

Source Water Protection for Nonmetropolitan Drinking Water Operators in British Columbia, Canada

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Abstract

This case study research has been conducted in British Columbia's Okanagan Valley. Situated in the southern interior of the province, the Okanagan Valley has experienced rapid expansion in agriculture and other resource activities as well as significant population growth since the mid-1900s. In response to new provincial drinking water regulations, local water operators in the Okanagan Valley have attempted to direct greater attention to drinking water source protection, the first barrier in the multi-barrier approach to clean drinking water. This paper examines constraints to source water protection from the perspective of nonmetropolitan drinking water operators. The results of this research indicate that many factors operate beyond the jurisdiction of local water operators in the Okanagan to constrain their ability to undertake effective source water protection. These results are not geographically unique to the Okanagan region but are representative of other nonmetropolitan areas throughout British Columbia.

1.0 Introduction

We've been charged with the responsibility of providing safe drinking water with no means of enforcement. We basically have our hands tied by the provincial government with some of the policies put down on us. We just don't have the money, time, or enforcement to do source protection in our watershed. (District manager, Lakeview Irrigation District, Westbank, British Columbia)

Source water protection is not a top priority for us. There is nothing the small rural water users in BC can do directly in our watersheds. We must rely on government to take action. We can't go up into Crown-owned land and do anything. So source water protection is not a top priority for us, because we can't control anything in the watershed areas; we have no authority. (Executive director, Small Water Users Association of British Columbia)

The above quotes suggest that a contradiction currently exists between the policies of the provincial regulator and the capacity of nonmetropolitan water operators in

British Columbia respecting watershed management generally and source water protection specifically. This contradiction frustrates local water operators and may be a contributing factor in their (in)ability to operationalize source water protection at the local level. This paper reports the results of four case studies undertaken in the Okanagan Valley, British Columbia, between August 2004 and July 2005 (see also Patrick, Kreutzwiser, & de Loë, 2008). Evidence from this research suggests that while nonmetropolitan water operators accept the provincial multiuse designation over Crown-owned watersheds, there is opportunity for improved communication between the provincial regulator and water operators as well as opportunity for expanded partnerships between all watershed users.

The term *nonmetropolitan* is used in this paper to include a range of rural and municipal identities, including incorporated areas, the urban periphery, and rural agricultural areas.

2.0 Background

Nonmetropolitan areas in Canada continue to experience numerous challenges respecting the operation of safe community water systems. Many of these challenges are well documented in the water resources literature and include limited financial capacity, aging infrastructure, and inconsistent levels of operator expertise (Davies & Mazumder, 2003; Ivey, de Loë, Kreutzwiser, & Ferreyra, 2006; Kreutzwiser & de Loë, 2000). More recently, and in response to water quality concerns of the public, many local water operators face a new regulatory challenge.

In most Canadian provinces and territories new drinking water policies and regulations have evolved largely in response to the tragic water contamination events of Walkerton, Ontario, in May 2000 where seven people died and hundreds more were made seriously ill. In British Columbia, for example, a series of government initiatives immediately followed the release of the Report of the Walkerton Inquiry (O'Connor, 2002a), including the BC Drinking Water Action Plan (Province of British Columbia, 2002), the BC Drinking Water Protection Act of 2001, and the new BC Drinking Water Regulations 200/2003 (Province of British Columbia, 2003).

Among the new policies and regulations is the provincial requirement that all water operators (metropolitan and nonmetropolitan) provide safe drinking water to all water customers by employing “source-to-tap” protection. Source-to-tap protection, also known as the multi-barrier approach (MBA), includes source water protection (SWP) as the first barrier. While few people would disagree with the logic of this requirement, the means by which water operators can achieve this requirement is highly uneven, favoring large metropolitan water systems. The vast majority of nonmetropolitan water operators lack legal jurisdiction over provincially regulated and Crown-owned land to effectively undertake SWP. The consequence of this condition, the requirement to provide safe drinking water yet the inability to regulate land use on Crown-owned land, is placing enormous pressure on local water operators to invest in expensive water treatment technologies—an approach many can ill afford, especially water operators in nonmetropolitan areas.

The contradiction between the “source-to-tap” rhetoric of provincial agencies and the capacity of nonmetropolitan areas to undertake SWP is the subject of this paper.

3.0 The Multi-barrier Approach

The Canadian Council of Ministers of the Environment (CCME) defines the MBA as “an integrated system of procedures, processes and tools that collectively prevent or reduce the contamination of drinking water from source-to-tap in order to reduce risks to public health” (CCME, 2004). The goal of the MBA in drinking water management is to reduce the risk of drinking water contamination through the presence of system redundancies, or barriers, built into the water system. CCME (2004) describes three main components in the MBA, beginning with source protection, followed by drinking water treatment and the drinking water distribution system. In addition to these three main elements of the drinking water system, CCME (2004) identifies a list of 15 safeguards (5 for each of the three elements), as shown in Table 1. These three main elements, or barriers, together with their integrated procedures and tools, compose the MBA for the purposes of this research. However, other authors include “monitoring” or “testing” as a fourth barrier (Christensen, 2003; Province of British Columbia, 1998/1999; Province of British Columbia, 2001). Other authors add “response plan” as a fifth barrier (Hrudey, Payment, Huck, Gillham, & Hrudey, 2003; O’Connor, 2002b; Ontario Ministry of Environment, 2004). In this paper, the MBA described by CCME (2004) and depicted in Table 1 will be utilized based on the logic of having specific integrated procedures and tools attached to each of the drinking water system elements. In addition, this paper will focus primarily on the first barrier, source water protection, while recognizing the importance of each barrier in the MBA.

Table 1. *The Multi-barrier Approach**

Elements of Drinking Water Systems	Integrated Procedures and Tools
1. Source protection	<ul style="list-style-type: none"> • Water quality monitoring and management of water supplies • Legislation and policy frameworks
2. Water treatment	<ul style="list-style-type: none"> • Public involvement and awareness
3. Distribution system	<ul style="list-style-type: none"> • Guidelines, standards and objectives • Research and development of science and technology

**Note.* From “From Source to Tap: Guidance on the Multi-Barrier Approach to Safe Drinking Water,” by the Federal-Provincial-Territorial Committee on Drinking Water and the CCME Water Quality Task Group. Copyright 2004 by the Canadian Council of Ministers of the Environment.

4.0 Source Water Protection

Most definitions state that SWP is not a single activity but a specific program, or process, with multiple components operating at the watershed scale. For example, Shrubsole (2004) defines SWP as the management of watersheds used to supply

water, both ground and surface, to people. Similarly, the (U.S.) National Research Council (2000) defines SWP as “essentially watershed management programs with a specific goal of protecting drinking water supplies.” The Ontario government is more specific, describing SWP as “a series of interrelated components involving the implementation of programs aimed at minimizing the chances of contaminants entering the water resource” (Ontario Ministry of Environment, 2004). Additionally, Gullick (2003, p. 37) recognizes the spatial variability among watersheds by stating “source water protection is a highly site-specific process that reflects the inherent diversity of natural waters and the areas from which they are derived.” This view is supported by Robbins, Glicker, Bloem, and Niss (1991, p. 44), where it is noted that “wholesale application of a program that was successful in one drainage basin may not be appropriate for another, because watersheds are extremely varied in terms of natural environmental features, land use, ownership, and institutional controls.” Different watersheds, therefore, may require widely different SWP initiatives and programs. The range of definitions offered in the literature suggests that SWP is a watershed-specific process encompassing numerous potential activities and components.

The public health and economic benefits of SWP are widely accepted in the water resources literature. SWP aims to reduce the risk of waterborne contamination at the water source (Davies & Mazumder, 2003; Hruday et al., 2003). SWP also makes economic sense for at least three principal reasons. First, it is reported to be less expensive to protect a water source from contamination than it is to remediate after contamination (Job, 1996; Leccese, 1998). Second, it has been shown to be more cost effective to invest in natural capital, such as purchasing development rights or land acquisition within a watershed, rather than to invest in physical capital, such as water treatment technologies (Chichilnisky & Heal, 1998; National Research Council, 2000). Third, several authors note that source protection, as a first line of defence for clean drinking water, significantly reduces water treatment challenges and costs (Barten & Ernst, 2004; Gullick, 2003). Moreover, Kundell and DeMeo (2000) identify additional rationales for SWP, including environmental quality, citizen awareness, legal responsibility, land conservation, smart development, and environmental management.

The water resources literature reports the component parts of an SWP program to be highly variable, reflecting the varied and unique characteristics of watersheds as well as the diversity of land-use practices occurring within watersheds. Table 2 identifies a range of SWP program components based on a review of current literature. Moreover, Table 2 provides sufficient evidence to suggest that SWP may be operationalized through multiple and varied practices.

Table 2. *SWP Program Components*

Author	Components of SWP programs
Ontario Ministry of Environment (2004)	<ul style="list-style-type: none"> • Delineation of a watershed or groundwater recharge area • Inventory of potential sources of contamination • Assessment of vulnerability of water supply to contamination • Implementation of a management plan
National Research Council (2000)	<ul style="list-style-type: none"> • Goal and objective setting • Watershed inventory and contaminant assessment • Development of protection strategies • Implementation • Effectiveness, monitoring, and evaluation • Stakeholder involvement
Gullick (2003)	<ul style="list-style-type: none"> • Source water protection vision • Source water characterization • Source water protection goals • Source water protection action plan • Implementation of the action plan • Periodic evaluation and revision of entire program
Lacey (2003)	<ul style="list-style-type: none"> • Mapping the watershed • Identifying potential sources of contamination • Assessing likelihood of contamination events • Watershed monitoring
Trust for Public Land (2004)	<ul style="list-style-type: none"> • Land purchase • Best practices • Land conservation
Kundell and DeMeo (2000)	<ul style="list-style-type: none"> • Identify existing and future threats • Extent of threat and their location • Assess effectiveness of protection strategy • Funding options

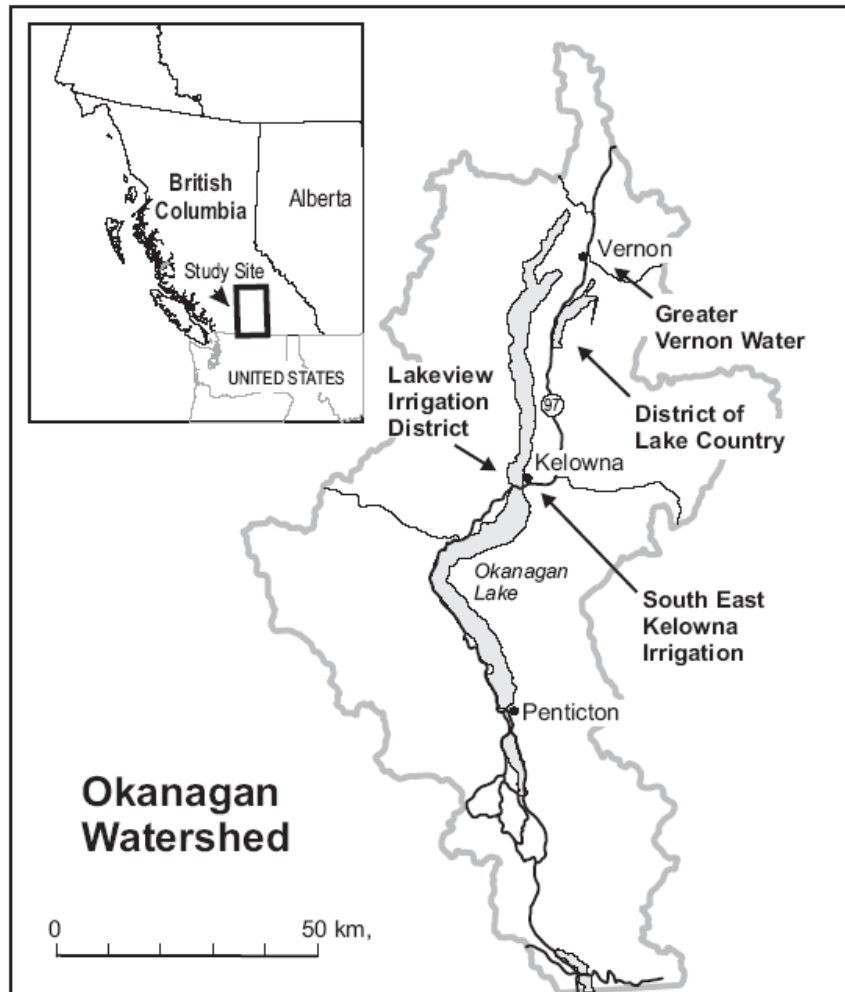
5.0 Methods

Four public water operators make up the case study areas for this research. All four utilities are located in British Columbia's Okanagan Valley and provide potable water service to nonmetropolitan mixed urban, small town, and rural areas (see Figure 1). Each water operator relies on surface water sources originating in mountain watersheds. The jurisdictional boundary of each water operator does not correspond to the watershed area of the operator, and in all cases the jurisdictional area of the operator is significantly smaller than the corresponding watershed area. In addition, Lakeview Irrigation District and South East Kelowna Irrigation District share portions of the same watershed. Moreover, the watershed area for each case study is contained within Crown-owned land under provincial jurisdiction, a condition common across British Columbia.

The four case study areas are within southern British Columbia under the jurisdiction of the Interior Health Authority of the BC Ministry of Health; they share similar climates, economies, development pressures, and provincial regulatory frameworks. The case study areas were selected, in part, for their aforementioned similarities, but also for their differences. The case studies are distributed across two regional districts, the Regional District of North Okanagan and the Regional District of Central Okanagan. As well, two of the case studies are irrigation districts (Lakeview Irrigation District and South East Kelowna Irrigation District), a third case study is a recently (1995) incorporated municipality (District of Lake Country), and the fourth is an amalgamated water utility (Greater Vernon Water Utility). In each case study area, agricultural water users make up the bulk of total annual water consumption, yet growing water demand from commercial, institutional, and residential users is noted (Okanagan Partnership, 2004).

Semistructured interviews were conducted between August 2004 and July 2005 in the Okanagan Valley and in the provincial capital, Victoria. In total, 20 interviews were conducted of water managers, regional and municipal planners, elected officials, private contractors, and industry representatives. Each voice-recorded interview was transcribed into text for qualitative content analysis. In addition, documents were collected for each case study and analyzed to help corroborate interview material. In total, 40 documents were analyzed, including newsletters of the water operators, position papers of various water organizations, statutes and regulations of the provincial government, and technical reports of professional consultants. The documents were also analyzed using quantitative content analysis, namely word search and word count.

Figure 1. The Okanagan Valley and case study areas. Arrows on map indicate general location of the four areas. Watershed boundaries and water service areas are not shown on map.¹



¹From "Factors facilitating and constraining source water protection in the Okanagan Valley, British Columbia," by R. Patrick, R. de Loë, & R. Kreutzwiser, 2008, *Canadian Water Resources Journal*, 33(1), pp. 39–54. Copyright 2008 by the Canadian Water Resources Association. Reprinted with permission of the Canadian Water Resources Association.

6.0 Results

The interviews and document reviews collectively served to identify factors both facilitating and constraining SWP. These results are reported below.

6.1 Facilitating Factors of SWP

The most commonly reported factor to facilitate SWP (48%) was local relationship building and improved communication between drinking water operators and industrial watershed users. Specific activities relating to this factor include field inspections with industry (namely forestry and recreation) and land-use referrals from the provincial government (Ministry of Forests) to local water operators.

These activities are mostly informal and voluntary on the part of industry and the water operator and infrequent on the part of the provincial government. It would appear that local water operator initiative, in most cases, is the catalyst for establishing relationships with industry. For the District of Lake Country, a dedicated staff person specifically targets relationship building with other watershed users.

If I go and talk to the people who are our main, I don't want to say *destroyers*, main users of the watershed, if we could just work together because I know they are going to be up there forever. We could help build cattle fences so they are not using the creeks as bathtubs for their cows, help with ditches, water troughs for cows. And the same with forestry, make sure they adhere to their rules, riparian protection with thick vegetation to keep the cows out. I don't see a problem, but no one has done this coordination work before. (Water quality technician, District of Lake Country, Winfield, British Columbia)

The second most commonly cited factor to facilitate SWP was public education and watershed awareness (24%). All four case study areas maintain public websites offering SWP information to the public. For example, between fall 2004 and fall 2006, six newsletters from the Lakeview Irrigation District contained more than 25% total content on the subject of SWP. The fall 2004 Lakeview Irrigation District newsletter featured a report on the irrigation district's dismay over a provincially supported intensive recreation designation over the entire watershed. In the area of watershed awareness, collaboration between individual water operators was cited as facilitating SWP.

We have a program through the Kelowna Joint Water Committee (five Kelowna water operators) called the Upper Watershed Awareness Program. The initiative has trailed off considerably in the last two years. We used to access provincial funds, the E-team program. We'd send a couple of students into the watershed to talk to recreation users, leave watershed awareness pamphlets on vehicles. The students had no official authority in the watershed, but we felt their presence modified watershed users' behavior. (General manager, South East Kelowna Irrigation District, Kelowna, British Columbia)

Interestingly, the third most commonly cited factor to facilitate SWP (20%) was the coordinated opposition of local water operators to provincial land-use proposals and drinking water policies deemed by the local water operators as having potential negative impact(s) on source water quality. Examples of multioperator opposition to provincial authorities include opposition to the proposed sale of Crown lease lots surrounding upland drinking water reservoirs (Water Supply Association of BC [WSABC], 2002). The WSABC further provides a strong recommendation to the BC Crown Agency that "in the interest of source protection, the BC Crown Agency should not renew these leases past the current tenure." In 2003 the WSABC bemoans the continuance of "ten provincial ministries and agencies" handling "fifteen separate pieces of legislation" while "no agency or legislation has drinking water as the primary mandate." In addition, the WSABC (2003) refers to enhanced source protection by calling upon the provincial government "to show leadership and commitment in protecting drinking water in the province, from source to tap." More recently, the WSABC (2006a, 2006b) is highly critical of the technocentric approach to safe drinking water taken

by the Interior Health Authority (IHA) (IHA, 2004, 2006). IHA has indicated all surface water suppliers throughout the Okanagan Valley should filter their water. The WSABC (2006a, 2006b) argues instead for greater attention to “[a] balanced approach ... (relying) on high quality water from valley lakes, utilization of the best quality water from the watersheds, enhanced disinfection practices, filtration where necessary, and comprehensive source protection programs.” The WSABC (2006a, 2006b) strongly emphasizes the practicality and affordability offered through the MBA, including source protection, particularly for the many small town and rural areas of the Okanagan Valley.

In no instance did the local operator report a current program, activity, or action from the province that facilitated local SWP. In fact, actions of the province were commonly reported to constrain local SWP. Such actions became the subject of public condemnation by local water operators.

6.2 Constraining Factors of SWP

The factor most commonly reported to constrain SWP (27%) was the apparent lack of provincial government commitment, consistency, and leadership in the area of SWP. As a result, water operators often spoke of their uncertainty regarding the roles of provincial agencies. For example, the director of engineering of the District of Lake Country, in Winfield, British Columbia, said, “I think it is *authority* that is the key word we are looking for. Who has the authority in the watershed to deal with the drinking water issue? In my opinion they [provincial government] are not there.”

Often, the conflicting interests of the provincial government were voiced by the interviewee as a constraining factor.

The new DWPA [Drinking Water Protection Act] states that the operators are responsible for delivering good clean water not only into their pipes but also into their intakes. But the new FRPA [Forest and Range Practices Act] states that forest companies will no longer be regulated around riparian areas. Forestry can cut right up to the streams now, so long as the result is not negative. The theory goes: If the result was fine then the practice was fine. But there are problems. Some of the impacts will not be known until well after the activity. So the new FRPA is conflicting with the new DWPA. They are at cross-purposes. (A senior geoscientist, Summit Environmental Consultants Ltd., Vernon, British Columbia)

The second most commonly cited factor constraining SWP (17%) was lack of local authority around watershed land uses. In the words of the chair of the Water Supply Association of BC:

We [water suppliers] are not having direct input in land-use decisions of the Crown [provincial government]. In a lot of instances we are given less priority than the snowshoe club, the snowmobile club, and the fly-fishing club. We are not, in a lot of cases, even brought to the table. People forget that this is our water source out there.

The director of development services, District of Lake Country, echoes these comments:

We don't have the jurisdiction to regulate land uses in our watershed. This is Crown-owned land. If we were the ones in control in the upper watershed we could look at land-use impacts on water quality. We do have some control on the lower elevation lakes within our jurisdiction, but not the upper watershed.

The third most commonly cited factor constraining SWP (16%) was the perceived lack of cooperation and communication between levels of government. A local engineering consultant with more than 25 years of local experience said, "We've got a great number of [provincial] agencies that are managing their own silos, and a whole series of silos that are not talking to each other very well, and really no one talking for water."

Other constraining factors included inappropriate watershed land uses (11%), lack of funding (8%), rapid regional population growth (8%), lack of human resources (6%), and climate change (3%).

7.0 Discussion

The results from this research identify two characteristics relating to scale. Factors facilitating SWP tend to concentrate at the local scale, whereas factors constraining SWP tend to concentrate at the provincial scale. This observation is important when identifying future policy initiatives aimed at facilitating SWP.

Moreover, a number of unexpected outcomes came forward as a result of this research. The first of these suggests that while SWP is supported across all four case study areas for either its financial sensibility or practical logic, SWP is also recognized as something not easily attainable for local water operators. In the words of the district manager for the Lakeview Irrigation District:

We just don't have the control or power [jurisdiction] in our watershed. When they [province] talk about source-to-tap protection they don't have the means or the people to do the enforcement, so it's really tap to source. And the onus is really on the improvement district and we are up against the cattle operators and all the recreation people. To what degree should our ratepayers pay for a watershed [repair] that is used by everybody? The province is allowing multiple users into our watershed, cattle, forestry, and now intensive recreation. Are they [province] collecting money? Nothing is coming back to us as compensation for the uses going on in this watershed.

It was clearly evident in virtually all the interviews that water treatment is seen, somewhat reluctantly, as the more expensive yet only politically feasible option by which local water operators may provide safe drinking water. The executive director of the Small Water Users Association of British Columbia expressed this reality in an almost defeatist tone:

SWP is not something that concerns us, because we can't control anything in the watershed area. We have far bigger problems looking after water treatment under the DWPA. This is a major issue that is overwhelming us right now. Source protection is way at the bottom of the list.

This comment acknowledges the legal requirement under the BC Drinking Water Protection Act of 2001 for water operators to provide safe drinking water.

However, without jurisdiction to undertake SWP, nonmetropolitan water operators are forced to look at expensive water treatment technologies, forcing an imbalance in the MBA and a focus away from SWP. Some interviewees made clear the difficulty of processing all water, including agricultural water, in a water treatment facility. For example, the general manager of the South East Kelowna Irrigation District said, “We can’t afford a big fancy water treatment facility; we can’t afford to treat all the water for all of the users all of the time.”

The second unexpected outcome was revealed during document review and suggests that professional engineering reports submitted to local water operators displayed a disproportionate attention to water treatment over SWP. For example, a word-search analysis of the master water plan for the Greater Vernon area (Associated Engineering [B.C.] Ltd., 2002) revealed that the term “source protection” was not used and the term “watershed protection” was utilized only twice. Conversely, the term “water treatment” was used 101 times. In the 2004 addendum to the master water plan (Associated Engineering [B.C.] Ltd., 2004), there is no reference to “watershed protection” or “source protection,” while “water treatment” is mentioned 34 times. The potential consequence of such bias in professional engineering reports may distort local comprehension of the MBA. Additionally, favoring water treatment has potential to influence locally elected decision makers, resulting in overinvestment (and reliance) on water treatment technology while devaluing the importance of SWP.

A third unexpected outcome resulting from this research suggests that the exclusive control over a watershed by a local water operator was not seen to be a priority. In fact, virtually all interviewees preferred a shared, multiuse watershed over a closed, single-use watershed. The closed watershed examples of large metropolitan areas, such as Vancouver and Victoria, were not regarded in high esteem by interviewees. For example, the manager of the Lakeview Irrigation District said, “I don’t want to see a closed watershed like they have in Vancouver. I’m a user of the watershed too, but on the other hand, we have to have some better controls, legal authority, and enforcement.” This comment reflects the willingness of local water operators to accept the shared use of watershed areas but at the same time recognizes the gap between the legal requirement of local water operators to provide safe drinking water and their (in)ability to undertake SWP on the ground.

8.0 Conclusion

In water resources management, problems are often easier to identify than to solve. This condition is only compounded in nonmetropolitan areas where local water operators are subjected to the same provincewide policy initiatives of large metropolitan areas. However, unlike large metropolitan areas, local water operators in British Columbia often lack financial and technological capacity to build their way out of water quality problems through such means as expensive water treatment (Greater Vancouver Water District) or Crown-land purchase for watershed reserves (Greater Vancouver Water District, Greater Victoria Water District). Consequently, nonmetropolitan water operators must develop other strategies if they are to see effective implementation of SWP within their watershed areas.

This research has recognized the importance of local scale communication and cooperation with all industrial and recreational watershed users. While local scale

relationship building has facilitated SWP, provincial scale constraints act as a barrier to effective SWP. These constraints include but are not limited to provincial interagency jealousy, administrative fragmentation, and uneven power relations between the provincial government and local water operators. It is a result of the latter that helps explain the contradiction between what the province requires of nonmetropolitan water operators and what those same water operators are legally able to implement respecting SWP.

9.0 Recommendation

This research suggests that local scale communication and cooperation between watershed users will not be enough to advance SWP over Crown-owned land. Additional support from the province for cooperative multiparty SWP strategies is necessary. A restructuring of the provincial organizational structure respecting drinking water is required to reduce agency fragmentation, ministerial overlap, and interagency jealousy in order to advance SWP.

Given the geographic consistency of provincial regulations respecting Crown-owned land, the results of this research extend to other nonmetropolitan water operators across British Columbia. In this respect, the four case studies reported herein are emblematic of a provincewide conundrum facing nonmetropolitan water operators. The advantage of this condition is that effective multiparty SWP strategies in one region may be transferable to another.

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