

EXAMINING POLICY IMPLEMENTATION GAPS IN SOURCE WATER PROTECTION IN  
NEWFOUNDLAND and LABRADOR

By

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A Thesis submitted to the School of Graduate Studies in partial fulfillment of the requirements

for the degree of

Masters of Arts in Environmental Policy

Environmental Policy Institute, Division of Social Science

Memorial University of Newfoundland

Grenfell Campus

February, 2019

Corner Brook, Newfoundland and Labrador

## **ABSTRACT**

Source water protection (SWP) has gained importance in the literature related to water resources, with the general knowledge that drinking water sources can be more easily, economically and safely guarded from pollution through SWP than by remedying water sources after they have been contaminated. In addition to the actions of citizens, SWP requires policy commitments from government including regulatory activity. However, results of prior studies have suggested that gaps exist between policy and regulations and the reality of practices in communities of rural Newfoundland and Labrador (NL). Previous studies suggest that these gaps are due to the limitations in various kinds capacity at both local and provincial levels but suggest that further research is needed to better understand these limitations within the NL context.

This research sought to identify the key factors in the context of NL that deter implementation of SWP measures and to explore options for addressing these factors. In particular barriers to implementation were examined using a four part capacity framework, including: institutional, technical/human, financial and social capacities. Data collection methods included document review, reanalysis of survey data and telephone interviews across six case study communities with varied levels of compliance to SWP policies and regulations. Data analysis was done through categorization and coding using Nvivo software followed by pattern analysis.

As suggested in past research, areas of concern identified in this study include monitoring activities within protected water supply areas, uncertified drinking water operators, and limited watershed planning, because of limitations in local government's ability to implement their SWP responsibilities under provincial regulations and policy. The study found deficiencies in all four capacity categories and contributes to enhancing the understanding of these challenges within SWP policy implementation and drinking water management in rural NL. Finally, the study's

recommendation for addressing implementation gaps in SWP policy and regulations in NL include: adequate financial support for SWP; expanded communication, education and awareness initiatives; increased community involvement and participation and collaboration among the various actors involved, and strengthening monitoring and enforcement efforts.

## **ACKNOWLEDGEMENTS**

First and foremost, to God be the Glory for the Great things He has done for me throughout this study.

I would also like to thank my thesis supervisor Dr. Kelly Vodden, for her indispensable and constructive advice. This study would not have been possible without her patience, support, guidance and encouragement.

Finally, I wish to express my very profound gratitude to my wife and family for providing me with constant support and encouragement throughout my years of study and writing this thesis.

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## LIST OF ACRONYMS

<b>BWA</b>	Boil Water Advisories
<b>CCME</b>	Council of Canadian Ministers of the Environment
<b>DEOC</b>	Department of Environment and Conservation
<b>DMAE</b>	Department of Municipal Affairs and Environment
<b>ILUC</b>	Interdepartmental Land Use Committee
<b>LSD</b>	Local Service Districts
<b>MBSAP</b>	Multi-Barrier Strategic Action Plan
<b>MNL</b>	Municipalities Newfoundland and Labrador
<b>NCCEH</b>	National Collaborating Centre for Environmental Health
<b>NEIA</b>	Newfoundland and Labrador Environmental Industry Association
<b>NL</b>	Newfoundland and Labrador
<b>PPWSA</b>	Protected Public Water Supply Area
<b>SWP</b>	Source Water Protection
<b>WHO</b>	World Health Organization
<b>WRP</b>	Water Resource Portal

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# **CHAPTER ONE**

## **BACKGROUND OF THE STUDY**

### **1.0 Introduction**

Without a doubt, drinking water is an essential requirement for living in optimum health and wellbeing and ought to be protected from undesirable bacteria and chemical components, which have the potential to negatively affect human safety and health. In addition to these health and safety concerns, drinking water must also be aesthetically acceptable for human consumption (Fonkwe, 2016). Any untreated surface and ground water supply such as a lake, river, and aquifer, used to supply public and/or private drinking water systems for human consumption is referred to as a source water (CCME, 2014; Simms, Lightman, & de Loë, 2010). Source waters, both surface and groundwater, according to Sklenar, Sham & Gullick (2012) are exposed to several possible point and nonpoint sources of pollution. Point source pollution begins from known sources such as spills and leaks from industrial chemicals, whilst non-point source pollution originates from many different and often difficult to track sources (Rahman, 2014). The sources of drinking water ought to be looked after and protected to safeguard the health of humans, ecosystems and economies (Pollution Probe, 2004; WHO, 2016; United Nations, n.d). This is because water is not only important for households and human health but also serves as a vital resource for several industrial and economic sectors such as manufacturing, mining and energy generation (Renzetti, 2005).

Source water protection (SWP) involves taking initiatives that ultimately boost drinking water quality and/or quantity (Folifac et al., 2009). It also entails putting together programs and activities that will reduce the likelihood of water resource contamination (Patrick, 2011) and guard water sources for future generations (Christensen, 2011; Ivey et al., 2006). SWP is critical because

the contamination of drinking water sources brings about a significant threat to the health of the public and drastically increases the amount of money spent on drinking water treatment (Folifac et.al, 2009). As shown by the *Escherichia coli* (E. coli) and *Cryptosporidiosis* contamination events highlighted in Table 1 below, drinking water contaminations in Canada have led to disastrous outcomes.

**Table 1: Drinking Water Tragedies in Canada**

Disease Outbreak	Location	Dates	Impact	Known or suspected cause
<b>Escherichia coli (E. coli)</b>	Walkerton, Ontario	2000	Over 2,300 cases of illness and 7 deaths out of 4,800 people	<ul style="list-style-type: none"> <li>• Cattle manure</li> <li>• Heavy rainfall causing runoff into the water source</li> <li>• System deficiencies, including treatment</li> <li>• Operational failures, including incompetence and fraud</li> </ul>
<b>Cryptosporidiosis</b>	North Battleford, Saskatchewan	April 2001	5,800–7,100 cases of illness out of 15,000 people	<ul style="list-style-type: none"> <li>• Sewage from a sewage treatment plant</li> <li>• Calf feces runoff from agricultural activity</li> <li>• Inadequate coagulation</li> </ul>

**Source:** Dore (2015, p. 6)

Dore (2015) stated that most human failures that result in disasters involve insufficient monitoring of source water, inadequate training of water operators, and improper and ineffective treatment of drinking water. The Walkerton inquiry report delivered by Justice O'Connor identified the causes for the Walkerton disaster, as shown in table 1 above, and made recommendations which included: the development and enforcement of SWP plans, continued monitoring of drinking water systems and supplies, and mandatory training of drinking water system operators (O'Connor, 2002). Many jurisdictions in Canada have instituted policies and regulations to curb the threats to human health from waterborne illnesses due to increased pressure on drinking water supplies, and to prevent tragedies such as those that occurred in Walkerton,

Ontario, and North Battleford, Saskatchewan (Walters, 2012; Rawlyk & Patrick, 2013; Minnes, 2015). Successful implementation of such policies and regulations and adequate drinking water safety require that drinking water supplies and infrastructure are appropriately managed, effectively planned, and adequately monitored (WHO, 2008).

Available literature suggests that drinking water contaminations continue to occur despite the implementation of the recommendations from the Walkerton inquiry and the lessons learnt from this and many other drinking water contamination tragedies. Capacity concerns, including resource deficiencies and municipal level governments' limited knowledge of the importance of SWP have contributed to ineffective implementation of drinking water regulations (NEIA, n.d). According to Timmer et al. (2007), ineffective implementation of SWP plans and regulations at the local level can be attributed to capacity limitations, both at the local and higher levels (e.g. among provincial governments). These factors have resulted in SWP policy implementation gaps that ultimately pose a risk to the safety of drinking water. Christensen (2011) has suggested that “the biggest risks to drinking water come from gaps or deficiencies in the frontlines of drinking water protection — the laws, programs, policies and personnel directly responsible for delivering safe and clean drinking water” (p. 2).

In Newfoundland and Labrador (NL), Canada there is increased apprehension regarding the implementation of SWP regulations, particularly with regards to watershed planning deficiencies and the lack of water supply monitoring. Available studies indicate that many of these concerns result from a lack of human, technical and financial capacity at the local level (Minnes & Vodden, 2014, 2017). Previous research suggests the existence of a gap between the regulation and implementation of SWP in NL, specifically in relation to monitoring and enforcement activities within protected water supply areas (Holisko et al., 2014; Minnes & Vodden 2014; Hanrahan et

al., 2016). Additionally Edinger and Hermanutz (2015) have stated that “most of the time, the problem [is not] that the provincial or municipal regulations and policies [are] bad or insufficient, but that they were not properly implemented or enforced” (p.61).

The existence of implementation gaps, according to Okoroma (2006), provokes an inquiry to identify the factors that constrain effective implementation. Specifically, because SWP is fundamental to providing safe drinking water, it is essential to identify possible impediments to its development and implementation (Maura & Dosu, 2017). This justifies the need for this research to further examine what the key factors are in the context of NL that deter implementation of SWP-related regulations and guidelines and to explore options for addressing these barriers to SWP.

### **1.1. Research Objectives**

Considering the concerns regarding SWP in Canada and in NL specifically raised above, this research aims to further explore the existence of implementation gaps in SWP policy and regulation in the context of NL, focusing on protected water supply regulations in NL, factors contributing to existing gaps, and ways to address them at the local level and within the municipal sector. The objectives of this research are as follows:

1. To assess the extent and nature of the gap between protected water supply area regulations and implementation in NL.
2. To identify the factors that contribute to successful implementation of SWP measures in some cases, and implementation failure(s) in others.
3. To identify measures that might be taken to address identified implementation gaps.

## **1.2. Research Questions**

In pursuing these objectives, this research will seek to find answers to the following questions:

1. What are the deficits/shortcomings in the implementation of protected water supply regulations in NL?
2. What factors contribute to the successful implementation of SWP measures in some cases, and implementation failure(s) in others?
3. What steps could be taken to address existing implementation gaps?

## **1.3. Organization of the Thesis**

This thesis on examining policy-implementation gaps in SWP in NL is divided into five chapters as follows:

**Chapter one** deals with the background of the study and is comprised of an introduction, research questions and objectives, the scope and justification of the research as well as the organization of the research.

**Chapter two** provides a literature review involving the examination of related literature on SWP in Canada and NL, policy implementation gaps in SWP, and capacity factors accounting for SWP implementation successes or failures.

**Chapter three** outlines the research methodology, which includes data collection methods such as document review, survey re-analysis, case studies and interviews. Also discussed in this chapter are data analysis processes and methods.

**Chapter four** presents the results of the data collected through document reviews, survey re-analysis, case studies and interviews.

**Chapter five** contains the discussion of the results and findings in relation to the research questions of the study. Additionally, the conclusions, recommendations, study limitations and suggestions for future research are discussed in chapter five.

## **CHAPTER TWO**

### **LITERATURE REVIEW**

#### **2.0. Introduction**

In this chapter, the literature review introduces SWP and the Multi Barrier Approach (MBA) to drinking water management. It further provides background information on SWP policy in Canada in general and discusses SWP NL in more detail. Additionally, literature on policy implementation gaps in general and more specifically policy implementation gaps in SWP are discussed. Finally, capacity factors accounting for SWP implementation successes or failures are also reviewed.

#### **2.1. Source Water Protection**

SWP has to do with taking initiatives that ultimately boost drinking water quality and/or quantity (Folifac et al., 2009), including programs and activities that reduce the likelihood of water resource contamination (Patrick, 2011) and protect water sources for future generations (Christensen, 2011; Ivey et al., 2006).. These initiatives include activities such as recognizing dangers to water sources and formulating plans to adequately protect the quality and quantity of water necessary for human and ecological sustainability (CCME, 2004).

A unique advantage of engaging in SWP according to Leccese (1998), is the substantial savings accrued from investing in proactive SWP activities, compared to the huge investments in addressing issues after water supply contamination. Existing research suggests that the cost of putting into practice SWP is six to 20 times less than taking care of and remedying contamination in drinking water supplies (Timmer et al., 2007; Patrick, 2011). According to Simpson et al. (2007), the ratio is far greater in rural communities where SWP has been recognized as not only fundamental for preserving drinking water quality and preventing pollution (Ivey et al., 2006), but

also as a significant contributor to managing the often limited financial and natural resources in rural communities (CCME, 2004). Minnes and Vodden (2017) have also stated that putting in place SWP activities contributes to the building of local capacity in solving water challenges.

#### **2.1.1. Source Water Protection Policy**

Birkland (2014) defines a policy as a statement by government of what it intends to do or not do about a problem or issue. A policy according to Kalaba (2016) may take many forms such as a law, regulation, ruling, decision or a combination of these to govern an issue area or problem. Ahmed (1997) further states that: “A policy implies a systemized attack on a certain specific problem or a methodical way of dealing with a certain sector. Usually all government action is taken, or is supposed to be taken, under the directions of a certain overall policy... implying a framework of continuous government action” (p. 123). SWP policy, therefore, includes programs, plans, and regulations with the aim of protecting the quality and quantity of drinking water sources. Policies can be reactive and proactive policies (thoughtfully instituted and practiced to prevent future concerns) (Torjman, 2005). SWP policies, including those in NL, tend to fall into this latter category.

#### **2.1.2. Source Water Protection Programs**

As shown in table 2 below, available literature has identified several components of SWP programs. Protecting drinking water sources encompasses several voluntary strategies including land conservation and protection and public education, as well as regulatory and planning approaches (Hopper & Ernst, 2005).

**Table 2: SWP Program Components**

Author	Components of SWP programs
<b>Ontario Ministry of Environment (2004)</b>	<ul style="list-style-type: none"> <li>• Delineation of a watershed or groundwater recharge area</li> <li>• Inventory of potential sources of contamination</li> <li>• Assessment of vulnerability of water supply to contamination</li> <li>• Development and implementation of a management plan</li> </ul>
<b>National Research Council (2000)</b>	<ul style="list-style-type: none"> <li>• Goal and objective setting</li> <li>• Watershed inventory and contaminant assessment</li> <li>• Development and implementation of protection strategies</li> <li>• Efficiency aided by monitoring and evaluation</li> <li>• Stakeholder involvement</li> </ul>
<b>Lacey (2003)</b>	<ul style="list-style-type: none"> <li>• Mapping the watershed</li> <li>• Identification of potential sources of contamination</li> <li>• Assessment of likelihood of contamination events</li> <li>• Watershed monitoring</li> </ul>
<b>Trust for Public Land (2004)</b>	<ul style="list-style-type: none"> <li>• Land purchase</li> <li>• Land conservation</li> </ul>
<b>Kundell and DeMeo (2000)</b>	<ul style="list-style-type: none"> <li>• Identifying existing and future threats, extent and location of threat(s)</li> <li>• Assessing the effectiveness of protection strategy</li> <li>• Funding options</li> </ul>

Source: Adapted from Patrick (2008 p. 68)

According to Horton et al. (2003): “One of the most effective source water protection strategies is to purchase significant portions of a watershed leading to the water supply source and protect it from further development or disturbance” (p.2). In order to overcome multiple planning challenges, particular with regards to the protection of drinking water sources, land conservation has been identified as powerful tool (Hopper & Ernst, 2005). Hopper and Ernst (2005, p. 11) have suggested that “although regulation and planning are important components of source protection, acquiring land through purchase or conservation easements guarantees the most complete and permanent protection.” Although Hopper and Ernst (2005) identify land acquisition more specifically as the most effective strategy for protecting drinking water sources, they add that a mixture of voluntary and regulatory tools will be required to protect a watershed. Furthermore,

Simms et al. (2010) state that the the use of regulatory and non-regulatory approaches to SWP should reflect local needs and particular community issues and capacities.

### **2.1.3. Source Water Protection and Watershed Management Plans**

One component of SWP programs is often the development and implementation of watershed management plans. According to Simms et al. (2010), watershed management plans are used in some provinces to protect water sources and SWP measures are incorporated into the broader objectives of these plans. Examples include the Tay River watershed management plan in Ontario and Gander Lake watershed management plan in NL.

According to Simms et al. (2010), elements of watershed plans generally include: (1) assessment of water quality, water quantity, water use and/or ecosystem health; (2) characterization of land use activities; (3) identification of water-related issues and concerns; (4) development of objectives and recommendations; and (5) discussion and development of implementation and monitoring mechanisms.

### **2.1.4. Source Water Protection Regulation**

Regulations are indispensable to the proper functioning societies by protecting the rights and safety of citizens and ensuring the delivery of public services (OECD, 2011). According to Islam et al. (2011) SWP regulations such as the *Clean Water Act* (2006, 2006b) in Ontario, the *Environmental Protection and Enhancement Act* (1993a, 1993b) in Alberta, and British Columbia's *Ecological Reserve Act* (1975) and *Environmental Management Act* (2004a, 2004b) (see also Table 3) help to manage potential threats to the quality of source water through encouraging the practice of various SWP strategies. These strategies include among other activities, identifying existing and future threats (including potential sources of contamination), land purchase or conservation easements, land-use regulations that restrict development in

sensitive areas, watershed monitoring and stakeholder involvement. The Government of NL (2016) suggest that, the main vehicle for attempting to guarantee SWP in NL is through designations of Protected Public Water Supply Area (PPWSA) regulations (under the Water Resources Act), which is the main focus of this study. Literature on gaps in implementation of SWP policies and regulations and factors that contribute to this are discussed below and further in Chapter 3 of this study. In Canada, SWP programs and regulations are often part of a Multi-Barrier Approach (MBA) to drinking water management.

## **2.2. The Multi-Barrier Approach**

The Multi-Barrier Approach (MBA) has been recognized as a suitable approach to drinking water management following the catastrophic drinking water tragedies that occurred in Walkerton, Ontario, and North Battleford, Saskatchewan, and the increased recognition of the extreme effects that threats to drinking water can have on health, environment and the economy (Christensen, 2006). According to Health Canada (2013), the MBA approach:

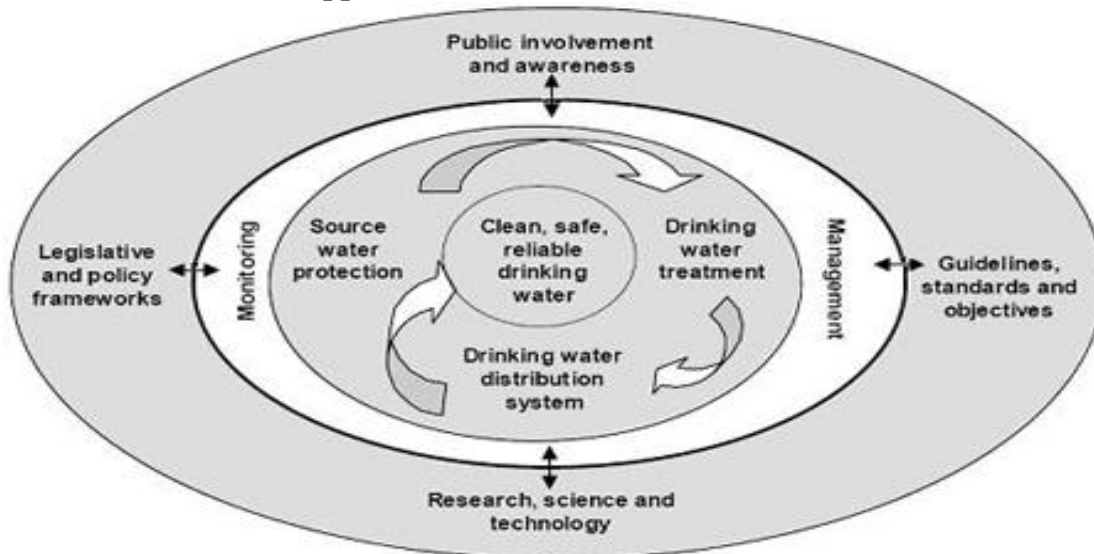
...makes sure if there are "barriers" in place, to either eliminate them [threats] or minimize their impact. It includes selecting the best available source (e.g., lake, river, aquifer) and protecting it from contamination, using effective water treatment, and preventing water quality deterioration in the distribution system (para 2).

In Canada, the MBA has been generally accepted as the basic standard for effectively managing drinking water quality and guaranteeing the safety of drinking water supply, beginning with the source (Krewski et al., 2002). The Canadian Council of Ministers of the Environment (CCME) describes the MBA to safe drinking water, as an “integrated system of procedures, processes and tools that collectively prevent or reduce the contamination of drinking water from source to tap to reduce risks to public health” (CCME, 2004, p. 6). In support of the MBA, it has been asserted that “regulation alone will not be effective in ensuring safe drinking water unless the

other requirements – a multiple barrier approach, cautious decision- making and effective management systems – are met” (Swain, Louttit, and Hrudey, 2006, p.18).

As shown in Figure 1 below, the main objective for the MBA according to the CCME is to guarantee clean, safe and reliable drinking water. According to the CCME (2004), all provinces except Prince Edward Island and Quebec have adopted SWP as the primary action in the MBA and make use of a combination of tools, processes and procedures that together avert or decrease the possibility of drinking water pollution from source to tap (see table 3 below).

**Figure 1: The Multi-Barrier Approach**



**Source:** CCME (2004 p.16)

### **2.3. Source Water Protection Policy in Canada**

According to the Canadian Municipal Water Consortium (2014) safeguarding drinking water supplies in Canada is a basic facet of the development of sustainable communities and defending the human right to water for current and future generations. In Canada there are various levels of government, including: federal, provincial/territorial and municipal in addition to Indigenous governments. With regards to water governance in Canada, the federal government has

authority over water in areas such as international boundary waters, federal lands, and fisheries and oceans, whilst provincial governments have primary responsibility over most areas of freshwater and drinking water management and protection (Government of Canada, 2017).

The Government of Canada has direct regulatory responsibility over drinking water management in Indigenous communities (Christensen, 2006). According to Walden et al. (2017) typically “water safety is regulated under provincial jurisdiction; yet, the federal government is responsible for providing safe drinking water to First Nations reserves” (p.1). However, Minnes and Vodden (2014) explain that “As with any public drinking water system in NL, water systems in Indigenous communities are overseen and managed (as per the Multi-Barrier Strategic Action Plan (MBSAP) and the Municipalities Act, 1999) by the provincial government with their local community governments)” (p.22). Winfield (n.d) has suggested that regulating the use and quality of water resources, in addition to managing the operations of municipal and private communal drinking water systems is a fundamental responsibility of provincial and territorial governments.

Numerous Canadian provinces according to Burt (2014) have reinforced and modified their source water planning methods in the last decade by creating regulations to defend their drinking water, particularly after the water pollution calamities in Walkerton, Ontario (2000) and North Battleford, Saskatchewan (2001). This is supported by Patrick (2009) and Plummer et al. (2011) who have reported that there have been alterations to drinking water policies in Canada following the tragedy in Walkerton. Nowlan (2007) points out that the recommendations put forward by Justice O’Connor in the Walkerton Inquiry emphasized the significance of SWP to avert future tragedies.

**Table 3: Source Water Protection Policy in Canada**

<b>Jurisdiction</b>	<b>Multi-barrier Approach</b>	<b>Enabling Legislation</b>	<b>Dedicated Water Agency</b>	<b>SWP Required or Discretionary</b>	<b>Scale of SWP Planning</b>
<b>Alberta</b>	Yes	Water Act (2000); Environmental Protection and Enhancement Act (2000)	No	Discretionary	None
<b>British Columbia</b>	Yes	Drinking Water Protection Act (2001)	No	Discretionary	Watershed-based
<b>Manitoba</b>	Yes	Drinking Water Safety Act (2002); Water Protection Act (2006)	Yes	Required	Watershed-based
<b>New Brunswick</b>	Yes	Clean Water Act (1989)	No	Discretionary	“Wellfields” designated as protected areas
<b>Newfoundland and Labrador</b>	Yes	Water Resources Act (2002); Environmental Protection Act (2002)	No	Discretionary	Municipal/ Local
<b>Nova Scotia</b>	Yes	Water Resources Protection Act (2000)	Yes	Discretionary	“Protected Water Areas” delineated
<b>Ontario</b>	Yes	Clean Water Act (2006)	Yes	Required	Watershed-based
<b>Prince Edward Island</b>	No	Environmental Protection Act (1998)	No	Required	“Wellfield” Protection Plans
<b>Quebec</b>	No	Groundwater Catchment Regulation (2002)	No	Discretionary	Watershed-based
<b>Saskatchewan</b>	Yes	SWP are not legally binding and have no regulatory authority	Yes	Discretionary	Watershed-based

**Source:** Adapted from Patrick et al. (2013)

As noted above, in Canada, the provincial and territorial governments have jurisdiction over water management and therefore are responsible for the development of regulations governing drinking water management (Simms, et al., 2010; Timmer et al., 2007; Ivey et al., 2006). With regards to designations of drinking water sources, provincial governments issue and regulate designations through restrictions of land use and activities in the designated zones, while

implementation of these regulations is undertaken by municipalities at the local level. For instance, in NL, New Brunswick, Nova Scotia and Quebec, municipalities bear responsibility and enforcement of protected drinking water supply area designations (Simms et al., 2010).

Additionally, four provinces (Manitoba, Nova Scotia, Ontario and Saskatchewan) have a dedicated water agency to support the province's SWP efforts (Patrick et al., 2013). While SWP is required in the provinces of Manitoba, Ontario and Prince Edward Island, it is, however, discretionary in all others, making SWP largely optional according to Patrick et al. (2013). This also demonstrates that SWP regulations differ substantially from province to province (Patrick, 2013; Walters, 2012; Lebel & Reed, 2010), resulting in further differences in local SWP activities and general water management in Canada (Simms, et al., 2010; de Loë & Murray, 2012).

According to Simms et al. (2010) and Patrick (2013), the provinces of Ontario and New Brunswick have developed and implemented specific SWP legislation (i.e. *Clean Water Acts*, 2009 and 1989 respectively). In Ontario SWP plans are watershed based and mandatory in regions with operational conservation authorities, who control SWP planning process performed by a SWP committee made up of local, municipal and regional government and nongovernment actors (Simms et al., 2010; Patrick, 2013). These plans contain inputs from local level consultations on identifiable local sources of water supply contamination, determining the level of risk and defining roles and responsibilities to addressing the risk (Government of Ontario, 2017). Additionally, to ensure protection of drinking water sources, SWP authorities, the province, local health boards and municipalities in Ontario are required to execute these plans and policies and provide progress reports (Government of Ontario, 2017).

According to de Loë & Murray (2012), watershed groups have often assumed responsibility for SWP activities planning and implementation in Canada since the responsibility

for managing water resources is passed on first to the provincial level and then further entrusted primarily to municipalities with support from non-governmental organizations at the local level. The difference between watershed groups and municipalities is that municipalities are created by the provincial government whilst watershed groups are typically non-governmental organizations. Ideally, the relationship between the two types of organizations should be collaborative with regards to water related issues such SWP. Additionally, SWP governance is closely tied to local circumstances, leading to the potential for collaborative approaches to water governance. This type of approach is considered appropriate for SWP as it allows local level organizations to create plans to guide operational decisions made by the provincial and federal governments (de Loë & Murray, 2012; Simms et al., 2010).

## **2.4. Drinking Water Safety in Newfoundland and Labrador**

The province of Newfoundland and Labrador (NL) is the most eastern province in Canada and according to the 2016 census has a population of 519,716 (Statistics Canada, 2017). Dore (2015) describes majority of the province as rural in nature with only two major urban areas (St. John's metropolitan area and Corner Brook). Surface water and groundwater are the main sources of drinking water in the province. The presence of many lakes, ponds and rivers make surface waters the most used drinking water sources in the province due to their easy access (Government of NL, 2013). As a result, natural organic matter, color and turbidity make treatment problematic and challenging for the province in providing drinking water (Dore, 2015).

### **2.4.1. Multi-Barrier Strategic Action Plan**

With ample freshwater resources (Hearn, 2007), like other provinces in Canada, the province of NL utilizes the MBA in drinking water management (Baird et al., 2014). The Multi-

Barrier Strategic Action Plan (MBSAP) was instituted in 2001 as the overall guiding framework for ensuring the safety of drinking water in the province of NL (Government of Newfoundland and Labrador, 2015). The MBSAP according to the Government of NL acknowledges the chances of breakdown of technology, systems or people involved in managing water systems and therefore is comprised of three components as shown below in table 4.

**Table 4: Components of the Multi-Barrier Strategic Action Plan**

<b>Level 1</b>	<ul style="list-style-type: none"> <li>• Source water protection</li> <li>• Drinking water treatment</li> <li>• Drinking water distribution</li> </ul>
<b>Level 2</b>	<ul style="list-style-type: none"> <li>• Monitoring</li> <li>• Data management and reporting</li> <li>• Inspection and enforcement</li> <li>• Operator education, training, and certification</li> <li>• Corrective measures</li> </ul>
<b>Level 3</b>	<ul style="list-style-type: none"> <li>• Legislative and policy frameworks</li> <li>• Public involvement and awareness</li> <li>• Guidelines, standards, and objectives</li> <li>• Research and development</li> </ul>

**Source:** Government of NL (2015 p.1)

As shown in table 4 above, SWP is a level one activity and the first activity in the entire MBSAP. The components of the first level of the MBSAP protect drinking water from the source to the tap, whilst the standard of performance achieved in level one of the MBSAP is verified through the components of Level two and finally, level three involves a number of public and government activities since the management of drinking water depends on the contribution of several levels of government as well as the public. Therefore, SWP is a continuous activity undertaken at every level of the MBSAP to ensure drinking water safety and quality. The implementation of the MBSAP Plan involves the collaborative efforts of three provincial government departments:

Department of Municipal Affairs and Environment<sup>1</sup> (DMAE), which is the lead agency; Health and Community Services; and Service NL (Government of NL, 2015).

#### **2.4.2. Protected Public Water Supply Areas**

The enforcement of SWP in NL is given legal backing under Section 39 of the Water Resources Act SNL 2002 cW-4.01, which for the purposes of protecting public water supplies states that:

- 39. (1) The minister may, by regulation, designate an area surrounding a present or potential source of public water supply as a public water supply area, and shall give notice of that area by publication in the Gazette, or as otherwise required under this Act.
- (2) A person operating a waterworks and using or intending to use water from that source shall protect that source of public water supply in accordance with this Act.
- (3) Notwithstanding subsection (2), the minister may do those things that he or she considers to be necessary to protect a public water supply from adverse effects.
- (4) In the area defined under subsection (1), a person shall not
  - (a) place, deposit, discharge or allow to remain in that area material of a kind that might impair the quality of the water;
  - (b) fish, bathe, boat, swim or wash in, or otherwise impair the quality of the water; or
  - (c) use or divert water that may unduly diminish the amount of water available in that area as a public water supply.

Government of Newfoundland and Labrador (2013 p. 3&4)

The 2016 annual report on drinking water safety in NL states that 92% of the NL population (378,880) is serviced by public drinking water systems. The report further says that, out of a total of 472 public water sources in the province, 294 were surface water (251 protected and 43 unprotected) and 178 groundwater sources (118 unprotected and 60 protected) (Government of Newfoundland and Labrador, 2016).

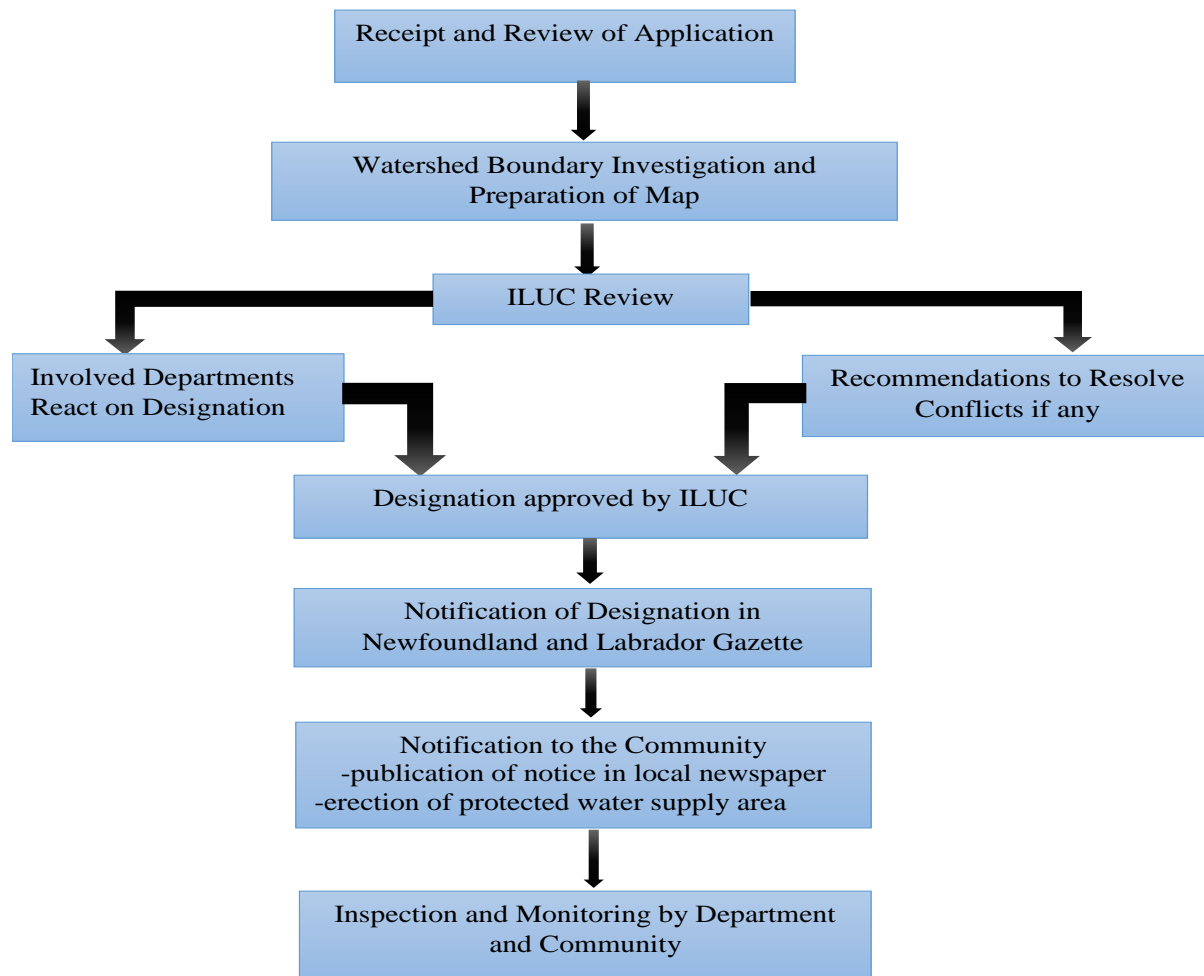
Designations constitute a major SWP activity in NL (Simms et al., 2010). Activities involved in the designation of PPWSA's in NL are illustrated in figure 2 below. Municipalities, under the Water Resources Act 2002, are responsible for applying for PPWSA designation and monitoring

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<sup>1</sup> Two formerly separate departments, Departments of Environment and Conservation and Municipal Affairs, have now been amalgamated into one (Government of NL, 2016)

designated areas (Government of NL, 2013). They are mandated to submit applications and pay a fee (\$400 plus HST) to the Water Resources Management Division (WRMD) of the DMAE for the designation and protection of their water supply areas as a PPWSA<sup>2</sup> (Government of NL, 2016).

**Figure 2: Process for Protection of a Public Water Supply**



**Source:** Government of NL (2013 p.6)

<sup>2</sup> In the case of water supplies sourced by groundwater these are called Wellhead Protected Water Supply Areas. For the purposes of this study, both types of protected areas are referred to as PPWSAs.

### 2.4.3. Drinking Water Responsibilities

In NL, like in other provinces, both provincial and municipal governments have some responsibilities in ensuring drinking water safety (Government of NL, 2000). Additionally, in some areas where settlements without municipal governments exist Local Service Districts (LSDs) are created to offer a variety of services including drinking water supply within a community or geographic area (Government of NL, 2018).

Municipal governments are responsible for applying for PPWSA designation, providing baseline information, posting signage, monitoring designated areas and reporting violations to DMAE, which is then responsible for resolving conflicts, enforcing the Water Resources Act and ultimately protecting water quality (see table 6 below).

**Table 6: Responsibilities DMAE and Municipal Authorities under PPWSA**

<b>DMAE</b>	<b>Municipal Authority</b>
<ul style="list-style-type: none"><li>- Maintain the overall responsibility to protect water quality</li><li>- Process watershed designation applications and permits for developments in designated areas</li><li>- Assess existing land uses and its impact on water quality</li><li>- Resolve conflicts dealing with land use and resource developments in designated areas</li><li>- Take appropriate measures to prohibit or regulate those activities which might impair water quality</li><li>- Inspect sites to investigate any reported unauthorized activity or development</li><li>- Monitor water quality on a routine basis</li><li>- Lead and promote the development of environmental protection guidelines for resource development and land use activities in designated watersheds</li><li>- Assist in and promote the development of watershed management plans</li><li>- Enforce the Water Resources Act</li></ul>	<ul style="list-style-type: none"><li>- Apply to the Department of Environment and Conservation to have a water supply area protected</li><li>- Provide baseline information on existing land uses, resource development and water quality for the area to be designated</li><li>- Assist the Environmental Scientist in collecting information on an ongoing basis</li><li>- Inform the community about the designation notice by publishing it in a local newspaper and posting it on community notice board</li><li>- Placement of protected public water supply area signs along the boundaries of the designated area</li><li>- Inspect the watershed on a regular basis and report any unauthorized activity to the Environmental Scientist in their region</li><li>- Conduct surveillance of the designated area to ensure that the existing activities are not causing any water quality problems and that newly approved developments are being conducted according to the terms and conditions of the permit and in compliance with the environmental protection guidelines for the resource development activity.</li></ul>

**Source:** Government of NL (2013 p.12)

The WRMD employs many tools in controlling and supervising development activity around PPWSAs. Examples include the requirement to obtain permits for development activity, watershed management plans, watershed management committees, community monitoring and inspections, regulatory inspections and referrals from the Interdepartmental Land Use Committee (ILUC) (Government of NL, 2016). Dore (2015) states that, the ILUC “reviews proposal for a new protected system for any land-use conflicts and creates possible resolutions for the conflicts” (p.139). Data from the annual drinking water report indicates that a total of 34 and 52 referrals from the ILUC with regards to PPWAs were processed in the 2014-15 and 2015-16 fiscal years respectively (Government of NL, 2015; 2016).

#### **2.4.4. Watershed Management Committees**

Watershed management committees are established by municipal governments to supervise potential development, land use management and conflicting resource uses within PPWSA, and to create watershed management plans (Government of NL, 2015). The membership of the committee is comprised of individuals and representatives from organizations, groups with vested interest or stake in the watershed, and those who the watershed management plan will affect (Hearn, 2007) as shown in the table 7. There is no set number of members for the committees due to the potentially extensive list of stakeholders and interested parties (as indicated in the table below), therefore, Hearn (2007) has stated that “the municipality must determine what individuals, groups or agencies are essential to make the Committee effective without making the membership so large as to be non-functional” (p.11). Hearn (2007) further states that establishing the watershed management committee is considered the first action to developing a watershed management plan. For water supplies not legally protected, achieving PPWSA status is the initial focus of the

watershed management committee. Where the water supply area is already designated as PPWSA, the committee collects information on present and future water and land uses (Hearn, 2007).

**Table 7. Watershed Management Committee – Membership Composition**

<b>Stakeholders/Interested Parties</b>	
<b>Municipal councils and/or private incorporated communities</b>	<ul style="list-style-type: none"> <li>• Representatives seek protection of their water supply and/or the supply of others with the same water source or within the watershed boundary</li> </ul>
<b>Resource utilization interests (Groups, Agencies and Companies)</b>	<ul style="list-style-type: none"> <li>• Mining</li> <li>• Transportation</li> <li>• Agriculture</li> <li>• Military operations</li> <li>• Forestry</li> <li>• Commercial/industrial development</li> <li>• Recreation/tourism industry (outfitters)</li> <li>• Residential development (real estate agencies)</li> <li>• Linear development/utility</li> <li>• Sewage/waste treatment facilities</li> </ul>
<b>Local non-governmental organizations or individuals</b>	<ul style="list-style-type: none"> <li>• Service groups</li> <li>• Local citizens</li> <li>• Environmental groups</li> <li>• Community associations</li> <li>• Landowners or landowner associations</li> </ul>
<b>Government agencies</b>	<ul style="list-style-type: none"> <li>• Department of Government Services – Environmental Health Officer</li> <li>• Department of Municipal Affairs, Regional Managers</li> <li>• Department of Environment &amp; Conservation, Crown Lands – Regional Managers</li> <li>• Natural Resources, Forestry Branch</li> <li>• Tourism, Culture &amp; Recreation</li> <li>• Natural Resources, Mines Branch</li> <li>• Transportation &amp; Works</li> <li>• Natural Resources, Agrifoods Branch</li> <li>• Fisheries and oceans Canada (Federal)</li> <li>• Environment and Conservation, Wildlife Division</li> </ul>

Source: (Hearn, 2007, p. 10 -11)

Following the process of identifying present and future water and land uses, a determination of possible pollutants and a process of risk assessment is conducted. This process involves aspects of SWP such as delineation of a watershed or groundwater recharge area, inventory of potential sources of contamination and assessment of vulnerability of the water supply to contamination. Approval is granted by the provincial Interdepartmental Land Use committee (ILUC) after the assesement of any proposed use and any concerns are addressed.

Notwithstanding the important role of these committees and plans, not very many exist in NL. Currently, there are only five watershed management committees (Clareville, Corner Brook, Gander, Grand Falls-Windsor, and Steady Brook), and three watershed management plans (Corner Brook, Gander, and Steady Brook) out of the five committees (Government of Newfoundland and Labrador, 2016). Constraints in the establishment of such committees and plans are discussed further in chapter four below.

## **2.5. Policy Implementation Gaps**

Hayes (2001) describes policy implementation as composed of organized activities by government directed towards the achievement of goals and objectives stipulated in a policy. Van Meter and Van Horn (1974, p. 447) also define policy implementation “as encompassing those actions by public or private individuals (or groups) that are directed at the achievement of objectives set forth in prior policy decisions.” Additionally, policy implementation encompasses translating policy decisions into on-the-ground actions, often supported by statutes (Kalaba, 2016).

Nadgrodkiewicz et al. (2012) define a policy implementation gap as the variation between the establishment of a policy and the practical exercise of the policy. Nakagaki (2013) describes implementation gaps as the variations between documented policies or regulations and their actual execution in practice, further stating that implementation gaps develop due to inconsistent and improper applications of laws and regulations, especially at the local level. “An implementation gap is where a set of institutions (often created via decentralization), policies or budgets (or all three) exist on paper, but are absent on the ground” (Green, 2012. para 2). Following these definitions, the researcher refers to an implementation gap in this thesis as the difference between

what is expected by a policy, plan, regulation or law and is what is actually done (e.g. failures to adhere to established regulations).

Policy implementation gaps can occur because of varying political, economic and social circumstances, for instance, local factors (such as legitimacy and quality of laws, divergent political agendas and social structures and cultural legacy) and inadequate resources (Cerna, 2013; Nakagaki, 2013). A search for “policy implementation gap” in Google Scholar revealed numerous factors accounting for implementation gaps, as illustrated in table 8 below.

**Table 8: Causes of Implementation Gaps**

Author	Publication Title	Causes of Implementation Gaps
<b>Raphael et al. (2005)</b>	<ul style="list-style-type: none"> <li>Researching income and income distribution as determinants of health in Canada: gaps between theoretical knowledge, research practice, and policy implementation</li> </ul>	<ul style="list-style-type: none"> <li>Poor conceptualization</li> <li>Lack of linked databases</li> <li>Little inter-disciplinary work</li> <li>Lack of longitudinal studies</li> </ul>
<b>Teddy (2016)</b>	<ul style="list-style-type: none"> <li>Policy Implementation Gap: A Multi Country Perspective</li> </ul>	<ul style="list-style-type: none"> <li>Lack of collaboration</li> <li>Lack discretionary power</li> <li>Lack of resources</li> <li>Lack of governance</li> <li>Lack of service user experiences</li> </ul>
<b>Chigudu (2015)</b>	<ul style="list-style-type: none"> <li>Navigating Policy Implementation Gaps in Africa: The Case of Zimbabwe</li> </ul>	<ul style="list-style-type: none"> <li>Lack of authority</li> <li>Inadequate material resources</li> <li>Lack of continuity in government policies</li> </ul>
<b>Nakagaki (2013)</b>	<ul style="list-style-type: none"> <li>Improving Public Governance: Closing the Implementation Gap Between Law and Practice</li> </ul>	<ul style="list-style-type: none"> <li>State bureaucracy</li> <li>Legitimacy and quality of laws</li> <li>Divergent political agendas</li> <li>Resources to implement laws</li> <li>Barriers to economic activity</li> <li>Vested interests</li> <li>Influence of local elites</li> <li>Social structures and cultural legacy</li> </ul>
<b>Ahmad et al. (2012)</b>	<ul style="list-style-type: none"> <li>Implementation Gaps in Educational Policies of Pakistan: Critical Analysis of Problems and Way Forward</li> </ul>	<ul style="list-style-type: none"> <li>Lack of continuity in successive government policies</li> <li>Corruption</li> <li>Inadequate financial allocations</li> <li>Lack of human resource training</li> <li>Lack of visionary leadership</li> <li>Lack of political will from successive governments</li> <li>Poor monitoring and policy evaluations</li> <li>Centralized implementation approach</li> </ul>

<b>Makinde (2005)</b>	<ul style="list-style-type: none"> <li>Problems of Policy Implementation in Developing Nations: The Nigerian Experience</li> </ul>	<ul style="list-style-type: none"> <li>Corruption</li> <li>Lack of funds</li> <li>Lack of continuity in government policies</li> <li>Inadequate human and material resources</li> <li>Inadequate monitoring of projects</li> </ul>
<b>Grunow (2011)</b>	<ul style="list-style-type: none"> <li>Structures and Logic of EP Implementation and Administration in China</li> </ul>	<ul style="list-style-type: none"> <li>Insufficient financial resources and control capacity</li> <li>Inadequate instruments of coordination</li> <li>Lack of relevant knowledge</li> <li>Lack of training among staff members</li> </ul>
<b>Khosa (2003)</b>	<ul style="list-style-type: none"> <li>Towards Effective Delivery: Synthesis Report on the Project Entitled 'Closing the gap between policy and implementation in South Africa</li> </ul>	<ul style="list-style-type: none"> <li>Unrealistic policies</li> <li>Lack of managerial expertise</li> <li>Insufficient coordination</li> <li>Inadequate staffing and authority</li> </ul>

As observed from table 8 above, existing literature has identified several common factors that lead to policy implementation gaps across different countries sectors and industries such as limited authority, inadequate finances, inadequate human resources, insufficient coordination, and lack of training.

## 2.6. Implementation Gaps in SWP

Moving to the more specific topic of implementation gaps in SWP, the literature suggests similar contributing factors. According to Rawlyk & Patrick (2013) SWP implementation gaps are caused by a multitude of factors. They argue that it is mainly financial, institutional, technical/human, and social factors that constrain the implementation of SWP policies or plans. This is supported by Timmer et al. (2007), who have suggested that both provincial agencies and local organizations need enough resources such as funding, training, technical supports, public consultation and authority from institutional arrangements for effective implementation of SWP policies and plans. A study by Ivey et al. (2006) also indicated that selection, development, implementation, and enforcement of institutional arrangements for SWP require commitment of

adequate and appropriate financial and staff resources. Timmer et al. (2007) describe the absence of such resources as challenges to effective SWP plans and as capacity limitations, often at the ground level, that result in SWP implementation gaps.

## **2.7. Capacity Factors**

The term “capacity” as used in this research denotes the capability of municipalities and all agencies with SWP responsibility to develop and implement SWP plans, policies or regulations with the aim of effectively managing the quality of drinking water to avert source water contamination. In this regard, Rawlyk and Patrick (2013) refer to capacity as “the ability, or capability, of a local community to meet regulations, policies or standards that have been established” (p.22). According to this definition, capacity means the ability of groups to actively and effectively contribute to the planning and implementation of SWP policies.

Deficient local capacity results in a reduced number of SWP initiatives and imprudent decisions from local governments in protecting drinking water sources, for example investing in costly technologies as an alternative (Hanrahan et al., 2016; Rawlyk and Robert, 2013). This is a particular concern for many smaller communities since larger communities have been shown to have greater capacity (Hanrahan et al., 2016). Therefore, as Minnes and Vodden (2017, p. 175) have suggested that “more support is required for local actors, especially in rural and small towns, who often have little capacity and a great deal of responsibility in relation to the provision of clean, safe drinking water.”

To effectively implement SWP policies, municipal governments require financial, technical, institutional, and social/political capacity (de Loë et al., 2002; Ivey et al., 2006; Timmer et al., 2007). Drawing from the literature on policy implementation gaps and authors such as

Robins (2008), Rawlyk and Patrick (2013), and Minnes & Vodden (2017) identify four major categories or types of capacity factors (institutional, technical/human, financial and social) as contributing to SWP implementation successes and failures (or SWP policy implementation gaps), as shown in table 9 below. Each of these capacity categories are discussed further in the sections that follow in relation to SWP.

**Table 9: Elements of Capacity for Source Water Protection**

Element	Definitions and Indicators
<b>Institutional</b>	<p>The legislation, regulations, policies, protocols, governance arrangements and delegation of responsibility to plan and enact SWP.</p> <p>Example indicators include:</p> <ul style="list-style-type: none"> <li>• Provincial legislation and policies provide guidance for drinking water protection at the local level</li> <li>• Municipal planning strategies and by-laws protect current drinking water supplies</li> <li>• Land use activities are controlled in municipal well field, recharge and watershed water supply areas</li> <li>• Land has been purchased for the protection of current municipal water supplies</li> <li>• Plans have been developed to guide municipal actions during water quality emergencies</li> <li>• All responsible for SWP know their responsibilities for implementation and enforcement</li> <li>• Institutional arrangements for land and water management are integrated</li> <li>• Local land use planning supports SWP at a watershed or regional level</li> </ul>
<b>Financial</b>	<p>The ability to acquire adequate funds to pay for SWP efforts as well as for ongoing planning, governance and management efforts.</p> <p>Example indicators include:</p> <ul style="list-style-type: none"> <li>• Organizations responsible for protecting source water supplies are able to maintain a balanced budget</li> <li>• Organizations responsible for protecting source water supplies are able to obtain funding from outside sources</li> <li>• Water rates for customers reflect the full cost of protecting and providing municipal drinking water (including treatment, distribution, maintenance, and SWP)</li> <li>• Funding is available for municipal SWP projects</li> <li>• Financial mechanisms are used to reduce water use (e.g., water rates charged by municipal water utility are used to reduce water consumption)</li> </ul>
<b>Social</b>	<p>The social factors that influence SWP governance and implementation. This includes social norms (e.g., values, attitudes, behaviours, sense of place, trust, reciprocity, commitment and motivation) that impact public awareness, stakeholder involvement, community support, and public and private partnerships in SWP efforts. This also incorporates structural networks, communications and the relationships between different groups interests and actors.</p> <p>Example indicators include:</p> <ul style="list-style-type: none"> <li>• Clear leadership for water quality protection at the watershed level exists</li> <li>• Active linkages between municipality and provincial agencies exist (vertical linkages)</li> <li>• Active linkages among watershed municipalities exist (horizontal linkages)</li> <li>• Active linkages between municipality and relevant community organizations exist (horizontal linkages)</li> <li>• Community awareness and support for watershed protection</li> </ul>

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<b>Technical/Human</b>	<p>The physical and operational ability of an organization to perform SWP management and operations adequately. In addition, having the human resources, with adequate knowledge, skills and experience to properly create source protection plans and implement needed measures.</p> <p>Example indicators include organizations responsible for protecting source water supplies that have:</p> <ul style="list-style-type: none"> <li>• Employees dedicated to water management</li> <li>• Access to individuals with the necessary skills and training to manage drinking water</li> <li>• Education and training opportunities available to staff members and decision makers</li> <li>• Access to individuals with the expertise needed to undertake technical activities related to drinking water quality</li> <li>• Access to the data needed to manage water supplies, delineate watersheds and aquifers, and develop source protection plans</li> </ul>
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**Source:** Minnes & Vodden (2017, p. 21-22)

### **2.7.1. Institutional Capacity**

Institutional capacity refers to the existence of suitable policies, legislation, and by-laws required to support SWP (Ivey et al., 2006). These tools help to provide well-defined objectives, which are considered imperative for successful policy implementation (Cerna, 2013). This type of capacity also denotes the presence of institutional arrangements like governance structures that offer support and legal assistance for protecting sources of drinking water through measures such as land acquisition, land use planning, and protective zoning (Timmer, et al., 2007; Ivey et al., 2006).

### **2.7.2. Technical/Human Capacity**

Competent water operators are important resources for the delivery of safe drinking water. According to Lebel & Reed (2010), providing safe drinking water involves technical competence in various areas including SWP and monitoring. For instance, in Nova Scotia, water operators are charged with the responsibility of developing and/or enforcing of SWP measures (Simms et al., 2010). Capable managers [water operators] are also a primary requirement for an efficient water system (Hrudey and Hrudey, 2004; O'Connor, 2002; Lebel & Reed, 2010). SWP policy implementation gaps may arise in smaller communities because they do not possess the resources

to recruit and retain specialized staff to carry out technical activities (de Loë et al., 2002; Lebel & Reed, 2010), and hence depend on the availability of specialists from outside to carry out these functions (Timmer et al., 2007; Lebel & Reed, 2010). Training for water operators is critical to SWP. The post Walkerton report therefore recommended that “.... measures [should] be taken to ensure that training courses are accessible to operators in small and remote communities and that the courses are tailored to meet the needs of the operators of these water systems” (O’Connor, 2002 p. 388).

### **2.7.3. Financial Capacity**

The availability (or scarcity) of financial resources is also a crucial consideration in SWP (de Loë & Kreutzwiser, 2005; Timmer et al., 2007), and this can be a particular challenge in rural communities where financial capacity may be limited and even declining with shrinking, ageing populations and/or struggling traditional economies (Minnes & Vodden, 2014). de Loë & Kreutzwiser (2005) have pointed out, for example, that the size of a municipality’s budget can be one factor that affects the level of spending on SWP and thus the level of SWP implementation. For example, it can influence the community’s ability to invest in expensive technical programs such as monitoring or the undertaking of technical studies needed for SWP like the assessments of vulnerabilities of water supply to contamination and the effectiveness of protection strategy as indicated in table 3 (de Loë, Di Giantomasso, & Kreutzwiser, 2002; de Loë & Kreutzwiser, 2007).

### **2.7.4. Social Capacity**

Durley, de Loë, & Kreutzwiser (2003) state that social and political support are also important aspects of capacity for SWP implementation; for instance, the public must be aware of local water issues and be willing to participate in the water planning process, whilst good leadership is needed at all levels of government for successful implementation of SWP policies.

Commitment from community members boosts the capacity of local SWP groups through increased knowledge, skills, credibility and financial resources (de Loë et al., 2002).

#### **2.7.5. Summary**

In Canada and NL, SWP policies are formulated by provincial and territorial authorities and implementation is largely carried out by municipal authorities. However, literature suggests that municipal authorities often lack the capacity required for effective policy implementation, resulting in implementation gaps that threaten the delivery of safe drinking water. The existence of SWP policy implementation gaps have been attributed to numerous factors related to institutional, technical/human, financial and social capacity, especially at the local level. Thus, this study will seek to investigate the importance of each of these considerations with the NL context. This is consistent with the thesis aim of exploring the existence of implementation gaps in SWP policy in the context of NL, factors contributing to existing policy implementation gaps, and ways to address them.

## **CHAPTER THREE**

### **METHODOLOGY**

#### **3.1. Introduction**

To achieve the primary goal of this study, which is to examine the existence (or absence) and nature of source water policy implementation gaps in the province of NL and factors contributing to this situation, the researcher chose to use a primarily qualitative research approach. Document review, semi-structured interviews and multiple case studies were employed for this study to effectively delve into procedures used to ensure SWP as well as the constraints in implementing such procedures (Conger, 1998). While the study is largely qualitative in nature, the researcher also re-examined already existing quantitative data to assist in answering the question of the extent to which implementation gaps exist. Further, water quality and other statistical data were used to examine conditions in case study communities.

Qualitative research approaches were selected for this study because they involve interpretation in the natural setting (Lincoln & Guba, 2000), enabling researchers to determine the significance people attach to their involvement in activities (Bogdan & Biklen, 2003). Lincoln and Guba (2000 p.3) have suggested that “qualitative researchers study things in their natural settings, attempting to make sense of, or to interpret, phenomena in terms of the meanings people bring to them.” This study included stakeholder interpretations of the factors that contribute to current SWP measures (or lack of them). This allowed for an understanding of the meaning(s) they give to and importance they place on SWP and a range of related conditions.

Data collection for the study was conducted in two phases, with the information from the first phase leading into the second phase. The first phase involved a review of secondary sources, including document review and re-analysis of previous survey data, related to SWP in the province. Phase two involved case study selection based on phase one, followed by a review of

secondary sources specific to six selected case study communities (two compliant, two partially compliant and two non-compliant with SWP regulations according to the available documentation) and semi structured telephone interviews with selected participants from these communities as well as provincial government officials.

A multiple case study approach was undertaken to supplement and verify the findings from the document review, while providing a greater depth of understanding. According to Yin (2009), case studies are an effective strategy of inquiry for research that asks “how” or “why” questions and, where the focus is on a contemporary, real-life process, and the researcher cannot control events. This is therefore appropriate for this research because case studies provided further insight into the issues of SWP and policy implementation gaps in NL, an ongoing, “real-life” process. Case studies allow the researcher to explore a “bounded system” in context with considerable detail (Creswell, 1998). To adequately answer question two (i.e. the factors that contribute to successful implementation of SWP measures in some cases, and implementation failure in others), multiple case studies were conducted in what were identified during phase one to be compliant, partially compliant and non-compliant communities (two each for a total of six cases). Case study selection is discussed further below.

### **3.2. Phase One: Document analysis**

Document analysis involves the process of systematically assessing or evaluating documents—both printed and electronic (computer-based and Internet-transmitted) material (Bowen, 2009). According to Stake (1995), document analysis is used mainly for qualitative case studies and intensive studies producing rich descriptions of a single phenomenon, event, organization, or program. Documents can also provide broad coverage; they may cover a long span

of time, many events, and many settings. This was helpful in obtaining a picture of the state of SWP province-wide. Other benefits are efficiency and availability. According to Bowen (2009) document analysis is less time-consuming and therefore more efficient than other research methods. This does not, however, mean that is more effective and robust than other types of data or able to answer all research questions. Document review and analysis requires data selection, instead of data collection. Many documents are in the public domain, especially since the advent of the Internet, and are publicly available. This makes document analysis an attractive option for specific research questions.

Table 10 outlines the documents and information from electronic sources that were included as part of the data collection in phase one and then reviewed and analyzed for insights into each of the three research questions. Each document type and related data selection techniques are described further below.

**Table 10: Phase One – Document Analysis Breakdown**

<b>Documents</b>	<b>Quantity</b>
<b>Provincial Policy Documents and Reports</b>	19
<b>Academic and Scholarly Documents</b>	31
<b>Municipalities NL (MNL) Documents - Meeting notes, reports and presentations</b>	5
<b>Media Scan – Newspaper articles</b>	41
<b>Total Number of Documents</b>	96

The documents were reviewed and analyzed using the Nvivo software (see detailed analysis in section 3.5). A total of 73 codes related to SWP protection and policy implementation were chosen from the secondary documents based on their relevance and contribution to achieving the aims of the study (see appendix 2) and then the the number of mentions within the documents for each code was calculated (see Table 12). This enabled the researcher to identify the dominant themes within the documentation.

### **3.2.1. Provincial Policy Documents and Reports**

Source water protection in NL is legally enforced through the Water Resources Act; the researcher therefore reviewed this Act as it relates to SWP to understand the policy and related legislation for which there is a suggested implementation gap according to previous research (Holisko et al. 2014; Minnes & Vodden 2014; Hanrahan et al, 2016). These included annual drinking water safety reports, which provide current information on the overall state of public water supplies in NL. The reports are prepared by DMAE to communicate how the Government of NL is protecting the province's drinking water quality and outlines the government's plan for ensuring safe drinking water in the future. Relevant information in these reports for this study included initiatives, activities and accomplishments pertaining to the MBSAP for safety of public drinking water systems. The researcher reviewed the reports over the last 10 years (2007 – 2016) to assess provincial government's drinking water initiatives and activities over this recent period and how this has influenced SWP policy implementation in NL. Other government reports and presentations related to the study were also reviewed, including the municipal guide to the development of a watershed management plan and presentations by government officials at a provincial drinking water workshop organized by MNL in 2016.

### **3.2.2. Academic Reports**

As shown in table 11 above, a total of 31 academic documents were utilized for the study, including eight reports from the Exploring Solutions for Sustainable Rural Drinking Waters Systems project (hereafter referred to as the Exploring Solutions project) and other NL drinking water-related studies. The Exploring Solutions project was conducted from 2013-14 and focused on communities with 1,000 or less residents in rural NL and the unique challenges these communities face concerning their water systems. The focus on communities of this size was

chosen after consultation among the research team, as communities of 1000 residents or fewer were deemed representative of rural communities in the NL context (Vodden & Minnes, 2014).

The Exploring Solutions study was undertaken as a partnership between Memorial University of Newfoundland researchers and two provincial associations, MNL and the Professional Municipal Administrators of NL. The research team, led by the Environmental Policy Institute, included researchers from departments of environmental studies, environmental science, civil engineering, community health, and humanities, as well as industry associations, other non-governmental organizations, and municipal, provincial and federal governments as part of the project's Advisory Committee (Minnes and Vodden, 2014). This study identified the types of risks and challenges influencing drinking water quality and availability in NL. The study assessed four major components of drinking water systems: 1) source water quality and quantity; 2) infrastructure and operations; 3) public perceptions, awareness and demand; and 4) policy and governance. Critical issues identified from the findings of the project included long term boil water advisories, use of untreated water sources, minimal SWP and lack of capacity to address drinking water challenges (Vodden & Minnes, 2014; Minnes & Vodden, 2017). The project research team created a series of reports that were drawn from in this study (see [http://nlwater.ruralresilience.ca/?page\\_id=17](http://nlwater.ruralresilience.ca/?page_id=17)).

The Exploring Solutions project was funded by the Harris Center RBC Water Research and Outreach Fund. The Fund offers funding to researchers with research interests relates to drinking water in NL, supporting research that promotes public policy or advances local community decision-making and promotes research on issues of rural drinking water (Harris Centre, 2016). Nine academic reports and relevant research supported by the fund related to this study were therefore consulted (see <http://www.mun.ca/harriscentre/reports/>). Memorial

University's e-library was also scanned for academic reports and information related to SWP in NL using databases such as ProQuest, Springer, EBSCO and desLibris. SWP, policy implementation gaps, and watershed management in the context of NL were some of the terms used by the researcher in the search over period of four months. The researcher found that implementation gaps existed and watershed management was limited in NL from existing literature.

### **3.2.3. Municipalities Newfoundland and Labrador (MNL) Documents**

Municipalities Newfoundland and Labrador (MNL) is a membership organization established for the welfare and benefit of municipalities in the province. Sustainability and efficient local governance resulting in improvement in living standards are major components of the vision of MNL. Their mandate is to help communities present a unified position on issues affecting governance at the local level and to assist member communities to access services and connect with other communities for mutual benefits (MNL, 2010). (See <http://www.municipalnl.ca/> for more information). MNL organizes regional meetings, conventions and symposia for its members. The regions are as follows: Avalon, Central, Eastern, Labrador, Northern and Western. During the summer of 2016 the researcher completed an internship with MNL as part of his academic program, where he gained access to relevant and useful data for this study. MNL has been actively engaged in discussions on issues related to drinking water in the province since its formation in 1951 (MNL, n.d.). As part of the internship, the researcher assisted in the organization of drinking water workshops organized by MNL in 2016 both in St. John's and Corner Brook.

A total of five MNL documents, including meeting/workshop presentations, notes, reports and other documents from 2013 to 2016 related to this study were consulted as part of phase one

to provide further insight into SWP practices and awareness within NL municipalities. The researcher selected this three year time frame due to time and resource limitations. These included presentations from the 2014 rural drinking water forum, 2015/16 MNL municipal symposium on drinking water, and the 2016 regional meetings, where drinking water sessions were conducted. Additional meeting notes from two MNL drinking water workshops that took place in Corner Brook on Friday June 10, 2016 and in St. John's on Monday, June 13, 2016 respectively were also consulted. The objective of these workshops was to help build the capacity of local staff and elected officials for effective governance and management of their drinking water systems. These workshops were attended by municipal elected officials, administrative staff, water operators, provincial government representatives and consultants. Topics discussed included an update on the MNL water resolutions, a tutorial on the water resource portal (a provincial online information resource), monitoring of PPWSAs, and creating a maintenance assurance manual. Top water issues and the next steps in moving forward with solutions/actions on the local, regional and provincial level were also discussed. The results of these workshops are reported on in a document entitled "Report on Municipal Drinking Workshop and Source Water Protection Regional Workshop Session", which was included in the document review.

#### **3.2.4. Media Coverage**

To obtain data related to SWP in NL the researcher also reviewed the NL media scan from the above noted Exploring Solutions project, which covered over 200 newspaper articles published in the years 2003 to 2015. The researcher selected SWP related articles relevant for this study, mainly from the period between 2013-2015 under the following topics: contamination, water supply, maintenance, funding, BWA, facility upgrades and policy. This period was selected because of existing data on media coverage from the Exploring Solutions project. Adding to this,

the researcher conducted a further media scan of the Western Star, Gazette, Telegram (major provincial newspapers) and CBC for SWP related articles in Newfoundland between 2016 and 2017 to continue with the data from media scan from the the Exploring Solutions project as stated above. In all, 41 articles were analyzed for the purpose of data collection for this study.

### **3.2.5. Survey Re-analysis**

As noted above, the Exploring Solutions project was a provincial-wide research study which provided an overview of drinking water issues in rural NL communities (from source to tap) focusing on small communities of 1000 residents or fewer and the unique challenges that small water systems pose. Two surveys were conducted as part of the provincial project: one for administrators (i.e. town managers, clerks and town staff) and one for water operators, with the intention of revealing information concerning municipalities' and local service districts' (LSDs) drinking water systems not available from previous research and documentation (see appendix 4). The administrators survey targeted 454 communities (178 LSDs, 276 municipalities) from July to September, 2013; 199 respondents returned surveys (48 LSDs, 151 municipalities), which constituted an overall response rate of 44% (27% of LSDs, 55% of municipalities). The water operators survey was delivered from October 2013-March 2014 and had 71 respondents, representing approximately 22% of communities that have permits to operate (i.e. that operate a water system for residents) (Minnes and Vodden, 2014).

Survey questions on prohibited activities (see appendix 4) in municipal drinking water sources and how these restrictions are monitored and enforced were particularly relevant for this research. Answers to these questions were therefore re-analyzed to identify compliant and non-compliant communities. Re-analysis for this research was conducted as part of an internship with MNL in summer 2016 by categorising participant responses to SWP related questions from the

survey. In addition to enabling the researcher to identify regulation compliant and non-compliant communities and the prevalence of compliance/non-compliance, the survey data also provided insights into the factors that may be contributing to SWP protection barriers (e.g. noted challenges), and related suggestions for enhancing SWP policy and/or practice. Although survey results from the the Exploring Solutions project separated municipalities that have fewer than 1000 residents from those with more, community size was not the main focus of this study.

### **3.3. Phase Two: Case Studies**

Following the document review and re-analysis of the Exploring Solutions survey data, case studies were conducted in six communities: two identified as compliant with SWP regulations through previous research, two compliant in some but not all aspects, and two non-compliant, as shown in table 11 below based on community responses to the survey questionnaire. Criteria for case study selection included availability of previous research (to provide insights into the research questions additional to primary data collection), the size of the community, and level of compliance with SWP regulations (seeking a range of circumstances). Size was deemed to be a consideration given that the literature suggests that smaller communities face greater capacity challenges. Three communities were selected with populations less than 1,000 residents and three over 1,000 residents to provide continued exploration of these challenges and the extent to which they are unique to small municipalities. Community names provided in this thesis are pseudonyms to protect the identities of the communities involved in this study.

**Table 11: Case study communities**

<b>Community Group</b>	<b>Community Name</b>
Compliant	1. Pure Water (PW) Community
	2. Clear Water (CW) Community
Partial Compliant	3. Quasi Bay (QB) Community
	4. Demi Bay (DB) Community
Non-Compliant	5. Open Flow (OF) Community
	6. Free Flow (FF) Community

### **3.3.1. Secondary Sources Related to the Case Study Communities**

To understand case study communities better, the researcher consulted provincial government documents and resources such as the water resource portal (Government of Newfoundland and Labrador, n.d.). The water resources portal contains very useful and relevant community information for this study including: drinking water quality data and treatment profiles; protection areas for ground and surface water supplies; boil water advisories; ambient water quality data and watersheds.

Additionally, the researcher used interviews and secondary data from a previous research project as part of the researcher's MNL internship (discussed above). Other relevant previous studies on selected cases study communities were also consulted. However, due to the ethical requirements of the study, the researcher used a pseudonym to reference consulted articles and approximated figures to protect the identities of participating communities in this project.

### **3.3.2. Semi-structured Telephone Interviews**

Semi-structured telephone interviews were conducted with key informants such as elected officials, administrative and/or water operations staff from case study communities. Interviews

were selected as a method of data collection to capture many different views from participants, including varying opinions, experiences, and meanings (Stake, 2005). The interviews were semi-structured to allow additional, possibly unexpected information to be gathered as it arises. Adaptability and flexibility are two strengths of semi-structured interviews (Dunn 2005), and the main reasons this approach was used in this study. It allows the researcher the flexibility to adapt to the informant's way of addressing questions. Given the varied experiences and understanding of participants a semi-structured format allowed them the freedom to be more detailed in their responses (Dicicco-Bloom and Crabtree, 2006).

Respondents were chosen using a combination of purposive and snowball sampling. The use of purposive sampling was to focus on individuals and organizations who have the knowledge and experience of SWP to help the researcher in answering the research questions. Snowball sampling was also used to identify other potential interviewees. A total of seven semi-structured telephone interviews were conducted between March and July 2017, at least one in each case study community. Interviews included questions about watershed monitoring, prohibited activities within the watershed, quality of source water, implementation and enforcement of PPWSA regulations, and factors contributing to SWP implementation successes and failures (questions attached in appendix B). The interviews lasted for approximately 30 minutes and were conducted by telephone.

Musselwhite, Cuff, McGregor, and King (2007) describe several advantages of using telephone interviews: first, the efficient use of economic and human resources (e.g., reduction of travel time and financial cost, thereby increasing the number of participants involved in the study). Second, they can minimize disadvantages of in-person interviews (e.g., researchers can take detailed notes of an interview without making participants feel uncomfortable, response bias may

be reduced in the absence of facial expressions, and the anonymity afforded by the phone may enable participants to be more open in their responses). Third, this method can improve the quality of data over a survey by allowing those who may have reading/writing difficulties to participate in research. These factors are confirmed by Shuy (2003), who also states that phone interviews minimize interviewer effects and allow for better interviewer uniformity in delivery and greater standardization of questions, as well as enhanced researcher safety, cost-efficiency, and faster results. Notwithstanding the advantages of telephone interviews stated above, one disadvantage identified by Groves and Khan (1979) is that “individuals may respond differently over the telephone than they will in person due to anonymity provided by separation and challenges to interpersonal communication, specifically in the formation of trust, caused by separation between interviewer and subject” (p. 434). Further, according to Opdenakker (2006), face to face interviews provide advantages such as the ability to observe social cues, such as body language, voice and intonation of the interviewee that provide additional information to the interviewer in addition to the verbal responses of the interviewee.

Due to time constraints and non-response on the part of interviewees, out of the 12 interviewees contacted first by email and subsequently by phone, only seven were successfully interviewed, whilst five others did not respond to the emails or phone calls of the researcher. Nevertheless, the researcher managed to obtain a picture of case study circumstances using a range of sources.

### **3.3. Analysis**

Data collected from document review and telephone interviews were analyzed through categorization and coding, where a code is defined as “a word or short phrase that symbolically

assigns a summative, salient, essence-capturing, and/or evocative attribute for a portion of language-based or visual data” (Saldana, 2009, p.3). Some codes were determined in advance based on the research questions and literature related to SWP implementation gaps (e.g. compliance and non-compliance; financial, institutional, technical/human, and social factor categories as well as others related to indicators outlined in table 12). Other codes were identified based on research data and emerging themes as the research progressed. To facilitate analysis, pattern analysis was used. This involved identifying characteristics such as patterns of common response in the coded qualitative data (Saldana, 2009). In particular, I looked for similarities within the patterns. For instance monitoring and enforcement were identified as complimentary with regards to policy implementation because limited monitoring to some extent resulted in limited enforcement and resulted in implementation gaps. NVivo software was used for the coding of data in this study. The codes used are provided in appendix 2.

### **3.4. Ethical Considerations**

To ensure that the study was conducted with the highest ethical standards possible, the researcher completed the tri council policy statement tutorial (TCPS 2) and received approval from the Grenfell Campus Research Ethics Board (GC-REB) for this study (see Appendix 1). There was minimal risk to participating for participants from compliant communities, however it was recognized that non-compliant community participants may be exposed to greater than minimal risk such as embarrassment and scrutiny from the public and provincial government officials if their identity or that of their communities were revealed. Knowledge of non-compliance could affect the community’s permit to operate, and therefore put its ability to offer drinking water at risk.

To minimize these potential risks associated with participating in this research, pseudonyms were used to conceal and protect the identities of the actual communities involved in this study. No personal or identifiable characteristics of participating individuals or communities were used in this study. Only fictitious names and characters have been used in place of the actual identities of participants, which are known only by the principal researcher and his supervisor. Participants' involvement entailed confidentiality to the greatest extent possible. Notes related to participant identities, interview transcripts, as well as digital recordings were stored safely (e.g. in locked and/or password protected locations), only accessible to the principal researcher and supervisor. A coding system was used on all data collected in place of identifiable information to protect participants' responses and data, which has been securely stored and is accessible only to the research team. Additionally, community specific references were not cited to protect the identity of participating communities.

### **3.5. Knowledge Mobilization**

The researcher identifies the key audiences for this research to include among others, NL municipalities and communities, provincial government officials, and academia. Therefore, plans for knowledge mobilization and reporting back include disseminating research findings to NL municipalities. The researcher intends to consult with MNL upon completion of this research on the appropriate channel(s) of disseminating the research findings to its members. Some of the results from this research have been published by the researcher prior to the completion of this thesis. The resulting article is cited in the results section below accordingly.

## CHAPTER FOUR

### RESULTS

#### 4.0. Introduction

The results of this research are based on the two phases of data collection and analysis described in chapter three and are presented in this chapter. Additionally, this chapter is divided into sections in alignment with the methods of data collection. The results from phase one of data collection involving document and survey re-analysis are presented in section one, whilst case study results are presented in section two respectively.

#### 4.1. Document Analysis

The table below contains the most frequently mentioned themes identified (by total number of mentions) within the document review (see table 12). The six themes with the highest number of mentions are further discussed below.

**Table 12: Dominant Themes**

Themes	Number of mentions within the documents
Monitoring	84
Financial capacity	79
Enforcement	75
Public awareness	74
Watershed management	63
Water operators & training	61
Collaborations	59
Infrastructure challenges	53
Human resource capacity	51
Permit to operate	39
Education & training	37
Implementation & gaps	33

Compliance & non-compliance	24
Legislations	19
Threats	19
Water system	17
Volunteers	15
PPWSA	14
Capacity building	12
Multi-use watersheds	10
Capacity limitations	9

#### 4.1.1. Monitoring

As shown in table 12 above, monitoring was the most mentioned theme in the documents analyzed, further emphasizing the importance of monitoring in SWP and quality drinking water provision. Table 13 contains information from the NL government regarding drinking water supply area monitoring processes, including where to monitor and what activities to look for.

Notwithstanding, the information provided in table 13 below on how monitoring should be conducted, the documents reviewed revealed that monitoring is lacking in NL because many communities depend largely on the public and volunteers to carry out their monitoring obligations (Minnes, 2016). For instance, in a study conducted by Edinger and Hermanutz (2015) participants disclosed that “nobody monitors whether regulations have been implemented or how they have been implemented” (p.61). Available literature also suggested that there was a lack of awareness of how monitoring really works, for example, the false impression that roadside springs are monitored in NL (Breen & Minnes, 2015).

**Table 13: Where to monitor and what to look for**

<b>Where to Monitor</b>	<b>Monitoring Activities – What to look for?</b>
<ul style="list-style-type: none"> <li>- Monitor within the watershed or catchment area that contributes to the intake/well.</li> </ul> <p>Focus on:</p> <ul style="list-style-type: none"> <li>- Intake or well</li> <li>- Around intake pond/reservoir or well</li> <li>- Along road or trails in the water supply area</li> <li>- Around existing developments such as cabins, quarries, power lines, etc.</li> <li>- Around ongoing activities such as forest harvesting</li> </ul>	<ul style="list-style-type: none"> <li>- Signage: is signage in place to inform people that a water supply area is being entered? Is signage in good condition or does it need to be replaced?</li> <li>- Signs (scat) of wildlife, beaver dams (eg: beavers, muskrats, geese, sea gulls) near waterbodies.</li> <li>- ATVs, snow mobiles, or domestic animals crossing intake pond, brooks and streams</li> <li>- Illegal activity such as hunting, fishing, boating, camping, people or animals swimming, etc.</li> <li>- Illegal activities (ie. wood cutting, buildings, etc) within shoreline buffer zones</li> <li>- No development should occur within 150m of the intake pond, 50m from any waterbody that flows directly into the intake pond, and 30m from any other waterbody within the water supply area.</li> <li>- New developments or construction (eg: cabins, vegetable gardens, etc.) that do not have a permit.</li> <li>- Condition of private buildings and structures (ie. are they deteriorating and have the potential to cause impairment to the water supply).</li> <li>- Indication of fuel leakage from any fuel storage tanks.</li> <li>- Indication of septic leakage at any cabin/cottage properties.</li> <li>- Presence of garbage, abandoned vehicles or RVs.</li> <li>- Water quality concerns such as increased turbidity from runoff after heavy rain, other environmental disturbances?</li> </ul>

Source: Government of Newfoundland and Labrador. (n.d).

Data analysis from MNL notes and reports, particularly from regional meetings suggest some misunderstanding between drinking water quality monitoring (testing) conducted by DMAE in most cases and the monitoring of PPWsA. MNL drinking water workshop notes state that:

“No hands were raised when participants were asked “who had a monitoring plan in place.” It was realized from the table discussion notes, however, that there appeared to be some confusion between monitoring as applied to water testing/facility checks and the specific feedback on periodic walk-about surveillance of the PPWSA” (MNL, 2017. p. 8).

Lack of monitoring also means obligations under the permit to operate are not being met, including requirements for inspecting the watershed on regular basis and conducting surveillance of the designated area. The results from the document analysis suggest that communities fail to act despite the monitoring obligations of communities with PPWSA designation under their permit to operate (Minnes, 2016).

#### **4.1.2 Financial Capacity**

Financial capacity was the second most mentioned theme from the document analysis (see table 16). The main explanation for capacity deficiencies in small communities have been attributed to insufficient financial resources (Eledi et al., 2017). This has been recognized as a province-wide challenge by provincial and municipal officials (Will, 2014). Additionally, Minnes and Vodden (2017) found that the lack of financial resources committed to implementing and enforcing provincial programs and policies was a source of concern with regards to the health of water supplies and water systems in the province of NL.

Factors accounting for financial capacity limitations in NL communities according to the documents reviewed included small tax base, aging demographics and low populations (Minnes & Vodden, 2017). Inadequate financial capacity resulted in communities’ inability to fund water systems and upgrades (Will, 2014; Speed, 2014), attract and retain qualified staff (Minnes & Vodden, 2017), and monitor watersheds (MNL Drinking Water Report, 2016).

#### **4.1.3. Enforcement**

Investigations are conducted after the Department of Environment and Conservation (DEOC) is informed about contraventions of the Water Resources Act or associated regulations and permits (Government of NL, 2014/15). This implies that communities must carry out their monitoring obligations and report non-compliance, before enforcement can take place. Additionally, departmental staff conduct inspections of water supply systems under construction, the operation of water treatment and distribution systems, groundwater wells being drilled, and activities taking place in PPWSAs to ensure that they comply with the terms and conditions of their permit (Government of NL, 2016).

Document analysis revealed that the enforcement of restrictions and regulations around PPWSAs was low in NL (Minnes, 2015). Some linked this lack of enforcement to the resource concerns noted above. For instance, one Mayor wanted to know “if you do a good job monitoring, how do you enforce? ... You’ve got to have resources to enforce or your laws are no good” (Kean, 2016 para 10). Available literature further suggests that although certified water operators are needed for all public drinking water systems under their Permit to Operate, there was no enforcement in this regard (Christensen, 2011; Minnes & Vodden, 2014; Breen & Minnes, 2015). Considering that communities are closer to water sources, it is easier for municipal governments to be entrusted with enforcement of regulations than provincial officials, yet this is considered unfeasible due to capacity limitations such as human, financial or technical challenges (Breen and Minnes, 2015).

#### **4.1.4. Public Awareness**

One of the best ways to protect a community's water supply according to the 2016 annual drinking water report (Government of NL, 2016) is through public outreach and education. Therefore the DEOC encourages and supports all communities to promote public involvement and awareness of watershed areas (Government of NL, n.d). However, documents reviewed suggest that awareness and knowledge of general SWP protection practices was limited on the part of both municipal authorities and community members. According to workshop notes, participants could not distinguish water quality monitoring from watershed monitoring (MNL, 2017, p. 8). This was due to a lack of awareness of the need for SWP and of municipal responsibilities for watershed planning and management (Minnes, 2015; Holisko et al., 2014).

#### **4.1.5. Watershed Management**

Watershed management plans are encouraged in PPWSA's to ensure the judicious use of resources by outlining processes and procedures for activities around designated areas to prevent pollution and safeguard water quality (Department of Environment and Conservation, 2013). According to Edinger and Hermanutz (2015) "exploring integrated watershed management is crucial for implementing best practice techniques for managing drinking water quality in NL, especially on the Northeast Avalon, where development has seen an exponential increase" (p.41). Additionally, watershed management plans and monitoring committees have succeeded in addressing land use conflicts in PPWSA (Government of NL, 2001).

Notwithstanding the importance of watershed management and committees discussed above, it was found that, particularly in rural NL, a SWP implementation gap currently exists as few watershed management plans exist. For instance, there are only five watershed management committees (Clareville, Corner Brook, Gander, Grand Falls-Windsor, and Steady Brook), and

three watershed management plans (Corner Brook, Gander, and Steady Brook) out of the five committees (Government of Newfoundland and Labrador, 2016).

#### **4.1.6. Water Operators and Training**

Training for drinking water operators is crucial for successful SWP, because operators need to understand how drinking water systems work from the source to final discharge at the tap (Water Canada, 2016). The post Walkerton report therefore recommended that “.... measures [should] be taken to ensure that training courses are accessible to operators in small and remote communities and that the courses are tailored to meet the needs of the operators of these water systems” (O’Connor, 2002 p. 388). In this regard, the NL government established Operator Education, Training and Certification (OETC) Program in 2002 to enable municipalities to deliver safe, clean drinking water and restore public confidence in drinking water quality (Government of NL, 2015).

Data from the annual drinking water report revealed that proper maintenance of drinking water quality and quantity [from the source] depends on knowledge of the water operator and adherence to best management practices and operational procedures (Government of Newfoundland and Labrador, 2010). Furthermore, drinking water operators are required to as per their permit to operate drinking water systems, establish and maintain frequent inspection and regular monitoring of activities within PPWSAs (MNL, n.d). However, this has turned out to be a challenging task for drinking water operators particularly in rural areas (Hamilton et al., 2006; Rizak and Hrudey, 2007; Kot et al., 2011).

## 4.2. Survey Re-analysis

The Exploring Solutions project sought to identify the types of risks and challenges influencing drinking water quality and availability in rural areas of the province. Therefore, survey questions concerning policies and the regulatory framework of municipal water systems related to SWP were re-analyzed for this research. As discussed above, prohibited activities within PPWSA under section 39 of the Water Resources Act SNL 2002 cW-4.01 include activities that impair the quality of the water such as fishing, bathing, boating, swim or washing or using or diverting water in a way that reduces water availability in a public water supply (Government of Newfoundland and Labrador, 2013). Contrary to this regulation, survey results indicated that many communities did not prohibit these activities in municipal drinking water sources, as shown in table 14 below.

**Table 14: Non-Compliance with Prohibited Activities under PPWSA Regulations**

Prohibited activities in PPWSA	LSDs	Municipalities with Populations 1000 or Fewer	Municipalities with Populations over 1000
Bathing or washing clothes	45%	35%	16%
Boating	47%	27%	19%
Fishing	47%	32%	26%
Material deposit	47%	27%	2%
Swimming	43%	28%	19%
Use or diversion of water for purposes other than municipal drinking water supply	63%	41%	30%
None of the above	43%	22%	2%

Source: Eledi et al., 2017

As shown in table 14 above, in LSDs, municipalities with populations under 1000 and populations above 1000, the use or diversion of water for purposes other than municipal drinking water supply was the highest violation of the requirement to prohibit activities at 63%, 41% and

30% that are not prohibiting this use respectively according to survey results. In LSDs, 47% of participants did not ban boating, fishing and material deposits in their drinking water source, while 43%, 22% and 2% of LSDs, municipalities with populations under 1000 and populations above 1000 respectively did not prohibit any of the banned activities.

According to their permit to operate drinking water systems, municipal drinking water operators are responsible for establishing and maintaining frequent inspection and regular monitoring activities within PPWSAs (MNL, n.d). However, the results the survey pointed to non-compliance with this provision by some municipalities and most LSDs, as shown in table 15 below. As illustrated in table 15 , only 15%, 55% and 43% of LSD, municipalities with populations 1000 or fewer and over 1000 respectively had their drinking water supply monitored on a regular basis by municipal/LSD staff while only slightly more LSDs (20%) and far fewer municipalities (12% and 2% of municipalities with populations 1000 or fewer and over 1000 respectively) had their source drinking water supply monitored on a regular basis by volunteers. Further, 20% of LSDs, 11% of municipalities with populations below 1000 and 10% of municipalities with populations 1000 and above acknowledged that they do not have the human resources to monitor activities in their drinking water supply areas.

**Table 15: Compliance with Source Water Monitoring**

<b>Monitoring activities in PPWSA</b>	<b>LSDs</b>	<b>Municipalities with Populations 1000 or Fewer</b>	<b>Municipalities with Populations over 1000</b>
<b>Source drinking water supply is monitored on a regular basis by municipal/LSD staff.</b>	15%	55%	43%
<b>Source drinking water supply is monitored on a regular basis by volunteers.</b>	20%	12%	2%

<b>Source drinking water supply is monitored occasionally by municipal staff.</b>	5%	21%	31%
<b>Source drinking water supply is monitored by volunteers.</b>	30%	9%	7%
<b>Source drinking water is only monitored when there are complaints.</b>	10%	12%	24%
<b>Town does not have the human resources to monitor activities in our drinking water system.</b>	20%	11%	10%
<b>When a prohibited activity is observed or reported, the municipality notifies the Department of Environment and Conservation</b>	25%	33%	33%

Source: (Eledi et al., 2017, p.8)

As indicated in table 16, identifying existing and future threats to drinking water sources is an important SWP activity. The results from the Exploring Solutions project indicate that, with regards to threats to drinking water sources, 48% and 17% of municipalities with populations less than 1000 and populations over 1000 respectively identified no threats to their main municipal water source (table 16). Activities identified by both small and large municipalities as threats to the drinking water source were domestic wood cutting, hunting and fishing, and recreational uses. Oil and gas exploration, hydroelectricity, agriculture, commercial forest harvesting, transmission lines and roads mining were the threats least identified by municipalities with populations of under 1000 and above 1000.

**Table 16: Threats to Municipal Drinking Water Sources**

<b>Threats</b>	<b>Municipalities with population under 1000</b>	<b>Municipalities with populations over 1000</b>
<b>Agriculture</b>	1.6%	5.7%
<b>Commercial forest harvesting</b>	4.8%	8.6%
<b>Domestic wood cutting</b>	25.4%	31.4%
<b>Hunting and fishing</b>	19.0%	34.3%

<b>Hydroelectricity</b>	0.0%	2.9%
<b>Mining</b>	3.2%	14.3%
<b>Oil and gas exploration</b>	0.0%	2.9%
<b>Recreational use</b>	28.6%	45.7%
<b>Residential cabin development</b>	4.8%	17.1%
<b>Transmission lines and roads</b>	3.2%	5.7%
<b>There are no threats to our main municipal water source</b>	47.6%	17.1%

Although water operator training certification is stipulated in the Permit to Operate (Government of NL, 2014), results from the Exploring Solutions project suggest non enforcement or adherence to this provision by many municipalities. Survey data shows uncertified water operators in many communities, including 35% of LSDs and 25% municipalities with populations under 1000. Further analysis of the data from the survey on water operator certification and training suggests that the size of the community played a role in a community's certification status. No municipalities 1000 and over indicated that they had uncertified water operators, contrary to responses from communities under 1000.

#### **4.3. Case Studies and Interview Results**

The case study communities involved in this study included compliant, partial complaint and non-compliant communities. Compliant communities were identified from the document review and survey re-analysis as communities that adhered to key investigated aspects of designation and PPWSA regulations involving restrictions and monitoring activities within drinking water sources which are key aspects of designation. Partially compliant communities on the other hand were identified as communities that adhered to some but not all the PPWSA regulations involving restrictions and monitoring activities within drinking water sources. Finally,

non-compliant communities were identified as communities that did not comply with any or the majority of the PPWSA regulations involving restrictions and monitoring activities within drinking water sources. Each community was given a pseudonym (table 17).

**Table 17: Case study communities**

Case No.	Community Name Given	Compliance Status
1.	Pure Water (PW) Community	<b>Compliant</b>
2.	Clear Water (CW) Community	
3.	Quasi Bay (QB) Community	<b>Partial Compliant</b>
4.	Demi Bay (DB) Community	
5.	Open Flow (OF) Community	<b>Non-Compliant</b>
6.	Free Flow (FF) Community	

The results from the case studies are presented in the remainder of this chapter for each case study community. Interviews were conducted with municipal representatives from the case study communities and were combined with data from secondary sources to develop the findings presented in the sections that follow.

#### **4.3.1 Compliant Communities**

The Pure Water (PW) and Clear Water (CW) communities have been identified as compliant communities in this study based on the responses provided by the communities' representatives within the Exploring Solutions survey (i.e., as communities that adhered to key aspects of designation and PPWSA regulations involving restrictions and monitoring activities within drinking water sources).

##### **i. Pure Water (PW) Community**

The Pure Water (PW) community has a population of approximately 250 according to 2016 population census (Statistics Canada, 2017). In terms of governance, the community is governed

by a Town Council comprised of seven elected volunteers and employs a full time Town Manager and a part time Maintenance Officer who together manage the community's drinking water system. The Town Manager of PW community also works as the Chief Water Operator for the community. Information from the Water Resource Portal (WRP) revealed that, the PW community has a surface drinking water supply from a pond (Government of NL, 2018). The PW community's drinking water source has PPWSA designation and has enough quantity to meet the community's present and future drinking water needs because it is connected to several ponds in the watershed area, according to one academic report<sup>3</sup>. The community adheres strictly to the PPWSA regulations, hence there is no built infrastructure near the pond, including no cabins or industrial development, minimal human activity, mounted signage and a high level of public enforcement. Data from literature and the survey data further confirmed the community's compliance with the regulations of PPWSA designation such as the banning of all prohibited activities (swimming fishing, etc.) and conducting regular monitoring of their water supply as stipulated in their permit to operate.

A former municipal official of the PW community for more than 27 years disclosed that the community's drinking water source is patrolled daily because "it was relatively easy to patrol [the drinking water supply] because the main road was right by and you can see the whole catchment area and we could patrol it daily". The interviewee further stated that the town office, specifically the Town Manager and the Maintenance person, are responsible for daily monitoring of the water supply:

... we went there every single day in the week to monitor so that we knew if someone had a flat tire in the area. So, there was absolutely no fishing in the supply, there was no activity whatsoever except for wildlife.

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<sup>3</sup> Specific references that will identify the community are not cited to protect community identity.

The former municipal official, in a response to questions related to source water contamination asserted that because no development activities were allowed within the watershed, there was very little chance that contamination would occur:

...there is absolutely no development in the area unless there is an accident where a vehicle went into the water supply, there is little chance of any contamination from an outside source.

The PW community took control of the water supply source in the 1980's and there have been no major issues with their water source due to the restrictions of activities and development around the supply. According to the municipal official, the DMAE assigned the designation and put up boundaries whilst the community posted signs and conducts regular monitoring around the watershed.

With regards to public awareness and support for SWP, the PW community benefits a great deal from community support and involvement. Community members are aware of the restrictions around the watershed and comply fully with them. Beyond simply abiding by the restrictions, community members also ensure that the regulations are enforced by reporting all activities of non-compliance to the town office for immediate action.

...if someone drove out past the water supply and saw someone there fishing, we got a call immediately, so we went over and asked them to leave. So yes, we had strong community support.

Despite their successes in SWP, financial challenges was identified as one of the major concerns by the PW municipal representative, particularly with regards to the cost of running and maintain the water systems. He/She stated that:

the biggest challenge for any small town is actually the cost of running the system, the cost of chlorine, the cost of keeping the pumps maintained, that was always the challenge. To actually look out for the source supply, that was never a challenge, but it was maintaining it from the pump house to the residents that seems to be always the problem and a concern.

Another challenge identified in the PW community from previous research and confirmed during the researcher's interview was human resources, particularly with regards to succession planning of future drinking operations according to one academic report<sup>4</sup>. According to the interviewee, human resource and financial challenges are intertwined, because you need the finances to attract the best or qualified people to the job, but this is not always possible in small communities with small budgets. It was stated that:

... most of the time, we talk about human resources, [however] it is the person that you can get for the job and not necessary the person who can do the job best because not a lot of people apply for these positions. So basically, in today's environment, if you are not making a hundred thousand dollars year, you are not making anything. Most water operators are only making like forty thousand dollars a year and some are less than that.

So, of course with good money, you could attract someone but the thing is the small towns don't have the financial resources to attract the necessary people.

In response to the researcher's question of whether the provincial government was doing enough with regards to SWP regulations, the interviewee called for stronger regulations and enforcement, particularly with regards to operator training and education. He/She stated that:

we just need stronger regulations and I know that will come with a resistance for a lot of people ..... I know there will be some kickbacks but the benefits to the community no doubt will be good returns for your "buck" if you have your people trained to do the job they are doing.

The interviewee further added that:

enforcement is the problem, if someone is doing it, someone is not trained, there is no fine for it. You just get a little letter saying by the way your water operator should be trained.... it's just like a slap on the wrist or even lighter than that. So, enforcement needs to be more strengthened in lots of cases.

Finally, the interviewee mentioned that education of water operators as a very important for successful SWP and guaranteeing quality drinking water for rural communities. In his/her opinion,

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<sup>4</sup> Specific references that will identify the community are not cited to protect community identity.

it should be mandatory for operators to attend training programs in order to stay abreast with technological advancement on water systems. A respondent stated that:

I think education of the operators for the water treatment plants must be mandatory. It is more of a suggestion right now but I think it should be mandatory that operators will attend at least a day or two course every year to keep them up on the local things and the new technology and basically how to help them run their system.

In summary, the PW community observes strictly to the PPWSA regulations and their permit to operate drinking water systems. In addition to prohibiting and enforcing PPWSA regulations, the community conducts regular monitoring of their water supply as stipulated in their permit to operate the drinking water supply on daily. Key factors in this compliance include the community's proximity and accessibility/visibility of the water supply and great public involvement and support. No implementation gaps were identified in the community, however capacity issues such as financial and human resource challenges were identified as major concerns in the community and for other small towns. Interviewees suggested public and drinking water operator education as solutions to successful SWP implementation.

## **ii. Clear Water (CW) Community**

The Clear Water (CW) community has a population of over 5000 residents according to 2016 population census (Statistics Canada, 2017). The community has a surface water supply from a pond and the quality is ranked as excellent according to the WRP (Government of NL, 2018). A municipal official employed on a full-time basis for several years confirmed that the quality of drinking water after treatment is excellent, demonstrating his/her confidence in the community's drinking water treatment system, processes and methods. The interviewee further stated that:

We do no testing at the source. I know Service NL does. The only testing we do is at the end (at the tap).

The CW community has two certified water operators and another just recently received training, which brings the total number of certified water operators to three in the community. The community's drinking water supply is sourced from three ponds that are connected together and PPWSA designated. Additionally, the community has restrictions on activities within the water supply, as required under their protected status. Signs have been put up to inform community members of the restrictions. According to one municipal interviewee:

there is no hunting, no fishing, no ATVs, so we have the government signs up and I believe we had a couple extra last year to put up and we have signs all through the public water supply.

Notwithstanding the above, the municipal representative raised some apprehensions with regards to their ability to adequately protect the water supply, particularly with regards to the distance between the municipal office and the water supply. The interviewee stated that:

It's hard because, the pond is out there but just because we have the signs up doesn't mean people are listening. So, people could be still hunting and fishing because to get to our source water from here [the municipal office] is about 20 minutes drive. That's a fair distance to get to our source water supply. In that time, even if we do get calls sometimes saying somebody dropped something off, or someone has cut a tree. We will get there but by the time we get there, everyone is gone. I'd like to be able to have more, if I was closer we'd probably be able to monitor it more, where we will do videos. It's one of the hardest things to really do.

Clearly, monitoring challenges and public awareness are two major concerns facing the CW community with regards to the protection of the community's drinking water supply. The distance from the municipal office to the water supply is a major constraining factor to regular watershed monitoring in the community, reducing it to weekly visits and periodically during the winter by the supervisor for outside operations. According the interviewee, "there is not much to see [during the winter], you just go up just to ensure there is no quad tracks and stuff like that." The monitoring efforts of the community around it's drinking water supply area are, however, supported by the public who will report any activities that are likely to contaminate the drinking water supply according to the interviewee. He/she said:

in terms of calls and the protected area, we generally get calls from the public. It is not because we are there watching and seeing something, certainly, its someone driving by and saying, just drove by and seen someone drop something.

With regards to the pollution of the drinking water source of the community the interviewee stated that:

We had a car, 'cause one of our ponds is close by the road [...] and we had a car drive off the road and sort off land a little bit in the pond last year. We had Environment out and some issues checked on and everything, luckily there was no major leaks or anything like that. It looked worse than it was, so, we fight with that as well 'cause its right on the main road, so we have to check.

The municipal representative had very little awareness and knowledge of the monitoring responsibilities of communities with PPWSA designations and suggested that this may an area where support is needed. He/she stated that:

...In talking with Water Resources and all the other ones, they never once said that we need to talk about source water. Now I am going to, there is a meeting in June talking about source water. I will be attending that and maybe that's something that we need the town to check into and start doing. The only thing that we do is to put the signs up and try to encourage everyone to stay off our area.

Further indicating a lack of clarity on the Town's monitoring responsibilities, the interviewee added that:

In terms of Source Water Protection, I don't know how much, like in terms of the town, like what are we looking for? What are we going to test the source water for? As long as it's clear ... Do we just check for a moose carcass or a beaver or something like that. And like we do, the guys there, they look for the moose and beavers. But in terms of, if we don't test our source water, I don't if we are supposed to or if we are just looking at it to make sure, to observe it and watch it.

With regards to challenges, such as human resource and finances to adequately monitor and protect drinking water sources, the interviewee believed that it was not a problem for the CW community because it was a large community with resources:

I think we have no problem doing it, 'cause we are little bit bigger community. We are a larger community and we have some staff [...]. I will just encompass it in our workplans and say listen we need to start looking after this. This is just another job duty. Well, I can

definitely see it being a problem for a lot of communities that might have one only staff, or only one volunteer person looking after the water. We are a lucky, we are larger ..... We have some manpower, so there is no issue for us I don't think. My opinion on the rest of the towns is that it could be a little problem for some.

It was also revealed that some of regulations regarding prohibited activities were being violated occasionally within the community's drinking water supply area by residents. The municipal official said he/she gets approximately two calls a year about wood cutting or dumping violations in their PPWSA:

... I get probably, I might get two calls a year. There is some wood being cut like the things I have heard is wood cut [...], and I have heard some people dumping stuff on the side of the road. Nowhere, not really within the water supply but just near the trees and stuff enroute to it. So little bit of dumping and little bit tree cutting. [...] that's in four years [since I have been here] so probably twice a year maybe that I get a call about someone breaking the rules.

He/she further suggested that, like PW, within the CW community's water supply, there may be fishing and hunting going on despite the signs posted around the area:

We have the signs up and I wish people will look up the signs like its just [...] we have the signs up and they still cut trees down, we have the signs up "no dumping" and they still dump and I am sure they might be people fishing and hunting there. The signs are up, the signs are up through out the protected area. I don't know what happens throughout the provinces. As a suggestion, you will just wish people will read and abide by it.

The interviewee called for public cooperation with regards to compliance on banned activities within PPWSA's. The municipal representative also expressed his intention to attend a SWP workshop to build his capacity and learn more about the municipality's responsibilities in protecting their drinking water source, stating that:

My source water protection [am glad I am gonna go to this presentation] is sort of lost because is like I said, the drive is 20 minutes to 30 minutes depending on traffic, away. I don't get to actually look at the policies and regulations that we have in place for it. I just assume that Service NL is doing their checks and balances and I am doing my check here at the tap and everything is good and you just assume everything.

Again, this raises some concern about the current level of knowledge of municipal representatives with respect to their responsibilities in the area of SWP, particularly those related to monitoring of the water supply area.

In conclusion, limited implementation gaps were identified in the CW community, particularly with regards to monitoring and enforcement of dumping and wood cutting. Key lessons from this community with regards to positive SWP practices included the use of certified drinking water operators, applying PPWSA restrictions and posting signs to inform community members of these restrictions. Additionally, public awareness and limited knowledge of SWP responsibilities by municipal government officials were also identified as factors affecting negatively affecting SWP in the community despite their overall compliance. These issues can be effectively addressed through education and training. Distance to the water supply was also mentioned a source of concern, however, because it makes effective monitoring of the PPWSA more difficult.

#### **4.3.2 Partially Compliant**

The Quasi Bay (QB) and Demi Bay (DB) communities have been identified as partially-complaint communities in this study based on the responses provided by the communities' representatives to the Exploring Solutions survey (i.e., as communities that adhered to some key aspects of designation and PPWSA regulations involving restrictions and monitoring activities within drinking water sources but not to others).

**i. Quasi Bay (QB) Community**

According to 2016 population census, QB has a population of approximately 300 (Statistics Canada, 2017) and is administered by a Town Council consisting of seven elected volunteers, namely: the Mayor, Deputy Mayor, Fire Chief and representatives for Community Living, Finance and Administration, and Public Works. The community, according to one academic report<sup>5</sup>, has three fulltime employees, namely: the Town Manager, Office Assistant, and a Maintenance person who oversees the maintenance department consisting of an additional two part-time employees.

Survey results suggest that the QB community restricts bathing or washing of clothes, material deposit (i.e. dumping), use or diversion of water for purposes other than municipal drinking water supply and swimming within thier drinking water supply area. However, unrestricted fishing activities identified from survey responses raised non-compliance issues for this community. This resulted in the communities classification as partially compliant.

The water quality at source before treatment was described as excellent by the town representative during an interview. The WRP confirmed this information by ranking the quality of the community's drinking water as excellent. Additionally, the community has a surface water supply from a reservoir according to data from the WRP. An interviewee stated that the town's water source was not a PPWSA and hence has no provincial designation. He/She further said that, the process of designation was started a year ago but not completed.

Asked if there are challenges in the designation process resulting in the delay, she/he said "No, I don't think so, it's just a matter of you start a project and put it to one side and when you get back at it, it gets shuffled in the pile. Where I am right, I am just in the starting." Asked specifically if provincial authorities were contributing to the delay, the interviewee stated that:

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<sup>5</sup> Specific references that will identify the community are not cited.

No, I don't think so, I know when I started this process last year, it was fairly easy getting applications online. I called the provincial office and the person I spoke to was very helpful on what I needed to do as part of application process.

Regarding the prohibitions of activities that could potentially contaminate the drinking water source, the town has posted "no entry" and "no swimming" signs. There has been a violation of the rules prohibiting activities within the water supply area in the past, prompting the town to put up these signs around the water supply even before their official PPWSA designation.

We did have one instance where, just through the residents advising us that they saw someone go up there and was swimming in the intake. So that's what prompted us to put up the notice that said no swimming in the water intake.

Additionally, because the pump house is by the brook, there is a gate across with the signs. There is therefore very little development or human activity occurring near the water supply, however there is a local skidoo trail bridge that crosses the water supply source. The community generally adheres to the signage according to the interviewee and hence there is generally no swimming. Asked what factors may have contributed to the success and compliance with the signage, the town manager stated that:

Am not sure, but its common knowledge through the community that this brook is our water supply, so, I think the very fact that people know this, they avoid the area.

With regards to monitoring, the town has a maintenance man that monitors the water intake on daily basis. According to the representative, there was limited contamination of the water supply area, however, the community relied on the signage to inform people of prohibited activities rather than monitoring. He/She also believes that the measures put in place are adequate for the protection of their water source until they have their application submitted and receive provincial designation. This will provide legal protection to the communities drinking water supply.

In summary, although the QB community has no formal PPWASA designation, the community has restricted activities around their water supply area and mounted signage to inform

the public about these restrictions. Monitoring of the water supply area however, appears to be absent. The representative believes that "...its common knowledge through the community that this brook is our water supply. So, I think the very fact that people know this, they avoid the area".

## **ii. Demi Bay (DB) Community**

The Demi Bay (DB) community in NL has a population of over 10,000 residents according to 2016 population census (Statistics Canada, 2017). The community's drinking water supply is surface water sourced from a large lake and a multi-use watershed used for drinking water, recreation, natural resource extraction and development. Additionally, the water source provides drinking water to three other communities.

Interviews conducted for a previous study in the Demi Bay community revealed that the community had good drinking water quality. However, as a result of high Haloacetic Acids (HAA) values which surpasses the guidelines the WRP has not ranked the quality of drinking water since August, 2016 when it was ranked as excellent. At one time, concerns were raised over color and organic matter in the water, however, this was fixed after new filtration and treatment systems were installed. Additionally, from one academic report, interviewees stated that the quantity of water at the supply was not an issue. The community was considered as semi-compliant based on the Exploring Solutions survey responses, however, which suggested that mining (including quarrying), recreational uses (e.g. swimming, snowmobiling, boating), and residential cabin development were activities permitted within the watershed of the community. Survey results suggest that the QB community does restrict bathing or washing of clothes, material deposit (i.e. dumping), use or diversion of water for purposes other than municipal drinking water supply, however.

With regards to threats to the community's water supply, a municipal representative expressed concern about the size of the watershed and the impact of the contamination to the community. "I mean, we've got such a huge water supply; any contamination within the watershed will have to be almost catastrophic to have an impact on our water supply". For several years, the community has had a watershed management committee and a watershed management plan. The plan identifies several threats to their drinking water source such as forestry, urban development, agricultural, mining, logging camps and cottages, fishing, marinas, swimming and sewage treatment facility discharges. Elaborating on the threats identified in the plan, interviewees also mentioned an antimony mine, applications for quarry, and illegal cabins as threats to the community's water supply. Illegal cabins were identified as a continuing challenge because the cabins typically lack appropriate septic systems and are placed there without permits or authorization. The sewage from these cabins is not treated, and in addition other cabin related activities like fishing and swimming pose a risk of contamination of the drinking water supply.

In compliance with the PPWSA designation status of the water supply, permits are required for all activities that take place within the water supply. These permits are approved with the consent of the community through the watershed management committee whose duty it is to scrutinize each application and raise potential drinking water contamination issues for resolution prior to approval. In this regard, a provincial government representative stated:

The communities are the ones that know the area the most because they are the ones that are out on the field doing their own you know personal things as well as the work things. You need to look at those applications and see if you can provide any valuable feedback that we may not know about because we are not in those watersheds as much as the local residents and the councils.

Concerning enforcement, a provincial government representative stated that,

...we do have environmental scientists in the [...] that will field any potential complaints that might come up on any type of activity that's in that watershed or might do just a random inspection on any of the permits that we do issue.

With regards to community involvement and participation in PPWSA activities, a municipal government representative interviewed stated that:

We are really trying to push a little bit more community involvement in the protected water supply areas because it is such a large watershed. It is protected under the Water Resources Act, but the town has the big responsibility in sort of proactively managing their watershed as well and not just depending solely on provincial people to try to do that monitoring.

Though communities are responsible for monitoring as per their permit to operate drinking water systems, this is a challenge in the community according to municipal representatives due to the lack of resources and hence the call for public support. One interviewee explained:

So, one of the challenges is that we rely heavily on the general public, so getting the information out to the general public and saying listen, if you see anything that is suspicious, if you see a dirty looking stream in our water. Its pristine in Newfoundland, so if you see a milky stream that should give you concern, or if you see suspicious activity. That's one the biggest challenges with having such a huge geographic [area] for our watershed.

In summary, the community was considered as semi-compliant based on the survey responses by municipal representatives to the Exploring Solutions provincial drinking water study. The questionnaire results suggested that mining, recreational uses and residential cabins were permitted within the watershed. Therefore considering the size of the watershed and its multiuse nature, monitoring is a challenge in the community. The existence of illegal cabins and limited monitoring and enforcement of regulations due to the size of the water supply area and its multiuse nature are key factors that limit full compliance. Reporting of these activities to the appropriate provincial authority can help, but often this does not occur.

#### **4.3.3 Non - Compliant**

The Open Flow (OF) and Free Flow (FF) communities have been identified as non- complaint communities in this study based on the responses provided by the community's representatives to

the Exploring Solutions survey (i.e., the responses suggested that the community was non-compliant in most key aspects of designation and PPWSA regulations involving restrictions and monitoring activities within drinking water sources).

#### **i. Open Flow (OF) Community**

The Open Flow (OF) community<sup>6</sup> has a population of approximately 600 according to the 2016 population census (Statistics Canada, 2017). A municipal representative explained that the community gets its drinking water supply from a neighbouring community (OF2). The intake valve is located in OF2 which has a population of approximately 1000 people according to the 2016 population census (Statistics Canada, 2017). For the purpose of this case study, both communities will be considered as one (OF and OF2). OF2, the neighbouring town where the OF community gets its water source, is responsible entirely for monitoring and testing of the source water. The town of OF receives its water from OF2 based on 60-40 cost sharing arrangement (the town of OF pays 40% of the total costs of system operations), while there is 50-50 cost sharing on major breakdowns of the system. The community was considered to be non – complaint based on responses provided for the Exploring Solutions survey, which indicated they did not ban any of the prohibited activities within their drinking water source.

The town's drinking water quality is not ranked according information from the drinking water portal due to the presence of high THM values exceeding acceptable guidelines. In addition to the regular water quality testing of Service NL, the OF1 community also conducts its own water testing every two days for chlorine. The OF municipal representative interviewed said that:

Before we add chlorination, our water was pretty deplorable actually. The last few years we've had a new system in. We still get a lot of stone and sand in the system, but we do testing. We do our own testing within our municipality and that's the only thing I can talk

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<sup>6</sup> Two communities considered as one for this case study.

about... in our municipality, every two days we do test the water for Chlorine and Service NL do it regularly.

Though the source is in another community (OF2), the interviewee confirmed that drinking water source has PPWSA designation and the neighbouring community is responsible for its protection.

The source water is protected. There is no fishing or activities within the area. Its posted. They do their best they try to make sure there is no activity or any kind of snowmobiling, quad use or fishing, that kind of activity within the water source.

The survey results from OF2 confirm that indeed there are restrictions on activities around the watershed that are likely to contaminate the drinking water source. However, the OF municipal representative had some concerns with regards to enforcement of SWP regulations. He/she was of the opinion that there should be more regulations relating to water testing at the source and greater enforcement:

There should be some kind of regulation or enforcement saying this should be done and needs to be adhered to. It's a little soft right now, but I think we need to check to make sure the numbers are posted and makes sure your community is doing whatever you can to make sure that, that water that's at the source is good drinking water that is safe for your community.

For the OF community, he/she further stated;

We are doing what we can do but we want to make sure that the host community (the intake) is doing what they can. ....We do everything possible actually when it comes to drinking water to make sure it is reliable.

The municipal representative interviewed had very little knowledge of the water operations of the OF2 community except to say that:

.... I don't know if they do their own testing but they do rely upon the government services water drinking analysis and the quality index reports and stuff. So, I don't know what kind of reporting they do individually, but I know what kind of testing we do when it meets our community.

With regards to monitoring and enforcement of prohibited activities within drinking water sources as required of PPWSA designations, the interviewee stated that this was done to some extent:

I don't think a lot of the enforcement is done to the point where it's heavily done. Some enforcement is done. I know there is no swimming in that area, like I said, the fishing you can pretty well almost control it but I can't sit here and say it's 100 percent for sure something is being done. Some enforcement is being done because you can see the water source from the community, so you are pretty aware of what is going on that area.

The municipal representative does not recall any violations within the drinking water source during his/her involvement with the affairs of the community for more than 20 years, apart from a deceased animal or moose. He/she stressed, however, the importance of enforcing regulations and training drinking water operators. In his/her opinion government funds should only be given to people who adhere to the regulations and avail themselves for training. That may enhance compliance with the regulations and ensure enforcement;

I think when you are training, there should be proof enough that you are doing and availing your end of the agreement when it comes to clean drinking water. If you are not availing yourself for training schedules or you are not getting trained, government should come and say that we are not going to give you money on this end if you are don't comply on the other end. Maybe some regulation or some enforcement that way.

Human resource challenges, including the lack of volunteers, was a source of concern expressed by the interviewee. He/she stated that:

I think lots of people become complacent after some time. Its not that they don't care, its that they don't realize it, only if it happens somewhere and then they say okay is this going on in my community too? I think certainly a lot of people just put it in the back burner. They don't really understand... People just don't look at it until it happens in someone else's back yard, and then its far too late. Regular home owners probably don't look at it that way but I think for a community, especially when you are supplying a resource to your community, I think you should be more aware of what you are supplying especially when it comes to clean drinking water and stuff.

According to the municipal representative, the residents of the community feel safe about their drinking water because they have enough information from the municipal office. He/she

added that information is very accessible and readily available and there is excellent communication between the people and the municipal office, hence the people are aware of what kind of testing is conducted by the municipality and Service NL. The municipal representative further added that successfully managing drinking water resources comes down to resources:

If you got lack of resources, you got lack of getting the information or doing the job that you should be doing. It all comes in at the end of the day to making sure that you have the money available to do the right testing or have the right components in place to make sure that the job that you are doing or needs to be done, can be done and can be done correctly.

Finances are a major challenge that communities face, but it comes down to what you take as a priority. Communities might have several priorities at one time and several community needs must be juggled, sometimes pushing drinking water to the back seat, according to this interviewee, even though it should be at the very top because everybody needs water to survive.

Water and waste water is some of the biggest problems that we have in rural Newfoundland, some of the biggest issues and something that we must deal with and trying to deal with federal and provincial regulations is sometimes not the best to deal with, especially, we are dealing with lots of the waste water regulations too now. Drinking water is something that you need, something that you need to look at so regulations needs to be enforced but you need to ensure that, you have the money and the people to do that.

Finally, the municipal representative shared some recommendations with regards to drinking water management:

Make sure that drinking water is your priority and stays on top there. Make sure you have qualified and professional people to deal with situations and make sure that your water testing is done. Make sure you probably know what your water and water analysis is and at least make the numbers available to the people. Make sure that you understand what drinking water should be and what needs to be done within your community. ...Educate yourself, do the best that you can do.

In summary, implementation gaps existed in this community particularly with regards to enforcement of banned activity regulations like fishing. Capacity issues identified included financial and human resource challenges. Education and hiring of qualified water operators were identified as solutions to some of the challenges the community faced.

## **ii. Free Flow (FF) Community**

The community of Free Flow (FF) has a population of just under 10,000 according to 2016 population census (Statistics Canada, 2017). The quality of water in the community is good and meets all the parameters outlined by the Canadian Drinking Water Guidelines (CDWQ) according to the drinking water portal. Hence, it is considered a safe potable drinking water supply. According to a municipal government representative, the provincial drinking water portal rates the water quality of the community as excellent and very good respectively<sup>7</sup>. However, there is some dissatisfaction with the taste of the water. In particular some residents have a problem with taste within a particular portion of the water supply, according to a municipal government official interviewee.

Whilst the initial Exploring Solutions survey results suggested that the community does not prohibit any of the banned activities under PPWSA regulations, the interview with a municipal government representative suggested otherwise. He/she revealed that the community's drinking water source is designated as a PPWSA and the nature of its protection conforms with the provincial regulations. The municipal government representative further stated that "we work with the provincial government to test the water daily and we follow all of the provincial, federal regulations". Access to the water supply area is gated and controlled, hence the public does not have access to the area. Additionally, physical monitoring is conducted by staff members to make sure that there is nothing that will impair the quality of the water:

Our workers monitor the location of the wells, and actually they monitor the wells and the vicinity of the water treatment plant. They do physical monitoring of the wells and the area to make sure there is nothing deleterious happening in that area. No harmful activities have been recorded by the community in the monitoring of the area.

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<sup>7</sup> The community has two different drinking water sources, hence the two different ratings on the portal.

The proximity of the water supply area results in regular monitoring of the area to address all potential issues of contamination. An interviewee revealed that:

There are no challenges to the town's monitoring of the water supply because its close to the public, the public do not have access to the area. We don't have any issues with any conduct or potential contamination of the water supply area..

There is an extremely high general awareness of drinking water issues in community resulting in regular reporting of drinking water issues in the media and on social media. Nevertheless, the municipal government representative further stated with regards to the provincial water portal that:

I think that is good and like we know its there as at hand, but for the general public, I don't think it is enough. I think it needs to be just better communicated in plainer language and different means of communicating it as well because not everyone goes onto websites anymore.

Financial challenges, maintenance and distribution systems are major issues constraining the provision of drinking water in the community according to a municipal government representative:

the maintenance and reinvestment into the distribution systems is a big expensive task and I sometimes worry about who is going do that and where is the money going come from for all the reinvestment and I also worry about sometimes about the quality of distribution systems in people's homes especially homes and how that can impact water quality where the issues maybe within the homes themselves.

In summary, the community was considered non-complaint based on responses to the Exploring Solutions survey that suggested limited monitoring of source water. Financial and human resource challenges were identified as major capacity issues in the community while strengths included greater awareness of drinking water issues in the community in recent years, resulting in regular reporting of drinking water issues in the media and and some level of monitoring.

#### 4.4. Summary

This chapter presented the results from all data collection methods. Document analysis and case studies point to the capacity factors in drinking water management specifically with regards SWP in NL. The results point to some extent to the presence of SWP policy implementation gaps in NL specifically, particularly limited watershed monitoring (e.g. as evident in survey data and in the case studies). The case studies in this research identified compliance concerns with PPWSA regulations in four communities (see table 18). It should be noted that there were differences in findings from the Exploring Solution study and interviews conducted during this research. This may be a result of limited understanding of survey questions on the part of community administrators, changes over the time period of the two studies, and/or different people offering different perspectives.

**Table 18: Summary of Community Case Studies**

Community Group	Community Name	Non – compliant Activities	Compliant Activities	Contributing Factors
<b>Compliant</b>	(PW) Community		<ul style="list-style-type: none"> <li>- No built infrastructure</li> <li>- No cabins or industrial development- Minimal human activity</li> <li>- Mounted signage</li> <li>- Conducting regular monitoring</li> </ul>	<ul style="list-style-type: none"> <li>- High level of public enforcement</li> <li>- Financial challenges</li> <li>- Human resources</li> <li>- Education of water operators</li> </ul>
<b>Compliant</b>	(CW) Community	<ul style="list-style-type: none"> <li>- Possible hunting and fishing, dumping, wood cutting</li> </ul>	<ul style="list-style-type: none"> <li>- Restrictions on activities: no hunting, no fishing, no ATVs, signage</li> <li>- Some monitoring but rely on public</li> </ul>	<ul style="list-style-type: none"> <li>- Two certified water operators</li> <li>- Distance to drinking water source</li> <li>- Public enforcement</li> <li>- Monitoring challenges</li> <li>- Limited awareness and knowledge of responsibilities</li> </ul>
<b>Partial Compliant</b>	(QB) Community	<ul style="list-style-type: none"> <li>- Local skidoo trail bridge acrosses the water supply source</li> <li>- No monitoring of water supply area</li> </ul>	<ul style="list-style-type: none"> <li>- “No entry” and “no swimming” signs</li> <li>- Gate across with the signs.</li> </ul>	<ul style="list-style-type: none"> <li>- No provincial designation (no reason)</li> </ul>

				- Very little development or human activity occurring near the water supply	
<b>Partial Compliant</b>	(DB) Community	- Illegal cabins and cabin related activities like fishing and swimming permitted		- Restricts and regulates activities like mining, forestry and quarrying	- Concern about the (huge) size of the watershed - Watershed management committee and plan
<b>Non-Compliant</b>	(OF) Community	* No restrictions on swimming, material deposit (dumping) <sup>8</sup>		- Restrictions on some activities like fishing - Signage	- Human resource challenges, including the lack of volunteers - information is very accessible and readily available and there is excellent communication between the people and the municipal office - Financial challenges
<b>Non-Compliant</b>	(FF) Community	* No restrictions on swimming, material deposit (dumping), Fishing, swimming <sup>9</sup>		- Monitoring	- Greater public awareness - Financial challenges - Human resource challenges

As illustrated in table 20, types of non-compliance include illegal cabins and cabin related activities like fishing and swimming and no monitoring of water supply areas. On the other hand, positive results include restrictions and regulations of activities like mining, forestry and quarrying. Institutional, financial, technical and social capacity factors were identified in the as factors accounting for the SWP policy implementation gaps. Some of the most common factors noted were limited funds and lack of qualified water operators as well as the difficulty monitoring distant water sources, particularly when human and financial resources are limited. Lack of SWP awareness on the part of the both the public and municipal officials, and multiple watershed uses

<sup>8</sup> According to community representative responses from the Exploring Solutions survey.

<sup>9</sup> According to community representative responses from the Exploring Solutions survey.

were also identified in both data collection phases, including community case studies, as factors for implementation gaps. A discussion of these results follows in the next chapter.

## CHAPTER FIVE

### DISCUSSION OF RESULTS, CONCLUSIONS AND RECOMMENDATIONS

#### 5.0. Introduction

This chapter focuses on providing answers to the research questions posed in chapter one by drawing from the results discussed in chapter four. The results from this research are discussed in relation to the four types of capacity factors identified in the literature as contributing to policy implementation gaps generally, and SWP gaps more specifically (institutional, financial, technical/human and social capacity). Additionally, the chapter offers reflections on the limitations of this study and recommendations for future research.

#### 5.1. SWP Policy Implementation Gaps

This study first sought to determine what, if any, deficits/shortcomings exist in the implementation of protected water supply regulations in NL. The study results from the case study analysis reveal disparities in the implementation of SWP related policies and regulations in NL, especially with regards to three major areas: 1) enforcement of section 39(4) of the NL *Water Resources Act* (2002) on prohibited activities within PPWSA; 2) compliance with the provisions on watershed monitoring around PPWSAs; and 3) recruitment of qualified drinking water operators as stipulated in permits to operate drinking water systems in the province, who in turn contribute to SWP activities. Additionally, study findings indicated limitations in the identification existing and future threats to drinking water supply and the formation of watershed management plans and committees.

As stated in Chapter 2, section 39(4) of the NL *Water Resources Act*:

a person shall not (a) place, deposit, discharge or allow to remain in that area material of a kind that might impair the quality of the water; (b) fish, bathe, boat, swim or wash in, or

otherwise impair the quality of the water; or (c) use or divert water that may unduly diminish the amount of water available in that area as a public water supply.

(Government of Newfoundland and Labrador, 2013, p. 3-4)

Although this provision in the NL *Water Resources Act* seeks to protect the pristine nature of water sources in the province, research results revealed that four out of six case study communities do not fully enforce these prohibitions within their PPWSA. Comparably, Exploring Solutions survey results suggested 43%, 22% and 2% of LSDs, municipalities with populations under 1000 and equal to or above 1000 respectively did not prohibit any of the banned activities (suggesting that this is a concern primarily in many of the province's small communities), whilst 47% of participating LSD's did not ban boating, fishing and material deposits in their drinking water source. Document review also suggested similar findings of non enforcement and compliance with the regulations on probited activities. Finally, while none of the case study communities in this research were found to be non-compliant with all provisions of section39(4) of the Water Resources Act SNL 2002 cW-4.01, compliance was discovered to be taking place to varying degrees. For example, due to the size of some of the watersheds of some communities, multiple uses were permitted such as fishing and swimming in the case study community of DP. This is supported by existing literature from the Indian Bay watershed (Holisko et al., 2014).

Additionally, contrary to the requirements for communities to take on the responsibility of watershed monitoring within PPWSA, survey results suggest that 12% and 2% of municipalities with populations 1000 or fewer and over 1000 respectively used volunteers to monitor their source drinking water supply on a regular basis whilst, 20% of LSDs, 11% of municipalities with populations below 1000 and 10% of municipalities with populations 1000 and above conceded that they do not monitor activities in their drinking water supply areas at all. Due to scarcity of resources four out of six cases depend on volunteers who have no obligation to assist with or even

carry out this responsibility in the community or on paid water operators who may not be adequately trained. Further, insights from secondary document review suggest similar trends in many communities in NL.

Finally, according to the regulations for obtaining their permit to operate drinking water sources, communities are required to employ qualified drinking water operators to manage their drinking water systems. Survey results revealed that 50% of water operators for LSD's were volunteers, whilst 31% were paid but only part-time. Additionally 34.5% were uncertified according to reports, whilst 34% of respondents did not know if their water operators were certified or otherwise. Furthermore, the community administrator and water operator surveys also revealed that uncertified water operators are common in municipalities of 1,000 residents or less (MOTOLs), specifically, the survey results indicated that 21% of MOTOLs have water operators with no certification. Additionally, while it was a challenge for communities of 1000 or fewer residents to comply with recruitment and retention of qualified drinking water operators, this was not found to be a problem for communities over 1000, highlighting compliance variations due to the size of the communities (i.e., greater challenges for small communities).

Watershed management committees are critical because they oversee potential development, land use management and conflicting resource uses within PPWSA (Government of NL, 2015). Despite the crucial role of watershed management plans and committees to successful SWP, it was discovered that, particularly in rural NL, a SWP implementation gap currently exists as few watershed management plans exist. For instance, there are only five watershed management committees (Clareville, Corner Brook, Gander, Grand Falls-Windsor, and Steady Brook), and three watershed management plans (Corner Brook, Gander, and Steady Brook) out of the five committees (Government of Newfoundland and Labrador, 2016). Minnes & Vodden (2014) have

suggested inadequate capacity as one reason why many NL communities (including compliant case study communities) have not developed watershed management plans. According to Guo (2014) various expertise and skills such as technical expertise, group facilitation, project management, data analysis, communication, and public relations are needed for implementing a watershed management plan and the watershed management committee. Therefore, successful implementation of watershed management plans and committees requires financial, technical and human resource capacities which is often non-existent or insufficient in many communities in NL, including case study communities from this study.

Overall, these findings suggest that there are significant gaps in implementation of SWP policies in NL and support the statement of one interviewee who believes: “There should be some kind of regulation or enforcement saying this should be done and needs to be adhered to. It’s a little soft right now.”

## **5.2. Contributing Factors to SWP Implementations Successes/Failures (Capacity Factors)**

The results of this research demonstrate that limited capacity (including financial, institutional, technical/human and social factors, some more important than others) is the main reason for the SWP policy implementation gaps in the province of NL. Study results further revealed that capacity limitations hindered the ability of many communities to employ and retain qualified drinking water operators. At least two of the case study communities in this research have been unable to employ such operators, due mainly to financial and human resource capacity challenges. For instance, one interviewee stated that, “Drinking water is something that you need, something that you need to look at so regulations need to be enforced but you need to ensure that you have the money and the people to do that.” Another interviewee states that, “We’ve had

struggles recruiting people and in some cases retaining people with the right qualification and training that's needed to operate, maintain the water system”.

The capacity deficiencies noted in this study and suggested in previous research are not unique to the NL province alone, but are evident in numerous small Canadian communities and even common internationally among other communities (Ferreira et al., 2008; Hanharan and Dosu, 2017). The study found that the levels of capacity deficiencies for SWP in NL varied from community to community due to several factors, including size and resources availability (financial and human resources being particularly critical and apparently linked to community size). These factors (such as insufficient financial capacity, limited funds, lack of awareness, amongst others) are discussed in detail below based on their prevalence within the data.

Insufficient financial capacity was the most dominant factor contributing to the existence of policy implementation gaps in NL communities according to study results. This is supported by the assertion of Timmer et al. (2007), Wang (2014) and others that communities require financial capacity to be able to successfully develop, implement and maintain SWP policies and regulations:

without sufficient funding, many constraining factors relating the plan implementation will occur, such as lack of public education and awareness, lack of government communication, lack of staff stability and encouragement, lack of information sharing and lack of professional development.

(Wang, 2014, p. 61)

The study results suggest that three of the six case study communities in NL lack the necessary funds required for time and travel to monitor large watersheds. Limited financial capacity results in policy implementation gaps in the province as communities are unable to completely comply with the SWP provisions on monitoring under their permit to operate drinking water systems or, in most cases, to create watershed management plans and committees. Results also suggested that many communities such as the PW, CW and DB communities do not have the financial capacity

to employ qualified water operators to manage their community's drinking water supply, including their SWP efforts. This gap in human resources capacity is discussed further below.

Following the financial challenges raised, the next most prevalent concern was human resource capacity. Human resources, with adequate knowledge, skills and experience are needed to properly create source protection plans and implement related measures (see table 10). Research results suggest that recruiting and maintaining qualified and well-trained staff for SWP and drinking water management in NL is a major challenge for many communities. As expressed by a municipal representative, "We've had struggles recruiting people and in some cases retaining people with the right qualification and training that's needed to operate, maintain the water system". Not all communities had human resource challenges, however, particularly the bigger communities. One municipal representative stated that:

I think we have no problem doing it, 'cause we are little bit bigger community. We are a larger community and we have some staff. Well, I can definitely see it being a problem for a lot of communities that might have one only staff, or only one volunteer person looking after the water. We are a lucky, we are larger ..... We have some manpower, so there is no issue for us I don't think.

Results also indicated that some municipal government officials and drinking water operators lack the technical capacity for understanding threats to source water. Education and training of drinking water operators in NL communities is important to successful SWP policy implementation. Therefore, Hamdy et al. (1998) states that: "training and staff development should undoubtedly have high priority for source water protection".

Institutional capacity refers to legislation, regulations, policies, protocols, governance arrangements and delegation of responsibility to plan and enact SWP (see table 10). Evidence of institutional capacity issues from the study included limited enforcement and "soft" regulation of SWP. While Exploring Solutions survey results revealed that 76% of municipalities agree that

provincial regulations around drinking were appropriate for their community, several interviewees in this study suggested the need for regulations and enforcement of them to be strengthened. For instance, a municipal official stated that:

There should be some kind of regulation or enforcement saying this should be done and needs to be adhered to. It's a little soft right now, but I think we need to check to make sure the numbers are posted and makes sure your community is doing whatever you can to make sure that, that water that's at the source is good drinking water that is safe for your community.

Another municipal representative further stated that:

we just need stronger regulations and I know that will come with a resistance for a lot of people because if you force someone that their maintenance person has to go out and drive two hours to do training course, that has to find something more there. So, I know there will be some kickbacks but the benefits to the community no doubt will be good returns for your "buck" if you have your people trained to do the job they are doing.

Yet another stated that:

Enforcement is the problem, if someone is doing it, someone is not trained, there is no fine for it. You just get a little letter saying by the way your water operator should be trained.... it's just like a slap on the wrist or even lighter than that. So, enforcement needs to be more strengthened in lots of cases.

The absence or limited education of municipal government officials and community members on issues of SWP regulations and policies was a major factor contributing to implementation gaps in the province. It appears that very little awareness has been created on water related issues and particularly the importance SWP among residents. An interviewee stated, for example, that

I think lots of people become complacent after some time. Its not that they don't care, its that they don't realize it, only if it happens somewhere and then they say okay is this going on in my community too? I think certainly a lot of people just put it in the back burner, they don't really understand THM's or other materials that are found in your water source.

Without educating and creating awareness at the local level about SWP policies and regulations, implementation inconsistencies are bound to occur. The findings of this research further suggest

how important this awareness is when members of the public are being relied upon to assist with identifying and reporting on threats. According to an interviewee, “the communities are the ones that know the area the most because they are the ones that are out on the field doing their own you know personal things as well as the work things”. Successful SWP policy implementation therefore depends on the members of the community, particularly in communities with very large watersheds.

To conclude, the major SWP policy implementation gaps identified in this study included the lack of capacity within NL communities to monitor watersheds and enforce regulations on restricted activities within PPWSA. These implementation gaps, according to the study, exist mainly due to capacity limitations that include financial, technical/human, institutional, and social aspects respectively, presented in order of importance from the case studies and other evidence provided above. Small communities with large watersheds are particularly challenged in this regard. It should be noted as well that there are strong interconnections between the various types of capacities discussed. For instance, technical/human capacity depends on the availability funding to pay staff and conduct training programs, whilst institutional capacity requires people for successful policy design and implementation.

### **5.3. Recommendations for Addressing Gaps**

Recommendations for addressing implementation gaps in SWP policy and regulations in NL are discussed below.

### **5.3.1. Adequate Financial Support for SWP**

Financial challenges for undertaking and complying with SWP activities and regulations were one of the major findings of this study, ultimately contributing to the SWP policy and regulation implementation gaps in NL. This is particularly evident in small communities with limited source of revenue. Adequate financial support and funding opportunities for SWP related activities is key to addressing the existence of implementation gaps. Ensuring the appropriate level of investments from stakeholders (governmental and non governmental organizations), both financially and from a perspective of human resource capacity, is critical to ensure that source water protection regulations and associated policies and programmes are implemented (WHO, 2011). Limited or no funding implies that activities related to watershed monitoring, education and public awareness, communication and recruitment of qualified staff will be affected and ultimately result in compromises to safety of drinking water supplies.

Financial viability of the source water protection plan and process is critical, especially over the long-term. Funding may be needed for specific pollution control activities, including civil works, stakeholder awareness, engagement and conflict resolution, and for the inspection of activities and checking of compliance (WHO, 2011, p 3)

### **5.3.2. Communication, Education and Awareness**

SWP implementation gaps can be addressed through education, training and awareness. As stated by the WHO (2011) to minimize implementation gaps there must be adequate resources dedicated to education and awareness building on the importance of SWP regulations and policies to drinking water safety. Islam et al. (2011) have suggested that educating the public is crucial to the many facets SWP, for instance, if not through direct human health risk, then through their support of successful regulatory implementation. Additionally, education and awareness according to the WHO (2011, p.3) “helps improve stakeholders’ [water operators, municipal and provincial

government officials, community members, etc] understanding of the importance of source water protection and can mitigate the impact stakeholders have on source waters.”

Capacity building at the local level through education, awareness creation and collaborative approaches must be encouraged and sustained across the province to help bridge implementation gaps. In this regard Edinger and Hermanutz (2015) have stated that,

more effort should be done to create connections between residents and their natural environment, encouraging them to take personal pride and interest in their local environment. For instance, municipal government and local NGOs should help familiarize local residents with their natural environment, raising awareness about the environment and, more importantly, creating a sense of stewardship and ownership (p.60).

Given limitations in public and municipal awareness of the importance of SWP and SWP requirements, more education and capacity-building opportunities are needed for decision makers such as mayors, councilors and town staff concerning best practices for managing drinking water systems and land owners and other local individuals and groups. For example the drinking water workshop organized by the MNL and the Environmental Policy Institute, Grenfell Campus must be sustained and made accessible to many communities in NL.

### **5.3.3. Community Involvement and Participation**

Community involvement and participation in provincial policy decisions must also be prioritised (Illsley, 2003). This will enhance implementation success and reduce implementation gaps. Local community members also have a significant role to play in addressing implementation gaps according to Timmer et al. (2007) in developing and enforcing SWP regulation. Provincial authorities should therefore consult and cooperate with municipalities and other communities (e.g. LSDs), NGO's, and all water resources stakeholders for their input and suggestions to maximize effectiveness. According to de loe & Simms (2009, p.1):

Many threats to the quality and quantity of drinking water sources are local in nature. Therefore, most countries around the world realize that municipalities, local water management agencies, land owners and other local actors must be involved.

Additionally, capacity-building opportunities for municipal representatives, such as the drinking water workshop organized by MNL, should be organized annually and the materials made accessible to all municipalities.

#### **5.3.4. Collaboration**

As noted by de loe & Simms (2009) collaborative approaches to water governance is another way of ensuring successful policy implementation and addressing inconsistencies in SWP. As Minnes & Vodden (2017) suggest, local, provincial and federal governments in NL ought to collaborate with non-governmental organizations, community-based organizations and academia to ensure successful drinking water management and SWP. For instance, allocation of funds by the provincial governments for drinking water in NL increased with encouragement from the collaborative efforts of the Environmental Policy Institute (EPI) and MNL (Kean, 2017). This collaboration between EPI and MNL involves drinking water research and dissemination of this information to municipalities to aid them in their decision making. Increased collaboration is needed between MNL, the provincial government and Memorial University to enhance community-based research and ensure funding for the implementation of research findings, as suggested in document review.

According to the OECD (2015), collaborations with academic institutions can contribute to addressing implementation gaps in SWP through the production and sharing of technical and scientific data and facts needed for effective formulation of policies and decision making on SWP. Additionally improved communication through information and experience sharing can enhance

collaboration between municipalities and even better collaboration between provincial and municipal governments (Edinger and Hermanutz, 2015).

### **5.3.5. Strengthen Monitoring and Enforcement**

To address implementation gaps, provincial and municipal governments would have to do more with regards to monitoring and enforcement of SWP regulations and policies. As Edinger and Hermanutz (2015) state, a lot of improvement is needed when it comes to enforcing policies and regulations. This is corroborated by an interviewee who stated that:

enforcement is the problem, if someone is [not] doing it, or someone is not trained [water operator], there is no fine for it. You just get a little letter saying by the way your water operator should be trained.... it's just like a slap on the wrist or even lighter than that. So, enforcement needs to be more strengthened in lots of cases.

To successfully ensure compliance, therefore, with SWP regulations and policies in NL, provincial and municipal governments must make sure that there is punishment for those who engage in illegal activities to serve as a deterrent to others (e.g. larger fines). At the same time, people who are compliant should be recognised as motivation and encouragement to them and to others. For example, the annual drinking water operator award presented as recognition to deserving employees and volunteers who demonstrated professionalism and dedication to providing clean and safe drinking water in the NL province must be encouraged.

In summary, SWP policy implementation gaps occur mainly as a result of capacity limitations, as observed from the results of this study and existing literature. Therefore, capacity building, resource mobilization and cooperation are key to addressing existing implementation gaps. Key capacity gaps identified in this research include finance, human resource, social and institutional capacity limitations resulting in gaps in implementation of SWP policies and regulations.

#### **5.4. Limitations and Future Research**

Time and resource constraints limited the number of interviews conducted for this study and therefore the primary data available, particularly for the case study research. This also contributed to the researcher's ultimate choice of telephone interviews, which did not receive the anticipated participation from municipal government officials. It is anticipated that a greater response rate would have been achieved with in person visits to the communities. Therefore, the researcher suggests that a more comprehensive study on SWP barriers and solutions be carried out province wide using a mixed method approach and in-person interviews, possibly combined with participant observation to provide additional insights regarding community conditions and from observing activities within drinking water supply areas. This would enable researchers to obtain first hand information on SWP policy implementation in the province.

Further research could also be carried out to determine the extent and ways in which specific capacity factors like finance or human resource contribute to SWP policy implementation (and implementation gaps) at the provincial level, such as recruiting and retaining qualified drinking water operators. Models for secure funding for SWP would also be useful to research further. Finally, how to get communities members to buy-in to watershed monitoring, particular in communities with large watersheds, deserves further investigation.

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## APPENDIX 1: ETHICS APPROVAL LETTER

**GRENFELL**  
CAMPUS



Research Ethics Board  
University Drive, Corner Brook, NL Canada A2H 5G4  
Tel: 709-639-2399 Fax: (709) 637-2885 <http://www.grenfell.mun.ca/research-ethics-board>

March 8<sup>th</sup>, 2017

Reference number: 20171323

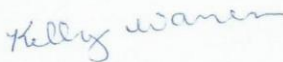
Dear Mr. Eledi,

Thank you for your application for ethical clearance for your proposal *Examining Policy-Implementation Gaps in Source Water Protection in Newfoundland and Labrador*. The Grenfell Campus Research Ethics Board (GC-REB) has reviewed your application and finds your proposal in ethical compliance with the Tri-Council Guidelines.

Your approval for this project expires on March 8<sup>th</sup>, 2018. To remain in compliance with Article 6.14 (Continuing Research Ethics Review) of the Tri-Council Policy Statement on Ethics in Human Research (TCPS2), should your project continue past that date, you are required to renew your ethics approval before that time. As well, please note that any changes to the proposed study will need to be cleared by the GC-REB first.

The Board wishes you success with your research.

Best wishes,

A handwritten signature in blue ink that reads 'Kelly Warren'.

Kelly Warren, Ph.D., Chair

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### IMPORTANT REMINDERS – PLEASE READ:

**Student Project(s):** you must maintain active ethics clearance until the final version of your thesis/dissertation has been approved by your department / the School of Graduate Studies. If you have graduated prior to receiving this notice, please note that you are still required to submit an annual update indicating completion of your project and requesting closure of your ethics clearance.

**Funded project(s):** it is strongly recommended that you submit your annual update at least 4 weeks prior to expiry of your clearance. Lapsed ethics clearances may have negative impacts on administration of your funding.

GRENFELL CAMPUS, MEMORIAL UNIVERSITY  
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FIND YOUR CORNER 

## APPENDIX 2: DOCUMENT ANALYSIS CODES

Awareness	Financial	Skidoo
Banning	Fishing	Snowmobile
Bathing	Forestry	Staff
Boating	Funds	Stewardship
Buffer	Human	Surveillance
BWA	Hunting	Sustainable
Cabin	Implementation	Swimming
Capacity	Infrastructure	SWP
Certification	Inspections	Technical
Challenges	Legislations	Technological
Collaborative	Maintenance	Threats
Complaints	Management	Training
Compliance	MBSAP	Treatment
Conservation	Monitoring	Uncertified
Consultations	Noncompliance	Unmonitored
Contamination	Operators	Unpermitted
Cooperation	Permits	Untrained
Coordination	PPWSA	Volunteers
Designation	Prohibit	Watershed
Developments	Recreational	Woodcutting
Ecosystem	Regulations	Zones
Education	Repairs	
Enforcement	Resources	
	Restrictions	

### APPENDIX 3: INTERVIEW GUIDE

1. What town do you live in?
2. What is your role in your community?
  - Is your position paid full time/part time /volunteer?
3. How long have you been in this position?
4. How would you describe the quality of your town's drinking water before treatment (when it comes from the source)?
5. Is your water source designated as a protected public water supply area?
6. Are there any activities that are allowed or prohibited in your PPWSA?

Examples include:

- place, deposit, discharge or allow to remain in that area material of a kind that might impair the quality of the water
  - fish, bathe, boat, swim or wash in, or otherwise impair the quality of the water
  - use or divert water that may unduly diminish the amount of water available in that area as a public water supply
  - use or divert water that may unduly diminish the amount of water available in that area as a public water supply.
7. Are there activities that are not prohibited that you think should be? Please explain what your concerns are and why they are not currently prohibited.
  8. Are there activities that are prohibited that you think shouldn't be? Please explain what your concerns are.
  9. Do you have permission from the Minister for permitted activities in PPWSA? (e.g. fish, bathe, boat, swim – will make reference to their answers to Q5)
  10. Does your town monitor your PPWSA?
    - If yes, how do you do this monitoring? Who conducts monitoring? How often?
    - Have there been any violations? What type? Who found the violation? How was it responded to?
  11. Are you successful with the implementation and enforcement of regulations protecting PPWSA in your community?
  12. What factors account for your community's success/ failure to enforce SWP regulations?

(Open question and then prompt on: financial, human resource, education)

13. Do you have any suggestions ideas with regards to the successful implementation of SWP regulations?

## **APPENDIX 4: SURVEY QUESTIONS ON PROHIBITED ACTIVITY**

### **Policies and Regulatory Framework of MUNICIPALITY Water Systems**

30. Which of the following activities are prohibited in your MUNICIPALITY's drinking water source (ground water of surface water).

Choose all that apply.

- ☐ Bathing or washing of clothes
- ☐ Boating
- ☐ Fishing
- ☐ Material deposit (i.e. dumping)
- ☐ Swimming
- ☐ Use or diversion of water for purposes other than drinking water supply
- ☐ None of the above. Please proceed to question 32

31. If one or more of the activities listed in Question 30 above are prohibited in your drinking water source, how are the restrictions monitored and enforced in your MUNICIPALITY?

Choose all that apply.

- ☐ My MUNICIPALITY's source drinking water supply is monitored on a regular basis by MUNICIPALITY staff
- ☐ My MUNICIPALITY's source drinking water supply is monitored on a regular basis by volunteers (e.g. council members, watershed organizations)
- ☐ My MUNICIPALITY's source drinking water supply is monitored occasionally by MUNICIPALITY staff
- ☐ My MUNICIPALITY's source drinking water supply is monitored occasionally by volunteers (e.g. council members, watershed organizations)
- ☐ My MUNICIPALITY's source drinking water supply is only monitored when there are complaints
- ☐ My MUNICIPALITY does not have the human resources to monitor activities in our drinking water source
- ☐ When a prohibited activity is observed or reported, the MUNICIPALITY notifies the Department of Environment and Conservation
- ☐ Other (please specify)

32. Has your MUNICIPALITY ever purchased or expropriated lands next to the MUNICIPALITY's water supply to prevent pollution in those waters?

☐ Yes

☐ No

☐ Don't know

33. Based on your knowledge and experience, are the Province's current policies and requirements for drinking water appropriate for your MUNICIPALITY?

☐ Yes

☐ No

☐ I don't know

If you answered no, why not? What drinking water policies or requirements would you like to see changed?