Identifying Drinking Water Regulatory Frameworks

Danielle Hubbert, MPA Candidate

School of Public Administration

University of Victoria

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Client:	Jamie Lafontaine, Program Manager Environmental Public Health Division, Health Canada
Supervisor:	Dr. Kimberly Speers School of Public Administration, University of Victoria
Second Reader:	Dr. Catherine Althaus School of Public Administration, University of Victoria
Chair:	Dr. Richard Marcy School of Public Administration, University of Victoria

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EXECUTIVE SUMMARY

INTRODUCTION

For most communities in Canada, drinking water quality is regulated by the provinces and territories. For First Nation communities, provincial legislation and regulations do not apply, as the Government of Canada has exclusive authority to create legislation for these communities. Currently, there are no regulations governing drinking water quality for First Nations communities. In 2005 and 2011 audits, the Office of the Auditor General of Canada (OAG) (2011) points out that "First Nations communities did not benefit from a level of drinking water protection comparable to that available to people living off reserves because provincial legislation and regulations are not applied on reserves" (p. 15). The policy problem to be identified in this project is the lack of drinking water regulations for First Nations communities, which creates a regulatory gap between these communities and non-aboriginal communities in Canada.

Drinking water safety for First Nations communities is a complex problem with many challenges. The 2011 report produced by the OAG noted that absence of drinking water legislation, and subsequent regulations, among First Nations communities in Canada can lead to barriers to drinking water monitoring, such as a lack of clarity concerning roles and responsibilities (OAG 2011, p. 3, 16).

The current responsibility for drinking water safety is shared between First Nations communities, Health Canada, Aboriginal Affairs and Northern Development Canada (AANDC), and Environment Canada. Typically drinking water service facilities are owned and operated by First Nations communities themselves; however, 19% have municipal-type agreements (MTA) for the provision of water to their drinking water systems (INAC 2011, p. i).

The Minister of Aboriginal Affairs and Northern Development proposed new legislation (Bill S-8, *Safe Drinking Water for First Nations Act*) to address drinking water in First Nations communities. Passed into law on June 19, 2013, the Act grants the Minister of Health exclusive authority to make regulations regarding drinking water quality standards, as well as share joint authority with the Minister of Aboriginal Affairs and Northern Development over monitoring, reporting, testing frequencies, drinking water advisories and specific emergency measures in the event of contamination of water on First Nations lands. The Act is intended as enabling legislation for a regulatory framework (AANDC 2013). In addition, the Act includes a provision that would allow subsequent regulations to incorporate by reference provincial drinking water regulations. This would bring uniformity to regions, where all communities of the same size and delivery capacity would adhere to the standards of the province.

Non-governmental organizations have criticized the degree of First Nations involvement in developing enabling legislation for regulations, largely for determining the next course of action before engagement with First Nations took place. Other concerns have been raised with the proposal of legislation for safe drinking water among First Nation communities, such as attempts by the federal government to offload responsibilities and gaps in infrastructure and resources, which will make it difficult to implement regulations without additional federal assistance. Although the engagement process on the development of the new legislation has been criticized for not engaging enough with First Nations, AANDC (INAC at the time) also accepted written submissions (e.g. e-mail, fax or mail) until April 17, 2009 (AANDC 2012d). It is important to note that since the formal round of consultations for the former Bill S-11 (introduced in Parliament most recently as Bill S-8), discussions continued between the Government of Canada and First Nation organizations from October 2010 to October 2011 (AANDC 2012a). In addition, federal investment in drinking water for First Nations communities will continue after the regulations are in place (AANDC 2012d).

The intention of this research is to identify regulatory frameworks and programs pertaining to drinking water monitoring for Indigenous communities to inform the development of drinking water regulations for First Nations communities in Canada. This research focuses on drinking water regulations in the provinces and territories of

Canada, as well as the drinking water programs and regulations pertaining to Indigenous populations in Australia, New Zealand and the United States. Recommendations provided in the project were informed by the analysis of interviews and the regulatory frameworks identified in the jurisdictional scan, including programs pertaining to Indigenous populations from other jurisdictions.

METHODOLOGY AND METHODS

The report is based upon qualitative research comprising of three methodologies. The first methodology found in this report consists of a jurisdictional scan of the Canadian provinces and territories for the purposes of identifying existing drinking water regulations in the country. The primary data collection method used was a document review of the pertinent regulations and associated government publications. The second methodology is a current state analysis of drinking water monitoring among First Nations communities in Canada. The primary data collection method for this methodology was comprised of key informant interviews of Environmental Health Officers (EHOs) who work with First Nations communities in Canada. Finally, the third methodology is a comparative case analysis of international jurisdictions, specifically Australia, New Zealand and the United States. The primary data collection method for this international component consisted of key informant interviews of government employees working in drinking water program management or monitoring intended for (or including) Indigenous communities.

The research identified advantages and challenges to current drinking water monitoring approaches for First Nations communities, the feasibility of adopting regulations in First Nations communities, current standards across Canadian jurisdictions for non-Aboriginal communities, and a comparative analysis of the drinking water regulatory frameworks and programs pertaining to Indigenous populations in Australia, New Zealand and the United States.

FINDINGS

The research uncovered existing drinking water regulations throughout Canada, as well as regulations or programs pertaining to Indigenous populations in Australia, New Zealand and the United States. In addition, the research incorporated the observations of Environmental Health Officers (EHOs) who are employed by Health Canada and currently work in First Nations communities to gain an understanding of the impediments to achieving compliance with the *Canadian Drinking Water Guidelines*, as well as other challenges associated with drinking water that may pose risks to public health.

The main challenges to ensuring drinking water quality, as observed by Environmental Health Officers (EHOs) included issues relating to infrastructure, insufficient number of operators, insufficient training of drinking water personnel (i.e. truck drivers or operators), the size and capacity of the community, inaccessibility due to remoteness, the source of the water, as well as a lack of enforcement mechanisms. The perception of the quality and safety of the water supply was also discussed and the potential reasons that contribute to that lack of confidence, such as over chlorination, misreporting of drinking water advisories in the media and a misunderstanding regarding the factors that contribute to contamination among residents. When prompted to speak to the development of regulations, EHOs stated that the communities will need to be involved in the development of regulations and several suggested that drinking water regulations should come from within the community. Alternatives to regulations were not suggested by EHOs. Provincial drinking water standards were discussed with EHOs and confirmed to be used in their drinking water programs among First Nations communities.

Across the provinces and territories, municipalities were typically found to own and operate the drinking water systems, with the exception of Newfoundland. All jurisdictions in Canada were found to adhere to regulated standards that are either equally as stringent as or more stringent than the *Guidelines for Canadian Drinking Water Quality*. A common approach among Canadian jurisdictions and Australia, United States and New Zealand is the implementation of a multi-barrier approach to managing drinking water quality, which is aimed at reducing risks to

public health from drinking water contamination by integrating policies and procedures from the water source to the consumer to create preventative barriers (CCME 2004, p. 15).

Specifically relating to drinking water monitoring, several jurisdictions have strategic programs or tools intended to complement their regulatory frameworks. Some provinces have developed additional surveillance programs such as Ontario's voluntary emerging parameters program, which monitors parameters that are not contained in the Guidelines or provincial regulations, as well as PEI's program for monitoring pesticides in drinking water. Saskatchewan has developed the Drinking Water Quality Index, which ranks the quality of drinking water supplies intended for consumers. Tools intended for water suppliers to aid in delivering drinking water that is in compliance with the regulations and mitigate risks to public health were found in British Columbia (Source-to-Tap Screening Tool) and Alberta (Water Safety Plan), as well as a guidance document for small supplies in Manitoba. Although not directly related to monitoring, Quebec has a drinking water conservation program and Nova Scotia has a program to manage and protect watersheds, which are in keeping with multi-barrier approaches to drinking water.

From the research conducted on international jurisdictions, there were several program elements that would be worth further consideration because of their integration of risk management practices and/or policies that directly or indirectly serve Aboriginal populations. Australia and New Zealand both had tools or programs to assist small and/or remote communities in adhering to the legislated standards. In Australia, the community water planner is an online tool for managers of drinking water systems of remote areas to create water safety plans that are tailored to that particular community. In New Zealand, the Drinking-Water Technical Assistance Programme provides subsidized technical assistance to small water suppliers by various means, such as encouraging collaborative capacity building groups, as well as independent technical advice. The *Safe Drinking Water Act* in the United States includes a stipulation for federally recognized tribes to seek primacy, if they meet the requirements.

RECOMMENDATIONS

Based on the research conducted for this report, four primary recommendations are proposed: the incorporation by reference of drinking water standards; the multi-barrier approach; measures intended to improve compliance with regulations; and involvement of First Nations in the development of regulations.

Consistency between non-First Nation communities and First Nations communities may be achieved through the incorporation of provincial standards into drinking water regulations for First Nations communities in Canada. The *Safe Drinking Water for First Nations Act* includes a provision for subsequent regulations to allow for First Nations communities to incorporate the drinking water monitoring standards contained in the regulations of their respective provinces. It was uncovered in the findings through the EHOs interviewed that the First Nations communities they work with use a combination of the most stringent standards, between the standards found in province or the Guidelines for Canadian Drinking Water Quality. To ensure the regulations offer similar protection to First Nations communities as provided to non-First Nations communities by the provinces, it is recommended that the communities officially adopt the provincial standards for testing and treatment procedures, which would serve as a baseline requirement for all regulations as they relate to public health. Although, it is not necessarily recommended that full incorporation of the provincial drinking water regulations take place; instead it is recommended that First Nations communities are involved in the development of regulations, including determining the contents.

It is recommended that risk reduction measures are developed with the intention of contributing to compliance with the regulations. A multi- barrier approach is employed by all jurisdictions in Canada, as well as in Australia, New Zealand and the United States. Health Canada and AANDC has used a multi-barrier approach in the former First Nations Water Management Strategy (FNWMS) and following First Nations Water and Wastewater Action Plan (FNWWAP). First Nations communities may benefit from a regulatory framework that incorporates this approach, which will require continued coordination between Health Canada, AANDC, Environment Canada and First Nations communities. In addition, the existence of additional barriers in the prevention of risks to health may

improve health equity for First Nations communities relative to non-aboriginal communities that likely fall under a regulatory framework inspired by this approach.

It is recommended that continued collaboration with Environment Canada and AANDC after the development of drinking water regulations takes place for the purposes of harmonizing initiatives intended to ensure First Nations communities' regulatory compliance. It is important to continue to encourage communities to develop capacity to contribute to their drinking water management framework, while offering support to the communities that may lack the capacity to take on a drinking water program or innovative community-led programs that seek to complement drinking water regulatory compliance. Accordingly, it will be important for Health Canada to work together with First Nations, AANDC and Environment Canada beyond the development of enabling legislation to ensure common goals are met. To achieve this, an accompanying program that facilitates partnerships or agreements between First Nations communities, and possibly neighbouring municipalities, to collaborate is recommended. For example, New Zealand's Drinking-Water Technical Assistance Programme provides subsidized technical assistance to small water suppliers and encourages collaborative capacity building groups, as well as facilitators who provide training on how to write public health risk management plans. Also pertinent, the Community Water Planner tool in Australia is intended to serve as guidance for remote and Indigenous communities and generates management plans specific to the community. Also for the purposes of achieving compliance, it is recommended the accompanying drinking water programs facilitate community-led initiatives. More specifically, the WHO suggests moving beyond data collection to include other strategies in a surveillance program, such as public health education, as mentioned in the literature review section and discussed among EHOs.

In terms of building confidence in the resulting regulations, it is recommended that the regulations are developed in a manner that enables direct engagement with First Nations, such as determining the overall content of the regulations. Primary research from the perspectives of First Nations was not included in this report, and therefore any recommendations provided would need to be discussed with First Nations.

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1.0 INTRODUCTION

1.1 PROJECT CLIENT AND PROBLEM

For most communities in Canada, drinking water quality is regulated by the provinces and territories; however, provincial legislation and regulations do not apply to First Nations communities, as the Government of Canada has exclusive authority to create legislation for these communities (OAG 2011, p. 14-15). At present, First Nations communities in Canada do not have regulations governing the quality of their drinking water (AANDC 2012b). Therefore, "there is a regulatory gap between communities on reserve and those communities off reserve" (AANDC 2012b). The problem to be discussed within this project is the current lack of drinking water regulations for First Nations communities.

The responsibility for drinking water safety is shared between First Nations communities, Health Canada, Aboriginal Affairs and Northern Development Canada (AANDC), and Environment Canada. Health Canada is responsible for monitoring drinking water quality among First Nation communities south of the 60th parallel. Drinking water for communities north of the 60th parallel is the responsibility of the territorial governments, including First Nations and Inuit communities within their geographic boundaries (Health Canada 2013). AANDC, in collaboration with Health Canada, has developed the *Safe Drinking Water for First Nations Act*, which is enabling legislation intended to lead to the development of regulations.

Health Canada monitors and provides advice on drinking water quality to First Nations communities and AANDC through its Environmental Public Health Program. Specific to Health Canada, the work is carried out within the First Nations and Inuit Health Branch (FNIHB) by the Environmental Public Health Division, who is the client for this project. This project has been completed for Jamie Lafontaine, Program Manager of the Water Regulations and Data Analysis Unit within the Environmental Public Health Division.

1.2 PROJECT OBJECTIVES

This project is intended to serve as preliminary research for Health Canada by identifying existing regulatory frameworks of several jurisdictions, with a particular emphasis on drinking water quality monitoring requirements and standards for Indigenous communities. On June 19, 2013, federal legislation for First Nations drinking water passes into law in Canada (i.e. the *Safe Drinking Water for First Nations Act*). The Act grants the Minister of Health the authority to work in collaboration with First Nations to develop regulations on drinking water quality standards, monitoring and reporting practices.

Recommendations provided in the project were informed by the analysis of the key informant interviews and the regulatory frameworks identified in the jurisdictional scan, including programs pertaining to Indigenous populations from other jurisdictions.

The main research question of this project is:

- From a comparative perspective, what are the drinking water regulations and/or programs for Indigenous populations in Canada, Australia, New Zealand and the United States, with regards to standards, monitoring and precautionary public health measures?

The sub-questions are:

- What are the current challenges of drinking water quality, monitoring and reporting practices for First Nations communities in Canada?

- How do regulations for drinking water quality, precautionary public health measures and monitoring and reporting requirements differ across Canadian jurisdictions?

- What can be learned from the pertinent regulations for Indigenous communities in the United States, Australia and New Zealand?

1.3 RATIONALE OF THE RESEARCH

The intention of this research is to identify regulatory frameworks and programs pertaining to drinking water monitoring to inform the development of drinking water regulations for First Nations communities in Canada.

Currently, there are no regulations governing drinking water quality for First Nations communities. In 2005 and 2011 audits, the Office of the Auditor General of Canada (OAG) (2011) points out that "First Nations communities did not benefit from a level of drinking water protection comparable to that available to people living off reserves because provincial legislation and regulations are not applied on reserves" (p.15). The policy problem to be identified in this project is the lack of drinking water regulations for First Nations communities, which creates a regulatory gap between these communities and non-aboriginal communities in Canada.

Drinking water safety for First Nations communities is a complex problem with many challenges. The 2011 report produced by the Office of the Auditor General of Canada (OAG) noted that the absence of regulations among First Nations communities in Canada can lead to barriers to drinking water monitoring, including a lack of clarity concerning roles and responsibilities. Accordingly, the *Safe Drinking Water for First Nations Act* is enabling legislation that is intended to lead toward a regulatory framework. In addition, the Act includes a provision that would allow subsequent regulations to incorporate by reference provincial drinking water regulations. This would bring uniformity to regions, where all communities of the same size and delivery capacity would adhere to the standards within a province.

The project's client is interested in this particular issue at this time due to the proposal and passage of the *Safe Drinking Water for First Nations Act*. The new legislation would address drinking water in First Nations communities. This legislation grants the Minister of Health exclusive authority to make regulations regarding drinking water quality standards, as well as share joint authority with the Minister of Aboriginal Affairs and Northern Development over monitoring, reporting, testing frequencies, and specific emergency measures in the event of contamination of water on First Nations lands.

This research focuses on drinking water regulations in the provinces and territories of Canada, as well as the drinking water programs and regulations pertaining to Indigenous populations in Australia, New Zealand and the United States.

1.4 BACKGROUND

The drinking water outbreaks in the springs of 2000 and 2001 in Walkerton, Ontario and North Battleford, Saskatchewan were major events for drinking water policy in Canada. These incidents were the result of pathogen contamination of the drinking water supply. In the case of Walkerton, the supply was contaminated with *Escherichia coli*, leading to seven deaths and over 2,300 people becoming ill (Ontario Ministry of the Attorney General 2002a, p. 2). In the case of North Battleford, it is estimated that between 5,800 and 7,100 people became ill due to waterborne cryptosporidiosis (Health Canada 2010, p. 2).

Although the drinking water outbreaks of Walkerton, Ontario and North Battleford, Saskatchewan did not affect First Nations communities, AANDC (INAC at the time) and Health Canada responded by evaluating the approach of the time to ensuring safe drinking water for First Nations . The results of this assessment were released by AANDC in 2003 in the *National Assessment of Water and Wastewater Systems in First Nations Communities - Summary Report* and by Health Canada in 2007 in the *Summative Evaluation of the First Nations Water Management Strategy*. AANDC found that 24% of drinking water supply systems "pose[d] a potential high risk to water quality and safety and therefore to human health," while Health Canada's assessment "concluded that drinking water quality monitoring in First Nations communities was not sufficient to protect public health" (Health Canada 2010, p. 2).

In 2006, AANDC in collaboration with Health Canada, Environment Canada and the Assembly of First Nations (AFN) announced the development of the Expert Panel on Safe Drinking Water for First Nations, "to provide advice on options for an appropriate regulatory framework, including new legislation for drinking water and wastewater on First Nation lands" (AANDC 2013). The Expert Panel held engagement sessions with First Nations in nine locations across Canada and released its findings and recommendations in November 2006 (AANDC 2013; Swain, et al. 2006).

The current allocation of responsibility for drinking water safety is shared between First Nations communities, Health Canada, Aboriginal Affairs and Northern Development Canada (AANDC), and Environment Canada. Municipal governments of non-aboriginal communities do not possess jurisdiction over the management or provision of drinking water among First Nations communities; however, it is possible for First Nations communities to enter into municipal service agreements with neighbouring municipalities or other First Nations and these agreements may include the provision of drinking water. Typically drinking water service facilities are owned and operated by First Nations communities themselves; however, 19% have municipal-type agreements (MTA) for the provision of water to their drinking water systems; while 52% rely on groundwater and 29% rely on surface water directly (INAC 2011, p. i).

Drinking water monitoring is shared between Health Canada and First Nations communities. Health Canada works in partnership with First Nations communities under the Drinking Water Safety Program to ensure their drinking water is monitored according to the *Guidelines for Canadian Drinking Water Quality* (2013a, p.2). Through Health Canada's Community-Based Water Monitor program, funding is provided to Chief and Councils for drinking water monitoring and training is provided for Community-based Drinking Water Quality Monitors to test the drinking water (Health Canada 2013, p. 2-3). If a community does not have a monitor, an Environmental Health Officer (EHO) employed by Health Canada, or by a First Nations community, samples the water with the community's permission. The EHO is responsible for immediately communicating the appropriate recommendations to the Chief and Council if the drinking water quality is found to be unsafe (Health Canada 2013, p. 3).

Currently, the *Guidelines for Canadian Drinking Water Quality* are applied to First Nations communities as the standards for drinking water quality (Health Canada 2012b). The Federal-Provincial-Territorial Committee on Drinking Water establishes the Guidelines and Health Canada publishes them. Guidance documents have also been

developed for drinking water authorities, containing information relating to contaminants, drinking water management issues or emergency situations (Health Canada 2012b, p. 21).

For drinking water that is determined to be unsafe, the precautionary public health measures are typically drinking water advisories, which are recommended to Chief and Council by the EHO. Issuing the actual drinking water advisory is the responsibility of Chief and Council for the affected community, as well as taking the necessary actions to communicate drinking water advisories to residents and other appropriate stakeholders (Health Canada 2013). The Chief and Council are also responsible for taking necessary action to protect residents of the affected community if an immediate threat to health and safety of the community is identified. For follow-up sampling and investigation, Health Canada provides advice and assists First Nations to help identify the source of the problem (Health Canada 2013).

In terms of infrastructure, operation and maintenance, AANDC provides funding for First Nations communities (Health Canada 2013). Training and certification for operators is also financially supported by this department (Health Canada 2013). In addition, most First Nations do not pay a fee for their water service, such as through taxes.

Water Systems serving First Nations communities in Canada largely rely on groundwater as the source (52% of systems), followed by surface water (29% of systems) and the remaining systems rely on a Municipal Type Agreement (19% of systems) (INAC 2011, p. i).

In total, 560 First Nations are served by 807 drinking water systems and 11 First Nations serviced entirely by individual water supplies (INAC 2011, p. i). First Nations drinking water systems required to meet AADNC's Protocol for Safe Drinking Water in First Nations Communities serve five or more households, or a public facility, in addition to producing water intended for human consumption (INAC 2010). There are four drinking water supplies pertinent to First Nations drinking water supply systems in Canada: small community systems, community systems, public facilities and trucked systems (Health Canada 2007, p. vi).

TABLE 1: TYPES OF SUPPLY AMONG FIRST NATIONS COMMUNITIES IN CANADA

Supply Type	Service
Small Community Systems	• Between 5 and 100 connections • Private households and/ or public facilities (Health Canada 2007, p. vi).
Community Systems	• More than 100 connections • Private households and/ or public facilities (Health Canada 2007, p. vi).
Public Facilities	• Non-commercial, owned or operated by the Government of Canada or Chief and Council • Serves a public function (e.g. school, nursing home, health clinic) (Health Canada 2007, p. vi).
Trucked Systems	• Tank trucks deliver drinking water to some communities (Health Canada 2007, p. vi).

Infrastructure varies depending on the supply, as indicated by systems served by water delivery trucks. *The National Assessment of First Nations Water and Wastewater Systems* found the majority (72%) of homes among First Nations communities to receive their drinking water via pipes; 13.5% rely on delivery to the community by truck; 13% of homes rely on individual wells; and 1.5% of homes do not have water service (INAC 2011, p. i).

1.5 Argument and Major Findings

The intention of this research is to identify regulatory frameworks and programs pertaining to drinking water monitoring to inform the development of drinking water regulations for First Nations communities in Canada. Creating a regulatory base for drinking water quality monitoring in these communities will contribute to equitable management of drinking water quality for First Nations communities relative to other communities in Canada, as well as relieving the regulatory gap that currently exists.

This report provides recommendations for the next steps in developing a regulatory framework by identifying existing drinking water monitoring regulations and programs pertaining to measures targeted toward preventing adverse drinking water quality events, as well as achieving compliance.

2.0 METHODOLOGY AND METHODS

The report is based upon qualitative research comprising of three methodologies: 1) a jurisdictional scan of the drinking water regulations among the Canadian provinces and territories; 2) a current state analysis of drinking water monitoring among First Nations communities in Canada; and 3) a comparative case analysis of international jurisdictions, specifically Australia, New Zealand and the United States.

The research identified advantages and challenges to current drinking water monitoring approaches for First Nations communities, the feasibility of adopting regulations in First Nations communities, current standards across Canadian jurisdictions for non-Aboriginal communities, and a comparative analysis of the drinking water regulatory frameworks and programs pertaining to Indigenous populations in Australia, New Zealand and the United States.

This research is intended to inform the development of drinking water regulations for First Nations communities in Canada. The research identified advantages and challenges to current drinking water monitoring approaches for First Nations communities, the feasibility of adopting regulations in First Nations communities, current standards across Canadian jurisdictions for non-Aboriginal communities, and a comparative analysis of the drinking water regulatory frameworks and programs pertaining to Indigenous populations in Australia, New Zealand and the United States.

2.1 DATA COLLECTION

The primary data collection method used for the jurisdictional scan of Canadian provinces and territories was a document review of all relevant drinking water regulations. The same type of data collection method was used for the current state analysis and the comparative case analysis, which was the key informant interview.

2.1.1 DOCUMENT REVIEW

The jurisdictional scan of the Canadian provinces and territories was employed to identify the drinking water standards, monitoring practices and precautionary public health measures contained within their respective regulations. Since provincial legislation for drinking water does not apply to First Nations communities, this portion of the research was not focused on a particular type of community, such as the focus on Indigenous communities in the remainder of the research. Data were collected through a document review of pertinent provincial and territorial legislation and regulations, and supplemented by government publications. Topics that provided the basis for regulatory comparison included the following:

- Roles and responsibilities of departments or agencies involved in the oversight of the drinking water regulations;
- Notable standards (or drinking water parameters);
- Types and procedures for precautionary public health measures;
- Disinfection requirements; and
- Notable monitoring practices.

All ten provinces and three territories were reviewed and the results are compiled into two tables found in the appendices due to their size. The first table (Appendix 1) summarizes the pertinent legislation and regulations, as well as the departments and agencies responsible. The second table (Appendix 2) summarizes notable practices or tools employed to improve compliance with the drinking water standards or expand the scope of monitoring practices. The analysis of the Canadian provincial and territorial jurisdictional scan is found in the Discussion Section, along with the analyses for EHO and international components of the research.

2.1.2 Key Informant Interviews

Key informant interviews were conducted with government employees working in drinking water program management or monitoring intended for (or including) Indigenous communities. The sampling method for this research was convenience sampling, where the researcher recruited and contacted participants directly via an email invitation to participate. During the initial phase of recruitment, the researcher observed a low response rate from potential participants. To increase the number of participants, the researcher's client sent an email drafted by the researcher to all possible participants informing them of the research and its value to the client's organization. The project's client was involved in the selection of divisions and the researcher used the contact information obtained from employee directories to contact potential participants. The client was not involved in the selection of individual participants, nor was he informed of who chose to participate. As well, no power over relationship existed between the researcher and the participants or the client and the participants.

A qualitative approach was taken to the interviews, which is reflected in the decision to use open-ended questions. Interview instruments (i.e. the interview questions) can be found in Appendix 3. The key informant interviews were conducted one-on-one and over the telephone. Topics that were discussed during the interviews included the following:

- Roles and responsibilities for drinking water monitoring, such as which departments/agencies are involved;
- Types infrastructure for drinking water containment, such as cisterns;
- Consumer perceptions of drinking water;
- Community-led initiatives relative to drinking water quality;
- Similarities and differences between Indigenous communities and other communities in reference to drinking water monitoring, testing standards, reporting requirements and precautionary public health measures, such as drinking water advisories;
- Potential drinking water monitoring improvements due to the adoption of regulations among First Nations communities in Canada;
- Advantages and disadvantages of the current approach among First Nations communities in Canada with regards to reporting, standards and precautionary public health measures for drinking water monitoring;
- Drinking water standards or programs specifically designed for Indigenous communities in Australia, New Zealand and the United States; and
- Innovative practices among regulatory frameworks for Indigenous communities in Australia, New Zealand and the United States.

The key informant interviews were divided into two participant groups.

Group One: Environmental Health Officers (EHOs) from Health Canada

Interviewees for this segment of the research were limited to EHOs who work for Health Canada. Gathering information from this group was valuable as EHOs are responsible for providing advice to First Nations communities to help them manage public health risks, including drinking water quality. Interviews of EHOs provided greater insight into the current approach to monitoring drinking water, as well as the promises and/or challenges to adopting an alternative approach based on their observations and experiences.

A total of 11 EHOs working for Health Canada were interviewed. These EHOs work in British Columbia, Alberta, Manitoba or Ontario.

Group Two: Employees of the Governments of Australia, New Zealand and the United States

Interviewees for group two consisted of Senior or Principal Advisors, Directors and Managers, where drinking water for Indigenous populations is covered (either directly or indirectly) by the scope of their roles. A total of 6

participants from group two were interviewed from the Government of United States of America (2), the Government of New Zealand (1), and the Australian state and territorial governments of New South Wales (1), Northern Territory (1) and South Australia (1).

The purpose of including this second participant group was to compare the similarities/differences of the drinking water monitoring programs and regulations offered in each country for Indigenous populations with the drinking water monitoring program for First Nations communities in Canada. Including this participant group was valuable to the research by contributing to an understanding of alternative approaches in drinking water programming and regulations for First Nations communities in Canada.

Additionally, a document review supplemented the findings in this section, specifically government regulations with respect to Indigenous peoples for the United States, New Zealand and Australia to provide context or greater detail to the discussion raised in the interviews.

NON RESPONDENTS

Of the potential interview participants from group one, a total of 48 Health Canada employees were contacted. This total includes EHOs and Regional Environmental Health Managers (REHMs). Two EHOs did not participate due to an inability to commit to the proposed interview dates. A total of seven EHOs responded to the researcher indicating they were not interested in participating in the research. The remaining EHOs and REHMs did not respond to the researcher's invitation to participate in an interview. The interviews were voluntary in nature; therefore, the researcher did not coerce individuals into participating.

For group two, a total of eight potential participants were contacted by the researcher. Of the two who did not participate in the interviews, one individual indicated that the scope of the research did not match his/her job responsibilities and the second individual was interested but was unavailable for an interview.

2.2 LIMITATIONS AND DELIMITATIONS:

2.2.1 DELIMITATIONS

The scope of the project is an analysis of existing regulations that are in force and what is often called a snapshot study. All regulations in Canada (provinces and territories) that pertain to drinking water quality, monitoring and reporting requirements and precautionary public health measures were included. For the international component, only the government regulations and/or programs pertaining to Indigenous peoples in Australia, New Zealand and the U.S. were included. Provincial regulations in Canada (which do not pertain to First Nations) are included in the scope of this research because the *Safe Drinking Water for First Nations Act* includes a provision for the incorporation of provincial drinking water regulations. The international component was included because Australia, New Zealand and the United States have drinking water regulations that pertain to their Indigenous populations and the research would benefit from exploring alternative approaches. Certification processes and water system maintenance and operational requirements do not fall within the responsibilities of Health Canada and are not directly related to drinking water monitoring practices. Therefore, these and similar regulatory components were excluded from the research.

Interviews were conducted to clarify the context or background for the current approach in Canada and provide insight into the feasibility of adopting the approaches uncovered in the jurisdictional scan of regulations from technical and policy perspectives. Although the proposal of this report included the intention to explore the legal perspective through interviews, there is only one individual working for Health Canada who provides legal advice for consultations on drinking water in First Nations communities. For this situation, the possible benefits of contacting this individual did not appear to outweigh the possible consequences of risking this individual's anonymity in this process. Consequently, the researcher did not contact this individual and an alternative was proposed by the project's client (i.e. interviews for the international component of the research).

2.2.2 LIMITATIONS

While the research is concerned with issues that directly relate to First Nations communities, individuals from these communities did not participate in this project. This report is only phase one of a multi-phase initiative. Although First Nations were not interviewed for this study, they have been previously consulted during the development of the former Bill S-11 (*Safe Drinking Water for First Nations Act*, tabled May 2010) and the Government committed in Bill S-8 (tabled February 2012) of the same Act to work in partnership with First Nations to develop federal regulations and standards, based on the needs of each region. The Government has a duty to consult Aboriginal peoples in Canada on matters that affect them and will do so now that Bill S-8 has received Royal Assent.

The University of Victoria Human Research Ethics Board noted that the research focuses on Aboriginal populations in Canada and indicated that the findings may impact these communities. As a result, the researcher was requested to seek out support for this research from an arm of the Government of Canada that includes Aboriginal representation. On June 13, 2012, the researcher met with members of the Health Canada Research Ethics Board to discuss the project and determine if there is any risk to First Nations communities or individuals as a result of this project. The Board includes Aboriginal representation and reviews several projects that impact Aboriginal individuals and communities each year. The Board reviewed the proposal and ethics application for this research and concluded that there is no risk to First Nations communities, individuals or the proposed interviewees.

The Health Canada Research Ethics Board acknowledged that this research falls within a greater scheme for developing federal regulations, where communication and consultation with the potentially affected communities will take place at a later date. The Board also acknowledged that this research will serve to provide a consolidated understanding of the current approaches to drinking water regulations, where the interviews will be based on the interviewees' regular work. Since there is no direct contact with First Nations communities or individuals and since the contents of the research focuses on recognized health standards, this project does not present a risk to First Nation communities, individuals or interview participants.

Consequently, the project is limited to providing recommendations based on the regulations governing drinking water for non-aboriginal communities in Canada, the regulations or programs pertaining to Indigenous peoples in other countries (i.e. Australia, New Zealand and the United States), the feedback from First Nations communities to Bill S-8 and the former Bill S-11, and the advice of Environmental Health Officers (EHOs) who provide monitoring assistance for First Nations communities and work for Health Canada.

In terms of recruitment for the interviews, the project's client (Jamie Lafontaine) and the division he works for (the Environmental Public Health Division) of Health Canada were not included to avoid concerns regarding power over and voluntary participation among interview participants, despite the division's relationship with the development of the Act. Due to the voluntary nature of the research, only participants from New South Wales, Northern Territory and South Australia were available to participate; therefore, information regarding the other jurisdictions in Australia was not included in this research. The EHO interviews do not represent a comprehensive scan of the regions in Canada. In keeping with the voluntary nature of this research, differences among all provinces were not captured as responses to the invitation to participate were not received from EHOs in every province; however, the researcher used the results from the responses received. As well, only Health Canada employees were interviewed for this report, which excludes any EHOs working directly for First Nations communities.

3.0 LITERATURE REVIEW

This chapter reviews approaches and pertinent concepts to the development of drinking water regulations for First Nations communities in Canada. Academic sources and grey literature were consulted for purposes of the literature review, and the grey literature largely consisted of publications by government and international organizations. This section is intended to provide insight into the topics raised in the jurisdictional scan and key informant interviews. The literature review is organized under six main themes: 1) the drinking water contamination events of Walkerton, Ontario and North Battleford, Saskatchewan; 2) the widely discussed and adopted Multi-Barrier Approach to drinking water management; 3) Indigenous Rights to water; 4) reactions to the introduction of Bill S-8, *Safe Drinking Water for First Nations Act*; 5) the reporting of drinking water advisories in Canada; and 6) consumer perceptions of drinking water safety.

The presence of specific substances in the drinking water and/or the health effects of specific substances dominate the literature regarding drinking water quality, as well as drinking water regulations. In terms of literature concerning drinking water regulations, much of the literature is focused on the United States, particularly the *Safe Drinking Water Act*. Literature concerning the adverse drinking water events relative to First Nations communities in Canada appears in scholarly articles, as well as publications by non-governmental organizations and government departments. Many of these documents speak to the importance of engaging with Aboriginal communities to reach a solution, as well as, weak accountability for monitoring results, the lack of a regulatory framework, and a lower degree of protection from unsafe water relative to other communities in Canada. Academic literature pertaining to First Nations drinking water is largely focused on the frequency and/or longevity of drinking water advisories, whereas documents produced by non-governmental organizations largely concerned the development of drinking water regulations for First Nations communities.

3.1 WALKERTON AND NORTH BATTLEFORD

Literature concerning Canadian drinking water phenomena highlights changes or introductions to provincial drinking water legislation, largely in response to the drinking water contamination crises in Walkerton, Ontario and North Battleford, Saskatchewan. Much of the relevant literature associated with monitoring drinking water quality in Canada is centred on recommendations from the tragic incidents in these communities.

Scholarly articles are available that criticize the policies in place when the Walkerton and North Battleford tragedies took place. Management of drinking water quality is criticized among the literature, chiefly for the adoption of neoliberal policies for the purposes of reducing regulatory burdens and their associated costs, yet at the expense of human health and safety (Snider 2003, p. 34-35). Prudham (2004) argues that an era of neoliberal reforms in the province "was predicated in significant measure on the re-configuration of provincial environmental governance" (p. 344). Hrudey and Hrudey (2002) refer to the inadequate drinking water management in Walkerton and North Battleford at the time of the contamination crises as only employing compliance monitoring, or a single barrier, to reduce risks to human health (p. 332; Health Canada 2010, p. 1).

In Walkerton, the contaminated source was a shallow groundwater supply, which the operators presumed to be "safe" and "chlorination was merely an unnecessary requirement that led to consumer complaints about taste" (Hrudey and Hrudey 2002, p. 332). The supply in this case was chlorinated; however, the chlorination levels were insufficient to inactivate the degree of bacterial contamination that occurred in May 2000 (Hrudey and Hrudey 2002, p. 332). Although North Battleford relied on a different type of source water (the North Saskatchewan River), a similar misperception of the potential risks to human health resulted. The adverse drinking water incident occurred in North Battleford when "processes for turbidity removal were allowed to become sub-optimal" for a source that was reported to have high fecal coliform levels (Hrudey and Hrudey 2002, p. 332).

To address the management of drinking water and ensure that greater safe guards for health are put in place, the Walkerton Inquiry was called and produced two reports, including recommendations for improving the safety of drinking water in Ontario (Ontario Ministry of the Attorney General 2002a, p. 2). The Walkerton Inquiry found that the outbreak could have been prevented had "effective implementation of continuous chlorine residual monitoring (an investment of -$8,000), in accordance with policies for groundwater under the influence of surface contamination that had been adopted in the 1994 Ontario Drinking Water Objectives" been employed (Hrudey and Hrudey 2002, p. 333). Inadequate training of the operators was blamed in the case of Walkerton; however, North Battleford's operators were trained yet their concerns for the safety of the drinking water supply were neglected by senior managers and City politicians (Hrudey and Hrudey 2002, p. 333). Due to the shortcomings of relying on single barriers for reducing risks to health, an entire chapter of Part Two of the Report of the Walkerton Inquiry is dedicated to recommending the implementation of a multi-barrier approach, as no one barrier is perfect at guarding public health from risks to drinking water (Ontario Ministry of the Attorney General 2002b, p. 72).

Part Two of the Report of the Walkerton Inquiry (2002) identifies drinking water for First Nations reserves, as well as Métis and non-status Indian communities, as “some of the poorest quality water in the province,” and these particular communities do not benefit from the same “standards that generally prevail throughout Ontario” (Ontario Ministry of the Attorney General 2002, p. 486). The Report identified the following concerns for First Nations communities in the Province:

- Infrastructure is either obsolete, entirely absent, inappropriate, or of low quality;
- Not enough operators are adequately trained or certified;
- Testing and inspections are inadequate;
- Microbial contamination is frequent; and
- Distribution systems, especially on reserve, are sized to deliver about half the water per capita available to other Ontarians. (p.486).

3.2 Multi-Barrier Approach

Literature concerned with employing a multi-barrier approach to drinking water quality management focuses on reducing risks to human health. Compliance monitoring was commonly the drinking water management strategy in place throughout Canada and around the world, until the adverse drinking water quality events of Walkerton and North Battleford occurred (Health Canada 2010, p. 1). Compliance monitoring refers to a strategy employed by drinking water suppliers as a means of determining the safety of the water for consumption. This approach involves, “sampling small amounts of water in a drinking water system and testing those samples for the presence of known and quantifiable organisms or contaminants. If those samples comply with established requirements for drinking water quality, the water is considered safe to drink” (CCME 2004, p.14). Following the Walkerton and North Battleford incidents, AANDC and Health Canada re-evaluated their approaches to drinking water management, as did provincial governments (Health Canada 2010, p. 1).

As indicated in the previous section, the Walkerton Inquiry recommended the adoption of a multi-barrier approach to drinking water management (Ontario Ministry of the Attorney General 2002b, p. 72). Following their assessments of drinking water management among First Nations communities, AANDC and Health Canada also concluded that a multi-barrier approach would be more suitable to guarding against risks from a public health perspective. The departments developed the First Nations Water Management Strategy (FNWMS) in 2003 and the First Nations Water and Wastewater Action Plan (FNWWAP) "to upgrade infrastructure, improve drinking water quality monitoring initiatives, build capacity among First Nations, widen the scope of the program, develop public awareness tools, and develop a legislative framework" (Health Canada 2010, p. 2). The multi-barrier approach has been cited in much of the literature concerning drinking water quality frameworks, as well as the government publications and websites of the Canadian provinces and territories.

The Multi-Barrier Approach is the primary framework guiding drinking water quality monitoring, endorsed by the World Health Organization (WHO) and recommended by the Federal-Provincial-Territorial Committee on Drinking Water and the Canadian Council of Ministers of the Environment in the document, *From Source to Tap: The Multi-barrier Approach to Safe Drinking Water* (2002). Under this approach, policies and procedures from the water source to the consumer are integrated to create several barriers aimed at preventing or reducing risks to public health from drinking water contamination (CCME 2004, p.15). Multi-barrier approaches consider three components: the source, drinking water treatment, and drinking water distribution (CCME 2004, p.15).

The World Health Organization (WHO) is widely cited among this literature. The World Health Organization (WHO) has released several guidance documents outlining the merits of an approach known as the Multi-Barrier Approach. The WHO-hosted International Network of Drinking-water Regulators (RegNet) released *Drinking-water: Optimizing regulation to protect health,* intended for drinking water regulators. RegNet has produced a series of tools, or issue sheets, promoting regulatory development for drinking water, viewing the accountability and liability established in the regulations as important barriers to risks from public health (WHO RegNet 2013, p. 1). The multi-barrier approach is recommended for drinking water regulations, such as source water protection, going beyond simply identifying the maximum or minimum allowable concentrations for substances in drinking water (WHO RegNet 2013, p. 2). Regulatory development for small supplies is also among the issues covered by the issue sheets, noting greater challenges faced by small supplies relative to larger supplies. The WHO RegNet recommends regulations reflect the capacities of small supplies, such as finding an alternative to operator certifications for communities where this may not be financially feasible (WHO RegNet 2013, p. 3). Finally, according to this approach, regulations should not standalone; rather, other measures are encouraged by the WHO RegNet to support the regulation, such as the capacity for implementation and enforcement (WHO RegNet 2013, p. 4).

3.2.1 Water Safety Plans

The WHO is a proponent of the adoption of water safety plans to implement a multi-barrier approach. Water safety plans are intended for water suppliers and are useful as a means of risk management by identifying known and potential risks to the water source and distribution system, which informs the development of a risk management protocol (Gray 2008, p. 42). According to the WHO, a drinking water monitoring framework should consist of the following components:

- Health based targets;
- System assessment;
- Operational monitoring;
- Management plans; and
- System of independent surveillance (WHO 2005, p. 6).

Water safety plans are intended to address three of these five elements: system assessment, operational monitoring and managements plan (WHO 2005, p. 7). System assessment involves a description of the supply from the source, treatment, distribution system as well as an analysis of potential hazards and identification of the controls that will be implemented to meet health based targets (WHO 2005, p. 29; 48). Operational monitoring refers to establishing a system of observation to determine if components of the supply system are operating correctly by setting operational limits for contaminants to complement health based targets (WHO 2005, p. 58). Finally, management plans refer to establishing corrective actions in the event of an adverse water quality event, as well as record keeping and processes of validation and verification of the sampling results (WHO 2005, p. 66; 78; 82).

3.2.2 Monitoring - Drinking Water Surveillance

Compliance monitoring employed in the absence of additional methods of assessing drinking water quality has been criticized for the time required to complete sampling analyses, while consumers continue to consume the water, as well as overlooking any health concerns that are not associated with the assigned parameters (CCME 2004, p. 14).

In addition, compliance monitoring has been criticized for being a "single barrier" in the prevention of drinking water contamination, as found in previous sections.

The WHO recommends a two-tier system, where the water supplier continues to conduct routine testing of the water, and a surveillance agency has legislated authority over administering the standards and regulations which govern the supply, including activities such as audits of the supplies and enforcement (WHO 1997, p. 18-19). The WHO makes further recommendations by suggesting moving beyond data collection to include other strategies in a surveillance program. The example given by the WHO is public health education, potentially emphasizing a particular activity or risk (WHO 1997, p. 20). In the event that water treatment and sampling procedures do not meet intended objectives, "education may be the most important part of the multi-barrier approach to risk minimization for drinking water safety" (BC Ministry of Health 2007, p.16). In addition, the WHO recommends intersectoral and horizontal cooperation in surveillance, such as intergovernmental support between all departments involved in water management, as well as meaningful coordination between the various levels of government involved in drinking water quality management (WHO 1997, p. 19).

3.2.3 Standards - Health-Based Targets

Health-based targets for drinking water are used to indicate the quality of the water by determining the presence or concentration of specified contaminants that may pose a risk to public health. The standards prescribed by the WHO are founded on health-based targets and “are based on a review of the current epidemiological and medical research” (Gray 2008, p. 37).

The World Health Organization (WHO) has released a fourth edition of its Guidelines for drinking-water quality based on the primary objective of protecting public health through oversight of microbial, chemical and radiological contaminants which may pose a risk to water safety (WHO 2011, p. 1; 4). The Guidelines also recommend consideration of parameters that may not constitute a health concern, such as taste, odour and colour, yet may reduce consumer confidence in the supply and "could lead to the use of water from sources that are less safe." (WHO 2011, p. 219). The Guidelines refer to these characteristics as acceptability aspects.

In addition, the WHO notes that there is no universal or international standard for managing the risks associated with drinking water quality. Rather, the WHO recommends that the Guidelines are considered "in the context of local or national environmental, social, economic and cultural conditions." (WHO 2011, p.2). Canada is involved in the development of the WHO Guidelines through Health Canada, and publishes the *Guidelines for Canadian Drinking Water Quality* (2012), developed by the Federal-Provincial-Territorial Committee on Drinking Water (CDW) (Health Canada 2012b; Health Canada 2012a).

3.2.4 Drinking Water Sources and Supplies

A critical factor in determining the level of risk posed to public health by drinking water is its source. Surface water as a drinking water source refers to open bodies of water, such as rivers and lakes. Due to the high potential for organic materials to be present, such as exposure to wild animals and run-off from nearby farm lands, contamination by microorganisms is anticipated for surface water (CWWA 2012). Groundwater refers to subsurface aquifers as the source of water and the quality of water drawn from this source depends on the geological structure, which may make the water hard or contaminated by chemicals, such as arsenic (CWWA 2012). Otherwise, groundwater sources that are not under the influence (GUDI) of surface water are often determined to be free from microorganisms (CWWA 2012). Other sources, such as raw water, include drinking water protected springs or household rainwater harvesting systems (WHO 2012, p. 1).

Under a broader definition from the WHO, small supplies include all of the above defined systems with the exception of Community Systems. The WHO acknowledges the variances among countries regarding definitions of small water supplies, for example, some jurisdictions determine the size of the supply by the number of connections

to the system, the population served or the quantity of water distributed (WHO 2012, p. 3). Although, small supplies often face similar challenges with regards to operation and management (WHO 2012, p. 3).

The WHO has developed a guidance document of water safety plans particularly for small supplies. The WHO breaks Water Safety Plans down into six tasks, for example, task one involves assembling a team that represents the community and technical experts to develop and implement the water safety plan (WHO 2012, p. 5). Acknowledging that small supplies may have more difficulty meeting local or national standards than larger supplies, the guidance document for small supplies emphasizes incremental progress through prioritization of risks to the supply (WHO 2012, p. 4). The guidance document also provides a summary of outputs for each task, which do not require sophisticated technology to produce (e.g. drawn maps of the community water supply) (WHO 2012, p. 16).

3.3 Right to Water

Among the literature, water is deemed a human right. The UN Right to Water and Sanitation (resolution 64/292) recognizes “the importance of equitable access to safe and clean drinking” as a human right (2010, p. 2). In addition, the resolution affirms that states have the responsibility to uphold and protect this right (UN 2010, p. 2). Importantly, the resolution is legally binding, obligating states, such as Canada, to ensure equitable access to safe drinking water for all Canadians (UN News Centre 2010).

Equitable access of drinking water between First Nations and non-First Nations communities is a concern among several Canadian publications. According to Patrick (2011), "[a]ccess to safe drinking water in Canada is a function of both where you live and who you are" (p. 387). This argument relates to the frequency of boil water advisories among First Nations communities relative to other communities in Canada. Patrick (2011) reports boil water advisories are 2.5 times more frequent among First Nation communities than other communities in Canada (p. 386). In addition, the history of health outcomes for First Nations communities provides a useful backdrop with which to examine the disparities in risks to health due to drinking water. Phare (2009) highlights risks to health due to ongoing drinking water safety concerns among many First Nations communities. According to Phare (2009), "[i]t has been reported that 450 current cases of H1N1 flu in Manitoba are First Nations, even though only 20 percent of Manitoba's population is Indigenous," which is presented as largely the result of a lack of running potable water (p. 9).

Right to water as a theme is intermingled with much of the literature that focuses on Indigenous peoples' engagement in decision making processes. Literature concerning Indigenous Peoples' rights to water in Canada make the case that Indigenous Peoples' in Canada have more than a right to safe drinking water access, they have a right to manage water. The literature demonstrates that these rights stem from "inherent rights to water before Canada and the provinces were created, and that these rights were never given up anywhere in Canada" (Phare 2009, p. 45-46). The overlapping provincial and federal jurisdictions over water contribute to the complexity of source water policy; where Phare (2011) states that First Nations should be included in these types of discussions among provincial and federal counterparts (p. 42). In terms of Indigenous Peoples' right to water in Canada, Phare (2009) argues that Indigenous Peoples' rights in conjunction with Canadian laws should form the basis of a system of Indigenous governance and management of water resources (p. 78-79). The UN Declaration on the Rights of Indigenous peoples "recognizes [Indigenous peoples] rights to participate in decision-making matters that might affect their rights and to decide what development occurs on their lands" (Phare 2009, p.41).

The UN Declaration on the Rights of Indigenous peoples emphasizes the equality of Indigenous Peoples and individuals to all other peoples and individuals (UN 2007, p. 1). The Declaration recognizes rights to health for Indigenous peoples and individuals, among other rights, such as education and employment (UN 2007, p. 1). As well, states have a responsibility to protect the health of Indigenous communities by employing the use of monitoring approaches, and "Indigenous peoples have a right to be actively involved in developing and determining

health" programs that affect them (UN 2008, p. 9, article 23 and p. 11, article 29.3). The General Assembly adopted the declaration under resolution 61/295 (UN 2008). The United Nations Declaration on the Rights of Indigenous Peoples was endorsed by the Government of Canada on November 12, 2010 (AADNC 2012a).

3.4 Safe Drinking Water for First Nations Act

A number of key documents have been released from the Government of Canada in recent years regarding safe drinking water for First Nations communities, such as the Standing Senate Committee on Aboriginal Peoples document, *Safe Drinking Water for First Nations* (2007); the Report of the Expert Panel on Safe Drinking Water for First Nations (2006); and Chapter 4 of the 2011 June Status Report of the Auditor General of Canada to the House of Commons. The most recent publication, from the Office of the Auditor General of Canada (OAG) (2011), reports that a regulatory regime would address the following challenges associated with drinking water monitoring among First Nations communities in Canada:

- Uncertainty regarding responsibilities;
- Less frequent testing of water than what is recommended in the Guidelines for Canadian Drinking Water Quality; and
- The federal government is not required to inform community members of the water testing results (p. 4).

The *Safe Drinking Water for First Nations Act* was first introduced in May 2010 as Bill S-11, followed by an introduction in February 2012 as Bill S-8 (AANDC 2013). Bill S-8 passed into law on June 19, 2013 (AANDC 2013).The implications for First Nations communities after the adoption of drinking water legislation (the *Safe Drinking Water for First Nations Act*) are discussed among the literature.

Literature concerning the regulation of drinking water for First Nations communities in Canada appears to be largely written by government departments and non-governmental organizations rather than academics. These documents speak to the importance of engaging with Aboriginal communities to reach a solution, as well as, weak accountability for monitoring results, the lack of a regulatory framework, and a lower degree of protection from unsafe water relative to other communities in Canada. The federal government has released information on the results of consultations with First Nations communities concerning the former Bill S-11. Although, other organizations have written documents in response out of concern for the degree of First Nations involvement, which has been deemed to be inadequate. As a result, these reports focus on the consequences of limiting the involvement of First Nations in the decision to regulate.

Countering literature acknowledges that a consultation took place; however, it has been criticized for determining the next course of action regarding drinking water safety among First Nations communities before engagement with First Nations leaders. The Indigenous Bar Association (IBA) as well as the Ontario Native Women's Association (ONWA) argues that meaningful consultation would reflect local knowledge and recognition of the "legitimacy of Indigenous governance in relation to water resources" (IBA 2011, p. 2). For example, ONWA explains that Indigenous women are entrusted to pass on the significance of water and the hold the responsibility for its protection, as told in traditional teachings (ONWA 2012). The Idle No More movement developed in response to Bill C-45, a budget omnibus bill, which includes several legislative measures affecting Aboriginal Canadians, including Bill S-8. The movement seeks to revitalize the manner in which the federal government engages with First Nations, which includes observing treaty and Indigenous rights (Idle No More 2013). As a result, these reports focus on the consequences of limiting the involvement of First Nations in the decision to regulate.

Various concerns have been raised with the proposal of legislation for safe drinking water among First Nation communities, such as attempts by the federal government to offload responsibilities and gaps in infrastructure and resources which will make it difficult to implement regulations without additional federal assistance. On its website, the NishnawbeAski Nation (NAN) states that “most NAN communities would be unable to meet these regulations"

due insufficient resources and infrastructure that will not meet the standards (NAN 2013). NAN indicates concern that current infrastructure poses risks to health and due to service gaps that exist, "[n]early all 49 NAN communities have been subject to a boil water advisory in the past five years" (NAN 2013).

The role of the government is a common issue raised among the literature concerning First Nations drinking water in Canada. The IBA (2011) states "that in order to implement a consistent and functional water management system on reserve lands, Indigenous nations must be equipped with the resources and tools necessary to govern their own on-reserve water management systems" (p. 2). Commenting on Bill S-8, the Assembly of First Nations (AFN) expressed concern for the potential for the legislation to influence First Nations rights, and the IBA specifically seeks answers to what the legislation would mean for Indigenous rights to self-government (AFN n.d.; IBA 2011, p. 2).

Although the engagement process for the development of the Act has been criticized for not engaging enough with First Nations, AANDC (INAC at the time) also accepted written submissions (i.e. e-mail, fax or mail) until April 17, 2009 (AANDC 2012d). It is important to note that since the formal round of consultations for the former Bill S-11, discussions continued between the Government and First Nation organizations from October 2010 to October 2011 (AANDC 2012a). In addition, federal investment in drinking water for First Nations communities will continue after the regulations are in place (AANDC 2012d).

3.5 Precautionary Public Health Measures: Drinking Water Advisories

Canadian literature also explores the frequency and longevity of drinking water advisories in particular communities or types of communities (e.g. First Nation versus non-First Nation). This is likely due in large part to role of drinking water advisories as the de facto indicator of household access to safe drinking water. As reported by Isfeld (2009) in the *Boil Water Advisory Mapping Project: An exploration and review of available data*, comparative evaluations of drinking water safety across Canadian communities are difficult to conduct due to a lack of a national indicator of household access (p. 2).

The charity, Ecojustice, provides a scoring report card for the country's drinking water regulations. This particular scoring system is not only based on the stringency of standards, although that does apply, but also on the presence and usefulness of source water protection measures (Ecojustice 2011). Although this means of scoring assesses approaches to drinking water management, rather than their health outcomes. There is a database of drinking water advisories from across Canada available to the public online provided by Water Chronicles (Isfeld 2009, p. 2). Statistics Canada conducts the *Survey of Drinking Water Plants* for the purposes of providing Canadians with information "on volumes of water drawn and treated, treatment type, financial aspects of the operation, as well as raw and treated water quality" (Statistics Canada 2013). In addition, the survey does not include small drinking water systems, as it only includes drinking water plants serving at least 300 people (Statistics Canada 2013). Consequently, drinking water advisories, boil water advisories in particular, serve as an indication of the level of quality of the drinking water supply from a health perspective.

Drinking water advisories are precautionary public health measures used in the event of known or suspected drinking water contamination (Health Canada 2007, p.vi). Therefore, the underlying cause of contamination is not typically addressed by drinking water advisories. For example, according to Health Canada (2009) in *Drinking Water Advisories in First Nations Communities in Canada: A National Overview 1995 – 2007,* seasonal variations can contribute to drinking water contamination, which leads to a "seasonal cycle in the issuance of DWA" (p. 19).

There were 117 First Nations communities in Canada under a drinking water advisory as of December 31, 2012 (Health Canada 2013). Although, this number does not indicate "the occurrence of unsafe drinking water, nor indicate a uniform level of risk" (Isfeld 2009, p. 4). Due to inconsistency in definitions across Canadian jurisdictions, the type of drinking water advisory in one region may not indicate the reason for the advisory, nor the

severity of the reason, when compared to the advisory from another region (Isfeld 2009, p.4). According to Isfeld (2009), "boil water orders, do not consume orders or emergency advisories are terms used when there is evidence that an outbreak of illness is or may be associated with drinking water" (p. 4). Under circumstances where a precautionary public health measure, such as a boil water advisory, has been in place for an extended period of time, it may be termed as a permanent order (Isfeld 2009, p. 4).

TABLE 2: DRINKING WATER ADVISORIES – TYPES AND DEFINITIONS

Purpose	Measure/Action	Definition
Contamination	Drinking Water Advisory	Preventive measures to protect public health from contaminants that could be, or are known to be, present in drinking water. Blanket term that includes boil water advisories, boil water orders, do not consume orders, do not consume advisories, do not use orders and do not use advisories (Health Canada 2007, p.vi).
Microbial contamination, such as bacteria and viruses.	Boil Water Advisories	Put in place to advise the public that they should boil their tap water for drinking and for other uses, such as brushing teeth (Health Canada 2013).
Chemical or other contaminants	Do Not Drink Advisory / Do not Use Advisory	Put in place to advise the public that they should use an alternative source of drinking water for drinking and for other uses (e.g. bottled water) (Health Canada 2013). "A Do Not Consume Order (DNCO) or a Do Not Consume Advisory (DNCA) is issued to the public when the water in a community's water system contains a contaminant, such as a chemical, that cannot be removed from the water by boiling"(Health Canada 2007, p. vii). "A Do Not Use Order (DNUO) or a Do Not Use Advisory (DNUA) is also issued when an unknown contaminant has polluted the drinking water supply (e.g. a chemical spill)" (Health Canada 2007, p. vii).
Natural Disaster	Water avoidance advisory	"Water avoidance advisories are much less common than boil water advisories. They would typically be issued following a catastrophic event such as a natural disaster or as a result of accidental or deliberate action, where the drinking water or its source may have become heavily contaminated (usually by chemicals) and its use could pose a significant public health risk. These advisories are not intended to address short-term minor exceedences over existing guideline values, as the guidelines generally represent a level of exposure that is acceptable over a lifetime (70 years) without causing an increased risk to health" (Health 2009, p.2).

Due to this inconsistency in definitions, it is difficult to capture an accurate picture of the scope of households that do not have access to safe drinking water across. Reasons for drinking water advisories vary, as well as the frequency of the advisories (i.e. the number of advisories over a specified period), and the longevity of advisories (i.e. the total number of hours or days for each individual advisory) are difficult to capture on a national scale simply using drinking water advisory data (Isfeld 2009, p. 5).

In addition, reporting of drinking water advisories do not distinguish between the size of the population served by the drinking water supply. When drinking water advisories are being tallied, each reported unit refers to a drinking water facility rather than a community, and vary in terms of population size served and affected in the case of a drinking water advisory (Isfeld 2009, p. 5). Importantly, most communities are served by multiple drinking water

facilities (Isfeld 2009, p. 5). Therefore, determining the level of risk to human health is difficult to extrapolate from total reported drinking water advisories.

It is also difficult to draw accurate conclusions regarding drinking water quality among First Nations communities simply using drinking water advisory data. As Isfeld (2009) reports, a comparative analysis of the distribution of drinking water advisories among First Nations communities and non-First Nations communities was not possible to conduct due to limited access for the public to data regarding First Nations drinking water advisories (p. 2).

Publications by the Government of Canada do speak to the importance of improving drinking water quality among First Nations communities through a variety of means, including legislation. For example, the *National Assessment of First Nations Water and Wastewater Systems* reported in 2011 provides the context for existing infrastructure, capacity, drinking water advisories, etc. among 571 of 587 First Nations in Canada (INAC 2011, p. i).

3.6 Consumer Perspectives on Drinking Water Quality

Challenges relating to drinking water monitoring include the perceived threat of contamination among consumers. According to Gray (2008) consumer awareness of the health risks associated with contaminated drinking water has resulted from an "increased public awareness of environmental issues" over recent years (p. 455). Although, the public is argued to typically assess drinking water from an emotional standpoint, by basing perceptions of quality on physical characteristics, rather than known health risks (Gray 2008, p. 455-457). Therefore, the challenge becomes an issue of building consumer confidence in the quality of drinking water. A challenge for regulators and water suppliers is to educate the public on water quality, as Ofwat surveys demonstrate that the public's perception of drinking water is largely based on the physical characteristics of their own water supply, rather than its quality in relation to the prescribed standards" (Gray 2008, p. 457). To achieve this, suppliers and regulators would need to uncover the factors important to the public when perceiving drinking water quality (Gray 2008, p. 457). According to AANDC, there has been an increase in the number of First Nations residents who view their tap water supply as safe, from 62 % in 2007 to 71 % in 2011 (AANDC 2012c).

4.0 CONCEPTUAL FRAMEWORK

The conceptual framework is intended to guide the project by informing the major findings of the report. For the purposes of this research a health equity lens will be applied. Health equity is closely related to health equality; however, it "…focuses attention on the distribution of resources and other processes that drive a particular kind of health inequality—that is, a systematic inequality in health (or in its social determinants) between more and less advantaged social groups…" (Braveman and Gruskin 2003, p. 255). To determine what would constitute an equitable level of health, Braveman and Gruskin (2003) recommend "…the standard of health enjoyed by the most socially advantaged group within a society" (Braveman and Gruskin 2003, p. 255).

Health equity complements the mandate of the First Nations and Inuit Health Branch, through "assist[ing] First Nations and Inuit communities address health barriers, disease threats, and attain health levels comparable to other Canadians living in similar locations" (Health Canada 2005).

The World Health Organization (WHO) Commission on the Social Determinants of Health final report, titled *Closing a Gap on a Generation*, explores action on the social determinants of health to reach health equity. The report is guided by three main recommendations:

1. Improve daily living conditions;
2. Tackle the inequitable distribution of power, money, and resources; and
3. Measure and understand the problem and assess the impact of action. (WHO Commission of the Social Determinants of Health 2005, p.2)

As a basic human and societal need, the Commission identifies daily living conditions, like clean water, as contributing to health and health equity (WHO Commission of the Social Determinants of Health 2005, p.14; 4). Drinking water legislation and subsequent regulations for First Nations communities in Canada would contribute to an improvement of daily living conditions comparable to the rest of Canada, where clean water is an aspect of the first recommendation made by the WHO Commission.

The United Nations (UN) General Assembly goes beyond observing water as a need and declared equitable access to water and human right in July 2010 under resolution 64/292, the Human Right to Water and Sanitation (UN 2010; UNDESA n.d). Despite an initial vote abstention in 2010, the Government of Canada recently recognized water as a human right (UN 2010; Public Services International 2012).

5.0 FINDINGS

5.1 FIRST NATION COMMUNITIES IN CANADA

5.1.1 CURRENT CHALLENGES

With the objective in mind of seeking to understand any barriers to achieving compliance among First Nation communities with the *Guidelines for Canadian Drinking Water Quality*, the researcher asked for any challenges observed by participating Environmental Health Officers (EHOs). Challenges were identified and can be categorized as issues pertaining to the following: training of drinking water personnel; misunderstandings among residents; legislation; infrastructure; the size and location of the community, enforcement and perceptions. Although many of the issues raised by the EHOs are not overseen by FNIHB, such as infrastructure, community size, geography, etc., they are pertinent to understanding the current nature of compliance with the guidelines.

NUMBER OF OPERATORS

A commonly reported challenge among EHOs is the insufficient number of trained operators for First Nations drinking water supplies. According to several EHOs, a common reason for the insufficient number of trained operators is a difficulty with retention. An EHO in Alberta explained that operators in his province may not be compensated for travelling all over the community or may receive a low wage ($12/hour without overtime) (Participant 7, interview, August 23, 2012). As well, water treatment plant operators and Community Based Water Monitors (CBWMs) are usually from the community where they work (Participant 9, interview, August 30, 2012). A possible downside of being from the community and known to other community members would be the potential for the operator to receive calls directly about drinking water at any point in the day (Participant 9, interview, August 30, 2012).

A consequence of an insufficient number of trained operators is the reliance on precautionary public health measures when these operators are absent. An EHO from Alberta explained that very few water treatment plants in First Nations communities have trained back-up operators (Participant 7, interview, August 23, 2012). In some cases, there may only be one trained operator and if he/she takes leave (e.g. illness, vacation, etc.) there is no one trained to take over. In these situations, the community is placed on boil water advisory as a precautionary measure until the operator returns (Participant 9, interview, August 30, 2012).

TRAINING

Several EHOs commented on the difficulty many communities have regarding the level of training their operator possesses as a lack of sufficient training can contribute to the potential for an adverse drinking water event. According to an EHO in Alberta, "[o]ne of the most significant challenges is that many First Nation communities do not have operators who are trained to the level that the plant requires" (Participant 7, interview, August 23, 2012). Alberta Environment certifies First Nation operators, which has led to improvements among many communities in terms of training (Participant 7, interview, August 23, 2012). Although, there still remains operators who have not completed the training and few First Nations communities have plants with trained back-up operators (Participant 7, interview, August 23, 2012). Training of operators or other drinking water personnel was an observed challenge by EHOs from every province interviewed. Some communities must have their water delivered via truck and the knowledge of the driver regarding the potentials for contamination may pose an issue as well (Participant 11, interview, September 5, 2012).

MISUNDERSTANDING REGARDING THE POTENTIALS FOR CONTAMINATION

A misunderstanding regarding the potentials for contamination among some residents was cited as a potential hurdle. For example, one EHO spoke of observing unsanitary storage practices for household drinking water, where some residents defended the practice on the premise of it taking place for several years without harm (Participant 2,

interview, August 7, 2012). In addition, it was noted in Manitoba that language can at times be a barrier to communicating messages regarding safe drinking water practices (Participant 2, interview, August 7, 2012).

GEOGRAPHY

Geographic distance can pose challenges for First Nations communities in Canada. Communities that are more remote often do not have sophisticated water delivery systems, in part due to their distance from larger water delivery lines (Participant 3, interview, August 17, 2012). Northern communities may be further from laboratories that examine samples, as well they may be more difficult to access, such as fly-in communities. Under these circumstances, it can be a challenge to reach these communities in the event that samples need to be sent to a lab for emergency testing or the immediate assistance of an EHO would be beneficial. Northern communities, such as the case in Ontario, are more isolated than communities in Southern Ontario, leading to difficulty in accessing a laboratory quickly with emergency samples (Participant 3, interview, August 17, 2012). It was also explained that water treatment operators in the southern portion of the province are able to get assistance from one another if one of them is ill and an emergency arises through agreements with surrounding First Nations (Participant 3, interview, August 17, 2012).

SIZE AND CAPACITY

The differences between community size and capacity are key considerations. The size of the community can affect the capacity of the community in terms of a pool of skills and resources to draw from. One EHO pointed out that in his/her experience, some communities are pretty self-reliant, whereas some of the smaller communities may require some more assistance and guidance from the EHOs (Participant 11, interview, September 5, 2012). As observed by several EHOs, the size of a community can affect the pool of resources that they have to draw upon for drinking water management. EHOs explained that there might be a public works manager who looks after drinking water concerns, but in the experience of a few EHOs, the band office may have fewer staffs and may not include a position like this. Consequently, Chief and Council might be occupied with other important matters and may not have the time to routinely dedicate attention to drinking water (Participant 11, interview, September 5, 2012). Given the breadth of responsibilities, Chief and Council may not be educated on drinking water monitoring to the extent that a dedicated public works manager would be (Participant 11, interview, September 5, 2012).

INFRASTRUCTURE

Numerous challenges were observed by EHOs in terms of infrastructure. The delivery of water was cited as a potential for contamination. For an EHO in Manitoba, the communities he/she is responsible for collect water in buckets and often these buckets are left uncovered (Participant 2, interview, August 7, 2012). In other cases, the possibility for contamination may be due to issues associated with maintenance, such as the case for cisterns. For example, in northern Ontario some communities have elected to build walls and roofs around their cisterns to prevent the water from freezing; however, it is no longer possible to clean the cistern with this type of structure in place (Participant 9, interview, August 30, 2012). Unfortunately, if not maintained, the cistern may become damaged (Participant 11, interview, September 5, 2012). An EHO from Alberta noted that if a cistern is covered with the proper lid, the fill pipe could freeze in the winter, but if taken off, animals, debris or other items can fall in (Participant 11, interview, September 5, 2012). When filling the cistern, the lid covering the cistern may be removed to visibly determine when the cistern has been filled to capacity; however, this can lead to damage of the lid and a potential for contamination of the water in the cistern (Participant 11, interview, September 5, 2012). Otherwise, if the lid is left on and the fill pipe is used, the ability to visibly determine if the cistern is full is impaired, which can lead to overflow and soil being drawn inside the cistern (Participant 11, interview, September 5, 2012).

The prevalence of private wells adds a layer of complication for monitoring and compliance. An EHO mentioned that there are a number of individual homes on constant advisories because they lack the funds to make the necessary improvements to their systems (Participant 8, interview, August 27, 2012). In this case the burden is on the individual or family to maintain their water system and make any improvements, as the band in many cases does

not have the funds (Participant 8, interview, August 27, 2012). The situation varies by community; some may have a population of 2,000 with a grid water system versus a community with 40-50 homes on individual wells (Participant 8, interview, August 27, 2012).

SOURCE

Among many Aboriginal and non-aboriginal communities in Canada, surface water, such as rivers or lakes, is the source used for their drinking water. In Ontario, there are several Aboriginal and non-aboriginal communities that rely on surface water for their source, which are open to the potential for contamination for shipping lines, farmlands, etc. (Participant 9, interview, August 30, 2012). For example, around Sarnia, Ontario there are several chemical plants which have released or spilled small amounts of chemical contaminants into the St. Clair River (Participant 9, interview, August 30, 2012).

ENFORCEMENT

Lack of enforcement mechanisms was cited by some EHOs as another challenge. Occupying a consultant-like function, EHOs do not enforce the Canadian Guidelines, due to the lack of legislation and subsequent regulation governing drinking water on reserves, as previously discussed. For non-aboriginal communities in Canada, water plant operators typically report to the ministry of the environment for the province; however, First Nations communities "…are not reporting to anybody, they don't report to us either…essentially it's the Chief and council that will hold them accountable" (Participant 2, interview, August 7, 2012; Participant 11, interview, September 5, 2012). Since there is no current enforcement mechanism, EHOs are limited to providing recommendations and guidance to the communities. Due to regulations, "provincially they have the ability to lay charges or to sort of force things, make things happen, whereas on reserve you provide information, you provide advice and you have a responsibility to make sure that it's good advice" (Participant 3, interview, August 17, 2012).

CONSUMER PERCEPTIONS OF WATER SUPPLY SAFETY

For factors contributing to perceptions of drinking water, aesthetic properties, over chlorination and representations of advisories in the media were identified. Although drinking water may meet the guidelines and has no health effects, and presence of an odour and/or colour may contribute to low confidence in the quality of the supply among residents (Participant 3, interview, August 17, 2012; Participant 9, interview, August 30, 2012). Elements like magnesium are brought out of solution when chlorine is added during disinfection, leading to visible precipitates and dark coloured water (Participant 9, interview, August 30, 2012).

In terms of chlorine, one EHO explained that operators may chlorinate a bit excessively. Without proper training and experience, over chlorination may be intended as a precautionary measure (Participant 3, August 17, 2012). In the past, operators had a tendency to over chlorinate when the limits for certain parameters, such as total coliform, were exceeded (Participant 8, interview, August 27, 2012). Excessive chlorination contributes to the taste of chlorine in the water, which may lead to complaints among residents (Participant 3, August 17, 2012). For British Columbia, it was argued that residents are aware of the necessity of chlorine for disinfection and EHOs report to the communities regarding the tests for chlorine by-products (Participant 8, interview, August 27, 2012).

An EHO mentioned that drinking water advisories may be misreported in the media. The EHO explains, "[t]he audience assumes that each of these systems represent the entire community having an advisory when it may only affect 5 homes on a small system. Unfortunately, the number of people on an advisory is not reported" (Participant 7, interview, August 23, 2013). Several EHOs suggested that the prevalence of drinking water advisories for First Nation communities is similar to small systems within the same province (Participant 3, August 17, 2012; Participant 8, interview, August 27, 2012). All EHOs acknowledged the variations between First Nations communities in Canada.

5.1.2 Potential for Adopting Regulations

The potential of adopting provincial drinking water regulations for First Nations communities in Canada was discussed with EHOs. It was noted among participants that the drinking water standards from their respective provinces are already being used as the standards for the communities they work with. During several interviews, it was presented that the EHOs have elected to use the more stringent of standards between the Canadian Guidelines and the provincial regulations of their region. According to an EHO in Ontario, the decision to meet the Ontario Safe Drinking Water Act was driven by First Nations, where the program in place uses the standards set out in the monitoring portion of the legislation (Participant 9, August 30, 2012).

Beyond standards, EHOs interviewed were somewhat sceptical of regulations, where most were sceptical that regulations alone would improve drinking water quality for the communities they work with. The reasons provided for the scepticism stemmed from concerns that some communities do not have the capacity (i.e. sufficient funds, water supply staff and/or infrastructure) to meet the standards. (Participant 5, August 20, 2012; Participant 8, August 27, 2012). In addition, concerns were raised over the addition of an enforcement mechanism to the regulations. Some EHOs have expressed concern for a change in their relationship with the communities if they were to become responsible for enforcing the regulations (Participant 3, August 17, 2012; Participant 5, August 20, 2012). According to other EHOs, the challenge brought on by a decision to include enforcement mechanisms in the regulations will be determining who is responsible. For example, an EHO suggested that it is unclear as to whether the community or AANDC would be responsible if the water supply operators were not properly trained (Participant 7, August 23, 2012).

The EHOs also discussed drinking water measures that would contribute to the health and safety of the community. One EHO in particular spoke about the challenges of maintaining the awareness of the community on drinking water issues, as some communities may become tired of the same messaging and other issues may begin to take precedent (Participant 8, August 27, 2012). Many EHOs saw attainable improvements through education. One EHO saw the potential to get youth into positions among drinking water personnel, such as through career-related programs (e.g. Thompson River University) (Participant 8, August 27, 2012). As well, one of the roles of EHOs is to provide education to the communities regarding public health concerns, such as drinking water (Participant 6, August 20, 2012). There were EHOs that spoke of the usefulness and success of several initiatives due to engaging with the First Nations communities. For example, an EHO from Ontario spoke about a children's water festival that is now led by the communities (Participant 9, August 30, 2012).

Other supports may be useful for communities in terms of drinking water quality. EHOs from Alberta spoke about a database that was developed for the region, which captures and trends data relating to drinking water sampling results for bacteriological and chemical parameters (Participant 11, September 5, 2012). This kind of information would be useful to communities and EHOs in identifying particular risks, such as persistence of a particular contaminant or seasonal variations.

Multiple EHOs spoke about the possibility of agreements between First Nations communities, and at times, between a First Nation community and a municipality. According to an EHO, these agreements are common in British Columbia, particularly in the lower mainland (Participant 8, interview, August 27, 2012). When asked if the size of the community had any bearing on an agreement with a municipality, it was clarified that location is a greater consideration (Participant 8, interview, August 27, 2012). An EHO from Ontario spoke of an agreement between a First Nation community and a municipality for sharing water treatment operators through a Memorandum of Understanding (Participant 3, interview, August 17, 2012). An EHO from Alberta observed this possibility and mentioned that this may be easier if they shared the same standards (Participant 11, interview, September 5, 2012). Although, some communities may be hesitant to enter into similar agreements with municipalities, fearing that if they cannot pay their bills their water will be turned off (Participant 11, interview, September 5, 2012).

Several EHOs commented on the involvement of First Nations communities in the establishment of regulations. The communities will be responsible for implementing the new regulations and will need to be involved in the development phase (Participant 9, August 30, 2012). Rather than prescribing a method to achieve improvement, an EHO in Ontario suggested the federal government create a space for discussions, to be "a vehicle of negotiation." (Participant 9, August 30, 2012).

5.2 United States

The *Safe Drinking Water Act* (SDWA) provides the framework, based on a multi-barrier approach, to promote safe drinking to populations. The SDWA also permits states to develop and enforce their own drinking water regulations as long as the standards meet or exceed the level of stringency found in the National Drinking Water Regulations (Participant 17, interview, October 15, 2011; US EPA 2012c; US EPA 2012b). Accordingly, most states and territories with the exception of the District of Columbia and Wyoming, have taken the opportunity to create independent drinking water standards (US EPA 2012c).

Under the SDWA, the Environmental Protection Agency (EPA) is authorized to develop and administer regulations for chemical, physical, radiological, and microbiological contaminants in terms of assigning maximum concentration levels (MCL) for harmful substances as well as requiring treatment techniques (US EPA 2012a). The National Primary Drinking Water Regulations (primary standards) are set by the EPA and enforced through the Public Water System Supervision (PWSS) program (US EPA 2007, p. 1).

The PWSS program oversees public drinking water compliance with the primary standards. Under the program, the EPA works in partnership to supervise public water systems with the states that have been delegated authority to develop and enforce their own drinking water regulations (US EPA 2011). State laws do not apply to tribes with regards to environmental regulations; therefore, the EPA directly administers the PWSS program for tribes through its regional offices (US EPA 2007, p. 1).

The potential to assume enforcement authority over drinking water regulations also exists for tribes under the SDWA. Tribes that wish to implement their own standards must apply and successfully obtain the approval from the EPA, known as obtaining "treatment in the same manner as a state" (TAS) (US EPA 2007, p.1). To manage their own PWSS program in place of the EPA, a tribe "may apply for a program development grant under section 1443 of the SDWA" in addition to meeting the TAS eligibility requirements and any other requirements placed on states (US EPA 2007, p. 1).

Only the Navajo Nation has sought and acquired primary enforcement authority, or "primacy" (US EPA 2007, p. 1; US EPA 2012e). The Navajo Nation has a population of approximately 200,000 people living on 17.6 million acres, making it the "largest reservation in the country" (US EPA 2012d). According to the EPA, over 30% of the Nation's residents lack access to safe drinking water and many residents live in remote areas of the reservation (US EPA 2012d). The Nation has its own drinking water standards, the Navajo Nation Primary Drinking Water Regulations, which are implemented by the Navajo Nation Environmental Protection Agency through the PWSS program and authorized under the Navajo Nation Safe Drinking Water Act (NNSDWA) (Navajo Nation Environmental Protection Agency 2013)

5.2.1 Standards and Monitoring Requirements

The primary standards are legally enforceable and set out in the National Drinking Water Regulations (US EPA 2012f). The goal of the standards is to "protect public health by limiting the levels of contaminants in drinking water" (US EPA 2012f). Limits of specified drinking water contaminants are included as well as frequency schedules and methods for testing to be followed by water system operators (US EPA 2012c). For treatment, "[t]he amount and type of treatment applied by a Public Water System (PWS) varies with the source water type (surface or groundwater) and quality" (US EPA 2008). Tribes that have not assumed primacy must meet the federal drinking

water standards for their water systems, whereas the Navajo Nation must comply with the standards set out in the Navajo Nation Primary Drinking Water Regulations (US EPA 2008; Navajo Nation Environmental Protection Agency 2013).

Lists of contaminants and their MCLs are found on the Drinking Water Contaminants page of the EPA, for:

- Microorganisms;
- Disinfectants;
- Inorganic chemicals;
- Organic chemicals; and
- Radionuclides (US EPA 2012f).

There are also secondary standards, or the National Secondary Drinking Water Regulations, which are guidelines overseeing contaminants that may lead to cosmetic effects for the consumers of the water, such as tooth discolouration, or aesthetic effects in the water, such as taste and odour (US EPA 2012f). The Unregulated Contaminant Monitoring (UCM) program is employed by the EPA to "collect data for contaminants suspected to be present in drinking water, but do not have health-based standards set under the SDWA" (US EPA 2012g). As stipulated by the SDWA, the EPA reviews a list of contaminants every five years, which had been based on tracking a representative sample of public water systems providing for fewer than 10,000 people (US EPA 2012g). The results of this work are stored in the National Contaminant Occurrence Database (US EPA 2012g).

In the United States, "[a] regulated PWS is any water system that makes water available for drinking to 15 or more connections, or regularly serves an average of 25 individuals daily at least 60 days out of the year" (US EPA 2008). The public water system owners, "are responsible for complying with all regulations, record keeping and public notice requirements" (US EPA 2004, p. 1). The EPA adds the data on violations submitted by tribes and states to the Safe Drinking Water Information System (SDWIS), which is a database that consumers can use to find information about public water systems throughout the country (US EPA 2013b; Participant 17, interview, October 15, 2012).

According to an employee from the Indian Health Service, most tribal communities are either on small tribal municipal systems or individual systems. Homes that are scattered around a community rather than clustered may have individual systems (Participant 13, interview, September 27, 2012). For communities that are not on reservation lands, the water systems may not be operated by a tribe. For example, there are large populations of American Indians in urban areas, as well as areas in the United States that do not have reservations, like Oklahoma (Participant 13, interview, September 27, 2012).

Tribes typically own and manage public drinking water supplies for their communities, regardless of whether a tribe has assumed primacy for drinking water (Participant 13, interview, September 27, 2012). Therefore, tribes are responsible for employing water system operators, verifying that the necessary samples are collected and tested and submitting the results to the EPA (Participant 13, interview, September 27, 2012; Participant 17, interview, October 15, 2012; US EPA 2008). The tribes are also responsible for issuing a notice to consumers in the event that a parameter has exceeded its limits when tested. The same precautionary actions exist for tribes as any other community in the country (Participant 17, interview, October 15, 2012). The EPA makes a compliance determination after receiving the testing results from the community and issues a violation if data demonstrate that the parameters exceed the criteria for the rules (Participant 17, interview, October 15, 2012). The policy is called the enforcement response protocol and the EPA is in the process of, "developing guidance to our reasons on how to implement this in tribal communities" (Participant 17, interview, October 15, 2012).

5.2.2 Support for Indigenous Communities

There is no direct federal support or program tailored to tribes to assist in compliance with drinking water monitoring standards. The EPA does not travel to the tribes and engage in additional monitoring under routine

conditions; however, there are unique situations where the EPA would send an officer to take a sample (Participant 17, interview, October 15, 2012). For example, if there appears to be a risk to public health, like an outbreak, and there is a lack of sampling data in the reports sent to the EPA (Participant 17, interview, October 15, 2012). According to an EPA officer from the Office of Ground Water and Drinking Water, the support to ensure tribal communities achieve compliance is offered through the provision of funds to build infrastructure (Participant 17, interview, October 15, 2012).

There are EPA provisions for technical assistance funding, which can provide indirect support for training on how to properly collect samples and the appropriate actions in the event of contamination (Participant 17, interview, October 15, 2012). The EPA regional offices that have tribes in their regions may alternatively choose to use the technical assistance funds to finance the chemical analysis, the development of a database or sanitary surveys. The EPA officer explains, "there's a lot of demand on those funds, those funds have been around $6 million per year for the last 15 years, without an increase for inflation. There are not a lot of funds there to do everything that needs to be done" (Participant 17, interview, October 15, 2012).

There are other departments that also serve tribal communities in terms of drinking water. There are 566 federally recognized tribes that are supported by the Indian Health Service (IHS), which is a division of the Department of Health and Human Services and "is responsible for providing federal health services to American Indians and Alaska Natives" (Participant 13, interview, September 27, 2012; IHS n.d.). There is variation among the 12 administrative regions delivering the programs for the IHS, which allows each region to customize their drinking water program to meet the particular needs of that region (Participant 13, interview, September 27, 2012). Under the IHS Office of Environmental Health there is the Environmental Health Support Center, which provides training to tribal engineers, environmental health services staff, and tribal operators' drinking water facilities (Participant 13, interview, September 27, 2012). IHS also oversees environmental health programs for tribes, which entail conducting inspections of tribal facilities (Participant 13, interview, September 27, 2012).

The Infrastructure Task Force to Improve Access to Safe Drinking Water and Basic Sanitation in Indian Country has a Memorandum of Understanding between several federal government departments (i.e. the Department of Agriculture, Department of Health and Human Services, Department of Housing and Urban Development, Department of the Interior, and the Environmental Protection Agency) with the purpose of gaining "a common understanding of the programs and policies of each party that pertain to providing infrastructure services in Indian country," as well as, "identify barriers and programmatic inefficiencies, and; to work toward implementing solutions to overcoming these barriers and inefficiencies" (US EPA 2012h). The EPA also participates in the Local Government Environmental Assistance Network (LGEAN), which offers regulatory information for local government staff, including drinking water standards (LGEAN n.d.).

5.2.3 Confidence Building and Community Measures

In terms of confidence building measures for consumers, there is a legislative requirement for all water systems in the country to produce an annual Consumer Confidence Report (CCR), which provides the results of the monitoring and compliance, as well as a listing of any violations (EPA 2013; Participant 17, interview, October 15, 2012). As well, there is the SDWIS database for consumers to use and found on the EPA website (EPA 2013b).

According to the EPA officer, there a community-based outreach project on tribal lands associated with drinking water on the Navajo Nation. The Nation is engaged in communicating with residents that unregulated agricultural wells, presumably used as a source of drinking water, are unsafe for human consumption (Participant 17, interview, October 15, 2012).

5.3 New Zealand

Drinking water is governed under the Health (Drinking Water) Amendment Act (2007) and the Ministry of Health produces the *Drinking-water Standards for New Zealand* (DWSNZ). The DWSNZ are based on the following standards and guidelines:

- The World Health Organization's (WHO) *Guidelines for Drinking-water Quality* (2004);
- Former versions of the *Drinking-water Standards for New Zealand* (from 1984-2005); and
- The *National Primary Drinking Water Regulations: Long Term 2 Enhanced Surface Water Treatment Rule: Final Rule* from the United States (New Zealand Ministry of Health 2008, p. 2).

In addition to complying with the DWSNZ, all public water systems serving over 500 people are obligated "to develop and start to implement a Public Health Risk Management Plan, also known as water safety plans, to guide the safe management of their supply before 2013," as set out in the Health (Drinking Water) Amendment Act 2007 (Participant 14, interview, October 1, 2012; New Zealand Ministry of Health 2008, p. 1). The Plan is intended as a tool "to help suppliers identify, manage and minimise events that could cause water quality to deteriorate" (New Zealand Ministry of Health 2008, p. 1).

5.3.1 Standards and Monitoring Requirements

The DWSNZ gives the maximum acceptable values (MAVs) for drinking water contaminants that waters suppliers are required to test for, as well as compliance criteria (New Zealand Ministry of Health 2008, p. 2). To ensure that legislation and regulations are implemented to their full potential, the Ministry for the Environment "has developed a suite of 'tools'," which "gather information about the about the way in which water supplies are being managed" (New Zealand Ministry of Health 2013a). The Standards outline compliance criteria for the following parameters:

- Bacterial;
- Protozoal;
- Viral;
- Cynotoxin;
- Chemical; and
- Radiological (New Zealand Ministry of Health 2008).

In addition to addressing the public health risks, the DWSNZ also offer guideline values for aesthetic parameters (New Zealand Ministry of Health 2008; Participant 14, interview, October 1, 2012). Taking a wider stance on drinking water monitoring, such as looking at aesthetic parameters, incorporates the well-being of the community as it is understood that the water will be used for other purposes (e.g. dishes and clothing) where public health also plays a role (Participant 14, interview, October 1, 2012). As explained by an interview participant from the Ministry of Health, "we also want people to be able to not only use the water for other purposes… but also to be able to consume the water without any adverse effects," such as a misunderstanding as to the safety of the drinking water (Participant 14, interview, October 1, 2012). "People need to have confidence in the water as well as not feeling as if they're drinking something that may not be safe" (Participant 14, interview, October 1, 2012).

There was no legislation for drinking water prior to 2007 and although standards existed, they were not mandatory (Participant 14, interview, October 1, 2012). In 2007, all drinking water systems were required to take "practical steps" to comply with the standards (Participant 14, interview, October 1, 2012). There are different categories of supply determined by the size of the population it serves and "each category of supply has different dates by which they had to comply up until 2016" (Participant 14, interview, October 1, 2012). The categories range from large, medium, minor and small supplies (Participant 14, interview, October 1, 2012).

According to the drinking water adviser from the Ministry of Health, there are two types of supplies: the first are "operated by local councils or local authorities or municipalities," and they are the large and medium supplies; whereas the second type "would be a community water supplier that is owned and operated by the community themselves," such as the minor and small supplies (Participant 14, interview, October 1, 2012). Most of the country's population is supplied by the former, such as a city or district (New Zealand Ministry of Environment 2012). Regardless of the type of the system, the same policies and procedures apply (Participant 14, interview, October 1, 2012). As well, there are no unique standards for communities that have higher proportion of Indigenous peoples (Participant 14, interview, October 1, 2012).

The Ministry of Health assists with the interpretation of the DWSNZ and the drinking water assessors monitor compliance according to the Health Act among drinking water systems (Participant 14, interview, October 1, 2012). The assessors take samples from the supplies they monitor and provide advice and guidance on those samples (Participant 14, interview, October 1, 2012).

Drinking water assessors are appointed under the *Health (Drinking Water) Amendment Act* (2007) and employed by the public health units, which are under contract with the district health boards and in turn, delegated authority by the Ministry of Health (New Zealand Ministry of Health 2008, p. 146; Participant 14, interview, October 1, 2012). In addition, they are required to complete a drinking water assessors course to become internationally accredited (Participant 14, interview, October 1, 2012). The Ministry of Health found that Environmental Health Officers may not have a sufficient level of technical competency and expertise (Participant 14, interview, October 1, 2012).

In the event that an MAV is exceeded, the water suppliers are required to refer to the standards and follow the appropriate action based on the particular contaminant (New Zealand Ministry of Health 2008; Participant 14, interview, October 1, 2012). In the case of an E. coli transgression, the water supplier would follow the process laid out in the standards and notify the drinking water assessor (Participant 14, interview, October 1, 2012). The water supplier and the drinking water assessor would work together to verify that the MAVs for E. Coli were exceeded by taking more samples, and if it is a concern they will then issue a boil water notice to the community (Participant 14, interview, October 1, 2012).

5.3.2 Support to Indigenous Communities

Although some communities might have a higher proportion of Indigenous populations, New Zealand does not have a reserve system. Consequently, programs are not based on any specific ethnicity, though there are Ministry of Health programs that seek to address inequalities in terms of drinking water (Participant 14, interview, October 1, 2012). According to the interview participant from the Ministry of health, "we're not focusing in terms of drinking water on any specific ethnicity. What we're trying to do is assist every single drinking water supply out there and give them all an equal opportunity to improve their water supplies" (Participant 14, interview, October 1, 2012).

In particular, the Drinking Water Assistance Programme (DWAP) includes a technical assistance component and a subsidy scheme intended to provide technical assistance to small water suppliers serving less than 5,000 people (New Zealand Ministry of Health 2013b; Participant 14, interview, October 1, 2012). The purpose is to improve the sustainability level of small water supplies, "in terms of the more people you have, the more affordable it could potentially be for the community in terms of maintaining the system and the replacement of assets" (Participant 14, interview, October 1, 2012). The focus is on connecting these supplies with wider communities, or collaborative capacity building groups (Participant 14, interview, October 1, 2012; New Zealand Ministry of Health 2013b). DWAP facilitators are located in the public health units and "provide training on how to write Public Health Risk Management Plan, and provide DVDs and other training resources on aspects of small drinking-water supplies. They will also arrange for independent technical advice to assist these groups make informed decisions about their supplies" (New Zealand Ministry of Health 2013b) This seeks to offer the same access to engineering and technical advice that would be available to a larger supply run by a local council (Participant 14, interview, October 1, 2012). Although the DWAP is not funded specifically for Indigenous communities, "you may find that you have, for

example, more Maori in a specific community that would have a higher deprivation level (lower socio-economic standards - lower income) than some folks in other areas, this is where in terms of our subsidy scheme we will be addressing that through the deprivation index, one of the key criteria to be able to receive a subsidy. We can potentially help more of those small communities than perhaps a country that would have different challenges and would potentially have to have a more targeted approach at addressing other inequalities or public health risks" (Participant 14, interview, October 1, 2012).

Another function of the DWAP is health education, which includes a series of DVDs that are distributed to communities, regardless of the size, as well as other government agencies (Participant 14, interview, October 1, 2012). Some DVDs contain technical advice such as drinking water storage and developing public health risk management plans for water suppliers. There are DVDs that deliver public health messaging that are used by schools to educate the students and also to take those messages home to the community (Participant 14, interview, October 1, 2012). As well, there is a DVD intended for small water supplies that explains the existence of pathogens in the drinking water (New Zealand Ministry of Health 2013b).

5.3.3 Confidence Building and Community-led Initiatives

The Ministry of Health has a national database where all information in terms of compliance is captured (Participant 14, interview, October 1, 2012). Water supplies that register and use the database and are required to keep it updated in terms of complying with the standards as well as complying with the legislation. Small water supplies are not required to enter their data into the system (Participant 14, interview, October 1, 2012). In addition, it is a statutory requirement for the Ministry of Health to publish an annual report on drinking water quality (*Annual Review of Drinking-Water Quality in New Zealand 2010-2011***)**, which lists all drinking water supplies that serve over 100 people and is made available to the public on the Ministry's website (New Zealand Ministry of Health 2012; Participant 14, interview, October 1, 2012). The report provides a snapshot of the water quality in the country for those supplies by providing information on the frequency of exceedences of Maximum Acceptable Concentrations of bacteriological and chemical parameters, as well as the public health significance of exceedences (New Zealand Ministry of Health 2012; Participant 14, interview, October 1, 2012).

The interview participant was not able to speak to any specific community-led initiatives.

5.4 Australia

Much like Canada, drinking water regulations are generally a provincial, or state, issue. The federal government in Australia offers guidance on water quality including drinking water standards through the National Water Quality Management Strategy (NWQMS), which is a joint "approach to improving water quality in Australian and New Zealand waterways" (Australia Department of Sustainability 2012). The process "for planning, implementing and managing water quality projects," was developed under the Water Quality Management Framework, which includes the 2011 Australian Drinking Water Guidelines (ADWG) (Australia Department of Sustainability 2012). The ADWG are produced by the National Health and Medical Research Council (NHMRC), in collaboration with the Natural Resource Management Ministerial Council (NRMMC), and acts as an "authoritative reference" regarding safe drinking water, by offering local governments and the water supply industry recommended levels of contaminants that may pose a public health risk (NHMRC 2012).

In addition, the National Water Initiative (NWI) is the primary water policy agreement of the Council of Australian Governments (COAG), and "signed by all governments in Australia," for "a more cohesive national approach to the way Australia manages, measures, plans for, prices, and trades water" (NWC n.d. a; NWC n.d. b). The National Water Commission "promotes the objectives and outcomes of the National Water Initiative" (NWC n.d a).

As explained by a participant from South Australia, the federal government originally had primary responsibility for infrastructure, including funding and upgrades, while states were responsible for management (Participant 15,

interview, October 2, 2012). For example, in Northern Territory there are bilateral agreements with the Commonwealth where responsibility for aspects of management may be delegated to the territory (Participant 12, interview, September 24, 2012; Participant 15, interview, October 2, 2012; Australia Department of Sustainability 2012). In South Australia (SA), management of the larger water supplies has been transferred to SA Water, the water utility owned by the state (Participant 15, interview, October 2, 2012). SA Water looks after roughly 20 of the significant Indigenous communities in the state (Participant 15, interview, October 2, 2012).

5.4.1 Standards and Monitoring Requirements

New South Wales (NSW)

The New South Wales *Public Health Act 2010* and Public Health Regulation 2012 include safety measures for drinking water. In other matters pertaining to drinking water quality, such as outlining standards for specified contaminant levels, the state "endorses" the Australian Drinking Water Guidelines 2011 (NSW Government Health n.d.). As stipulated in the Guidelines, public drinking water supplies are monitored routinely and "in proportion to the size of the population and the area supplied" (NSW Health 2002, p.1). For example, "the largest towns in regional areas will collect several samples per week for bacteriological testing and at least one sample per month for chemical testing; the small communities might only be one sample per month for bacteriological testing and one or two samples a year for chemical testing" (Participant 16, interview, October 10, 2012).

Although, communities own the drinking water supplies, state agencies are responsible for the hiring or contracting of water supply operators (Participant 16, interview, October 10, 2012). According to an interview participant from the state, NSW Health administers a drinking water monitoring program for the entire state, which includes towns, regional areas and Aboriginal communities (Participant 16, interview, October 10, 2012). For example, local councils are responsible for supplying drinking water in regional areas and NSW Health has a thorough Drinking Water Monitoring Program for these supplies (NSW Health 2002, p.1). The role of NSW Health is to work with communities, and the role of the NSW Office of Water is to develop risk-based water and sewage management plans, which are similar to WHO Water Safety Plans (Participant 16, interview, October 10, 2012).

In addition to administering the program, NSW Health also covers the costs associated with testing (Participant 16, interview, October 10, 2012). The actual testing of the water is completed by either water utilities or community-based water samplers who are employed by a local council, and these samplers are often Environmental Health Officers (Participant 16, interview, October 10, 2012). Most of the samples are sent to a NSW laboratory (Participant 16, interview, October 10, 2012).

In the event that the water quality is a concern, NSW Health has three response protocols for water utilities and Public Health Units to follow depending on the contamination characteristic:

1) Physical and chemical characteristics;

2) Treatment failure or detection of giardia or cryptosporidium; and

3) Microbiological characteristics (NSW Government Health n.d.).

The protocols are used to determine whether contamination has occurred and the appropriate responses, which are commonly boil water alerts (Participant 16, interview, October 10, 2012). Section 22 of the *Public Health Act 2010* grants the Chief Health Officer the authority to issue advice in the event that contamination from any of these parameters poses a risk to public health (NSW Health n.d.). These protocols apply regardless of whether it is a large town or an Aboriginal community (Participant 16, interview, October 10, 2012).

Alternative types of disinfection to chlorine are permitted in state. The interview participant spoke of two Aboriginal communities using Ultra Violet light disinfection without the accompaniment of a chemical disinfectant for the purposes of maintaining a disinfectant residual (Participant 16, interview, October 10, 2012).

In terms of programs that target Indigenous communities' drinking water, New South Wales has the NSW Aboriginal Communities Water and Sewerage Program, which is offered through the partnership of the New South Wales Aboriginal Land Council and the NSW State Government Office of Water (Office of Water 2012). The program provides support to over 60 Aboriginal communities with regards to operation, maintenance and monitoring of services (Participant 16, interview, October 10, 2012; Office of Water 2012). To determine appropriate actions to be taken, "[c]onsultation is arranged between the local Aboriginal community, the local water utility, the Office of Water and other interested stakeholders to examine the existing infrastructure and services...to improve the service levels to the standard expected in the wider community" (Office of Water 2012).

In terms of confidence building measures, "the communities are involved in the process to develop water risk management plans, so the communities are involved in a discussion of the perception of their supply and risks, in a discussion about how those risks are being evaluated and if they're considered to be real risks, how those risks are managed" (Participant 16, interview, October 10, 2012). The purpose of these measures is to help the communities comply with the Australian Drinking Water Guidelines, and focus "is really on optimizing what is there" in terms of resources and infrastructure (Participant 16, interview, October 10, 2012). All communities in New South Wales are supported under this program (Participant 16, interview, October 10, 2012).

NORTHERN TERRITORY

The Northern Territory has the majority of Aboriginal communities, 73 discrete major Aboriginal communities with 200 to 300 people, as well as about 500 homeland communities that are completely mobile, consisting of 5 to 50 people of one to ten houses depending on family relations (Participant 12, interview, September 24, 2012). Power and Water Corporation, the Northern Territory Government owned utility, provides water services (as well as electrical services) to the 73 major Aboriginal communities. Legislation and eventual regulations in the territory apply to these communities, whereas the mobile communities are the responsibility of the Department of Housing, Local Government and Regional Services (Participant 12, interview, September 24, 2012).

The *Public and Environmental Health Act* includes the supply and quality of drinking water; however, it is relatively recent (came into force in July 2011) and regulations are anticipated for the summer of 2013 (Participant 12, interview, September 24, 2012; Department of Health Northern Territory 2013a). The Northern Territory *Water Supply and Sewerage Services Act* authorizes the Minister of Health and Community Services to outline drinking water standards, and through this authority the Department of Health has adopted the ADWG as the basis for monitoring (Participant 12, interview, September 24, 2012; Northern Territory Department of Health 2013b).

Rather than declare the national Guidelines as law, the Department of Health has elected to provide emergency advice to the utility on actions to be taken by the water supply. For example, in the case of a water boil alert and also the standard operating procedure for technicians if an adverse water quality event were to occur. Power and Water Corporation is responsible for contacting the Department of Health via email or text message if a particular community exceeds the limit for bacterial count (Participant 12, interview, September 24, 2012). An interview participant from the Department of Health indicated that most Australian states have adopted the National Guidelines in the same manner as Northern Territory, through a memorandum of understanding with their utilities (Participant 12, interview, September 24, 2012).

The Department of Health's monitoring program for drinking water supplies is based on the Australian Drinking Water Guidelines, while also incorporating "specific water quality characteristics that are problematic in the Northern Territory and not necessarily described in the ADWG in great detail" (Northern Territory Department of Health 2013b). The legislation applies to Aboriginal communities as well as other communities in the territory

(Participant 12, interview, September 24, 2012). The interview participant for this territory explained that the monitoring program has had success in decreasing the number of water boil alerts from ten in previous years to two (Participant 12, interview, September 24, 2012). This success was attributed to the program being proactive rather than simply reactive to emergencies, by taking a multi-barrier approach (Participant 12, interview, September 24, 2012).

In terms of disinfection, most communities are chlorinated and maintain a disinfection residual, as it is an inexpensive, readably available and the preferred disinfect of the Department of Health due to the apparent disinfection residual (Participant 12, interview, September 24, 2012). Chlorine residual is tested on a weekly basis or daily in some communities (Participant 12, interview, September 24, 2012).

With regards to confidence building measures, the territory has a remote community water management workshop that is run by the utility (Participant 12, interview, September 24, 2012). Through this workshop, Power and Water Corporation and the Department of Health collaborated to engage with community members regarding their views on the community water planner tool (see 5.5.2 Support to Indigenous Communities) to involve the community in decision making (Participant 12, interview, September 24, 2012).

In addition, the Department of Health has a dedicated officer to go around to the communities to discuss drinking water with the elders, to uncover how they view water, any barriers to water quality and whether or not community members drink the water or consume substitutes (Participant 12, interview, September 24, 2012). Through these discussions the Department of Health learned that people avoid drinking the water if it tastes too salty even though it is not a risk to public health (Participant 12, interview, September 24, 2012). This discovery is of note to the Department of Health since there is "a high level of kidney disease among Aboriginal people in the remote communities and we believe that hydration is very necessary, but if people avoid drinking water and they're drinking other things like beer, tea or coffee or orange juice, coca cola or whatever, anything else that's not water, they're not getting the necessary hydration for their kidneys to function properly" (Participant 12, interview, September 24, 2012). The temperature of the water also can have an impact on consumers, where residents may choose sugary beverages, like colas which are cold, rather than drink the water (Participant 12, interview, September 24, 2012). Since the water in many communities can be as warm as 40°C, some schools now have chilled water fountains (Participant 12, interview, September 24, 2012).

SOUTH AUSTRALIA (SA)

In South Australia, the *Safe Drinking Water Act* was recently passed in 2011 (previously drinking water was regulated under the *Food Act*), and the Safe Drinking Water Regulations are anticipated for 2013 (Participant 15, interview, October 2, 2012). Under these regulations all drinking water supplies must comply with the same rules, including Aboriginal communities (Participant 15, interview, October 2, 2012). All water supplies are required under these regulations to have a monitoring plan and an incidence response protocol approved by the Department of Health (Participant 15, interview, October 2, 2012). The intention of the new regulations goes beyond compliance, "it's also about giving direction and clarity about what you need to do to ensure the supply is safe and how that's measured" (Participant 15, interview, October 2, 2012). The new regulations will require every community to have their risk management plans audited or inspected every two years, which will be carried out by the Department of Health in the case of remote communities (Participant 15, interview, October 2, 2012).

The water supplier is responsible for taking samples from the supply for testing, which includes SA Water, which serves roughly 95 % of the population (Participant 15, interview, October 2, 2012). If testing reveals non-compliance with the incidence protocol, water supplies must immediately report these results by voice or by email, depending on the priority level (Participant 15, interview, October 2, 2012). The Department of Health does not travel out to the communities to collect its own samples; rather, it receives all of the results from the water suppliers (Participant 15, interview, October 2, 2012). SA Water maintains a database of sampling results and the Department of Health is able to access this information by contacting the utility or in the monthly reports from the utility water

supplies (Participant 15, interview, October 2, 2012). Monitoring follows the same principles as the regulatory standards; they apply equally to Indigenous communities in remote arid areas as to non-Indigenous communities, "because it's based on the level of risk" (Participant 15, interview, October 2, 2012). As well, there are no established frequencies for monitoring, it is done on a case by case basis for each supply; however, "it'll be risk-based, so we'll apply the same approach to a community whether they're Indigenous or not" (Participant 15, interview, October 2, 2012).

Groundwater is a common source for drinking water in the state; therefore, the state allows for UV light as an alternative disinfection method for small systems and a residual chemical disinfectant is not required (Participant 15, interview, October 2, 2012). As explained, "[t]hese are very small systems, the UV is on the outlet of the service tank so from it just goes to houses, so as I said very discrete, very small systems, small communities. And it is very rare we pick up E.coli" (Participant 15, interview, October 2, 2012). The drinking water advisor for South Australia mentioned that one community in the state chose to have a rain water supply (Participant 15, interview, October 2, 2012).

In terms of confidence building measures, the interview participant found that switching from irregular monitoring to routine monitoring of the supply has somewhat improved the perception of drinking water among communities (Participant 15, interview, October 2, 2012). Salinity is common for the groundwater and occasionally a community will be disturbed by the taste and concerns will be raised that the water may be unsafe (Participant 15, interview, October 2, 2012). The interview participant commented that now with the routine monitoring, "they know if something goes wrong that the state water utility is going to take care of it" (Participant 15, interview, October 2, 2012).

5.4.2 Support to Indigenous Communities / Confidence Building Measures

The Community Water Planner is a national, online tool intended for use across all jurisdictions and developed jointly by NHMRC and the National Water Commission (WQRA 2013). The tool looks at multiple barriers, in particular water catchment areas (Participant 12, interview, September 24, 2012). The tool is particularly intended for smaller communities "to assist managers of remote community water supplies in managing microbiological, physical, chemical and radiological water quality risks" (WQRA 2013; Participant 12, interview, September 24, 2012; NHMRC 2012). The tool produces a range of documents, such as management plans, action plans, action plan help, verification monitoring plans, operational monitoring plans, etc. (NHMRC 2012). Using the tool, remote and Indigenous communities can generate water safety plans that are specific to their communities (WQRA 2013). According to an interview participant, the community water planner is similar to a tool being developed by the WHO (Participant 12, interview, September 24, 2012). Accompanying the tool is the *Field Guide to the Community Water Planner*, which includes a page of factors to consider, such as language group, remoteness and resources available, as well as appropriate and inappropriate actions when working with Indigenous communities (NWC 2009, p. 9).

6.0 Discussion Section

6.1 Provincial/Territorial Jurisdictional Scan

The jurisdictional scan included a review of the pertinent regulations in each province and territory across Canada; as well as, the roles and responsibilities of the departments or agencies involved oversight; precautionary public health measures; disinfection requirements and notable practices that contribute to monitoring. The findings from the jurisdictional scan can be found in Appendices 1 and 2 of this report.

Upon review of the relevant regulations and associated government publications and/or websites, it was noted that all provinces and territories in the country identify the multi-barrier approach as guiding the management of their drinking water quality. For example, British Columbia employs a "Source-to-Tap" framework, which is described in the province's *Comprehensive Drinking Water Source-to-Tap Assessment Guideline* and incorporates the multi-barrier approach (Ministry of Healthy Living and Sport 2010, p. 10). The charity, Ecojustice, scores the country's drinking water regulations based on the stringency of standards, as well as the presence and usefulness of source water protection measures (i.e. source protection is a component of the multi-barrier approach). In a recent "report card" released by Ecojustice, Ontario and Nova Scotia received the highest scores (Ecojustice 2011). These findings are consistent with the literature review chapter of this report, as jurisdictions throughout Canada redirected their approaches to drinking water management following the tragedies in Walkerton and North Battleford and the recommendations for a multi-barrier approach from the Walkerton Inquiry (Health Canada 2010, p. 2).

With regards to drinking water monitoring, the WHO recommends a two-tier system to ensure that both routine testing is taking place in addition to surveillance by an agency that has legislated authority over administering the standards and regulations which govern the supply, including activities such as enforcement (WHO 1997, p. 18-19). Drinking water monitoring across the provinces and territories follows the two-tier system, as water suppliers conduct routine sampling for pathogens and other contaminants, while the provincial or territorial departments of health or environment oversee the overall risks to public health presented by the supply (see Appendix 1). The water supplier conducts routine testing for parameters prescribed either by the provincial/territorial regulations or recommended by the *Guidelines for Canadian Drinking Water Quality* (see Appendix 1). All jurisdictions in Canada were found to adhere to regulated standards more stringent than or as stringent as the Guidelines. Manitoba is the only province to completely adopt the Guidelines without the creation of independent standards or monitoring practices for (approved) public systems (see Appendix 1).

Drinking water surveillance programs may benefit from moving beyond data collection and incorporating other strategies, as suggested by the WHO and previously examined in the literature review (WHO 1997, p. 20). Specifically relating to drinking water monitoring, several provinces and territories have strategic programs or tools to complement their regulatory frameworks. In terms of surveillance of drinking water systems, Ontario has a voluntary emerging parameter program for municipalities that goes beyond the provincial regulations or the national Guidelines and PEI has a program for monitoring pesticides. A notable program intended for the public was found in Saskatchewan, the Drinking Water Quality Index, which ranks drinking water supplies for consumers. Tools intended for water suppliers were found in British Columbia (Source-to-Tap Screening Tool) and Alberta (Water Safety Plan), as well as a guidance document for small supplies in Manitoba. Although not directly related to monitoring, Quebec has a drinking water conservation program and Nova Scotia has a program to manage and protect watersheds (see Appendix 2).

Precautionary public health measures, such as boil water advisories, are a legislated requirement for water supplies in all Canadian jurisdictions, except for Northwest Territories and Nunavut. Inconsistencies in the terminology for drinking water advisories was identified in the literature review, which was reflected in the review of drinking water regulations across Canada (Isfeld 2009, p. 4) The jurisdictional scan found some jurisdictions distinguished between

advisories and orders, where "advisories," which are typically issued under situations of potential risks to human health; versus "orders," which are issued under situations of known risks to human health (see Appendix 1). In addition, public drinking water advisories other than boil water advisories, such as do not consume orders/advisories/notices, were found in British Columbia, Alberta, Quebec and New Brunswick (see Appendix 1).

Across the provinces and territories, municipalities were typically found to own and operate the drinking water systems, with the exception of Newfoundland and Labrador. The most unique governance structure was found in Newfoundland and Labrador as the province is completely responsible for the provision of drinking water (see Appendix 1). Elsewhere in Canada, local governments have responsibility for treating and supplying drinking water, as well as notifying the public in the event of risks due to potential or known contamination (see Appendix 1).

6.2 EHO Observations of First Nations Communities in Canada

The challenges observed by the EHOs interviewed included the following: adequate training for drinking water personnel; sufficient number of water treatment operators, misunderstandings among residents regarding safe storage of drinking water; lack of legislation; the type of infrastructure; the size and location of the community, lack of enforcement and perceptions of the safety of drinking water supplies. These challenges relate to the quality of drinking water systems in a number of ways.

An operator who is inadequately trained may not have sufficient understanding of sampling and treatment procedures, which could lead to an inability to respond appropriately, such as possessing sufficient knowledge of appropriate actions in the event of an emergency, such as selecting over chlorination of the water supply if bacteriological contamination is suspected. An insufficient number of operators may put a water supply at risk of contamination if the only operator is absent since monitoring of the water supply will not be taking place. The size and location of communities affect their capacity to retain trained personnel, as well as the resources they have at their disposal (size) and their access to support from other communities or laboratories for testing (location). Misunderstandings among residents regarding safe storage of drinking water could lead to contamination and several EHOs spoke about public education with regards to safe drinking water practices, either facilitated by community members or EHOs. With regards to consumer perceptions of the water supply, EHOs generally commented that community members understood the role of chlorine in disinfection. Although, EHOs mentioned factors that may lead to low consumer confidence in their water supply, such as misreporting of drinking water advisories in the media or presence of an odour and/or colour in the drinking water, which may lead consumers to choose unsafe alternatives (e.g. untreated surface water), for example. In addition, the current lack of enforcement was observed by some EHOs as a challenge, while others (some of the same participants) viewed a challenge in incorporating enforcement mechanisms into regulations for these communities.

The potential for adopting drinking water regulations, particularly provincial regulations, was discussed among interview participants. Adopting provincial standards into First Nations drinking water regulations is feasible since EHOs explained that provincial standards are already being used in the communities they work with. Although, aside from the incorporation of provincial standards, EHOs were sceptical that regulations would improve the quality of drinking water systems if not create impediments for communities to meeting the standards. Many of the concerns that were raised in this regard do not fall directly within the jurisdiction of Health Canada, but other departments, particularly AANDC.

In addition, EHOs discussed measures aside from regulations that may reduce the risks to public health from drinking water among First Nations communities. Education was observed by EHOs as beneficial, both for drinking water personnel and consumers. Although education may not be incorporated into regulations, it may become a component of a drinking water strategy that accompanies the regulations. Agreements between nearby First Nations communities, and possibly neighbouring municipalities, was suggested by EHOs as a means of sharing operators

and other resources associated with drinking water supplies. Other supports may be useful for communities, such as a regional database used to capture trends in contamination, as found in Alberta.

Most importantly, First Nations community involvement in the establishment of regulations and other strategies for improving the quality of drinking water for their residents is critical. Several EHOs argued that First Nations should be involved in the development of regulations. The UN Declaration on the Rights of Indigenous peoples stresses "Indigenous peoples have a right to be actively involved in developing and determining health" programs that affect them (UN 2008, p. 9, article 23 and p. 11, article 29.3).

6.3 International Comparisons

Regulating drinking water is the responsibility of the states and territories in Australia and the central government in New Zealand. States in the United States are permitted under the federal Safe Drinking Water Act (SDWA) to regulate drinking water as long as the standards meet or exceed the level of stringency in the National Drinking Water Regulations.

Drinking water regulations pertain to the Indigenous populations in all three countries (i.e. Australia, New Zealand and the United States). More specifically, the regulations in Australia and New Zealand apply to all residents within the appropriate regulating jurisdiction for that country; without making the distinction between Aboriginal and non-aboriginal communities for regulatory purposes as seen in Canada. In the United States, the National Drinking Water Regulations apply to tribes regardless of which state that tribe resides, as state laws do not apply to tribes. The SDWA in the United States allows for tribes to apply for primacy over their drinking water to create their own regulations rather than adhere to state or federal legislation. Only the Navajo Nation has applied and obtained primacy to date.

Although the United States has a reserve system much like Canada, the United States does not provide support to tribes to assist in compliance with the drinking water monitoring standards. This is a significant contrast to the level of service EHOs provide to First Nations communities in Canada. Unlike EHOs, the EPA and the IHS do not travel to the tribes to conduct additional monitoring under routine conditions. In Northern Territory, Australia, the Department of Health has a dedicated officer to go around to the communities to discuss drinking water with the elders, to uncover how they view water, any barriers to water quality and whether or not community members drink the water or consume substitutes. New Zealand has taken a different approach, where programs to improve equality among drinking water supplies with regards to risks to public health do not explicitly target Indigenous communities.

Australia and New Zealand both had tools or programs to assist small and/or remote communities in adhering to the legislated standards. In New Zealand, the Drinking-Water Technical Assistance Programme provides subsidized technical assistance to small water suppliers by various means, such as encouraging collaborative capacity building groups, as well as independent technical advice. Australia's community water planner is an online tool for managers of drinking water systems of remote areas to create water safety plans that are tailored to that particular community. As well, New South Wales, Australia, was found to involve all communities in the process of developing water risk management plans for the purpose of helping communities comply with the Australian Drinking Water Guidelines.

Strategies that might improve consumer confidence as well as comprehension of drinking water quality were discussed. In the US, tribes can access consumer reports, which include information on the frequency of testing and the frequency of adverse drinking water events. Interview participants from Australia and New Zealand placed importance on the aesthetic guidelines in their drinking water standards, taking into consideration that the average consumer will not consider drinking water to be safe if it is a usual colour or has an odour. In addition, it was noted from South Australia that perceptions of safety of the drinking water somewhat improved when irregular monitoring was replaced with routine monitoring.

7.0 RECOMMENDATIONS

Recommendations provided in this section are intended for consideration by Jamie Lafontaine, Manager of the Water Regulations and Data Analysis Unit within the Environmental Public Health Division. Based on the research conducted for this report, four primary recommendations are proposed and are organized into four sections. The four sections address the incorporation by reference of drinking water standards; the multi-barrier approach; measures intended to improve compliance with regulations; and involvement of First Nations in the development of regulations.

7.1 INCORPORATE PROVINCIAL STANDARDS

Consistency between non-First Nations communities and First Nations communities may be achieved through the incorporation of provincial standards into drinking water regulations for First Nations communities in Canada. The new legislation, (the *Safe Drinking Water for First Nations Act*) includes a provision for subsequent regulations to allow for First Nations communities to incorporate the drinking water monitoring standards contained in the regulations of their respective provinces. It was uncovered in the findings through the EHOs interviewed that the First Nations communities they work with use a combination of the most stringent standards, between the standards found in province or the Guidelines for Canadian Drinking Water Quality. To ensure the regulations offer similar protection to First Nations communities as provided to non-First Nations communities by the provinces, it is recommended that the communities officially adopt the provincial standards for testing and treatment procedures, which would serve as a baseline requirement for all regulations as they relate to public health. Although, it is not necessarily recommended that full incorporation of the provincial drinking water regulations take place; instead it is recommended that First Nations communities are involved in the development of regulations, including determining the contents.

7.2 MULTI-BARRIER APPROACH

It is recommended that risk reduction measures are developed with the intention of contributing to compliance with the regulations. A multi- barrier approach is employed by all jurisdictions in Canada, as well as in Australia, New Zealand and the United States. Health Canada and AANDC has used a multi-barrier approach in the former First Nations Water Management Strategy (FNWMS) and following First Nations Water and Wastewater Action Plan (FNWWAP). First Nations communities may benefit from a regulatory framework that incorporates this approach, which will require continued coordination between Health Canada, AANDC, Environment Canada and First Nations communities. In addition, the existence of additional barriers in the prevention of risks to health may improve health equity for First Nations communities relative to non-aboriginal communities that likely fall under a regulatory framework inspired by this approach.

7.3 CONTINUED COLLABORATION WITH AANDC AND ENVIRONMENT CANADA

It is recommended that continued collaboration with Environment Canada and AANDC after the development of drinking water regulations takes place for the purposes of harmonizing initiatives intended to ensure First Nations communities' regulatory compliance. It is important to continue to encourage the communities to develop capacity to contribute to their drinking water management, while offering support to the communities that may lack the capacity to take on a drinking water program or innovative community-led programs that seek to complement drinking water regulatory compliance. Accordingly, it will be important for Health Canada to work together with First Nations, AANDC and Environment Canada beyond the development of enabling legislation to ensure common goals are met. To achieve this, an accompanying program that facilitates partnerships or agreements between First Nations communities, and possibly neighbouring municipalities, to collaborate is recommended. For example, New Zealand's Drinking-Water Technical Assistance Programme provides subsidized technical assistance to small water suppliers and encourages collaborative capacity building groups, as well as facilitators who provide training on how

to write public health risk management plans. Also pertinent, the Community Water Planner tool in Australian is intended to serve as guidance for remote and Indigenous communities and generates management plans specific to the community. Also for the purposes of achieving compliance, it is recommended the accompanying drinking water programs facilitate community-led initiatives. More specifically, the WHO suggests moving beyond data collection to include other strategies in a surveillance program, such as public health education, as mentioned in the literature review section and discussed among EHOs.

7.4 First Nations Involvement

In terms of building confidence in the resulting regulations, it is recommended that the regulations are developed in a manner that enables direct engagement with First Nations, such as determining the overall contents. Primary research from the perspectives of First Nations was not included in this report, and therefore any recommendations provided would need to be discussed with First Nations. Although engagement sessions have taken place, the federal government has been criticized by Aboriginal organizations for resolving to create regulations before seeking input from First Nations and focus on the consequences of limiting the involvement of First Nations in the decision to regulate.

8.0 CONCLUSION

The adoption of regulations will improve health equity for First Nations communities as it will provide the same level of protection from risks to public health from drinking water as found in other communities in Canada by closing the regulatory gap. Although regulations do not currently exist for drinking water in First Nations communities, enabling legislation has recently passed into law (i.e. the *Safe Drinking Water for First Nations Act*). As a result, this project was developed to identify regulatory frameworks and programs pertaining to drinking water monitoring to inform the development of drinking water regulations for First Nations communities in Canada. To do so, the research uncovered existing drinking water regulations throughout Canada, as well as regulations or programs pertaining to Indigenous populations in Australia, New Zealand and the United States. In addition, the research incorporated the observations of EHOs who currently work in First Nations communities to gain an applied understanding of the impediments to achieving compliance with the *Canadian Drinking Water Guidelines*, as well as other challenges that may pose risks to public health. As one phase of a multi-phase initiative, this project was not intended to serve as an alternative to engagement sessions or consultations.

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APPENDICES

APPENDIX 1 - CANADIAN JURISDICTIONAL SCAN: PROVINCIAL AND TERRITORIAL DRINKING WATER REGULATIONS

P/T	Legislation and Regulations	Roles	Parameters	Precautionary Public Health Measures	Disinfection
BC	*Drinking Water Protection Act 2001* Drinking Water Protection Regulation (B.C. Reg. 200/2003)	**Ministry of Health:** responsible for the legislation and regulations pertaining to drinking water. **Health Authorities:** responsible for administering and enforcing the Act and the Regulation. **Municipalities:** own the water systems and responsible for the actual provision of the water. Includes adherence to the standards, meeting appropriate methods and frequencies of sampling, as well as notifying the public and the health authorities of any adverse drinking water outcomes. **Drinking Water Officers:** employed by the Health Authorities, administer the Drinking Water Program, monitor drinking water systems, provide interventions in the interest of public health, and enforce the Drinking Water Protection Act (BC Ministry of Health n.d.).	Limits for E.coli and Total Coliform: same as *Guidelines for Canadian Drinking Water Quality* (Drinking Water Protection Regulation 2011, Schedule A). Additional testing requirements may be requested by a certified Drinking Water Officer (Drinking Water Protection Regulation 2011, Section 8 (3)).	Advisories and notices: 1) Boil Water Notices (BWN) address the issue by bringing water to a rolling boil; 2) Water Quality Advisory (WQA) reduce risk without requiring boiling or do not use; 3) Do Not Use Notice, boiling or other means are not sufficient to render the water safe; 4) Public Water Communication, relates to the appearance and there is no health risk. (BC Ministry of Health n.d b).	Municipal supplies relying on surface water must be disinfected, as well as any supplies relying on groundwater that are at risk of containing pathogens according to the opinion of a DWO (CWWA 2012).
YK	*Public Health and Safety Act 2002* Drinking Water Regulation 2007	**Department of Health and Social Services:** responsible for ensuring drinking water standards are met, as well as conducting inspections and providing advice and enforcement services (Government of Yukon 2011a). **Department of Community Services:** "Responsible for providing drinking water in unincorporated communities" (Government of Yukon 2011b). "Ensures that where surface water is a drinking water source, additional treatment systems are in place and meet the requirements of the Drinking Water Regulations"(Government of Yukon 2011b). **Large public drinking water systems:** "supply and distribution is undertaken by the Yukon Government, municipalities, and First Nations, and varies by community"(Government of Yukon 2011c). "The Regulation sets out requirements for large public drinking water systems: defined as any drinking water system with 15 or more service connections to a piped distribution system, or five or more delivery sites on a trucked distribution system" (Government of Yukon 2011c).	Suppliers to large systems must meet the health-related criteria set out in the *Guidelines for Canadian Drinking Water Quality* (Water Chronicles 2012a). Most consumers are supplied from groundwater sources. "New wells are tested against bacteriological, radiological, aesthetic and other health-related parameters" (Environment Yukon 2013).	1) Boil water advisory: "states that the drinking water is or may present a health or safety risk unless the water is boiled" (Drinking Water Regulation 2007, Section 61). 2) Boil water orders are issued in the case that there has been significant deterioration in the quality of source water, malfunction of treatment equipment, inadequate disinfection, microbiological quality poses a health risk, or other concerns relating to the quality of the water and its effect on public health (Drinking Water Regulation 2007, Section 46).	Most drinking water is "supplied by groundwater which benefits from natural filtration processes and has an advantage over surface water supplies that require more protection from contamination" (Government of Yukon 2011b).

		Public health officers: monitor the quality of the drinking water and have the authority under the regulation to issue advisories, orders or "any method the health officer considers appropriate," as well as enforce the standards set out in the regulation for large public supplies (Drinking Water Regulation 2007, section 49; Section 84).			
AB	*Environmental Protection and Enhancement Act 2000* Potable Water Regulations 2003 *Public Health Act*	**Alberta Environment:** oversees drinking water monitoring. (Government of Alberta 2009, p.6). **Alberta Health and Alberta Health Services:** look after the unapproved public systems (developments less than 3km and 15 connections) using the *Guidelines for Drinking Water Quality*. **Regional Health Authorities:** responsible for issuing boil water advisories or boil water orders, enforce the Public Health Act, which applies to all systems, as well as, work with treatment operators and Alberta Environment in monitoring the drinking water quality (Alberta Environment and Sustainable Resource Development 2013a). **Municipalities:** own the water systems and primarily responsible for drinking water distribution (Government of Alberta 2010, p.57). **Regional Drinking Water Operations Specialists:** work with systems operators in the event of an incident or emergency situation, such as treatment challenges (i.e. seasonal variation, algae blooms), non-conformance with health-related quality standards, interrupted service, etc.	Water suppliers are required under the regulations to meet the minimum Maximum Acceptable Concentration or Interim Maximum Acceptable Concentration for physical, microbiological, chemical and radiological characteristics from the *Guidelines for Canadian Drinking Water Quality*, or when applicable, the *Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems* (Potable Water Regulations 2003, Section 6).	Advisories and orders: 1) Boil water advisories/orders: issued in the event that a risk to health may exist and boiling is appropriate to correct the issue (e.g. presence of E.coli). (Government of Alberta 2012, p.24). 2) No-Drinking Water Advisory (NDWA): issued when public health may be at risk, but boiling the water will not correct the issue (e.g. contamination by toxic chemicals) (Government of Alberta 2012, p.24).	All municipal supplies are required to provide disinfection (CWWA 2012).
NT	*Public Health Act* Water Supply System Regulations 2009 (replaced the "Public Water Supply Regulations")	**Government of NWT:** responsibilities shared between Environment and Natural Resources (ENR), Health and Social Services (H&SS), Municipal and Community Affairs (MACA) and Public Works and Services (PWS), and the "work is coordinated through a technical committee guided by the GNWT's *Managing Drinking Water in the NWT: A Preventative Framework and Strategy*"(Government of Northwest Territories 2011, p.1). **EHOs:** have authority to lay charges or issue tickets for non-compliance, as well as provide instructions if a parameter limit is exceeded (Government of Northwest Territories Health and Social Services 2009). **Chief Public Health Officer:** notified in the event there is a risk of serious illness or death due to an issue with the drinking water (Government of Northwest Territories Health and Social Services 2009). **Community Governments:** responsible for the operation and	There is monitoring for 1 bacteriological parameter as well as physical and chemical parameters (Program on Water Governance 2007).	There are no regulatory criteria stipulating when boil water advisories should be issued or the appropriate notification procedures (Water Chronicles 2012a).	Municipal supplies relying on surface water must be disinfected. Also, any supplies using groundwater "that may be subject to contamination in the well or in storage reservoirs or mains (CWWA 2012). The Standard Operating Procedures section of the Drinking Water Operators Corner provides guidance documents on disinfection,

		maintenance of water treatment plants" (Government of Northwest Territories 2011, p.1).			including one for water delivery trucks (Government of Northwest Territories Municipal and Community Affairs n.d.).
SK	*Environmental Management and Protection Act*, 2002 Water Regulations, 2002	**Saskatchewan Environment:** responsible for implementing, inspecting and regulating drinking water quality for all municipal waterworks and privately owned, yet publicly accessible, waterworks that have a flow rate of 18,000 litres or more per day (SaskH2O 2011); **Sask Water:** Crown Utility that "provides wholesale water delivery service to the community, who then delivers the service to its residents" (SaskWater n.d.); **Municipalities:** typically own the distribution systems and are responsible for their operation. **EHOs:** employed by the Saskatchewan Environment and appointed under section 65 of the Environmental Management and Protection Act. Their duties include inspection of facilities and enforcement (Environmental Management and Protection Act 2002, Section 67; Section 69).	Monitoring for E.coli and total coliform, and the standards are more stringent than the *Guidelines for Canadian Drinking Water Quality* (Water Chronicles 2012a). As well as, monitoring for turbidity and 61 chemical, radiological and other parameters (Program on Water Governance 2007). The list of chemical parameters includes a list of 12 chemical pesticides "commonly used in Saskatchewan (Saskatchewan Environment 2006)."	Advisories and orders: 1) Precautionary Drinking Water Advisory (PDWA) - issued by Saskatchewan Environment in consultation with Saskatchewan Health" for the potential of health risk, "although an immediate health risk has not been identified." This type of advisory is "typically used for service and maintenance repairs (SaskH2O 2012)." 2) Emergency Boil Water Orders (EBWO) - issued by local Health Regions in consultation with Saskatchewan Environment when a threat to public health exists. Rolling boil for one minute to ensure bacteriological safety (SaskH2O 2012)."	All municipal systems are required provide disinfection (CWWA 2012). Also, the province requires continuous disinfection by chlorination or other approved means (The Water Regulations 2002, Section 30(5)).
NU	*Nunavut Waters and Nunavut Surface Rights Tribunal Act (2002)* Public Water supply regulations	**Department of Health and Social Services:** "provides leadership, direction, and expertise in defining the mission, principles, and strategies for various health protection programs delivered within the Territory of Nunavut to promote public health including drinking water" (Government of Nunavut 2010). In the process of the developing a "made in Nunavut" *Public Health Act*, which will include drinking water safety (Public Health Act, 1988). *Very little information available*.	Monitoring 1 bacteriological contaminant, as well as physical and chemical contaminants Program on Water Governance 2007).	There are no regulatory criteria stipulating when boil water advisories should be issued or the appropriate notification procedures (Water Chronicles 2012a).	Municipal supplies relying on surface water must be disinfected. Also, any supplies using groundwater "that may be subject to contamination in the well or in storage reservoirs or mains" (CWWA 2012).
MB	*Drinking Water Safety Act* Drinking Water Quality Standards Regulation Drinking Water Safety Regulation	**Manitoba Health:** enforces the Public Health Act. Medical Officers of Health are appointed under the Public Health Act and issue advisories. **Office of Drinking Water:** established under the Drinking Water Safety Act to be "Single focal point to coordinate all drinking water safety issues" (Drinking Water Safety Act 2002, Section 4). **Drinking water officers:** appointed under the Drink Water Safety Act, and carry out inspections of water systems, and provide technical assistance to water system operators and the	Limits for E.coli and Total Coliform: same as *Guidelines for Canadian Drinking Water Quality* (Drinking Water Quality Standards Regulation 2007, Section 3). Monitoring also for microbial, chemical and radiological contaminants, and turbidity under the Drinking Water Quality Standards Regulation (2007).	Advisories and orders: 1) Boil water advisories: issued due to concern for possible bacteriological contamination. (Drinking Water Safety Act 2002, Section 17(1)). 2) Drinking water safety order: issued if there is reason to believe the quality of drinking water may risk public health (Drinking Water Safety Act 2002, Section II (1)).	Municipal supplies relying on surface water and supplies using groundwater under the influence of surface water must be disinfected (CWWA 2012).

		public (Sec 6(2)). **Municipalities:** own public drinking water supplies and are responsible for their operation, maintenance and meeting the standards set out in the regulations. **Drinking Water Officers:** Drinking water officers offer surveillance services for drinking water quality. **Medical Health Officers:** have the authority to issue boil water advisories and approve drinking water safety orders.	Additional system-specific standards and monitoring requirements may also be stipulated in an operating licence" (Manitoba Water Stewardship Division n.d.) The Office of Drinking Water adopts the *Guidelines for Canadian Drinking Water Quality* regarding water quality standards and goals (Manitoba Water Stewardship Division n.d.).		
ON	*Safe Drinking Water Act* Ontario Drinking Water Quality Standards (Reg. 169/03) Drinking Water Systems Regulations (170/03) *Health Protection and Promotion Act (HPPA).* Small Drinking Water Systems (Reg. 319/08)	**Ontario Ministry of Environment:** oversees the *Safe Drinking Water Act*. **Chief Drinking Water Inspector:** is appointed under the Safe Drinking Water Act and ensures that regulated drinking water systems meet the health-based standards for drinking water (Drinking Water Ontario 2012). **Public Health Inspectors:** take scheduled samples of drinking water systems for bacteriological parameters. **Regional Medical Officers:** contacted in the event of an "adverse water quality incident (Water Chronicles 2012b). **Municipalities:** own and operate the systems, making them responsible for the provision of safe drinking water. **Ministry of Health and Long-Term Care (MOHLTC):** oversees the legislation pertaining to small drinking water systems (SDWS) in the Province.	Limits for E.coli and Total Coliform: same as *Guidelines for Canadian Drinking Water Quality* according to the Drinking Water Systems Regulations (170/03). Monitoring for chemical, radiological contaminants as well; however, turbidity and other physical parameters were not included (170/03).	Advisories and orders: 1) Boil Water Advisory (BWA), which involves boiling the water enough to "render the water safe (Ontario MOHLTC 2009, p.4; 170/03)." 2) Drinking Water Advisory (DWA), used "when an action is needed to protect users" (Ontario MOHLTC 2009, p.4). 3) Boil/Drinking Water Order (B/DWO), under this situation the MOH or the PHI issue the order according to section 13 of the HPPA which states what actions by the operator to take (Ontario MOHLTC 2009, p.4). Schedule 17 of the Regulations (170/03) states the corrective actions for large municipal, residential systems and schedule 18 sets out the corrective actions for small municipal residential systems.	Municipal supplies relying on surface water must be disinfected, "and groundwater unless an exemption is obtained" (CWWA 2012).
QC	*Loi sur la qualité de l'environnement (LQE)* Règlements sur la qualité de l'eau potable	**Ministère de la santé et Services sociaux:** manages surveillance of water quality for consumption. **Ministère du Développement durable, de l'Environnement et des Parcs (MDDEP):** responsible for the quality of drinking water and the implementation of the drinking water regulation for owners of public systems (Water Chronicles 2012b).	Tests are required for Microbiological contaminants, inorganic and organic chemicals, turbidity and pH.	Under the Regulations respecting the quality of drinking water, the owner / operator of a drinking water distribution system must immediately inform users that the water is unfit for consumption and should be boiled if bacteriological analyses reveal the presence of fecal coliform (Règlements sur la qualité de l'eau potable 2012, Section 35(1)). Situations other than the presence of fecal bacteria that would warrant a corrective action include the breakdown or defect of the treatment or distribution equipment; inadequate disinfection; or sudden increase in turbidity (Règlements sur la	Municipal supplies relying on surface water and supplies using groundwater under the influence of surface water must be disinfected (CWWA 2012).

				qualité de l'eau potable 2012, Section 35). Advisories and notices: 1) Do Not Consume Notices 2) Boil Water Notices	
NB	*Clean Water Act* Potable Water Regulation	**Department of Environment:** enforces the Clean Water Act, which authorizes the Potable Water Regulation. **Department of Health:** responsible for a sampling strategy and establishing the New Brunswick drinking water guidelines, issuing public advisories and investigating water quality conditions that might affect public health. **Public drinking water systems:** either municipally or provincially owned and operated, and are required to sample their water according to the Clean Water Act. **District Medical Officers of Health:** have the authority to issue orders or advisories where public suppliers fail to meet the Health Advisory limits.	*The Canadian Guidelines for Drinking Water Quality* are adopted and municipally and provincially-owned water systems must sample water for a specified list of microbiological, chemical and aesthetic parameters.	Advisories and orders: 1) Boil order 2) Do-not-consume 3) Other directive, as determined by the District Medical Officers of Health	No mandatory treatment requirements, "although treatment may be required (to meet drinking water quality standards) through the approval process for individual municipal water systems" (Ecojustice 2011, p.60).
NS	*Environment Act* Water and Wastewater Facility Regulations *Health Protection Act*	**Nova Scotia Environment:** has been designated as the lead agency to take such measures as are reasonable to provide access to safe, adequate and reliable public water supplies" **Medical Officer of Health:** provides advice to the Minister of Health, the Minister of Environment, the owner and the public, as well as issue boil water advisories.	Nova Scotia Environment adopted *Canadian Guidelines for Drinking Water Quality* as legally binding. Monitoring is required for bacteriological, physical, and chemical parameters, as well as turbidity, disinfection residuals, and fluoride levels (Nova Scotia Environment 2011).	Boil water advisories: issued when sampling detects higher than accepted amounts of coliform bacteria or if there are deficiencies with regard to chlorination or other forms of disinfection.	"Filtration and disinfection are both required for surface water and disinfection is required for groundwater. Minimum standards are set for both" (Ecojustice 2011, p.61).
PE	*Environmental Protection Act* Drinking Water and Wastewater Facility Operating Regulations	**Environment Division (of the Department of Environment, Labour and Justice):** responsible for sustainable management and enforcement of drinking water, and also provides water testing services for microbiological and chemical parameters, as well as engineering advisory services to the general public, provincial departments, industry and municipalities. **Municipalities:** own and operate public drinking water systems. **Department of Health and Wellness:** through the Office of Environment Health, issues Boil Water Advisories. The Office of Environment and Health is a division of the Chief Public Health Office.	"Standards are not independently binding, but testing is required for microbiological and chemical analysis, and testing is prescribed with reference to the Canadian guidelines" (Ecojustice 2011).	Sections 12(2) and 13(3) of the Drinking Water and Wastewater Facility Operating Regulations (2006) state that if a water quality sample is analyzed by a laboratory other than the PEI Analytical Laboratories and where the result of the analysis indicates the presence of E.Coli, the owner must notify the Department of Environment and Energy immediately by phone or fax of the results of the analysis. Section 12 speaks to small public or semi-public systems and section 13 is for public drinking water systems.	No disinfection requirements; however drinking water is only drawn from groundwater (CWWA 2012).
NL	Water Resources Act	**Department of Government Services and Department of Health and Community Services:** "jointly responsible for monitoring the bacteriological quality of public water supplies in the province." (NL Department of	Guidelines used for bacteriological and chemical standards are based on the *Guidelines for Canadian*	Boil Water Advisories are issued when there are higher than accepted amounts of coliforms (bacteria) or if there are deficiencies with regards to disinfection.	All community water supplies must be disinfected (CWWA 2012).

		Environment and Conservation 2012). **Medical Officers of Health:** may recommend boil water advisories, along with the EHOs. **EHOs:** employed by the Department of Environment and Conservation, and sample of drinking water on a regular basis and they are located throughout the province (NL Department of Environment and Conservation 2012).	*Drinking Water Quality.*		

APPENDIX 2 - CANADIAN JURISDICTIONAL SCAN: NOTABLE MONITORING PRACTICES AND TOOLS

P/T	Notable Practices
BC	***Drinking Water Source-to-Tap Screening Tool*** The tool was developed in 2004 and is designed as a simple questionnaire (97 questions) intended to aid water suppliers as a secondary method for assessing risk among drinking water sources and supplies. When completed, the tool is submitted for evaluation of the results, although completion is voluntary (BC Ministry of Health Services and Ministry of Water, Land and Air Protection 2004, p.2). This enables the DWO to "determine if a water supplier needs to undertake a comprehensive source-to-tap assessment to further analyze the risks, if significant risks are identified" (BC Ministry of Health n.d.). The tool is available at: http://www.health.gov.bc.ca/protect/pdf/BC_Drinking_Water_Screening_Tool.pdf
AB	***Drinking Water Safety Plans*** These plans are intended to complement the drinking water regulations by offering a proactive approach to risk assessments of factors that could negatively impact the quality of the water. These plans are another tool that operators can use to help ensure the quality of water delivered to consumers is consistently good. Effective drinking water safety plan are composed of four principals: • Collecting and evaluating the best information available about the water supply system; • Analyzing and understanding potential risks; • Correctly assessing risk mitigation – how to reduce risks to an acceptable level; and • Determining what resources and actions are necessary to ensure identified risks are reduced (Alberta Environment and Sustainable Resource Development 2013b).
MB	***Best Practices Manual for Small Drinking Water Systems*** "It is recognized that many small drinking water systems may not have the same level of access to technical services and resources as larger public water systems. This manual of best practices (a comprehensive, integrated and co-operative approach to continuous improvement of all facets of operations for delivering superior standards of performance) is to assist small drinking water systems with regulatory, management and operational challenges" (Manitoba Water Stewardship 2007, p.1). The document is available at: http://www.gov.mb.ca/waterstewardship/odw/reg-info/operations-monitor/best_practices_for_small_drinking_water_systems-manual.pdf

SK	***Drinking Water Quality Index (WQI)*** Based on the work of Canadian Council of Ministers of the Environment (CCME), the index ranks water quality for consumers. It is based on a comparison of "23 commonly monitored chemical constituents within a community's drinking water to the Saskatchewan Drinking Water Quality Standards and Objectives" (SaskH2O 2008).The data is derived from community submissions within the last three years. The index is not meant as an absolute indicator of water quality, rather the numerical value assigned from 0 to 100 is ranked as being either poor, marginal, fair, good or excellent (SaskH2O 2008). Calculations for the index are based on the following trace substances found in drinking water: "Alkalinity; Aluminum; Arsenic; Barium; Boron; Cadmium; Chloride; Chromium; Copper; Fluoride; Hardness; Iron; Lead; Manganese; Nitrate; Selenium; Sodium; Sulphate; Total Dissolved Solids; Trihalomethanes; Uranium; Zinc; and pH" (SaskH2O 2008). ***Training for First Nations*** SaskWater also offers operator training to First Nations communities in the province on behalf of Aboriginal Affairs and Northern Development Canada SaskWater (n.d.b).
ON	***Drinking Water Surveillance Program (DWSP)*** A program for monitoring drinking water that strategically looks at emerging parameters of concern. Established in 1986 by the Ontario Ministry of Environment, it is a voluntary program for municipalities. It is a water-quality monitoring program that "focuses largely on monitoring: • chemicals and radionuclides that are not currently regulated • emerging contaminants" (Ontario Ministry of the Environment 2010). The incentive for municipal participation in the DWSP - "Municipalities can show consumers that they are going beyond regulatory testing requirements and making an additional effort to ensure they are providing safe, clean drinking water. All sample analysis is free of charge" (Ontario Ministry of the Environment 2010, p.2).
PE	***Drinking Water Quality Application*** An online application that provides a summary of the drinking water quality testing conducted Province of PEI Analytical Laboratory, which can be used by residents. Searches can be conducted using the tool by community, watershed or by a radius of 1km, 5km or 10km. Although results for bacterial contamination and concentrations of lead, zinc, and copper in drinking water are not available (PEI Department of Environment, Labour and Justice 2012a). ***Pesticide Monitoring Program*** Annual monitoring for pesticides is conducted throughout the province, and sampling of groundwater includes drinking water supplies and private homes (PEI Department of Environment, Labour and Justice 2012b). For groundwater, this is a voluntary program and a summary spreadsheet is available on Program's website.

APPENDIX 3 - INTERVIEW QUESTIONS

GENERAL (EXPERIENCE)

1) What is your current role with the government?
2) What are your responsibilities?
   a) What is your involvement with private systems?
   b) What is your role relative to the water treatment operator?
   c) What is your role relative to the Chief in council?

The following interview questions have been divided by issue area. The focus of the interview was determined by the response given to the "General" questions.

BACKGROUND (FIRST NATIONS/INDIGENOUS ISSUES)

1) What are the similarities or differences between the First Nations/Indigenous communities of _____ (*name of province/territory/country*) and non-aboriginal communities in _____ with regards to drinking water quality?
   a) What are the reasons for these similarities or differences?
   b) What is the typical types of infrastructure used for drinking water containment (cisterns? running water?)

2) Have you encountered negative consumer perceptions of drinking water? Please Explain.

REGULATORY FRAMEWORKS

1) What promises or challenges exist for the new regulations?

2) What are some of the innovative or "best practices" among regulatory frameworks you are aware of?
   a) In relation to indigenous populations?
   b) Are there any community-led initiatives?

3) What are the advantages of regulating drinking water over the current approach?
   a) What potential do regulations have in changing/improving the current state of drinking water in First Nations communities?
   b) Does some form of regulation seem feasible?

4) Do you see any room for attainable improvements in general?

REPORTING/MONITORING REQUIREMENTS

1) What are the advantages and/or challenges of the current system of reporting requirements? Please explain.
   a) (*Researcher begins by explaining an alternative model*) - What is the feasibility of adopting alternative requirements?

2) In your view, what are the challenges or promises of the reporting structure (i.e. allocation of responsibility/accountability)?

3) What sort of contamination prevention measures exist?
   a) What could take place?

4) What is the reporting structure for indigenous communities in Australia/New Zealand/United States?

STANDARDS

2) What are the advantages and/or challenges associated with the current standard treatment drinking water in First Nations/indigenous communities?
   a) Use of chlorine?

3) What is the feasibility of revising or changing the current standards (the *Guidelines for Canadian Drinking Water Quality*) to match the standards of another jurisdictions?
   a) (*For example*) Current standards require the use of chlorine as a disinfectant. Is there potential for the adoption of an alternative method, such as ultraviolet disinfection?

4) Are there drinking water standards/programs specifically for indigenous communities in Australia/New Zealand/United States? Why or why not?
   a) If yes, what are the advantages of this tailored approach? Are there any challenges?

PRECAUTIONARY PUBLIC HEALTH MEASURES

1) What are the advantages and/or challenges associated with current structure of precautionary public health measures?

2) Which divisions, organizations, or types of other entities are involved in the precautionary public health measures?
   a) Which divisions, organizations, or types of other entities are responsible for ensuring the drinking water advisory is put in place if a risk is determined?
   b) How is the community notified?
   c) How long is a drinking water advisory in affect?

3) Are there other actions taken if water is determined to be unsafe?
   a) Why or why not?

4) Are Indigenous communities directly involved if their community is found to be under a drinking water advisory? Why or why not?