Figure 6.1). The Fraser River is the fifth largest drainage area in Canada, stretching from the Rocky Mountains in the east to the Strait of Georgia in the west (Fraser Basin Council 2004a, 2004b). A small portion of the river system drains lands in the United States. The Fraser Basin Council's interest covers the drainage basin within Canada, plus the region from North Vancouver to Whistler, which is technically beyond the watershed boundaries.

Much of the human land use in the basin is associated with forestry. Small urban centres are scattered throughout the watershed, with the majority of people residing in the lower Fraser Valley. Urban areas, supporting a population of 2.73 million people, represent only 2.2 per cent of the land use (Fraser Basin Council 2009). Agriculture represents an even smaller percentage (0.6 per cent) (Reynoldson et al. 2005). Urban and agricultural uses compete for the limited land in the lower valley. The river system drains the traditional lands of nine First Nations peoples, including the Coast Salish, Nlaka'pamux, Secwepemc, Stl'atl'imx, Tsilhqot'in, Wet'suwet'en, Sekani, Dakelh and Okanagan (Fraser Basin Council 2006).

Figure 6.1. Fraser Basin Council Regions, British Columbia



Source: Fraser Basin Council *(Used with Permission).*

The major sources of point-source discharges are municipal sewage treatment plants and pulp mills. Non-point source effects, induced by soil erosion, are primarily the results of forestry practices on the landscape. Water quality degradation is noticeable in the urbanized areas of the basin where stormwater, industrial, and municipal discharges combine to contribute to poor water quality (Hall and Schreier 1996).

A critical management issue in the basin is the decline of salmon stock. This trend causes concern, even though fishing has been restricted. Biodiversity also appears to be declining. The mountain pine beetle is destroying much of the forested interior of the basin, transforming the landscape and undermining the economy (Jago 2009). The deposition of sediment has raised the riverbed in some locations, increasing flood and erosion hazards, inhibiting navigation and damaging or destroying fish habitat.

From a social-economic perspective, one key issue relates to the continuing need for improved living conditions among BC's First Nations and people on low incomes. In addition, since 2000, there has been a marked decline in overall housing affordability and increased homelessness (Jago 2009).

6.3.2 North Saskatchewan Watershed Alliance (NSWA)

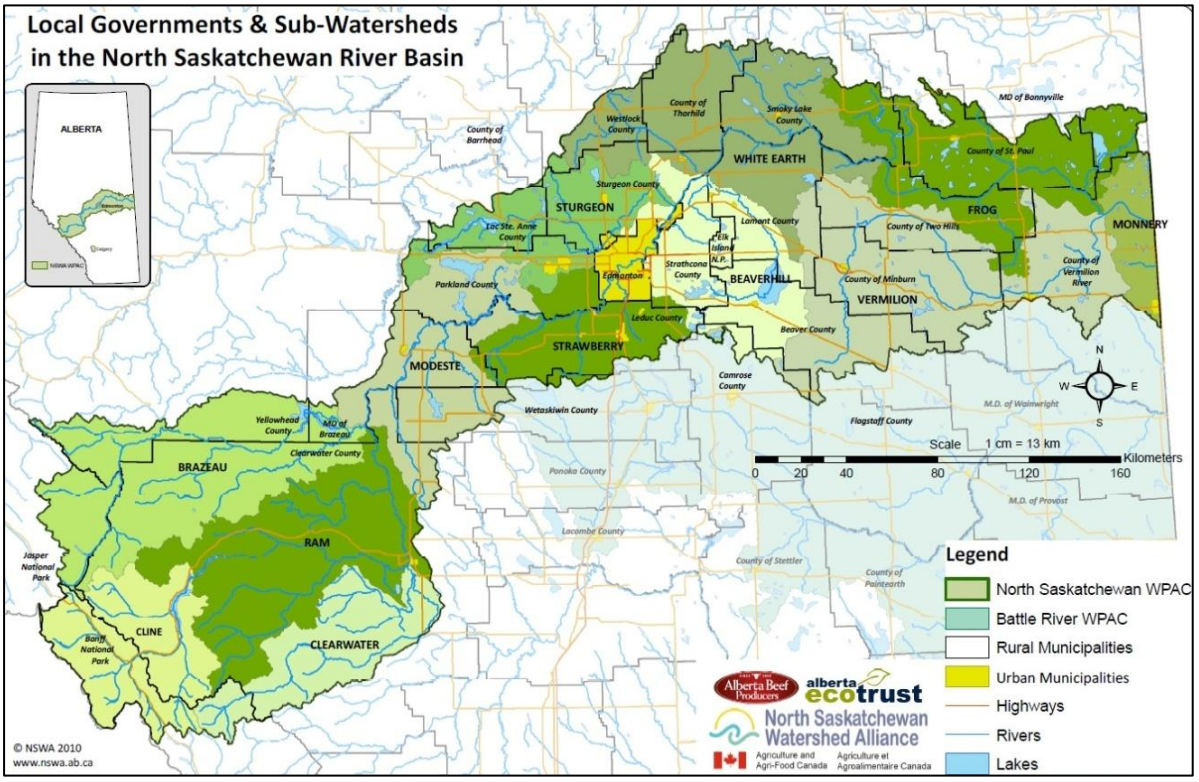
The North Saskatchewan River flows from its source in the Rocky Mountains, through the Province of Alberta and joins the South Saskatchewan River just east of Prince Albert, Saskatchewan (Figure 6.2). The NSWA concentrates its activities on the North Saskatchewan River watershed within the Province of Alberta, excluding the Battle River watershed. The drainage area of this portion of the watershed is about 57,000 square kilometres (Trew 2009). The watershed includes 12 sub-watersheds and 37 recreational lakes.

The river's drainage area spans 20 counties, including 100 cities, towns and villages including 14 First Nations and Métis communities, although the majority of the basin's 1.18 million people live in or close to the City of Edmonton. The upper river reaches are sparsely populated. Forestry and agriculture are the main human land uses in the upper reaches and foothills, while urban settlements and agriculture predominate in the Edmonton area. About 45 per cent of the watershed is forested and 36 per cent is rural agricultural (Sullivan 2009).

River hydrology is influenced by two large dams and reservoirs created to generate hydroelectric power. The Bighorn Dam is located near Nordegg on the North Saskatchewan River and the Brazeau Hydroelectric Dam is situated on a main tributary, the Brazeau River. The watershed contains four

large coal power plants and is home to several major petrochemical industries (Bow River Basin Council 2005).

Figure 6.2. North Saskatchewan River Basin, Alberta



Source: North Saskatchewan Watershed Alliance *(Used with Permission).*

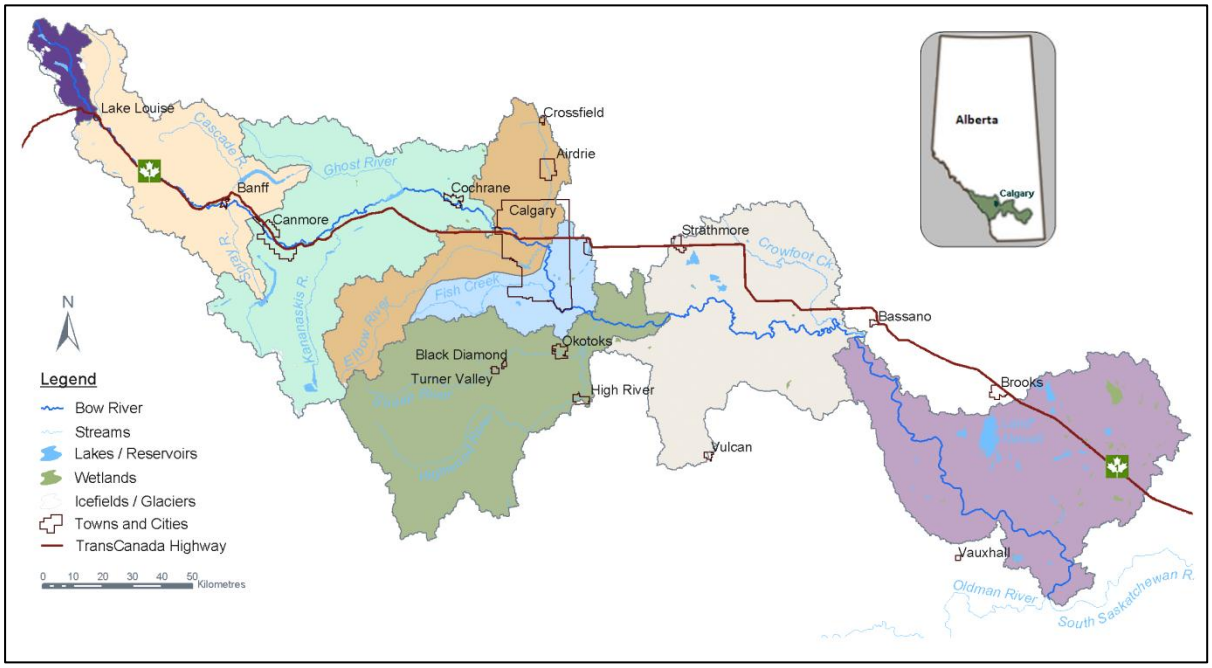
Five key resource issues include the impact of climate change on the glacier-fed headwaters of the river system (Demuth and Pietroniro 2003), reservoir operations, water withdrawals for energy production, protection of drinking water, degraded water quality from urban development (e.g., suspended solids, combined sewer outlets and wastewater treatment effluent), and the impacts of industrial development (Trew 2009).

6.3.3 Bow River Basin Council (BRBC)

The BRBC's interest extends across the entire Bow River watershed. The Bow River basin includes the area drained from the river's source in the Rocky Mountains near Lake Louise, to its confluence with the Oldman River in southeastern Alberta. It is the largest tributary of the South Saskatchewan River, with a drainage area of over 25 000 square kilometres (Figure 6.3). This drainage area accounts for 23 per cent of the entire drainage basin of the South Saskatchewan River. The river system is glacier-fed in its upper reaches and is affected by three irrigation districts in the mid and lower reaches. Approximately 40 per cent of the annual natural river flows have been altered by

dams and diversions, creating seasonal differences from the natural flows, particularly in the lower reaches (Bow River Basin Council 2005).

Figure 6.3. Bow River Basin, Alberta



Source: Bow River Basin Council (*Used with Permission*).

Water is used for hydroelectricity generation, agricultural irrigation and domestic consumption through the licensing and allocation of water rights, effluent dilution and recreation. Water withdrawals result in water transfers between reaches or its diversion to neighbouring sub-basins within the South Saskatchewan River system (e.g., Red Deer River Basin, Oldman River Basin) (Bow River Basin Council 2005).

While 23 municipalities are partially or wholly within the watershed, over 75 per cent of the basin's over 1.3 million residents live in Calgary (Alberta Water Council 2009). In addition, the Stoney Nakoda Nation has reserve lands throughout the foothills of the Bow River basin. Tsuu T'ina Nation reserve lands extend west from Calgary to Bragg Creek, and Siksika Nation reserve lands straddle the Bow River valley near Bassano (Natural Resources Canada n.d.).

Key resource issues include persistent contributions of urban expansion effects, including stormwater flows and municipal effluents that degrade water quality, disproportional variations in water availability for certain uses as a result of water licensing, interprovincial water apportionment

and drought, and the ecological impacts of accelerated development in headwater, riparian and wetlands areas, and on alluvial aquifers (Bow River Basin Council 2005; Alberta Environment 2006).

An extremely controversial resource issue in Alberta is the allocation of water rights. The Province of Alberta retains a 'first-in-time, first in right' approach to water licences. In August 2006, pursuant to the approved South Saskatchewan River Basin Water Management Plan (SSRB Plan), the Province placed a moratorium on water allocations on the Bow, Oldman, and South Saskatchewan River sub-basins. The SSRB Plan prohibits further water allocations from these river basins and reserves all remaining water in favour of the Province (Alberta Environment 2006). Water allocations can still be transferred among users. However, the user must demonstrate that the water proposed for transfer under a licence is, or will be, no longer required for human purposes due to water conservation or other planned reductions in need. It is hoped that this rule will be an incentive for water conservation because licence holders, by conserving water, have opportunity to trade their water licence, or portions thereof, for an economic gain (Alberta Economic Development Authority Sustainable Development Committee 2008). Critics of this approach are concerned that the restrictions encourage water trade, licence brokering, and inter-basin transfers to the detriment of the environment, and call for robust regulations and citizen engagement to protect the public interest and the environment (Alberta Economic Development Authority Sustainable Development Committee 2008; Karunananthan and Harris 2010).

6.3.4 Meewasin Valley Authority (MVA)

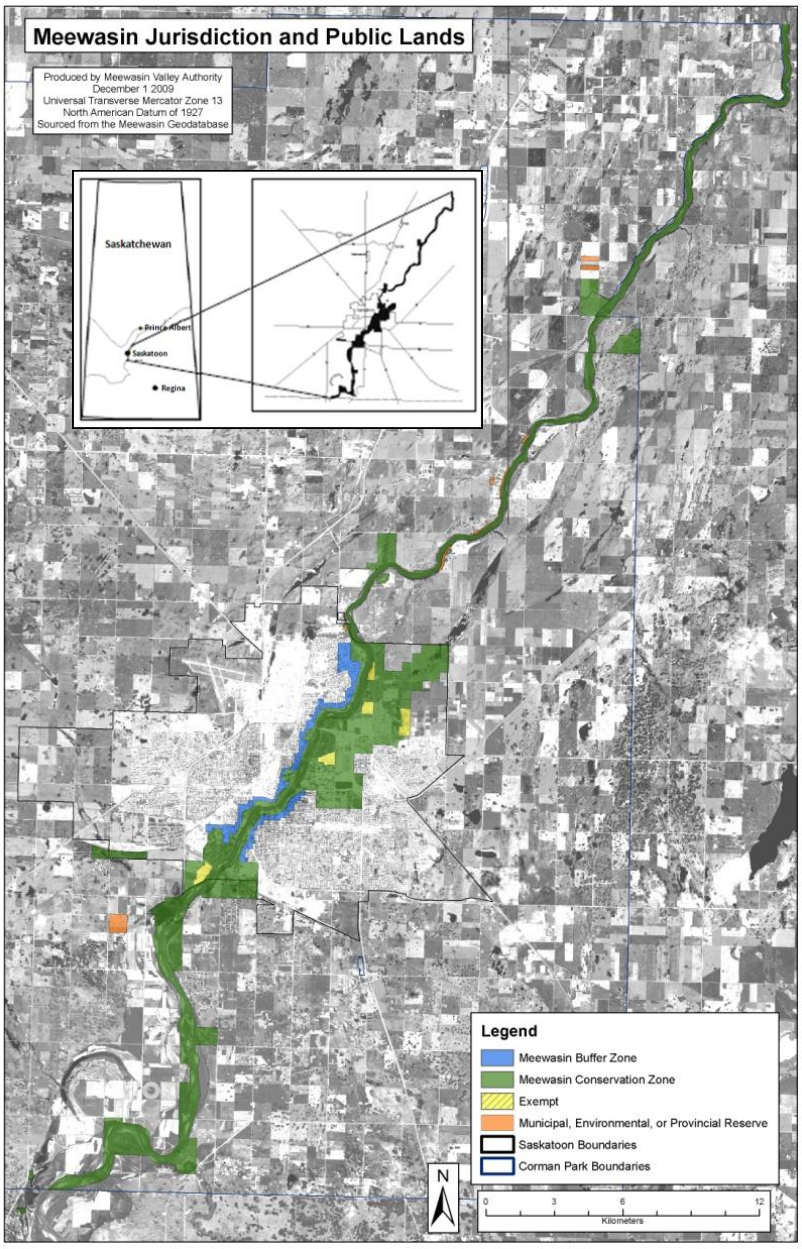
The Meewasin Valley Authority's jurisdiction is specified by the Meewasin Valley Authority Act and includes a portion of the South Saskatchewan River corridor as it passes through the City of Saskatoon and adjacent areas (Figure 6.4). This defined corridor runs approximately 80 kilometres through Saskatoon and the Rural Municipality of Corman Park from Pike Lake in the southwest to Clarke's Crossing in the northeast and encompasses the river and its shores and certain university, provincial and city lands.[71] Including the South Saskatchewan River, about 63 square kilometres are under the jurisdiction of MVA.

The authority of the MVA under the terms of the Meewasin Valley Authority Act has been amended since its promulgation. The original mandate gave MVA powers over private lands and authority to plan the river corridor, regulate land and water use, acquire land through purchase, expropriation and right of refusal, and develop, maintain, and regulate lands within its jurisdiction. Public hostility and lack of municipal support forced the province to amend the legislation to remove

[71] This distance represents the length of the river reach within the control of the MVA, although its jurisdiction is not continuous within the Regional Municipality of Corman Park.

private lands from MVA's jurisdiction and eliminate its powers of expropriation (Tomalty et al. 1994; Hodge and Robinson 2001).

Figure 6.4. Meewasin Valley, Saskatoon, Saskatchewan



Source: Meewasin Valley Authority (*Used with Permission*).

While the MVA's jurisdiction is confined to certain lands within the river corridor, its area of interest extends to a broad swath of land 2 kilometres beyond these boundaries (Meewasin Valley Authority 2003). Much of the area within the jurisdiction of the MVA is public land, accessible to over 234,000 residents living within the Saskatoon Census Metropolitan Area (Statistics Canada

2006). These lands include conservation areas, parks, museums, interpretive centres, university lands, canoe launches, community links and over 60 kilometres of trails. Major threats to the ecological integrity of the valley include development encroachment, habitat fragmentation and invasive and noxious plant species (Meewasin Valley Authority 2009). The impacts of climate change, preserving aesthetic and cultural authenticity, source water protection, and erosion are key concerns expressed by senior staff and officials (Appendix C.1).

6.3.5 Muskoka Watershed Council (MWC)

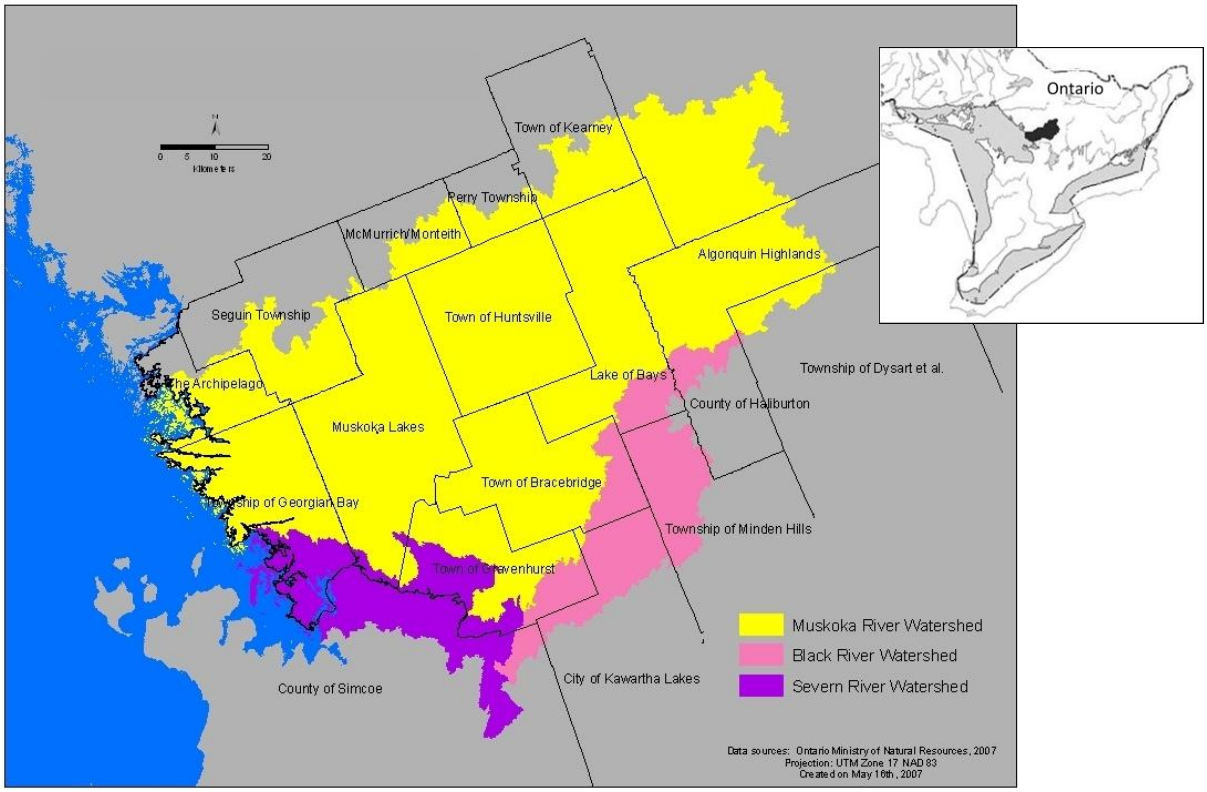
The MWC has an interest in all of the watersheds totally or partially within the District Municipality of Muskoka, including those of the Muskoka, Black, and Severn Rivers as well as several smaller rivers that flow directly into Georgian Bay (Figure 6.5).

The headwaters of the Muskoka River are located on the western slopes of Algonquin Park. The river flows to the southwest and discharges into Lake Muskoka before it continues to Georgian Bay through the Moon and Musquash Rivers, draining about 4 660 square kilometres (The District Municipality of Muskoka 2009). The Black River begins in the Haliburton Highlands and flows to the southwest, passing through the southeast corner of Muskoka. The Severn River is the lower end of the western portion of the Trent-Severn Historic Waterway and flows from Lake Simcoe and Lake Couchiching to Georgian Bay at Port Severn. The combined drainage area of these two rivers is 2 538 square kilometres (Muskoka Watershed Council 2010). The Muskoka watersheds represent a transition zone between agricultural southern Ontario and the boreal forests of northern Ontario (The District Municipality of Muskoka 2008).

The whole Muskoka area is characterized by over 500 lakes and interconnecting watercourses (Muskoka Watershed Council 2007). The area is Ontario's recreation playground and tourism is the principal contributor to the economy. While the area population is estimated to be about 150,000 people, only one-third are considered permanent residents (The District Municipality of Muskoka 2008). The area also is traditional First Nations territory but only the Wahta Territory, a small Mohawk community, is located within the Muskoka watersheds.

About 80 per cent of the land cover is natural vegetation, including wetlands. About 15 per cent is water, with the remainder of the land use evenly split between barrens, urban uses and agriculture and open fields (Tran 2007). As the prime recreational area for southern Ontario, Muskoka is experiencing growth pressures. Related resource issues include habitat fragmentation, degrading water quality, wetland loss, altered lake shoreline, and stormwater management (Muskoka Watershed Council 2007).

Figure 6.5. Muskoka Watersheds, Ontario



Source: Muskoka Watershed Council *(Used with Permission).*

6.3.6 Upper Thames Conservation Authority (UTRCA)

The Thames River rises at 3 distinct points in Oxford and Perth Counties and flows through southwestern Ontario to its mouth at Lake St. Clair near Tilbury, draining 6 695 square kilometres of land[72] (Figure 6.6). Two conservation authorities jointly manage the river system, the Upper Thames River Conservation Authority (UTRCA) and the Lower Thames Valley Conservation Authority (LRVCA). The jurisdiction of the UTRCA includes 3 420 square kilometres in the upper reaches of the watershed from its sources to just downstream of the City of London.

The watershed is predominantly rural with about 76 per cent of the land used for livestock and crop agriculture. About 10 per cent of the watershed is classified as urban, including the municipalities of London, Stratford, and Woodstock, with a total population of about 485,000 people

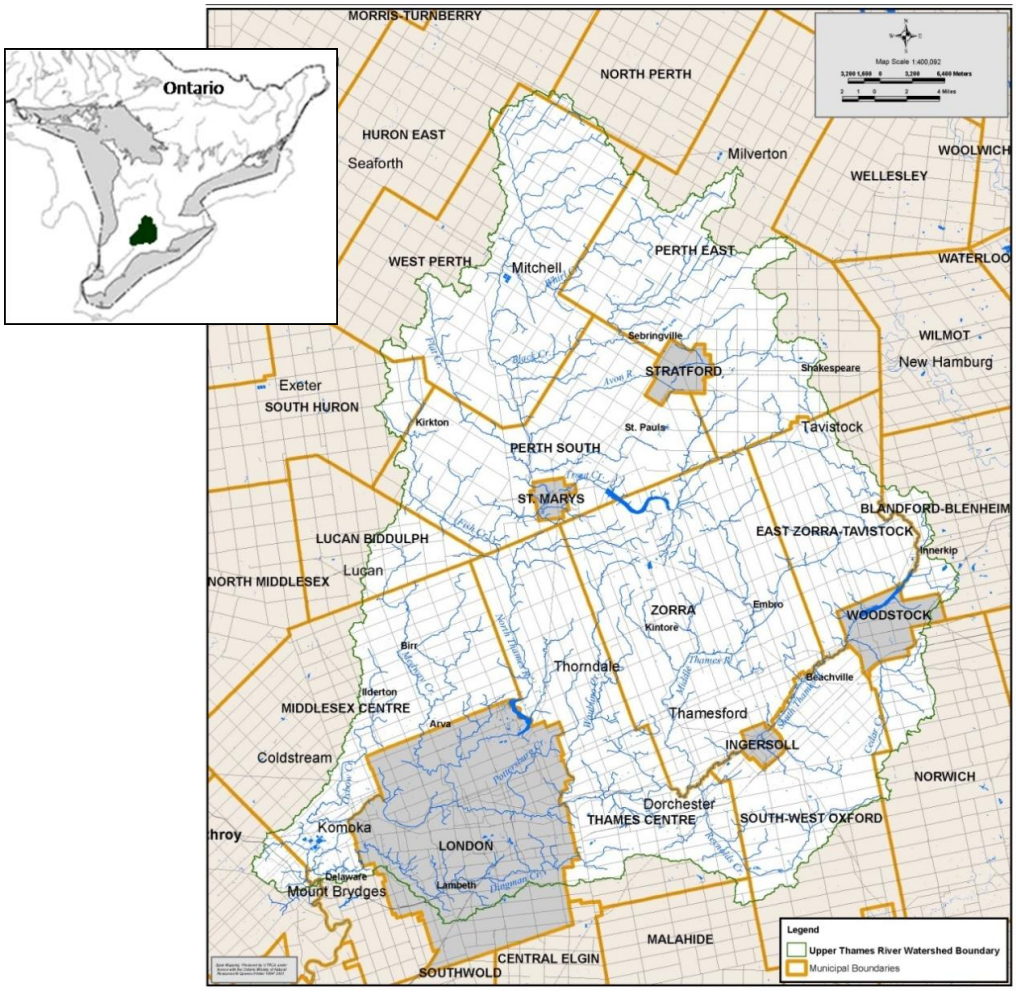
[72] This figure was determined by adding the total watershed drainage area for the upper Thames River as reported in the 2007 Watershed Reports (Upper Thames River Conservation Authority 2007) and the total watershed drainage area for the lower Thames River as indicated on the Lower Thames Valley Conservation Authority website (Lower Thames River Conservation Authority n.d.).

(Hebb and Mortsch 2007). The percentage of land under forest cover varies in each sub-watershed and averages 12 per cent.

The natural river system has been altered substantially by human uses. An inventory undertaken in 2001 identified 170 low-head dams in the upper watershed which impede river flows and trap sediments. Three large dams and reservoirs, Fanshawe, Pittock, and Wildwood, are operated by the UTRCA for flood control and in the case of the latter two, low flow augmentation (de Laronde 2001).

Stresses in the watershed are apparent from both urban and rural land uses. Drainage practices, loss of natural forest cover, contaminated and agricultural runoff, spills, and bank alterations combine to impair water quality. Severe, periodic, localized flooding is also experienced (The Thames River Ecosystem Recovery Team 2005). Aggregate extraction and landscape restoration are additional resource issues identified by senior staff (Appendix C.1).

Figure 6.6. Upper Thames River Watershed, Ontario

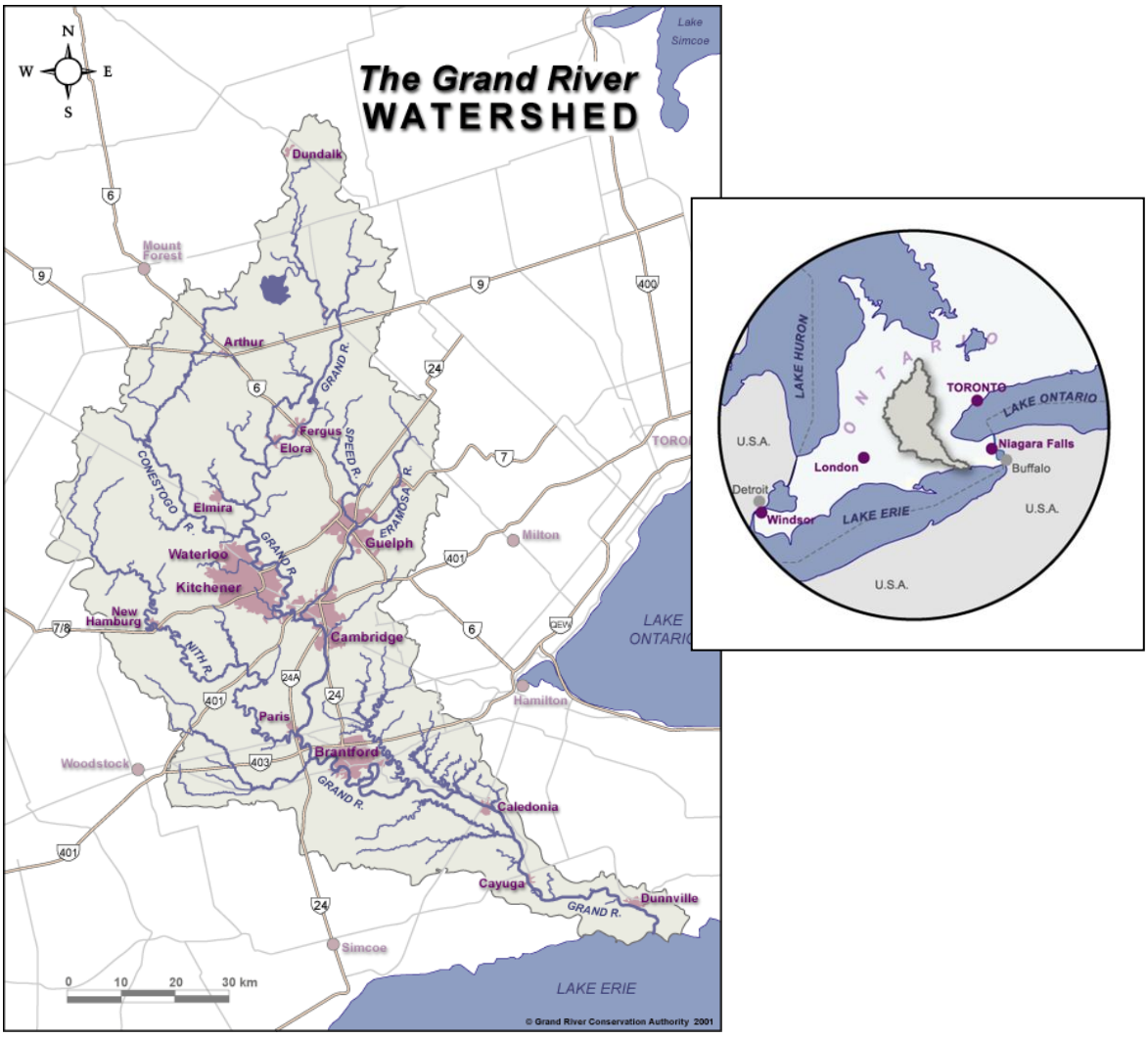


Source: Upper Thames River Conservation Authority *(Used with Permission)*

6.3.7 Grand River Conservation Authority (GRCA)

Draining an area of over 6 800 square kilometres, the Grand River watershed is the largest direct drainage basin to Lake Erie on the Canadian side of the border with the United States (Figure 6.7). The river arises in the Dundalk Highlands north of Grand Valley and is joined by four major tributaries as it makes its way to its mouth at Lake Erie. The watershed includes 39 municipalities[73] and two First Nations reserves located south of Brantford: Six Nations of the Grand River and the Mississaugas of the New Credit.

Figure 6.7. Grand River Watershed, Ontario



Source: Grand River Conservation Authority *(Used with Permission)*

[73] Municipalities refer to counties (e.g., Oxford, Dufferin, Perth, Wellington), regional municipalities (e.g., Waterloo, Halton) and area municipalities (lower-tier municipalities within the upper-tier regional municipal structure), and single-tier municipalities such as incorporated cities (e.g., Guelph, Brantford, Hamilton).

The watershed is experiencing escalating population growth and rapid agricultural and urban intensification (Grand River Conservation Authority 2008b). About 67 per cent of the watershed is used for agriculture, while urban land uses occupy 7 per cent. Forest cover extends over 19 per cent of the watershed. Since the turn of the twentieth century, over 65 per cent of the wetlands in the watershed have been lost. In some areas, particularly in the southern reaches of the watershed, this percentage is greater than 85 per cent (Lake Erie Source Protection Region Technical Team 2008).

The majority of drinking water supplies for the watershed's almost one million people come from groundwater sources (69%) and surface water sources (28%) (Grand River Conservation Authority 2008b). Many groundwater sources are provided by the Waterloo, Paris-Galt, and Orangeville moraines. These moraines are facing sizeable development pressures through the continued intensification and expansion of existing urban centres, including Kitchener, Waterloo, Cambridge, Guelph, and Brantford. There is increasing concern that this growth could impair the recharge functions provided by the moraines and that the cumulative impact of progressive water takings may significantly adversely affect the hydrology of the river system.

There are four surface water intakes in the Grand River system. Surface water is extracted in the Region of Waterloo and the City of Guelph to supplement groundwater supplies. The City of Brantford and the Six Nations of the Grand River extract their drinking water solely from the Grand River. The Brantford Water Treatment Plant services about 93,000 people while the Six Nations Water Treatment Plant services 594 customers[74] (Six Nations Council Environment Office 2007: 15). The Six Nations of the Grand River is Canada's largest First Nations reserve with a membership of 22,294 people and a population of 11,297 living on the reserve (Six Nations of the Grand River n.d.)

The Grand River receives effluent from 29 wastewater treatment plants and rural run-off from non-point pollution sources such as farms and urban development (Lake Erie Source Protection Region Technical Team 2008). Deteriorating river water quality is a major concern (Grand River Conservation Authority 2007, 2008b). Other key resource issues include groundwater contamination, invasive species, habitat fragmentation and loss, wetland loss, aggregate extraction, flooding, and increasing water demand.

The Grand River system is highly managed. Seven multipurpose water control structures are operated to reduce potential flood damages and to maintain summer flows for water supply and water quality. Climate change experts predict more extreme rainfall events, drier summers, greater

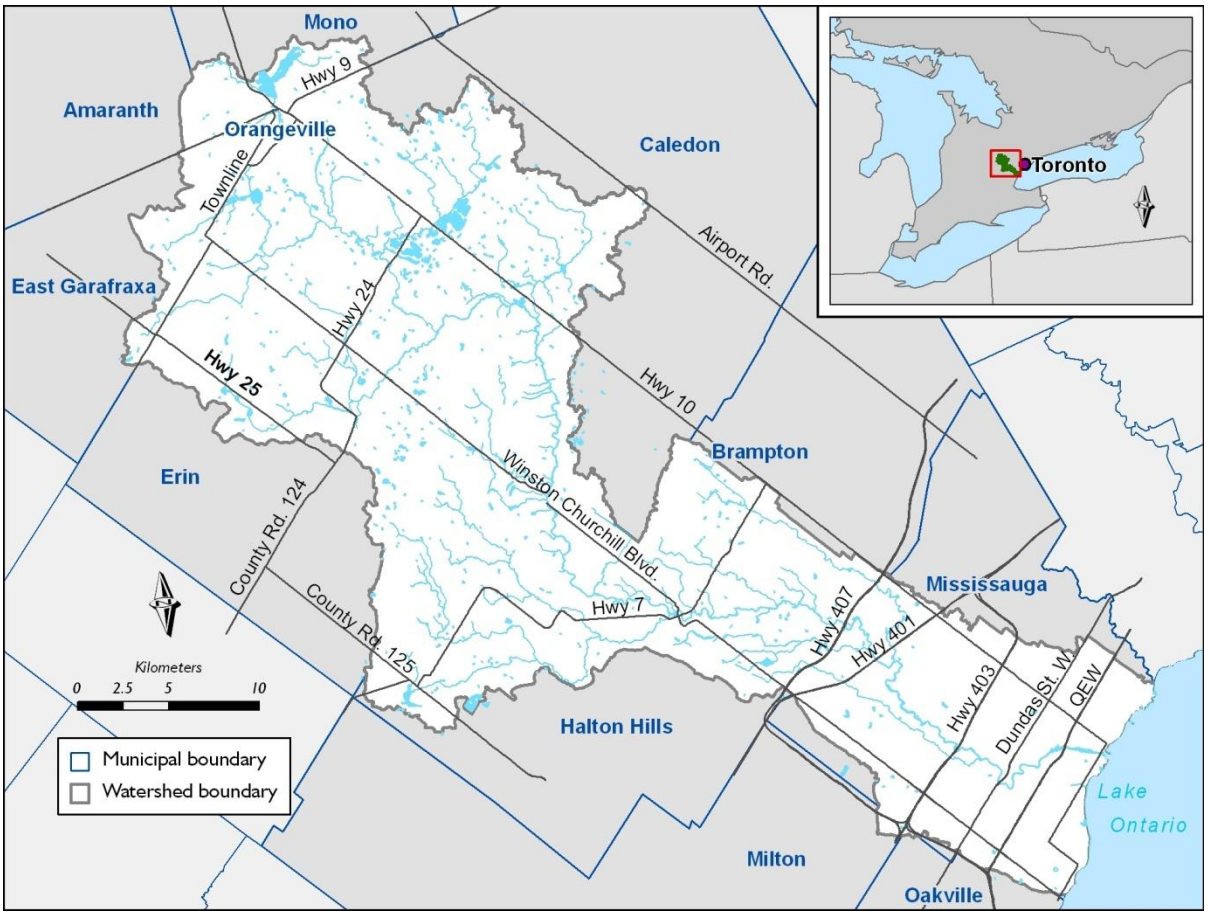
[74] These customers include 406 residential households, 97 commercial establishments, and 91 residents who have approved access to public taps.

evaporation, and more winter freeze-thaw cycles. Managing the river system to reduce flood and erosion damages, protect public health and safety, ensure adequate water supply, and protect fisheries has become more complex.

6.3.8 Credit Valley Conservation (CVC)

The Credit River system is located just west of Toronto (Figure 6.8). The river's source lies above the Niagara Escarpment in the hilly, hummocky topography of the Orangeville Moraine. Fed mostly by groundwater, the river cuts across the Niagara Escarpment and part of the Oak Ridges Moraine as it flows southeast to the lower, relatively flat, lower reaches to Lake Ontario. Its drainage area, including some small creeks that drain directly into Lake Ontario, is approximately 1 000 square kilometres (Credit Valley Conservation 2007).

Figure 6.8. Credit River Watershed, Ontario



Source: Credit Valley Conservation (*Used with Permission*).

The watershed is a rapidly changing landscape, with intensive urban development in the lower reaches. Its proximity to Toronto makes it a desirable location for commuters, while the scenic,

rolling landscape in the middle and upper reaches is appealing for estate residential development and hobby and equestrian farms. The current population is estimated at over 750,000 people, the majority residing in Mississauga and Brampton. Domestic water supply in these two cities is extracted from Lake Ontario (Credit Valley Conservation 2008).

Land use is almost evenly split between agricultural and urban uses, together accounting for 66 per cent of the watershed area. Forests, wetlands and meadows comprise about 32 per cent of the remaining lands (Kennedy and Wilson 2009). Major resource concerns focus on the effects of continued urban and suburban sprawl, conventional storm water management, and land conversion from rural to urban uses on water quality and river hydrology. The supplemental impacts of climate change and increasing water demand for recreational and commercial purposes are also cited as key issues (Credit Valley Conservation 2007; Kennedy and Wilson 2009). Additional resource issues identified by senior staff relate to fisheries, flooding, erosion, and aggregate extraction (Appendix C.1).

6.3.9 Humber Watershed Alliance (HWA)

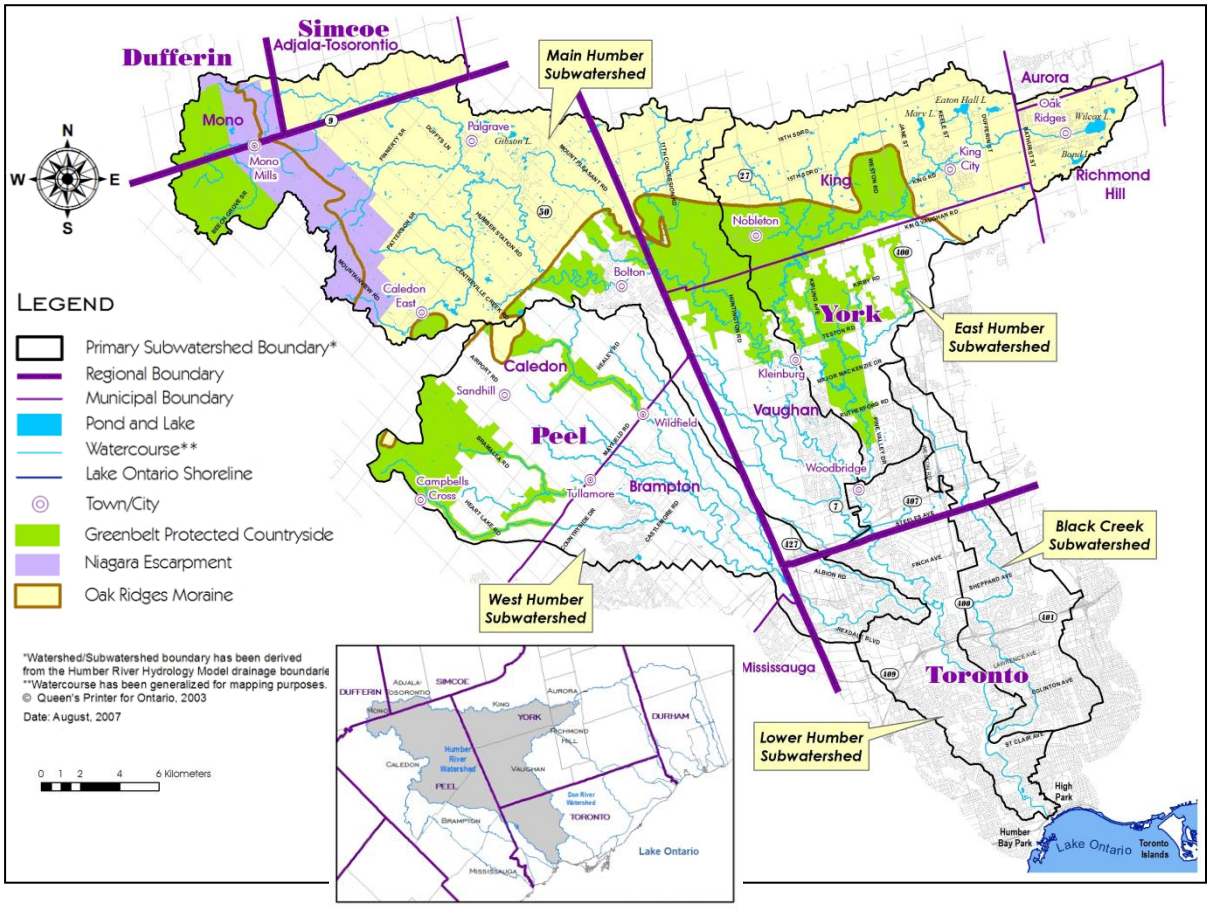
The Humber Watershed Alliance's attention extends over the entire Humber River watershed. The watershed spans 903 square kilometres and is the largest watershed flowing into Lake Ontario within the jurisdiction of the Toronto and Region Conservation Authority (Figure 6.9). The river system flows through significant physiographic areas, including the ancient rock of the Niagara Escarpment, the rolling hills and kettle lakes of the Oak Ridges Moraine, the high-quality agricultural lands of the South Slope and Peel Plain, and the ancient Lake Iroquois shoreline, before emptying into Lake Ontario (Toronto and Region Conservation Authority 2008).

The Humber River watershed is home to over 732,000 people (Toronto and Region Conservation Authority 2009a). It includes portions of 10 local municipalities, including the City of Vaughan, the Town of Richmond Hill, the Township of King and the Town of Aurora in the Regional Municipality of York; the Cities of Brampton and Mississauga and the Town of Caledon in the Regional Municipality of Peel; the City of Toronto; the Town of Mono in Dufferin County; and the Township of Adjala-Tosorontio in Simcoe County.

About 27 per cent of the watershed is urbanized, mostly in the lower reaches. Urbanization is occurring at a rapid rate. By 2021, this percentage could increase to 45 per cent. Within Toronto, 87 per cent of the land use is already urban. Existing rural lands account for 40 per cent in the mid to upper reaches of the watershed with about 32 per cent natural cover (Toronto and Region Conservation Authority 2008).

While 45 per cent of the Humber River watershed is governed by provincial protected areas legislation, including the Niagara Escarpment Plan (Niagara Escarpment Commission 2005), the Oak Ridges Moraine Conservation Plan (Ontario Ministry of Municipal Affairs and Housing 2002), and the Greenbelt Plan (Ontario Ministry of Municipal Affairs and Housing 2005),[75] urbanization continues to transform the landscape, displacing natural cover and agricultural lands.

Figure 6.9. Humber River Watershed, Ontario



Source: Toronto and Region Conservation Authority (*Used with Permission*).

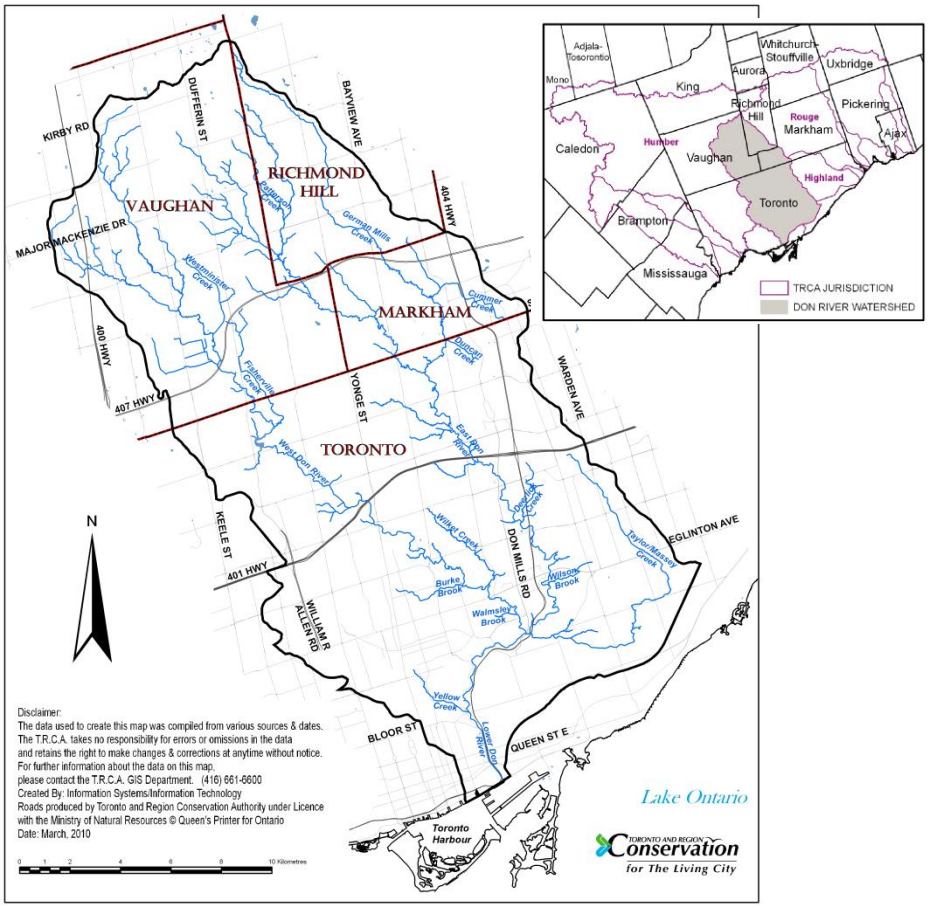
[75] The Niagara Escarpment Planning and Development Act (Revised Statutes of Ontario 1990) established a planning process to protect 525 kilometres of the Niagara Escarpment from Queenston on the Niagara River to Tobermory on the Bruce Peninsula. The Niagara Escarpment Plan guides land use decisions within the planning area. Completed in 2005, the plan has been subject to a series of amendments. The Oak Ridges Moraine Conservation Plan, 2002 was developed in conformity with the Oak Ridges Moraine Conservation Act (Statutes of Ontario 2001) and pertains to 190 000 hectares of land. Stretching 160 kilometres, the moraine is a significant landform that gives rise to river systems flowing south to Lake Ontario and north to Georgian Bay, Lake Simcoe and the Trent River system. The Greenbelt Plan was developed under the terms of the Greenbelt Act (Statutes of Ontario 2005). The Greenbelt includes a 728 434 hectare swath of land that extends along the periphery of the urban areas located adjacent to the shores of Lake Ontario (Greater Golden Horseshoe). It includes portions of the Niagara Escarpment and the Oak Ridges Moraine.

Along with the impacts of rapid urbanization, the lack of stormwater management systems in about 75 per cent of existing urban areas is an escalating management challenge. Changing precipitation patterns anticipated as a result of climate change may further exacerbate erosion and flooding, leading to an incremental and progressive degradation of wetlands and habitats, biodiversity, and water quality, particularly in the lower reaches. Invasive plant species are spreading and threaten native habitats (Toronto and Region Conservation Authority 2008). The loss of cultural heritage resources was also identified as a major concern by senior staff (Appendix C.1).

6.3.10 Don Watershed Regeneration Council (DWRC)

The Oak Ridges Moraine, just north of Toronto, is the headwater area of the Don River which has a drainage area of about 360 square kilometres (Figure 6.10). The river flows southeast through glacial and lacustrine deposits to Lake Ontario. Over 80 per cent of the watershed is urbanized, with only 4 per cent of the land base in agricultural use. The remaining lands are naturally vegetated (Toronto and Region Conservation Authority 2009c).

Figure 6.10. Don River Watershed, Ontario



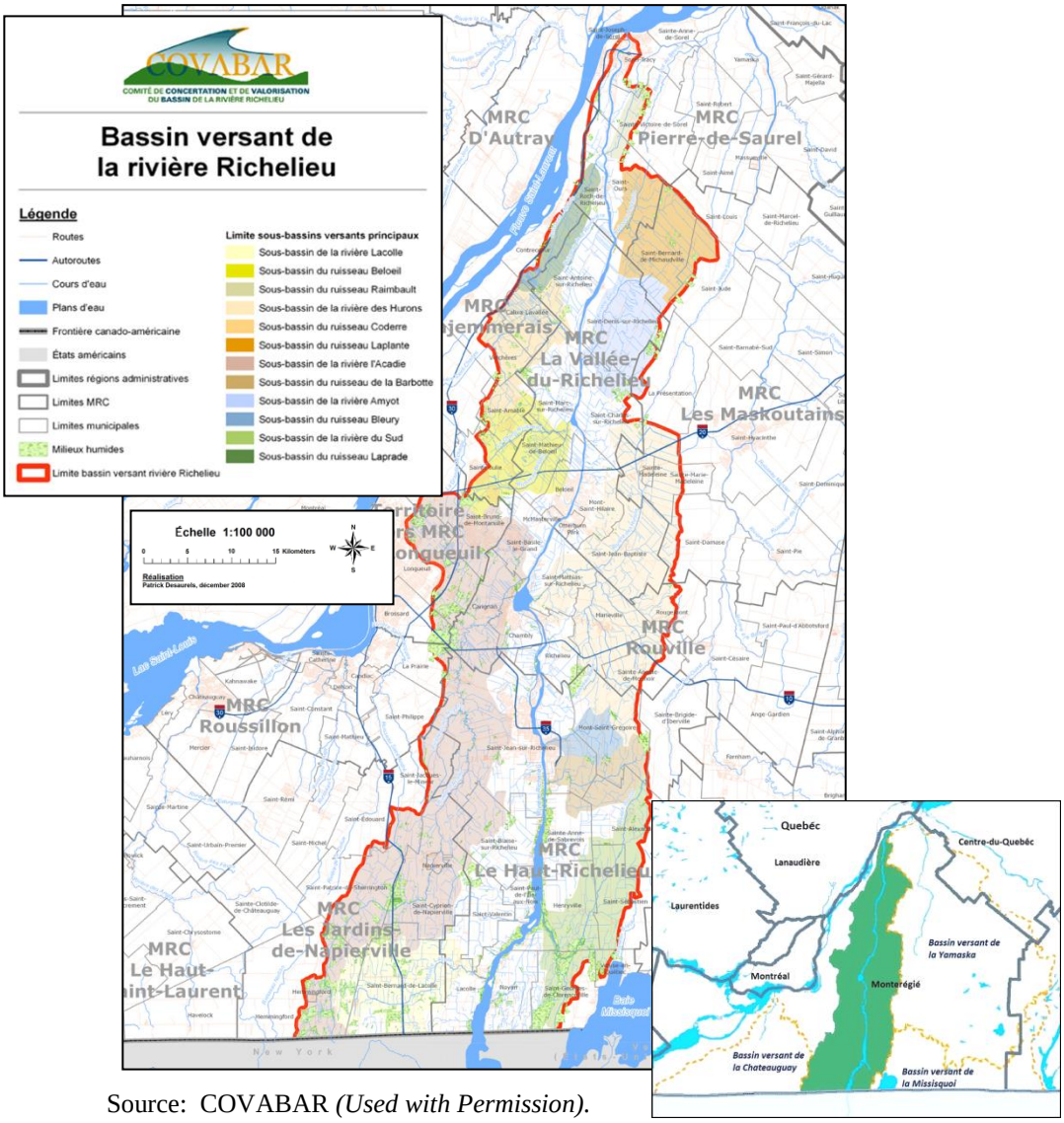
Source: Toronto and Region Conservation (*Used with Permission*)

The watershed is home to over 1.2 million people. Rates of population growth are expected to remain high (Toronto and Region Conservation Authority 2009c). Land use change, urbanization, increasing population densities, heavy use of green space, and lack of stormwater controls have resulted in extensive degradation to the natural and hydrologic systems. Flooding, erosion, poor water quality, and degraded terrestrial and aquatic ecosystems are key concerns. The potential impacts of poor air quality and climate change are also cause for concern (Toronto and Region Conservation Authority 2009c).

6.3.11 Comité de concertation et de valorisation du bassin de la rivière Richelieu (COVABAR)

The focus of COVABAR is the Richelieu River watershed in Québec (Figure 6.11).

Figure 6.11. Richelieu River Watershed, Québec



Source: COVABAR *(Used with Permission).*

The Richelieu River, an international river, flows north from the United States into Canada and is an integral part of the Lake Champlain watershed. The river flows from the United States border and empties into Lake Saint-Pierre on the St. Lawrence River, just east of Montréal and has a total drainage area of 23 720 square kilometres (Figure 6.11) (Comité de concertation et de valorisation du bassin de la rivière Richelieu n.d.).

The drainage area within Québec covers about 2 506 square kilometres (Comité de concertation et de valorisation du bassin de la rivière Richelieu et le Conseil régional de l'environnement de la Montérégie 2000). The watershed is predominately rural with about 71 per cent of the land used for agriculture. The regional population is growing rapidly, with eight Regional County Municipalities (Municipalités régionales de comté), and 65 towns and municipalities either wholly or partly within the watershed. The population of the watershed is approximately 436,000 people (Comité de concertation et de valorisation du bassin de la rivière Richelieu n.d.).

Key issues include degraded water quality and river debris, flooding, unstable sensitive clays (e.g., Champlain clay), invasive species (e.g., zebra mussels, water chestnut), threatened and endangered species (e.g., copper redhorse, peregrine falcon, red headed woodpecker, pickerel frog, four-toed salamander), loss of riparian vegetation (grooming to the edge of the river), and livestock intensification (Comité de concertation et de valorisation du bassin de la rivière Richelieu et le Conseil régional de l'environnement de la Montérégie 2000; Comité de concertation et de valorisation du bassin de la rivière Richelieu 2002; Quinn et al. 2009).

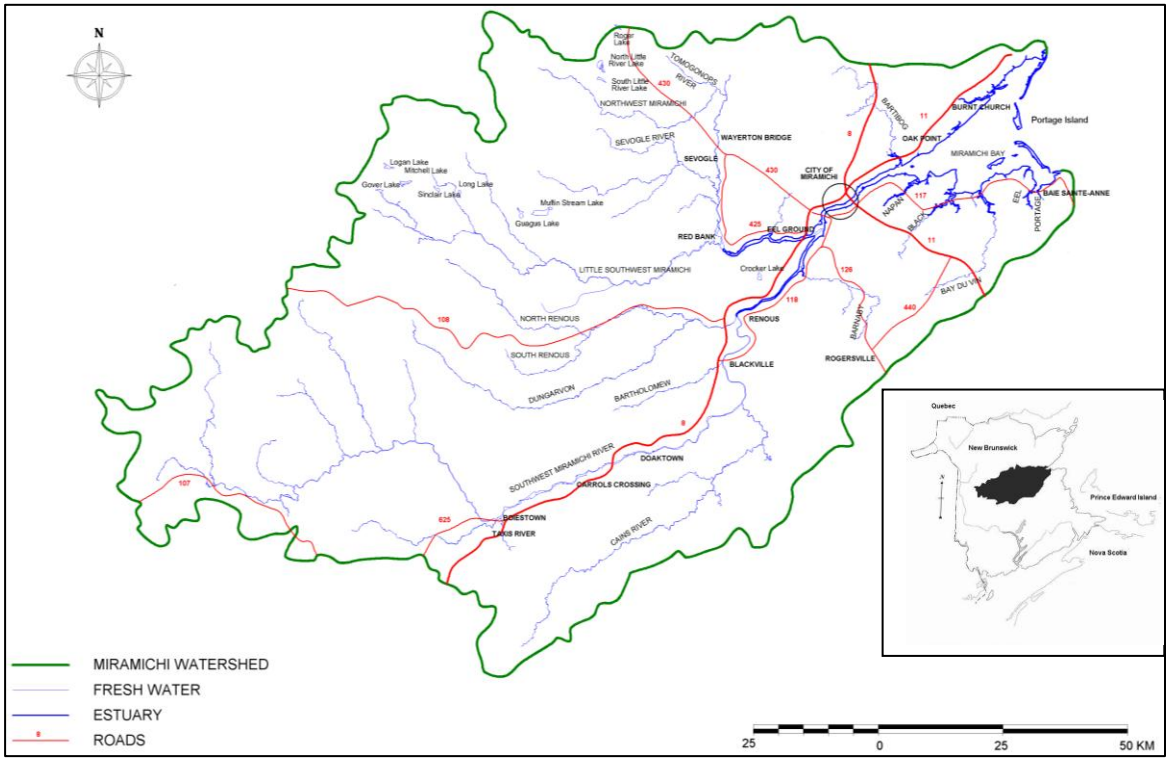
6.3.12 Miramichi River Environmental Enhancement Committee (MREAC)

The main tributaries of the Miramichi River, including the Northwest, Little Southwest, and Southwest, are set in a broad glacial river valley and flow from sources in the granitic and volcanic Miramichi Highlands in western New Brunswick, through the sands and silts of the Maritime Plain to its estuary on Miramichi Bay (Chiasson 1995) (Figure 6.12). The Miramichi River is the second largest river in the Canadian Maritimes and has no barriers to fish passage on its three main branches. It supports a wide variety of fish species both in its freshwater reaches and the brackish waters of the estuary which empties into the Northumberland Strait (Cunjak and Newbury 2005).

More than 90 per cent of the watershed is forested. Tree harvesting has taken place throughout the watershed since 1779. The focus has shifted from lumber export to timber harvesting to support the pulp and paper industry. While agriculture and gravel extraction are carried out in the lowlands, forestry and tourism are the major sources of income for watershed residents. The watershed includes the counties of Northumberland, Victoria, Carleton, York, Gloucester, and Sunbury. The population

is estimated to be between 50-55,000 people. The largest urban centre, Miramichi, is located on the upper estuary with a population of 18,129 people (Statistics Canada 2006). More than half of the population of the watershed is concentrated within 15 kilometres of the centre of the city (Miramichi River Environmental Assessment Committee and Atlantic Coastal Action Program 2007). The watershed is home to three First Nations bands, including Eel Ground, Burnt Church and Red Bank First Nations.

Figure 6.12. Miramichi River Watershed, New Brunswick



Source: Miramichi River Environmental Assessment Committee (*Used with Permission*).

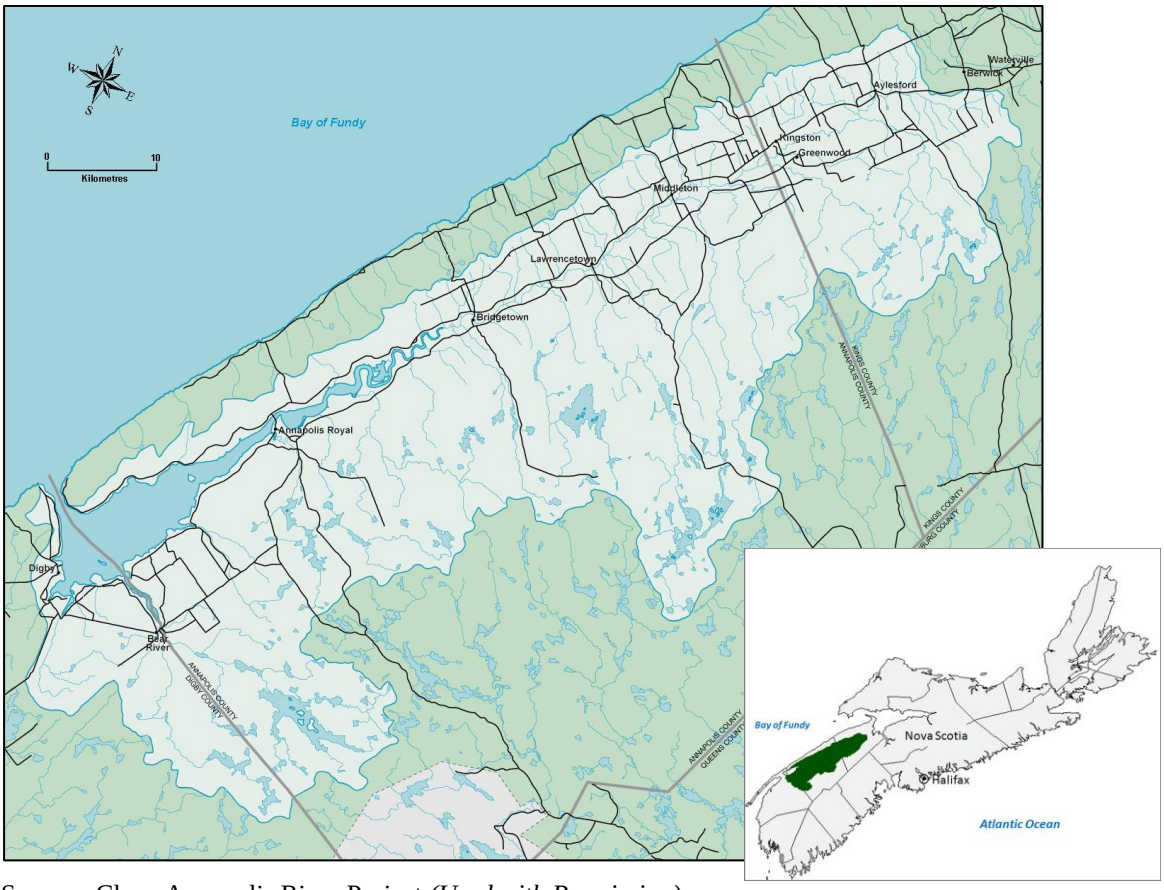
Key resource issues include declining Atlantic salmon stocks and tainted estuarine shellfish. Residual contamination from wide-spread spraying of forests with DDT in the 1950s to combat spruce bud worm, poorly regulated base-metal mining activities and discharges, and wood treatment and wood processing waste effluents continue to affect water quality and river sediments. Pollution from untreated sewage from failing on-site septic systems is also a concern (Miramichi River Environmental Assessment Committee and Atlantic Coastal Action Program 2007).

6.3.13 Clean Annapolis River Project (CARP)

The CARP focuses on resource issues within the Annapolis River watershed, an area of Nova Scotia drained by the Annapolis River from Caribou Bog near Aylesford, west to the river's mouth at the

Annapolis Basin plus other small watercourses that drain directly into the Annapolis Basin (Figure 6.13). The valley is characterized by fertile, well-draining soils protected by two igneous mountain ridges (Isaacman and Daborn 2006).

Figure 6.13. Annapolis River Watershed, Nova Scotia



Source: Clean Annapolis River Project *(Used with Permission)*

The watershed is predominantly agricultural, containing over one-third of the farmland in Nova Scotia, with a drainage area of 2 250 square kilometres (Sutherland 2003). The population of about 50,000 people (Sharpe 2010) is distributed among several small towns within Digby, Annapolis, and Kings Counties. The Bear River First Nations reserve is located southwest of Annapolis Royal.

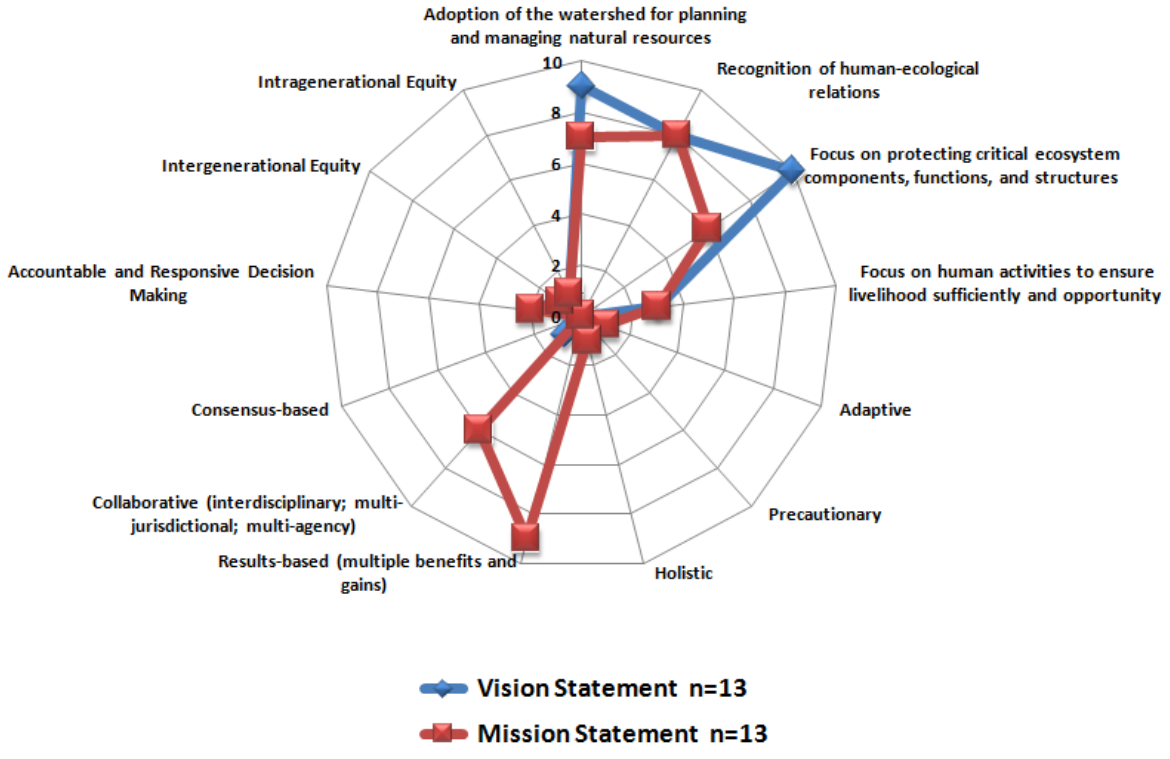
Several resource issues have attracted increasing public concern, including contaminated surface and ground water, periodic water shortages, poor air quality, degraded aquatic and terrestrial habitats, climate change, and coastal flooding (Sutherland 2003). Poor water quality is primarily due to inadequate agricultural practices, municipal sewage and industrial effluents, and deficient on-site septic system management (Timmer, de Loë, and Kreutzwiser 2007).

6.4 The Interests, Roles, and Functions of Case-Study Watershed Organizations

The interests, roles, and functions of case-study watershed organizations are communicated through a series of public statements which describe aspirations and activities in increasing detail. The most encompassing statement is usually about a desired future or vision for the watershed. A formal vision statement has been developed by every watershed organization studied. These statements have no legal authority, but are created to invoke a shared view or mental picture of what the watershed should be like in the future. Most statements either explicitly stress sustainability or broad watershed/ecosystem health couched within the context of human health and well-being as an ultimate ambition. Exceptions to this approach are the visions by the Grand River Conservation Authority, Muskoka Watershed Council and the Upper Thames River Conservation Authority which emphasize the health of the natural system, without reference to the needs or well-being of humans.

To garner broad interest and commitment to action, watershed vision statements are often crafted with extensive public input, recognizing that sustainability and/or watershed health are influenced by all stakeholders and collective goals and complementary actions are essential to these ends. A comparison of the 13 vision statements to the management principles identified in Chapter 2 (Table 2.4) reveals that while vision statements provide a sweeping portrait of the watershed to capture collective aspirations, they do not specifically single out management principles (Figure 6.14).

Figure 6.14. Vision and Mission Statements Compared to Alternative Management Principles



The mission of the case-study watershed organizations is often framed within the context of their terms of reference or mandates under legislation or as an incorporated society. As with the vision statements, the protection and improvement of environmental conditions for the public good is a common thrust among all of the mission statements. However, mission statements more specifically address how the watershed organizations will conduct themselves and/or state the broad aims and activities of the organization. These statements tend to articulate a mix of specific strategic and tactical intentions in support of the vision statement. These intentions most often stress collaboration with partners and tangible goals to benefit society (Figure 6.14). Table 6.3 provides an overview of the vision and mission statements of the case-study watershed organizations.

Institutional mandates and goals are ensconced in legislation, partnership agreements, or have been developed by the watershed organization (Table 6.4). Specific objectives which support these mandates and goals provide direction and focus for the programs and services offered and are described in Appendix E.1. Regardless of the nature and scope of the activities of the watershed organization, each strives to champion the watershed vision by adopting multiple responsibilities. While the nature and extent of these activities vary, each watershed organization assumes management, facilitation, coordination, and educational roles, recognizing that progress towards the vision must be a shared venture among all stakeholders. Even so, some frustration is expressed by informants with respect to the limitations that hamper the ability of the watershed organization to carry out strategic actions. In the words of one informant (Informant #21, 2009),

> Many individual projects are very successful, but they tend to be reactive. More to the point they tend to be followed if funds are available (this is the nature of the operation).

Table 6.5 lists the primary functions of the case-study watershed organizations and demonstrates the diversity and scope of their respective roles. These functions are not mutually exclusive. Activities such as land acquisition, ecological restoration, administration of regulations, and community stewardship and education are all management tools that can be used simultaneously to protect and restore vulnerable ecological landscapes. In addition, certain management activities are multipurpose. For example, some conservation authorities control river flows to reduce flood potential, maintain and/or improve water quality, augment low summer flows, and protect aquatic habitat.

Table 6.3. Vision and Mission Statements of Case-Study Watersheds

Watershed Organization	Vision	Mission
FBC	A place where social well-being is supported by a vibrant economy and sustained by a healthy environment.	To promote and monitor the implementation of the Charter for Sustainability by advancing sustainability in British Columbia with a geographic focus on the Fraser River Basin.
NSWA	The North Saskatchewan River basin is a watershed in which ecological integrity is the foundation for environmental, cultural, social and economic decision making. Actions taken and policies implemented result in the wise use and management of the North Saskatchewan River watershed in Alberta.	To protect and improve water quality, water quantity and the health of our watershed by: seeking, developing and sharing knowledge; facilitating partnerships and collaborative planning; and working in an adaptive management process.
BRBC	The Bow River Basin is conserved and protected as a fragile and unique resource and recognized as our lifeline. Multiple uses are balanced, ensuring the needs of all stakeholders are met, while maintaining a healthy ecosystem.	BRBC is dedicated to conducting activities for the improvement and protection of the waters of the Bow River Basin, considering: • riparian zones; • aquatic ecosystems; • quality and quantity of water; and, • effects of land use on surface and groundwater.
MVA	Vision (from 100 Year Conceptual Plan): • spine is the river; • base is the natural system; • broad concept is health and fit; • principle is access to and along the river; • theme is linkage; • operational model is one of links and nodes; • parts are the dreams and realities passed down by the pioneers and the forefathers, the perceived and stated needs of the people today and the observed needs and experiences of the project team; • key is balance; and, • process links the creativity of people and the dynamics of time to the long-range potentials and options.	To ensure a healthy and vibrant river valley, with a balance between human use and conservation by providing leadership in the management of its resources, promoting understanding, conservation and beneficial use of the valley, and undertaking programs and projects in river valley development and conservation for the benefit of present and future generations
MWC	Muskoka Watershed Council Champions Watershed Health.	MWC wants to preserve and enhance the air, water and terrestrial ecosystems of the area's watersheds for the environmental, health, economic, spiritual and intrinsic values they provide.
UTRCA	Inspiring a Healthy Environment.	Dedicated to achieving a healthy environment on behalf of the watershed municipalities through leadership, expertise, education and community collaboration to: protect life and property from flood and erosion; ensure a sustainable water supply; protect and enhance water quality; preserve and manage natural areas; and provide outdoor recreational opportunities.

Table 6.3 (cont'd). Vision and Mission Statements of Case-Study Watershed Organizations

Watershed Organization	Vision	Mission
GRCA	A healthy and sustainable natural environment in the Grand River watershed.	• we will develop and implement programs, directly or with our partners, to improve water quality, reduce flood damages, maintain a reliable water supply, facilitate watershed planning, protect natural areas and biodiversity, and provide environmental education; • we will be an environmentally responsible provider of outdoor recreation opportunities; and, • we will maintain a responsive, innovative and accountable organization.
CVC	An environmentally healthy Credit River watershed for present and future generations.	To improve the quality of life of watershed residents by delivering cost effective programs which: protect life and property from the hazards of flood and erosion; direct the use of watershed natural resources for the betterment of the community; and enhance watershed natural resources and their appreciation.
HWA	To protect and enhance the Humber River watershed as a vital and healthy ecosystem where we live, work, and play in harmony with the natural environment.	• to implement "Legacy: A Strategy for a Healthy Humber" and to monitor results; • to help achieve the TRCA's vision for a Living City - a healthy, attractive, sustainable urban region extending into the 22nd century; and, • to periodically produce a report card to describe the condition of the Humber River watershed.
DWRC	The quality of life on Earth is being determined in the rapidly expanding city regions. We envision the future Don as a revitalized urban river, flowing with life-sustaining water through regenerated natural habitats and human communities, from its headwater tributaries to the mouth of the Don River and into the receiving waters of Lake Ontario. We envision the watershed as an integral contributor to the "Living City", where human settlement can flourish forever as part of nature's beauty and diversity.	• to implement "Forty Steps to a New Don" and to act as a vital link between governments, interested citizens and members of the general public; • to help achieve the TRCA's vision for a Living City, - a healthy, attractive, sustainable urban region extending into the 22nd century; and, • to periodically produce a report card to describe the condition of the Don River watershed.
COVABAR	The decision-making process that links scientific knowledge of ecological relationships with the socio-political values of a (given) community with long-term/ongoing respect for the natural equilibrium of a particular ecosystem (translation).	COVABAR is a community-based, non-profit organization that promotes sustainability through integrated watershed management.
MREAC	MREAC is "a community based multi-stakeholder organization" dedicated to the continual improvement of the environmental quality of the Miramichi River ecosystem with emphasis on the Miramichi watershed.	Same as vision.
CARP	An ecologically healthy Annapolis River watershed.	To restore and protect the ecological health of the Annapolis River watershed through science, leadership and community engagement.

Table 6.4. Broad Mandate and Goals of Case-Study Watershed Organizations

Watershed Organization	Stated Mandate and/or Broad Goals
FBC	FBC goals are to (1) be instrumental in solving complex, inter-jurisdictional sustainability issues, (2) be a catalyst and educator, (3) assume an impartial role as convener and facilitator of inclusive and constructive dialogue, and (4) measure and report on progress towards sustainability in the Fraser Basin.
NSWA	NSWA goals are to (1) complete an Integrated Watershed Management Plan (IWMP) for the North Saskatchewan River (2) implement the Vermilion River Sub-Watershed Management Project, and (3) provide ongoing educational, communications and information exchange opportunities for watershed stakeholders NWSA goals as a Watershed Planning and Advisory Committee (WPAC) are to (1) prepare a State of the Watershed Report, (2) prepare an Integrated Watershed Management Plan, and (3) develop a collaborative approach to watershed planning.
BRBC	BRBC participates in or promotes activities that will help the Bow River Basin achieve the highest water quality of any highly populated river basin in Canada. It works with partners in establishing the Bow River Basin as the best managed watershed in the world. As a WPAC, the BRBC has the same goals as the NSWA.
MVA	MVA goals are to (1) protect the natural and heritage resources of the Meewasin Valley, (2) develop and encourage projects that enhance these resources and add to the quality of life in Saskatoon; and (3) increase awareness and understanding of the resources in the valley.
MWC	MWC goals are to sustain and enhance the air, water and terrestrial ecosystems of the watersheds of Muskoka for the environmental, health, economic, spiritual and intrinsic values they provide.
UTRCA	UTRCA goals are to establish and undertake, …, a program designed to further the conservation, restoration, development and management of natural resources other than gas, oil, coal and minerals (Conservation Authorities Act, R.S.O. 1990, c. C.27, s. 20).
GRCA	Same as UTRCA.
CVC	Same as UTRCA.
HWA	HWA goals are to protect, restore and celebrate the Humber River watershed and to assist TRCA and its partner agencies.
DWRC	DWRC goals are to protect, regenerate and celebrate the Don River watershed and to assist TRCA and its partner agencies.
COVABAR	COVABAR goals are to inform, educate and motivate collaborative actions to improve watershed health and quality of life. In addition, COVABAR promotes public access to watercourses for recreation and tourism (translation).
MREAC	MREAC focuses on science-based research and environmental projects in order to protect and manage the Miramichi River watershed, promoting a positive attitude and developing an awareness among the region's citizens that quality of life is intrinsically linked to environment.
CARP	CARP carries out activities based on a four-pronged approach which focuses on action projects, public outreach, problem identification, and environmental planning initiatives.

Table 6.5. Primary Functions of Case-Study Watershed Organizations

Watershed Organization / Primary Functions	FBC	NSWA	BRBC	MVA	MWC	UTRCA	GRCA	CVC	HWA	DWRC	COVABAR	MREAC	CARP
Watershed Planning		✓	✓	✓		✓	✓	✓			✓	✓	✓
Monitoring and Data Management					✓	✓	✓	✓				✓	✓
Watershed Reporting	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Municipal Plan Review						✓	✓	✓				✓	
Land Acquisition (Wetlands, Environmentally Sensitive Lands)				✓		✓	✓	✓					
Project Management and Coordination	✓			✓		✓	✓	✓				✓	
Water Management (Quality and Quantity)						✓	✓	✓					
Ecological Restoration				✓		✓	✓	✓					
Community Stewardship	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Administration of Regulations				✓		✓	✓	✓					
Public Education and Community Outreach	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Volunteer Training (Citizen Monitoring)													✓
Advocacy									✓	✓			
Mapping				✓		✓	✓	✓			✓	✓	✓
Research				✓		✓	✓	✓			✓	✓	✓
Advisory Services (to other agencies)	✓	✓	✓			✓	✓	✓			✓		
Advisory Services (to parent organization)					✓				✓	✓			
Capital Development/Riverbank Improvement				✓									
Operation of Public Parks						✓	✓	✓					
Provision of Outdoor Recreational Opportunities				✓		✓	✓	✓					
Conflict Resolution Services	✓												
Catalyst and Facilitator	✓				✓								

Three main functions are shared among all case-study watershed organizations. These are (1) reporting progress towards watershed health and/or sustainability, (2) community stewardship, and (3) public education and community outreach to build general awareness and support.

The BRBC, NSWA, and COVABAR have official watershed planning functions under Alberta's Water for Life Strategy and Québec's Water Policy, even though implementation of the plans may be shared among interested stakeholders. The Water for Life Strategy identifies three goals: (1) a safe, secure drinking water supply, (2) healthy aquatic ecosystems, and (3) reliable, quality water supplies

for a sustainable economy (Government of Alberta 2008). The BRBC and NSWA, in their role as Watershed Planning Advisory Committees, are required to conduct basin planning and evaluation in coordination with the Province. They are responsible for producing state of the basin reports, providing recommendations in watershed management plans, and presenting issues to the Alberta Water Council.[76] In Québec, watershed groups that have status as Watershed Organizations are responsible for preparing a Master Plan for Water (MPW) using a participatory approach and signing agreements with partners for implementation. They are also expected to participate in implementing integrated management of the St. Lawrence River. Conservation authorities are empowered to undertake watershed planning under the Conservation Authorities Act. The MVA is enabled by legislation to oversee the Meewasin Valley development plan. The maritime ACAP organizations are required to undertake a comprehensive environmental management plan (CEMP).

The functions of the FBC are unique. Four directions guide activities: (1) understanding sustainability, (2) caring for ecosystems, (3) strengthening communities, and (4) improving decision making. Activities include maintaining and updating the Sustainability Charter, developing action plans, monitoring and reporting on progress towards sustainability, facilitating coordination and integration of regional and local activities, facilitating the resolution of inter-jurisdictional and multiparty conflicts, and promoting education and awareness of sustainability in the Fraser Basin.

The Fraser, Thames, Grand, and Humber Rivers, and a small portion of the North Saskatchewan River within Banff National Park, are designated Canadian Heritage Rivers.[77] As part of the requirement for maintaining the heritage river status, an annual report must be submitted to the Canadian Heritage Rivers Board (CHRB) highlighting major changes to the human heritage and/or natural resources which support the designation. Every ten years, a more detailed monitoring report must be tabled with the CHRB. The UTRCA, GRCA, and TRCA have additional responsibilities for monitoring heritage features and submitting reports through the Province of Ontario to the CHRB. In British Columbia, the provincial government is responsible to generating annual reports. Parks Canada is the lead agency for reporting on the status of the North Saskatchewan River reach.

[76] The Alberta Water Council (AWC) is a consensus-based, multi-stakeholder partnership with the primary role to monitor implementation of the Water for Life Strategy. Membership consists of representatives from industry, NGOs, six provincial ministries and agencies, and other governments. Specific responsibilities of the AWC include investigating and reporting on existing and emerging water issues, setting priorities for water research, and spearheading ongoing public consultation processes. Alberta Environment supports the activities of the AWC by providing a full-time secretariat and dedicated project teams (Government of Alberta 2008).

[77] The Canadian Heritage Rivers System (CHRS) was established in 1984 by the federal, provincial and territorial governments to conserve and protect the best examples of Canada's river heritage, to give them national recognition, and to encourage the public to enjoy and appreciate them.

Delivery of on-the-ground management of natural resources in the watershed varies. Most watershed organizations included in this study implement watershed management by actively supporting local stewardship activities primarily at the community level as resources and capacity allow. Through stakeholder engagement (e.g., community events, volunteer training, watershed awards, presentations), they also encourage members, partners, and the public to undertake actions in support of the vision, broad goals, objectives, and/or targets established for the watershed.

Under the Conservation Authorities Act, conservation authorities have mandates giving them broad responsibilities for managing natural resources on a watershed basis. In addition to participating in and supporting community stewardship activities, activities include (1) data collection and assessment, (2) flood forecasting and warning, (3) construction, operation, and maintenance of water control infrastructure, (4) implementation of watershed-wide forestry and fisheries programs, (5) land acquisition, (6) outdoor education, and (7) public land management. Conservation authorities provide environmental planning and advisory services to municipalities and other agencies and also administer regulations to control development and works in areas where natural hazards are known to occur or could be created through the development.[78]

Under the terms of the Meewasin Valley Authority Act, the MVA also plays a regulatory role in the development process within its area of jurisdiction. Approval from the MVA is required for any development in a conservation zone on public lands (except the expansion of a water treatment plant or a sewage treatment facility) or improvements worth over $25,000 on private lands, as well as any improvement in the river channel or shoreline (Meewasin Valley Authority n.d.).

6.4.1 Administrative and Financial Arrangements

The administrative structure for each watershed organization is different, even among conservation authorities set up under the same legislation. Each operates under a distinct set of by-laws and administrative procedures. Several watershed organizations have an open membership[79] representing a broad range of community interests and an Executive Committee, elected by the members for a specified time frame (e.g., BRBC, CARP, MREAC, NSWA). Others have more formal membership arrangements consisting of a Board of Directors, either elected or appointed (e.g., CVC, FBC, GRCA, MWC, MVA, UTRCA). COVABAR solicits members from a wide range of organizations

[78] All conservation authorities administer an Ontario Regulation called the Development, Interference with Wetlands and Alterations to Shorelines and Watercourses Regulation. This regulation is permissive. Proposals for works and activities within river or stream valleys, wetlands, watercourses, and adjacent areas require permits issued under the terms and conditions of the regulation. Permits may be granted where, in the opinion of the conservation authority, the control of flooding, pollution, erosion, conservation of land, and dynamic beaches is not affected (Province of Ontario 2004).

[79] An open membership means that anyone can join the organization, usually by paying a membership fee.

representing different communities of interest within the watershed.[80] Potential members are nominated by these organizations and formally approved by the membership at the annual general meeting.

The HWA and the DWRC have a unique administrative arrangement as subcommittees of a parent watershed organization – the Toronto and Region Conservation Authority (TRCA). Members are solicited from the general public as well as from member municipalities. Expressions of interest from a broad range of sectors are invited prior to the commencement of each new two-year term. Potential members submit an application. Committee members are then selected by the TRCA. The committees are guided by a terms of reference approved by the conservation authority.

Regardless of the process for selecting members, the operating procedures of many watershed organizations in Canada encourage a blend of sectoral (i.e., communities of interest) and government representation. Exceptions include Ontario's conservation authorities and the MVA. Members of these organizations are appointed by participating municipalities or government agencies.[81] The case-study organizations typically have a number of sub-committees or ad hoc committees created to advance particular projects or to oversee finances and personnel matters. The term of office for members serving on the Board of Directors varies considerably among the case-study watershed organizations and ranges from one to four years. The MWC and MREAC have no set terms of office for Board members.

The range of programs and services offered by a watershed organization depends on the level of funding, administrative capacity, staff expertise, and membership support. Annual funding to the case-study organizations ranges from about $185,000 (MREAC) and a staff complement of two people to over $31 million (GRCA) and a staff complement of 125 people. Case-study watershed organizations in Alberta, Québec, and in the Atlantic Provinces, have a small staff, limited resources, and rely heavily on a network of volunteers and the active participation of members and partners to implement programs and projects.

Regardless of the level of resources available, key administrative issues identified by respective chiefs of staff during the interviews generally relate to the challenges associated with insufficient funding, administrative capacity, and political will. These constraints limit the range of actions that can be undertaken to deal with key resource issues. This concern is captured in the words of one

[80] Communities of interest typically include provincial and federal agencies, municipalities, academia, community groups, business, First Nations, and citizens-at-large.

[81] Most municipalities in Ontario appoint elected officials to their conservation authority board. However, municipalities have discretion to appoint community representatives.

informant (Informant #8, 2009) who stated that,

> Some key issues include the lack of stable funding (the provincial share is declining and funding changes from year to year), lack of moral support, lack of resources and staff capacity, and difficulty interfacing with the provincial government because there are several departments and ministries that have to be dealt with and provincial ministries are not integrated. There is also a need for cross-ministry programs to integrate planning initiatives.

Table 6.6 provides an overall synopsis of the administrative and financial arrangements for each case-study watershed organization.

6.4.2 Watershed Planning

The majority of case-study watershed organizations have developed at least one watershed or strategic plan. Organizations in existence for a number of decades have completed several editions of plans. BRBC, COVABAR, and NSWA are in the midst of developing their first integrated watershed management plan supported by State of the Watershed reports already completed. Typically, these plans fulfill multi-purpose roles. Common thrusts include (1) identification of issues, (2) development of priorities for action which protect and restore environmental features and functions, and (3) cultivation of a collective mindset towards sharing responsibility and local activities in support of community stewardship.

In contrast, FBC and MWC have not produced a watershed management plan because their primary roles are to monitor and report on watershed health and sustainability. The FBC's Charter for Sustainability endorses 12 principles and encourages agencies and stakeholders to voluntarily adopt and actively incorporate them into their business practices and decision-making processes. Nonetheless, FBC does participate in specific resource planning initiatives at the provincial, basin, and community levels. Examples of initiatives include flood hazard and fisheries management in the Fraser Basin, smart planning for communities, energy and emissions, and invasive plants.

The approval processes for formalizing watershed plans vary. Plans are generally endorsed by the Board of Directors for each watershed organization. In many cases, the watershed organization invites partners to voluntarily accept or support the plan through a signatory process. Implementation of these plans is not legislated, rather it relies on the good will and commitment of partner organizations. This was the experience in the Grand River watershed. In 1982, the Grand River Basin Water Management Study, a 4-year study, was completed. This 1.6 million dollar project was funded by the Province of Ontario. Key partners included the GRCA and 5 provincial ministries.

Table 6.6. Administrative and Financial Arrangements for Case-Study Watershed Organizations

Watershed Organization	Membership	Size and Composition of Board of Directors	Term of Office	Full-Time Staff Complement	Revenue/Expenses Over 5 Years
FBC	**Appointed Membership:** 36 members representing regional districts, federal and provincial agencies; First Nations language groups; non-government representatives from five geographic regions and dimensions of sustainability (economic, social, environmental) and an impartial Chair. Appointments are made by the Fraser Basin Council Society.	36 directors. An operations committee functions as an executive committee.	**3 years** with renewable terms. Terms are staggered.	37	2005 - Revenue: $2,832,460; Expenses: $2,555,324 2006 - Revenue: $3,915,181; Expenses: $3,797,138 2007 - Revenue: $4,332,583; Expenses: $4,480,026 2008 - Revenue: $4,684,108; Expenses: $4,722,178 2009 - Revenue: $6,018,193; Expenses: $6,639,137
NSWA	**Open Membership:** 176 members (March 12, 2010) representing communities of interest.	Maximum 18 executive directors elected by the members to achieve a balance among communities of interest.	**2 years.** The terms are staggered.	6	2004 - Revenue: $289,999; Expenses: $221,908 2005 - Revenue: $430,260; Expenses: $365,590 2006 - Revenue: $447,285; Expenses: $383,249 2007 - Revenue: $338,014; Expenses: $387,051 2008 - Revenue: $733,492; Expenses: $572,787
BRBC	**Open Membership:** 170 members (March 2008) representing communities of interest.	12 directors elected by the membership. The treasurer is appointed and there is opportunity for two more appointments.	**2 years.** The terms are staggered (except appointed board members (up to three), which is one year).	2	2005 - Revenue: $391,721; Expenses: $376,901 2006 - Revenue: $573,934; Expenses: $512,319 2007 - Revenue: $678,798; Expenses: $612,889 2008 - Revenue: $909,187; Expenses: $813,774 2009 - Revenue: $640,478; Expenses: $505,177
MWC	**Appointed Membership:** Varies between 20-30 representing communities of interest.	Maximum 12 executive committee members composed of four representatives from The District Municipality of Muskoka, four representatives from the Muskoka Heritage Foundation, the Chair of the Council, and the chairs of key subcommittees.	**1-4 years**, depending on the organization. Members may be reappointed for consecutive terms by their respective agencies and organizations.	2	Muskoka Watershed Council does not have a budget. Staff salaries are part of the District Planning budget. Office and operating supplies are part of the Heritage Foundation budget. Program dollars are acquired through third party funding.
MVA	**Appointed Membership:** 3 member organizations: Province of Saskatchewan, City of Saskatoon and University of Saskatchewan.	12 directors; 4 members appointed by the Saskatchewan Lieutenant Governor in Council; 4 members appointed by Saskatoon City Council; 4 members appointed by the Board of Governors, University of Saskatchewan.	**No set term**	23	2005 - Revenue: $5,334,379; Expenses: $5,395,209 2006 - Revenue: $4,169,261; Expenses: $4,656,305 2007 - Revenue: $4,400,021; Expenses: $4,526,047 2008 - Revenue: $5,795,906; Expenses: $5,384,433 2009 - Revenue: $3,586,141; Expenses: $3,267,925
UTRCA	**Appointed Membership:** 17 member municipalities	15 directors appointed from 17 participating municipalities.	**4 years** to coincide with municipal elections	72	Operating Budget: 2005 - $ 9.43 M 2006 - $10.27 M 2007 - $10.32 M 2008 - $10.68 M 2009 - $11.80 M

Table 6.6 (cont'). Administrative and Financial Arrangements for Case-Study Watershed Organizations

Watershed Organization	Membership	Size and Composition of Board of Directors	Term of Office	Full-Time Staff Complement	Revenue/Expenses
GRCA	**Appointed Membership:** 34 member municipalities	26 directors appointed by 34 participating municipalities.	**4 years** to coincide with municipal elections	125	2005 - Revenue: $21,967,844; Expenses: $21,049,227 2006 - Revenue: $23,624,366; Expenses: $21,706,498 2007 - Revenue: $23,424,736; Expenses: $23,321,421 2008 - Revenue: $27,801,589; Expenses: $28,328,330 2009 – Operating Budget: $31.4 M
CVC	**Appointed Membership:** 11 member municipalities	12 directors appointed by 11 participating municipalities.	**4 years** to coincide with municipal elections	110	Operating Budget: 2005 - $ 8.35 M 2006 - $10.1 M 2007 - $12.0 M 2008 - $23.7 M 2009 - $27.3 M
HWA	**Selected Membership:** Approximately 40 members representing communities of interest.	Chair's Committee including Chair, Vice-Chair, working committee chairs, and other key members, as well as appropriate TRCA support staff.	**2 years** with an option to renew for another two years to coincide with municipal elections.	TRCA provides a secretariat (one full time equivalent, secretarial support, access to TRCA technical staff).	HWA does not have a budget. TRCA provides funding for 2 major events each year, and financial support for developing and publishing a report card.
DWRC	**Selected Membership:** Approximately 40 members representing communities of interest.	Chair's Committee including Chair, Vice-Chair, two working committee chairs, and other key members, as well as appropriate TRCA support staff.	**2 years** with an option to renew for another two years to coincide with municipal elections.	TRCA provides a secretariat (one full time equivalent, secretarial support, access to TRCA technical staff).	DWRC does not have a budget. TRCA provides funding for 2 major events each year, and financial support for developing and publishing a report card.
COVABAR	**Nominated Membership:** 105 general members; 80 Members of the Le Conseil de concertation (C.C.) nominated by communities of interest and approved at the Annual General Meeting; 8 observers from the provincial and federal agencies.	14 directors elected by members (Le Conseil d'administration (C.A.)); 5 executive committee members (Le Conseil exécutif (C.E.)).	**2 years.** The terms are staggered so that 50% of the members' term begin concurrently.	4	2005 - Revenue: $172,612; Expenses: $189,855 2006 - Revenue: $245,059; Expenses: $261,343 2007 - Revenue: $219,218; Expenses: $256,884 2008 - Revenue: $411,085; Expenses: $352,006 2009 - Revenue: $387,296; Expenses: $343,639
MREAC	**Open Membership:** About 40 members representing communities of interest.	5 members on an executive committee.	**No set term**	2	2005 - Revenue: $205,169; Expenses: $204,100 2006 - Revenue: $195,504; Expenses: $203,477 2007 - Revenue: $237,189; Expenses: $220,611 2008 - Revenue: $184,987; Expenses: $175,911 2009 - Revenue: $171,611; Expenses: $151,040
CARP	**Open Membership:** About 100 members representing communities of interest.	Maximum 15 directors (minimum 5) elected by the membership representing a diversity of geographic and sectoral interests, plus one non-voting member each from Environment Canada and Nova Scotia Environment.	**3 years**	7	2005 - Revenue: $407,841; Expenses: $442,122 2006 - Revenue: $514,409; Expenses: $516,898 2007 - Revenue: $445,194; Expenses: $444,686 2008 - Revenue: $606,802; Expenses: $589,172 2009 - Revenue: $579,339; Expenses: $568,662

While there was no formal mechanism for approval, over 84 per cent of the recommendations were carried out within 10 years. The successful implementation of most of the recommendations by the mid-1990s was attributed to the fact that the individuals responsible for implementing recommendations were part of the planning process. Implementation of recommendations declined in the late 1990s as the people involved either retired or moved on to different positions or agencies. (Conservation Ontario 2003). In other cases, where the plan has been developed as a legislative requirement, the approval process is more official. For example, the watershed plan produced by the TRCA for the Humber and Don River watersheds fulfill requirements legislated by the Oak Ridges Moraine Conservation Plan. Ontario Regulation 140/02 (s. 24 (2)) requires that the "objectives and requirements of each watershed plan shall be incorporated into the municipality's official plan" (Province of Ontario 2002).

Table 6.7 provides an overview of the watershed management plans currently in use or in progress and where relevant, provides a brief chronology of noteworthy predecessors. The approval mechanisms for the plan are also described.

The planning process embraced by all case-study watershed organizations is based on the dual premise of inclusivity and collaborative decision making. The participation techniques used for eliciting public engagement typically include public open houses, focus groups, surveys, written submissions, and other consultative mechanisms. Often, interested stakeholders directly assist in the development of the plan by participating on ad hoc, advisory committees set up by the watershed organization.

6.5 Watershed Report Cards

One criterion for selecting case-study watershed organizations was that at least one report card or indicator-based watershed report had been completed. The case-study organizations have produced an array of such reports, prompted by a range of circumstances.[82] These reports vary in format and include not only watershed report cards that provide an extensive list of ranked indicators, but also state of the watershed reports and watershed characterization reports.[83]

[82] A total of 43 watershed report cards have been produced by the case-study watershed organizations. For the purpose of this study, 39 were reviewed. The two reports produced in 1995 and 1996 by the forerunner of the Fraser Basin Council, the Fraser Basin Management Board, are not included in this study. This is because the process and methods used to develop these reports were not adopted by the Fraser Basin Council for developing its Sustainability Snapshots. The CARP released its annual Report Card and the MWC released its fourth Report Card in 2010, after the report card analysis was completed.

[83] Watershed characterization reports are similar to state of the watershed reports. They provide a description of the physical and human attributes of the watershed including hydrology, soils, topography, geology, land cover, population, and land use and identification of key issues.

Table 6.7. Key Watershed Planning Initiatives of Case-study Watershed Organizations

Watershed Organization	Key Watershed Plans	Description / Goals of Plans[a]	Mechanism for Adoption / Implementation
FBC	**Strategic Plan for the Fraser Basin Management Program, 1993-98** **Charter for Sustainability, 1997** **FBC Strategic Plan, 2006-2011**	The Charter for Sustainability is not a management plan. The Charter promotes a collaborative process of decision making and establishes 12 sustainability principles: (1) mutual dependence, (2) accountability, (3) equity, (4) integration, (5) adaptive approaches, (6) coordinated and cooperative efforts, (7) open and informed decision making, (8) exercising caution, (9) managing uncertainty, (10) recognition (of existing rights, agreements and obligations), (11) aboriginal rights and title, and (12) transition takes time (Fraser Basin Council 1997: 4). The Charter embraces two sets of values. The first set includes: (1) understanding sustainability, (2) caring for ecosystems, (3) strengthening communities, and (4) improving decision-making. The second set establishes how people interact with each other in their collective efforts to achieve sustainability and includes: (1) understanding and respecting the opinions of others, (2) accepting all members as peers, (3) valuing balance over extreme positions, (4) taking action based on consensus, and (5) creating strong trust among members. FBC strategic plans build on the 12 principles.	The Charter was signed by representatives from the federal, provincial, and local governments as well as First Nations. Implementation occurs through the voluntary adoption of strategies by stakeholders.
NSWA	NSWA is developing the first integrated watershed management plan (IWMP) for the North Saskatchewan River Basin.	A Terms of Reference for the watershed management plan was developed in 2005, recognizing linkages with other provincial planning initiatives, directives, and legislation. The objectives of the IWMP are to (1) develop strategies to sustain drinking water, aquatic ecosystems, and economies, (2) identify land use practices that impact water resources and develop strategies to reduce negative effects, (3) identify critical knowledge gaps and identify agencies or programs to fill those gaps, and (4) develop the plan in consultation with stakeholders and the public in order to meet economic, social, health and environmental needs (AMEC Earth & Environmental 2005: 21).	Following public review, the IWMP will be approved by the NSWA Board of Directors. The NSWA will submit the approved IWMP to the Province. Provincial approval may apply only to those portions of the plan that address the Water Act. In 2009, the Province passed the Alberta Land Stewardship Act. This Act calls for Regional Land Use Plans, with boundaries similar to the Watershed Planning and Advisory Committees (WPACs). The relationship between the two planning processes has not been formally defined.
BRBC	**DRAFT - Bow Basin Watershed Management Plan (BBWMP)** **Phase One: Water Quality, 2008**	The BBWMP goals are to (1) protect and enhance water quality, (2) recommend changes that will affect education and awareness programs, public policy, practice and regulation, and (3) serve as a catalyst for proactive action by land, water and resource decision makers (Bow River Basin Council 2007: 1). The watershed management planning process is led by the BRBC through a BBWMP collaborative Steering Committee involving key partners. The BBWMP will be carried out in 4 phases and employ an environmental performance management system based on the identification of outcomes, indicators, targets, thresholds, strategies for implementation, and associated timelines for actions, monitoring and evaluation. The BBWMP will build on the South Saskatchewan River Water Management Plan.	The BRBC Board, the Southern Regional Director of Alberta Environment, and Calgary approved Phase 1 in 2008. By May 2008, 31 of 35 identified stakeholders had approved the plan; the remaining 4 approvals are pending. Partners/stakeholders are expected to prepare an Implementation Plan and make periodic progress reports.

Table 6.7 (cont'd). Key Watershed Planning Initiatives of the Case-Study Watershed Organizations

Watershed Organization	Key Watershed Plans	Description / Goals of Plans[a]	Mechanism for Adoption / Implementation
MVA	**The Meewasin Valley Project: 100-Year Conceptual Plan (1978)** **Five Year Action Plans (2003-2008)** **Development Plan and specific management plans.**	The 100-Year Conceptual Plan provides the context for all plans. The Development Plan consists of a Five-Year Action Plan and detailed site-specific plans. The Action Plan and is based on the State of the Valley Reports, public opinion polls, and an analysis of planning efforts in the valley. Principles which guide these plans are (1) resources and amenities should be accessible to everyone to use and enjoy year round insofar as financially possible and environmentally desirable, (2) recreation and other development should be balanced with natural and heritage resource conservation, (3) a diversity of activities should be provided in different settings to serve a variety of interests and needs, (4) significant natural and heritage resources should be preserved, and, (5) opportunities should be provided for individuals and groups to participate in the preparation of plans and decision making on matters, which directly affect them (Meewasin Valley Authority n.d.).	Plans are vetted through committees and project-specific public processes as established by the legislation. Depending on the level of the plan, it can become a legal document and part of the larger Development Plan. There is often a formal sign-off on the plans by the three partners. There is greater interest from the public in the planning for the Meewasin Valley. The MVA is taking an increasing leadership role in natural landscape protection and management.
MWC	A watershed plan has not been completed for the Muskoka watersheds.	MWA participates in and provides comments on planning initiatives in the area. The Ontario Ministry of Natural Resources has a plan for the Muskoka River watershed that deals with water levels and their impact on ecological values, recreational values, and hydro power. Several lake associations have developed lake management plans.	n/a
UTRCA	**Upper Thames Valley Conservation Report, 1952** **Water Management Study: Thames River Basin, 1975** **Watershed Management Plan Framework, in progress**	The Conservation Report investigates flood control, land use, forestry, wildlife and recreation, identifies resource issues and develops recommendations for action.[b] The Water Management Study documents sources and causes of pollution for the Thames River and suggests solutions. The development of an updated watershed management plan framework is in progress.	The Terms of Reference are approved by the UTRCA Board, municipalities, and participating stakeholders. The framework, including components, scale, update interval, and key audiences, will be approved by the UTRCA Board. Updates are the responsibility of the UTRCA. A governance model is proposed that promotes inclusion and responsibility for implementation.
GRCA	**Grand River Hydraulics Report, 1954, 1962** **A Review of Planning for the Grand River Watershed, 1971** **Grand River Basin Water Management Study (GRBWMS), 1982** **The Grand Strategy for Managing the Grand River as a Canadian Heritage River, 1994** **Grand River Fisheries Management Plan, 1998**	The Hydraulics Report identifies water issues and recommends remedial measures. A Review of Planning, a provincial study, considers alternative solutions to protecting water quality and securing new water sources. The GRBWMS, a multi-agency, multi-year $1.6 million study identifies issues relating to water quality, water supply, and flooding. The GRBWMS recommends a preferred approach to guide more than $180 million in investments (Grand River Conservation Authority 2008a: 4). The study includes 22 recommendations calling for action by the GRCA, municipalities and the Province. Other watershed-wide plans deal with the management of specific resources. In 2009, the GRCA began an update to the GRBWMS which will remain focused on water issues, but will look at new aspects such as the in-stream ecology and health of the river system, implications of climate change and new contaminants, new technologies, and a wider range of structural and non-structural adjustments. The update is expected to be completed in 2012.	GRBWMS was approved by the GRCA Board and submitted to the Management Committee of the Ontario Cabinet. The Grand Strategy was approved by the GRCA Board and accepted by the provincial and federal governments. Declarations of support were received from municipalities, agencies, and other stakeholders. Other watershed-wide plans received GRCA Board approval. The approval process for the GRBWMS update has not yet been determined.

Table 6.7 (cont'd). Key Watershed Planning Initiatives of the Case-Study Watershed Organizations

Watershed Organization	Key Watershed Plans	Description / Goals of Plans[a]	Mechanism for Adoption / Implementation
CVC	**Credit Valley Conservation Report, 1956** **Credit River Water Management Strategy Phase I (Water Quantity), 1990; Phase II (Water Quality), 1992** **Credit River Water Management Strategy Update (CRWMSU), 2007** **Numerous sub-watershed plans**	A key recommendation from the Water Management Strategy was the undertaking of sub-watershed plans. Plans have now been completed for most sub-watersheds. Other technical studies were carried out and a comprehensive monitoring program was initiated in 1999. The 2007 CRWMSU builds on previous initiatives and links water quality – quantity (surface and groundwater) with selected terrestrial management issues and considerations. The goal is to ensure abundant, clean, and safe water (Credit Valley Conservation 2007: 4). The CRWMSU is not a fully integrated Watershed Management Plan. Sub-watershed plans completed after 2007 address terrestrial and natural heritage systems in a more comprehensive way.	The CVC Board approved the CRWMSU. It was also endorsed by (most) municipalities through a Charter signed by the mayors of the member municipalities. Implementation is achieved through voluntary policy amendments to municipal official plans and CVC policy updates, and through ongoing stakeholder consultation and participation.
HWA	**Humber Valley Conservation Report, 1948** **Legacy: A Strategy for a Healthy Humber and A Call to Action (1997, Humber River Task Force)** **Humber River Watershed Plan Pathways to a Healthy Humber TRCA, 2008**	The 'legacy' strategy provides a watershed overview of the natural environment, society, and economy, sets 30 objectives, and recommends actions. The 2008 watershed plan builds on the 'legacy' strategy and provides strategies to protect and expand natural heritage systems, build sustainable communities, and enhance the regional open space system.[c] To achieve a healthy watershed, the goals are to (1) increase awareness of the watershed's resources, (2) protect the Humber River watershed as a continuing source of clean water, (3) celebrate, regenerate, and preserve our natural, historical, and cultural heritage, (4) increase community stewardship and take individual responsibility for the health of the Humber River, (5) establish linkages and promote partnerships among communities, (6) promote the watershed as a destination of choice for recreation and tourism, and (7) build a strong watershed economy based on ecological health (Toronto and Region Conservation Authority 2008: 9).	The 2008 watershed plan will go through additional public consultation, technical peer review, one-on-one presentations with local and regional municipal councillors, approval by HWA, approval by the TRCA Board, and request for approval-in-principle by local and regional municipal governments.
DWRC	**Don Valley Conservation Report, 1950** **Watershed Plan, 1980** **The Watershed Plan of the Metropolitan Toronto and Region Conservation Authority, 1986** **Forty Steps to a New Don, 1994** **Don River Watershed Plan, 2009**	Several watershed plans have been developed since the first Conservation Report. The 2009 watershed plan focuses on filling information gaps, recommends updated management strategies to guide land and water use decisions, establishes priorities for regeneration projects, and includes an implementation plan to guide municipal policy planning.[c] The watershed plan embeds three principles that build on the Forty Steps: (1) Protect what is healthy • headwaters, ground waters, watercourses; natural linkages, habitats and wildlife. (2) Regenerate what is degraded • re-establish the natural watercourse patterns; restore clean, life-sustaining water to the river; • nurture degraded habitats back to health; reconnect them and nearby human communities; • restore the Don's historical past and encourage activities that reflect cultural diversity; and, • require all projects to improve the health of the natural system. (3) Take responsibility for the Don • contribute to a healthy, sustainable natural environment in all daily activities; • help neighbours, governments, and businesses work together to regenerate the Don; and, • visit the Don and share enjoyment (Toronto and Region Conservation Authority 2009c: 2-1).	The 2009 watershed plan will go through additional public consultation, technical peer review, one-on-one presentations with local and regional councillors, approval by DWRC, and TRCA Board approval. Regional and local municipalities will be requested to approve the plan in principle.

Table 6.7 (cont'd). Key Watershed Planning Initiatives of the Case-Study Watershed Organizations

Watershed Organization	Key Watershed Plans	Description / Goals of Plans[a]	Mechanism for Adoption / Implementation
COVABAR	A watershed plan has not been completed. A planning process for developing a Master Plan for Water has been initiated.	As a watershed organizations recognized under the Quebec Water Policy, COVABAR must: (1) prepare a Master Plan for Water using a participatory approach, (2) sign watershed agreements with stakeholders for actions, (3) update the plan, (4) inform and educate watershed residents, and (5) participate in the integrated management of the St. Lawrence River. The plan will identify issues, determine targets and indicators, and include an action plan. Two watershed profile reports provide background information. The Master Plan for Water will adhere to the principles established under the Quebec Water Policy including: (1) recognizing water as a collective heritage, (2) providing high-quality, affordable drinking water, (3) exercising precaution, (4) making users accountable, (5) protecting public health and aquatic ecosystems, (6) integrating sustainable water management, and (7) acquiring and disseminating information on the state of water resources (Province of Québec 2002: 17).	The Master Plan for Water will be approved by the provincial Minister of the Environment. Agreements will be signed between COVABAR and stakeholders for specific actions.
MREAC	**Environmental Action Plan, 1994** **Miramichi Watershed Environmental Management Plan: Reaching 2002, 1997**	The 1994 Action Plan defines 10 program areas including: River Watch; Swim Watch; Process Wastewater Treatment; Municipal Waste Water Treatment; Rural Wastewater Treatment; Fish Habitat Protection; Watershed Mapping; Environmental Monitoring/Research; Community Planning. In 1997, two new programs were added - Environmental Management Planning (EMP) for industries and the Canadian Heritage Rivers nomination. The overall goal is to promote and engender a greater awareness and stewardship within the Miramichi watershed (Miramichi River Environmental Assessment Committee 1997: ii).	No formal mechanism is in place. MREAC has an informal cooperation agreement with partners who update members on their current stakeholder status at monthly meetings.
CARP	**Our Watershed, Our Responsibility: Annapolis Watershed Environmental Management Handbook, 1996** **Moving Forward: An Environmental Management Plan for the Annapolis Watershed, 2003**	The 1996 plan identifies environmental issues, develops actions to address the issues through a process of establishing goals, and identifies stakeholders who could take a leadership role in implementing actions. In addition to replacing the earlier plan and highlighting pertinent issues, the purpose of the 2003 plan is to: (1) identify actions already undertaken towards achieving the stated goals, (2) develop and prioritize actions to address issues and meet management goals, and (3) promote the positive economic effects of a conservation ethic (Sutherland 2003: 1).	The CARP Board approved the plans. Implementation occurs as funding becomes available. Partners are involved in project design and implementation. They provide financial and human resources and participate on project teams. Updates to the plan are done every 5-7 years.

[a] Information from the identified watershed planning documents was supplemented with information obtained through the interview process.

[b] Conservation Reports were completed for all conservation authorities by the Ontario Department of Planning and Development during the 1950s. Each report followed a similar template and was created to identify issues and recommend projects and programs to fledgling conservation authorities.

[c] The watershed plans developed for the Humber River and the Don River are elements of the Remedial Action Plan for the Toronto Area of Concern under the Great Lakes Water Quality Agreement and fulfill requirements under the provincial Oaks Ridges Moraine legislation. These plans, produced by the TRCA, were developed in consultation with partners and with the input and advice of the HWA and DWRC.

No standard reporting cycle exists for the watershed report cards generated by the case-study watershed organizations. The reports issued by the CARP and the GRCA are produced annually. More often, watershed organizations produce report cards every two to five years. The state of the watershed reports included in this study are generally viewed as an initial step for assessing baseline watershed conditions and determining specific data gaps, and as an essential prerequisite for the preparation of pending integrated watershed management plans (e.g., NSWA, BRBC, COVABAR). One outcome expected from the management planning process is a recommended protocol for tracking trends and a justification for boosting river monitoring programs.

Data used to inform the report cards are collected from numerous sources. The Ontario conservation authorities have independent or shared monitoring programs with watershed municipalities and government agencies for the collection of primary resource data. The Clean Annapolis River Project relies exclusively on the Annapolis River Guardians, a volunteer group of citizens who collect water samples at eight selected sites within the Annapolis River watershed. These samples are analyzed for specific properties, the results of which inform the annual report card. In the Meewasin Valley, land use change is tracked by MVA using Geographic Information Systems (GIS) tools. The Meewasin Valley Authority, Humber Watershed Alliance and Don Watershed Regeneration Council supplement quantitative data with qualitative data collected through residents' surveys. Other watershed organizations depend solely on secondary sources of information from watershed municipalities, provincial agencies, private corporations, Statistics Canada, scientific studies, and public opinion polls. Most often, data gathered from a variety of sources are used as a basis for assessment. A listing and general overview of the watershed report cards and other indicator-based reports generated by the case-study watershed organizations is provided in Table 6.8.

All indicator reports, with the exception of *Preserving Our Lifeline: A Report on the State of the Bow River, 1994*, and *Summary Final Report Miramichi River Environmental Assessment Committee 1989-1992*, are publicly accessible through the watershed organizations' respective websites. Both of these reports have been included in this study. An in-depth analysis of these reports is provided in Chapter 7.

6.6 Similarities and Differences among Case-Study Watershed Organizations

Incidents of degraded environmental conditions triggered by human activity are common drivers for watershed management in Canada. Degraded soil and water conditions in Ontario spurred the creation of Canada's first watershed organizations. Decades later, when deterioration of environmental conditions was experienced in other provinces, watershed organizations emerged in response, led by grassroots activism.

Table 6.8. General Overview of Watershed Report Cards Generated by Case-Study Watershed Organizations

Watershed Organization	Report Card / State of the Watershed Report	Impetus	Data Sources	Purpose	Schedule for Updates
FBC	**A Snapshot on Sustainability: State of the Fraser Basin Report, 2003** **2004 State of the Fraser Basin Report: Snapshot 2** **2006 State of the Fraser Basin Report: Sustainability Snapshot 3** **Inspiring Action; 2009 The Many Faces of Sustainability: Snapshot 4**	One goals of the Fraser Basin Council is to achieve life-long learning that enables residents to achieve sustainability goals. Reporting regularly to basin residents is part of FBC's constitution and mandate.	Based on federal and provincial data, and other quantitative and qualitative research findings from academia, research institutions, private sector industries, and non-government organizations.	To: • monitor progress towards sustainability goals identified in the Charter for Sustainability; • increase public awareness of sustainability issues; • inform and influence decision making and policy development; • assist identifying FBC organizational priorities and workplans; • build partnerships among communities, businesses, governments and non-governmental organizations; and, • identify information gaps and research priorities (Fraser Basin Council 2000).	Every 2 years
NSWA	**State of North Saskatchewan Watershed Report, 2005**	The impetus for preparing a State of the Watershed Report came from NSWA members. The report was deemed necessary to provide data that could be used to define priorities for actions within the watershed.	Based on data from federal and provincial agencies, municipalities, Alberta Lake Management Society, Ducks Unlimited Canada, Riverwatch, and other agencies.	To: • educate and raise awareness, among stakeholders and citizens, of the current condition of the watershed and the value of watershed protection to safeguard the water, ecology, human health and economy of the North Saskatchewan Watershed into the future; • make recommendations for sustainable management of the watershed; • encourage studies in areas of watershed functioning that are poorly understood; and, • be considered the first step toward developing a North Saskatchewan Watershed Management Plan under the Alberta Water Act (North Saskatchewan Watershed Alliance 2001:5).	To be determined.
BRBC	**Preserving Our Lifeline: A Report on the State of the Bow River Basin, 1994** **Nurture Renew Protect: A Report on the State of the Bow River, 2005**	The impetus for developing the State of the Basin report stemmed from concerns over deteriorating water quality. The BRBC committed to produce a report that could be used to make informed decisions regarding water management in the basin and educate and inform the public. The 1994 report focused on the condition of the Bow River, whereas the 2005 report assessed aquatic, terrestrial, and human aspects.	Based on data from federal and provincial agencies, municipalities, and other qualitative and quantitative research from academia, research institutions, private sector industries, and non-government organizations.	In 1994, to: • assist river users, decision makers and the public in defining river use objectives and determining management strategies both locally and regionally; • be a benchmark against which future reports can compare water quality and strategies for river use management; • improve overall understanding of the Bow River; • aid in informed decision making on issues concerning water quality; • provide a reference point from which to monitor the Bow River ecosystem; and, • engage stakeholders and water management resource managers in public discussion and provide direction on local and regional water quality improvement measures (Bow River Basin Council 1994:6). In 2005, to: • provide an update and expand on the information contained in the 1994 report, including information on water quantity, water quality, and natural ecosystems (Bow River Basin Council 2005:4).	Every 5 years

Table 6.8 (cont'd). General Overview of Watershed Report Cards Generated by Case-Study Watershed Organizations

Watershed Organization	Report Card / State of the Watershed Report	Impetus	Data Sources	Purpose	Schedule for Updates
MVA	**State of the Valley Reports, 2003; 2009**	MVA perceived a need to monitor change within the valley to develop and modify the management plan.	Based on aerial photographs and satellite imageries, resident surveys, and other qualitative and quantitative data.	To: • identify priorities for action; • as a benchmark for future assessments; • as a framework and source of tools for project level assessment, planning, and management; • gain foresight on potential consequences of decisions affecting ecosystems; • identify response options to achieve conservation, education, and development goals; • help build individual and institutional capacity to understand integrated ecosystems; and, • guide future research (Meewasin Valley Authority 2009:5).	Every 5 years
MWC	**2004 Muskoka Watershed Report Card** **The Muskoka Watersheds Report Card, Summer 2007**	A principle reason for establishing the Watershed Council was to engage watershed residents about watershed health issues. The report card was seen as the communications tool of choice.	Based on data from the District of Muskoka, lake associations, and provincial agencies.	To: • develop a tool to provide benchmarks and targets for key programs and environmental values for monitoring and evaluating change; • encourage proactive programs and remedial actions which contribute to the long-term health of the area; • stimulate action on the part of MWC, governments, businesses, and individuals; and • provide the basis for developing a work plan focusing research, policy development, education and communications activities in those areas where the trends are not satisfactory or where adequate knowledge and understanding do not exist (Muskoka Watershed Council 2003:3, 2004:1).	Every 3 years. (This schedule will change to every 4 years after 2010 to coincide with municipal elections)
UTRCA	**2001 Upper Thames River Watershed Report Cards** **2007 Upper Thames River Watershed Report Cards**	Public awareness heightened by issues including agricultural intensification, low flow water conditions, and the Walkerton contaminated water tragedy, resulted in an increased demand for environmental information and "state-of the resource" reports. Also, there was a concern that investment in monitoring was not resulting in value.	Based on data from the UTRCA Benthic Monitoring Program, provincial agencies, and the City of London.	To: • integrate and simplify information and make it available to public; • establish a benchmark from which future changes in environmental conditions can be tracked; • provide a guide for UTRCA staff and for public and community groups; and, • prompt the development of targeted sub-watershed strategies.	Every five years (to match the availability of Canada Census data)

Table 6.8 (cont'd). General Overview of Watershed Report Cards Generated by Case-Study Watershed Organizations

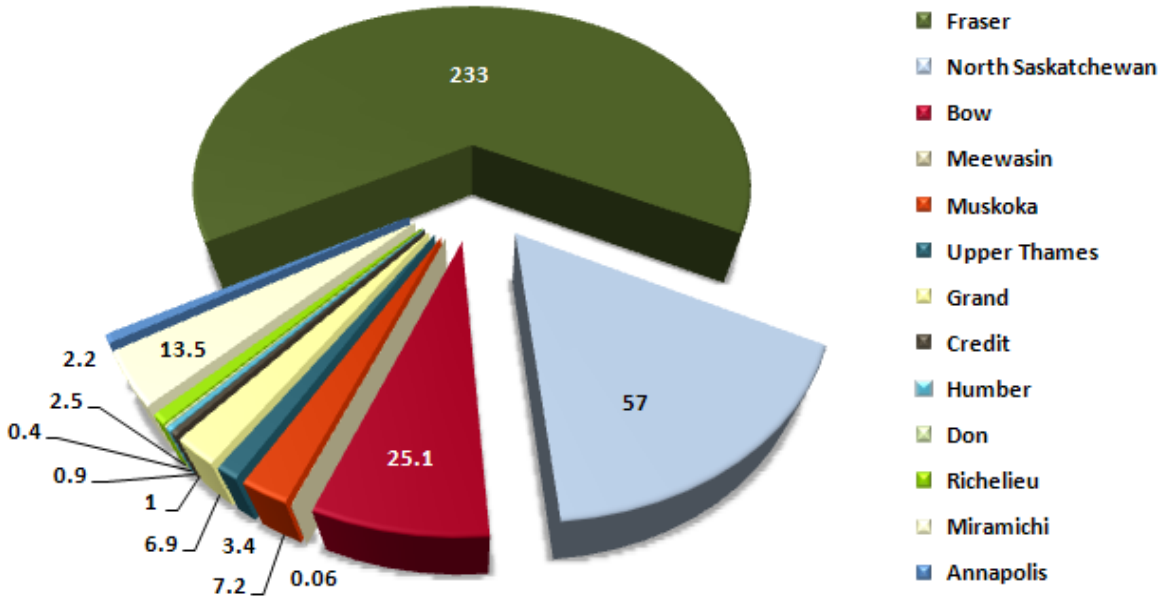
Watershed Organization	Report Card / State of the Watershed Report	Impetus	Data Sources	Purpose	Schedule for Updates
GRCA	**Watershed Reports, 2003-2009**	GRCA developed watershed reports as part of its role to monitor and report on the health of the Grand River watershed.	Based on federal and provincial data, data collected at GRCA monitoring sites, and other quantitative and qualitative research.	To: • provide watershed residents with an overview of the conditions and resource management concerns along the Grand River and its tributaries; and, • provide information on selected issues, outline the actions being taken to address them and identify what future issues may emerge.	Every year
CVC	**Credit Valley Conservation Watershed Report Card, 2005**	The drivers were internal (municipal partner interest) and external (parallel initiatives by other conservation authorities and Conservation Ontario promotion).	Based on data from CVC monitoring sites established in 1999. The next report will be based on data up to 2008.	To: • create public awareness of the watershed, current environmental conditions, and the challenges faced in maintaining and improving watershed health; and, • build awareness of CVC and support for its initiatives.	Every 5 years
HWA	**A Report Card on the Health of the Humber River Watershed, 2000** **2003 Humber Watershed Progress Report** **Listen to Your River: A Report Card on the Health of the Humber River Watershed, 2007**	The report card was begun to fulfill objective #30 contained in the "Legacy: A Strategy for a Healthy Humber."	Based on data from the Regional Monitoring Program, led by TRCA in partnership with member municipalities and others, residents' surveys, and data from federal and provincial agencies.	To: • monitor the health of the watershed using targets and indicators and to publish them as a marketing tool for celebrating successes or generating action (Toronto and Region Conservation Authority 1997:55); and, • guide workplan priorities and assist with short and long term budget forecasting.	Every 3 years
DWRC	**Turning the Corner, the Don Watershed Report Card 1997** **A Time for Bold Steps, The Don Watershed Report Card 2000** **Breathing New Life into the Don, Don Watershed Report 2003** **Forging a New Deal for the Don, Progress Report, 2006** **Don River Watershed Plan, 2009 (Chapter 3)**	The report card was established as a mechanism to track progress and effort resulting from the Forty Steps to a New Don, 1994.	Based on data from the Regional Monitoring Program, led by TRCA in partnership with member municipalities and others, residents' surveys, and data from federal and provincial agencies.	The purpose of the early report cards (1997-2003) was to: • establish baseline watershed conditions and track changes in condition over a regular interval. The purpose of the 2006 progress report was to: • "close out" the Forty Steps to a New Don era in watershed planning for the Don by celebrating successes (e.g., regeneration activities) and identifying challenges for the future. The purpose of the report card embedded in the watershed plan (2009) was to: • establish new baseline conditions to track future changes to the watershed with respect to new management objectives and targets.	Every 3 years to 2009 (schedules for reporting on effort and baseline conditions may be separated and may vary in the future)

Table 6.8 (cont'd). General Overview of Watershed Report Cards Generated by Case-Study Watershed Organizations

Watershed Organization	Report Card/State of the Watershed Report	Impetus	Data Sources	Purpose	Update Schedule
COVABAR	**Profil du bassin versant de la rivière Richelieu, 2000** **Profil du bassin versant de la rivière Richelieu, 2002 (Watershed Characterization Reports)**	The basin profiles were created as a direct outcome of a workshop organized by the Conseil régional de l'environnement de la Montérégie (Montérégie CRE) in 1998.	Based on data from municipal, provincial and federal sources, and other organizations.	To: • inform and promote public awareness within the Richelieu Valley community about watershed-based management in keeping with the principles of sustainable development; • foster a watershed approach; and, • facilitate development of the Master Plan for Water, currently in progress and scheduled for completion in 2011.	n/a
MREAC	**Summary: Final Report Miramichi River Environmental Assessment Committee 1989-1992 by Dr. M. Burt** **State of the Environment Report for the Miramichi Watershed, 2007**	The terms of reference for MREAC, includes an assessment of the environmental quality of the Miramichi watershed.	Based on federal and provincial data, data collected at MREAC monitoring sites, and other scientific research findings.	To: • determine trends in environmental indicators; and, • determine the degree of change in indicators over time (Miramichi River Environmental Assessment Committee 2007:1).	Every 10 years
CARP	**The Annapolis Watershed 2008 Report Card** **The Annapolis Watershed 2007 Report Card** **The Annapolis Watershed 2006 Report Card** **The Annapolis Watershed Report Card, 2005** **Summary of 2004 Water Quality Monitoring Results**	Developed to provide an easily understood tool to report results to a non-scientific audience including the general public and local politicians.	Based on data from the River Guardian program sponsored by CARP.	To: • establish and support a regular observation system that provides an early warning of environmental problems; • provide a long-term record of the river's health; • develop interest in the Annapolis River and community stewardship to ensure a viable resource for future generations; and, • provide a knowledgeable group of local individuals who can promote the preservation, rehabilitation, and use of these aquatic resources in the future (Clean Annapolis River Project 2008:3).	Every year

Despite differences in the scale, scope, and complexity of resource issues, the watershed is recognized as the most appropriate unit for assessing and tackling resource problems. Consequently, watershed organizations have diverse geographic areas of interest, generating distinct administrative and operational opportunities and challenges (Figure 6.15).

Figure 6.15. Geographic Extent of Interest of Case-Study Watershed Organizations (000s km^2)



The prevailing resource issues in each watershed are directly proportionate to the frequency and intensity of anthropogenic stresses at play and their cumulative downstream impacts over time. The predominant resource issues experienced in each case-study watershed are summarized in Table 6.9. Common issues within many watersheds relate to urban development pressures, including stormwater management and municipal waste effluent. Habitat degradation and fragmentation is another growing concern in both urban and rural areas.

The governance models created for, functions assumed by, and funding and resources available to watershed organizations differ. Provincial legislation empowers Ontario's conservation authorities and the MVA, prescribes their goals, administrative and operational functions, and core funding arrangements, and establishes formal arrangements among partners (e.g., municipalities, provincial agencies, academic institutions). The FBC is founded on a formal partnership agreement among four levels of government. Consequently, these watershed organizations administer the largest budgets and staff complements of all the case studies and implement a diverse range of activities and services.

Ontario's conservation authorities have multi-million dollar budgets, which vary by jurisdiction.[84] The MVA and FBC also administer multi-million dollar budgets and carry out many programs.

Table 6.9. Key Natural Resource Issues Identified in Case-Study Watersheds

Watershed Organization / Key Resource Issues	FBC	NSWA	BRBC	MVA	MWC	UTRCA	GRCA	CVC	HWA	DWRC	COVABAR	MREAC	CARP
Municipal/Industrial Waste Effluent	✓	✓	✓									✓	✓
Urban Stormwater	✓	✓	✓		✓	✓		✓	✓	✓			
Agricultural Contaminants						✓	✓				✓		✓
Forestry Practices	✓											✓	
Degraded Septic Systems												✓	✓
Groundwater Contamination							✓						✓
Periodic Water Shortages			✓										✓
Flooding	✓					✓	✓	✓		✓	✓		✓
River Debris	✓									✓	✓		
Erosion	✓			✓			✓	✓		✓			
Shoreline / Riverbank Alterations					✓	✓							
Water Allocation		✓	✓										
Water Demand							✓	✓					
Water Withdrawals		✓											
Unstable Soils											✓		
Degraded Habitats / Fragmentation / Loss of Wetlands	✓	✓		✓	✓		✓	✓	✓	✓	✓		✓
Declining Fisheries	✓							✓		✓		✓	
Invasive Species	✓			✓			✓			✓	✓		
Air Quality										✓			✓
Climate Change Impacts	✓	✓		✓	✓		✓	✓		✓			✓
Urban Development Impacts	✓		✓	✓	✓	✓	✓	✓	✓	✓			✓
Agricultural Intensification	✓						✓	✓			✓		
Source Protection – Drinking Water		✓		✓				✓					
Aggregate Extraction						✓	✓	✓					

[84] The four conservation authorities that participated in this study have budgets ranging from about $10 million (UTRCA) to about $80 million (TRCA). The GRCA and the CVC have similar budgets of approximately $30 million. Revenues are derived from member municipalities, provincial grants, self-generated revenue, and other sources such as foundations.

The HWA, DWRC, and MWC receive in-kind support from their parent or partner organizations and do not administer their own budgets. Each is supported by a secretariat with access to additional professional expertise within the parent or partner organizations. Not surprisingly, their roles and responsibilities are more narrowly defined and focus on reporting, promoting community stewardship, stakeholder engagement, and advisory services.

The remaining watershed organizations have strong grassroots origins, which impelled their formation. These community-based organizations have since been recognized formally under Alberta's Water for Life Strategy, the Québec Water Policy, and the Atlantic Coastal Action Program (ACAP) administered by Environment Canada. Budgets supporting these organizations range between $150,000 and $700,000 annually. Government funding supports a small staff, but the implementation of programs and projects depends mostly on the degree to which the watershed organization can gather partners and obtain their ongoing commitment to pool financial and in-kind resources and/or undertake actions. Even to fulfil their primary roles, including watershed planning and reporting, public awareness and education, and stakeholder engagement, these watershed organizations rely heavily on funding partners, fund raising, and volunteer support.

Under the direction of Environment Canada, the ACAP program allows each watershed organization to evolve independently, using a bottom-up governance model which builds local capacity, encourages community participation and decision making, and levers funds (Mcneil, Rousseau, and Hildebrand 2006). After the initial planning phases undertaken during the 1990s, CARP and MREAC have advanced many projects and programs, responding to local issues in collaboration with partners. Similarly, the watershed programs in Alberta and Québec promote a collaborative, participatory approach with a current focus on developing watershed/water management plans in response to provincial priorities.

While the geographic scope, complexity, and extent of resource issues, governance models, and functions of watershed organizations differ, this review has revealed eight underlying concepts and values that are shared:

- watersheds are a preferred management unit to address natural resource issues;
- watershed health and/or sustainability are broad goals;
- grass roots lobbying and activism have shaped watershed governance in Canada;
- decision making has shifted from a top-down centralized approach to de-centralized decision making, building on the concepts of partnerships, participation, and collaboration;
- watershed organizations with long-term core funding have broad management responsibilities;

- watershed planning and reporting are primary tasks assumed by all case-study watershed organizations;[85]
- delivery of on-the-ground programs and projects by watershed organizations varies, depending on several factors, including institutional capacity, availability of funding, access to in-kind services, and volunteer engagement; and,
- implementation of watershed plans requires shared commitment and will by partners to undertake both individual and collective actions; the watershed organization itself cannot 'do it all'.

A detailed analysis of the key attributes of the various watershed report cards produced by the case-study watershed organizations is presented in Chapter 7. Chapter 8 presents the opinions, perceptions, and insights of informants regarding the influence of watershed report cards on the specific aspects of watershed management identified in this chapter.

[85] Although HWA and DRWC are not responsible for watershed planning, they provide input and advice to the TRCA regarding the Humber River and Don River watershed plans. The FBC provides facilitation and project management services for various planning initiatives in the Fraser Basin.

Chapter 7: The Nature and Scope of Watershed Report Cards

7.1 Analysis of Watershed Report Cards

This chapter presents an analysis of the nature and scope of the 39 indicator reports produced by the 13 case-study watershed organizations.[86] These include watershed report cards, state of the watershed reports, and other watershed reports. For the purpose of this analysis, the term 'watershed report card' is used for all three types of reports.

Section 7.1.1 describes the various types, styles, and formats of the watershed report cards. Section 7.1.2 compares and contrasts indicator selection processes, while Section 7.1.3 details the nature and focus of the indicators. Data sources are described in Section 7.1.4. The methods to rank indicators and the approaches to establish management targets are outlined in Sections 7.1.5 and 7.1.6. Section 7.1.7 explores the nature and scope of recommendations for action. Key points are summarized in Section 7.2.

7.1.1 Report Types, Styles, and Formats

No standard template exists for watershed report cards in Canada. Some watershed report cards examined rely heavily on quantitative measures to portray key messages. Others offer highly-descriptive, narrative assessments that may include indicators, but information is not necessarily structured around them. Most often, a mix of quantitative, qualitative, and descriptive measures is used. Table 7.1 provides a synopsis of the types and styles of watershed report cards reviewed.

Watershed report cards also vary in length from a few pages to over 200 pages. Some watershed organizations release stand-alone summary report cards for 'popular' consumption. These are synthesized from more in-depth report cards (e.g., FBC, CVC, HWA). Others produce a short, concise report card which negates the need for a summary (e.g., MWC, CARP). The UTRCA produces 28 distinct watershed report cards for sub-watersheds within its jurisdiction. These 6-page reports are available individually or in a consolidated format. For lengthier report cards, a watershed summary report card is sometimes included as a separate section within the document. While the reports produced by the NSWA, BRBC, COVABAR, and MREAC are lengthy and provide a detailed narrative of the state of the watershed supported by several indicators, they do not include an indicator synopsis. An analysis of summary formats used for the watershed report cards is highlighted in Table 7.1, with elaboration in Appendix B.1.

[86] This study examines watershed report cards produced prior to April 2010 but excludes two watershed report cards produced by the Fraser Basin Management Board in 1995 and 1996, as noted in Chapter 4.

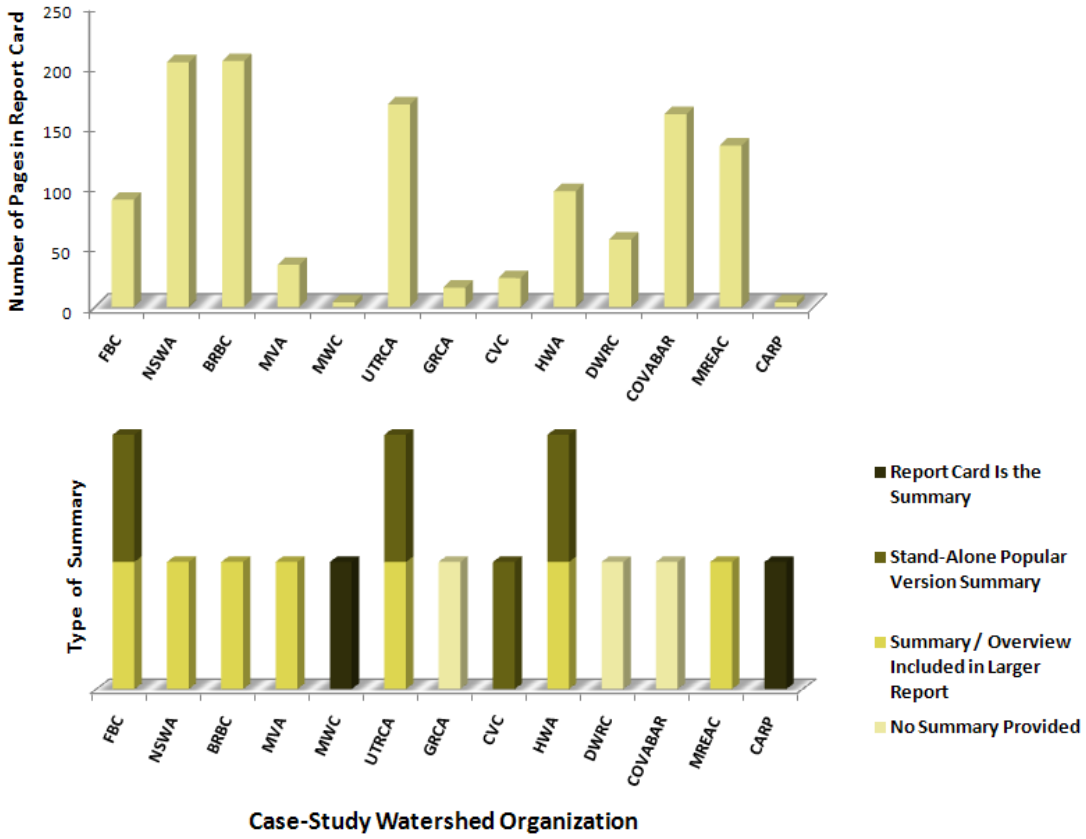
Table 7.1. Types and Styles of Watershed Report Cards

Watershed Organization	Report Title	Report Date	Type of Report					Style of Report			
			Report Card - Watershed Scale	Report Card - Sub-watershed Scale	Progress Report	State of the Watershed / Valley Report	Watershed Report	Interpretive Based Mostly on Quantitative Measures	Interpretive Based Mostly on Qualitative / Descriptive Measures		Interpretive Based on a Mix of Measures
FBC	Snapshot 1	2000	X								X
	Snapshot 2	2003	X	X							X
	Snapshot 3	2006	X	X							X
	The Many Faces of Sustainability Snapshot 4	2009	X	X							X
NSWA	State of North Saskatchewan Watershed Report	2005				X					X
BRBC	Preserving Our Lifeline: A Report on the State of the Bow River	1994				X					X
	Nurture Renew Protect: A Report on the State of the Bow River	2005				X					X
MVA	State of the Valley Report	1998				X		X			
	State of the Valley Report	2003				X		X			
	State of the Valley Report	2009				X		X			
MWC	2004 Muskoka Watershed Report Card	2004	X					X			
	The Muskoka Watersheds Report Card	2007	X					X			
UTRCA	The Upper Thames River Watershed Report Cards	2001	X	X				X			
	The 2007 Upper Thames River Watershed Report Cards	2007	X	X				X			
GRCA	Watershed Report	2003					X				X
	Watershed Report	2004					X				X
	Watershed Report	2005					X				X
	Watershed Report	2006					X		X		
	Watershed Report	2007					X				X
	Watershed Report Fall 2008	2008					X		X		
	Watershed Report Fall 2009	2009					X		X		
CVC	Credit Valley Conservation Watershed Report Card: A Detailed Summary on the Ecosystem Health of the Credit River Watershed	2005	X					X			

Table 7.1 (cont'd). Types and Styles of Watershed Report Cards

Watershed Organization	Report Title	Report Date	Type of Report					Style of Report		
			Report Card - Watershed Scale	Report Card - Sub-watershed Scale	Progress Report	State of the Watershed / Valley Report	Watershed Report	Interpretive Based Mostly on Quantitative Measures	Interpretive Based Mostly on Qualitative / Descriptive Measures	Interpretive Based on a Mix of Measures
HWA	A Report Card on the Health of the Humber River Watershed	2000	X							X
	2003 Humber Watershed Progress Report	2003			X					X
	Listen to Your River: A Report Card on the Health of the Humber River Watershed	2007	X							X
DRWC	Turning the Corner, the Don Watershed Report Card	1997	X							X
	A Time for Bold Steps, The Don Watershed Report Card	2000	X							X
	Breathing New Life into the Don, Don Watershed Report	2003	X							X
	Forging a New Deal for the Don, Progress Report	2006			X				X	
	Don River Watershed Plan, (Ch. 3 - Current Conditions)	2009	X					X		
COVABAR	Profil du bassin versant de la rivière Richelieu	2000				X				X
	Profil du bassin versant de la rivière Richelieu	2002				X				X
MREAC	Summary: Final Report Miramichi River Environmental Assessment Committee	1992				X		X		
	State of the Environment Report for the Miramichi Watershed	2007				X				X
CARP	Annapolis River Guardians: Summary of 2004 Water Quality Monitoring Results	2005	X					X		
	The Annapolis Watershed Report Card	2006	X					X		
	The Annapolis Watershed Report Card	2007	X					X		
	The Annapolis Watershed Report Card	2008	X					X		
	The Annapolis Watershed Report Card	2009	X					X		

Figure 7.1. Report Card Length and Summary Styles



7.1.2 Indicator Selection

The selection of indicators for the watershed report cards is generally based on one of three approaches: (1) an extensive participatory process (2) a process engaging selected partners and science experts, or (3) an internal review led by staff.[87]

Indicator selection for four of the case-study watershed organizations is guided by broad environmental and socio-economic goals previously established through an inclusive community engagement process (e.g., FBC's Charter for Sustainability; MVA's 100-Year Concept Plan; Humber River Task Forces' Legacy: A Strategy for a Healthy Humber; DWRC's Forty Steps to a New Don). The MWC engaged in a broad participatory process to define a set of issues and indicators relevant to the public prior to developing its first report card. The remaining report cards focus specifically on aspects of ecosystem health. Expert opinion was sought to assist in the selection process in almost all cases. The final selection of indicators is made either by the Board of Directors and staff or through

[87] The GRCA and COVABAR are not included in this part of the analysis since their reports are primarily narrative descriptions of current issues or watershed conditions, although some indicators are included.

consultation with a broader group of members and/or partners. The mechanisms used for input and decision making include technical ad hoc committees and targeted workshops.

The selection of indicators is also influenced by whether or not there are any direct linkages to the goals established in existing watershed or other integrated plans. Where watershed plans exist, there is a direct link between the watershed report card and the watershed plan. However, no watershed plans have been developed or adopted for the Fraser Basin, Annapolis River watershed or the Muskoka watersheds. In Alberta, the NSWA and BRBC are currently developing their first watershed plans. The state of the basin reports generated for these watersheds provide important benchmark information to inform the planning process.

There is no evidence that the management principles pertaining to how institutions or governance structures should perform (e.g., consensus, collaboration, precautionary, responsive and accountable decision making, intergenerational and intragenerational equity), as presented in Table 2.4, are factors in selecting watershed indicators. An overview of the key facets of the indicator selection process for each of the case-study watershed organizations is presented in Table 7.2.

Table 7.2. Indicator Selection Process

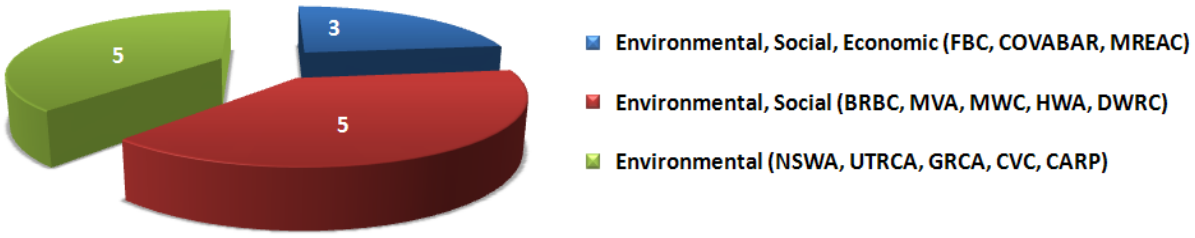
Watershed Organization	Framework for Developing the Report Card			Participants in Indicator Selection					Lead for Final Selection of Indicators		Links to Watershed Plans			
	Issue-Based	Based on Ecosystem Health	Pre-established Goals/Objectives	Community	Science Experts	NGOs	Watershed Organization Members / Partners [a]	Watershed Organization Staff	Watershed Organization (Board and Staff)	Watershed Organization and Members / Partners	Yes	No	Some	To Be Determined
FBC	X		X	X	X	X	X	X		X		X		
NSWA		X					X	X		X				X
BRBC		X					X	X		X				X
MVA			X				X	X	X		X			
MWA	X			X	X	X	X	X	X			X		
UTRCA		X			X		X	X		X				X
CVC		X						X	X		X			
HWA			X	X	X	X	X	X		X	X			
DWRC			X		X		X	X		X	X			
MREAC		X			X		X	X		X	X			
CARP		X					X	X	X			X		

[a] With the exception of Ontario's conservation authorities, members include experts from academia, business, non-government organizations, and federal and provincial ministries. Conservation authority members represent watershed municipalities. For the purpose of this analysis, conservation authority partners generally refer to provincial agencies.

7.1.3 Focus of Indicators

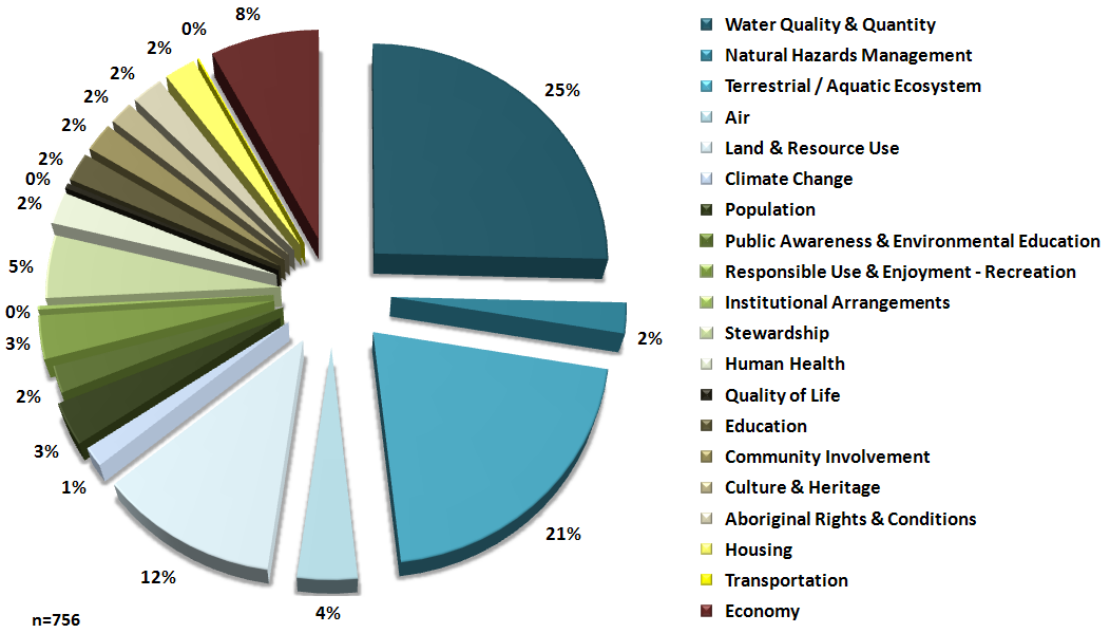
Indicators used to describe sustainability and watershed health are usually grouped into general themes which include environmental, social, or economic dimensions.[88] Several watershed organizations, including the FBC, COVABAR, and MREAC, have developed multiple themes that cut across all three facets of sustainability. While indicators frequently overlap across dimensions because of their interconnectedness, Figure 7.2 shows that the primary focus of indicators in the most recent watershed report cards reflects mainly environmental or socio-environmental themes.

Figure 7.2. Primary Focus of Watershed Indicators



A breakdown of 756 indicators aggregated across the 39 watershed report cards reveals that about one-half of the indicators are predominantly environmental, while the remainder are socio-economic. Figure 7.3 provides an overview of the general categories represented by the indicators.

Figure 7.3. General Themes Represented in Case-Study Watershed Report Cards

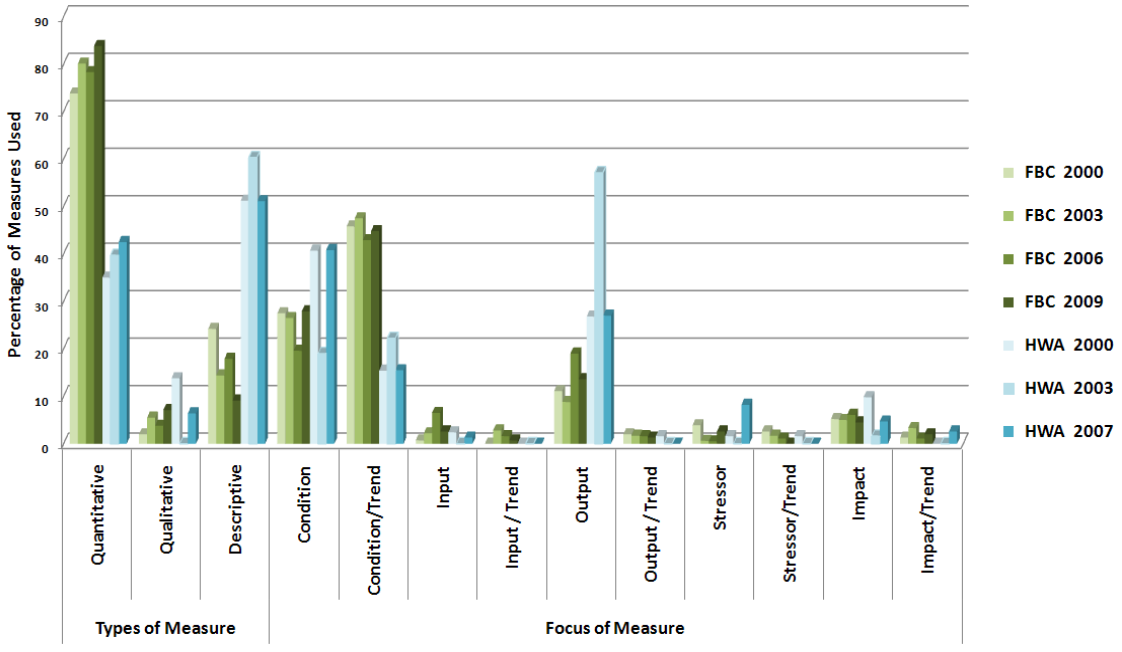


[88] Most report cards classify indicators by theme. The Richelieu and Miramichi State of the Watershed reports do not denote specific themes. The themes and indicators included in the report were identified and categorized by the researcher.

The number of indicators associated with various themes differs among watersheds. In general, the greater the number of themes, the more indicators reported on. Appendix B.3 shows the breakdown of indicators by theme, as presented in the most recent watershed report cards. Similarly, the number of measures consolidated to characterize specific indicators ranges from one to many. The use of quantitative measures to describe indicators is the preferred choice, including aggregated indices such as the Water Quality Index and the Index of Biotic Integrity. Qualitative measures based on opinion polls and public surveys are used by the FBC, MVA, HWA, and DWRC. Descriptive data (i.e., anecdotal statements, examples, or observations which describe indicator attributes) are frequently used to supplement both qualitative and quantitative measures.

A comparison of the types and focus of the measures used to assess the status of indicators between the most recent watershed report cards created by the FBC and HWA illustrates that over 80 per cent of the measures are quantitative, while less than 10 per cent are qualitative or descriptive. The measures in these two report cards depict current conditions and trends over time. Very few measures gauge levels of input, output, or impact (Table 3.1). Output measures are used more frequently, especially in the HWA's progress reports. In addition, most indicators are presented independently. While correlations among indicators are not expressly demonstrated, both watershed organizations use narrative descriptions to underscore the probable connections among them. Figure 7.4 illustrates the split in the type and focus of measures used by the FBC and HWA for all of their watershed report cards.

Figure 7.4. Percentage, Types, and Focus of Measures Used by the FBC and HWA



Measures are used to develop and describe indicators. In addition, they may be used to (1) rate the indicators, (2) identify trends, and/or (3) illustrate issues or aspects of the indicator or to 'tell a story'. Table 7.3 captures the general characteristics of the indicators used by the case-study watershed organizations in their most current watershed report card. Appendix B.4 provides a similar analysis for the 39 watershed report cards.

Table 7.3. General Characteristics of Watershed Report Cards Indicators

Watershed Organization	Report Date	No. of Themes	No. of Indicators	Areas of Focus			No. of Measures		Kinds of Measures				Purpose of Measures		
				Environmental	Social	Economic	≤3	Varies	Quantitative	Quantitative - Aggregated Index	Qualitative - Public Opinion	Descriptive	Rating	Identification of Trends	Illustrative (Tell the Story)
FBC	2009	18	77	X	X	X		X	X	X	X	X	X	X	X
NSWA	2005	3	15	X			X		X	X		X	X	X	X
BRBC	2005	4	7	X	X			X	X	X		X	X	X	X
MVA	2009	4	13	X	X			X	X		X		X	X	
MWC	2007	3	27	X				X	X	X		X	X	X	
UTRCA	2007	4	5	X			X		X	X		X	X	X	X
GRCA	2009	6	8	X			X		X			X	X	X	X
CVC	2005	7	9	X				X	X	X		X	X	X	
HWA[a]	2007	3	29	X	X		X		X	X	X	X	X	X	X
DWRC	2009	9	27	X	X			X	X	X		X	X	X	X
COVABAR	2003	9	17	X	X	X		X	X	X		X	X	X	X
MREAC	2007	8	25	X	X	X	X		X	X		X	X	X	X
CARP	2008	1	9	X			X		X	X			X	X	

[a] The Humber Watershed Report Card uses 28 indicators but one indicator has specific measures for 2 distinct indicator attributes.

Eleven case-study watershed organizations have produced more than one watershed report card. An analysis of these reports was carried out to ascertain the level of consistency among themes, indicators, and measures and between successive report cards. This analysis shows that considerable consistency exists among the themes used in successive watershed report cards, with the exception of

the watershed reports compiled by the GRCA. This latter result is not surprising since this annual publication is issue-driven and addresses immediate topics of concern which vary from year to year.

The indicators used to characterize the overall themes in the watershed report cards are more inconsistent, as are the measures to calculate indicator traits. The only watershed report cards that utilize all or a majority of consistent measures from one report card to the next were those developed by the UTRCA and CARP.

The rating systems for indicators were also scrutinized for consistency. In the majority of cases, there is either insufficient information in the watershed report cards to make a determination or the rating criteria and methodology are modified from the previous edition. Two case-study watershed organizations, the FBC and UTRCA, use similar criteria and methodologies to rate the indicators in the two latest versions of their watershed report cards. Table 7.4 illustrates the similarities and differences in indicator themes, measures, and ratings between the current watershed report card and the preceding edition produced by each case-study watershed organization. Appendix B.5 provides a similar analysis for all successive versions.

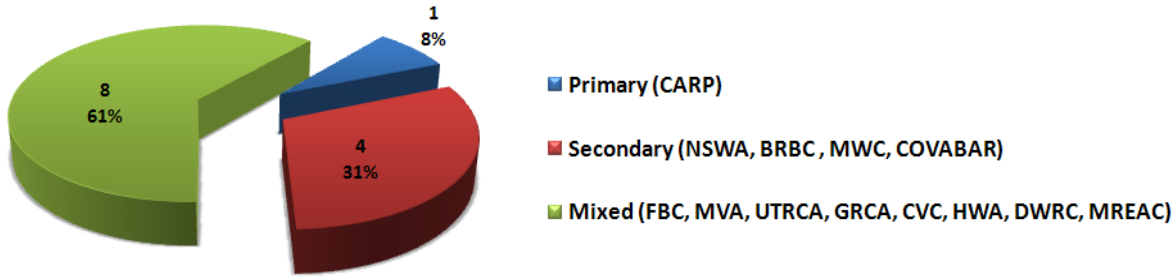
Table 7.4. Consistency of Themes, Measures, and Rating Criteria between Successive Report Cards

Watershed Organization	Report Date	No. of Previous Reports (Post 1990)	Indicator Themes Used in Previous Report				Indicators Used in Previous Report			Measures Used in Previous Report			Rating Criteria Used in Previous Report		
			Same	Majority are the Same (>50%)	Majority are Different (>50%)	Different	Majority are the Same (≥50%)	Majority are Different (>50%)	Different	Majority are the Same (≥50%)	Majority are Different (>50%)	Different	Majority are the Same	Majority are Different	Not enough information to determine
FBC	2009	3		X				X			X		X		
BRBC	2005	1	X					X			X			X	
MVA	2009	2		X				X			X				X
MWC	2007	1		X				X			X			X	
UTRCA	2007	1		X			X			X			X		
GRCA	2009	6			X			X			X			X	
HWA	2007	2	X				X				X			X	
DWRC	2009	4			X			X			X			X	
COVABAR	2002	1		X			X				X				X
MREAC	2007	1				X			X			X		X	
CARP	2009	4	X				X			X					X

7.1.4 Data Sources

The indicators in the 39 watershed report cards are supported by data sets that are either generated through the implementation of specific watershed monitoring programs conducted and/or overseen by the watershed organization, or obtained from an assortment of secondary sources of information (e.g., Statistics Canada, provincial agencies, municipalities, academic institutions, independent research studies, public opinion surveys). Only the CARP relies solely on primary data sources Figure 7.5 identifies the sources of data used to develop the indicators in the various report cards.

Figure 7.5. Sources of Data Used to Develop Indicators



For example, the MREAC delivers monitoring programs to collect specific environmental data. One program called Swim Watch has operated since 1993. Water quality is sampled weekly during the summer months at popular public swimming sites, and twice a year at 22 other sites. Water samples are tested by the provincial Department of the Environment for fecal coliform and are returned to MREAC, where the data are collected, tabulated, and made publicly available. MREAC also relies on partnerships and citizen monitoring to gather data regarding the health of the river estuary. Similarly, citizen monitoring plays a critical role in gathering water quality data at eight sites in the Annapolis River system through a program called River Guardians. This data directly supports the annual Annapolis River watershed report card. The MVA obtains data to inform its triennial report card through self-administered monitoring programs, in-house spatial analysis, citizen surveys, and data available from its two municipal partners.

In contrast, FBC, BRBC, NSWA, MWC, and COVABAR rely heavily on data collected by multiple agencies at various geographic and temporal scales. The lack of long-term, consistent data sets creates a significant challenge in some river systems. For example, the BRBC and NSWA State of the Basin reports identify specific indicators of watershed health. However, data to populate these indicators are not available for certain river reaches. The availability of water quality monitoring is dependent on decisions made at the provincial and federal levels rather than at the watershed level. In 2009, Water Matters (2009) reported that,

> Provincial government budget cuts are now affecting watersheds...funding for all surface water quality monitoring in 2009/10 could dramatically decline from $1.1 million to $300,000. Already only 20 out of hundreds of lakes in Alberta were tested last year. That number may now be reduced to 10 lakes.
>
> Water quality monitoring…is the only way to measure water quality changes in response to land-use and water-use activities. Water quality monitoring data helps identify the source of problems and is instrumental to defining cost-effective solutions.
>
> Decreases to water quality monitoring even for one year can be detrimental because ongoing monitoring is crucial to establishing a long-term data collection.

In 2010, the Alberta government announced cut-backs on water quality monitoring in 'remote areas' as part of its strategy to shrink the province's $4.7-billion budget deficit. Efforts will be focused on monitoring bodies of water in populated areas and near heavy industrial development. The Minister of the Environment was quoted as saying, "whether you measure it every year or every two years...as long as the trend is the same...then we're not really compromising, we believe, our ability to have an understanding of what's going on" (Gousseau 2010). Based on current funding restraints, it appears that identified data gaps are unlikely to be addressed in the near future.

Depending on the nature and scope of the watershed report cards, attributes of the data used to support the indicators such as year collected, references, and geographic extent, are usually specified in the watershed report card or a technical background report. Data gaps are acknowledged by NSWA, BRBC, MVA, UTRCA, CVC, HWA, DWRC, and CARP. The manner in which data are addressed in the 39 watershed report cards is provided in Appendix B.6.

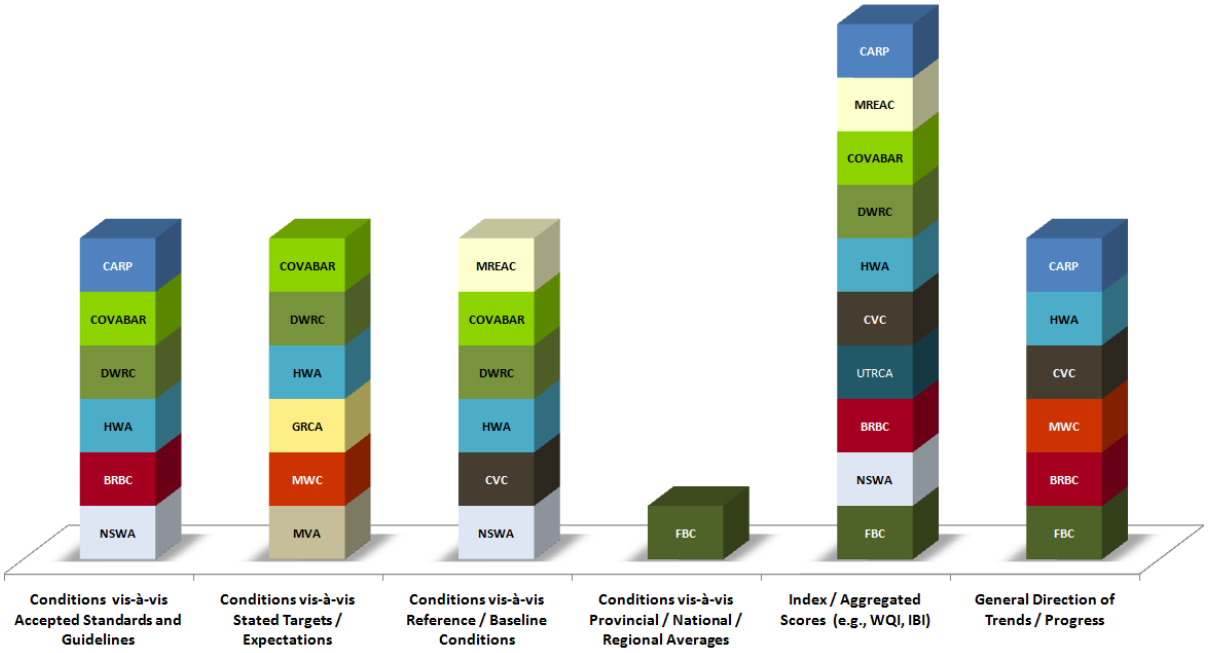
7.1.5 Indicator Rating Systems

The majority of watershed report cards use rating systems to report conditions, track trends, and assess progress towards sustainability or watershed health. Usually, the reason why some indicators are not rated is because there are insufficient data or methods available to do so. If the watershed report card is descriptive, there is generally not as much emphasis on the rating of indicators. The UTRCA and the most recent MWC watershed reports aggregate the scores of each individual indicator to create an overarching theme score.

The status of indicators is generally assessed relative to reference conditions, specific benchmarks (e.g., standards, statistical averages), stated targets, aggregated scores, and/or established grading systems. In addition, grading is sometimes based on or supplemented by an assessment of discernible trends. Figure 7.6 shows the rationale used by the watershed organizations for gauging indicators in their most recent report card. The application of multiple approaches for assessing indicators is a

common practice. An overview of the factors for assessing indicators in the 39 watershed report cards is provided in Appendix B.7.

Figure 7.6. Basis for Assessing Indicator Status



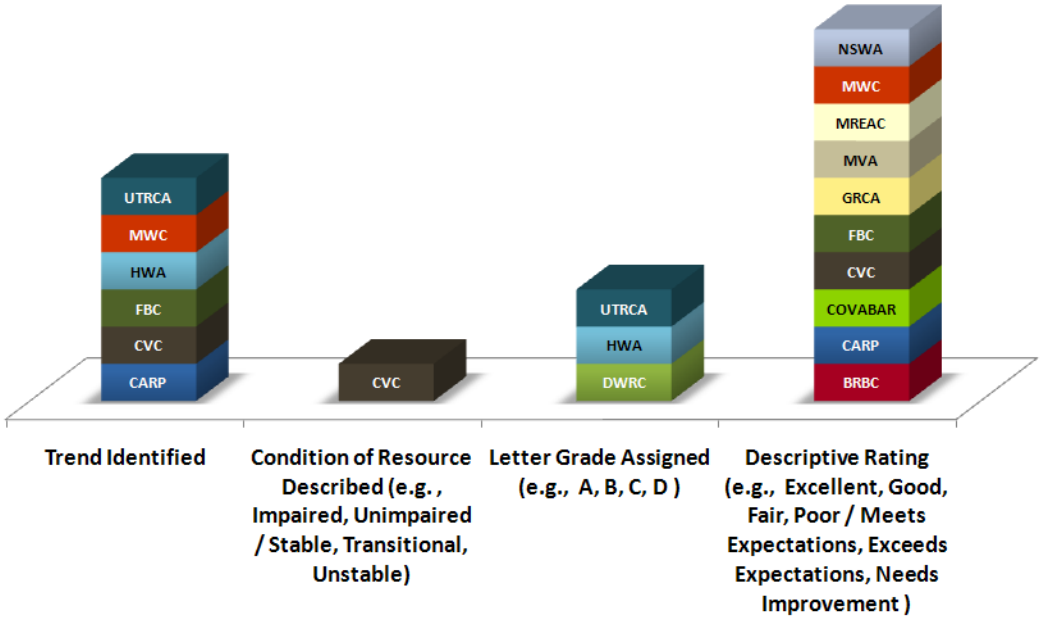
To assign a rating to the indicator, several techniques are used. The application of an aggregated index using established protocols and grading systems provides a systematic and widely-accepted method. Other ranking systems are based on national or provincial guidelines[89] to establish credible 'healthy' or upper points of reference for assigning high ratings. Lower grades are then established using equal intervals between high and low grades. In the absence of guidelines or specific targets, ratings are frequently assigned, based on expert opinion or the judgments of engaged stakeholders.[90] Many report cards assign letter grades (e.g., A - F) to convey the status of the indicator or theme. Others use descriptive categories such as excellent, good, fair, and poor. Where targets are not defined, the rating of indicators tends to be confined to descriptions about whether or not conditions are improving, declining, or stable. Where the data reveal dichotomous results (i.e., some measures suggest improvements, while others show decline), the results are often portrayed as mixed or uncertain. Sometimes an indicator is identified as an appropriate marker for judging aspects of a

[89] For example, a minimum of 30 per cent forest cover across a watershed is recommended to maintain the important functions that forests provide to both humans and wildlife (Environment Canada 2004). The Canadian Council of Ministers of the Environment has developed a number of environmental guidelines.

[90] The UTRCA uses a grading system developed by Conservation Ontario (Conservation Ontario 2003). Ranking categories were developed in consultation with technical experts.

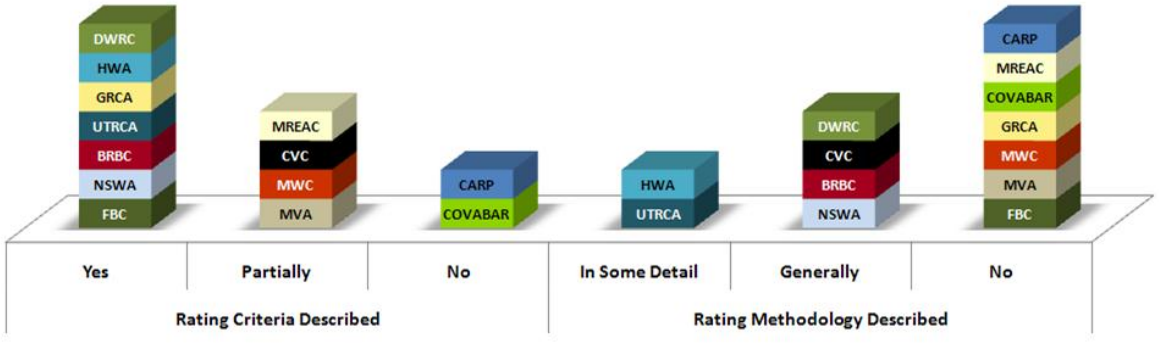
particular theme; however, insufficient data preclude it from being ranked. Figure 7.7 shows the categories used in the most recent watershed report cards regarding indicator status.

Figure 7.7. Categories Used to Illustrate Indicator Status



The majority of watershed report cards include at least a general description of the criteria used to rank the indicators. However, the methodology describing how indicators are rated is typically not included in the report card or an overview is provided, but not the details. The CVC and CARP provide details about the methodology in a separate background document. Figure 7.8 identifies which watershed organizations include a description of the rating criteria and methodology in their latest report cards. Appendix B.8 provides a general analysis of the data used, geographic scale of assessment, and categories used to illustrate indicator status in the 39 watershed report cards. It also identifies which report cards include descriptions of the criteria and methodologies used for rating.

Figure 7.8. Criteria and Methodologies Described for Rating Indicators

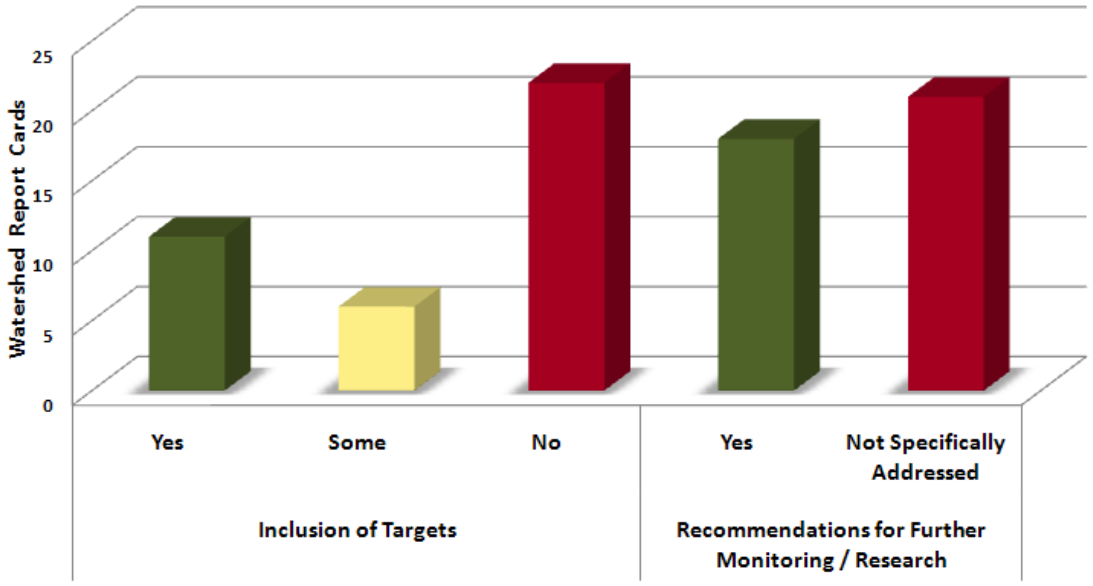


7.1.6 Watershed Targets

The use of targets against which to measure progress is not common among the 39 watershed report cards, although a mix of quantitative, qualitative, and descriptive targets has been established in the watershed report cards generated by MVA, HWA, and DWRC. Qualitative targets refer to a level of public awareness or regard for certain aspects of watershed sustainability or health. Descriptive targets refer to the inauguration of actions such as 'establishing priorities' or 'maintaining existing conditions'.

Similarly, a minority of watershed report cards identifies data gaps, monitoring requirements, and further research and make recommendations to address these shortfalls (Figure 7.9). Appendix B.9 specifies which report cards include targets, provide assessments towards these targets, identify trends, and make recommendations for further monitoring and research.

Figure 7.9. Targets, Monitoring, and Research Addressed in Watershed Report Cards



7.1.7 Recommendations for Action

Most watershed report cards acknowledge the current policies, programs, and efforts being carried out to advance sustainability and watershed health and include general recommendations for further action. Some report cards provide more specific guidance on activities needed to effect changes in conditions and trends and who should be undertaking those changes. The extent to which the 39 watershed report cards acknowledge and recommend actions for change is outlined in Table 7.5. The DWRC watershed plan, within which the indicators are identified and assessed, provides specific recommendations for action in a companion document which addresses implementation.

Table 7.5. Scope of Recommendations for Future Action Contained in Watershed Report Cards

Watershed Organization	Report Date	Current Actions Acknowledged		Recommendations for Action Included		Recommendations for Who Should Undertake Actions				
		Yes	No	Yes	No	General	Watershed Organization	Watershed Stakeholders	Government Agencies	Individuals
FBC	2000	X		X		X				X
	2003	X		X		X		X	X	
	2006	X		X		X		X	X	
	2009	X		X		X		X	X	X
NSWA	2005		X	X		X	X	X		
BRBC	1994	X		X		X				
	2005	X		X		X				X
MVA	1998	X		X			X			
	2003	X		X			X			
	2009	X			X					
MWC	2004		X	X		X				X
	2007		X	X		X		X	X	X
UTRCA	2001		X	X		X				
	2007	X		X		X				
GRCA	2003	X			X					
	2004	X			X					
	2005	X			X					
	2006	X			X					
	2007	X		X		X				
	2008	X			X					
	2009	X			X					
CVC	2005		X		X					
HWA	2000	X		X		X	X	X	X	X
	2003	X		X		X				
	2007	X		X		X	X	X	X	X
DWRC	1997	X		X		X	X	X	X	
	2000	X		X		X	X	X	X	X
	2003	X		X		X		X	X	
	2006	X		X		X				
	2009	X		X		X	I	I	I	I
COVABAR	2000	X			X					
	2002	X			X					
MREAC	1992		X	X		X	X			
	2007	X			X					
CARP	2005			X		X				
	2006			X			X			X
	2007			X			X			X
	2008			X			X			X
	2009			X			X			X

I = Included in the Watershed Plan Implementation Guide

7.2 Overview of Key Watershed Report Card Characteristics

No standard framework or methodology exists for assessing or reporting watershed sustainability or health in Canada. The watershed report cards are mostly created through autonomous processes, initiated and led by the case-study watershed organization. This results in a diversity of report card styles and formats. The indicator selection process also varies. The selection of indicators is specific to each watershed, generally guided by broad goals established through strategic long-range plans or watershed plans, where they exist. The process for selecting indicators is either participatory or led by 'experts' or staff. Regardless of the process used, scientists are frequently consulted. The number of indicators chosen by the case-study watershed organizations ranges widely.

The indicators used by the case-study watershed organizations are primarily environmental or a mix of socio-environmental. Only three watershed organizations use indicators that span the three conventional dimensions of sustainability (e.g., environmental, social, economic). Most watershed organizations use more than one measure to characterize an indicator. An analysis of the measures used by the FBC and HWA shows a preference for quantitative and descriptive measures to explain conditions, trends, and outputs. Measures to describe on-the-ground effects due to specific policies, programs, or projects are rarely included. Measures are also used to (1) rate progress, (2) verify the direction of change, and/or (3) illustrate indicator characteristics or 'tell a story'. Four case-study watershed organizations rely extensively on secondary sources of data to select measures, although the majority use data gathered through their own watershed monitoring programs, supplemented by information from other sources.

While indicator themes remain relatively static between consecutive watershed report cards, the majority of indicators, measures, and rating systems used to report progress or track change from one edition to the next are inconsistent. Many watershed report cards use a grading system or a descriptive ranking to assign status to an indicator, but do not specifically describe the methodology used to determine the rating. Where data are available, aggregated indices to assess water quality are commonly used. However, because few thresholds and targets have been established, most rating systems are based on expert opinion or the judgments of engaged stakeholders. Similarly, a minority of watershed report cards identifies data gaps or stipulates further research and monitoring requirements.

Actions to improve watershed sustainability or health that are underway or recommended are incorporated into the majority of watershed report cards. However, the nature, extent, and expected effects of these actions are often generalized.

Chapter 8 presents the opinions and perceptions of informants regarding the nature, scope, and impact of watershed report cards. Chapter 9 incorporates further analyses and discussion of this research as it relates to (1) other research, theories, and observations specific to the development of indicators and report cards outlined in Chapter 3, and (2) the research questions outlined in Chapter 1.

Chapter 8: Watershed Report Cards: Opinions and Perceptions

8.1 Introduction

This chapter summarizes the opinions, perceptions,[91] and insights expressed by informants about the nature, scope, and impact of the watershed report cards. It also explores the perceived relationships of the watershed report cards to the stated vision, mission, and goals of the watershed organization and other planning and decision-making processes within each watershed.

The participants in the study represent a broad range of disciplines and experience. Of the 49 interviews/questionnaires conducted with individuals in the case-study watershed organizations, 13 were with chiefs of staff (e.g., executive director or senior manager)[92] and 23 staff members directly involved in the development of the watershed report cards (8 from the FBC, 5 from the HWA/TRCA, and 10 from other case-study watershed organizations), and 13 were with current chairs, past chairs, or vice chairs (2 from the FBC, 1 from the HWA, and 10 from other case-study watershed organizations). In the Fraser Basin and the Humber River watershed, these interviews were supplemented with insights and opinions from 10 FBC directors and 9 HWA members. In addition, 22 interviews/questionnaires were completed with municipal staff, including 11 from the Regional Districts of Greater Vancouver (Metro Vancouver) and Fraser Valley, Cities of Vancouver, Surrey, and Abbotsford, and the Township of Langley in the Fraser Basin, and 11 with staff from the Regional Municipalities of York and Peel, Cities of Brampton, Mississauga, Toronto, and Vaughan, the Town of Caledon, and the Township of King in the Humber River watershed. Representatives from 6 NGOs in the Fraser Basin and 2 NGOs in the Humber River watershed, as well as one senior official from both the Vancouver Foundation and the Toronto Community Foundation also provided input. As well, 6 provincial and 3 federal agency staff within the Province of British Columbia participated. In total, 109 interviews/questionnaires were completed.

Section 8.1.1 summarizes the informant profiles and examines the motivations of people participating as FBC directors and HWA members. Section 8.1.2 examines the uptake and application of sustainability principles by the case-study watershed organizations and their perceived role in advancing the watershed vision and goals. Key administrative issues and the processes for setting watershed and corporate goals are identified in Sections 8.1.3 and 8.1.4. Section 8.1.5 highlights the processes and challenges experienced with selecting indicators for the watershed report

[91] 'Opinion' and 'perception' differ in meaning. Opinion refers to "a personal view not necessarily based on fact or knowledge" (Oxford Dictionaries 2009: 641), while perception refers to "a particular understanding of something" (Oxford Dictionaries 2009: 677).

[92] Ten executive directors and 3 senior managers from 13 case-study organizations were interviewed.

cards. The benefits ascribed to watershed report cards and the observed shortfalls which hinder full attainment of these benefits are described in Section 8.1.6. How watershed report cards are used is investigated in Section 8.1.7. The nature and extent of connections between the watershed report cards and other reporting processes within respective watersheds and beyond are explored in Section 8.1.8. The lessons learned by informants and their suggestions for improving the watershed report cards are summarized in Section 8.1.9. Section 8.1.10 highlights the factors that are most influential in shaping plans, policies, programs, and projects of the case-study watershed organizations. The principal findings are summarized in Section 8.2.

8.1.1 Informant Profiles

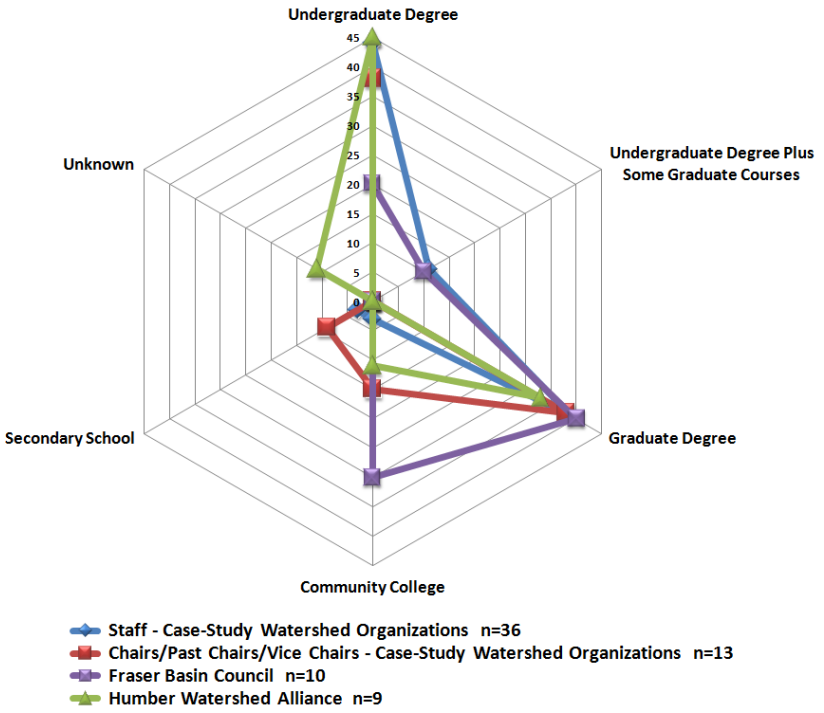
Staff and Board members[93] associated with the case-study watershed organizations are generally highly educated. Almost one-half of participating staff has a graduate degree or taken continuing educational and professional development courses, in addition an undergraduate degree. Disciplines represented typically include engineering, geography, planning and urban studies, biology, chemistry, and forestry. On average, staff has slightly over 10 years of work experience with their respective watershed organizations.

Similarly, individuals serving as chair, past chair, or vice chair of their respective watershed groups or serving as FBC directors or HWA members offer appreciable skill and a broad educational background, representing multiple disciplines and interests including engineering, history, art, communication, education, political science, health care, and facilitation. Many are retired professionals, former decision makers, and current local politicians. Those persons acting as chair, past chair, or vice chair have an average of slightly fewer than 10 years of service, while the length of service for other FBC directors and HWA members averages 5 years and 8.5 years, respectively.

Collectively, there is a substantial breadth and depth of experience and a high degree of competency among individuals associated with the case-study watershed organizations. The level of education attained by individuals directly associated with the case-study watershed organizations is shown in Figure 8.1. Similarly, informants associated with municipalities, government agencies, and non-government organizations (NGOs) within the Fraser Basin and the Humber River watershed are highly-educated professionals with post-secondary degrees. Indeed, all of the provincial and federal informants in British Columbia have graduate degrees.

[93] Staff and Board members refers to all staff members (including the chiefs of staff and senior managers) and all FBC directors and HWC members (including the chairs, past chairs, and vice chairs) who were interviewed. This terminology is used throughout this chapter.

Figure 8.1. Level of Education Attained by Informants (%)



The FBC directors and the HWA members are appointed and serve different functions, although they both oversee the production of watershed report cards. The FBC is a decision-making body that guides the policies and direction of the organization. The HWA is an advisory body to the Toronto and Region Conservation Authority (TRCA).

Thirty-six directors serve on the FBC Board. Of these, 22 are nominated by the four orders of government: three by the federal government, three by the provincial government, one by each of the eight regional districts in the basin, and one by each of the basin's eight First Nations language groups. The remaining 14 are non-governmental representatives nominated by the FBC. These 14 include two representatives from each of the Fraser Basin's five geographic regions (Upper Fraser, Cariboo-Chilcotin, Thompson Fraser Valley, Greater Vancouver Sea to Sky), one basin-wide representative for each of the three dimensions of sustainability (economic, social, and environmental), and an impartial chair. All appointments are made by the Fraser Basin Council Society (Calbick et al. 2004).

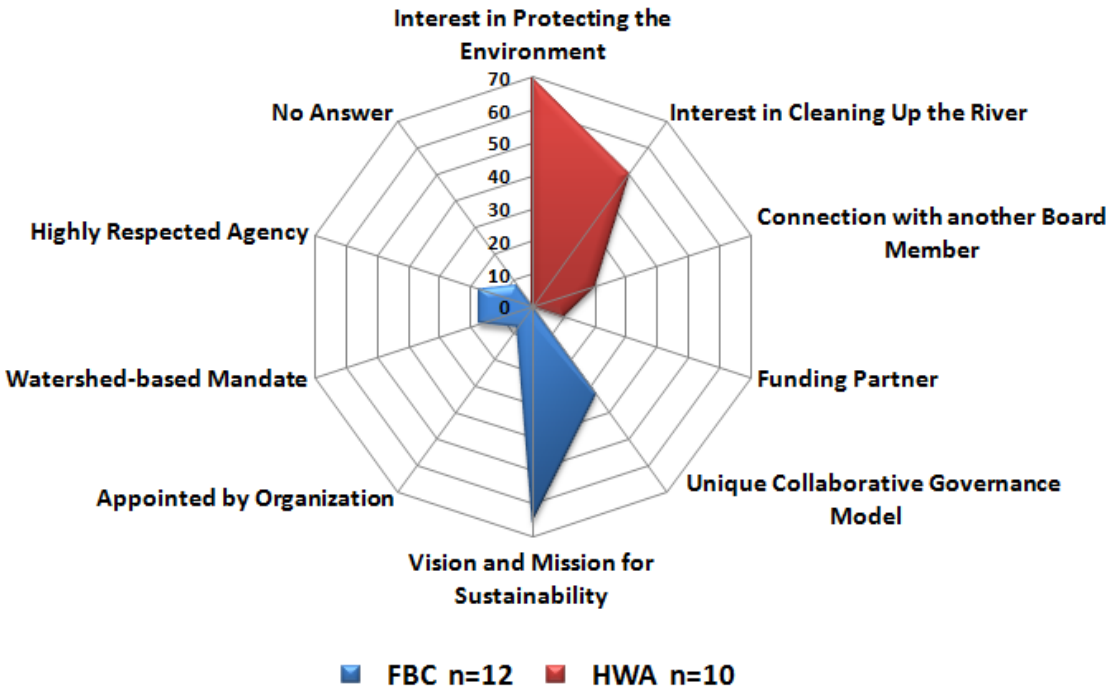
The HWA has about 40 members, excluding ex-officio members.[94] Ex-officio members include the chair of the TRCA, representatives from each of the 12 member municipalities (either a staff representative or a council member) and Federal and Provincial Members of Parliament whose area

[94] This number fluctuates depending on whether or not all of the appointments are filled.

of jurisdiction is within the Humber River watershed. Selected federal and provincial agencies and community groups are requested to appoint a representative. [95] Members at large are selected by the TRCA and include three individuals each from business and academia as well as 20 residents with specific interests (Toronto and Region Conservation Authority 2009b).

A total of 12 FBC directors and 10 HWA members participated in the interview/questionnaire. Results reveal that the motives for individuals to become members of the FBC and HWA are distinctly different. Generally, altruism is a key motivator for FBC directors while the discovery and promotion of practical on-the-ground solutions to key issues in the Humber River watershed is a prime incentive for HWA members. In the case of the FBC, informants indicate that the main reasons why they serve on the board are because the vision and mission of the organization (n_{FBC}=8, 66%) and the unique collaborative decision-making model (n_{FBC}=4, 33%) appeal to them. In contrast, the key rationale for HWA members is their interest in protecting the environment (n_{HWA}=7, 70%) and cleaning-up the Humber River (n_{HWA}=5, 50%). The full suite of reasons articulated by informants for serving on these two organizations is shown in Figure 8.2.

Figure 8.2. Informants' Reasons for Serving on the FBC and the HWA (%)

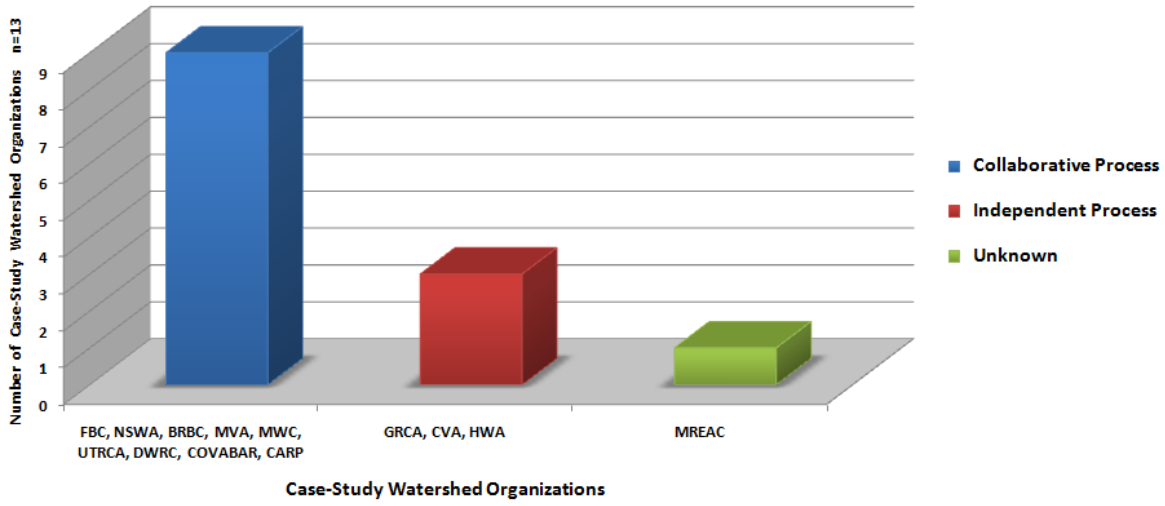


[95] Member municipalities include the Regional Municipalities of York and Peel, Cities of Vaughan; Mississauga, Brampton, and Toronto; Towns of Richmond Hill, Aurora, Caledon, and Mono; and the Township of Adjala-Tosorontio. Municipalities are requested to appoint one council member or staff representative with the exception of Toronto which is asked to appoint one member each from the Toronto North Community Council, Toronto South Community Council, and Toronto West Community Council.

8.1.2 Sustainability Principles in Action

Each case-study watershed organization has developed a broad vision statement. Although no formal vision statement has been articulated by the Miramichi River Environmental Assessment Committee (MREAC), its mission serves the purpose of both a vision and mission statement. Many of these vision statements have been developed and vetted through an extensive public engagement process. Others have been created by the staff and Board members of the watershed organizations independently. Figure 8.3 indicates whether the process used to craft the vision for the watershed organization was collaborative or independent.

Figure 8.3. Process Used to Define the Watershed Vision

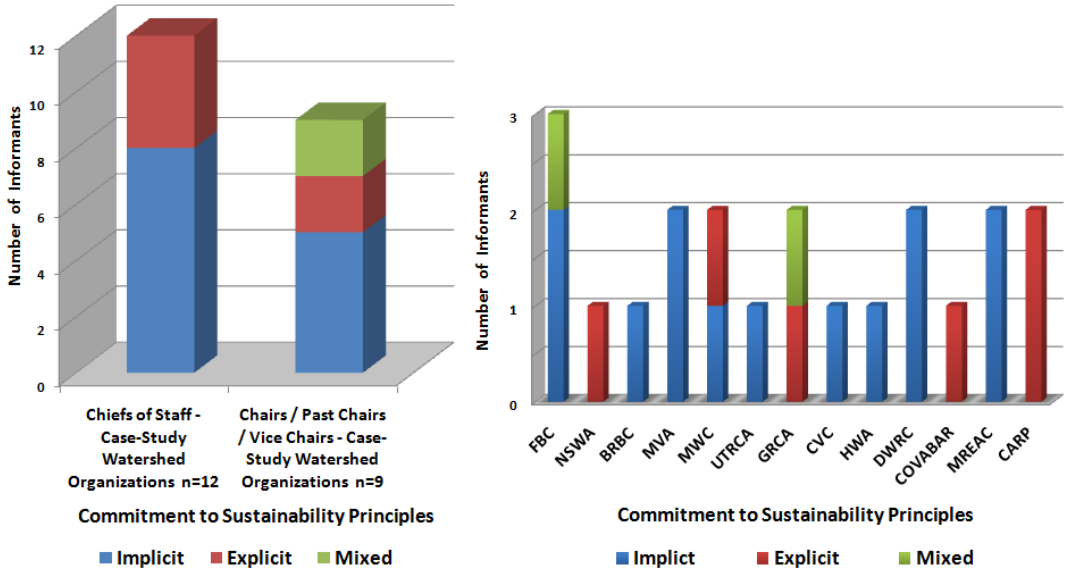


Each chief of staff and the chairs, past chairs, and/or vice chairs interviewed were asked if they believed that the vision statement of their respective watershed organizations demonstrated a commitment to sustainability, either implicitly (implied) or explicitly (stated). They were also requested to pinpoint those principles they felt were embedded in the vision and embraced by the organization through its operations. This distinction was made to discover if certain management principles were embraced tacitly, rather than overtly.[96] In order to identify and compare relevant principles important to informants, each was provided with a pre-established list, consistent with Table 2.4 in Chapter 2, and was invited to add any missing principles. While this tactic may have prompted some answers that would not have otherwise been expressed autonomously, it provides a uniform platform from which to compare answers and relate them to the principles associated with contemporary watershed management identified in the literature (Table 2.4).

[96] An analysis of the stated vision and mission statements of the case-study watershed organizations may exclude any 'operational' principles that are unstated, yet embraced by the watershed organization.

All who responded (n=21) believe that the principles of sustainability are ingrained within their respective visions.[97] The majority of informants (n=13, 62%) think that sustainability is an implied value. In contrast, informants from five watershed organizations (e.g., NSWA, MWC, GRCA, COVABAR, CARP) deem that their vision explicitly addresses sustainability. Two individuals, one from the FBC and one from the GRCA, believe that some principles of sustainability are explicit, but others are implicit (mixed). Figure 8.4 illustrates the split in opinion between the chiefs of staff and the chairs/past chairs/vice chairs of the case-study watershed organizations and provides the breakdown of opinions by watershed organization.

Figure 8.4. Perceived Sustainability Connections to Stated Vision Statements

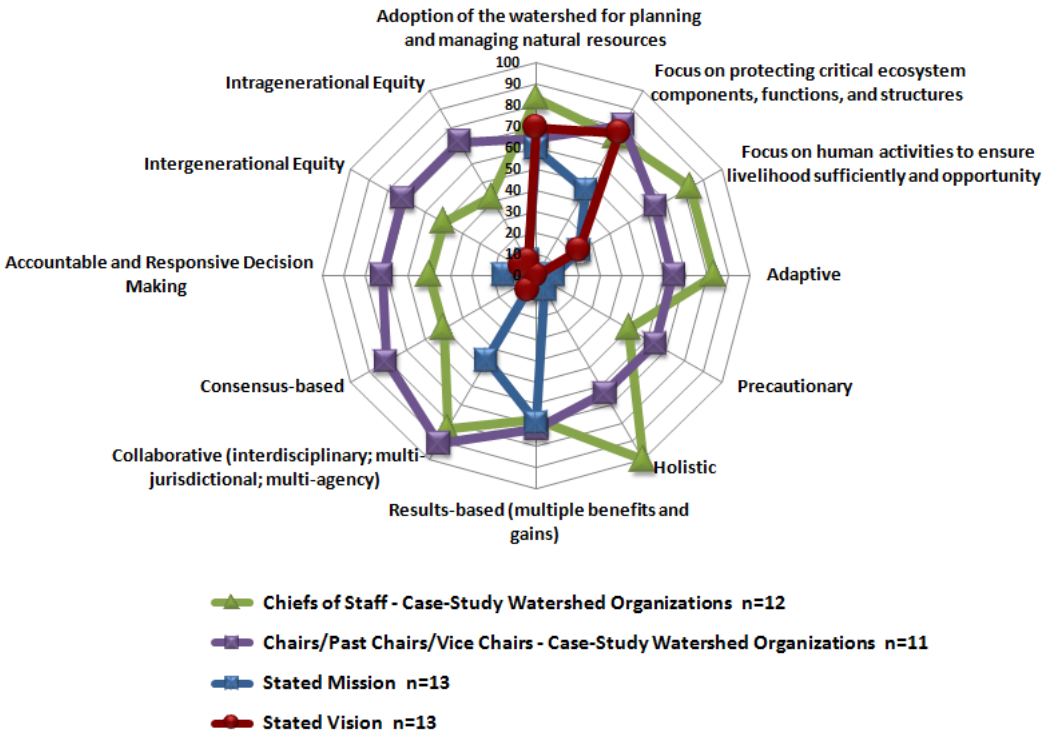


The sustainability principles chosen as the most pertinent to the vision and day-to-day operations of the respective watershed organizations are compared with those detected in the vision and mission statements (Chapter 6) and summarized in Figure 8.5. Results show that the vision and mission statements do not clearly portray the full suite of principles championed by the informants and that certain principles are intrinsic to day-to-day operations. Among 12 chiefs of staff (CS), there is a clear preference for principles that support (1) a holistic approach (n_{CS}=12, 100%), (2) watersheds as a management unit (n_{CS}=10, 83%), (3) a focus on managing human activities (n_{CS}=10, 83%), (4) adaptive management (n_{CS}=10, 83%), and (5) collaboration (n_{CS}=10, 83%). The emphasis on specific principles is not as clearly defined among 11 chairs/past chairs/vice chairs (C) who collectively support a more balanced suite of principles. Leading principles among this group accentuate collaboration (n_C=10, 91%), consensus (n_C=9, 82%), and a focus on protecting critical ecosystem

[97] One chief of staff and 4 chairs/past chairs/vice chairs did not provide an opinion.

components, functions, and structures (n_C=9, 82%). This analysis reveals that decision makers tend to recognize a more complete suite of sustainability principles as relevant to their work, whereas staff members place less emphasis on intragenerational and intergenerational equity, the precautionary approach, consensus, and accountable and responsive decision making.

Figure 8.5. Sustainability Principles Identified by Informants (%) and Interpreted from Vision and Mission Statements (%)



In addition to the principles provided in the pre-established list, others were suggested, including:

- understand, respect, and do not exceed the carrying capacity and tolerances of supporting ecosystems;
- restore ecosystems (not just protect);
- harmonize built design with the existing natural landscapes;
- make stakeholders accountable for creating a common vision and implementing appropriate actions;
- know and manage risks and uncertainty; a lack of certainty should not prevent decisive actions for sustainability;
- initiate and maintain communications among stakeholders;
- acknowledge that transition takes time and that in the short term, elements of sustainability may not always be in balance;
- acknowledge and reconcile Aboriginal rights and titles in a just and fair manner; and,
- recognize existing rights, agreements, and obligations in all decision making.

These suggested additions elaborate on the overarching principles already identified in Table 2.4 and relate specifically to the state of supporting ecosystems, human-ecological relations, accountable and responsive decision making, and intragenerational equity. Risk and uncertainty are acknowledged as elements which must be addressed but not used as an excuse for not taking action (alludes to the precautionary principle and results-based courses of action being applied simultaneously).

Although many informants believe that all of the principles should be embraced by their respective watershed organizations, several provide further insights and cautions regarding their application. As one informant (Informant #13, 2009) notes,

> A fully-shared commitment to sustainability must incorporate all of the [principles listed]. In practice it is extremely difficult to get and keep everyone on the same page around these [sustainability] concepts. Most disagreements surround how to balance environmental and economic considerations in the face of ongoing population growth and resource extraction/utilization. Collective experience suggests it is very difficult, if not impossible, to accommodate significant growth without some environmental loss. The concepts of zero impact or no net loss require further examination. Some legislation…and local decision making processes contribute to situations where development rights can trump the environmental safeguards necessary for ensuring the sustainability or restoration of key watershed features, functions, and systems.

It was also acknowledged that while the concept of adaptive management is supported, its practice is hampered by forces that watershed organizations cannot control. One informant (Informant #26, 2009) notes that, "adaptive management is maybe not done as well as it should be because decisions are influenced by the values of the day and goals shift." Another informant (Informant #21, 2009) offers the following observation,

> The [watershed organization] has no legal power to make things happen…It is also dependent on funds from government and industry to operate. This means much effort is needed to 'network' and understand the political system…as a result, the [watershed organization] tends to be reactive rather than proactive.

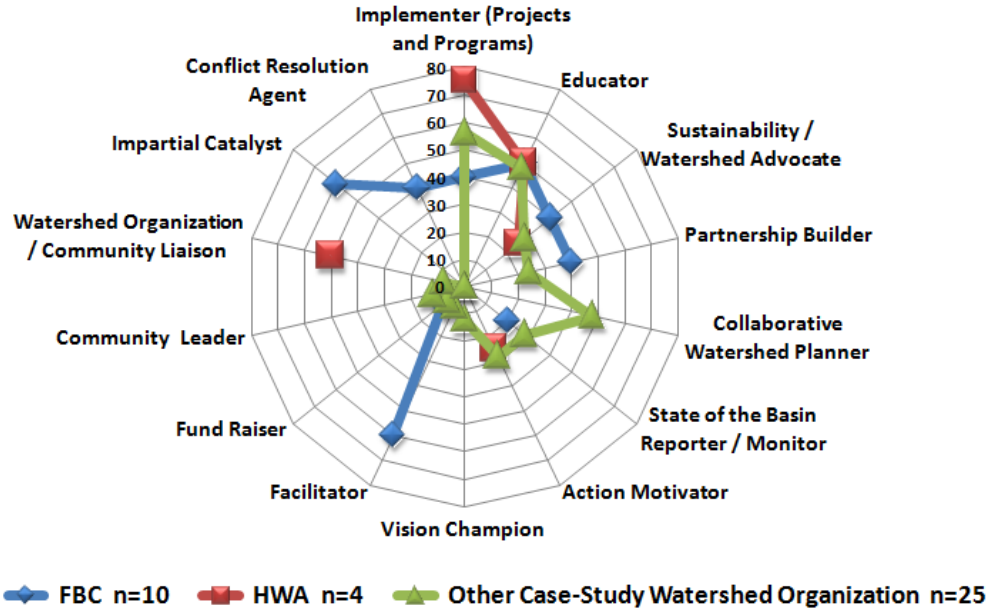
When asked about what role the watershed organization plays in achieving the vision, the most common response was that it functions as an on-the-ground implementer of specific programs and projects. Watershed organizations are also seen to play an essential role in educating watershed residents since they are not the sole proprietor of the watershed health or sustainability agenda. The importance of educating watershed residents is described by a informant (Informant #36, 2009), who states that,

> The [watershed organization] attempts to provide up-to-date and scientifically-based information to stakeholders in an effort to engage them in good decision- making

> choices and to engage in discussions concerning water management issues in the basin. Through stakeholders forums…the organization is bringing people together to learn more about what work is being done in the basin and to engage in dialogue with each other. Other information distribution methods include special issue workshops, State of the Basin reporting, website, and standing and project specific committees. The membership has a large scope of interests and professional backgrounds and technical expertise which help in discussions and decision making from multiple perspectives. The [watershed organization] is always looking to engage more interested individuals.

Figure 8.6 shows the most frequently-mentioned roles identified by staff and Board members from the 13 case-study watershed organizations (n=39).[98] In addition to being on-the-ground implementers and community educators, informants believe that watershed organizations play important roles in advocating sustainability and watershed health. Informants from the HWA cite its liaison role between the TRCA and communities (n_{HWA}=2, 50%), while the majority of informants from the FBC (n_{FBC}=6, 60%) identify impartial catalyst and facilitator as particularly noteworthy roles for their organization. The relative importance of other roles varies among informants. Among other case-study watershed organizations (OCSWO), collaborative watershed planning as a fundamental role is mentioned by almost one-half of the informants (n_{OCSWO}=12, 48%). Other important but less frequently-mentioned roles include partnership builder, action motivator, and state of the basin reporter/monitor. The full range of responses is summarized in Appendix C.2.

Figure 8.6. Key Roles for Watershed Organizations in Achieving the Vision as Identified by Informants (%)



[98] Ten staff and Board members from the 13 case-study organization did not provide a response and are not included in this specific analysis.

8.1.3 Key Administrative Issues

Among case-study watershed organizations, the most common administrative issue identified by 13 chiefs of staff is the lack of funding to implement on-the-ground actions. As one participant (Informant #2, 2008) states, "the key issue is money, money, money – how to get it and how to spend it wisely..."

Navigating bureaucratic processes and protocols imposed either internally by the Board of Directors or by external agencies was cited as another key administrative burden. The composition of the board was also seen as an issue. One informant (Informant #10, 2009) notes that, "the commitment and strength of the Board members is an issue when they wear their municipal rather than watershed hats; perhaps direct elections would provide more of a sectoral mix. We need to move to a new model." The suite of administrative issues identified by the 13 chiefs of staff is shown in Figure 8.7.

Figure 8.7. Key Administrative Issues Identified by Chiefs of Staff

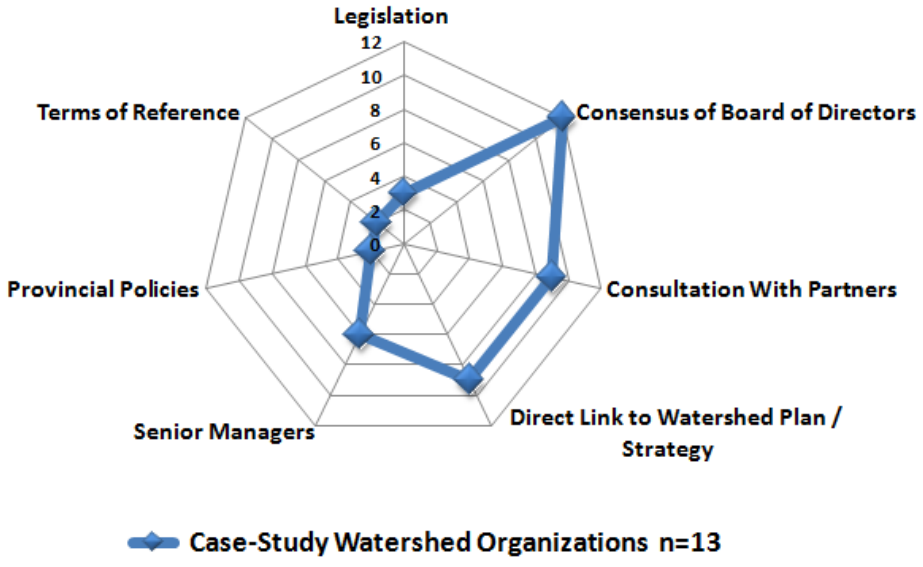
8.1.4 Goal Setting

Questions about how the operational goals and objectives are set by the case-study watershed organizations were posed to chiefs of staff and chairs/vice chairs/past chairs. Responses were elicited from 21 of 26 informants. Answers reveal that goals are shaped by a number of interrelated factors.

For the most part, overarching goals are set by the Board of Directors within the context of applicable legislation (e.g., Ontario's conservation authorities and the MVA), provincial policy directives, specific Terms of Reference (e.g., HWA and DWRC), or directly linked to broad goals established in watershed plans or strategies, which are usually set to complement and support the watershed vision. Watershed partners may also contribute to corporate goal setting through collaborative planning processes. On a day-to-day basis, senior managers often set direction for programs and projects within the framework of these broader goals.

Several case-study watershed organizations engage in facilitated strategic planning sessions on a periodic or annual basis with the Board of Directors, staff, members, and/or partner agencies to review existing goals and identify new management targets and directions (e.g., FBC, BRBC, MWC, CARP). One informant (Informant #8, 2009) cautions that the goals defined for the watershed organization, "can be influenced by the province and the priorities and issues that it is responding to." The primary factors which contribute to goal development as identified by the informants are aggregated by case-study watershed organization in Figure 8.8.

Figure 8.8. Factors Which Contribute to Goal Setting in Watershed Organizations

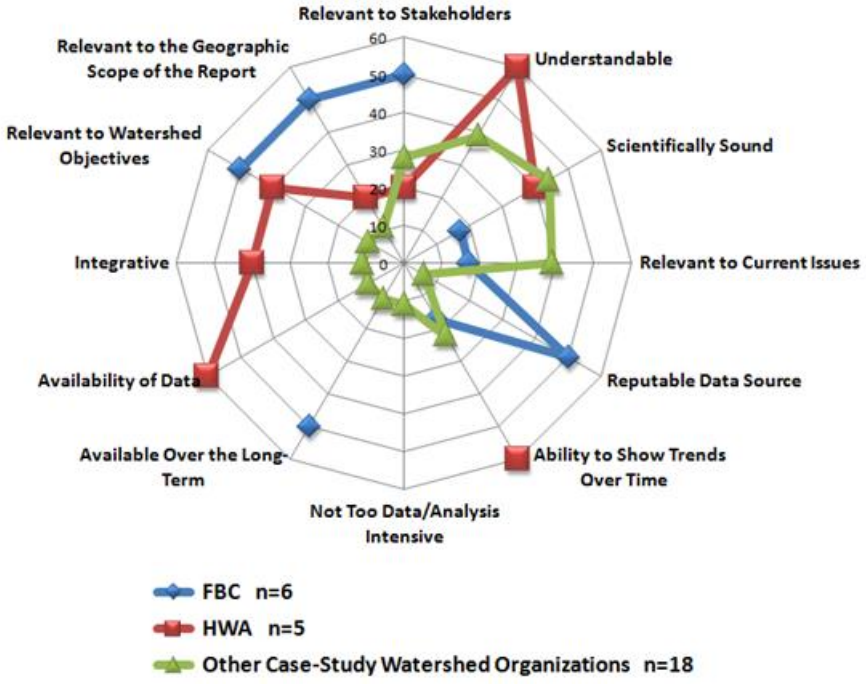


8.1.5 Selecting Watershed Indicators

Sections 7.1.2 and 7.1.3 in Chapter 7 distinguish the general traits of the indicators used for the watershed report cards included in this study. The process of indicator selection and the associated challenges, as perceived by staff members from 13 case-study watershed organizations directly associated with the oversight and/or development of watershed report cards, are the focus of this section.

Twenty-nine staff members provided insights and views regarding the most important criteria for selecting indicators. Figure 8.9 suggests general concurrence on key criteria, but opinions diverge regarding their relative importance. Informants from the FBC most often stress indicators that are relevant to watershed objectives, stakeholder interests, and the geographic scope of interest and long-term data that are available from a reputable source (n_{FBC}=3, 50%). In the Humber River watershed, informants emphasize indicators that are understandable to the public, have the ability to show change, and are available (n_{HWA}=3, 60%). Other characteristics noted by HWA informants are (1) integrative, (2) scientifically sound, and (3) relevant to watershed objectives. Informants from the other case-study watershed organizations underscore the need for understandable, scientifically-sound indicators that show trends over time and relevance to current issues.

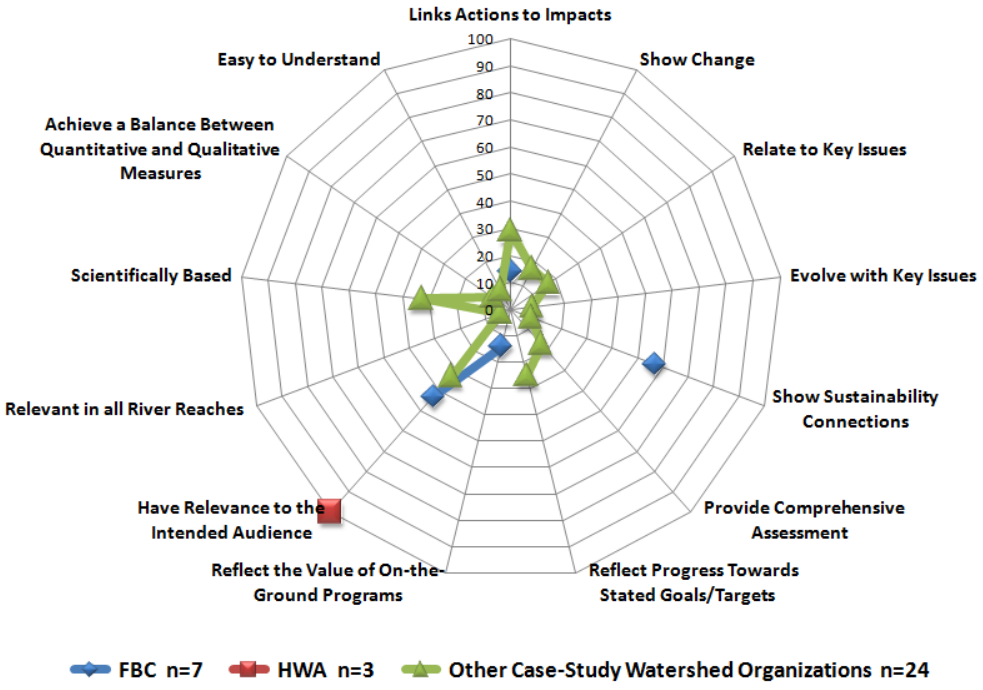
Figure 8.9. Informants' Opinions about the Most Important Criteria for Selecting Indicators (%)



Staff and Board members were asked about which indicator attributes are the most useful. This question elicited a wide range of divergent responses because some informants identified desirable indicator traits, while others specified specific indicator themes. Thirty-four informants identified a suite of indicator traits that were considered most effective. Indicators that have relevance to the intended audience are valued by informants from the FBC, MWC, CVC, HWA, DWRC, and CARP. The majority of FBC informants (n_{FBC}=4, 57%), identified indicators that can illustrate sustainability connections as most beneficial, while indicators that have relevance to the intended audience are cited as most useful by all HWA informants (n_{HWA}=3, 100%). Indicators that are scientifically based, relate

to key issues, and reflect progress towards goals and targets are considered most valuable by a number of informants from other case-study watershed organizations. Figure 8.10 identifies indicator traits considered to be the most useful by informants.

Figure 8.10. Informants' Opinions about the Attributes of Most Useful Indicators (%)

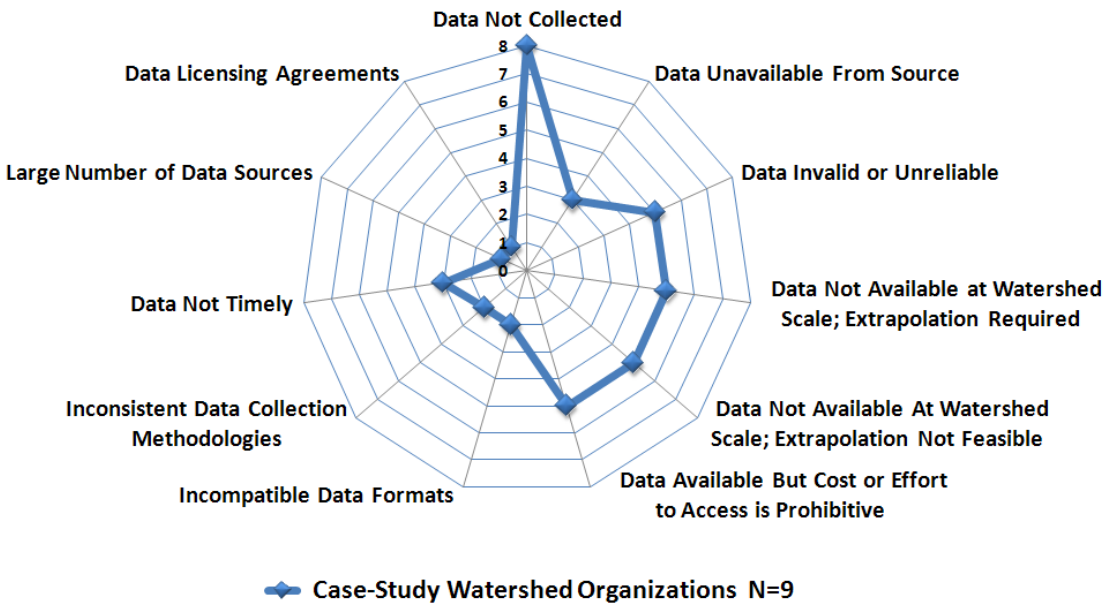


A wide range of specific indicators were considered most useful by 26 staff and Board members. In the Fraser Basin, 10 FBC informants provided a diverse range of opinions about core indicators for environmental, social, and economic factors. Indicators measuring water quality, fisheries, and air quality conditions and trends are identified by 30 per cent (n_{FBC}=3, 30%) as the foremost environmental indicators, while key social indicators gauging human health, homelessness, and poverty are considered important by 20 per cent (n_{FBC}=2, 20%). Income levels are an overriding economic indicator recognized by 50 per cent (n_{FBC}=5, 50%). In the Humber watershed, 9 individuals identified a wide range of leading environmental indicators. Wetlands, water quality and water quantity, fisheries, and forest cover emerged as areas of equal interest (n_{HWA}=2, 22%). Measures to assess community stewardship are also considered important (n_{HWA}=3, 33%). Seven informants from other case-studies also focused on environmental indicators and identified measures of water quality and fish habitat and health as most useful (n_{OCSWO}=3, 43%).

The staff persons directly involved in gathering, collating, and interpreting data for the watershed report cards from nine case-study watershed organizations[99] (n=9) indicate that the main hurdles associated with selecting indicators relate to data properties and availability. A major constraint in eight watersheds is the paucity of data. Data are either not collected resulting in significant data gaps, or collected at a geographic scale not pertinent to or coincident with the watershed boundary. Even when data are available, the effort and cost to retrieve them may be sizeable if secondary sources of data are relied upon. In addition, the time it takes to collect and assemble data is often problematic if multiple data sources are used. Administrative and logistical barriers such as data licensing agreements and inconsistent data collection methodologies may further complicate data accessibility and use. One significant drawback lies in the fact that Statistics Canada, a key data source, collects data by census tract, every five years, while many watershed report cards are produced biennially or triennially.[100] Figure 8.11 identifies the key data challenges experienced by the nine case-study watershed organizations.

Other challenges noted by informants include (1) determining the best way to depict trends, (2) choosing terminology that relates to the intended audience, (3) setting realistic short-term goals, and (4) selecting an appropriate number of indicators.

Figure 8.11. Data Challenges Associated with Indicator Selection

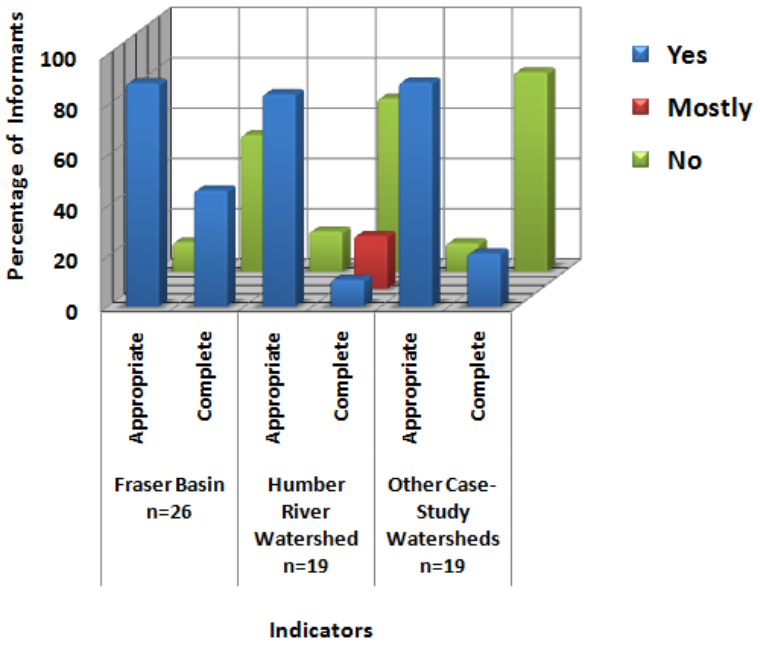


[99] Informants from MVA did not identify any data challenges associated with indicators used in its report cards. The lack of resources is believed to be the key challenge. Responses were not solicited from the GRCA, COVABAR and MREAC since their report cards are descriptive, with less emphasis on indicators.

[100] Census tracts are small, relatively stable geographic areas that are located in census metropolitan areas (CMAs) and larger census agglomerations (CAs) and usually have a population of 2,500 to 8,000.

When asked whether the indicators chosen for the watershed report cards are appropriate and complete, 64 informants responded.[101] A majority (n=56, 88%) deem that while the indicators are appropriate, they are not necessarily complete.[102] Almost 70 per cent of the informants from the Humber River watershed (n_{HWA}=13, 68%), believe that the indicators are not complete. More specifically, 58 per cent informants (n_{HWA}=11) mention the need for more socio-economic indicators. In contrast, a slightly lower percentage of informants believe that indicators used for the Fraser Basin Snapshots are incomplete (n_{FBC}=14, 54%). Nineteen per cent of informants (n_{FBC}=5) in the Fraser Basin state that additional socio-economic indicators to address issues such as homelessness, poverty, crime, and addiction are needed. Another 16 per cent of informants (n_{FBC}=3) consider the water quality and quantity indicators to be insufficient. Seventy-nine per cent (n_{OCSWO}=15) from other case-study watershed organizations believe that the indicators used in their watershed report cards are incomplete. Additional indicators identified for inclusion include water quality (n_{OCSWO}=2, 11%) and stakeholder attitudes (n_{OCSWO}=1, 5%). The split in opinion among informants regarding whether or not the indicators selected for the watershed report cards are appropriate and complete is provided in Figure 8.12.

Figure 8.12. Informants' Opinions about whether Indicators are Appropriate and Complete



[101] This total represents the number of individuals who responded from all groups except community foundations (n=107).

[102] Sixty-four informants provided an opinion about whether or not the indicators were appropriate and complete. Informants from the two community foundations were not asked to respond to this question.

8.1.6 Benefits and Shortfalls of Watershed Report Cards

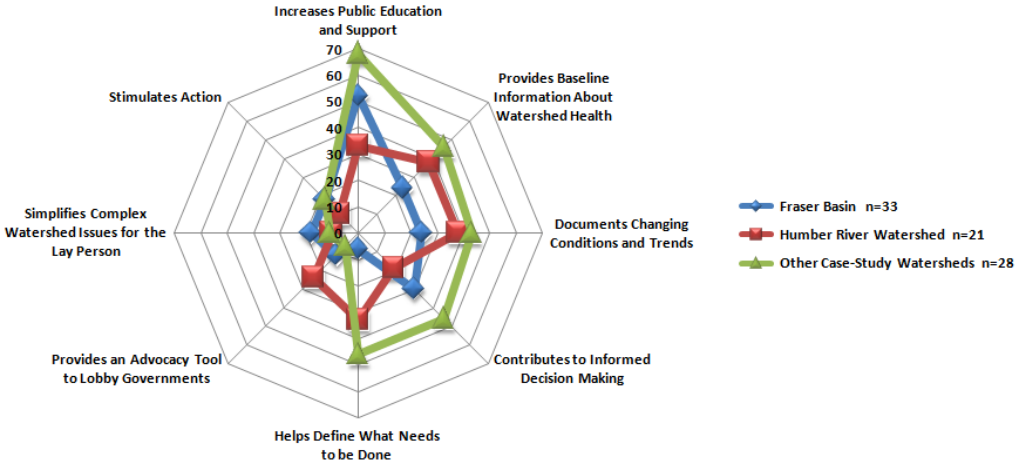
This section discusses the perceived benefits and shortfalls of the 39 watershed report cards. Each informant, with the exception of representatives from the two community foundations, was asked to identify benefits of watershed report cards (n=107). Only staff and Board members were specifically requested to pinpoint shortfalls.

The range of benefits assigned by 82 informants to watershed report cards is diverse (Appendix C.3). The most cited benefit is their contribution towards increasing overall public education, awareness, and support (n=43, 52%). Other responses centre on the watershed report cards as useful mechanisms to inform planning and decision-making processes. For example, watershed report cards are collectively valued for (1) providing baseline/benchmark information about the health of the watershed from which to measure change and progress (n=29, 35%), (2) documenting changing conditions and trends over the short and long terms (n=28, 34%), (3) contributing to informed planning and decision making (n=27, 33%), and (4) helping to define what needs to be done and what resources and actions are needed for implementation (n=22, 27%). In the words of one informant (Informant #3, 2008),

> We are seeing programs being developed both by [the watershed organization] and our watershed partners. In particular, it became evident very early that we had very little hard data on the terrestrial side and required more wetland evaluations to be undertaken. Both these initiatives are now underway.

Some informants also acknowledge watershed report cards as beneficial for lobbying governments for further support and/or funding, particularly in the Humber River watershed (n_{HWA}=5, 24%). Figure 8.13 identifies the key benefits of watershed report cards as perceived by informants from the Fraser Basin, Humber River watershed, and other case-study watersheds.

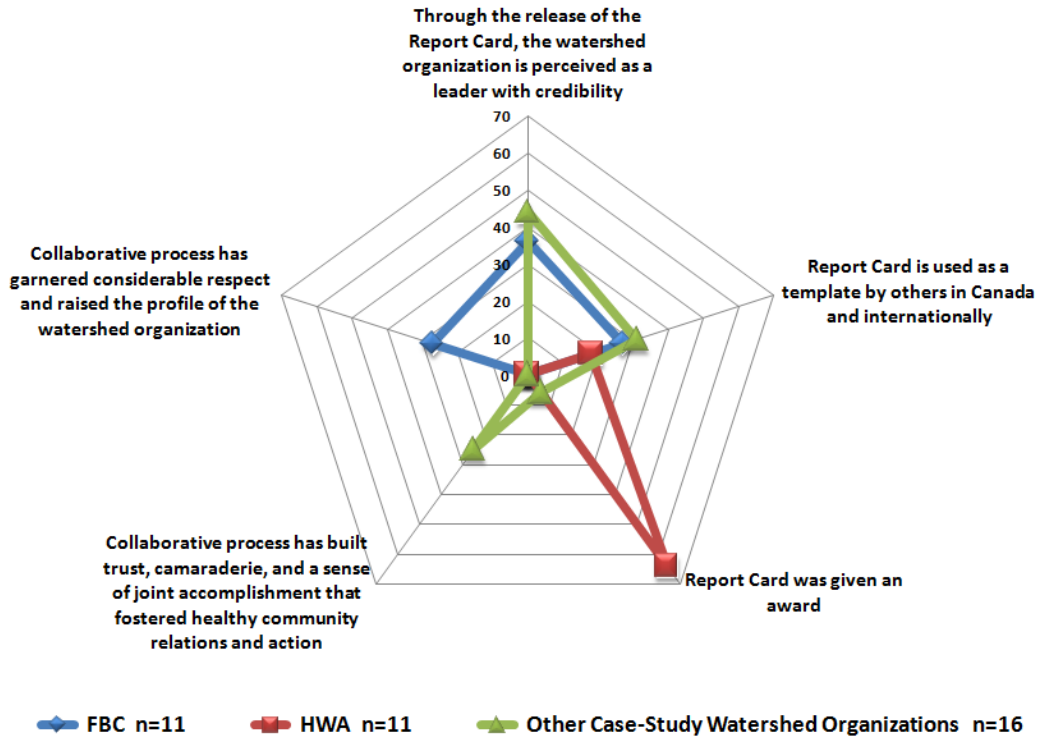
Figure 8.13. Leading Benefits of Watershed Report Cards Identified by Informants (%)



In addition to the anticipated benefits thought to be obtained through the creation of watershed report cards, several staff and Board members report unplanned benefits. The Fraser Basin informants mention that the Sustainability Snapshots increase the profile of and credibility given to the Fraser Basin Council. Informants from the Humber River watershed note that the most recent watershed report card was honoured with an award from the Canadian Institute of Planners. Similarly, informants from the NSWA cite the receipt of an Emerald Award from the Alberta Foundation for Environmental Excellence.

Informants associated with the other case-study watershed organizations remark that the inclusive processes used to develop the watershed report card foster a sense of community collaboration and fellowship and a collective call for action. In addition, watershed report cards help to raise awareness, support, and credibility for their respective watershed organizations. Figure 8.14 illustrates the leading unplanned benefits noted by informants. A full list is provided in Appendix C.4.

Figure 8.14. Unplanned Benefits of Watershed Report Cards Identified by Informants



Even though watershed report cards are viewed as vital instruments for defining essential actions for improving watershed conditions (except in the Fraser Basin), they are not believed to be a robust tool for stimulating local actions. One informant (Informant # 52, 2008) thinks that, "too much time

and effort is spent on something that has little impact…hands-on community action engages the public; not reports." This sentiment is echoed by another informant (Informant #29, 2008) who states that, "I'm not aware of any use the indicators report are being put to. From the perspective of this region, the report was greeted as interesting but it did not generate any change. The basin-wide report has limited interest in this area." Another informant (Informant #12, 2008) laments,

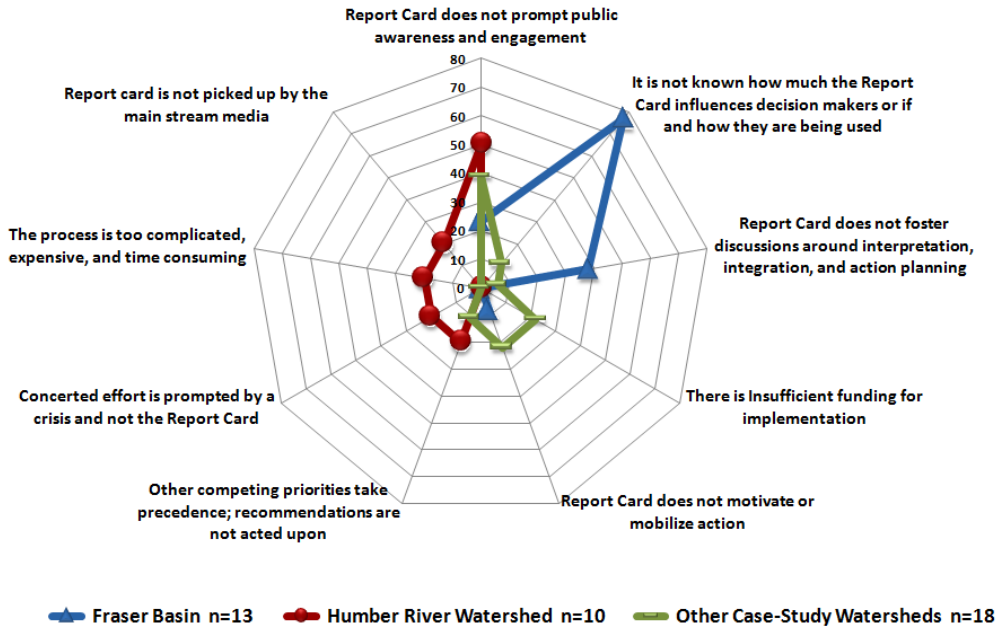
> Most people understand many of the problems but the urgency to accelerate efforts and improve upon the efforts is not taken seriously because of other pressures. Often, a major disaster or threat needs to be on the forefront to motivate the necessary actions at a scale which will have a measurable impact in a reasonable amount of time.

Staff and Board members were specially asked to identify major shortfalls associated with watershed report cards. Forty-two individuals offered views that are occasionally contradictory to the benefits ascribed to watershed report cards depicted in Figure 8.13. For example, in the Fraser Basin, even though 52 per cent (n_{FBC}=17) of the informants believe that Sustainability Snapshots increase public awareness and support and 30 per cent (n_{FBC}=10) think that they contribute to informed decision making, 71 per cent (n_{FBC}=10) of the staff and Board members, who provided opinions regarding the shortfalls, are uncertain about their impact on decision makers or how they are being used (Figure 8.15). Thirty-five per cent (n_{FBC}=5) also believe Sustainability Snapshots do not instigate public dialogue around interpretation, integration, and action planning and 21 per cent (n_{FBC}=3) think they do not prompt public awareness or engagement.

In the Humber River watershed, Figure 8.13 shows that 33 per cent (n_{HWA}=7) of informants think that report cards increase public awareness and support, while Figure 8.15 shows that 50 per cent (n_{HWA}=5) of the staff and Board members, who provided opinions regarding shortfalls, believe that they do not prompt public awareness and engagement to the extent that they should. This sentiment is also echoed by informants from other case-study watersheds (n_{OSCWO}=7, 39%).

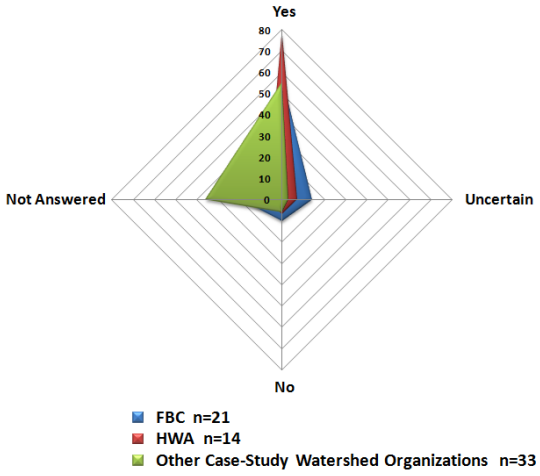
In addition, other reported shortfalls include (1) the report card process drains available resources, (2) the report card does not garner enough media attention and any exposure is short-lived, and (3) other priorities overshadow report card recommendations. It was also noted that crisis management often pre-empts strategic action. Figure 8.15 identifies the key observed shortfalls.

Figure 8.15. Key Shortfalls of Watershed Report Cards Identified by Informants (%)



Despite these shortfalls, the majority of the 68 staff and Board members who were interviewed (n=50, 74%) collectively believe that the benefits of developing a watershed report card exceed the costs, as illustrated in Figure 8.16.

Figure 8.16. Informants' Opinions about Whether Report Card Benefits Outweigh Costs (%)



Although the watershed report produced by the GRCA is not indicator-based, the staff and Board members interviewed unanimously support the development of an indicator-based report. However, they also concur on the main reasons why an indicator-based report has not yet been generated: (1) superseding priorities, (2) insufficient financial and human resources, and (3) the lack of a focused and efficient methodology which, when applied, shows change within a specified time frame. One

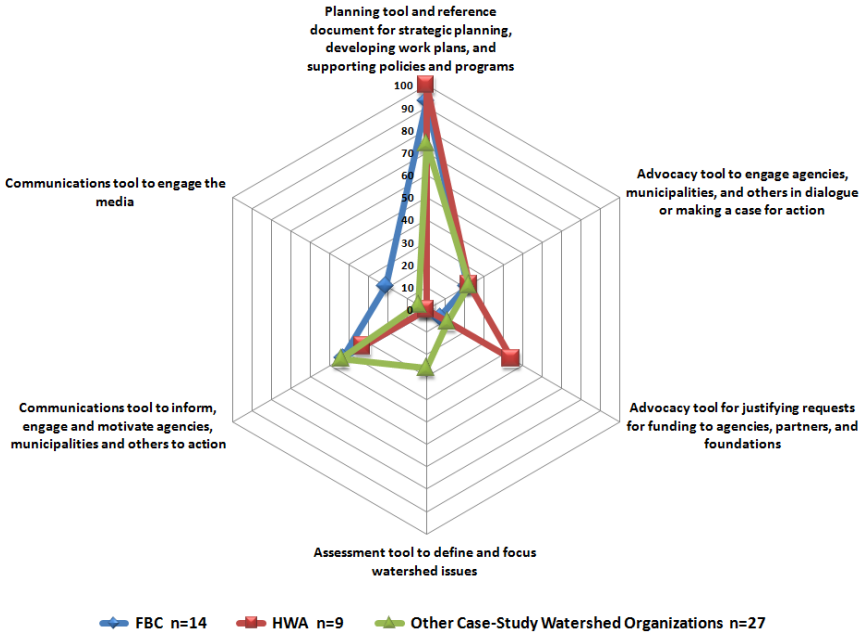
informant felt that one reason for not undertaking a report card is because the results may be discomforting or offensive to some.

8.1.7 Use of Watershed Report Cards

This section describes how watershed report cards are being used by the case-study organizations. In addition, it provides insights regarding how staff and Board members believe they are being used by others outside of the organization. These answers are compared with the responses received from municipal and NGO informants in the Fraser Basin and the Humber River watershed, and provincial and federal agencies representatives in the Fraser Basin.

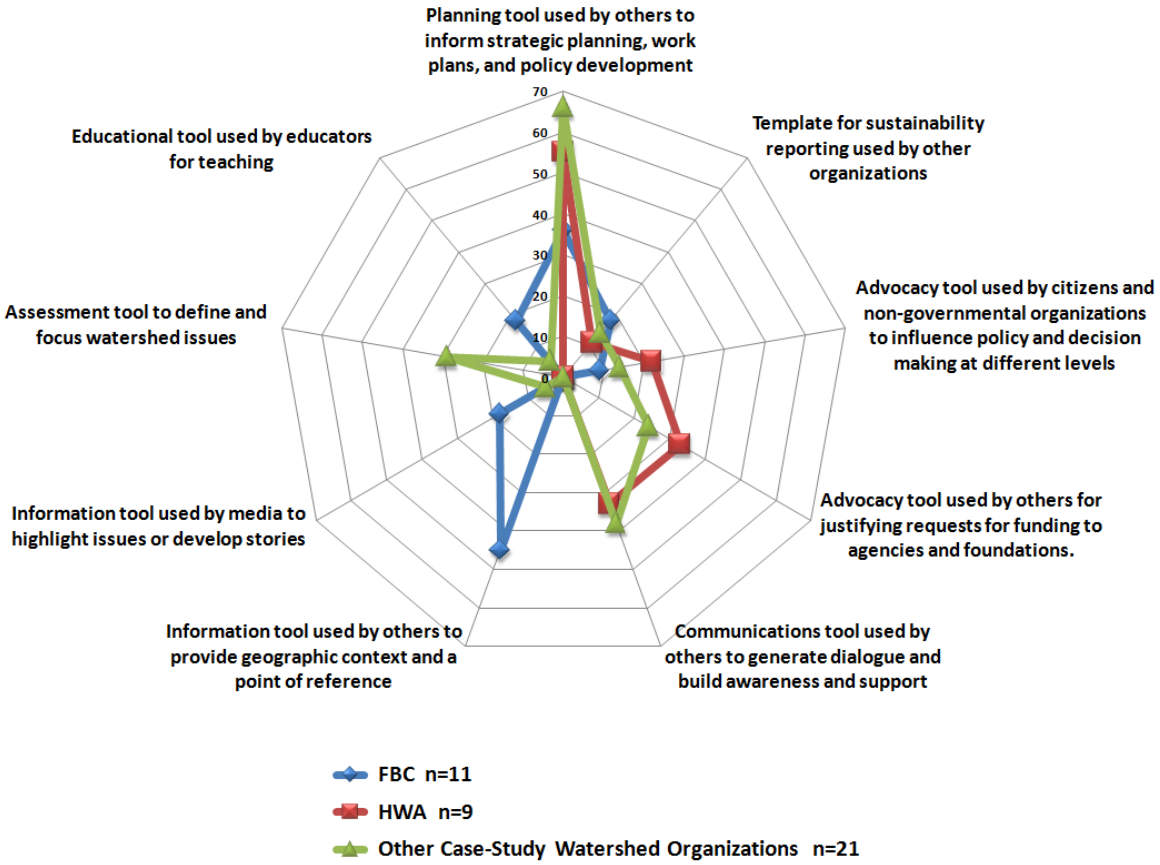
Fifty staff and Board members responded to questions about how watershed report cards are used by their respective watershed organizations. Results show that watershed report cards are principally used for strategic planning, work plans, and supporting in-house policies and programs (n=42, 84%). They are also used for engaging partners in dialogue about watershed issues and motivating action (n=21, 42%), advocating programs and building a business case for undertaking certain activities (n=11, 22%), or justifying funding requests (n=8, 16%). Informants from the FBC specifically point out that the Sustainability Snapshots provide an important means of engaging local media (n_{FBC}=2, 18%). Informants from other case-study watershed organizations also indicate that the report cards are used for defining watershed issues (n_{OCSWO}=6, 22%). Figure 8.17 shows the primary uses of the watershed report cards identified by staff and Board members. The full range of uses identified by informants is contained in Appendix C.5.

Figure 8.17. Uses of Report Cards by Watershed Organizations as Identified by Informants (%)



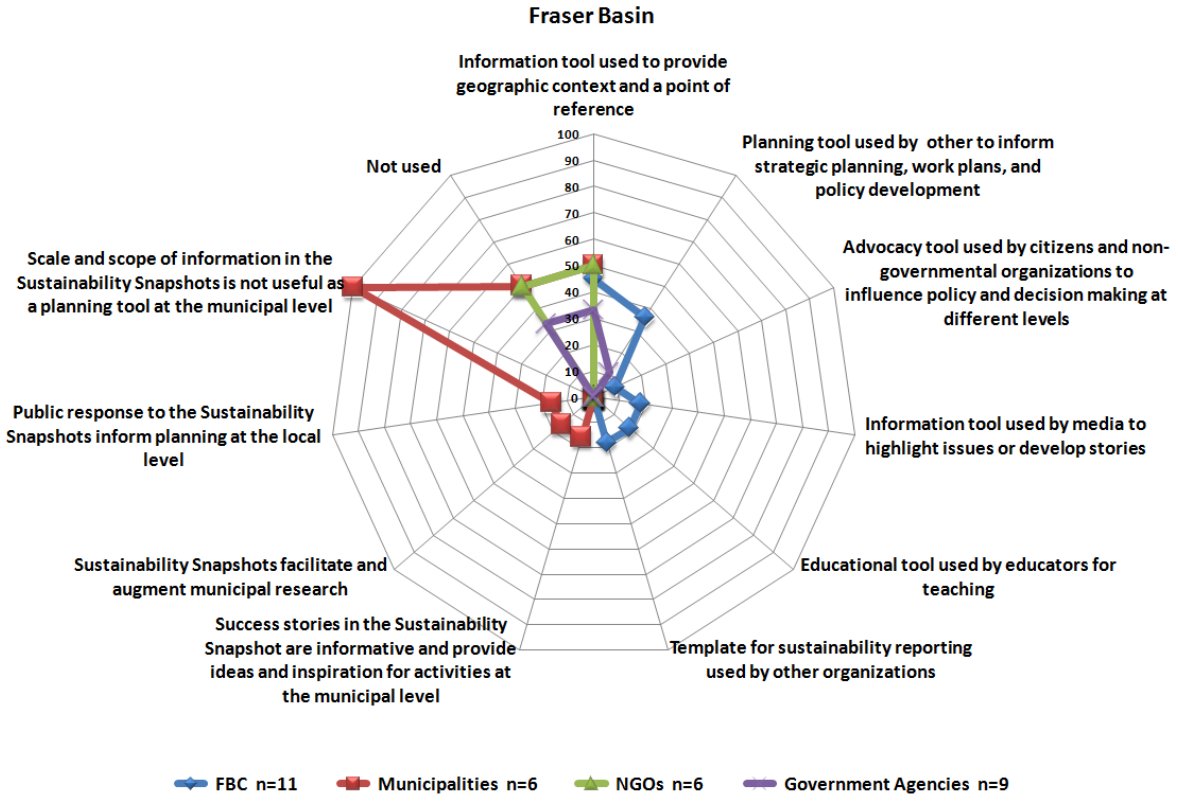
With respect to how watershed report cards are being used by other agencies, groups, and municipalities, 41 staff and Board members from the case-study watershed organizations provided their views. The majority of informants (n=23, 56%) think that watershed report cards are being used by other agencies and groups as a tool to inform strategic planning and/or policy development. Informants from the HWA and other case-study watershed organizations also believe that they are being used to generate dialogue about local issues and build awareness and support (n_{HWA}=3, 33%; n_{OCSWO}=8, 38%) and support community proposals for funding (n_{HWA}=3, 33%; n_{OCSWO}=6, 29%) and for community advocacy to influence policy and decision making (n_{HWA}=2, 22%; n_{OCSWO}=6, 29%). Informants from the FBC perceive that the Sustainability Snapshots offer a geographic context and point for reference for communities (n_{FBC}=5, 45%) and that they are being used by the media and educators (n_{FBC}=2, 18%), and by other organizations as a template for sustainability reporting (n_{FBC}=2, 18%). Figure 8.18 shows the breakdown of uses for watershed report cards as identified by the staff and Board members of the case-study watershed organizations.

Figure 8.18. Perceived Uses of Report Cards by Others as Identified by Watershed Organization Informants (%)



Informants who are not associated with the watershed organization have a different viewpoint about how the watershed report card is being used. Figure 8.19 compares the responses received from the staff and Board members of the FBC to those obtained from watershed municipalities,[103] NGOs, and provincial and federal agencies.

Figure 8.19. Watershed Report Card Uses in the Fraser Basin Identified by Informants (%)



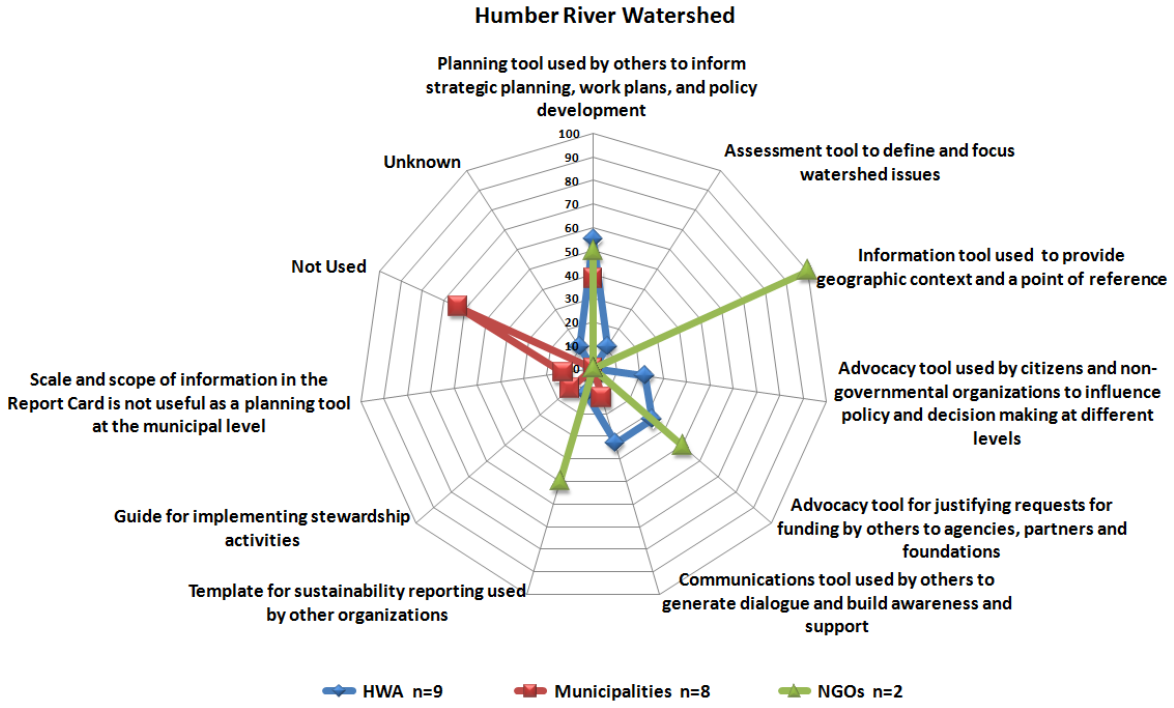
All of the municipal representatives interviewed in the Fraser Basin indicate that the scale and scope of the Sustainability Snapshots are too broad to be useful at the municipal level. Representatives from three municipalities (Vancouver, Surrey and Abbotsford) indicate that they do not use the Sustainability Snapshots at all. Representatives from the remaining three municipalities (Metro Vancouver, Fraser Valley Regional District, and the Township of Langley) use the reports as reference tools to provide a geographical context. The NGO representatives interviewed also convey

[103] In the Fraser Basin, responses were received from 11 municipal representatives in 6 municipalities, including Metro Vancouver, Fraser Valley Regional District, City of Vancouver, City of Surrey, City of Abbotsford, and Township of Langley. In the Humber River watershed, responses were provided by 11 municipal representatives in 8 municipalities: Region of York, Region of Peel, City of Toronto, City of Mississauga, City of Brampton, City of Vaughan, Town of Caledon, and Township of King. Answers among municipal informants were consistent. Therefore, results are aggregated by municipality, rather than by individual informant.

that the Sustainability Snapshots are either not used or used as a general reference tool.[104] One-third of the federal and provincial agency representatives (GA) indicate that they do not use the Sustainability Snapshots (n_{GA}=3, 33%). Another 33 per cent use them as a point of reference while only 11 per cent (n_{GA}=1) use them for planning. However, 56 per cent (n_{GA}=5) indicate they are uncertain about how the reports might be used by others within their respective agencies.

In the Humber River watershed, insights about how watershed report cards are being used were sought from municipalities and NGOs. Results show that the watershed report cards are being used as a planning and decision-making tool to inform municipal Official Plan policies in three municipalities (Regional Municipalities of York and Peel, City of Vaughan). However, informants from five of the eight municipalities indicate that they do not use the watershed report card. Two representatives from NGOs (Save the Oak Ridges Moraine, Oak Ridges Moraine Foundation) were interviewed. Both indicate that the watershed report card is useful in providing general contextual information. One NGO found the watershed report card to be useful for other purposes such as planning and proposal writing for funding grants. Responses are summarized in Figure 8.20.

Figure 8.20. Report Card Uses in the Humber River Watershed as Identified by Informants (%)



[104] Interviews were conducted with representatives from the Fraser River Estuary Management Program, Watershed Watch Salmon Society, Langley Environmental Partner Society, British Columbia Institute of Technology, Pacific Salmon Foundation, and the Nechako Watershed Council.

8.1.8 Links to Other Reporting Processes

One question posed to the chiefs of staff of each case-study watershed organization focused on the nature and extent of connections between the watershed report card and other reporting processes at the municipal, regional, and/or provincial levels. Representatives from the MWC, UTRCA, GRCA, COVABAR and CARP report that currently no linkages exist. Both NSWA and BRBC are associated with Alberta's Water for Life Strategy, but the ties between the State of the Watershed Reports and the next phases of the watershed planning process are unclear. The watershed report cards generated by the MVA and MREAC are linked to other reporting processes through partners, but the nature of this relationship was not specified.

The monitoring data, collected to inform the watershed report cards produced by CVC, HWA, and DWRC, are used for other planning initiatives undertaken by the conservation authority (e.g., sub-watershed plans, planning reports) and are shared with member municipalities. There is some consistency in indicators and measures used for the watershed report cards produced by watershed advisory groups such as HWA and DWRC that have been set up under the aegis of the Toronto and Region Conservation Authority. In addition, the information generated for the watershed report cards is used to develop periodic reports on the Toronto and Region Remedial Action Plan.[105] The Toronto Community Foundation's Vital Signs Report has its own process for developing indicators and is exclusive of the TRCA.

The connections to other indicator reporting processes appear to be strongest in the Fraser Basin where FBC staff actively participates in committees that steer initiatives such as Regional Vancouver Urban Observatory, Canadian Sustainability Indicators Network, Greater Vancouver - Social Sustainability Indicators, Genuine Progress Index – Pacific, Columbia Basin Trust, Clayoquot Biosphere Trust, and Metro Vancouver Vital Signs. While a representative from the FBC sits on the leadership advisory group for the Vancouver Foundation's Metro Vital Signs Report, the process for selecting indicators is independent of that used for the Sustainability Snapshot. In the opinion of one staff member from the Vancouver Foundation (Informant #108, 2009),

> …there were not as many links between or among the community reporting processes that there should or could have been…[we] have close ties with Metro Vancouver but the approach could be more transparent and coordinated.

[105] The Toronto and Region Remedial Action Plan is managed jointly by Environment Canada, Ontario Ministry of the Environment, Ontario Ministry of Natural Resources, and Toronto and Region Conservation Authority. Toronto and Region is one of the locations recognized as an Areas of Concern (AOC) in the Great Lakes Water Quality Agreement. The remediation of an AOC is guided by the Remedial Action Plan.

Despite the linkages noted above, most watershed report card initiatives are undertaken independently of other indicator reporting processes. The idea of a nested hierarchy of complementary watershed and community report cards was put forward as a desirable model by a few informants, but there is no evidence that such an approach exists anywhere in Canada. Perhaps the extent of linkages to other reporting processes can be best summed up in the words of one informant (Informant #11, 2008) who stated that "we generally stay in touch with other efforts to attempt to do complementary work and avoid duplication".

8.1.9 Lessons Learned and Opportunities for Improvement

Opinions about and ideas for improving the usefulness and effectiveness of watershed report cards are discussed in this section. Answers to questions concerning whether watershed report cards are fulfilling their intended purpose(s) and expected benefits are being realized are reviewed. Lessons learned and opportunities for improvement suggested by informants are also highlighted.

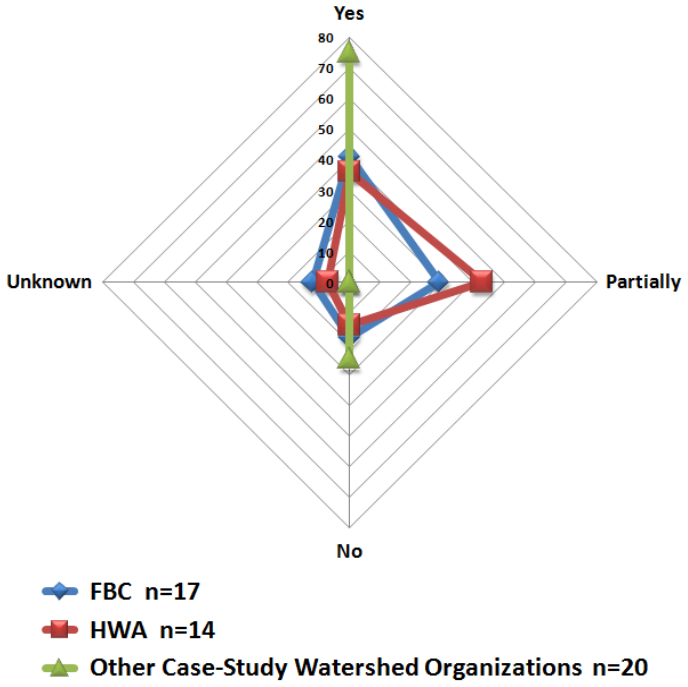
Staff and Board members of the 13 case-study watershed organizations were invited to provide comments regarding the extent to which watershed report cards are meeting their stated purpose(s). Forty-one informants responded to this question. In the Fraser Basin and Humber River watershed, less than 50 per cent of the informants believe that the watershed report cards achieve their purpose(s) (n_{FBC}=7, 41%). In the Fraser Basin, 29 per cent of informants (n_{FBC}=5) believe that the Sustainability Snapshots partially achieve their purpose(s), 18 per cent (n_{FBC}=3) conclude they do not achieve their purpose(s), and 12 per cent (n_{FBC}=2) are uncertain. In the Humber River watershed, 43 per cent of the informants (n_{HWA}=6) think that the Humber River watershed report cards partially achieve their purpose(s), 14 per cent (n_{HWA}=2) believe they fall short of their goals, and 7 per cent (n_{HWA}=1) are unsure. Conversely, in the other eleven case-study watersheds, 75 per cent of informants indicate that their watershed report cards are effective (n_{OCSWO}=15, 75%). Figure 8.21 illustrates the split in opinion among informants.

When asked about whether or not the watershed report cards produce the anticipated benefits, many informants were reticent.[106] Only 31 staff and Board members offered opinions. In the Fraser Basin, 20 per cent of informants from the FBC (n_{FBC}=1) believe that the benefits are partially realized while the remainder conclude that the expectations either exceed the outcomes (n_{FBC}=2, 40%) or they are uncertain about the effects (n_{FBC}=2, 40%). Over 50 per cent of informants from the HWA (n_{HWA}=4, 57%) and other case-study organizations (n_{OCSWO}=12, 63%) believe that their respective

[106] The reasons for this reticence were not given.

watershed report cards do achieve the intended benefits, although some deem them to fall short of expectations.

Figure 8.21. Informants' Opinions Regarding Whether Report Cards Achieve their Stated Purpose(s) (%)



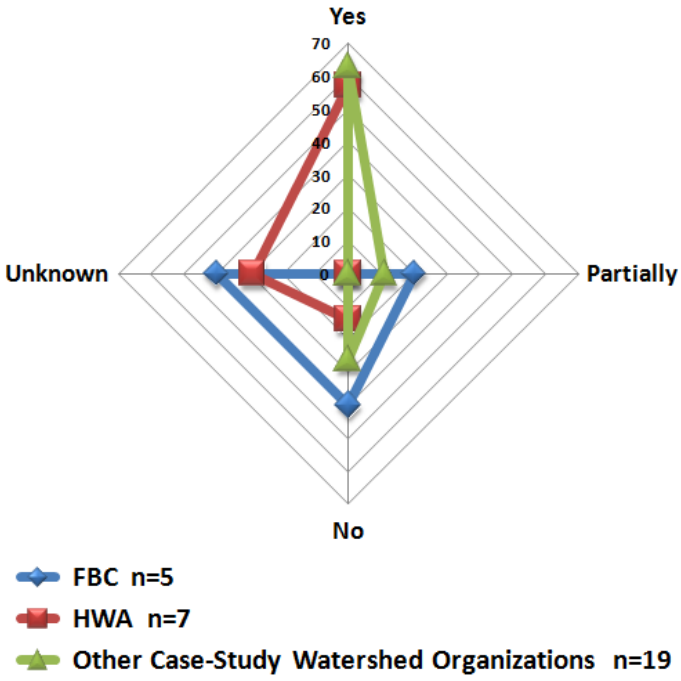
One of the reasons for this opinion relates to the time it takes to raise public consciousness. One informant (Informant #14, 2008) states that,

> I believe that the content of the Report Cards is slowly but inexorably permeating local government processes and the public mind because it is often repeated and referenced in our various strategies. We have miles to go raising the profile of our findings, but in the few short years that the [watershed organization] has been in place, we have made a significant mark in the community. We will address shortfalls through ongoing evaluation of the effectiveness of our strategies.

Problems with the timeliness and availability of data are also viewed as key factors which undermine effectiveness. One informant (Informant #19, 2008) observes that, "we expected the reports to serve as more of a catalyst, however, the fact that they were published with 3+ year-old data makes them of limited value." Another (Informant #40, 2009) cautions that, "the report card program is young… the length [of time data are collected] must be sufficient to make conclusions that are statistically and scientifically defensible."

The opinions expressed about whether the watershed report cards deliver the expected benefits are summarized in Figure 8.22.

Figure 8.22. Informant's Opinions Regarding Whether Report Cards Realize Expected Benefits (%)

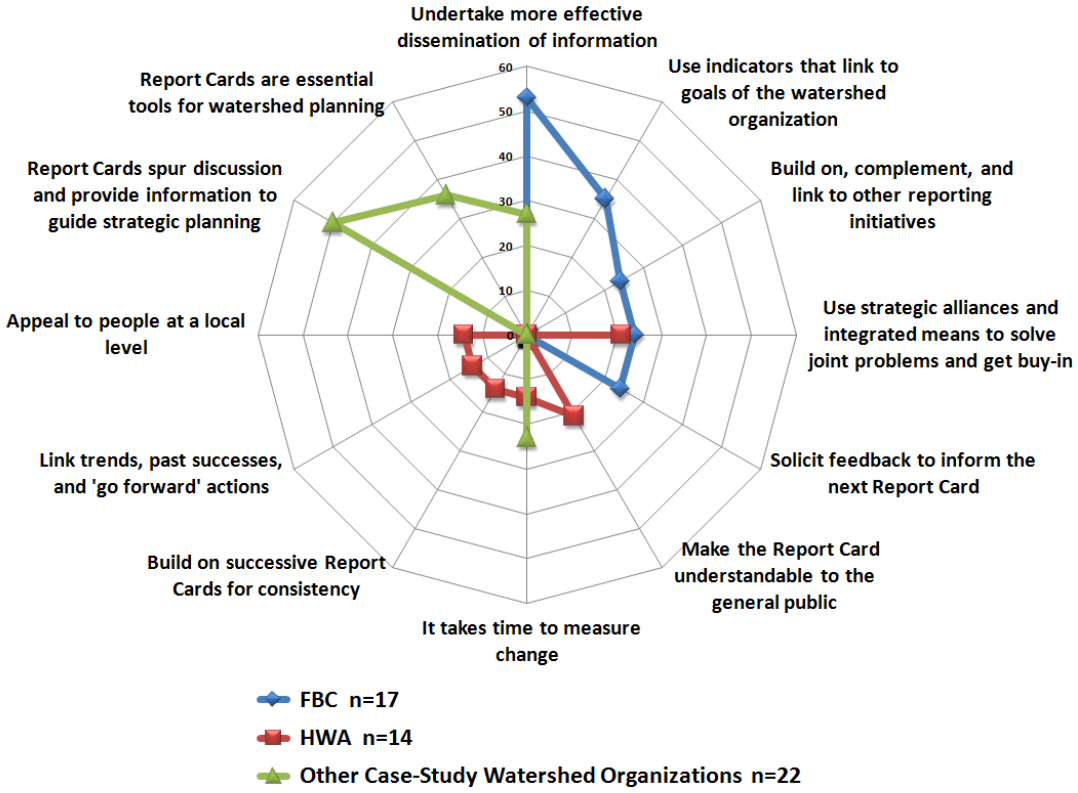


In response to an open-ended question asking what lessons have been learned from the watershed report cards, informants provided answers that relate to all aspects of report card development and dissemination. The full range of lessons identified by informants is provided in Appendix C.6. Figure 8.23 depicts the top three 'lessons learned'.

The top lessons identified by the FBC and HWA informants are tactical. Over 50 per cent of informants from the FBC (n_{FBC}=11, 53%) suggest that disseminating report card results and soliciting feedback for the next edition should be undertaken to garner more awareness and buy-in. Two key lessons are shared by 21 per cent of HWA informants (n_{HWA}=3): (1) issues are too broad, complex, and cross cutting for any one agency or community group to address alone; watershed organizations should facilitate broader processes, strategic alliances, and a holistic, integrated approach to solve problems, and (2) a simple, easily understood report that resonates at the community level and provides a consistent approach across successive versions of the watershed report card is essential.

Informants from the other case-study watershed organizations cite lessons pertaining to the benefits of producing report cards. Fifty per cent of informants (n_{OCSWO}=11) assert watershed report cards inspire dialogue and guide strategic planning.

Figure 8.23. Top Three Lessons Learned by Informants (%)



Twenty-three per cent of informants from other case-study watershed organizations (n_{OCSWO}=5) and 14 per cent from the HWA (n_{HWA}=2) stress that change takes time to measure and may not be easy to detect over the time span between successive report cards or even between the releases of several versions. Nevertheless, watershed issues should be kept in the forefront of public consciousness. One informant (Informant #48, 2008) asserts that, "report cards are more for communication than real science… [they are] useful to get everyone pulling in the same direction."

In the Fraser Basin, informants also recommend that indicators should relate to the goals of the watershed organization and that the watershed report card should build on, complement, and link to other reporting initiatives at different geographic scales throughout the watershed. Strategic alliances should be created to solve problems and undertake collective action.

Some lessons learned, however, are contradictory. For example, some informants believe that indicators should be based on available data, while others suggest that indicators should be based on the data required to understand the prevailing issues. One informant (Informant #43, 2009) asserts that "the biggest thing is to not let steering committee members dictate that just because data are not available, an indicator should be tossed. Find the best indicator; find the data or acknowledge that there is a data gap and use/plan to acquire the data for the next time around."

Another paradox is the call by some informants[107] to evolve the watershed report card in response to prevailing issues as 'works-in-progress'. For example, one informant (Informant #17, 2008) points out that,

> We've tried different formats and ratings, and each report card has taken a different approach. I don't think that is a bad thing. I have every confidence that the next report card will be suitable for the particular situation at the time. It would be a mistake to develop a standard formula for these report cards.

This stance conflicts with others[108] who urge more consistency in reporting by building on constant indicators and measures from one report card to the next. One informant (Informant #3, 2008) expresses this opposing view as follows,

> We need to tie the report card even more closely to programs so that we continue to provide a consistent and directed message. It is still too easy to get off track with side issues. We need to standardize our reporting format. As data become more available, this will become easier.

A third incongruity relates to how indicators are ranked. One informant from the Fraser Basin specifically notes that progress scoring should be very general and point scores should not be used. An informant from another case-study watershed organization emphasizes that a ranking system is worthwhile because it is easily understood by the public.[109] This opinion is prefaced by the caveat that because people are offended by low scores, it is essential to justify the scoring.

When asked about what improvements can or need to be made to bolster the effectiveness of watershed report cards, informants provided numerous ideas. The full list of suggested improvements is provided in Appendix C.7. Many of the ideas are strongly connected to the lessons learned. For example, the majority of informants suggest that a more strategic, cost-effective outreach approach would improve the value of the watershed report cards. This idea links directly to the observation that the process should be modified to more effectively disseminate report findings and to elicit more public feedback.

In the Fraser Basin, other ideas focus mainly on the means to motivate buy-in and supportive actions, while in the Humber River watershed they centre on improving data collection, expanding community engagement, and modifying the format of the watershed report card to improve its readability. The majority of informants from other case-study watersheds (n_{OCSWO}=14, 61%) feel that

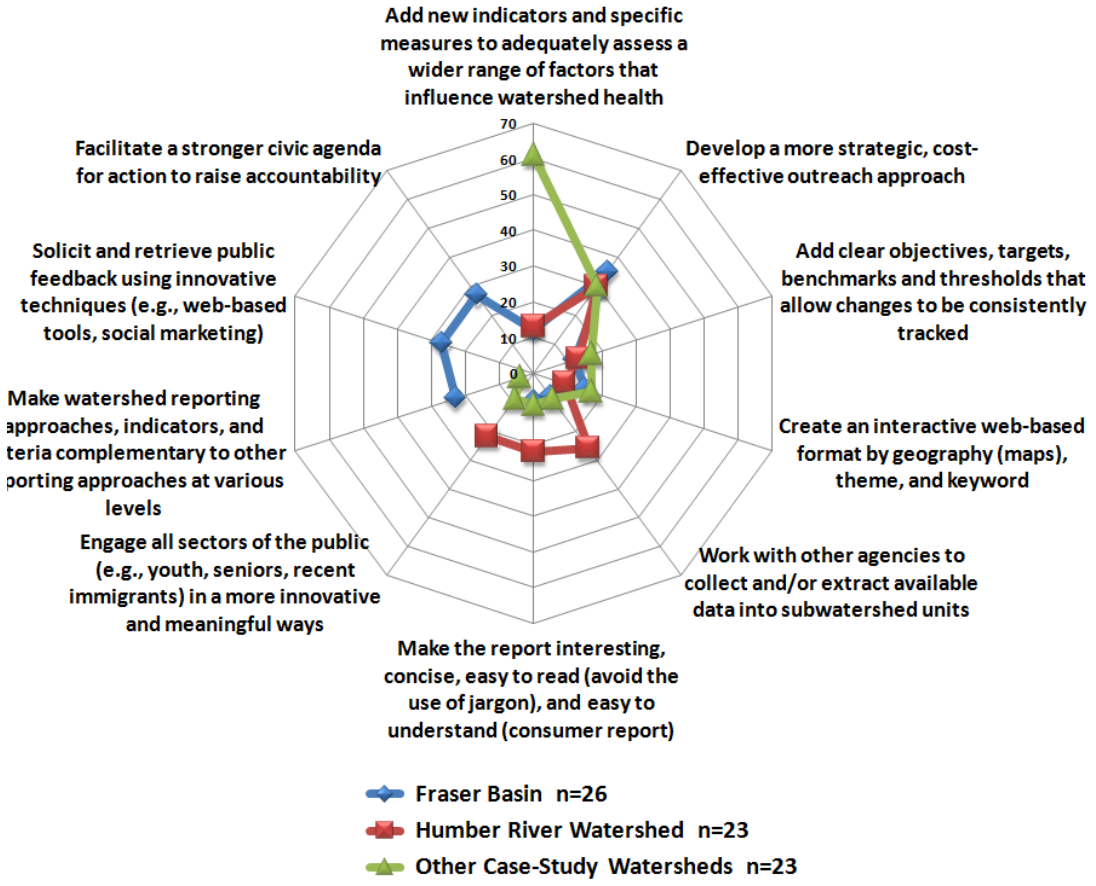
[107] This opinion is represented by 23 per cent (n_{OCSWO}=5) of informants from other case study organizations.

[108] Fourteen per cent (n_{HWA}=2) of informants from the HWA concur with this position.

[109] The Fraser Basin Sustainability Snapshots do not specifically grade indicators. Rankings are descriptive, based on whether indicators show improving, declining, stable, or mixed conditions and trends.

the addition of new indicators to broaden the watershed assessments is worthwhile. Figure 8.24 highlights the top three responses from informants directly associated with the case-study watershed organizations.

Figure 8.24. Top Three Improvements Suggested by Informants (%)



Municipal informants from the Fraser Basin and Humber River watershed are sceptical that watershed report cards can inform municipal decision making unless the issues of scale and scope are addressed. One informant (Informant #92, 2009) notes that,

> I don't believe that the report cards are a viable planning tool for the municipalities, unless a second tier (or third tier) report card can be developed that can take the broad and general information of the report card to the municipal level and/or sub-watershed/catchment level.

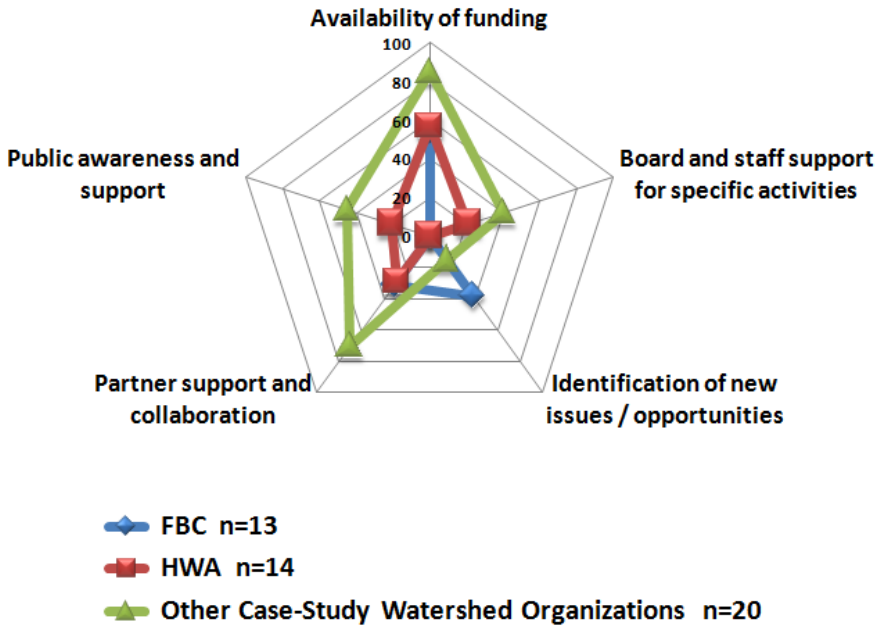
Another municipal informant (Informant #83, 2009) cautions that,

> The only suggestion I would make [for improvement] is to make the same information available at the local level. But then they might become a political animal by allowing local municipalities to compare with their peers.

8.1.10 Factors Which Influence Decision Making

Interview/questionnaire results clearly indicate that watershed report cards are viewed by staff and Board members as one factor among numerous determinants that influence decision making. There is general consensus that two significant factors influence how decisions are made: (1) the availability of funding or lack thereof (n=32, 68%), and (2) the level of collaboration and support gained from partners (n=22, 47%). Other key factors identified by informants from the HWA and other case-study watershed organizations are the level of public awareness and support for the watershed organization (n_{HWA}=3, 21%; n_{OCSWO}=9, 45%) and the degree of political and organization commitment for specific programs and activities (n_{HWA}=3, 21%; n_{OCSWO}=8, 40%). The emergence of new issues and opportunities is viewed as a key factor affecting decisions in the Fraser Basin (n_{FBC}=5, 38%) and among other case-study watershed organizations (n_{OCSWO}=3, 16%). The specific factors identified by informants are summarized in Appendix C.8. Figure 8.25 identifies the top three factors identified by informants from FBC, HWA, and other case-study watershed organizations.

Figure 8.25. Top Three Factors, Identified by Informants, Which Influence Decision Making (%)



8.2 Summary of Opinions and Perceptions

The analysis of the interview/questionnaire responses demonstrates that informants are highly educated and dedicated. They share many common opinions, perceptions, and observations regarding the concept of sustainability, the application of sustainability principles, and the development, dissemination, and effectiveness of watershed report cards. The 'lessons learned' are extensive and often mutually shared. An impressive range of specific ideas for improving watershed report cards is

offered by the informants. Nonetheless, some contrasting and/or mutually exclusive viewpoints and experiences emerge. Key findings are as follows:

- all informants believe that sustainability principles are implicit or explicit in their vision statements;
- the top three sustainability principles shared among staff of case-study watershed organizations focus on: (1) a holistic approach, (2) adoption of the watershed for planning and management natural resources, and (3) managing human activities. The foremost sustainability principles shared by chairs/past chairs/vice chairs centre on: (1) collaboration, (2) consensus, and (3) protecting ecosystem components, functions, and structures (in rank order);
- primary roles ascribed to watershed organizations include implementer of programs and projects and educator. Other roles include sustainability/watershed advocate, partnership builder, collaborative watershed planner, state of the watershed reporter, and action motivator;
- the least-mentioned sustainability principles among staff of case-study watershed organizations were (1) intragenerational equity, (2) precautionary approach, (3) consensus, and (4) accountable and responsive decision making (in rank order);
- two significant administrative issues are insufficient funding and excessive bureaucracy;
- goal setting at the watershed scale is supported by legislation, provincial policies, and/or a Terms of Reference, but goals are set by the Board of Directors, mostly through consensus;
- the most important criteria for selecting indicators are (1) relevant to current issues, (2) scientifically sound, (3) understandable, and (4) relevant to stakeholders (in rank order);
- the most useful indicators are (1) relevant to stakeholders, (2) link actions to impacts, and (3) show progress towards goals and targets (in rank order);
- the fundamental challenge associated with selecting appropriate indicators is lack of data;
- indicators used for watershed report cards in Canada are considered appropriate but incomplete, with particular gaps in social indicators in the Fraser Basin (e.g., homelessness, poverty, crime, addiction) and in the Humber River watershed (e.g., heritage, community stewardship), and environmental indicators in other case-study watersheds (e.g. water quality).
- the key benefits associated with watershed report cards are (1) increasing public awareness, education and support, (2) providing baseline/benchmark information about the health of the watershed from which to measure change, (3) documenting and detecting conditions and trends over the short and long terms and progress towards goals/outcomes, (4) contributing to informed planning and decision-making processes, and (5) helping to define appropriate remedial measures to reverse negative trends and required resources (in rank order);[110]
- while two main benefits attributed to watershed report cards are their contribution towards increasing public awareness, education and support as well as informing decision making, the nature and extent of this association are ambiguous. Despite this ambiguity, 60 per cent of informants believe that the benefits of watershed report cards outweigh the costs;
- watershed report cards are used by the watershed organization primarily to assist primarily in watershed planning and communication;

[110] This ranking is based on 82 responses from 13 case-study watershed organizations.

- the scale and scope of report card indicators at the watershed level are often too broad to be meaningful or easily applied at the local level. As a result, watershed report cards are not a preeminent tool for municipal decision makers;
- opinions are mixed regarding whether watershed report cards achieve their purposes and provide expected benefits, especially in the Fraser Basin and the Humber River watershed. There is more agreement among informants that the purpose(s) and benefits are being achieved in the other case-study watersheds;
- in the Fraser Basin, a key lesson learned is that more effective dissemination of information is required, while in the Humber River watershed, the need to create strategic alliances and engage more stakeholders in the development of the watershed report card and to design a simpler, easy to understand format are noted. Watershed report cards are thought to be an effective means to activate discussion and inform planning among partners in the other case-study watersheds;
- suggestions were identified for improving watershed report cards at all stages in their life cycle (i.e., process, product, and outreach). The need for a more strategic, cost-effective method of disbursing information is recognized by all case-study watershed organizations; and,
- the watershed report card is only one tool that contributes to decision making by watershed organizations. Key factors with significant impact on decision making include the degree of partner and public support and level of funding available for projects and programs. The impact of watershed report cards is not generally identified as a major factor influencing the plans, policies, programs, and projects of the case-study watershed organizations.

Chapter 9 compares and contrasts this research to other relevant empirical findings in the literature and discusses these results as they pertain to the research questions posed in Chapter 1 and then outlines how these study findings contribute to the theory and practice of watershed management and identifies areas requiring further research.

Chapter 9: Discussion, Conclusions, and Recommendations

9.1 Introduction

The goals of this research are to advance the theory and improve the practice of watershed management in Canada, and to identify opportunities to improve watershed indicator reports. To fulfil these goals, this chapter compares and contrasts study findings with the theories, concepts, methodologies, and empirical research reviewed in Chapters 2 and 3 and revisits the research questions. Opportunities for improving watershed management practices in Canada and enhancing the role of watershed report cards are presented. Finally, this chapter discusses strengths and limitations of the research, the contribution to knowledge, and then areas for future investigation.

9.2 Links between Principles and Practice

The nature and extent of links among the theories, concepts, and principles associated with contemporary watershed management and its actual practice in Canada is the focus of the first research question:

1. *What key principles are associated with contemporary watershed management and has consensus been reached among watershed organizations in Canada regarding their applicability?*

The concepts and theories associated with watershed management have evolved, particularly in the past three decades. Recognition of the ever-changing, complex, conflicting, and unpredictable nature of the forces that influence ecological and human systems has given rise to the concepts of ecological or watershed health, sustainability, and good governance. The literature suggests five major alternative, but complementary management approaches that embrace these three concepts: (1) ecosystem approach, (2) sustainability requirements, (3) principles for sustainable governance, (4) new watershed approach, and (5) good governance. Associated with these approaches are 13 innate principles, many of which overlap and are mutually-reinforcing. These principles are summarized in Table 9.1, Table 2.4, and Appendix D.1.

Table 9.1. Principles Associated with Five Alternative Management Approaches

Principles	
• Adoption of the watershed for planning and managing natural resources	• Recognition of human-ecological relations
• Focus on protecting critical ecosystem components, functions, and structures	• Collaborative (interdisciplinary; multi-jurisdictional; multi-agency)
• Focus on human activities to ensure lasting livelihood sufficiently and opportunity	• Consensus-based
• Results-based (multiple benefits and gains)	• Accountable and responsive decision making
• Adaptive	• Intergenerational equity
• Precautionary	• Intragenerational equity
• Holistic	

Numerous terms have emerged to describe and explain contemporary watershed management processes, incorporating these three concepts and 13 principles. These include 'integrated watershed management' and 'sustainable watershed management' and derivations thereof. In Chapter 2, I conclude that integrated watershed management (IWM) and sustainable watershed management (SWM) are closely linked concepts. The literature suggests a subtle distinguishing feature between SWM and IWM – scope. The primary goal of SWM is human well-being and watershed sustainability through integrating a broad spectrum of social, environmental, and environmental factors and fully incorporating all principles, whereas the central focus of IWM is the protection and/or restoration of water and land resources to sustain human well-being. While the principles are generally accepted and valued, they are not wholly subscribed to or incorporated uniformly. Sustainability is a related, but ensuing goal.

Examination of the vision and mission statements of the case-study organizations, combined with the indicators selected for watershed reporting, reveals that the primary focus is on the environment and its relationship to humans (e.g., retaining healthy ecosystems and restoring degraded ones to sustain human well-being). Watershed report cards measure mainly environmental conditions and trends, with little or limited attention given to socio-economic variables. The Fraser Basin Council (FBC) is the only case-study organization that places human well-being at the core of its vision and uses a broad set of environmental, economic, and social indicators to measure progress towards sustainability. However, none of the indicators used in watershed report cards demonstrates direct interactive effects among indicators or measure performance against sustainability principles. Failure to include the former is likely due to the lack of scientifically-defensible and conclusive evidence that indisputably explains cause-effect relationships or clearly pinpoints relationships that are complex, multi-layered, and intermingled. Reluctance to include the latter can be partly attributed to the perceived risk of negative political consequences.

Informants generally agree that sustainability is an ultimate goal of watershed management and the principles are relevant and implicit in the mandate of their watershed organizations. The top three principles identified by informants in rank order are (1) collaboration, (2) holistic approach, and (3) focus on protecting critical ecosystem components, functions, and structures. Despite this concurrence, opinions diverge respecting the relative importance of the principles. For example, the chairs, past chairs, and/or vice chairs most often underscore governance principles (e.g., collaboration and consensus), but also concur that the full suite of principles is embedded in the vision and embraced by the watershed organization. The chiefs of staff identify more with principles related to process and implementation (e.g., holistic approach, managing human activities, adaptive

management) and less with those related to governance (e.g., intergenerational and intragenerational equity, accountable and responsive decision making, consensus). This result is not surprising, given the distinct roles and responsibilities between decision makers and staff. Interestingly, not all informants identified the 'adoption of the watershed for planning and managing natural resources' as a principle, even though this position is implicit in their mandate.

While there is considerable agreement that all principles are firmly entrenched in the rationales adopted for watershed management in Canada, the degree to which they are applied varies, contingent on prevailing circumstances within each watershed. For example, although adaptive management is an accepted principle, its practice is generally passive and incremental, based on observations, experience, and expertise gained over time. Another example of variable application relates to the principle of consensus. While consensus is aspired to, many watershed organizations revert to a 'majority rule' approach if full agreement is unattainable. In fact, corporate by-laws typically specify the number of Board members needed to achieve a quorum and the level of agreement required to make decisions. The Fraser Basin Council is the only watershed organization that operates exclusively under a consensus model. However, one director (Informant #56, 2008) notes, "it takes a long time for us sometimes to 'do the right thing' in order to ensure consensus has been reached by the Board and affected communities/agencies".

The principle of 'holism' is also problematic. The idea that 'the whole is greater than the sum of its parts,' is widely accepted. However, enormous knowledge gaps exist regarding the synergies, dependencies, and interplay of components at the human-nature interface. This reality creates a dynamic tension between those seeking 'comprehensive' versus 'integrative 'approaches and may needlessly complicate matters when simple solutions by one organization may be effective (Mitchell 2005). Furthermore, it is a sizeable challenge for watershed organizations to completely apply sustainability principles because other forces such as politics, shifting priorities, institutional fragmentation, and availability of funding frequently drive decisions.

Based on this analysis, I conclude that IWM, rather than SWM is being actively pursued by watershed organizations in Canada. Sustainability is a concept that is 'front-of-mind' for many watershed managers and decision makers. Associated principles are acknowledged, valued, and applied. However, full incorporation of all principles into practice is difficult and unrealistic, given existing legal, administrative, and institutional barriers and constraints. Watershed organizations are struggling to deliver IWM, let alone SWM. While more inroads are being made to incorporate social and economic dimensions into watershed decision making, operational goals, by necessity, remain focused on human-nature interactions and the ecological health of river systems. Striving to achieve

an even broader sustainability agenda through watershed management is currently an elusive aspiration in Canada.[111]

9.3 Watershed Management Approaches: Similarities, Differences and Gaps

This section compares and contrasts the theory and practice of watershed management in Canada and answers the second research question:

2. *What are the similarities, differences, and gaps among the theories, concepts, and methods ascribed to contemporary watershed management in the literature and the practice of watershed management in Canada?*

Chapter 5 summarizes the context for watershed management in Canada and illustrates that support for watershed management is growing at all government levels. A modified rational comprehensive or synoptic approach prevails as the predominant implementation model. This model acknowledges an adaptive management cycle which includes monitoring and evaluation phases. However, in recognition of the need for and benefits of collaboration, coordination, and integration, new and varying governance structures emerging in support of IWM reflect a marriage between top-down and bottom-up approaches. The nexus shifts among jurisdictions and watersheds, depending on the distinct blend of contextual factors in each. These middle ground approaches engage civil society, build on communicative planning approaches, and are evolving and maturing. [112]

Watershed management processes are affected by the interplay of factors that vary significantly among jurisdictions, watersheds, and stakeholders. Individual factors, identified by informants, are presented in Figure 8.25 and Appendix C.8. While widespread agreement exists that insufficient funding and partner support are the most significant factors affecting decisions, opinions diverge regarding the relative importance of the remaining factors. Specific factors can be grouped into nine main areas that influence and shape decisions:

- Institutional capacity to sustain all stages of the model (e.g., human resources, scientific knowledge and expertise, availability of funding);
- Attributes of the governance model particular to each watershed organization, including the nature and scope of collaborations (including Aboriginal involvement), and partner resolve to undertake identified actions;
- Level of internal and external support and buy-in for the vision;

[111] The sustainability agenda in the Fraser Basin relies on partners at all government levels (i.e., municipal, provincial, federal, and First Nations) to implement appropriate policies, programs, and projects in support of sustainability goals. The FBC has limited watershed management responsibilities.

[112] According to the description of the different types of watershed organizations by Hooper (2006), the case-study watershed organizations fall into advisory, authority, association, or council categories (Table 2.1). However, elements of other styles are incorporated, including corporation, tribunal, and trust.

- Scale, scope, complexity, timing, and public perception of watershed issues;
- Presence/absence of a watershed or strategic plan and broad goals, objectives, and targets;
- Roles, responsibilities, accountabilities, and credibility of the watershed organization;
- Degree of government commitment, guidance, and support (i.e., federal or provincial);
- Availability of spatially explicit and salient data, specificity and constancy of existing monitoring programs, and ability to apply scientific rigour to monitoring and analysis; and,
- Degree of commitment to attain and apply collective learning to inform subsequent decision making.

These factors are consistent with those identified by Born and Genskow (2001), who also note that it is difficult to know which factors are critical in various circumstances or how factors interact to influence outcomes. This uncertainty arises because their relative importance shifts among individual watersheds and related stakeholders.

The rational comprehensive or synoptic model assumes a linear, systematic, and logical sequence of steps. Study findings support literature which asserts that there is an appreciable disconnect between the ideals of this model and practice. The rift results from the intricate interplay of economic, social, and biophysical forces specific to each watershed (Heathcote 2009). These forces dictate how watershed management is carried out by determining what steps in the process are emphasized and what questions are asked. This elicits a fluid, reactive, and highly iterative process, not the sequential, methodical, and straightforward approach implied by the synoptic model.

The emphasis placed on different steps in the management process also differs, depending on the mandate, interests, resources, and maturity of the watershed organization. For example, FBC, MWC, MREAC, and CARP focus on evaluating, documenting, and analyzing current watershed conditions and trends, whereas the NSWA, BRBC, and COVABAR are scoping and initiating watershed plans prescribed by provincial water strategies. Both watershed organizations in Alberta are struggling with their dual roles as Watershed Planning Advisory Committees (WPACs) and community-based watershed advocates. As expressed by one informant (Informant #25, 2009), "…[it is] confusing to try to incorporate a provincial program into an established watershed organization if the goals, objectives, and roles are not clearly spelled out." Further frustration was expressed because provincial funding to WPACs was cut in 2009, even though the program was renewed.

Ontario's conservation authorities are actively engaged in processes that span all of the steps entrenched in the synoptic model. Nevertheless, the implementation process is complicated because multiple, issue-specific planning initiatives may be at different stages at different times or they can coincide or overlap. For example, the UTRCA and CVC have undertaken separate planning

initiatives to address particular issues such as fisheries, heritage, and water and/or have completed a number of 'integrated' sub-watershed studies but have no umbrella 'watershed' plan.

While the GRCA has no formal watershed plan, it adopted *The Grand Strategy*, a framework that encourages an "ongoing, community-based watershed approach sustained by consensus, cooperation, and commitment," as an umbrella approach for evolving integrated watershed management (Veale 2009: 427). This approach is based on a common vision, beliefs, values, and principles, and goals established as part of the management plan in support of the Canadian Heritage River designation for the Grand River and its major tributaries. Maintaining momentum and nurturing a collaborative process among partners with significant staff turnover are acknowledged as continuing challenges.

Three predominant factors emerging from the study findings which contribute to major gaps between planning theory and practice and cause weak feedback loops between and among steps: (1) inadequate monitoring, data, and scientific methods to support robust evaluation and analysis, (2) insufficient institutional capacity, and (3) political inertia. Despite these challenges, the Fraser Basin Council, Meewasin Valley Authority, Ontario's conservation authorities, and Atlantic Canada's ACAP program have achieved success that has been nationally and internationally recognized.[113] Canadian examples of case studies and 'lessons learned' are often cited in the literature (Conservation Ontario 2003; Calbick et al. 2004; Goldstein and Huber-Lee 2004; Mcneil, Rousseau, and Hildebrand 2006; Hoover et al. 2007). One of the key strengths of watershed approaches in Canada is the widespread adoption of various middle ground approaches which enable dialogue, joint problem-solving, and commitments to action at community, provincial, and sometimes national levels.

In summary, while IWM is highly subscribed to in Canada, there are substantial gaps between concept and practice. The systematic, logical sequence of steps inherent to this concept are confounded by the complex interplay of environmental, social, and political factors specific to each watershed. Nonetheless, there are examples of the successful implementation of specific policies, programs, and projects by watershed organizations operating throughout Canada. As lessons learned are shared among jurisdictions and governance models continue to evolve and mature, prospects exist for at least partially overcoming the barriers acknowledged in Table 2.6.

[113] Three conservation authorities (the Grand River Conservation Authority (2000), Lake Simcoe Region Conservation Authority (2007, 2009) and Toronto and Region Conservation Authority (2001, 2002)) and the Meewasin Valley Authority (2004, 2006) were internationally recognized for excellence in river management as either an International Thiess Riverprize winner or finalist. The St. Croix International Waterway Commission was also a finalist in 2005.

9.4 Theoretical Perspectives on IWM

The tasks of planning, implementing, monitoring, and evaluating are recognized as integral components of the management process. The rational comprehensive or synoptic model provides a normative framework for guiding the phases of integrated watershed management (what should be done) and how the steps relate to one another (the order in which they should be done). However, the straightforward, cookie-cutter process implied by this approach (how phases should be carried out) and the tasks assigned to each phase are highly contested by contemporary planning theory. This section proposes a modified framework for IWM.

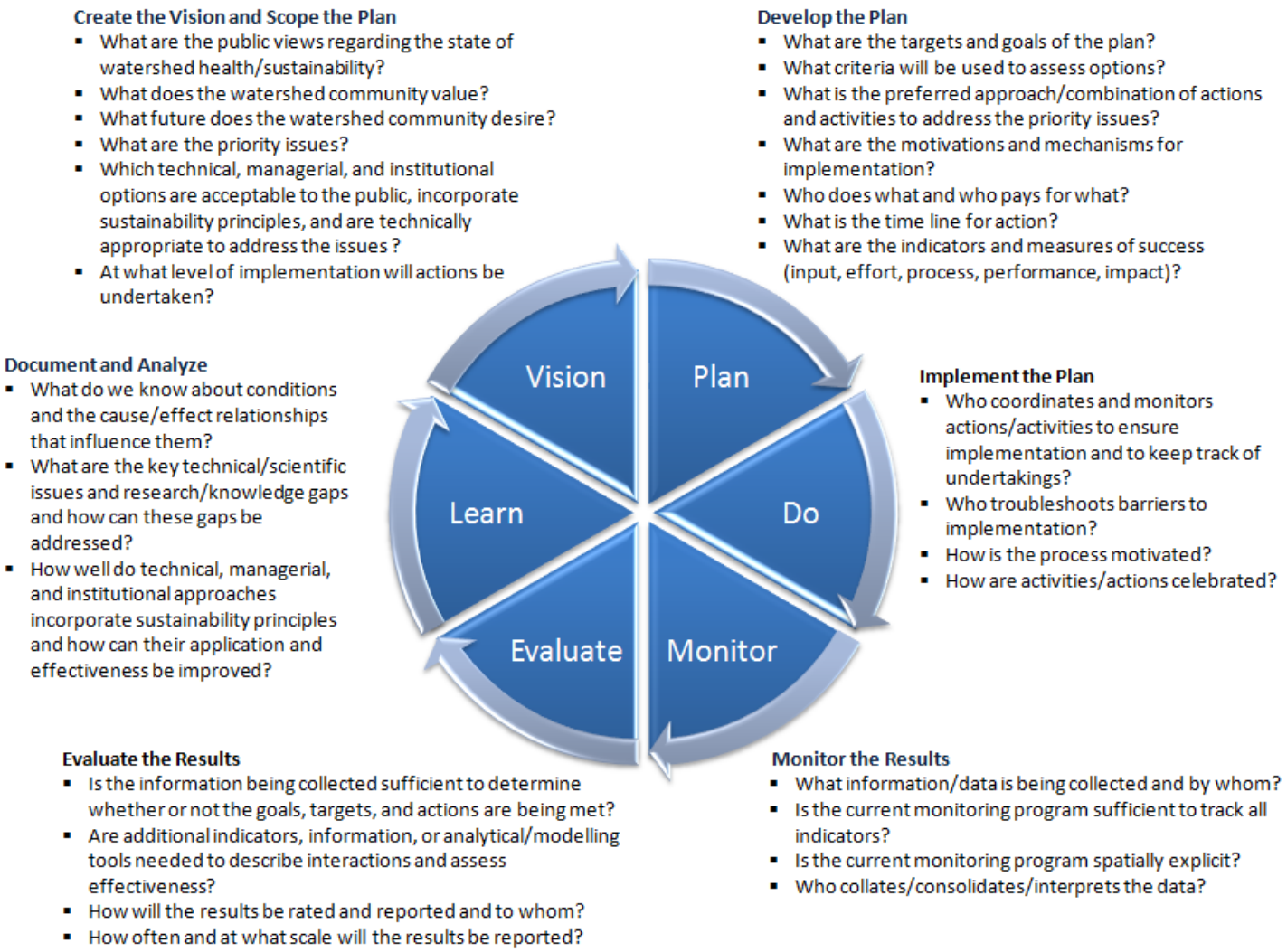
Research findings suggest that two additional steps should be expressly recognized. These are (1) visioning to identify community aspirations and values, and (2) a deliberate learning phase which elevates adaptive management as a key component of the watershed management process. While both steps are acknowledged in existing models, they are usually embedded in the planning and evaluation phases and are often overshadowed, given 'lip service', or missed completely.

The importance of defining a collective vision is stressed in the literature regarding IWM, governance, and indicator frameworks and in empirical studies related to community and watershed indicator initiatives (Chapters 2 and 3). The vision provides the central focus for rallying stakeholders and is often placed at the centre of the IWM process. While conceptually this emphasis is appropriate, the step to ensure that the vision is crafted and reaffirmed as part of the process is normally not explicit.

The 'learning' step in the process is also often obscured. Even when 'learning by doing' is inherent to the process, the model is portrayed conceptually as a series of cyclical, tactical steps. For example, the adaptive management model described in 2009, and promoted by the U.S. Department of the Interior (Williams, Szaro, and Shapiro 2009), stresses the importance of 'learning by doing' at two levels. First, it acknowledges that learning about the processes to be managed (e.g., ecological processes) is a critical element. Second, it highlights the value of learning about the process of adaptive management itself. However, the conceptual portrayal of the steps involved does not accentuate learning (e.g., the steps are: assess problem, design, implement, monitor, evaluate, and adjust). The final adjust step, at best, hints that learning is embedded in the process.

Figure 9.1 is based on a rational synoptic model, but includes vision and learning steps. These added steps reflect the concepts of collaboration and shared learning embraced by communicative planning theories and the principles of sustainability, good governance, and the 'new' watershed approach.

Figure 9.1. Key Questions Pertinent to the Different Steps of the Integrated Watershed Management Process



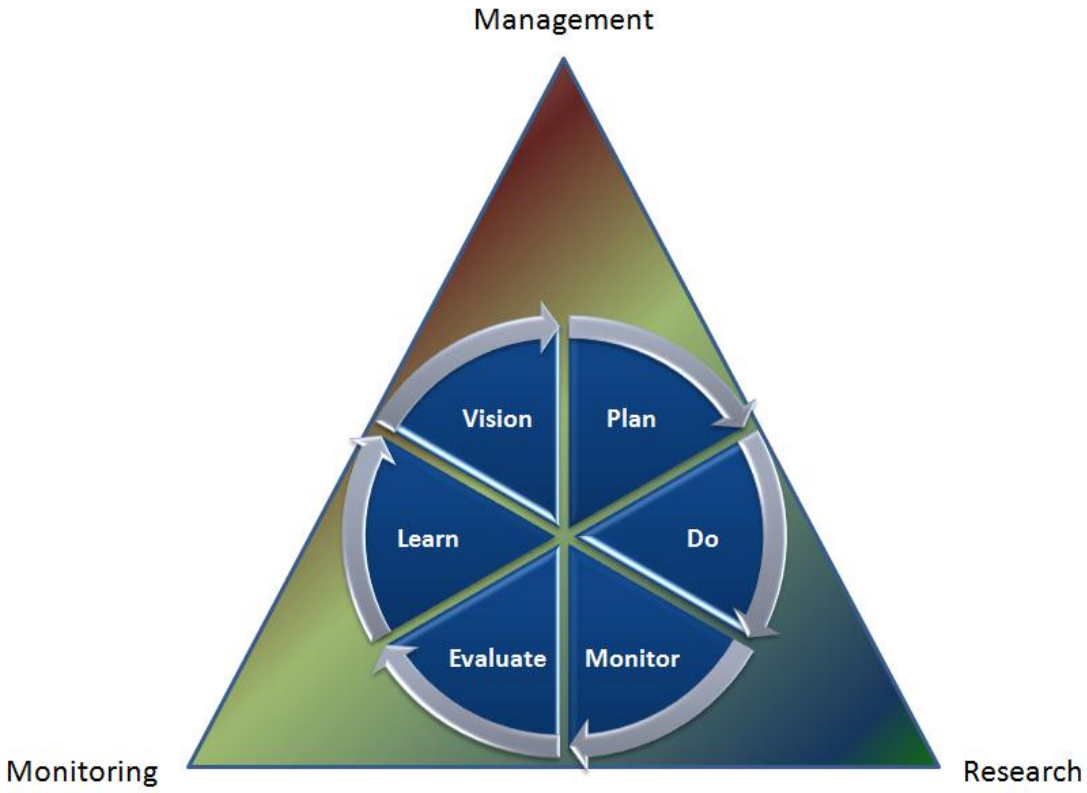
The model is depicted as a pie shape to convey the notion that the 'pieces' represent part of a 'whole' process and that they interact in a non-linear way. However, even with these two additional steps, this modified framework does not completely account for the complex realities that drive or motivate public behaviour and decision making. These realities suggest that the watershed management process requires innate flexibilities. In response, multiple 'grassroots' and 'middle ground' governance structures abound, developed in reaction to the 'top-down' approach.

Rather than focusing strictly on the sequence of steps and a prescribed process, Figure 9.1 includes context-specific questions that acknowledge the interconnectedness of the six watershed management phases and help to break down the 'boundary' or 'edge' issues. These questions also focus on what needs to be done to ensure progress towards watershed health and sustainability and how tasks are to be carried out. It guides management partners to include indicators to assess how well collective performance aligns with accepted sustainability principles.

Consideration of these open-ended questions can help stakeholders craft a customized, strategic (expedient) approach and reduce the barriers identified in Chapter 2 (Table 2.6), taking into consideration the circumstances unique to their watershed and the key factors that influence decision making. Rather than trying to understand the interplay among multiple issues over an entire river basin, this approach allows partners to identify and focus on the issues of greatest priority. It also prompts consideration of approaches that target easy challenges or opportunities (low-hanging fruit). This approach, in turn, should lead to visible success, boost confidence and skills, and create the necessary momentum and support for attracting new partners, engaging a broader set of stakeholders, and increasing capacity to expand the scope (e.g., staged approach) (Dennison and Wicks 2010). An incremental, adaptive process enables watershed organizations to develop and build institutional capacity and consider, more fully, the interconnections among the steps in the process.

In most case-study watershed organizations, monitoring and research components are persistently overshadowed by management issues and activities. Figure 9.2 couches the watershed management process within a framework that considers a balanced interplay among management, research, and monitoring activities (Chapter 3). This concept builds on the ideas proposed by Dennison and Wicks (2010) who contend that a more balanced consideration of these three activities is required to curtail 'kneejerk' reactive responses, focus monitoring programs, and guide applied research. These modifications to the conceptual model for IWM would create more conducive conditions for strengthening watershed report cards as governance tools by specifically and deliberately linking them to the other steps in the management process.

Figure 9.2. Additional Perspectives for the Integrated Watershed Management Process



One of the biggest challenges in undertaking watershed management is developing processes that are collaborative, yet streamlined to match stakeholder capacity and sustain interest and enthusiasm. This requires conscious and deliberate effort and a commitment and willingness to pool resources and work collectively to resolve issues of mutual concern.

In summary, IWM is a dynamic process that blends technical and scientific knowledge with community insights and aspirations. It represents much more than a series of sequential, systematic steps and embraces a communal process that requires intrinsic flexibilities to acknowledge, respect, lever, influence, and respond to human proclivities, preconceptions, and sensitivities. Watershed report cards can help bridge gaps in the IWM process by illustrating key interconnections among environmental, social and economic dimensions, tracking progress towards targets and goals, triggering community dialogue, debate, engagement, and stewardship, identifying research needs, data gaps and monitoring requirements, and measuring change.

9.5 Measuring Change

Monitoring, evaluating, and reporting are key components in the IWM process. Chapter 7 summarizes the approaches used by the case-study organizations to monitor, measure, assess, and

report progress towards sustainability and/or watershed health. This section discusses these approaches and suggests opportunities for enhancing the effectiveness of watershed report cards based on the literature and study findings.

9.5.1 Improving the Usefulness and Effectiveness of Watershed Report Cards

This section discusses how watershed report cards relate to indicator frameworks described in the literature, identifies report card attributes and limitations, and suggests opportunities for improving them. Specifically, the following research questions are answered:

3. *How do the processes and methods used to develop watershed indicator reports in Canada compare to and contrast with key indicator models identified in the literature?*
4. *What styles of watershed indicator reports and types of indicators are used by watershed organizations in Canada to measure, evaluate, and report on the effectiveness of watershed management and what are their perceived benefits and shortfalls, and how well do they match the principles?*
5. *To what extent do watershed indicator reports influence the practice of watershed management and what practical changes can be made to make them a more effective governance tool?*

The literature purports that indicator frameworks are shaped by four approaches: (1) bottom-up, (2) top-down, (3) cause-effect, or (4) systems (Table 3.3). These approaches are not mutually exclusive and can be blended to reduce inherent weaknesses and limitations of any one approach. In Canada, the first three approaches are commonly used for selecting environmental or watershed indicators. For example, the indicator frameworks utilized by the case-study watershed organizations are based generally on a top-down approach in which themes related to the watershed vision, goals, and/or issues are identified, indicators are selected based on specific criteria, data are gathered to populate the indicators, and the indicators are given a rating. Where indices based on established protocols have been calculated, they are included in the watershed report card as separate indicators. One exception is the UTRCA. It is the only watershed organization studied that uses a mathematical bottom-up approach to aggregate data into an overarching grade score for each indicator theme at the watershed and sub-watershed scales. Although none of the case studies utilizes a cause-effect approach, the PSR model has been adopted by the Province of Saskatchewan to assess watershed health and the Driving Force-Pressure-State-Impact-Response (DPSIR) model is being used to guide development of the State of the Gulf of Maine Report (Chapter 3).

Among case-study watershed organizations, indicators are identified and selected using three primary methods: (1) a participatory process, (2) a process engaging selected partners and science experts, or (3) an internal review led by technical staff, but including Board members/directors. A participatory process, similar to that used for community indicator initiatives, is the preferred

approach for the FBC, MWC, and HWA, whereas the remainder of the watershed organizations mostly utilize an internal process, with input from science experts.

Informants identified four primary uses of watershed report cards in rank order: (1) inform planning and decision making, (2) provide opportunities for communication, education and advocacy, (3) identify conditions and trends, and (4) identify data and research gaps. Although there was widespread agreement that watershed report cards are worthwhile, expectations often exceed outcomes. Informants believe that the value and benefits of watershed report cards are often overstated and overshadowed by competing and conflicting socio-political forces. Disappointment regarding the degree to which these benefits are achieved is frequently expressed. For example, one of the primary uses of watershed report cards is to inform planning and decision making. While they may inform planning, particularly within the watershed organization, decision making is influenced by a host of factors which often supplant report card and/or plan recommendations and disproportionately sway decisions. Many of the obstacles that limit community indicator initiatives are similar to those associated with watershed report cards. The lessons learned at the community level are therefore germane (Table 3.6).

While the indicator frameworks utilized by the case-study organizations are similar, each watershed organization has a unique approach to selecting, organizing, and presenting indicators. This results in a diversity of styles and formats. Most watershed report cards highlight environmental indicators over social or economic indicators. Despite these differences, watershed report cards share common traits that limit their effectiveness. Many of these shortfalls parallel those identified in the literature (Chapter 3). Key challenges and opportunities for overcoming some of the major drawbacks documented in the literature and by informants are identified in Table 9.2. These provide a checklist for assessing individual watershed report cards and identifying areas for improvement. The content, style, and level of detail required to strike a chord with the intended audience are often unclear and need attention. As watershed report cards evolve, the nature of these associations can be explored further.

Data collection and analysis are critical to 'getting the right science' (science that is influential in decision making and improves the quality of decisions) and 'getting the science right' (science that meets the highest standards) (Chess, Hance, and Gibson 2000: 250). The challenges associated with indicator selection are particularly exacerbated by the lack of relevant, timely, consistent, and spatially-specific data (Chapter 8). This gap between the 'ideal' set of indicators and the data to support it is an ongoing problem and limitation.

Table 9.2. Common Shortfalls and Opportunities for Improving the Substance of Watershed Report Cards

Common Shortfalls	Opportunities for Improvement
***Lack of specific goals and targets*:** Without reference or end points, it is difficult to interpret trends and report on progress (or lack of progress) in a way that is meaningful to people.	Clarify long-, medium-, and short-term goals. Set achievable targets from which to measure progress. Engage intended audience in defining broad goals and objectives. Engage the scientific community to help translate goals and objectives into targets and thresholds.
Inconsistent indicators and measures: Evolving indicators and measures between successive report cards make it challenging to illustrate and compare progress between successive reports.	Select consistent measures and data analysis methods. If data analysis methods are altered, back-calculate previous data to make measures comparable, if possible. Note how changes in assumptions and methods affect interpretation.
Too many themes and indicators: Key messages can be obscured by the use of too many themes and indicators.	Limit the number of indicators and focus on those that inform stakeholder issues.[114] Ensure that the key messages are clearly stated.
Indicators that will not show change: Some changes make take years or decades to detect.	Report on indicators that are slow to change at longer intervals (i.e., every 10 years) or report on a rotating subset of indicators at regular intervals. Set achievable output and performance targets to show progress. Alternatively, select only indicators that can detect change over the time frame of the report.
Ranking ambiguity: Without a clear, transparent, and replicable process for ranking indicators, the credibility of the ratings may be considered biased and unsubstantiated.	Provide a brief explanation that describes and justifies the ranking system and provide access to methods and detailed calculations. Engage university scientists to reduce perceived bias.
Difficult to comprehend: Watershed report cards must be easily understood for key messages to be conveyed to stakeholders.	Keep the report simple and concise. Ensure key messages are prominent and clear (sound bites). Consider different publication styles and communication mediums for different audiences. Consider creating a ranking system that can aggregate individual indicators to produce an overarching score.
Weak linkages between outputs and outcomes: If the connections between outputs and outcomes are not illustrated, there is no compelling story or sense of urgency to motivate action.	Consider the use of conceptual 'models' to show cause-effect relationships. This has proven to be an effective communications tool (Abal, Bunn, and Dennison 2005; Longstaff et al. 2010). Engage the scientific community to develop visual tools that illustrate economic and social linkages.
Irrelevant scale: To engage stakeholders at the community level, watershed report cards must be presented at a meaningful (local/sub-watershed) scale and address relevant issues.	Develop 'regional' watershed report cards which address issues of concern and allow sub-watersheds to be compared.[115]

There are two main aspects to this problem. First, study findings indicate that there is often a 'disconnect' between the information needs of the 'target' audience and the information provided in the report card. To narrow the gap and boost the propensity for uptake, key stakeholders should be actively engaged in the process of defining goals, objectives, and indicators. Second, organizations

[114] An analysis of ecological indicators in the U.S. National Parks Service Rock Creek Inventory and Monitoring Program showed that an optimal number of indicators for its objectives was 6 to 11. The standard error of the mean was compared against the number of metrics (Wicks et al. 2010).

[115] The UTRCA produces 26 sub-watershed report cards. The MWC released its most recent watershed report card in June 2010, including 20 sub-watershed report cards. The FBC has produced two regional report cards, one for the Thompson Region (2005) and one for Lower Mainland (May 2010).

that rely on secondary sources of information have no guarantee that data will be available over the long term. Finding means to ensure access to pertinent data requires the active participation and buy-in of data providers. This need means that building partnerships, alliances, and data-sharing agreements, engaging 'citizen scientists' in monitoring, and accessing local knowledge are essential.

In addition, data needs should be critically assessed to ensure that the 'right' data are being collected and scientifically-sound methods used to populate the selected indicators. Engaging 'arms-length' university scientists to assist in this regard is useful for gaining credibility and acceptance of results. Where key data are unavailable, report cards can help define research needs and data gaps. This information can be used to build a 'business case' for justifying enhanced monitoring. This strategy proved to be successful in bolstering the water quality monitoring program in the Upper Thames River watershed.

Modifying the content, style, and format of watershed report cards offer opportunities to enhance clarity and cogency. The enhancement of watershed report cards as planning and decision-making tools may also be possible by developing proactive and focused strategies for stakeholder participation to foster collective commitment and buy-in and more tightly coupling watershed planning and reporting processes. Table 9.3 presents opportunities to heighten impact and bridge the 'learning' gap identified in Section 9.4.

One of the primary shortfalls of watershed report cards identified by some informants is their relative ineffectiveness in raising public awareness and community stewardship. One informant (Informant # 25, 2009) observes that "the [watershed report card] has fallen off the table and is not fully utilized – [the watershed organization] failed to make it relevant." Study findings concur with community indicator literature that suggests insufficient resources are set aside for marketing and outreach activities. Strategies to raise the profile of the watershed report cards, kindle public discussion and debate, publicly celebrate accomplishments, and solicit feedback should be integral components of the reporting process. Although watershed report cards cannot directly address funding or data issues, the process of building public awareness, strengthening partnerships and collaborative activities, and fully engaging staff and Board members should enhance opportunities for financial support, pooling of available resources, and ultimately, greater institutional capacity.

Internet and social media tools offer effective means to deliver key messages and provide interactive access to data and technical information to key stakeholders. The possibility of designing a progressive reporting process that begins with a few 'core' indicators of particular interest to key

stakeholders and expands over time should also be considered, if resources, data, or expertise are limited.

Table 9.3. Common Shortfalls and Opportunities for Improving the Influence of Watershed Report Cards

Common Shortfalls	Opportunities for Improvement
Irrelevant to Intended Audience(s): Failure to resonate with key audiences precludes opportunities for building public awareness and support and restricts the utility of the report card for others.	Ensure that indicator themes address issues of concern to intended audiences by engaging them in early discussions and incrementally building a constituency of support. Use the existing report card to stimulate dialogue, reaffirm the vision and goals, and explore new issues and opportunities.
Poor links to planning: Weak ties to other planning initiatives limit the value of the report card to partners.	Engage in early discussion with staff and decision makers of partner agencies and groups to ensure that information generated in the report cards adds value to other planning processes. Directly link watershed plans and watershed report cards as vital components of the watershed management process.
Low profile and public awareness: Lack of exposure renders the report card invisible to others not involved in the process.	Invest in marketing and outreach activities. Commend successes. Present findings to target audiences. Find and engage credible, well-respected, and prominent individuals to act as spokespersons. Ensure that reports are easily accessible. Investigate innovative methods for engagement (e.g. adopt-an-indicator program).
Lack of organizational will, enthusiasm, and internal support for specific actions: If the report card is not considered a useful initiative internally, it will have limited regard as a planning and decision-making tool.	Engage all Board members and staff in the report card process. If possible, conduct a tour for staff and members to demonstrate successful on-the-ground activities. Use examples of how report cards are being effectively used to illustrate their value.
Limited window of opportunity for media coverage: Report cards have a brief appeal to the media.	Foster good media relations and set aside resources to create and implement a media strategy. Sponsor regular local debates about issues and tie to report card results. Use social media to keep issues at the forefront.
Indeterminate cause-effect interactions among indicators: Lack of clear relationships reduces information to an unprioritized and unconnected listing of issues.	Use 'before and after' images to illustrate successes and demonstrate results. Engage the scientific community to undertake research and develop models to explain and illustrate connections. Present and discuss relevant findings at public forums and incorporate findings into subsequent report card editions.
Limited credibility or confidence in the management process: The report card will be poorly regarded if the initiative is perceived as a public relations exercise or if the watershed organization is seen as ineffective or unable to make a difference.	Introduce sustainability performance measures for key partners. Introduce clear management targets and report on progress. Use a credible, trustworthy 'third party' assessor, if necessary.
Uncertainty about how report cards are being used: Opportunities for improving the usefulness of report cards are missed if feedback is not encouraged.	Meet with users to find out if and how the report cards are being used. Find out what needs to change to improve uptake. Introduce easy-to-use mechanisms to promote feedback from key groups and individuals.

9.6 Links Among Community Indicator Initiatives, Watershed Report Cards, and Watershed Plans

This section identifies the nature and extent of connections among indicator initiatives at different scales and watershed plans, and addresses the last research question:

6. *What challenges and opportunities exist in Canada to improve the practice of watershed management and what roles should watershed indicator reports play?*

Connections among indicator reports generated by watershed organizations, municipalities, and community foundations are weak to non-existent. Based on study findings, discussions to explore the potential for shared monitoring and linking of indicator initiatives between and among agencies at different scales (i.e., community, sub-watershed, and watershed) are not being seriously pursued. Continued dialogue among stakeholders is required to determine priority issues, data and monitoring requirements and synergies, and the most appropriate scale(s) for reporting. Prospects for integrating and streamlining reporting processes and creating complementary reporting mechanisms should be explored as part of the watershed management process (Figure 9.1).

Where watershed plans are not undertaken (e.g., Fraser Basin, Muskoka Watersheds) or where responsibility for watershed planning and implementation is highly fragmented, engaging key stakeholders, achieving profile and credibility, and securing commitments to action through the reporting process is crucial. By going through a process of joint discovery, the benefits of relationship and capacity building may be as important as the actual product.

Monitoring and assessment are integral components of the watershed management process. Most case-study watershed organizations have produced watershed plans or strategies. However, significant gaps between recommended actions and implementation exist. Indicator reports provide one means of evaluating existing watershed conditions and trends, and comparing results to established goals, objectives, and targets. In this regard, indicator reports are potentially important validation and learning tools.

In spite of the many associated challenges with producing watershed report cards, some positive results have been demonstrated. Watershed organization decision makers view report cards as useful tools for guiding agency activities and initiating dialogue with partners. Interested and engaged community stewardship groups use report cards to justify funding requests for on-the-ground activities. The close alignment of the most recent watershed plan, watershed report card, and implementation guidelines in the Humber and Don River watersheds and the legislative requirements

to link watershed planning to municipal official plan policies may be a positive step towards assisting municipalities craft better land use policies.

Over time, and provided that watershed partners are willing to change, I believe that watershed report cards can become a vital tool to facilitate joint learning and track progress towards achieving sustainability goals. An even stronger role for bridging the gaps between planning and implementation may be possible if indicator reports resonate with key stakeholders, link deliberately to watershed and municipal plans, and measure collective performance as well as changing conditions. If these outcomes occur, indicator reports may be a promising mechanism for driving change.

9.7 Strengths and Limitations

The broad scope of this research provided both opportunities and constraints. The inclusion of 13 case-studies yielded a substantial depth and breadth of valuable and salient information. Nevertheless, several related challenges emerged. First, arranging and conducting interviews and analyzing 39 report cards, took much longer than expected. Second, due to space and time constraints, some in-depth analyses and specific nuances associated with individual watershed organizations could not be incorporated into this dissertation.

Other limitations arose because some informants, especially those who completed questionnaires, neglected to answer specific questions. This pattern of responses resulted in fewer replies to some questions than anticipated.[116] In addition, two watershed report cards generated by case-study watershed organizations and released in 2010 are not included in this study.

Unfortunately, logistical and timing constraints precluded an in-depth analysis of the methodologies associated with community report cards and the specific opportunities for strengthening ties among community and watershed reporting initiatives, as well as the feasibility of developing a meaningful set of core indicators across watershed scales and among river basins.

9.8 Contribution to the Literature

The concepts associated with IWM and SWM and the role of watershed report cards, as developed in this dissertation, contribute and relate to the literature reviewed in Chapters 2 and 3. Ongoing debate exists regarding the merits of IWM. Some analysts call IWM a 'nirvana' concept, which promises more than it can deliver (Biswas 2008; Molle 2008). Others concede that while IWM is a challenge, it is unreasonable to view it as a panacea for resolving all environmental, social, and economic woes – if that standard is used, it is bound to fail. Rather, the principles inherent to the concept should be

[116] I do not consider this a major limitation given the number of interviews/questionnaires completed.

applied and the problems scoped based on context-specific factors. In this regard, 'lessons learned' from other jurisdictions are informative, not prescriptive. This dissertation concurs with the later stance.

Definitions of IWM and references to SWM abound in the literature. However, these definitions are imprecise and the differences between the two concepts are not distinct. In the absence of a clear description of SWM, this dissertation offers a definition and contends that the difference between the two concepts lies in the scope of the issues and elements being dealt with, not in the principles being applied. This interpretation supports the position that an "integrated approach is not all inclusive, rather it is focused and strategic," (Hooper 2006: 5) and that the full consideration of the interplay among environmental, social, and economic forces is not an overriding goal of IWM. SWM requires a broader, more complex and far-ranging process than can be achieved through integrated watershed management alone. Nonetheless, this dissertation supports the stance that IWM can play a significant role in supporting a broad sustainability agenda.

One gap in the literature identified in Chapter 2, relates to the extent to which the theories and concepts associated with the ecosystem approach, sustainability requirements, the 'new' watershed approach, and good governance, as well as the theories associated with planning are incorporated into the practice of watershed management in Canada. The results of this study show that while the rational comprehensive model underpins the practice of IWM, tangible links exist among these broader governance concepts and their attendant principles and the practice of watershed management. The strength of and priority attached to these links are constrained by competing and entrenched socio-political and economic doctrines and traditions. Thus, concerted effort is needed to counteract these prevailing forces and strengthen links through a modified planning model which incorporates visioning and adaptive learning as distinct steps in the process.

The extent to which indicator reports contribute or could potentially contribute to adaptive learning is another gap identified in the literature (Chapter 3). Rydin et al (2003) point to the need for more empirical studies investigating how reporting processes work and the forms, formats, and approaches that make indicators most effective. While several studies have been undertaken in the context of community indicator reports, there is a paucity of research relating to watershed reporting processes, how watershed report cards are used, and how they can be improved. The results of this study concur with the findings of empirical studies at the community level, which conclude that there is little evidence the indicators cause change independently or directly drive policy. However, indicator initiatives may contribute towards creating social knowledge and building connections among people, eventually shifting ingrained procedures and viewpoints. There are numerous

opportunities to enhance the substance and effect of watershed report cards as suggested in Section 9.5.1.

9.9 Future Research Opportunities

Numerous areas would benefit from additional research. Further research identifying and prioritizing primary factors that inspire adaptive learning in a collaborative watershed setting in which responsibilities are shared would be beneficial for determining if certain governance models for watershed management are more conducive to fostering adaptive management than others.

An associated area of inquiry relates to measuring the capacity of watershed organizations to implement IWM. Hooper (2006) suggests that a separate examination of management processes should be undertaken, in addition to state of the environment reporting, to identify whether 'best practice' is used and achieved and to determine where improvements can be made. He contends that to advance IWM, watershed organizations need to evolve and demonstrate their value and leadership qualities. Based on a review of the literature, he identifies 115 performance measures, categorized by 10 themes, to assess the ability of river basin organizations in the United States to undertake IWM and presents a self-assessment scorecard system that takes into account the maturity level of the watershed organization. The scorecard gives each indicator the same weight and provides a subjective ranking scheme based on a graduated scale of poor to excellent. Report card results can then be used to identify institutional weaknesses and design management processes to strengthen them. It is recognized that this evaluative framework is a 'work in progress' that requires further testing and refinement.

Hooper (2006) hypothesizes that if IWM characteristics are adopted and/or strengthened, a sequential level of 'auto-adaptiveness' in governance capacity is achieved. Over time, highly responsive and adaptive watershed organizations become 'referent organizations' with credibility and prominence, by providing overarching, coordinating functions for key stakeholders. Hooper's framework recognizes watershed report cards and strong ties to a watershed management plan as key components of IWM. A critical review of these IWM performance measures, their relative importance, their degree of changeability or stability over time, and their applicability for assessing not just the effectiveness of watershed organizations but of watershed governance in Canada should be investigated. In addition, the alignment between Hooper's IWM performance measures and the principles associated with watershed health, sustainability, and good governance should be examined and performance measures adjusted where gaps are discerned.

This study identifies several common shortfalls associated with existing watershed report cards and identifies opportunities to improve their use and effectiveness. In particular, it supports the premise that report cards could be more effective if concerted effort were funnelled to outreach and marketing activities – a notion echoed by informants. As successive editions are produced and more sophisticated communication and dissemination strategies are activated, the extent to which they stimulate community debate that ultimately converges and generates momentum towards democratizing decisions and influencing decision making over a longer time frame should be explored.

There are generally weak or non-existent linkages between watershed report cards and watershed plans. Tying these two products to common goals, targets, and aspirations should strengthen the role of watershed report cards in influencing decisions and fostering adaptive management. This assertion can and should be tested in the future as these ties intensify. Opportunities will also exist to explore whether 'authoritative' watershed plans, such as the ones developed for the Don River and Humber River watersheds under the aegis of the Oak Ridges Moraine Conservation Plan legislation, yield more expeditious and effective policy outcomes than their counterparts, which have to rely on collaboration and persuasion to drive the sustainability agenda forward.

Challenges inherent to watershed report cards include understanding and demonstrating cause-effect linkages and determining the extent to which conditions change due to specific policy changes and implementation of actions. Since conditions in a watershed are the sum total of all of the activities taking place in the air, land and water, further research to develop methods for pinpointing and illustrating key processes which affect ecosystem functions and services and their implications to social and economic health and well-being would be especially useful for watershed managers.[117]

Study findings demonstrate that no standard indicator framework or set of indicators is used for measuring watershed health and sustainability in Canada. Further examination of indicator frameworks used to assess watersheds in other countries and enquiry to identify the opportunities for and feasibility of developing a meaningful set of core indicators across watershed scales and among river basins is warranted. Furthermore, the current correlation between community report cards and watershed report cards is insubstantial. Opportunities for linking community reporting initiatives with watershed reporting initiatives within a nested hierarchy of geographic scales from the community to the sub-watershed to the watershed levels should also be investigated further.

[117] There is growing interest in the concept of 'ecohealth'. Integration of knowledge at the interface between ecological and health services is the goal of *Ecohealth*, an international peer-reviewed journal launched in 2004.

9.10 Conclusion

IWM is gaining popularity in Canada. Emphasis is on retaining and improving watershed health and promoting sustainability agendas. Middle-ground governance models have been created and are evolving in response to complex environmental, social, and economic factors, unique to each watershed. The principles associated with ecosystem management, sustainability, and good governance play an important role in defining how watershed management should be implemented. Integration and adaptive learning are acknowledged as critical, yet indistinct components of watershed management. Adaptive management is a 'buzz word' that is ostensibly supported, but seldom practiced intentionally, or with forethought.

Adjustments to the conventional rational, synoptic planning approach are required to reflect contemporary practice and facilitate inclusion of associated principles and integrative mechanisms into the management process. The conceptual framework offered by this study (Section 9.4) provides a broader perspective and guidance for altering the watershed management process to meet distinctive needs. This is a critical step if IWM is to play an increasing role in sustaining vital natural resources in the face of population growth, climate change, and ongoing resource exploitation.

Watershed report cards are a fledgling tool for bridging gaps in the watershed planning process. The 'lessons learned' from an assessment of the attributes and perceived benefits of watershed report cards parallel those discovered for community indicator initiatives. Targeted monitoring and research are crucial to support the development of relevant indicators, improve understanding of cause-effect relationships, demonstrate sustainability principles in action, and ensure credibility of report cards. However, without commitment to 'learning' within the watershed organization as well as among stakeholders, including the broader public, a watershed report card, no matter how credible and scientifically defensible, will have limited influence.

This study recommends several actions for improving watershed report cards and suggests that, given time, they can become an important tool in support of IWM. They can help illustrate the key interconnections among environmental, social, and economic dimensions, track progress towards specific goals, create social knowledge, build connections among people, and ultimately motivate action.

Many hurdles remain. Nurturing collaborative processes, building institutional capacity, and gaining political support to advance IWM and evolve watershed report cards require ongoing commitment, perseverance, and time. Provided that willingness to learn and work collectively to resolve issues of mutual concern prevails, Canada is poised to lead the way on both fronts.

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Appendix A: Interviews/Questionnaires

Appendix A.1. Coded List of Informants

Informant #	Position/Affiliation	Date of Interview/Receipt of Completed Questionnaire
1	Executive Director/Senior Manager	22-Aug-08
2	Executive Director/Senior Manager	25-Nov-08
3	Executive Director/Senior Manager	22-Sep-08
4	Executive Director/Senior Manager	07-Jan-09
5	Executive Director/Senior Manager	07-Apr-09
6	Executive Director/Senior Manager	03-May-09
7	Executive Director/Senior Manager	06-May-09
8	Executive Director/Senior Manager	03-Jun-09
9	Executive Director/Senior Manager	22-Jun-09
10	Executive Director/Senior Manager	21-Jul-09
11	Executive Director/Senior Manager	15-Aug-08
12	Executive Director/Senior Manager	14-Nov-08
13	Executive Director/Senior Manager	25-Mar-09
14	Chair/Past Chair/Vice Chair	22-Sep-08
15	Chair/Past Chair/Vice Chair	22-Sep-08
16	Chair/Past Chair/Vice Chair	24-Sep-08
17	Chair/Past Chair/Vice Chair	14-Nov-08
18	Chair/Past Chair/Vice Chair	27-Nov-08
19	Chair/Past Chair/Vice Chair	28-Nov-08
20	Chair/Past Chair/Vice Chair	14-Jan-09
21	Chair/Past Chair/Vice Chair	22-Jan-09
22	Chair/Past Chair/Vice Chair	19-Feb-09
23	Chair/Past Chair/Vice Chair	31-Mar-09
24	Chair/Past Chair/Vice Chair	06-May-09
25	Chair/Past Chair/Vice Chair	14-Jul-09
26	Chair/Past Chair/Vice Chair	31-Jul-09
27	Technical Staff	29-Aug-08
28	Technical Staff	30-Sep-08
29	Technical Staff	06-Oct-08
30	Technical Staff	09-Oct-08
31	Technical Staff	14-Nov-08
32	Technical Staff	25-Nov-08
33	Technical Staff	07-Jan-09
34	Technical Staff	08-Jan-09
35	Technical Staff	12-Jan-09
36	Technical Staff	20-Jan-09
37	Technical Staff	18-Feb-09
38	Technical Staff	23-Feb-09
39	Technical Staff	12-Mar-09
40	Technical Staff	09-Apr-09
41	Technical Staff	09-Apr-09

Appendix A.1 (cont'd). Coded List of Informants

Informant #	Position/Affiliation	Date of Interview/Receipt of Completed Questionnaire
42	Technical Staff	22-May-09
43	Technical Staff	13-Jul-09
44	Technical Staff	24-Jul-09
45	Technical Staff	04-Aug-09
46	Technical Staff	08-Sep-09
47	Technical Staff	11-Sep-09
48	Technical Staff	14-Nov-09
49	Technical Staff	14-Nov-09
50	Director/Member	24-Sep-08
51	Director/Member	24-Sep-08
52	Director/Member	24-Sep-08
53	Director/Member	24-Sep-08
54	Director/Member	24-Sep-08
55	Director/Member	05-Oct-08
56	Director/Member	07-Oct-08
57	Director/Member	29-Oct-08
58	Director/Member	29-Oct-08
59	Director/Member	29-Oct-08
60	Director/Member	08-Nov-08
61	Director/Member	20-Nov-08
62	Director/Member	26-Nov-08
63	Director/Member	18-Feb-09
64	Director/Member	24-Mar-09
65	Director/Member	31-Mar-09
66	Director/Member	02-Apr-09
67	Director/Member	30-Apr-09
68	Director/Member	18-Nov-09
69	Federal Representative	16-Mar-09
70	Federal Representative	23-Mar-09
71	Federal Representative	09-Apr-09
72	Provincial Representative	19-Mar-09
73	Provincial Representative	30-Mar-09
74	Provincial Representative	31-Mar-09
75	Provincial Representative	22-Apr-09
76	Provincial Representative	07-May-09
77	Provincial Representative	14-May-09
78	Municipal Representative	03-Oct-08
79	Municipal Representative	16-Oct-08
80	Municipal Representative	16-Oct-08
81	Municipal Representative	26-Nov-08
82	Municipal Representative	05-Feb-09
83	Municipal Representative	18-Mar-09

Appendix A.1 (cont'd). Coded List of Informants

Informant #	Position/Affiliation	Date of Interview/Receipt of Completed Questionnaire
84	Municipal Representative	06-Apr-09
85	Municipal Representative	06-Apr-09
86	Municipal Representative	08-Apr-09
87	Municipal Representative	09-Apr-09
88	Municipal Representative	21-Apr-09
89	Municipal Representative	23-Apr-09
90	Municipal Representative	24-Apr-09
91	Municipal Representative	11-May-09
92	Municipal Representative	14-May-09
93	Municipal Representative	02-Jun-09
94	Municipal Representative	05-Jun-09
95	Municipal Representative	15-Jul-09
96	Municipal Representative	31-Jul-09
97	Municipal Representative	08-Sep-09
98	Municipal Representative	08-Sep-09
99	Municipal Representative	09-Oct-09
100	NGO Representative	15-Dec-08
101	NGO Representative	19-Feb-09
102	NGO Representative	12-Mar-09
103	NGO Representative	24-Mar-09
104	NGO Representative	07-Apr-09
105	NGO Representative	07-May-09
106	NGO Representative	11-May-09
107	NGO Representative	07-Sep-09
108	Foundation Representative	15-Jan-09
109	Foundation Representative	02-Apr-09

Appendix A.2. Research Questions to Watershed Organizations - Chief of Staff

Research Questions

SECTION 1 - Respondent Profile

1. What is your current position with the [watershed organization]?
2. How long have you been employed with the [watershed organization]?
3. What is your area of expertise and work experience?
4. What is your educational background?

SECTION 2 - Organizational Structure and Decision Making

5. What year was the [watershed organization] established and what was the impetus for its establishment?
6. What legal mechanism was used for establishing the [watershed organization]?
7. Does the [watershed organization] operate under an approved set of bylaws? Who approves these bylaws? Please attach copy.
8. What is the legal mandate of the [watershed organization]?
9. What is the stated mission of the [watershed organization]?
10. What is the organizational structure of the [watershed organization]?
11. How large is the [watershed organization's} Board of Directors?
12. How are members of the [watershed organization's] Board of Directors chosen and what sectors/agencies do they represent?
13. What is the term of office for members?
14. How is the chair chosen? What is the term of office?
15. What is the [watershed organization's] current budget? Budget over the past five years?
16. What are the [watershed organization's] funding sources?
17. Who are the [watershed organization's] key partners and what is the nature of their partnership, in addition to those represented on the Board of Directors?
18. In your opinion, what are your key administrative issues?

SECTION 3 - Geographic Area of Interest/Responsibility

19. What is the area of the [watershed organization's] jurisdiction or geographic area of interest?
20. What is the current population within your area of jurisdiction or geographical area of interest?
21. In your opinion, what are the key resource management issues in the [watershed]?

SECTION 4 - Vision

22. Has a vision been developed for your area of jurisdiction/geographic area of interest?
23. What is the vision?
24. Was the vision developed independently or jointly with partners and/or other stakeholders? If developed jointly, who were the partners and/or other stakeholders who participated in the crafting of the vision and how was their input obtained?
25. In your opinion, is sustainability implicit (implied), explicit (stated) or absent from your vision?
26. If sustainability is implicit or explicit, in your opinion, what sustainability concepts are embraced by the vision?
    - Adoption of the watershed for planning and managing natural resources
    - Adaptive Management
    - Precautionary Approach
    - Holistic Approach
    - Results-based (multiple benefits and gains)
    - Focus on protecting critical ecosystem components, functions and structures

Appendix A.2 (cont'd). Research Questions to Watershed Organizations - Chief of Staff

SECTION 4 - Vision (cont'd)

- Focus on managing human activities
- Consensus
- Collaboration (interdisciplinary; multi-jurisdictional; multi-agency)
- Accountable and Responsive Decision Making
- Intergenerational Equity
- Intragenerational Equity
- Other Please explain.

Additional Comments:

27. What is the nature and extent of the role that the [watershed organization] plays in achieving the vision?

SECTION 5 - Watershed/River Plan or Management Strategy

28. Has one or more watershed/river plan(s) or management strategy(ies) [the plan] been developed for your watershed/river? If yes, please provide details of current and previous reports (e.g. title, date). If unavailable on website, please provide a copy.
29. Does [the plan] build on past planning processes? If yes, what are the main differences between the current plan and previous ones in your opinion?
30. What principles/values guide [the plan]?
31. Was [the plan] developed with other partners and/or stakeholders? If yes, who were they?
32. What is the mechanism for adoption, implementation and update of [the plan] by the [watershed organization]?
33. If developed jointly with other partners and/or stakeholders, what is the mechanism for adoption, implementation and update of [the plan] by other partners? Be as specific as possible.
34. Does [the plan] identify measures that will be used to evaluate the nature and extent of the plan's success? If yes, how will these measures be incorporated into an update of [the plan]?

SECTION 6 - Goals/Objectives/Activities of the [watershed organization]

35. What are the goals/objectives/activities of the [watershed organization]?
36. How are the goals and objectives of the [watershed organization] determined?

- Legislation
- Consensus of the Board of Directors
- Consultation with Partners
- Linked directly to watershed plan/strategy
- Organization Manager(s)
- Other Please explain.

Please describe the process and level of goal setting.

SECTION 7 - Data

37. What types of data are being (or have historically been) collected to monitor watershed/river conditions?
38. How long has the data been collected?
39. Is the data collected linked to the goals and objectives of your organization or is it being collected for another purpose? If collected for another purpose, please explain.
40. What methods are being used to assess watershed/river conditions?

SECTION 8 - Developing the Watershed Report Cards/State of the Watershed Reports

41. What are the titles/dates of all report card(s)/state of the watershed report(s) [the reports] completed to date?

Appendix A.2 (cont'd). Research Questions to Watershed Organizations - Chief of Staff

SECTION 8 - Developing the Watershed Report Cards/State of the Watershed Reports (cont'd)

42. What was the impetus for developing [the reports]?
43. What were the purpose and perceived benefits of developing [the reports]? If more than report has been completed, have the purpose and perceived benefits changed? Please explain.
44. Who funded [the reports] and at what cost?
45. Did the [watershed organization] partner with other agencies/organizations for the development of [the reports]? If yes, who were the partners?
46. When did the process for developing [the reports] begin?
47. What methodology/process was used for developing [the reports]? How was this methodology identified and selected?
48. What criteria and method/method(s) and frameworks were used for identifying potential watershed indicators?
49. Were the selected indicators linked to the goals and objectives of [the plan]? If yes, please explain the nature and extent of the link.
50. What were the most important criteria for selecting indicators?
51. Who was involved in indicator identification and selection?
52. If there is a link between the Charter and the indicators, were the same actors involved in the goal setting as the indicator selection?
53. How was the final set of indicators chosen?
54. What challenges were associated with selecting indicators?
    - Data not collected
    - Data unavailable from source
    - Data invalid or unreliable
    - Data not available at the watershed scale, extrapolation required
    - Data not available at the watershed scale; extrapolation not feasible for meaningful results
    - Data available but cost or effort to access the data is prohibitive
    - Other

    Additional Comments:
55. How were these challenges overcome or addressed?
56. Recognizing that the indicators in [the reports] have evolved, in your opinion, are the indicators used appropriate and complete? If no, what indicators are missing or inadequate?
57. In your opinion, which indicators are the most useful and why?
58. Have targets been established? If yes, how were they established? By whom?
59. Are there any connections between or among the reporting process and other reporting processes being carried out at the community/watershed/provincial/federal level (e.g. community report cards such as Vital Signs, larger watershed level, municipal/provincial State of the Environment Reports)? If yes, describe the nature and extent of the connection.

SECTION 9 - Updating the Watershed Report Cards/State of the Watershed Reports

60. Has a schedule been established for updating [the reports] at regular or periodic intervals? If yes, how often is an update planned? If no, why not?
61. Has a commitment to resource (funding/human resources) updates to [the reports] been made? If yes, what is the nature and extent of the commitment? If no, will you be pursuing funding sources as a priority activity?
62. What process is or will be used to evaluate and refine indicators for subsequent iterations of the report?

Appendix A.2 (cont'd). Research Questions to Watershed Organizations - Chief of Staff

SECTION 9 - Updating the Watershed Report Cards/State of the Watershed Reports (cont'd)

63. Are report recipients encouraged to provide feedback regarding the report? If yes, how and for what purpose?
64. How are gaps or inadequacies with indicators going to be addressed for future reports?

SECTION 10 - Format and Distribution of the Watershed Report Cards/State of the Watershed Reports

65. In what format is [the report] available?
    - Popular Version
    - Executive Summary Based on Technical Background Reports
    - Technical Background Report
    - Other Please explain.
66. Why were these formats selected and for whom (e.g., Board of Directors, partner agencies and organizations, general public, target groups, others, etc.)?
67. Who was each report distributed to?
68. How was each report distributed and publicized?

SECTION 11 - Use of the Watershed Report Cards/State of the Watershed Reports

69. How are [the reports] being used by ❶ the [watershed organization]? ❷ [watershed organization] partners? ❸ others? What actions, if any, have been undertaken because of the information and insights offered by [the reports]? Please provide examples.
70. In your opinion, what factors have most influenced the plans, policies, programs and projects (either positively or negatively) implemented by the [watershed organization] (e.g. findings from watershed report, availability of funding, organizational will, partner support, public awareness, etc.)? Please explain.
71. In your opinion, have [the reports] led to better decisions regarding plans, policies, programs and projects implemented by the [watershed organization]? Please explain.

SECTION 12 - Improving the Effectiveness of the Watershed Report Cards/State of the Watershed Reports

72. In your opinion are [the reports] fulfilling their intended purpose to the extent envisaged? If yes, please explain. If not, what are the shortfalls and how are or should they being addressed?
73. Are the benefits attributed to undertaking [the reports] being realized? If yes, please explain. If no, what are the shortfalls and how are they being addressed?
74. Are there any unanticipated benefits which have accrued through the development of [the reports]? If yes, what are they?
75. In your opinion, do the benefits of undertaking reports outweigh the costs? Why?
76. What additional improvements can or need to be made?
77. In your opinion, what are the lessons learned to date?

SECTION 13 - Additional Comments

78. Are there additional insights or comments you would like to offer? Comments:

Thank you very much for taking the time to complete this survey.

Appendix A.3. Research Questions to Watershed Organizations - Staff

Research Questions

SECTION 1 - Respondent Profile

1. What is your current position with the [watershed organization]?
2. How long have you been employed with the [watershed organization]?
3. What is your area of expertise and work experience?
4. What is your educational background?

SECTION 2 - Resource Management Issues

5. In your opinion, what are the key resource management issues in the [watershed]?

SECTION 3 - Vision

6. What is the nature and extent of the role that the [watershed organization] plays in achieving the vision?

SECTION 4 - Developing the Watershed Report Cards/State of the Watershed Reports

7. Are you actively involved in developing [the reports]? If yes, what is the nature and extent of your involvement?
8. In your understanding, who are [the reports] developed for and for what purpose?
9. In your opinion, what are the overall benefits of developing [the reports]?
10. In your opinion, what are the most important criteria for selecting indicators for [the reports]?
11. Recognizing that the indicators in [the reports] have evolved, in your opinion, are the indicators used appropriate and complete? If no, what indicators are missing or inadequate?
12. In your opinion, which indicators are the most useful and why?

SECTION 5 - Use of the Watershed Report Cards/State of the Watershed Reports

13. How are [the reports] being used by ❶ the [watershed organization]? ❷ [watershed organization] partners? ❸ others? What actions, if any, have been undertaken because of the information and insights offered by [the reports]? Please provide examples.
14. In your opinion, what factors have most influenced the plans, policies, programs, and projects (either positively or negatively) implemented by the [watershed organization] (e.g., findings from watershed report, availability of funding, organizational will, partner support, public awareness, etc.)? Please explain.

SECTION 6 - Improving the Effectiveness of the Watershed Report Cards/State of the Watershed Reports

15. In your opinion are [the reports] fulfilling their intended purpose to the extent envisaged? If yes, please explain. If not, what are the shortfalls and how are or should they being addressed?
16. Are the benefits attributed to undertaking [the reports] being realized? If yes, please explain. If no, what are the shortfalls and how are they being addressed?
17. Are there any unanticipated benefits which have accrued through the development of [the reports]? If yes, what are they?
18. In your opinion, do the benefits of undertaking reports outweigh the costs? Why?
19. What additional improvements can or need to be made?
20. In your opinion, what are the lessons learned to date?

SECTION 7 - Additional Comments

21. Are there additional insights or comments you would like to offer? Comments:

Thank you very much for taking the time to complete this survey.

Appendix A.4. Research Questions to Watershed Organizations - Chair, Past Chair, or Vice Chair

Research Questions

SECTION 1 - Respondent Profile

1. How long have you been [position] with the [watershed organization]?
2. What is your area of expertise and work experience?
3. What is your educational background?

SECTION 2 - Vision

Vision provided.

4. In your opinion, is sustainability implicit (implied), explicit (stated) or absent from your vision?
5. If sustainability is implicit or explicit, in your opinion, what sustainability concepts are embraced by the vision?
   - Adoption of the watershed for planning and managing natural resources
   - Adaptive Management
   - Precautionary Approach
   - Holistic Approach
   - Results-based (multiple benefits and gains)
   - Focus on protecting critical ecosystem components, functions and structures
   - Focus on managing human activities
   - Consensus
   - Collaboration (interdisciplinary; multi-jurisdictional; multi-agency)
   - Accountable and Responsive Decision Making
   - Intergenerational Equity
   - Intragenerational Equity
   - Other Please explain.

Additional Comments:

6. What is the nature and extent of the role that the [watershed organization] plays in achieving the vision?

SECTION 3 - Goals/Objectives/Activities of the [watershed organization]

7. How are the goals and objectives of the [watershed organization] determined?
   - *Legislation*
   - *Consensus of the Board of Directors*
   - *Consultation with Partners*
   - *Linked directly to watershed plan/strategy*
   - *Organization Manager(s)*
   - *Other Please explain.*

   Please describe the process and level of goal setting.

8. In your opinion, what are the key resource management issues in the watershed?

SECTION 4 - Developing the Watershed Report Cards/Sustainability Reports

9. In your opinion, what was the impetus for developing [the reports]?
10. In your opinion, what are the purpose and perceived benefits of developing [the reports]? If more than report has been completed, have the purpose and perceived benefits changed? Please explain.

Appendix A.4 (cont'd). Research Questions to Watershed Organizations - Chair, Past Chair, or Vice Chair

SECTION 4 - Developing the Watershed Report Cards/Sustainability Reports (cont'd)

11. Recognizing that the indicators in [the reports] have evolved, in your opinion, are the indicators used appropriate and complete? If no, what indicators are missing or inadequate?
12. In your opinion, which indicators are the most useful and why?

SECTION 5 - Use of the Watershed Report Cards/State of the Watershed Reports

13. How are [the reports] being used by ❶ the [watershed organization]? ❷ [watershed organization] partners? ❸ others? What actions, if any, have been undertaken because of the information and insights offered by [the reports]? Please provide examples.
14. In your opinion, what factors have most influenced the plans, policies, programs and projects (either positively or negatively) implemented by the [watershed organization] (e.g. findings from watershed report, availability of funding, organizational will, partner support, public awareness, etc.)? Please explain.

SECTION 6 - Improving the Effectiveness of the Watershed Report Cards/State of the Watershed Reports

15. In your opinion are [the reports] fulfilling their intended purpose to the extent envisaged? If yes, please explain. If not, what are the shortfalls and how are or should they being addressed?
16. Are there any unanticipated benefits which have accrued through the development of [the reports]? If yes, what are they?
17. In your opinion, do the benefits of undertaking reports outweigh the costs? Why?
18. What additional improvements can or need to be made, if any?
19. In your opinion, what are the lessons learned to date?

SECTION 7 - Additional Comments

20. Are there additional insights or comments you would like to offer? Comments:

Thank you very much for taking the time to complete this survey.

Appendix A.5. Research Questions to Watershed Organizations - Members of the FBC and HWA

Research Questions

SECTION 1 - Respondent Profile

1. How long have you been a member of the [watershed organization]?
2. Why were you interested in participating on the [watershed organization's board]?
3. What organization/agency/sector do you represent?
4. What is the relationship/role you play between the organization/agency/sector that you represent and the [watershed organization]?
5. What is your area of expertise and work experience?
6. What is your educational background?

SECTION 2 - Developing the Watershed Report Cards

7. In your understanding, what was the impetus and purpose for developing [the reports]?
8. Were you involved in developing one or more of [the reports]? If yes, what was the nature and extent of your involvement?
9. In your opinion, what benefits of developing [the reports]?
10. Recognizing that the indicators in [the reports] have evolved, in your opinion, are the indicators used appropriate and complete? If no, what indicators are missing or inadequate?
11. In your opinion, which indicators are the most useful and why?

SECTION 3 - Use of the Watershed Report Cards

12. How are [the reports] being used by ❶ the [watershed organization]? ❷ [watershed organization] partners? ❸ others? What actions, if any, have been undertaken because of the information and insights offered by [the reports]? Please provide examples.
13. In your opinion, what factors have most influenced the plans, policies, programs and projects (either positively or negatively) implemented by the [watershed organization] (e.g. findings from watershed report, availability of funding, organizational will, partner support, public awareness, etc.)? Please explain.

SECTION 6 - Improving the Effectiveness of the Watershed Report Cards

14. In your opinion are [the reports] fulfilling their intended purpose to the extent anticipated? If yes, please explain.
15. Are there any unanticipated benefits which have accrued through the development of [the reports]? If yes, what are they?
16. In your opinion, do the benefits of undertaking reports outweigh the costs? Why?
17. What additional improvements can or need to be made, if any?
18. In your opinion, what are the lessons learned to date?

SECTION 7 - Additional Comments

19. Are there additional insights or comments you would like to offer? Comments:

Thank you very much for taking the time to complete this survey.

Appendix A.6. Research Questions - Municipal Staff within the Fraser Basin and Humber River Watershed

Research Questions

SECTION 1 - Respondent Profile

1. What is your current position with the [municipality]?
2. How long have you been employed with the [municipality]?
3. What is your area of expertise and work experience?
4. What is your educational background?

SECTION 4 - Developing the Watershed Report Cards/State of the Watershed Reports

5. Did [the municipality] participate in developing [the reports] for the [watershed]? If yes, what level of decision making was represented and what municipal departments were involved? What was the nature and extent of their involvement? If no, go to question 10.
6. Were you actively involved in developing [the reports]? If yes, what was your role and nature and extent of your involvement?
7. In your understanding, what was the impetus for developing [the reports]?
8. In your understanding, who are [the reports] developed for and for what purpose?
9. In your opinion, what are the overall benefits of developing [the reports]? What are the benefits to the [municipality]?
10. In your opinion, are the watershed report card indicators appropriate and complete for the purpose of a sustainability assessment? If no, what indicators are missing or inadequate?

SECTION 3 - Use of the Watershed Report Cards/State of the Watershed Reports

11. Are [the reports] being used by the [municipality]? By the planning/engineering department? What actions, if any, have been undertaken because of the information and insights offered by [the reports]? Please provide examples.
12. In your opinion, what improvements can or need to be made to improve the effectiveness of [the reports] or what changes need to be made in order for them to become a useful planning tool for the [municipality]?

SECTION 4 - Links to Other Reporting Processes

13. Is the [municipality] involved in any other reporting processes to measure community health, sustainability or state of the community/environment? If yes, what are they?
14. Are there any links between or among the watershed reporting process and the reporting processes identified in Question 13? If yes, what are the nature and extent of these linkages? If no, what are the reasons?
15. Has there been any discussion about either strengthening the linkages among reporting processes or creating linkages, whatever the case may be? If yes, what is the nature of these discussions?

SECTION 5 - Additional Comments

16. Are there additional insights or comments you would like to offer? Comments:

Thank you very much for taking the time to complete this survey.

Appendix A.7. Research Questions to Agencies (Government and Non-Government)

Research Questions

SECTION 1 - Respondent Profile

1. What is your current position with the [agency]?
2. How long have you been employed with the [agency]?
3. What is your area of expertise and work experience?
4. What is your educational background?

SECTION 2 - Developing the Watershed Report Cards

5. Did [the agency] participate in developing [the reports] for the [watershed]? If yes, what level of decision making was represented and what municipal departments were involved? What was the nature and extent of their involvement? If no, go to question 10.
6. Were you actively involved in developing [the reports]? If yes, what was your role and nature and extent of your involvement?
7. In your understanding, what was the impetus for developing [the reports]?
8. In your understanding, who are [the reports] developed for and for what purpose?
9. In your opinion, what are the overall benefits of developing [the reports]? What are the benefits to the [agency]?
10. In your opinion, are the watershed report card indicators appropriate and complete for the purpose of a sustainability assessment? If no, what indicators are missing or inadequate?

SECTION 3 - Use of the Watershed Report Cards

11. Are [the reports] being used by the [agency]? If yes, how are they being used by the [agency]? What actions, if any, have been undertaken because of the information and insights offered by [the reports]? Please provide examples.
12. In your opinion, what improvements can or need to be made to improve the effectiveness of [the reports] or what changes need to be made in order for them to become a useful planning tool for the [agency]?

SECTION 4 - Links to Other Reporting Processes

13. Is the [agency] involved in any other reporting processes to measure health, sustainability or state of the community/environment? If yes, what are they?
14. Are there any links between or among the watershed reporting process and the reporting processes identified in Question 13? If yes, what are the nature and extent of these linkages? If no, what are the reasons?
15. Has there been any discussion about either strengthening the linkages among reporting processes or creating linkages, whatever the case may be? If yes, what is the nature of these discussions?

SECTION 5 - Additional Comments

16. Are there additional insights or comments you would like to offer? Comments:

Thank you very much for taking the time to complete this survey.

Appendix A.8. Research Questions - Community Foundations

Research Questions

SECTION 1 - Respondent Profile

1. What is your current position with the [foundation]?
2. How long have you been employed with the [foundation]?
3. What is your area of expertise and work experience?
4. What is your educational background?

SECTION 2 - Developing the Community Report Card

5. What was the impetus for developing [the community report card]?
6. How many community report cards have been produced? Please provide details (e.g. title, date).
7. What were the purpose and perceived benefits of developing [the community report card]? If more than one community report card has been completed, have the purpose and perceived benefits changed? Please explain.
8. Who funded [the community report card] and at what cost?
9. Did the [foundation] partner with other agencies/organizations for the development of [the community report card]? If yes, who were the partners?
10. What is your geographic area of interest?
11. What is the population within your geographic area of interest?
12. When did the process for developing the first [community report card] begin?
13. What methodology/process was used for developing [the community report card]? How was this methodology identified and selected?
14. What criteria and method/method(s) and frameworks were used for identifying potential community indicators?
15. In your opinion, what were the most important criteria for selecting indicators?
16. Who was involved in indicator identification and selection?
17. How was the final set of indicators chosen?
18. What challenges were associated with selecting indicators?
    - Data not collected
    - Data unavailable from source
    - Data invalid or unreliable
    - Data not available at the watershed scale, extrapolation required
    - Data not available at the watershed scale; extrapolation not feasible for meaningful results
    - Data available but cost or effort to access the data is prohibitive
    - Other Please explain.

    Additional Comments:
19. How were these challenges overcome or addressed?
20. In your opinion, is the final set of indicators appropriate and complete? If no, what indicators are missing or inadequate?
21. In your opinion, which indicators are the most useful and why?
22. Have targets been established? If yes, how were they established? By whom?
23. Are there any links between the community reporting process and the watershed reporting process being led by the [watershed organization]?
24. Are there any links between or among the community reporting process and other reporting processes being undertaken at the community/provincial/federal levels (e.g. municipal/provincial state of the environment reports)? If yes, describe the nature and extent of the connection. If not, why not?

Appendix A.8 (cont'd). Survey and Interview Questions - Community Foundations

SECTION 3 - Updating the Community Report Card

25. Has a schedule been established for updating [the community report card] at regular or periodic intervals? If yes, how often is an update planned? If no, why not?
26. Has a commitment to resource (funding/human resources) updates to [the community report card] been made? If yes, what is the nature and extent of the commitment? If no, will you be pursuing funding sources as a priority activity?
27. What process is or will be used to evaluate and refine indicators for subsequent iterations of the report?
28. Are report recipients encouraged to provide feedback regarding the report? If yes, how and for what purpose?
29. How are gaps or inadequacies with indicators identified earlier going to be addressed for future reports?

SECTION 4 - Format and Distribution of the Community Report Card

30. In what format is [the report] available?
    - Popular Version
    - Executive Summary Based on Technical Background Reports
    - Technical Background Report
    - Other Please explain.
31. Why were the above formats selected and for whom (e.g. Board of Directors, partner agencies and organizations, general public, target groups, others, etc.)?
32. Who was each report distributed to?
33. How was each report distributed and publicized?

SECTION 5 - Use of the Community Report Cards

34. How are [the community report cards] being used by ❶ the [foundation]? ❷ [foundation] partners? ❸ others? What actions, if any, have been undertaken because of the information and insights offered by [the community report card]? Please provide examples.

SECTION 6 - Improving the Effectiveness of the Community Report Cards

35. In your opinion are [the community report cards] fulfilling their intended purpose to the extent anticipated? If yes, please explain. If not, what are the shortfalls and how are or should they being addressed?
36. Are the benefits attributed to undertaking [the community report cards] being realized? If yes, please explain. If no, what are the shortfalls and how are they being addressed?
37. Are there any unanticipated benefits which have accrued through the development of [the community report cards]? If yes, what are they?
38. In your opinion, do the benefits of undertaking reports outweigh the costs? Why?
39. What additional improvements can or need to be made?
40. In your opinion, what are the lessons learned to date?

SECTION 13 - Additional Comments

41. Are there additional insights or comments you would like to offer? Comments:

Thank you very much for taking the time to complete this survey.

Appendix B: Watershed Report Card Analysis

Appendix B.1. Categories for Analyzing Watershed Report Cards

Characteristics of the Watershed Report	Categories for Analysis
General Attributes	
Type	• Report Card – watershed scale • Report Card – sub-watershed scale • Progress Report • State of the Watershed/Valley Report • Watershed Report
Style	• Interpretive based on quantitative measures • Interpretive based on qualitative/descriptive measures • Interpretive based on a mix of measures
Size	• Number of pages
Summary Versions	• Report card is the summary • Stand-alone popular version summary • Summary/overview included in a larger report • No summary provided
Rating Summary Provided	• Yes • No
Themes, Indicators, and Measures	
Indicator Themes and Indicators	• Number of themes • Number of indicators
Primary Area of Focus	• Environmental • Social • Economic
Number of Measures for Each Indicator/Theme	• Less than or equal to 3 • Greater than 3 • Varies
Kind of Measures Used	• Quantitative • Quantitative - aggregated index • Qualitative - public opinion • Descriptive
Purpose(s) of Measures	• Rating • Identification of trends • Illustrative (tell the story)
Rating	
Application of Rating	• All themes • All indicators • Majority of indicators (greater than 50%) • Some indicators • One indicator • No rating

Appendix B.1 (cont'd). Categories for Analyzing Watershed Report Cards

Characteristics of the Watershed Report	Categories for Analysis
Rating	
Criteria Used of Rating Themes/Indicators	• Conditions vis-à-vis accepted guidelines • Conditions vis-à-vis stated targets/expectations • Conditions vis-à-vis reference/baseline conditions • Conditions vis-à-vis provincial/national/regional averages • General direction of trends/progress • Index/aggregated scores (e.g. Water Quality Index (WQI); Index of Biological Integrity (IBI)) • Amount of work required to achieved desired condition • Degree of progress towards a stated target/goal
Nature of Data Used for Rating	• Science-based/Quantitative • Qualitative • Mixed
Basis for Identifying Rating Categories	• Mostly science-based/expert opinion/broadly accepted • Mostly descriptive/subjective • Mixed • Not explained
Geographic Scale for Rating	• Watershed • Sub-watershed/river reach
Rating Categories	• Direction/degree of progress (e.g., getting better; getting worse; mixed results; stable) • Condition of resource (e.g., impaired; unimpaired/stable; transitional; unstable) • Percentage of time meeting guidelines • Letter grade (e.g., A, B, C, D) – descriptive rating assigned • Descriptive rating (e.g. excellent, good, fair, poor/meets expectations; exceeds expectations; needs improvement)
Rating Criteria Described	• Yes • Partially • No
Rating Methodology Described	• In some detail • Generally • No
Targets/Trends	
Targets Included	• Yes • Some • No
Nature of Target	• Quantitative • Qualitative • Descriptive

Appendix B.1 (cont'd). Categories for Analyzing Watershed Report Cards

Characteristics of the Watershed Report	Categories for Analysis
Targets/Trends	
Assessment of Progress Towards Targets	• Yes • Partial • No
Identification of Trends	• Yes • Some • No
Recommendations for Further Monitoring/Research	• Yes • Not specifically addressed
Data	
Data Sources	• Primary (generated by the watershed organization) • Secondary • Not Stated
Year of Data Specified	• Yes • No • Sometimes
Data Sources for Specific Indicators Referenced	• Yes • No • Sometimes • Not applicable
General References Cited	• Yes • No • Sometimes
Technical/More Detailed Background Companion Reports Available on Website	• Yes • No
Geographic Extent of Data used to Inform Indicators	• Country • Province • Watershed • Sub-watershed/River Reach (es) • Estuary • Municipal • Selected Sites
Data Gaps	• Data gaps identified • Not generally addressed
Previous Reports	
Previous Reports (Post 1990)	• Number of reports

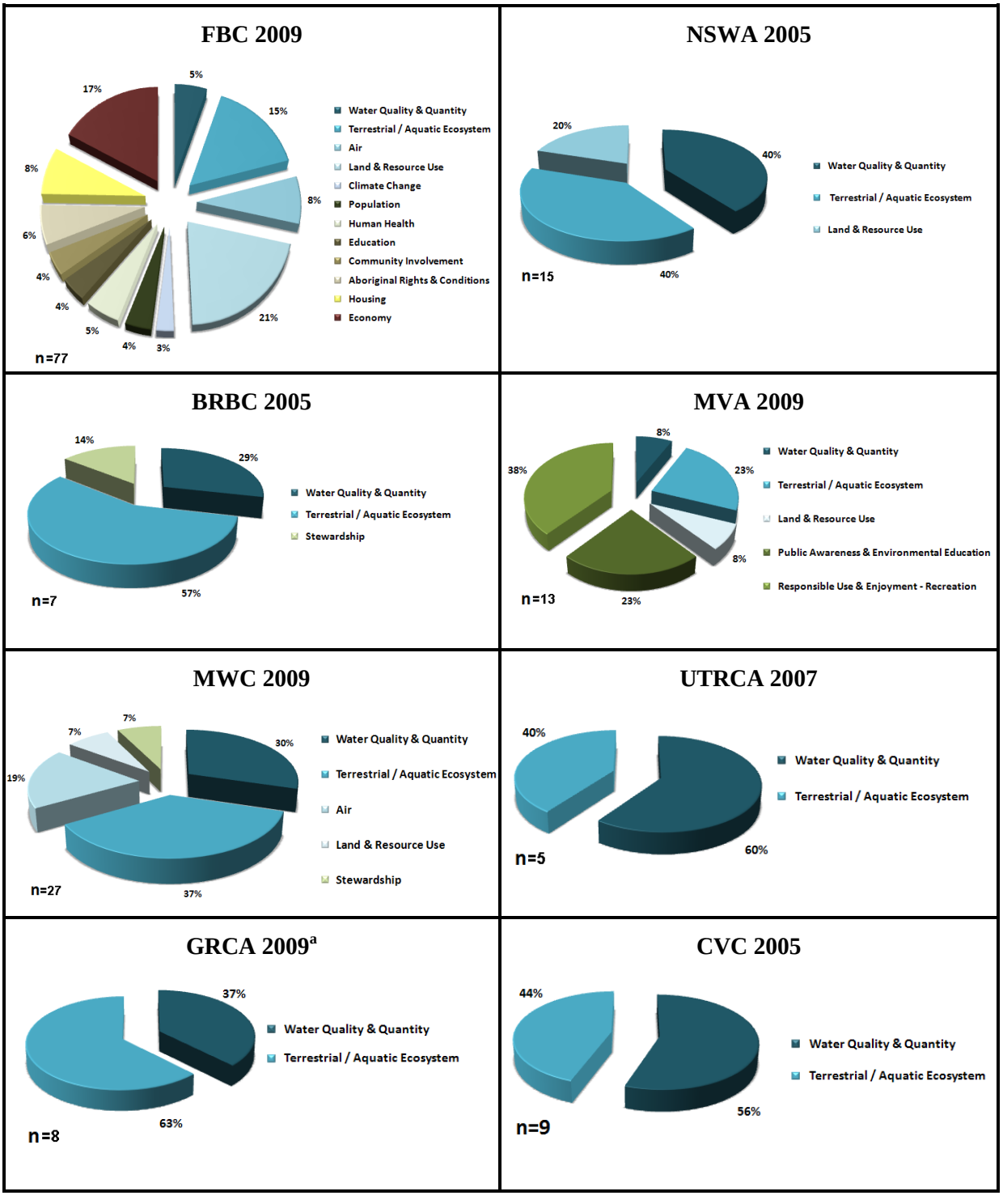
Appendix B.1 (cont'd). Categories for Analyzing Watershed Report Cards

Characteristics of the Watershed Report	Categories for Analysis
Previous Reports	
Indicator Themes Used in Previous Report	• Same • Majority are the same (greater than or equal to 50%) • Different • Majority are different (greater than 50%)
Indicators Used in Previous Report	• Same • Majority are the same (greater than or equal to 50%) • Different • Majority are different (greater than 50%)
Rating Criteria Used in Previous Report	• Majority are the same • Majority are the same with additions • Majority are different • Not enough information to determine • Not applicable
Actions	
Specific Current Actions/Roles Acknowledged	• Yes • No
Recommendations for Actions Included	• Yes • No
Recommendations for Who Should Undertake Actions	• General • Watershed organization • Watershed stakeholders • Government agencies • individuals

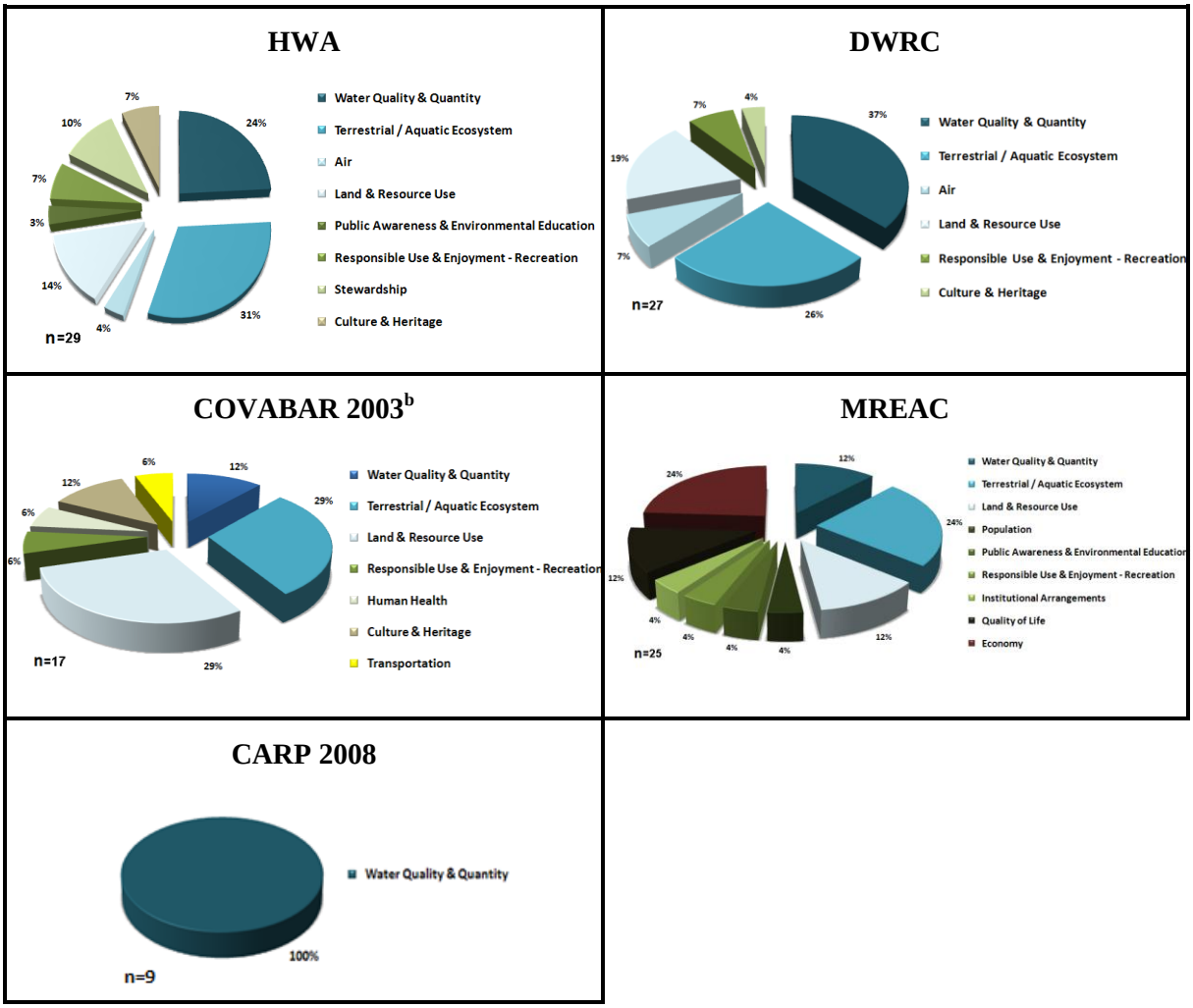
Appendix B.2. Types and Styles of Watershed Report Cards

Watershed Organization	Report Date	No. of Pages in Full Report	Summary Provided				Rating Summary	
			Report Card Is the Summary	Stand-Alone Popular Version Summary	Summary / Overview Included in Larger Report	No	Yes	No
FBC	2000	24			X		X	
	2003	28			X			X
	2006	28			X		X	
	2009	89		X	X		X	
NSWA	2005	203			X			X
BRBC	1994	98			X		X	
	2005	204			X			X
MVA	1998	37			X		X	
	2003	39			X		X	
	2009	35			X		X	
MWC	2004	4	X				X	
	2007	4	X				X	
UTRCA	2001	4		X	X		X	
	2007	6		X	X		X	
GRCA	2003	16				X		X
	2004	12				X		X
	2005	12				X		X
	2006	8				X		X
	2007	16				X		X
	2008	12				X		X
	2009	16				X		X
CVC	2005	24		X			X	
HWA	2000	68			X		X	
	2003	6	X				X	
	2007	96		X	X		X	
DWRC	1997	35				X		X
	2000	56				X		X
	2003	6	X					X
	2006	18	X					
	2009	56				X		X
COVABAR	2000	160				X		X
	2002	60				X		X
MREAC	1992	157			X			X
	2007	134			X			X
CARP	2005	4	X				X	
	2006	4	X				X	
	2007	4	X				X	
	2008	4	X				X	
	2009	4	X				X	

Appendix B.3. General Themes Represented by Watershed Indicators



Appendix B.3 (cont'd). General Themes Represented by Watershed Indicators



[a] The GRCA produces an annual report which is issue-based. The indicators change from year to year.

[b] The 2003 report produced by COVABAR was an update to the 2000 watershed characterization report. The topics covered included only those for which new information was available and is not representative of the suite of themes presented in 2000.

Appendix B.4. General Characteristics of Watershed Report Card Indicators

				Areas of Focus			No. of Measures[a]			Kinds of Measures				Purpose of Measures		
Watershed Organization	Report Date	No. of Themes	No. of Indicators	Environmental	Social	Economic	≤3	>3	Varies	Quantitative	Quantitative - Aggregated Index	Qualitative - Public Opinion	Descriptive	Rating	Identification of Trends	Illustrative (Tell the Story)
FBC	2000	16	55	X	X	X			X	X	X	X	X	X	X	X
	2003	17	70	X	X	X			X	X	X	X	X	X	X	X
	2006	18	74	X	X	X			X	X	X	X	X	X	X	X
	2009	18	77	X	X	X			X	X	X	X	X	X	X	X
NSWA	2005	3	15	X			X			X	X		X	X	X	X
BRBC	1994	4	17	X	X				X	X	X		X	X	X	X
	2005	4	7	X	X				X	X	X		X	X	X	X
MVA	1998	3	6	X	X		X			X		X		X	X	
	2003	3	6	X	X		X			X		X		X	X	
	2009	4	13	X	X				X	X		X		X	X	
MWC	2004	4	23	X	X		X			X			X	X	X	
	2007	3	27	X					X	X	X		X	X	X	
UTRCA	2001	2	7	X			X			X	X			X		
	2007	4	5	X			X			X	X		X	X	X	X
GRCA	2003	3	16	X	X				X	X	X		X	X	X	X
	2004	3	11	X	X		X			X	X		X	X	X	X
	2005	5	6	X	X		X			X			X	X	X	X
	2006	2	4	X			X			X			X	X	X	X
	2007	5	7	X	X		X			X			X	X	X	X
	2008	3	10	X	X		X			X			X		X	X
	2009	6	8	X			X			X			X	X	X	X
CVC	2005	7	9	X					X	X	X		X	X	X	
HWA	2000	3	28	X	X		X			X	X	X	X	X	X	X
	2003	3	15	X	X		X			X	X		X	X	X	X
	2007	3	29	X	X		X			X	X	X	X	X	X	X
DWRC	1997	6	18	X	X				X	X		X	X	X	X	X
	2000	6	18	X	X				X	X		X	X	X	X	X
	2003	4	18	X	X				X	X		X	X	X	X	
	2006	4	0	X	X			X					X			X
	2009	9	27	X	X				X	X	X		X	X	X	X
COVABAR	2000	15	43	X	X	X			X	X	X		X	X	X	X
	2003	9	17	X	X	X			X	X	X		X	X	X	X
MREAC	1992	7	14	X	X				X	X		X		X	X	X
	2007	8	25	X	X	X	X			X	X		X	X	X	X
CARP	2004	1	6	X			X			X			X			X
	2005	1	5	X			X			X	X			X	X	
	2006	1	5	X			X			X	X			X	X	
	2007	1	6	X			X			X				X	X	
	2008	1	9	X			X			X	X			X	X	

Appendix B.5. Consistency in Themes, Measures, and Rating Criteria between Successive Report Cards

Watershed Organization	Report Date	No. of Previous Reports (Post 1990)	Indicator Themes Used in Previous Report				Indicators Used in Previous Report				Measures Used in Previous Report				Rating Criteria Used in Previous Report				
			Same	Majority are the Same (>50%)	Different	Majority are Different (>50%)	Same	Majority are the Same (≥50%)	Different	Majority are Different (>50%)	Same	Majority are the Same (≥50%)	Different	Majority are Different / New (>50%)	Majority are the Same	Majority are the Same with Additions	Majority are Different	Not enough information to determine	Not Applicable
FBC	2003	1		X				X	X					X				X	
	2006	2		X						X				X				X	
	2009	3		X						X				X	X				
BRBC	2005	1	X							X				X			X		
MVA	2003	1	X				X				X							X	
	2009	2		X						X				X				X	
MWC	2007	1		X						X				X			X		
UTRCA	2007	1		X				X	X			X			X				
GRCA	2004	1		X				X	X					X	X				
	2005	2				X				X				X			X		
	2006	3				X				X				X			X		
	2007	4				X				X				X			X		
	2008	5		X						X				X			X		
	2009	6				X				X				X			X		
HWA	2003	1	X				X							X			X		
	2007	2	X					X						X			X		
DWRC	2000	1	X					X				X						X	
	2003	2		X			X					X					X		
	2006	3		X										X					X
	2009	4				X				X				X			X		
COVABAR	2002	1		X				X						X				X	
MREAC	2007	1			X				X				X				X		
CARP	2006	1	X					X				X						X	
	2007	2	X				X				X							X	
	2008	3	X					X				X						X	
	2009	4	X					X				X						X	

Appendix B.6. Data Supporting Watershed Report Cards

		Data Sources			Year of Data Specified			Data Sources for Specific Indicators Referenced				General References Cited			Companion Technical Reports		Geographic Extent of Data Used to Inform Indicators							Data Gaps	
Watershed Organization	Report Date	Primary	Secondary	Not Stated	Yes	No	Sometimes	Yes	No	Sometimes	Not Applicable	Yes	No	Sometimes	Yes	No	Country	Province	Watershed	Sub-watershed / River Reach	Estuary	Municipality	Selected Sites	Data Gaps Identified	Not Generally Addressed
FBC	2000		X		X					X		X				X	X	X	X	X		X		X	
	2003	X	X		X					X		X				X	X	X	X	X		X			X
	2006		X		X			X				X				X	X	X	X	X		X	X		X
	2009	X	X		X			X				X				X	X	X	X	X		X	X		X
NSWA	2005		X		X			X				X				X				X			X	X	
BRBC	1994		X		X				X			X				X			X	X				X	
	2005		X		X			X				X				X			X	X				X	
MVA	1998	X			X			X				X				X				X				X	
	2003	X			X			X				X				X				X				X	
	2009	X			X			X				X				X				X				X	
MWC	2004		X		O		X	O	X			O	X		X		X	X	X				X	X		X
	2007		X		O	X		O	X			O	X		X		X	X	X				X	X		X
UTRCA	2001	X	X		X			X				X			X				X	X		X		X	
	2007	X	X		X			X				X			X				X	X		X		X	
GRCA	2003	X	X				X			X			X			X	X		X	X		X	X		X
	2004	X	X				X			X			X			X			X	X		X	X		X
	2005	X	X				X			X			X			X			X	X		X	X		X
	2006	X	X				X		X				X			X			X						X
	2007	X	X				X			X			X			X			X	X		X	X		X
	2008	X	X				X		X				X			X			X	X		X	X		X
	2009	X	X				X			X			X			X			X	X		X	X		X

Appendix B.6 (cont'd). Data Supporting Watershed Report Cards

		Data Sources			Year of Data Specified			Data Sources for Specific Indicators Referenced				General References Cited			Companion Technical Reports		Geographic Extent of Data Used to Inform Indicators							Data Gaps	
Watershed Organization	Report Date	Primary	Secondary	Not Stated	Yes	No	Sometimes	Yes	No	Sometimes	Not Applicable	Yes	No	Sometimes	Yes	No	Country	Province	Watershed	Sub-watershed / River Reach	Estuary	Municipality	Selected Sites	Data Gaps Identified	Not Generally Addressed
CVC	2005	X	X		X			X				X			X				X	X				X	
HWA	2000	X	X				X			X			X			X			X	X		X	X	X	
	2003	X	X				X		X				X			X			X					X	
	2007	X	X		X					X		X				X			X	X		X	X	X	
DWRC	1997	X	X				X			X			X			X			X					X	
	2000	X	X		X			X						X		X			X					X	
	2003			X		X			X				X			X			X						X
	2006			X			X				X		X			X			X						X
	2009	X	X		X			O				X			X				X	X				X	
COVABAR	2000		X		X					X		X				X			X	X		X	X		X
	2002		X		X			X				X				X			X	X		X	X		X
MREAC	1992	X	X		X			X				X				X			X	X	X	X	X	X	
	2007	X	X		X					X		X				X	X	X	X	X	X		X		X
CARP	2005	X			X			O				O			X				X	O				O	
	2006	X			X			O				O			X				X	O				O	
	2007	X			X			O				O			X				X	O				O	
	2008	X			X			O				O			X				X	O				O	
	2009	X			X			O				O			X				X	X				O	

X = Included in Watershed Report Card
O = Included in Background or Technical Reports

Appendix B.7. Categories Used to Illustrate Indicator Status

Watershed Organization	Report Date	Rating						Criteria Used for Rating Themes / Indicators							
		All Themes	All Indicators	Majority of Indicators (> 50%)	Some Indicators	One Indicator	No Rating	Conditions vis-à-vis Accepted Guidelines	Conditions vis-à-vis Stated Targets / Expectations	Conditions vis-à-vis Reference / Baseline Conditions	Conditions vis-à-vis Provincial / National / Regional Averages	General Direction of Trends / Progress	Index / Aggregated Scores (e.g. WQI; IBI)	Amount of Work Required to Achieve Desired Condition	Degree of Progress Towards a Stated Target / Goal
FBC	2000			X							X	X	X		
	2003			X							X	X	X		
	2006			X							X	X	X		
	2009			X							X	X	X		
NSWA	2005				X			X		X			X		
BRBC	1994					X		X				X	X		
	2005					X		X				X	X		
MVA	1998	X							X						
	2003	X							X						
	2009		X						X						
MWC	2004		X					X	X	X		X			
	2007	X	X						X			X			
UTRCA	2001	X	X					X					X		
	2007	X		X									X		
GRCA	2003				X				X	X	X		X		
	2004				X					X	X	X	X		
	2005				X					X					
	2006					X				X					
	2007				X					X					
	2008						X								
	2009					X			X						
CVC	2005				X					X		X	X		
HWA	2000			X					X	X		X	X		
	2003			X											X
	2007			X				X	X	X		X	X		
DWRC	1997			X						X		X			
	2000			X						X		X			
	2003		X							X		X		X	
	2006						X								
	2009			X				X	X	X			X		
COVABAR	2000				X			X		X			X		
	2002					X		X	X	X			X		
MREAC	1992				X			X		X					
	2007				X					X			X		
CARP	2005						X								
	2006		X					X				X	X		
	2007		X					X				X	X		
	2008		X					X				X			
	2009		X					X				X	X		

Appendix B.8. Criteria and Methodologies Described for Rating Indicators

Watershed Organization	Report Date	Nature of Data Used for Rating			Basis for Identifying Rating Categories				Geographic Scale for Rating		Rating Categories					Rating Criteria Described			Rating Methodology Described*		
		Science-based / Quantitative	Qualitative	Mixed	Mostly Science-based / Expert Opinion / Broadly Accepted	Mostly Descriptive / Subjective	Mixed	Not Explained	Watershed	Sub-watershed / River Reach	Direction / Degree of Progress (e.g., Getting Better, Getting Worse, Mixed Results, Stable)	Condition of Resource (e.g., Impaired, Unimpaired) / Stable, Transitional, Unstable	Percentage of Time Meeting Guidelines	Letter Grade (e.g., A, B, C, D) - Descriptive Rating Assigned	Descriptive Rating (e.g., Excellent, Good, Fair, Poor / Meets Expectations, Exceeds Expectations. Needs Improvement)	Yes	Partially	No	In Some Detail	Generally	No
FBC	2000			X		X			X		X						X				X
	2003			X				X	X	X	X							X			X
	2006			X		X			X		X				X	X					X
	2009			X		X			X		X				X	X					X
NSWA	2005	X					X		X	X					X	X				X	
BRBC	1994	X				X		X	X	X			X			X			X		
	2005	X			X					X					X	X				X	
MVA	1998			X		X				X					X		X				X
	2003			X		X				X					X		X				X
	2009			X		X				X					X		X				X
MWC	2004			X		X			X		X				X		X				X
	2007			X		X			X		X				X		X				X
UTRCA	2001	X					X		X	X				X		X			X		
	2007	X			X				X	X	X			X		X			X		
GRCA*	2003	X					X		X	X		X			X		X				X
	2004	X					X		X	X	X	X			X		X				X
	2005	X				X			X	X		X					X				X
	2006	X				X			X			X						X			X
	2007	X				X			X	X		X				X					X
	2008																				
	2009	X				X			X	X					X	X					X

Appendix B.8 (cont'd). Criteria and Methodologies Described for Rating Indicators

Watershed Organization	Report Date	Nature of Data Used for Rating			Basis for Identifying Rating Categories				Geographic Scale for Rating		Rating Categories					Rating Criteria Described			Rating Methodology Described*		
		Science-based / Objective	Subjective / Qualitative	Mixed	Mostly Science-based / Expert Opinion / Broadly Accepted	Mostly Descriptive / Subjective	Mixed	Not Explained	Watershed	Sub-watershed / River Reach	Direction / Degree of Progress (e.g., Getting Better, Getting Worse, Mixed Results, Stable)	Condition of Resource (e.g., Impaired, Unimpaired) / Stable, Transitional, Unstable	Percentage of Time Meeting Guidelines	Letter Grade (e.g., A, B, C, D) - Descriptive Rating Assigned	Descriptive Rating (e.g., Excellent, Good, Fair, Poor / Meets Expectations, Exceeds Expectations. Needs Improvement)	Yes	Partially	No	In Some Detail	Generally	No
CVC	2005	X					O		X	X	X	X			X	O	X		O	X	
HWA	2000			X		X			X	X	X			X		X				X	
	2003			X		X			X		X						X			X	
	2007			X		X			X	X	X			X		X			X		
DWRC	1997			X		X			X		X					X					X
	2000			X		X			X		X					X					X
	2003			X		X			X		X			X		X					X
	2006																				
	2009			X		X			X					X		X				X	
COVABAR	2000	X					X		X	X		X			X			X			X
	2002	X			X				X						X			X			X
MREAC	1992	X			X					X		X			X			X		X	
	2007			X				X	X	X					X		X				X
CARP	2005																				
	2006	X						X	X		X				X			X			X
	2007	X						X	X		X				X			X			X
	2008	X						X	X		X				X			X			X
	2009	X					X		X	X	X				X	O			O		

X = Included in Watershed Report Card
O = Included in Background or Technical Reports

Appendix B.9. Targets, Monitoring, and Research Addressed in Watershed Report Cards

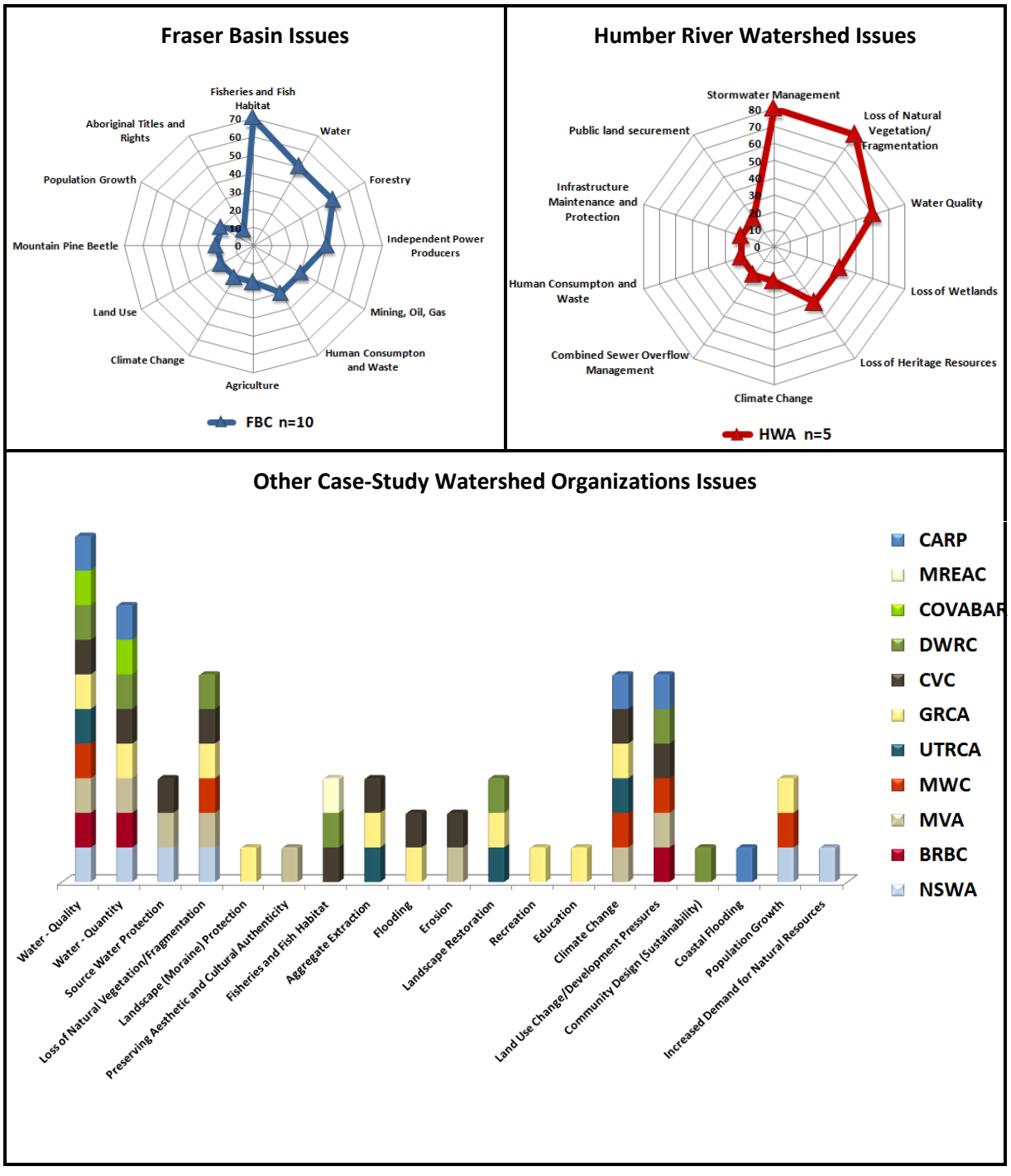
Watershed Organization	Report Date	Targets Included						Assessment of Progress Towards Targets			Identification of Trends			Recommendations for Further Monitoring / Research	
		Yes	Some	No	Quantitative	Qualitative	Descriptive	Yes	Partial	No	Yes	Some	No	Yes	Not Specifically Addressed
FBC	2000			X						X		X		X	
	2003			X						X		X			X
	2006			X						X		X			X
	2009			X						X		X			X
NSWA	2005			X						X		X		X	
BRBC	1994			X						X		X		X	
	2005			X						X		X		X	
MVA	1998	X				X	X	X					X		X
	2003	X				X	X	X					X		X
	2009	X				X	X	X			X			X	
MWC	2004	X					X		X		X				X
	2007			X						X	O				X
UTRCA	2001			X						X			X		X
	2007			X						X	X				X
GRCA	2003		X		X					X		X			X
	2004		X		X				X			X			X
	2005		X		X					X		X			X
	2006			X						X		X			X
	2007			X						X		X			X
	2008		X		X					X		X			X
	2009		X		X					X		X			X
CVC	2005			X						X	X				X
DWRC	1997	X			X	X	X			X	X			X	
	2000	X			X	X	X	X			X			X	
	2003	X				X	X	X			X			X	
	2006			X						X			X		X
	2009	X			X		X			X	X			X	
HWA	2000	X			X	X	X			X	X			X	
	2003	X			X	X	X	X				X		X	
	2007	X			X		X		X		X			X	
COVABAR	2000			X						X		X			X
	2002		X							X		X			X
MREAC	1992			X						X	X			X	
	2007			X						X		X			X
CARP	2005			X						X		X		X	
	2006			X						X	X			O	
	2007			X						X	X			O	
	2008			X						X	X			O	
	2009			X						X	X			O	

X = Included in Watershed Report Card

O = Included in Background or Technical Reports

Appendix C: Analysis of Informants' Opinions and Perceptions

Appendix C.1. Key Resource Issues Identified by Staff and Chairs/Past Chairs/Vice Chairs



Appendix C.2. Perceived Role of Case-Study Watershed Organizations

Perceived Role of Case-Study Watershed Organization	FBC	NSWA	BRBC	MVA	MWC	UTRCA	GRCA	CVC	HWA	DWRC	COVABAR	MREAC	CARP
Action Implementer	X		X	X		X	X	X	X	X	X		X
Educator	X	X	X	X	X		X		X	X		X	
Sustainability / Watershed Advocate	X		X				X	X	X	X			
Partnership Builder	X	X	X			X		X		X			
Collaborative Watershed Planner			X	X			X				X		
State of the Basin Reporter / Monitor		X	X		X			X		X			
Action Motivator			X		X	X	X				X		
Vision Champion			X							X		X	
Facilitator	X	X					X						
Fund Raiser	X	X	X										
Community Leader		X	X								X		
Watershed Organization / Community Liaison									X	X			
Policy Influencer									X				
Public Dialogue Convenor			X										
Impartial Catalyst	X												
Conflict Resolution Agent	X												
Secretariat	X												
International Sustainability Leader	X												

Appendix C.3. Perceived Benefits Derived from Watershed Report Cards

Perceived Benefits of Watershed Report Cards	Fraser Basin n=33	Humber River Watershed n=21	Other Case-Study Watershed Organizations n=28	Total n=82
Increases public education, awareness and support	17	7	19	43
Provides baseline/benchmark information about the health of the watershed from which to measure change and progress	9	8	13	30
Documents changing conditions and trends over the short and long terms	8	8	12	28
Contributes to informed planning and decision making processes	10	4	13	27
Helps define what needs to be done and what resources and actions are needed	5	7	13	25
Pinpoints hot spots and issues/threats in the watershed	1	3	9	13
Motivates stewardship and action	6	2	5	13
Condenses complex environmental conditions to make it understandable to the lay person	6	2	3	11
Provides an advocacy tool to lobby governments to action	4	5	2	11
Helps raise the watershed organization's profile and credibility	2	2	6	10
Defines research needs and where there are gaps in the data	1	3	3	7
Helps to define causal relationship between drivers that influence watershed health / sustainability.	4	0	2	6
Provides justification for funding requests or continuation of funding for projects and programs	2	1	3	6
Engages people	3	2	0	5
Celebrates successes and commends individual and collective efforts	3	1	1	5
Justifies/demonstrates the need for initiating, maintaining or revising a data collection/monitoring program	0	0	4	4
Provides a systematic framework/methodology for reporting	2	1	0	3
Provides an opportunity to create a network of people involved in developing, assessing and monitoring river health/sustainability	2	0	1	3
Motivates behavioural change through action and lifestyle modifications.	3	0	0	3
Influences political will for sustainability	2	0	0	2
Complements other programs and activities of partners	2	0	0	2
Keeps the state of the watershed at the forefront of people's minds	0	1	0	1
Forces watershed organization's Board of Directors to address their advocacy role	1	0	0	1

Appendix C.4. Unplanned Benefits Derived from Watershed Report Cards

Unanticipated Benefits of Watershed Report Cards	FBC N=11	HWA N=11	Other-Case Study Watershed Organizations N=16	Total N=38
Through the release of the Report Card, the watershed organization is perceived as a leader with credibility	**4**	**0**	**7**	**11**
Report Card is used as a template by others in Canada and internationally	**3**	**2**	**5**	**10**
Report Card was given an award	**0**	**7**	**1**	**8**
Collaborative process has resulted in increased exposure of the watershed organization to basin residents and civic groups	**2**	**0**	**3**	**5**
Collaborative process has built trust, camaraderie, and a sense of joint accomplishment that fostered healthy community relations and action	**0**	**0**	**4**	**4**
Collaborative process has garnered considerable respect and raised the profile of the watershed organization	**3**	**0**	**0**	**3**
Report Card spurred the development of sub-watershed reports	**2**	**0**	**0**	**2**
Report Card has justified additional funding for projects and programs	**2**	**0**	**0**	**2**
Report Card findings have provided more of a contribution to strategic planning than was anticipated	**2**	**0**	**0**	**2**
Report Card has fostered a shared interest among other watershed organizations	**0**	**0**	**2**	**2**
Report Card has created peer pressure by featuring success stories and motivating groups to do better	**1**	**0**	**0**	**1**
Report Card has provided justification for additional funding	**0**	**1**	**0**	**1**
Report Card has spurred the creation of a watershed inventory	**0**	**0**	**1**	**1**
The process of creating the Report Card has allowed for the development and testing of metrics	**0**	**0**	**1**	**1**
Collaborative process has resulted in a growing field of practice around indicators	**1**	**0**	**0**	**1**
Collaborative process has garnered considerable respect and raised the profile of the watershed organization	**3**	**0**	**0**	**3**

Appendix C.5. Uses of Watershed Report Cards by Others as Perceived by Informants from Case-Study Watershed Organizations

Uses by Others	FBC	HWA	Other Case-Study Watershed Organizations
Planning tool used by other to inform strategic planning, work plans, and policy development	X	X	X
Planning tool to help inform strategic directions and planning for scaling up within river basins			X
Planning tool used by others to identify future monitoring and research needs			X
Assessment tool to define and focus watershed issues			X
Advocacy tool used by citizens and non-governmental organizations to influence policy and decision making at different levels	X	X	X
Advocacy tool used by others to engage agencies, municipalities and others in dialogue or making a case for action			X
Advocacy tool used by partners to justify continued funding support to the watershed organization			X
Advocacy tool used by others for justifying requests for funding to agencies and foundations		X	X
Communications tool used by others to generate dialogue and build awareness and support among basin stakeholders regarding existing and emerging resource issues		X	X
Information tool used by others to provide geographic context and a point of reference	X		
Information tool used by media to highlight issues or develop stories	X		X
Educational tool used by educators for teaching	X		X
Template for sustainability reporting used by other organizations	X	X	X
Reference tool for researchers in developing proposals for research grants			X
Limited use			X

Appendix C.6. Lessons Learned

Input	Data	Indicators	Process	Formatting	Content / Impact	Outreach
Engage First Nations, youth, academia, and multi-cultural groups.	Coordinate technical resources to avoid unreliable/untimely data.	Use indicators that link to goals of the watershed organization.	Build on, complement, and link to other reporting initiatives.	Build on successive Report Cards to achieve consistency in reporting.	Link trends, past successes, and 'go forward' actions.	Undertake more effective dissemination of information.
Appeal to people at a local level.	More monitoring is needed to understand the factors which impact watershed health.	Use indicators that are science-based, relevant to the public, and that inform individual action.	Use strategic alliances and integrated means to solve joint problems and get buy-in.	Focus Report Cards on specific key issues.	Give a positive message and include stories / images and celebrate successes.	Solicit feedback to inform the next Report Card.
People care about their watershed and want to protect it.	It may take longer to obtain data than thought. Ample notice of data requests should be given.	Report Cards spur discussion and provide information to guide strategic planning.	Reporting requires an on-going commitment to resourcing (e.g., staff, funding, time).	Complete mapping at the end in case new data becomes available or changes are made.	Make the Report Card understandable to the general public.	Community champions can foster broad support.
Involve municipalities - they have the greatest input and influence over actions.	Data should be timely and interpreted accurately to ensure credibility.	An 'indicators' network of practitioners which enables peer input and review is valuable.	Report Cards should have the full support of watershed organization Board.	A good editor/designer is essential to simplify and effectively present data.	The influence of Report Cards is positive but mostly short-lived.	Use a 'formal' launch to increase attention on the Report Card.
Undertake a public opinion survey to gauge public awareness.	Use local community knowledge.	Use a short list of easily understood indicators and measures.	Let Report Cards evolve as works-in-progress.	Learn from others - use other Report Cards as templates.	The Report Cards appeal only to the 'converted'.	
	Community monitoring builds awareness and buy-in.	Indicators should be based on available data.	Community-led initiatives may lose drive as people vary.	Keep the progress scoring general (i.e., no point scale).	Low scores offend people; be prepared to defend them.	
	Assumptions should be clear when data is extrapolated.	Indicators should be based on data required to understand issues.	Monitoring of actions is needed to inform the next Report Card.	Lever web-based tools to foster more interaction.	Report Cards are essential tools for watershed planning.	
	Assess information needs of the target audience before developing a Report Card	A grading system needs to be scientifically defensible and easily understood.	Community-led initiatives are hard if priorities differ and science is not understood.	Produce hard copy Report Cards – they are still useful.	Report Cards do not spur change - hands-on action does.	

Appendix C.7. Suggested Improvements to Watershed Report Cards

Input	Data	Indicators	Process	Formatting	Outreach
Engage all sectors of the public (e.g., youth, seniors, recent immigrants) in more innovative and meaningful ways	Work with other agencies to collect and/or extract data into sub-watershed units	Add new indicators and specific measures to adequately assess the wide range of factors that influence watershed health	Allow the report cards and indicators to evolve in response to relevant issues and needs	Create an interactive web-based format by geography (maps), theme, and keyword	Develop a more strategic, cost-effective outreach approach
Engage municipalities in selecting indicators so that municipal needs are understood and met	Coordinate data collection, measures, and indicators with adjacent watersheds	Add clear objectives, targets, benchmarks, and thresholds that allow changes to be consistently tracked	Incorporate more multi-disciplinary integration	Make the report interesting, concise, easy to read (avoid jargon), and easy to understand (consumer report)	Use the Report Card as a teaching tool
Engage academic institutions	Build better relationships for efficient data exchange	Use and incorporate more timely data and more current indicators	Consider changing the timing of report cards	Provide an at-a-glance summary and/or create a stand-alone summary	Formally present the Report Card to partners and other decision makers
Engage the 'keepers' of the data in indicator selection	Ensure the accuracy of the data	Select indicators based on reliable, valid and consistent data sets so that comparisons for subsequent report cards can be made	Make watershed reporting approaches complementary to other reporting initiatives various levels	Standardize consecutive report cards to make them more consistent	Solicit and retrieve public feedback using innovative techniques (e.g., web-based tools, social marketing)
Engage First Nations in a more meaningful way	Incorporate local traditional First Nations knowledge	Use a science-based rating rather than perception-based or subjective rating	Harmonize watershed reporting approaches among conservation authorities	Consider different styles of reporting for different audiences	
		Separate indicators into more component parts that relate more specifically to policy issues	Find better ways to monitor the effectiveness of implementation/actions	Provide a technical companion document which breaks down the statistics	
		Use and incorporate more science-based indicators	Be open to new ideas		
		Reduce the number of indicators but provide more in-depth measures	Facilitate a stronger civic agenda for action to raise accountability		

Appendix C.8. Factors that Influence Decision Making in Case-Study Watershed Organizations

Factors Which Influence Decision Making	FBC	HWA	Other Case-Study Watershed Organizations
Availability of funding	X	X	X
Partner support and collaboration	X	X	X
Public awareness and support	X	X	X
Organizational will and enthusiasm	X	X	X
Identification of new issues / opportunities	X	X	X
Ability to build relationships with others	X	X	X
Compatibility with vision, goals, and objectives	X	X	X
Board and staff support for specific activities	X	X	X
Degree that the watershed organization raises awareness through the Report Cards	X	X	
Level of effort or remedial action required		X	X
Reactive versus proactive mode of operation		X	X
Availability of data and science to define the issues			X
Degree of volunteer participation			X
Sense of urgency			X
Level of innovation and creative thinking			X
Provincial legislation and policy direction			X
Level of administrative capacity			X
Stability and maturity of the organization			X
Continuity of staff and Board members			X
Diffuse nature and complexity of resource problems			X
Level of staff expertise			X
Transparent and accountable processes			X
Lessons learned from past events (e.g., flooding)			X
Inadequate facilities to house staff			X
Inability to coordinate efforts with other agencies		X	
Depressed economics		X	
Political influences - 'issues of the month'		X	
Changing corporate priorities		X	
Level of administrative support		X	
Degree of alignment between the goals/priorities of the watershed group and those of the sponsor watershed organization		X	
Corporate bureaucracy slows things down		X	
Many actions are opportunistic rather than strategic		X	
Actions depend on the level of influence specific volunteers on others		X	
Degree of fit with the strategic plan	X		
Success of previous efforts increases profile and service demands	X		
Aboriginal title and rights	X		
Challenge with Aboriginal participation	X		
Length of time it takes to reach consensus	X		
Focus on multi-year projects and projects that extend beyond the scope of the watershed	X		

Appendix D: Comparison of Sustainability Principles

Appendix D.1. Comparison of the Principles Underpinning Alternative Management Approaches

Characteristics of an Ecosystem Approach (Slocombe 2010)	**Sustainability Requirements** (Gibson et al. 2005)	**Principles for Sustainable Governance** (Costanza et al. 1998)	**New Watershed Approach** (Born and Genskow 2000)	**Good Governance** (Graham, Amos and Plumptre 2003)
Geographic Unit – define the ecosystem naturally (e.g., biophysical and/or cultural terms instead of arbitrarily) ***Systems Approach*** – describe parts, systems, and environments and their interactions; describe system dynamics, e.g., with concepts of homeostasis, feedbacks, cause-and-effect relationships, and self-organization. ***Scope –*** look at different levels/scales of system structure, process, and function. ***Holistic –*** use holistic, comprehensive, interdisciplinary descriptions and analyses. ***Inclusive*** – include people and their activities in the ecosystem; include an understanding of actor and stakeholder relationships and interactions, and institutional factors in analyses. ***Goal-oriented –*** recognize goals and take an active, management orientation. ***Environmental Limits -*** recognize systemic limits to action – defining and seeking sustainability. ***Adaptation*** – use an anticipatory, flexible research and planning process. ***Equity*** – entail an implicit or explicit ethics of quality, well-being, and integrity.	***Socio-Ecological System Integrity*** - build human-ecological relations to maintain the integrity of biophysical systems and the irreplaceable life support functions upon which human well-being depends. ***Livelihood Sufficiency and Opportunity*** – ensure everyone has enough for a decent life and opportunity to seek improvements in ways that do not compromise future generations' possibilities for sufficiency and opportunity. ***Socio-ecological Civility and Democratic Governance*** – build the capacity, motivation and habitual inclination of individuals, communities and other collective decision-making bodies to apply sustainability requirements through more open and better informed deliberations, greater attention to fostering reciprocal awareness and collective responsibility, and a more integrated use of administrative, market, customary and personal decision making practices. ***Resource Maintenance and Efficiency*** – provide a larger base for ensuring sustainable livelihoods for all while reducing threats to the long-term integrity of socio-ecological systems by reducing extractive damage, avoiding waste and cutting overall material and energy use per unit of benefit. ***Intragenerational Equity*** – ensure sufficiency and effective choices for all are pursued in ways that reduce dangerous gaps in sufficiency and opportunity (and health, security, social recognition, political influence, etc.) between the rich and the poor. ***Precaution and Adaptation*** – respect uncertainty, avoid even poorly understood risks of serious or irreversible damage to the foundations for sustainability, plan to learn, design for surprise, and manage for adaptation. ***Immediate and Long Term Integration*** – apply all principles of sustainability at once, seeking mutually supportive benefits and multiple gains.	***Participation*** – engage all stakeholders in formulation and implementation of decisions. ***Responsibility*** –use environmental resources in an ecologically sustainable, economically efficient, and socially fair manner. ***Scale-matching*** – match decision-making to the scale at which relevant information is available, response is quick and efficient, and integration can be achieved across scale boundaries. ***Precaution*** – err on the side of caution to avoid irreversible environmental impacts. ***Adaptation***– use feedback mechanisms to adjust management decisions based on new information. ***Full Cost Allocation*** – identify and allocate internal and external social and ecological costs and benefits.	***Geographic Unit*** – use watersheds and sub-watersheds as the fundamental analytical and management unit. ***Systems Approach –*** address a broad scope of issues, exhibit a systems orientation, incorporate multiple means, and include goals pertaining to healthy ecosystems, economic returns, and resource management. ***Knowledge Base*** – use science-based, local knowledge, and socio-economic information-driven assessments, plans and decisions. ***Coordination*** – ensure multi-agency and intergovernmental coordination (including information exchange, resource sharing, and shared decision-making). ***Consensus Orientation*** – recognize collaborative, voluntary, and consensus-oriented interaction of local stakeholders, government agencies, communities and other watershed interests that ebb and flow in intensity based on the issues at hand, and the formation of public-private partnerships. ***Collaboration –*** employ collaborative problem-solving, planning, and management based on consensus and negotiation. ***Adaptation –*** adopt action-oriented planning and management (including adaptive planning and decision-making processes) to reflect changing resource, socio-economic, and institutional conditions, and new knowledge gained from ongoing monitoring and evaluation.	***Strategic Vision*** – adopt a broad and long-term perspective on good governance and human development, along with a sense of what is needed for such development; understand historical, cultural, and social complexities in which the perspective is grounded. ***Participation*** – provide all men and women with a voice in decision-making, either directly or through legitimate intermediate institutions that represent their intention; build participation on freedom of association and speech, as well as capacities to participate constructively. ***Consensus Orientation*** – mediate differing interests to reach a broad consensus on what is in the best interest of the group and, where possible, on policies and procedures. ***Accountability*** – be accountable to the public, as well as to institutional stakeholders. ***Transparency –*** build transparency on the free flow of information; make processes, institutions and information directly accessible to those concerned with them, and provide enough information to understand and monitor them. ***Equity*** – provide all men and women with opportunities to improve or maintain their well-being. ***Rule of Law*** – employ fair and impartial legal frameworks. ***Responsiveness*** – serve all stakeholders. ***Effectiveness and efficiency*** – produce results that meet needs while making the best use of resources.

Appendix E: Broad Goals and Objectives of Case-Study Watershed Organizations

Appendix E.1. Broad Goals and Objectives of Case-Study Watershed Organizations

Watershed Organization	Broad Goals	Specific Objectives
FBC	To (1) be instrumental in solving complex, inter-jurisdictional sustainability issues, (2) be a catalyst and educator, (3) assume an impartial role as convener and facilitator of inclusive and constructive dialogue, and (4) measure and report on progress towards sustainability in the Fraser Basin.	There are four directions that guide FBC activities: understanding sustainability, caring for ecosystems, strengthening communities, and improving decision making. Activities include maintaining and updating the Charter; developing action plans; monitoring and reporting on progress towards sustainability; facilitating coordination and integration of regional and local activities; facilitating the resolution of inter-jurisdictional and multiparty conflicts; and promoting education and awareness of sustainability in the Fraser Basin. Examples of programs include: • Aboriginal and non-Aboriginal Partnerships • BC Climate Exchange • Community Action on Energy and Emissions (CAEE) • Fleet initiatives • Flood Hazard Management • Fraser Salmon and Watersheds • Fraser River Debris Trap • Invasive Plant Strategy for British Columbia • Smart Planning for Communities • Sustainability Purchasing Network • Transportation Demand Management • Youth and Sustainability • Water Governance.
NSWA	To (1) complete an Integrated Watershed Management Plan (IWMP) for the North Saskatchewan River, (2) implement the Vermilion River Sub-Watershed Management Project, and (3) provide ongoing educational, communications and information exchange opportunities for watershed stakeholders. NSWA goals as a WPAC are to (1) prepare a State of the Watershed Report, (2) prepare an Integrated Watershed Management Plan, and (3) develop a collaborative approach to watershed planning.	To: • promote and encourage collaborative decision-making and planning • raise awareness, share information and promote watershed-related activities to our members and the wider community • improve basin water quality by identifying human impacts and advocating for the enhancement of ecological function throughout the watershed - no reference to working groups • foster wise use and integrated management of land and water resources throughout the North Saskatchewan River watershed • ensure the sustainability of the NSWA as the key watershed planning and advisory organization for the North Saskatchewan Watershed.
BRBC	To help the Bow River Basin achieve the highest water quality of any highly populated river basin in Canada. The BRBC works with partners in establishing the Bow River Basin as the best managed watershed in the world.	To: • maintain a forum for all Council members to share perspectives and exchange information • prioritize water use management issues in the basin that may affect the quality and/or quantity of groundwater or surface water or riparian zones • participate in water use management and planning activities • develop and recommend improved water use management procedures and performance measures • encourage the implementation of cooperative water use management strategies • participate in activities that promote and demonstrate increased awareness of water use management issues to its members, the governments of Alberta and Canada, and the public conduct and direct fundraising for the BRBC • obtain and use assets and funds entrusted to the BRBC for benevolent, cultural, ecological, educational, planning and/or recreational purposes for the improvement and protection of the Bow River Basin (Alberta) watershed • review and decide upon requests for funds and/or resources from the Council and others on the basis of the merits of the requests, availability of funds, and sound financial and project management principles.
MVA	To (1) protect the natural and heritage resources of the Meewasin Valley, (2) develop and encourage projects that enhance these resources and add to the quality of life in Saskatoon, and (3) increase awareness and understanding of the resources in the valley.	To: • serve as a model of environmental stewardship • increase and enhance alliances to further objectives • expand the Meewasin trail system • provide leadership in the development of South Downtown and to secure public access • secure an enhanced funding base • continue to improve the development review process and provide input into City and University Development Plans • secure land to protect natural areas and provide public access to river.

Appendix E.1 (cont'd). Broad Goals and Objectives of Case-Study Watershed Organizations

Watershed Organization	Broad Goals	Specific Objectives
MWC	To sustain and enhance the air, water and terrestrial ecosystems of the watersheds of Muskoka for the environmental, health, economic, spiritual and intrinsic values they provide.	To: • develop and implement science-based programs to research, assess, monitor and evaluate the health of Muskoka's watersheds • advocate for sound air, land and water use planning and management practices and policies that sustain and improve the health of Muskoka's watersheds • develop and implement public information and education programs that promote understanding of the impact of human actions on the watersheds and encourage lifestyle choices that are compatible with healthy and functioning watersheds • promote and facilitate demonstration activities and best practices that support an environmentally sustainable economy and a healthy community structure.
UTRCA	To establish and undertake, in the area over which it has jurisdiction, a program designed to further the conservation, restoration, development and management of natural resources other than gas, oil, coal and minerals (Conservation Authorities Act, R.S.O. 1990, c. C.27, s. 20).	To: • develop a watershed management planning framework, utilizing sub-watershed assessment and planning approaches • undertake the preparation of an Infrastructure and Asset Management Plan • develop a Financial Plan • complete a comprehensive Business Plan for the Conservation Areas, involving exploring delivery and strategic marketing positioning approaches/strategies, development of Conservation Area Master Plans to support new approaches, and preparation for operating plans that support sustainable investment strategies, performance measures, etc. • undertake programs and services to implement the above strategies (e.g. flood/water control, environmental planning, watershed planning, environmental monitoring, research, soil conservation, forestry, conservation areas, lands and facilities, environmentally significant areas, community partnerships, drinking water source protection. service cost centres).
GRCA	Same at UTRCA.	To: • reduce flood damages • improve water quality • ensure an adequate supply of water • protect natural areas • play a key role in watershed planning • provide recreational opportunities • provide environmental education.
CVC	Same as UTRCA.	To: • manage the hydrological system of the watershed in a manner that emulates natural processes while recognizing human needs • protect and enhance the quality of surface and subsurface water for environmental and human uses • protect, enhance and restore the ecological integrity of the watershed's natural features, functions and systems • protect public safety and minimize property damage from natural hazards including flooding, erosion, wetlands and dynamic beaches • promote the social and economic health of the community through effective watershed management.
HWA	To protect, restore and celebrate the Humber River watershed and to assist TRCA and it partner agencies.	To assist TRCA and its partner agencies to: • secure political support at all levels of government and foster corporate partnerships to advance TRCA's vision for The Living City • achieve The Living City vision within the Humber watershed • implement priority recommendations in the Humber Watershed Task Force's report entitled, Legacy: A Strategy for a Healthy Humber (1997) • implement recommended actions to meet the targets identified in the Humber watershed report cards • maintain and improve the natural and human heritage and recreational values that distinguish the Humber as a Canadian Heritage River • implement the recommendations of the Toronto and Region Remedial Action Plan contained in Clean Waters, Clear Choices: Recommendations for Action and strategic directions contained in subsequent reports as they pertain to the Humber River watershed • implement strategic plans such as the Wet Weather Flow Management Master Plan (Toronto) and the regions of Peel and York sustainability initiatives • implement source water protection initiatives.
DWRC	To protect, regenerate and celebrate the Don watershed and to assist TRCA and its partner agencies.	To assist TRCA and its partner agencies to: • secure political support at all levels of government and foster corporate partnerships to advance TRCA's vision for The Living City • achieve The Living City vision within the Don watershed • develop, review and complete the updated watershed plan for the Don and its components incorporating new watershed understandings and TRCA's strategic plan and implementation actions • implement the recommendations of the Toronto and Region Remedial Action Plan and strategic directions contained in subsequent reports as they pertain to the Don watershed • implement strategic plans such as the Wet Weather Flow Management Master Plan (Toronto) and the Region of York's sustainability initiatives • implement source water protection initiatives.

Appendix E.1 (cont'd). Broad Goals and Objectives of Case-Study Watershed Organizations

Watershed Organization	Broad Goals	Specific Objectives
COVABAR	To inform, educate and motivate collaborative actions to improve watershed health and quality of life. COVABAR promotes public access to watercourses for recreation and tourism (translation).	To: • promote an ecosystem approach to sustainable development in the Richelieu River watershed • consult with and build consensus among watershed stakeholders for managing resources, including water, on a watershed basis • build awareness of the Richelieu River and its watershed • sensitize and inform watershed residents and relevant stakeholders of the need for integrated watershed management, decision-making and community action in keeping with the fundamental principles of sustainable development • foster and support tangible community actions that solve local or neighbourhood environmental problems and contribute to sustainable development through training, education and other outreach programs • make recommendations for managing resources and undertaking appropriate activities within the watershed • establish a 25-year action plan for environmental restoration which identifies broad objectives and priorities for action and provides a framework for developing five-year and annual action plans. • monitor and periodically evaluate actions • establish links with government agencies or others beyond the Richelieu River watershed which help advance COVABAR's goals • provide programs and services in support of COVABAR's goals (translation)
MREAC	To protect and manage the Miramichi River watershed, promoting a positive attitude and developing an awareness among the region's citizens that quality of life is intrinsically linked to environment.	To: • constructively consult, cooperate and partner with government, industry, municipalities and other stakeholders wherever possible • support the advancement and application of scientific knowledge • promote and support an appropriate level of enforcement of environmental regulation • be actively involved in independent environmental monitoring • promote the responsible use of technology in environmental improvement • celebrate and promote the Miramichi River's environmental qualities and values as appropriate to sustain a healthy sense of pride and stewardship • venture beyond our ecosystem boundary when needed to understand external factors impacting our watershed, to gain useful knowledge and promote sharing of information and technological exchange
CARP	To undertake action projects, public outreach, problem identification, environmental planning initiatives.	To: • actively promote, encourage and assist the wise use of estuaries in Atlantic Canada in both rural and urban areas • specifically assist in the rehabilitation and protection of estuaries and surrounding watersheds in the Annapolis Valley with initial attention to the Annapolis River • encourage co-operation between all existing public and private agencies with similar objects, and will all levels of government • provide information to human users of river systems with a view to encouraging multiple use • design, promote and implement specific projects aimed at the restoration of estuarine habitats that have suffered from damaging human impact and to conserve desirable attributes of the estuaries • provide an opportunity for private and public sector organizations and individuals to assist directly in the implementation of specific projects for the mutual benefit of all concerned • gather information from public and private sources which would aid in estuary conservation and development and make such material available by whatever means might, from time to time, be practical • undertake or facilitate research programmes to aid conservation development in Nova Scotia • support and encourage people who wish to develop healthy conservation opportunities, and to enhance the climate for such development by encouraging an exchange of ideas • promote the concept of volunteer citizen participation in community affairs • retain the services of specific consultants as needed to further the aims of the Society • administer funding received from public and private sources in a manner under terms as may be established from time to time • establish policies for the management of the Society • encourage participation in the Society by all people who share the objects of the Society and • do all such acts or things as are incidental or conducive to or consequential upon the attainment of the above objects.