

PERCEPTIONS OF HOUSEHOLD DRINKING WATER ACROSS A VARIETY OF WATER
DISTRIBUTION SYSTEMS IN THREE FIRST NATIONS IN MANITOBA

by

Kristy L. Anderson

A Thesis Submitted to the Faculty of Graduate Studies of The University of Manitoba in partial
fulfillment of the requirements for the degree of

MASTER OF SCIENCE

Department of Soil Science University of Manitoba Winnipeg, Manitoba

Copyright © November 2020

ABSTRACT

Anderson, Kristy Leone. M.Sc., The University of Manitoba, November 2020. Perceptions of household drinking water across a variety of water distribution systems in three First Nations in Manitoba. Major Professor; Dr. Annemieke Farenhorst.

Half of households on First Nations reserves in the Province of Manitoba do not have access to piped water, but rather rely on cisterns or wells, or have no running water (e.g., buckets). The purpose of this research was to assess whether First Nations perceptions of water is dependent on the type of water distribution system associated with the household. From July 2017 to October 2018, household surveys were developed in collaboration with each of three First Nations in Manitoba (Community A, B and C) and participants were recruited by going door-to-door in each community. Using a total of 273 responses, the study applied a factor analysis and found that four factors explained the majority of the underlying variance among survey answers: Safety, Sufficiency, Acceptability and Human Health. Households with cisterns reported significantly more safety and sufficiency concerns compared to households with piped water. Deductive and inductive analysis of open-ended survey responses identified how households were describing their concerns. Households with safety concerns described finding contaminants in their water (e.g., dirt) and some households expressed concerns surrounding insufficient community resources to fix the water safety problems (e.g., additional water cleaning equipment and staff are needed). Households lacking sufficient water described not being able to keep up with their basic family needs (e.g., cleaning, laundry and bathing). Descriptions of negative health concerns caused by the household's water largely included descriptions of gastrointestinal illness symptoms or skin irritations. Importantly, the research also examined whether survey participants had full access to water, as defined by the United Nation's General Assembly Resolution 64/292, *The Human Right to Drinking Water and Sanitation*, A/RES/64/292 (28 July 2010). The analysis indicated that 60.8% of households were not able to access water as described in this Human Right Resolution especially households with cisterns or no running water. There is an urgent need for improved water services for First Nations in Manitoba.

FOREWORD

The following is my own reflection on how this Master's project came about and how my collaborations with participating First Nations communities were established.

I began my thesis January 2017. That winter I spent time learning about the research being done by NSERC CREATE H2O students.

My supervisor, Dr. Annemieke Farenhorst, was supervising several students who were working with Community A on a drinking water study. These students were testing tap water samples taken from several points along the water distribution system (i.e., the community's source water, water treatment plant, household with piped water, water trucks, and households with cisterns) for chlorine concentrations, total coliforms and *Escherichia coli* (*E. coli*), and Antibiotic Resistance Genes (ARGs).

I was invited to a research team meeting in Community A during the spring of 2017. During that meeting we talked about how the community members involved in the study were telling the research team that the quality of their water did concern them, but their household's drinking water was affecting them in other ways too (e.g., not having enough water for their needs). I proposed looking further into how water delivery systems were affecting community members by collaborating with the community on a household water survey.

The community researcher and I went ahead with this plan and developed a survey for Community A using a previously and empirically tested questionnaire which had been developed through a collaboration involving the University of Saskatchewan and the Federation of Sovereign Indigenous Nations, among others (Waldner et al., 2017). The questionnaire had a mixture of quantitative and qualitative questions on participant's perceptions of and experiences with their household's drinking water. We brought the survey to Chief and Council and they supported the project with a letter of support.

That summer the community researcher and I recruited people from the community to fill out our surveys. After the surveys were complete, I prepared a summary of results for each participant, and a Household Water Survey report for the community that was submitted to Chief and Council and now held at the Band Office.

Following the work with Community A, the project coordinator for NSERC CREATE H2O reached out to several other First Nations to ask if they were interested in participating in this study. One First Nation in southern Manitoba and one remote First Nation in northern Manitoba said that they were. I worked with these two communities in the fall of 2018. We followed the same methods used in Community A to develop the survey, seek approval from Chief and Council, collect surveys and disseminate the survey results to participants and Chief and Council.

ACKNOWLEDGEMENTS

There are numerous people who have all contributed to the success of this thesis. First of all, I would like to thank the three First Nations (Pine Creek First Nation, Brokenhead Ojibway Nation, and Community C) for their partnership, support and advice. Thank you to Chief and Council from each First Nation, the community researchers that I was able to work beside, and the community members whose support and interest made this research possible.

First of all, I would like to thank my advisory committee; Dr. Annemieke Farenhorst, Dr. David Lobb and Dr. Tracey Peter and Dr. Lalita Bharadwaj. Thank you Dr. Annemieke Farenhorst for encouraging me to step into a master's program. I would also like to thank Dr. Tracey Peter for giving me a crash course into the software coding and qualitative methodology used in this thesis and for inspiring my own confidence in this research. I was fortunate to have been able to learn qualitative methods from Dr. Jennifer Dengate. Thank you Jennifer, you made learning a new methodology inspiring and fun!

I would like to thank the entire NSERC CREATE H2O and the Centre for Human Rights Research at the University of Manitoba teams from whom I learned from, received support from, and was able to share my journey with. In particular I'd like to mention Wendy Ross, Helen Falding, Lalita Bharadwaj, Karen Busby, Ruidong Mi, Anita Murdock, Geethani Eragoda Arachchilage, Mauli Gamhewage, Marufa Fatema, Teassa MacMartin and Sabrin Bashar. This research was made possible by funding provided by the Natural Science and Engineering Research Council of Canada (NSERC) as part of the CREATE H2O program for First Nations Water and Sanitation and Security. I would also like to thank the good people at the Department of Soil Science at the University of Manitoba who provided kind support along the way.

I would also like to thank my family, especially my parents Lisa and Barry Anderson. Their love and encouragement gave me the motivation to persevere during the hard times.

Thank you to Audrey Brass. Audrey's dedication, perseverance, and energy she gives to her work and community projects are evident to anyone who meets her. I was lucky to be able to

learn from, and work beside her. I would also like to thank Nora Whiteway and her family for welcoming me into their home and supporting me during my time in their community. Nora taught me many things while I was with her, and I am proud to be welcomed into her family.

TABLE OF CONTENTS

ABSTRACT.....	ii
FOREWORD	iii
ACKNOWLEDGEMENTS.....	v
LIST OF TABLES	ix
LIST OF FIGURES	x
1. INTRODUCTION	1
1.1. Canada’s Colonial History	1
1.2 Indigenous Water Laws.....	3
1.3 Drinking Water Governance in Canada	3
1.4 Drinking Water and Human Well-being	5
1.5. Human Rights and Water	9
1.6 Research Purpose	11
1.6 Research Questions	11
1.7 References	12
2. DRINKING WATER IN THREE FIRST NATIONS RESERVES THROUGH THE UNITED NATIONS HUMAN RIGHTS LENSE AND SELF-REPORTING	19
2.1 Abstract	19
2.2 Introduction	19
2.3 Human Rights Framework	22
2.3 Materials and Methods	25
2.3.1 Design of the community-based participatory research approach.....	25
2.3.2. Survey Distribution and Participation	26
2.3.3. Qualitative Analysis Procedure: Deductive and inductive approaches	27
2.3.4. Human Right to Water and Sanitation: Quantitative Analysis.....	28
2.4 Results	31

2.4.1. Qualitative Results.....	32
2.5 Discussion	35
2.6 Conclusion.....	39
2.7 References	40
3. OVERALL SYNTHESIS	45
3.1 Summary of the Research	45
3.2 Practical Implications.....	47
3.3 Limitations of the Research and Recommendations for Future Studies	48
3.4 References.....	50
APPENDICES	52
I. Consent form used in Community A	52
II. Consent form used in Community B	56
III. Consent form used in Community C.....	60

LIST OF TABLES

Table	Page
2.1 Definitions of sufficient, safe, acceptable, physically accessible and affordable water as it applies to United Nation’s General Assembly Resolution 64/292, The Human Right to Water and Sanitation, A/RES/64/292 (28 July 2010).....	24
2.2 The 11 open-ended survey questions used in deductive and inductive approaches, with reference to which surveys included them.....	28
2.3 Independent Measures and Descriptive Analysis. M=mean; SD=standard deviation; FL=factor loading; %V=% variation; E=eigenvalue.....	30
2.4 Impact of household water delivery on factors describing the safety, sufficiency and acceptability of tap water, and the impact of tap water on human health, as perceived by households with piped versus cistern water.....	32
2.5 Number of households with piped versus cistern water that showed concerns in the open-ended questions about the safety, sufficiency and acceptability of tap water, and the impact of tap water on human health.....	33

LIST OF FIGURES

Figure	Page
1.1 Water Chlorination and Typhoid Mortality in Ontario. Figure from The Progressive Fight against Typhoid Fever in Canada during the Past Twenty Years: With Special Reference to the Controlling Factors. Adapted from: Howard N.J, 1932.....	6
1.2 Annual Mortality rates per 100,000 attributed to typhoid fever in the City of Toronto, Ontario, Canada. Directly sourced from: Strategic Alternatives, 2001.....	7
2.1 Percentage of households on First Nations reserves that have piped (white with black dots), cisterns (diagonal stripes), wells (horizontal stripes) and no running water (black with white dots) in and across Canada. Adapted from: Neegan Burnside (2011a).....	21

1. INTRODUCTION

1.1. Canada's Colonial History

The Canadian Constitution Act of 1982 identifies three groups of Indigenous peoples in Canada as Metis, First Nations and Inuit. However, Indigenous and Inuit peoples have lived in the Americas since immemorial. Between 500,000 and 2,000,000 Indigenous people lived in the Americas before settlement by Europeans (Thorton, 1987). As early as the 1500s and well before Canada was founded in 1867, Europeans began settling and establishing colonies on land that is now known as Canada. While some colonialist established respectful agreements and relationships with Indigenous Nations, colonialist also caused war, famine, and disease that devastated the Indigenous population (Daschuk, 2013a). Scholars estimate up to 90% of the Indigenous population died due to the arrival of settlers to Canada (Schlesier, 1994).

In 1763, the British Crown issued the Royal Proclamation to establish British governance in Canada. The Royal Proclamation also set out a guideline for colonial settlement in Canada, referring to certain Indigenous rights and the protection of Indigenous peoples (e.g., “should not be molested or disturbed”) but also a process for purchasing land from Indigenous peoples. This opened the opportunity for government officials to establish treaties with Indigenous Nations such as the numbered treaties that stretch across the Prairie Provinces and thereby paved the way for mass settlement of immigrants into Canada.

The numbered treaties, established between 1869 and 1921, were political tools that meant to outline a process for respectful coexistence of two sovereign Nations in Canada. However, many Indigenous Nations were coerced into signing these Treaties as Canada was trying to open the country up for mass settlement (Daschuk, 2013b). Disease, war, the collapse of the great bison herds, and government supported starvation tactics forced bands to relinquish their independence and sign onto treaties (Daschuk, 2013c). Furthermore, the government of Canada used these treaties to confine Indigenous people to small and undesirable settlements (i.e., reserves), seize control over prime agricultural land, and open the country to increased settlement and trade through the construction of the *Canadian Pacific Rail line* (Daschuk, 2013d).

The Canadian government's commercial interests in Canada's natural resources and the government's inability to honour the autonomy of Indigenous Nations eventually led to the creation of the *Indian Act* in 1876. The *Indian Act* was specifically created by the Federal Government to assimilate First Nations into Euro-Canadian society. The *Indian Act* was the tool the Federal Government used to force political, governance and education systems onto First Nations (Henderson, 2006). The residential school system, the pass and permit system, the banning of cultural ceremonies, practices, and banning First Nations people from hiring legal support such as lawyers are all examples of what was established through the *Indian Act* (Henderson, 2006). The efforts of the Federal Government to assimilate Indigenous people has had long lasting effects including intergenerational trauma from the legacies of the residential school system (Aguilar & Halseth, 2015), the Sixties Scoop (Sinclair, 2007), missing and murdered Indigenous women and girls (National Inquiry into Missing and Murdered Indigenous Women and Girls, 2019).

The actions of the Canadian Government can only be described as genocidal (United Nations, n.d.). Indigenous and non-Indigenous people in Canada continue to demand that the Federal Government acknowledge the harms from the past, honour the original intent of the treaties, and move forward together as two sovereign Nations, as it was always intended to be. The Canadian government has made some steps towards reconciliation, including: the *Royal Commission on Aboriginal Peoples* (RCAP) in 1991 to investigate and propose solutions to mend the relationship between Indigenous people in Canada, the government, and the Canadian society as a whole (Canada, 1996); the *Truth and Reconciliation Commission of Canada* (TRC) in 2008 to redress the legacy of residential schools and advance the process of Canadian reconciliation (Truth and Reconciliation Commission of Canada, 2015); and accepting the *United Nations Declaration on the Rights of Indigenous Peoples* (UNDRIP) in 2017 in an effort to commit to a nation-nation relationship with Indigenous people based on recognition of rights, respect, cooperation and partnership (Canada, 2017). The Federal Government of Canada can now use the 194 calls to action from RCAP, the 94 calls to action from TRC and the 46 articles declared by UNDRIP to truly move forward in reconciliation and create a country we all can thrive in.

1.2 Indigenous Water Laws

Indigenous laws come from specific landscapes, ecosystems and peoples and have been practiced here in Canada since time immemorial (Borrows, 2018; Craft A. , 2015). Manitoba is located on the traditional lands of the Ojibwe (Anishinabe), Cree, Oji-Cree, Dakota and Dene people (Government of Canada, 2014). Each of these Nations has their own distinct laws and legal systems.

Anishinaabe represent one of the five First Nations linguistic groups in Manitoba. A part of Anishinaabe law is Anishinaabe Nibi Inaakonigewin (Anishinaabe water law). Anishinaabe Nibi Inaakonigewin principles state that water has a spirit, is life, can heal, has duality, and can suffer. It also acknowledges that women are responsible for water, that we do not own water, and that we must respect water (Craft A. , 2015). Anishinaabe Nibi Inaakonigewin focuses on relationships and responsibilities, which is much different from western (i.e., colonial) ways of water governance that focuses on individualism and protection of property rights, as does western law (Craft A. , 2015). Anishinaabe have the duty to carry out these responsibilities to water through Anishinaabe Nibi Inaakonigewin. Canada has the duty to respect the right of Indigenous people to, “maintain and strengthen their distinctive spiritual relationship with their traditionally owned or otherwise occupied and used lands, territories, waters and coastal seas and other resources and to uphold their responsibilities to future generations in this regard” (United Nations, 2011).”

It is important to note that this thesis did not address water concerns in First Nations from an Indigenous legal framework, but rather used the United Nations definition of the Human Right to Drinking Water and Sanitation as a framework.

1.3 Drinking Water Governance in Canada

Drinking water governance includes the political, social, economic and administrative systems that dictate the management of water and its use. In Canada, water governance is decentralized, with Indigenous, federal, provincial and municipal governments each retaining some responsibility (Bakker & Cook, 2011). The Federal Government created the *Canadian Drinking Water*

Guidelines (CDWG). As guidelines, they are not legally enforceable unless a province adopts them into provincial law because the legislative responsibility for ensuring that the public has access to safe drinking water is under provincial and territorial jurisdiction (CCME, 2004). Provinces and territories set their own regulations based on the CDWG, and regulate water systems, including source water, water treatment plants, and distribution systems (Bakker & Cook, 2011). In Manitoba, for example, drinking water is regulated provincially through the *Office of Drinking Water* who enforces *The Drinking Water Safety Act (2002)*. Within provinces, municipalities are generally responsible for managing, operating, and sampling their water treatment plants and distribution systems. In contrast, on First Nations reserves, the management of drinking water supplies is solely the shared responsibility of the Federal Government and First Nations (CCME, 2004).

The 60th parallel (60°N) separates Canada's territories in the north (Yukon, Northwest Territories and Nunavut) from the western provinces in the south (British Columbia, Alberta, Saskatchewan and Manitoba). For First Nations reserves located south of 60°N, drinking water responsibilities are shared between First Nation Band Councils, Health Canada, and Indigenous Services Canada (ISC) (i.e., the Federal Government). Band Councils are generally responsible for the design, construction, maintenance and operations of water treatment plants and distribution systems. ISC provides funding for the construction or upgrading of water treatment plants, as well as some of the maintenance and operating costs. Health Canada is responsible for water quality monitoring programs on First Nations reserves.

Unlike provinces and territories, reserves do not have legally binding drinking water regulations. The lack of legally binding regulations for drinking water on reserves is thought to be a contributing factor in the poor water quality experienced by many First Nations (Dunn, Bakker, & Harris, 2014). People living on First Nations reserves in Canada do not have sufficient access to safe drinking water in the same way as First Nations people living off reserve and non-Indigenous Canadians (Dupont, et al., 2014; EKOS Research Associates Inc., 2009; O'Gorman & Penner, 2018). Poor drinking water access in First Nations reserves has lasted for decades, and primarily stems from the historically colonial practices that forced First Nations to settle on small plots of land that may not provide suitable access to drinking water (Baijius & Patrick, 2019). In addition,

the Federal Government has excluded First Nations from land and water management decisions in their traditional territory. Together, the practice of forced settlement and exclusion from water management decisions has led to the horrific water problems First Nations people face today (Baijius & Patrick, 2019).

Over the past two decades, the Federal Government has announced initiatives, funding, and targets focused on the provision of safe water for First Nations reserves. In 2010, Bill S-11, the *Safe Drinking Water for First Nations Act* was introduced into Senate. Key criticisms of this bill included a lack of meaningful consultation with First Nations, imposing penalties to First Nations for not meeting regulations, no indication of funding sources, and the potential to undermine Aboriginal and Treaty rights (Indigenous Bar Association, 2011). This bill was defeated in Senate on March, 2011. The government made some changes to Bill S-11 and reintroduced it to Senate in 2012 as Bill S-8, the *Safe Drinking Water for First Nation Act*. Bill S-8 passed in September 2013, received royal assent and it now considered law. Unfortunately, Bill S-8 still contains significant problems, such as imposing provincial laws onto First Nation lands, allowing Aboriginal and Treaty rights to be overridden “to the extent necessary to ensure the safety of drinking water on First Nations land”, and lacking any commitment to federal funding to close the infrastructure gap (Busby, 2016). Canada’s Parliamentary Budget Office estimated cost to close the drinking water infrastructure gap to be \$1.8 billion in 2017. The Federal Government’s current budget and planned spending only covers 70% of the investment needed (Parliamentary Budget Officer, 2017).

1.4 Drinking Water and Human Well-being

Access to clean drinking water plays a significant role in human health (Howard & Bartram, 2003). Around the same time of the Confederation, the construction of water distribution systems became more prominent in response to an increasing population’s need for drinking water and fire suppression (Strategic Alternatives, 2001). Prior to these constructions, there is evidence that illnesses such as typhoid and cholera affected and killed many settlers in the early 1800s, but such illnesses were perceived to be caused by bad air, or due to hereditary factors (Rutty & Sullivan, 2010). In fact, it was not until after 1850 that scientists and physicians were starting to suspect that

water was capable of carrying pathogens that were potential vectors for the outbreaks of cholera, typhoid, and infant mortality due diarrheal diseases (Howard N. J., 1932; Strategic Alternatives, 2001). Despite, towards the latter part of the nineteenth century, the early water distribution systems offered no filtration or treatment as they pumped water directly from the source to the user, and the systems tended to be privately owned (Strategic Alternatives, 2001). By the 1900s chlorine was discovered to be an effective water treatment method for killing bacteria (Strategic Alternatives, 2001). Water treatment plants started using chlorine to treat drinking water in the early to mid 1900s in Canada (Strategic Alternatives, 2011). The province of Ontario tracked the number of water treatment plants using chlorination and found that with increasing numbers of water treatment plants using chlorination, the rate of people dying from Typhoid was lowering (Figure 1.1).

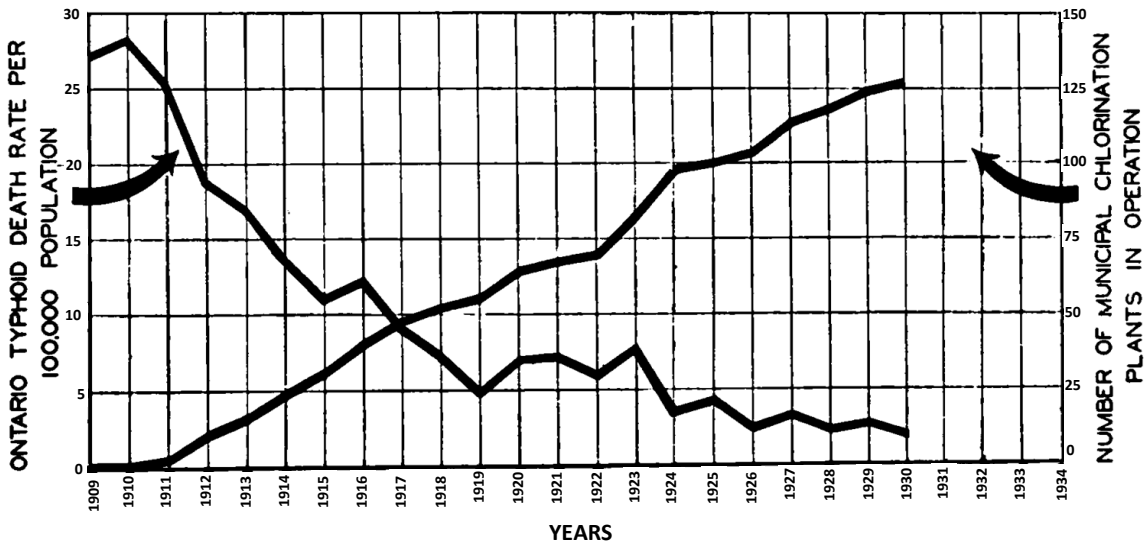


Figure 1.1 Water Chlorination and Typhoid Mortality in Ontario. Figure from *The Progressive Fight against Typhoid Fever in Canada during the Past Twenty Years: With Special Reference to the Controlling Factors*. Adapted from: Howard N.J, 1932.

Deaths from Typhoid fever in Toronto dropped from 44.2 per 100,000 people in 1910 to 0.9 per 100,000 people in 1928 due to the chlorination on the city’s water distribution system, which started in 1910 (Figure 1.2).

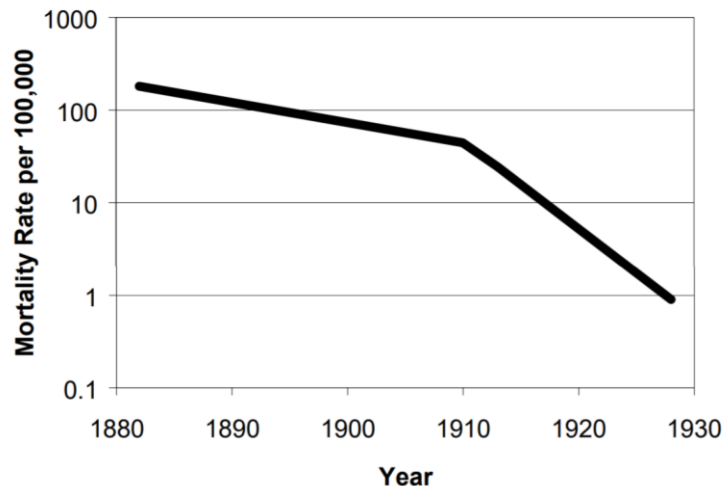


Figure 1.2 Annual Mortality rates per 100,000 attributed to typhoid fever in the City of Toronto, Ontario, Canada. Directly sourced from: Strategic Alternatives, 2001

By 1915, there were over 500 water plants in Canada serving just about half of the Municipal population (3.8 million people) (Statistics Canada, 2017). Municipalities, especially rural ones, were slow to construct water plants due to the high per capita costs of constructing them. However, particularly in the latter part of the twentieth century during the 1970-90s provincial governments invested hundreds of millions of dollars to support water treatment construction in municipalities (Strategic Alternatives, 2001).

In the Spring of 2000, the small municipality of Walkerton ON was hit with a public health crisis as their water distribution system had become contaminated with *Escherichia Coli* O157:H7 and *Campylobacter jejuni*, (O'Connor, 2002). Seven people died, and more than 2,300 people became ill (O'Connor, 2002). A 3-year police investigation ensued involving up to 87 police officers and ending with 12 charges against two Walkerton water operators (Mittelstaedt, 2003). During that time an inquiry was also carried out by the Court of Appeal for Ontario Associate Chief Justice Dennis O'Connor resulting in a two-part report numbering over 1,000 pages, budgeted to cost \$9,458,200 and offering 121 recommendations aimed to solve statutory, regulatory, technological, management, and operational systems and process weaknesses (O'Connor, 2002). The investigations revealed that water had become contaminated due to a range of factors including the washing of manure from a nearby farm into a source water well as a result of runoff induced

by heavy rains; the lack of chlorine and turbidity monitors at the well to alert to the problem, the overall low chlorine levels in the water distribution system, and the mismanagement by the local water operators who were later charged for their negligence (O'Connor, 2002).

More recently, in 2015, the City of Winnipeg issued a city-wide Boil Water Advisory immediately after 6 of 42 water samples tested positive for total coliforms and *Escherichia coli* (E. Coli) (AECOM, 2015). The Boil Water Advisory sent Winnipeggers scrambling as several businesses temporarily closed down, several press conferences were held, and stores sold out of bottled drinking water (The Globe And Mail, 2015; CBC, 2015; GlobalNews, 2015). Following two negative rounds of sampling, the City of Winnipeg rescinded the Boil Water Advisory just two days after issuing it (AECOM, 2015). The City of Winnipeg then hired an independent consultant to carry out an investigation and prepare a comprehensive report. The report numbered 874 pages and concluded that the water was likely never unsafe, and that the cause for the boil water advisory was likely due to sampling or analytical error (AECOM, 2015).

The City of Winnipeg has long been provided with clean running drinking water at the expense of Shoal Lake First Nation. In 1919, the City completed an aqueduct project to take water from Shoal Lake and transport it for approximately the 155 kilometres to the Deacons Reservoir from where the City of Winnipeg could then draw water to distribute to the city. City Officials and their stakeholders in a position of power, took 3,000 acres from Shoal Lake First Nation to build the aqueduct on First Nations land, built the aqueduct over native burial grounds without due process with the First Nations, relocated the Shoal Lake First Nation to a man-made island to make room for the City's project, and diverted the cleanest flow of water into the City's aqueduct leaving murky water behind for Shoal Lake First Nation to use (Greene & Paul, 2011) (Edwards, 2019) To date, Shoal Lake First Nation does not have clean running drinking water for themselves; the community has no drinking water treatment plant and has been under a Boil Water Advisory for 23 years (Canada, 2019).

Unfortunately, Shoal Lake First Nation is not alone in their water crisis. Access to safe drinking water is crucial for human health (Howard & Bartram, 2003), yet thousands of people living on First Nations reserves in Canada are dealing with insufficient, unsafe, unacceptable, unaffordable,

and hard-to-access drinking water sources (Human Rights Watch, 2016) (The Globe and Mail, 2016). As of February 2020, there were 40 short-term and 72 long-term DWAs in First Nations Communities, not including those within the Saskatoon Tribal Council (Canada, 2019) (First Nations Health Authority, 2020). The widespread lack of clean drinking water available on First Nations reserves is suspected to be a key factor in several health conditions (First Nations Information Governance Centre, 2018; Waldner, et al., 2017). Life expectancy for First Nations people at age 1 is considerably lower (75 years) than it is for Non-Indigenous Canadians (84 years) due to the socioeconomic disparities First Nations people are dealing with (Tjepkema, Bushnik, & Bougie, 2019). Insufficient access to clean, running drinking water has made it difficult for Indigenous communities to protect themselves from respiratory, gastrointestinal and skin infections (Thomas, et al., 2016). Lack of running water had a disastrous impact on the Island Lake First Nations during the 2009 A(H1N1) influenza epidemic in northern Manitoba (Embree, 2010) (Godbout, 2009). The water infrastructure and distribution systems that First Nations reserves have is sub standard compared to the rest of Canada, with approximately one out of every five First Nations reserves in Canada having been under a drinking water advisory at any given time over the past decade (Busby, 2016). The health disparities First Nations people face in Canada are the result of social, economic, cultural and political inequities caused by over a century of colonial, paternalistic, and discriminatory practices carried out by the Canadian government (Adelson, 2005), including systematically failing to address the drinking water crisis that many First Nations reserves in Canada continue to experience.

1.5. Human Rights and Water

Human rights are per definition what all human beings are entitled to. In 1948, the United Nations created the *Universal Declaration of Human Rights* in response to the atrocities that occurred during the Second World War (United Nations, 2019). Human rights are indivisible, meaning that each human right is connected to other human rights. Human rights are also interdependent, such that violating one right affects the exercise of other human rights; for example, the denial of the right to food and an adequate standard of living also impacts the right to life. Humans are the rights holders and States (e.g., Federal Governments) are the right bearers (OHCHR, 2016). States are defined as entities which possess “a permanent population; a defined territory; government; and

capacity to enter into relations with other states” (Convention on the Rights and Duties of States, 1933). The federal government is considered a member state of the United Nations. As right bearers, States are obligated to protect, respect and fulfill human rights. More specifically, within the context of the Canadian Human Rights Act (R.S.C.,1985, c. H-6) this means equal opportunities regardless of “*race, national or ethnic origin, colour, religion, age, sex, sexual orientation, gender identity or expression, marital status, family status, genetic characteristics, disability or conviction for an offence for which a pardon has been granted or in respect of which a record suspension has been ordered.*” The Federal Government’s creation of the reserve system and assertion of control over reserve lands, means that the Government of Canada has a fiduciary duty to provide clean running drinking water to First Nations living on reserves (Busby, 2016; MacIntosh, 2013). In fact, First Nations Band Councils continue to have limited options in making decisions about upgrades to water distributions systems on reserves (MacIntosh, 2013), a reflection that Canada’s colonial system is still negatively impacting First Nations peoples.

The United Nations rely on the World Health Organization (WHO) to defines sufficient and accessible water (United Nations, 2010). The WHO states that the water source must be within 1 kilometre of the household and the collection time must not exceed 30 minutes (United Nations, 2010). There is evidence that in some remote communities in Manitoba, Elders need to chop through thick ice to fetch household water for use in homes without running water (Fallding, 2010).The WHO also states that between 50 – 100 litres of clean water per person per day are sufficient to ensure the most basic needs are met (United Nations, 2010). Although many Canadians have more than sufficient access to clean household water, there is substantial evidence that the tap water of households in First Nations reserves and Inuit communities contain contaminants, particularly households with no running water or underground cisterns (Farenhorst, et al., 2017; Fernando, et al., 2016; McKeown, et al., 1999; Bernstein, et al., 1999; Jones, et al., 2012). In addition, the Canadian media continues to raise awareness that the tap water in households on First Nations reserves can be “brown and smelly”, “undrinkable”, “foul smelling”, and “sticky” (CBC, 2017; CBC, 2019; Palmater, 2019).

The United Nations Development Programme suggests costs not exceed 3% of a household's annual income (United Nations, 2010). The latter requirement is meant to ensure that individuals do not have to choose between buying water and other necessities, such as food and clothing. Although there are no comprehensive assessments on what portion of First Nations household's annual income is spent on drinking water, 10% of people living in eight First Nation reserves in Saskatchewan reported high monthly expenditures on bottled water (i.e., greater than \$50 per month); and some people living in St. Theresa Point First Nation reported not being able to afford the cost of refilling their cistern (i.e., \$25 per refill) (Waldner, Alimezelli, McLeod, Zagozewski, Bradford, & Bharadwaj, 2017; O'Gorman & Penner, 2018).

Human Right Watch (2016) continues to express concerns that First Nations reserves in Canada lack access to adequate water and sanitation systems. Through collaboration with three First Nations reserves in Manitoba, we examine whether or not Canada is violating the United Nation's General Assembly Resolution 64/292, *The Human Right to Water and Sanitation*, A/RES/64/292 (28 July 2010), in particular as it applies to providing households with clean, running drinking water.

1.6 Research Purpose

To utilize a participatory community-based approach in three First Nation reserves located in the Province of Manitoba to collect self-reported data from households on perceived access to safe, sufficient, affordable and acceptable drinking water. The reference used in this study to what is considered "*safe, sufficient, affordable and acceptable drinking water*" is the United Nation's General Assembly Resolution 64/292, *The Human Right to Drinking Water and Sanitation and Sanitation*, A/RES/64/292 (28 July 2010).

1.7 Research Questions

1. Is the Human Right to Drinking Water and Sanitation, as recognized by the United Nation's General Assembly Resolution 64/292, being fully realized in each of the three participating First Nation communities in Manitoba?

2. What is the impact of the type of household water delivery on the self-reported assessment whether tap water is safe, sufficient, acceptable, affordable and/or accessible?

1.8 References

- Adelson, N. 2005.** The embodiment of inequity. *Canadian Journal of Public Health*, **96**: S45 - S61.
- AECOM. 2015.** Comprehensive assessment of the city of winnipeg water system as it relates to recent boil water advisories. Winnipeg: city of Winnipeg. Retrieved March 17, 2020, from <https://winnipeg.ca/waterandwaste/water/BWAassessmentreport.stm>
- Aguiar, W., & Halseth, R. 2015.** Aboriginal peoples and historic trauma: the process of intergenerational transmission. Prince George, BC: National Collaborating Centre for Aboriginal Health.
- Baijius, W., & Patrick, R. J. 2019.** “We don’t drink the water here”: the reproduction of undrinkable water for First Nations in Canada. *Water*, **11(1079)**: 1-18. doi:10.3390/w11051079
- Bakker, K., & Cook, C. 2011.** Water governance in Canada: innovation and fragmentation. *Water Resources Development*, **27(2)**: 275-289 pp. doi:<https://doi.org/10.1080/07900627.2011.564969>
- Bernstein, C., McKeown, I., Embil, J., Blanchard, J., Dawood, M., Kabani, A., Kliwer, G., Smart, G., Coghlan, S., Cook, C., Orr, P. 1999.** Seroprevalence of helicobacter pylori, incidence of gastric cancer, and peptic ulcer-associated hospitalizations in a Canadian Indian population. *Digestive Diseases and Sciences*, **44**: 668-674.
- Borrows, J. 2018.** Introduction: Challenging law. In O. E. Fitzgerald, & L. Chartrand (Eds.), UNDRIP implemantation more reflections on the braiding of international, domestic and indigenous laws (pp. 1-8). Centre for International Governance Innovation in partnership with Wiyasiwewin Mikiwahp Native Law Centre of the University of Saskatchewan College of Law.
- Busby, K. 2016.** Troubling waters: recent developments in Canada on international law and the right to water and sanitation. *Canadian Journal of Human Rights*, **5(1)**: 1-26.

Canada. 2017a. United Nations Declaration on the Rights of Indigenous Peoples. Retrieved March 14, 2020, from Indigenous and Northern Affairs Canada: <https://www.aadnc-aandc.gc.ca/eng/1309374407406/1309374458958>

Canada. 2019. Ending long-term drinking water advisories. Retrieved September 8, 2020, from Indigenous Services Canada: <https://www.sac-isc.gc.ca/eng/1506514143353/1533317130660>

CBC. 2015. Winnipeg-wide boil water advisory in place. Retrieved March 17, 2020, from CBC Manitoba: <https://www.cbc.ca/news/canada/manitoba/winnipeg-wide-boil-water-advisory-in-place-1.2934088>

CCME. 2004. From source to tap: guidance on the multi-barrier approach to safe drinking water. Federal Provincial Territorial Committee on Drinking Water and the CCME Water Quality Task Group. Retrieved March 22, 2020, from https://www.ccme.ca/files/Resources/water/source_tap/mba_guidance_doc_e.pdf

Convention on the Rights and Duties of States. 1933. The Governments represented in the Seventh International Conference of American States. Dec. 26, 1933. United Nations Treaty Series. L.N.T.S. **165.** 19 pp.

Craft, A. 2015. Ki'inaakonigewin: reclaiming space for Indigenous laws. Retrieved from https://www.cerp.gouv.qc.ca/fileadmin/Fichiers_clients/Documents_deposes_a_la_Commission/P-317.pdf

Daschuk, J. W. 2013a. Clearing the plains. Disease, politics of starvation, and the loss of Indigenous life Regina, Saskatchewan: University of Regina Press. 11 – 77 pp.

Daschuk, J. W. 2013b. Clearing the plains. Disease, politics of starvation, and the loss of Indigenous life Regina, Saskatchewan: University of Regina Press. 79 – 98 pp.

Daschuk, J. W. 2013c. Clearing the plains. Disease, politics of starvation, and the loss of Indigenous life Regina, Saskatchewan: University of Regina Press. 114 pp.

Daschuk, J. W. 2013d. Clearing the plains. Disease, politics of starvation, and the loss of Indigenous life Regina, Saskatchewan: University of Regina Press. 99 – 126 pp.

Dunn, G., Bakker, K., & Harris, L. 2014. Drinking water quality guidelines across canadian provinces and territories: jurisdictional variation in the context of decentralized water governance. *International Journal of Environmental Research and Public Health*, **11**: 4634-4651. doi:10.3390/ijerph110504634

Dupont, D., Waldner, C., Bharadwaj, L., Plummer, R., Carter, B., Cave, K., and Zagozewski, R. (2014). Drinking water management: health risk perceptions and choices in First Nations and non-First Nations communities in Canada. *International Journal of Environmental Research and Public Health*, **11**: 5889-5903.

Edwards, K. 2019. We've been stranded on this man-made island for the past 100 years. Canada: Maclean's. Retrieved March 21, 2020, from <https://www.macleans.ca/news/canada/shoal-lake-40-first-nation-freedom-road/>

EKOS Research Associates Inc. 2009. Water quality on-reserve quantitative research. Final Report, Health Canada, Ottawa, Ontario.

Embree, J. 2010. Pandemic 2009 (A)H1N1 influenza (swine flu) — the Manitoba experience. *Biochemistry and Cell Biology*, **88**: 589-593.

Fallding, H. 2010. Winter, water-hauling a frigid mix. Retrieved from Winnipeg Free Press: <https://www.winnipegfreepress.com/no-running-water/without/winter-water-hauling-a-frigid-mix.html>

Farenhorst, A., Li, R., Jahan, M., Tun, H.M., Mi, R., Amarakoon, I., Kumar, A., and Khafipour, E. 2017. Bacteria in drinking water sources of a First Nation reserve in Canada. *Science of the Total Environment*, **575**: 813-819.

Fernando, D., Tun, H., Poole, J., Patidar, R., Li, R., Mi, R., Amarawansa, G., Fernando W., Khafipour E., Farenhorst, A., and Kumar, A. 2016. Detection of antibiotic resistance genes in source and drinking water samples from a First Nations community in Canada. *Applied and Environmental Microbiology*, **82(15)**: 4767-4775.

First Nations Health Authority. 2020. Drinking water advisories. Retrieved September 8, 2020, from First Nations Health Authority : <http://www.fnha.ca/what-we-do/environmental-health/drinking-water-advisories>

First Nations Information Governance Centre. 2018. National report of the First Nations regional health survey phase 3: Volume 1. Ottawa.

GlobalNews. 2015. No faith in city's water system: crisis. Retrieved March 17, 2020, from Global News: <https://globalnews.ca/news/1799302/no-faith-in-citys-water-system-critics/>

Godbout, A. 2009. 'We're in a war zone': Chief. *Winnipeg Free Press*. Retrieved March 21, 2020, from <https://www.winnipegfreepress.com/special/flu/were-in-a-war-zone-chief-47760982.html>

Government of Canada. 2014. First Nations in Manitoba. Retrieved from Indigenous Services Canada: <https://www.aadnc-aandc.gc.ca/eng/1100100020400/1100100020404>

Greene, C., & Paul, A. 2011. So near, so far. Winnipeg, Manitoba: Winnipeg Free Press. Retrieved from <https://www.winnipegfreepress.com/local/so-near-so-far-113126539.html>

Henderson, W. B. 2006. Indian Act. (Z. Parrott, Ed.) Retrieved March 14, 2020, from The Canadian Encyclopedia: <https://www.thecanadianencyclopedia.ca/en/article/indian-act>

Howard, G., & Bartram, J. 2003. Domestic Water Quantity Service Level and Health. Geneva, Switzerland: World Health Organization .

Howard, N. J. 1932. The progressive fight against typhoid fever in Canada during the past twenty years: with special reference to the controlling factors. *Canadian Public Health Journal*, **23(8)**: 367-383. Retrieved from <https://www.jstor.org/stable/41976688>

Human Rights Watch. 2016. Make it safe Canada's obligation to end the First Nations water crisis. New York, NY. Retrieved April 16, 2019, from <https://www.hrw.org/report/2016/06/07/make-it-safe/canadas-obligation-end-first-nations-water-crisis>

Indigenous Bar Association. 2011. Position paper on bill S-11 - safe drinking water for First Nations act. Retrieved September 18, 2019, from www.indigenousbar.ca/pdf/IBA%20Submissions%20on%20Bill%20S11%20Drinking%20Water.mar%202011.pdf

Jones, N. L., Chiba, N., Fallone, C., Thompson, A., Hunt, R., Jacobson, K., and Goodman, K. 2012. Helicobacter pylori in First Nations and recent immigrant populations in Canada. Canadian Journal Gastroenterol, **26(2)**: 97-103.

MacIntosh, C. 2013. The right to safe water and Crown-Aboriginal fiduciary law: litigating a resolution to the public health hazards of on-reserve water problems. In Martha Jackman and Bruce Porter, eds, Reconveiving Human Rights Practice for the New Social Rights Paradigm. Irwin Law. Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2261500

McKeown, I., Orr, P., Macdonald, S., Kabani, A., Brown, R., Coghlan, G., Dawood, M., Embil, J., Sargent, M., Smart, G., and Bernstein, C. 1999. Helicobacter pylori in the Canadian arctic - seroprevalence and detection in community water samples. The American Journal of Gastroenterology, **94(7)**: 1823-1829.

Mittelstaedt, M. 2003. Police lay charges in Walkerton. Retrieved March 16, 2020, from The Globe and Mail: <https://www.theglobeandmail.com/news/national/police-lay-charges-in-walkerton/article25283193/>

National Inquiry into Missing and Murdered Indigenous Women and Girls. 2019. Reclaiming Power and Place. Gatineau, QC. Retrieved from <https://www.mmiwg-ffada.ca/final-report/>

O'Connor, D. R. 2002. Part one: a summary report of the walkerton inquiry: the events of May 2000 and related issues. Toronto, Ontario: Ontario Ministry of the Attorney General.

O'Gorman, M., & Penner, S. 2018. Water infrastructure and well-being among First Nations, Metis and Inuit individuals in Canada: what does the data tell us? Environmental Science and Pollution Research.

OHCHR. 2016. Human Rights. Retrieved from <https://www.ohchr.org/Documents/Publications/HandbookParliamentarians.pdf>

Parliamentary Budget Officer. 2017. Budget sufficiency for First Nations water and wastewater infrastructure. Ottawa, Canada: Office of The Parliamentary Budget Officer.

Rutty, C., & Sullivan, S. C. 2010. This is public health: a Canadian history. Ottawa, Ontario: The Canadian Public Health Association.

Schlesier, K. H. 1994. Introduction. In Plains Indians, A.D. 500-1500: The Archaeological Past of Historic Groups (p. xxi). Norman: University of Oklahoma Press.

Sinclair, R. 2007. Identity lost and found: lessons from the sixties scoop. First Peoples Child & Family Review, **3(1)**: 65-82.

Statistics Canada. 2017. Survey of drinking water plants, 2015. Retrieved from The Daily: <https://www150.statcan.gc.ca/n1/daily-quotidien/171101/dq171101b-eng.htm>

Strategic Alternatives. 2001. Drinking water management in Ontario: a brief history. Ontario Sewer and Watermain Construction Association , Toronto, ON.

The Globe And Mail. 2015. Winnipeg's boil-water advisory continues as city runs more tests. Retrieved March 17, 2020, from The Globe And Mail: <https://www.theglobeandmail.com/news/national/winnipeg-water/article22672396/>

The Globe and Mail. 2016. Water systems at risk. Retrieved February 18, 2020, from <https://www.theglobeandmail.com/news/national/indigenous-water/article31589755/>

Thomas, T. K., Ritter, T., Bruden, D., Bruce, M., Byrd, M., Goldberger, R., Dobson, J., Hickel, Smith, J., Hennessy, T. 2016. Impact of providing in-home water service on the rates of infectious diseases: results from four communities in Western Alaska. Journal of Water and Health, **14(1)**: 132-141.

Thorton, R. 1987. American Indian holocaust and survival: a population history since 1492. Norman, Oklahoma: University of Oklahoma Press.

Tjepkema, M., Bushnik, T., & Bougie, E. 2019. Life expectancy of First Nations, Metis and Inuit household populations in Canada. Statistics Canada, Health Reports, **30(12)**: 3-10. doi:<https://www.doi.org/10.25318/82-003-x201901200001-eng>

Truth and Reconciliation Commission of Canada. 2015. Truth and reconciliation commission of Canada: calls to action. Winnipeg: Truth and Reconciliation Commission of Canada.

United Nations. 2010. The Right to Water Fact Sheet No.35. Geneva, Switzerland: Office of the United Nations High Commissioner for Human Rights. Retrieved February 22, 2019, from United Nations: <https://www.ohchr.org/Documents/Publications/FactSheet35en.pdf>

United Nations. 2011. United Nations declaration on the rights of Indigenous Peoples. Retrieved from https://www.un.org/development/desa/indigenouspeoples/wp-content/uploads/sites/19/2018/11/UNDRIP_E_web.pdf

United Nations. 2019. History of the document. Retrieved December 3, 2019, from Universal Declaration of Human Rights: <https://www.un.org/en/sections/universal-declaration/history-document/index.html>

United Nations. (n.d.). Genocide. Retrieved April 4, 2020, from United Nations Office on Genocide Prevention and the Responsibility to Protect: <https://www.un.org/en/genocideprevention/genocide.shtml>

Waldner, C. L., Alimezelli, H. T., Mcleod, L., Zagozewski, R., Bradford, L. E., & Bharadwaj, L. A. 2017. Self-Reported effects of water on health in First Nations Communities in Saskatchewan, Canada: results from community-based participatory research. *Environmental Health Insights*, **11**: 1-13.

2. DRINKING WATER IN THREE FIRST NATIONS RESERVES THROUGH THE UNITED NATIONS HUMAN RIGHTS LENS AND SELF-REPORTING

2.1 Abstract

Many people living on First Nations reserves in Canada do not have sufficient access to safe drinking water. The water crisis in First Nation reserves has lasted for decades. Half of households on First Nations reserves in the Province of Manitoba do not have access to piped water, but rather rely heavily on cisterns, wells, or have no running water. The purpose of this research was to assess whether First Nations households have full access to water, as defined in the United Nation's General Assembly Resolution 64/292, *The Human Right to Drinking Water and Sanitation and Sanitation*, A/RES/64/292 (28 July 2010); and whether households' perceptions of their water was dependent on their type of water distribution system. In partnership with three Manitoba First Nations, a cross-sectional door-to-door survey was administered from July 2017 to October 2018. Through factor analysis, safety, sufficiency, acceptability and human health were identified as the four factors that explained the majority of the underlying variance between the larger set of survey questions. Through chi-square inferential tests, the relationship between various types of water distribution with the four factors was examined. Deductive and inductive analysis of qualitative survey data identified the manner in which households described the safety, sufficiency, acceptability and health impacts of their households' water delivery system. Nearly two-thirds of households reported not fully experiencing the Human Right to Drinking Water. Households with cisterns reported significantly more safety and sufficiency concerns compared to households with piped water. Households with no running water also reported sufficiency concerns and negative health impacts, such as gastrointestinal symptoms.

2.2 Introduction

Indigenous people have lived in the Americas since time immemorial (Thorton, 1987). A substantial portion of Indigenous peoples in the Americas lack access to clean water and

sanitation, leading to human health problems (Dupont, et al., 2014; Farenhorst, et al., 2017; Waldner, et al., 2017; Thomas, et al., 2016; Hennessy, et al., 2008). In Canada, the poor water and sanitation infrastructure in First Nations reserves and Inuit communities contributes to greater incidences of *Helicobacter pylori* infections among community members, including incidences of painful stomach ulcers, for example (McKeown, et al., 1999; Bernstein, et al., 1999; Jones, et al., 2012). Also, during the 2009 Influenza A (H1N1) epidemic, limited access to clean running water left First Nations household in the Island Lakes Region of Manitoba vulnerable to the spread of the disease, with devastating impacts on community health (Embree, 2010). There is evidence that access to piped water at the household level leads to improved socioeconomic determinants of health (Howard & Bartram, 2003; Stelmach & Clasen, 2015) (Stelmach & Clasen, 2015). As a point of comparison, in Alaska USA, after un-serviced (i.e., less than 20% of households having piped water or cisterns) households in four communities were upgraded with piped drinking water and flush toilets, there was significant decrease in respiratory, skin and gastrointestinal infections among its Indigenous members (Thomas, et al., 2016). Additionally, Indigenous peoples living in regions in Alaska with good water service (i.e., greater than 80% of households having piped water or a cistern) were 2 to 4 times less likely to experience pneumonia, influenza, skin and soft tissue infections, MRSA (methicillin-resistant *Staphylococcus aureus*) and RSV (childhood Respiratory Syncytial virus) infections than Indigenous peoples living in regions with poor water services (Hennessy, et al., 2008).

There are close to one million First Nations peoples in Canada, accounting for about 60% of Indigenous peoples in Canada (StatsCanada, 2017). About one-third of First Nations live on reserves and many reserves are experiencing a water crisis. At any given time in the past decade, one out of every five First Nations reserves were under a Drinking Water Advisories (DWA) (Busby, 2016). The water distribution systems serving many First Nations reserves are not able to supply safe water, and it has been this way for decades. In 2011 a comprehensive national assessment of the status of water distribution systems on First Nations reserves found 72.0% of water distribution systems on First Nations reserves posed a medium to high risk to human health. A similar report commissioned by the Federal Government in 2003 had concluded that 75% of water systems posed a medium- to high-risk to human health (Indian and Northern Affairs Canada, 2003). Furthermore, many households on First Nations reserves are not

connected to a water treatment plant (Figure 2.1). Only one-half (51%) of households on First Nations reserves in the Province of Manitoba have piped water, with the remaining households relying on cisterns (31%), wells (13%) or have no running water (5%) (Figure 1). Cisterns are water tanks generally constructed of concrete, polyethylene, or fiberglass, which are used to store water delivered by a water truck that is first filled from a water treatment plant (Baird, Summers, & Plummer, 2013). In a door-to-door survey completed in a fly-in First Nation reserve in Manitoba, households with cisterns expressed concerns about both the safety and the accessibility of their tap water (O’Gorman & Penner, 2018). First Nations households with piped water have also expressed concerns about the accessibility of their tap water. Some households with piped water have reported not being able to access water due to the occurrences of water system malfunctions (Waldner, et al., 2017).

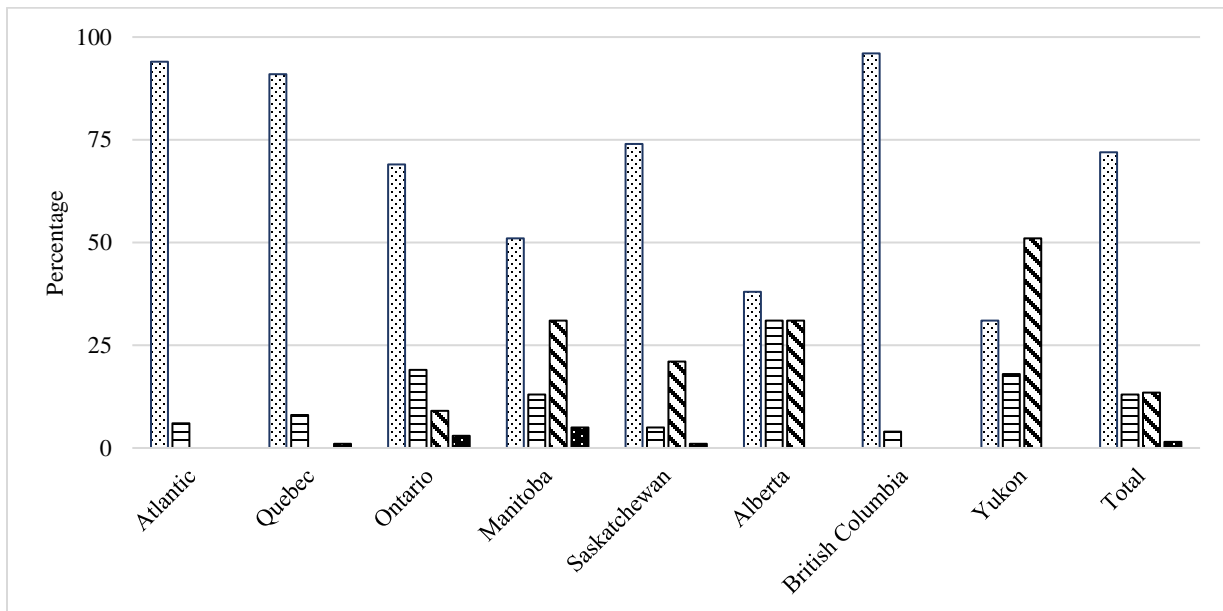


Figure 2.1 Percentage of households on First Nations reserves that have piped (white with black dots), cisterns (diagonal stripes), wells (horizontal stripes) and no running water (black with white dots) in and across Canada. Adapted from Neegan Burnside (2011a).

Finally, survey data from multiple sources show that individuals in First Nations reserves are less likely to perceive household water to be safe, relative to individuals living in non-Indigenous communities (Dewis, 2009; EKOS, 2009; First Nations Information Governance Centre, 2018).

In the current study, a door-to-door surveys was developed and administered in partnership with each of three First Nations reserves (referred here; as A, B or C) in Manitoba to better understand how household water is perceived and used by community members relying on different water distribution systems. Community A and B did not wish to stay anonymous in this thesis. Community A is Pine Creek First Nation, and Community B is Brokenhead Ojibway Nation. Households connected to piped water and households with cisterns were equally represented in the sample (45.8% each), while 4.1% of households were connected to wells, and 4.4% had no running water. Fifty-eight percent (58%) of households in Community A responded to the survey, 41% of the households in Community B, and 25% of the households in Community C.

2.3 Human Rights Framework

For decades, Canada has been a world leader in the protection and advancement of human rights. Indeed, Canada played a pivotal role in the drafting of the *Universal Declaration of Human Rights* in 1947-48 through its membership with the UN. Within Canada, individuals have rights that include the right to life, liberty and security of person, the right to education, and the right to be treated equal under the law.

Despite Canada's recognition of a wide range of human rights, Canada's reputation belies a more complicated reality for Indigenous nations in Canada; for example, not until 2016, the Federal Government of Canada declared their support for *United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP)*, which was a decade after UNDRIP was adopted by the UN. Moreover, Canada was one of only four colonialist-founded UN members to vote against UNDRIP in 2007 (i.e., those voted against were Canada, the USA, New Zealand, and Australia, each having a notable history of violations against its Indigenous populations). Even though Canada signed UNDRIP in 2016, its Federal Government failed to advance UNDRIP principles, as evidenced by the pushback in supporting Bill C-262, for example. Bill C-262 was introduced by Romeo Saganash on April 21, 2016 for "*ensuring the laws of Canada are in harmony with the United Nations Declaration on the Rights of Indigenous Peoples*". The Bill ultimately was defeated in its final stages at the Senate on June 21, 2019 due to concerns about halting economic

and resource developments in Canada should Indigenous Nations have the right for free, prior, and informed consent (Canada. Parliament, 2019).

In regard to the right to drinking water, while Canada recognized this right in 2012, Canada also has ratified conventions that express provision of safe drinking water. The human right to water is explicitly stated in three United Nations human rights treaties that were ratified by Canada in 1981 (The Convention on the Elimination of All Forms of Discrimination Against Women), in 1991 (The Convention on the Rights of the Child), and in 2010 (The Convention on the Rights of Persons with Disabilities) (Busby, 2016). In addition, academics have argued that Canada's Constitution Act of 1982 could be used to establish the provision of safe drinking water. Under section 26 of the Canadian Constitution Act of 1982, the Federal Government is committed to "*providing essential public services of reasonable quality to all Canadians*", which would infer clean drinking water (Busby, 2016; Boyd, 2011). The provision of clean drinking water is also essential to the right to life, liberty and security of person under section 7 of the *Canadian Charter of Rights and Freedoms*, whereas access for all Canadians is inferred by the right to be treated equal under section 15 of the same charter (Busby, 2016).

It was not until 2012 that Canada signed the United Nation's General Assembly Resolution 64/292, *The Human Right to Water and Sanitation*, A/RES/64/292 (28 July 2010) (Busby, 2016). As such, Canada acknowledges that all humans are entitled to sufficient, safe, acceptable, affordable and physically accessible water, as defined in Table 2.1 (United Nations, 2010; United Nations, 2014). International law also requires that Canada take special measures to prioritize marginalized and disadvantaged groups' rights to drinking water, adopt action plans that facilitate the realization of those rights, encourage the participation of those who are vulnerable to rights infringement (e.g., Indigenous Nations in colonial countries), ensure transparency and accountability, and ensure that there are effective remedies in place when water rights are breached (Busby, 2016).

Table 2.1 Definitions of sufficient, safe, acceptable, physically accessible and affordable water as it applies to United Nation’s General Assembly Resolution 64/292, *The Human Right to Water and Sanitation*, A/RES/64/292 (28 July 2010).

Sufficient: The water supply for each person must be sufficient and continuous for personal and domestic uses. These uses ordinarily include drinking, personal sanitation, washing of clothes, food preparation, personal and household hygiene.

Safe: The water required for each personal or domestic use must be safe, therefore free from micro-organisms, chemical substances and radiological hazards that constitute a threat to a person’s health. Measures of drinking-water safety are usually defined by national and/or local standards for drinking-water quality.

Acceptable: Water should be of an acceptable colour, odour and taste for each personal or domestic use. All water facilities and services must be culturally appropriate and sensitive to gender, lifecycle and privacy requirements.

Affordable: Water, and water facilities and services, must be affordable for all.

Accessible: Everyone has the right to a water and sanitation service that is physically accessible within, or in the immediate vicinity of the household, educational institution, workplace or health institution.

Since greater than 90% of the sample consisted of households with piped (Community, A, B and C) or cistern water (Community A and C), the study explored how household water is perceived and used by piped versus cistern households. It hypothesized that households’ perception of water varied according to the type of water services provided to the home and that some water distribution systems used in First Nations reserves might not meet the United Nations standards as defined in Table 2.1. As such, the survey data were used to test whether or not the Federal Government of Canada is meeting its obligations under the United Nation’s General Assembly Resolution 64/292, *The Human Right to Water and Sanitation*, A/RES/64/292 (28 July 2010). Approval to conduct this research was granted by the Joint-Faculty Research Ethics Board at the University of Manitoba (HS20727 & HS21998) and was supported by the Band Councils of each of the communities through letters of support or Band Council Resolutions.

2.4 Materials and Methods

2.4.1 Design of the community-based participatory research approach

A community-based participatory research approach was applied to each of the three First Nations reserves included in this study. Community A and Community B have year-round road access, whereas Community C has winter road access only. Each community has a water treatment plant that provides piped water to the households that are directly connected to the water treatment plant. University of Manitoba researchers met with Band Council in Communities A and C, and the Health Directors in Community B and C, as well as with other community members who were appointed to serve as research team members. Each community was provided with the same empirically-tested questionnaire that had been previously established through a collaboration involving the University of Saskatchewan and the Federation of Sovereign Indigenous Nations, among others (Waldner, et al., 2017). Topics covered included, but were not limited to, perceptions of water safety, how the household accessed water, and problems the household had experienced with their water. For each community, the appointed community researcher refined this questionnaire to ensure local relevancy and usefulness. In addition, communities A and B opted to develop both a short and long survey, as the short survey was an effective method to recruit more households to participate. Each short survey was designed using a subset of questions from that community's long survey.

Data was collected in Community A between July 2017 and August 2017, in Community B during September 2018, and in Community C between September 2018 and October 2018. Survey participants were recruited through convenience door-to-door recruitment. One adult participant from each participating household was invited to fill out a survey. The members of the household chose which adult household member would fill out the survey. Participants had the option of completing the survey through a face-to-face interview method or through a self-administered format for which the completed survey was picked up later that day or the next day by the university and community researchers.

2.4.2. Survey Distribution and Participation

Two hundred and seventy-three participants responded to the household water survey across the three communities. Just over sixty percent (60.7%) of the sample identified as female, and the remaining 39.3% identified as male. About the same amount of short (49%) as long (51%) surveys were completed in Community A (n=121). Surveys completed in Community B (n=84) consisted of 56% short and 44% long surveys. The short surveys, which were developed in Community A and B, did not contain every question used in the quantitative analysis. For example, the short survey in Community A included questions 4, 5, 9, 10, and 13. Community B's short survey included question 1, 4-13, and 15 (see table 3 for list of questions). There were 68 survey responses in Community C. Responses were from households that relied on piped water (34%) or cisterns (66%) in Community A, on piped water (87%) or private wells (13%) in Community B, and on piped water (18%) or cisterns (67%), or had no running water (15%) in Community C.

Survey questions were a mixture of closed- and open-ended questions. Questions that were unique to the community (i.e., not asked in the other two communities) accounted for 5% (short survey) and 33% (long survey) of the survey questions in Community A, 16% (short) and 30% (long) of the survey questions in Community B, and 32% of the survey questions in Community C. Other survey questions were identical among communities, aside from occasionally providing a different range of options from which the respondent could choose (e.g., "wells" listed as an option in the surveys of Community B, but not in the surveys of Community A and C).

Responses (n = 569) to sixteen of the identical survey questions were used in quantitative analysis. In addition, we performed a qualitative analysis of 11 open-ended survey questions (Table 2) that provided for a total of 246 responses from Community A, 94 responses from Community B, and 223 responses from Community C. One hundred and forty-eight questions were not used in the analysis for the current study. However, the Band Council in each community were provided with a report that contained aggregated responses to every survey question asked to households in their community. As well, all survey participants were provided

with an Infographic that summarized the survey findings for the community in which they resided.

2.4.3. Qualitative Analysis Procedure: Deductive and inductive approaches

A deductive approach was applied to the 563 responses based on the 11 open-ended survey questions (Table 2.2) in order to examine if households were specifically describing experiences that parallel with the concepts in the Human Right to Drinking Water definitions (i.e., safety, sufficiency, acceptability, accessibility and affordability) (Table 2.1). Safety, sufficiency, and acceptability were the dominant themes found in the household responses. An inductive approach was then used to analyze how the respondents were describing the issues of safety, sufficiency and acceptability. The inductive approach differs from the deductive approach in that it allows themes and concepts to emerge from the data without looking for specific themes and concepts. The inductive approach involved multiple rounds of open and focused coding of the responses, resulting in three themes emerging: *water quality, health, and sufficiency* problems. Axial coding techniques were applied to each theme to explore subthemes (Lofland et al, 2006). Subthemes were only identified within the theme of *water quality: safety and acceptability*. Subsequently, keeping the themes and sub-themes as guidelines, the 563 responses were analyzed using the constant comparison method (Corbin and Strauss, 2008) to compare how responses were similar or different depending on the type of water delivery system the respondent had (piped, cistern, well or no running water). First, by comparing the responses within the same community (Community A: piped versus cistern; Community B: piped versus private well; and Community C: piped versus cistern versus no running water), then identifying additional similarities and differences between piped versus cisterns by comparing communities to one another (Piped: communities A, B and C; Cistern: communities A and C).

Table 2.2 The 11 open-ended survey questions used in deductive and inductive approaches, with reference to which surveys included them.

<p>All surveys: Does your household's water affect your child socially? Does your household's water affect your child's attendance at school?</p> <p>All surveys, except short survey in Community A: Do you believe your water is safe? Has anyone in your household or person visiting your household ever become sick of developed any irritations from drinking your tap water? Have you experienced problems with your household's tap water?</p> <p>All long surveys: Do you have any concerns about the water that is delivered to your home? Do you have any concerns that, by drinking your tap water, your health is impacted in a negative way? Has anyone in your household or person visiting your household ever become sick or developed any irritations from bathing, cooking, or brushing their teeth with your tap water? Additional Comments</p> <p>All surveys, except short survey in Community A, and households with piped water in long survey in Community A: Are their times where you do not have enough water to take care of you or your families' hygiene needs? Are their times where you do not have enough water to wash clothes and dishes?</p>

2.4.4. Human Right to Water and Sanitation: Quantitative Analysis

Dependent variables: Dependent variables were the responses to sixteen survey questions that were selected based on their potential relevance to assessing whether community households have sufficient, safe, acceptable, physically accessible and affordable water for personal and household use. The variables included were dichotomous (yes/no), coded as (1/0) in which the higher value (1) corresponded to a negative issue related to the respondent's drinking water (e.g., water clarity concerns). Less than five people responded as having an accessibility problem, thus physically accessible water was excluded from analysis to ensure survey respondent's confidentiality.

Independent variables: The independent variable was the type of water delivery system the respondent had (piped=1, cistern=2, well=3 or no running water=4).

Univariate analysis: Univariate analysis was applied using the sixteen questions as dependent variables to examine their relationship in establishing a smaller set of factors that explained the underlying variance among dependent variables. Variables went into the factor analysis independently from their perceived association with the Human Right to Drinking Water and Sanitation definition (i.e., whether there is safe, sufficient, acceptable, and affordable water). Principal component extraction with an orthogonal/varimax rotation was employed to identify inter-correlated constructs from the variables. Results indicated a 4-factor solution as these four components explained a large amount of variance (64%) and each had eigenvalues greater than 1 (Table 2.3). The scree plot, a type of discontinuity test, also suggested a 4-factor solution given the straight-line function between the remaining 12 factors (Pett, Lackey, & Sullivan, 2003).

The four factors were given the following descriptive names to best describe their underlying relationship: 1) Safety, 2) Sufficiency, 3) Acceptability, and 4) Human Health (Table 2.3). Affordable water as defined in Table 2.1 did not emerge as a factor, however, monthly costs of bottled water did significantly load onto the safety factor. Indeed, survey responses indicated that households were more likely to buy bottled water when tap water was perceived not safe. Human Health emerged as a factor but is not defined as part of the United Nation's General Assembly Resolution 64/292 (Table 2.1). We perceive the Human Health factor to be an overarching assessment of the Human Right to Water and Sanitation, as well as to whether the Federal Government is "*providing essential public services of reasonable quality to all Canadians*" under section 26 of the Canadian Constitution Act of 1982.

Table 2.3 Independent Measures and Descriptive Analysis. M=mean; SD=standard deviation; FL=factor loading; %V=% variation; E=eigenvalue.

	M	SD	FL	%V	E
Factor 1 – Safety (n=71)	.676				
1. Do you believe your tap water is safe?	.30	.458	.811	34.664	5.546
2. Do you believe your tap water is safe for drinking year-round?	.34	.476	.801		
3. Do you have any concerns about the tap water that is delivered to your home?	.44	.498	.738		
4. Safety (You are worried about what is in your water. E.g. Bacteria, chemicals, etc.)	.40	.490	.635		
5. Spends \$50 or more per month on bottled water	.29	.457	.554		
Factor 2 – Sufficiency (n=161)	.559				
6. Are there times that you do not have enough water to take care of you and your family's hygiene needs (bathing, teeth brushing, shaving, etc.)?	.34	.473	.907	13.565	2.170
7. Are there times that you do not have enough water to wash clothes and dishes in your home?	.34	.476	.891		
8. Do you ever run out of water?	.54	.500	.826		
Factor 3 – Acceptability (n=189)	.630				
9. Taste (Your water does not taste good)	.22	.415	.775	8.524	1.364
10. Smell (Your water has an odd smell)	.28	.452	.767		
11. Have you experienced any problems with your tap water?	.55	.499	.610		
12. Have you ever made a complaint related to your tap water?	.22	.417	.543		
13. Clarity (How clear is it)	.21	.409	.442		
Factor 4 – Human Health (n=148)	.338				
14. Do you have any concerns that by drinking your tap water, your health is impacted in a negative way?	.30	.458	.513	6.997	1.119
15. Has anyone in your household or person visiting your home ever become sick or developed any irritations from drinking your household's (unfiltered) tap water?	.14	.353	.801		
16. Has anyone in your household or person visiting your home ever become sick or developed any irritations from bathing, cooking, or brushing their teeth with your household's (unfiltered) tap water?	.12	.325	.770		

Bivariate Analysis: Households with piped water (45.75%) and cisterns (45.75%) represented greater than 90% of the survey respondents. A chi-square inferential test was applied to each of the four factors (Table 2.4) to test for significant differences in responses between piped versus

cistern households, including Cramer's V analyses as a measure of effect size and strength of association. Finally, the factors were computed into dichotomous measures.

2.5 Results

The quantitative analysis resulted in the groupings of four factors: safety, acceptability, sufficiency and human health. Out of the 273 households, 29.3% answered yes to at least one question in one factor, 15.0% to at least one question in two factors, 12.8% to at least one question in three factors, and 3.7% to at least one question in all four factors. Thus, 60.8% of the households had one or more concerns about their household water.

Based on the univariate analyses, more than one-half of the households reported to have a problem with the safety (67.6% of 71 households reporting), acceptability (63%, n=189) and sufficiency (55.9%, n= 161) of their household water (Table 2.3). In addition, 33.8% of households (n=148) reported that their household's water has negatively impacted the health of their family or visitors to their home. Households with cisterns reported significantly greater concerns than households with piped water, both with respect to the safety (76.9% vs 51.9%, $\chi^2=4.51$, $p<0.05$, $V=0.12$) and sufficiency (80% vs. 23.8%, $\chi^2=45.01$, $p<0.001$, $V=0.56$) of their tap water (Table 2.5). Nearly two-thirds of households (63%) reported acceptability concerns with their household's drinking water (Table 2.3). The type of water distribution system had no statistically significant impact on the amount of acceptability or health concerns reported between households with piped water compared to households with cisterns (Table 2.4). However, proportionally more households with cisterns (36.8%) than households with piped (26.7%) water reported that the tap water negatively impacted the health of their family or friends.

Table 2.4 Impact of household water delivery on factors describing the safety, sufficiency and acceptability of tap water, and the impact of tap water on human health, as perceived by households with piped versus cistern water.

Factor	Piped	Cistern	Total	P value	Cramer's V
Safety	51.9% (14/27)	76.9% (30/39)	66.7% (44/66)	.034	.261
Sufficiency	23.8% (15/63)	80% (64/80)	55.2% (79/143)	.000	.561
Acceptability	63.3% (62/98)	62.3% (48/77)	62.9% (110/175)	.900	.010
Human Health	26.7% (16/60)	36.8% (28/76)	32.4% (44/136)	.208	.108

The quantitative results demonstrate that approximately two-thirds of households had safety and acceptability concerns, half had sufficiency problems, and nearly a third had human health concerns with their household drinking water. Households with cisterns were more likely to have safety and sufficiency problems with their households drinking water than households with piped water. Next, we used the qualitative results to contextualize how all households were describing their experiences with their households drinking water, and if there were differences between households with varying water delivery systems.

2.5.1. Qualitative Results

Safety: Safety concerns expressed by households included statements of undrinkable water, unsafe water, and reports of the presence of harmful substances in tap water such as sediment, mold or bacteria. Households described their water being unsafe due to “*large amount of sediment*” [Community B, well] in it, or not being able to trust their water, “*Sometimes we're not sure of the water quality even at the standpipe. Sometimes we notice that we get diarrhea from it. Not sure the safety of it*” [Community C, cistern]. Households with the most frequent safety concerns were households with cisterns (Table 2.5). Households with cisterns described having the “*taps clog up all the time[sic]*” as a result of “*sand and other debris*” [Community A, cistern]. Also, there were concerns that water becomes contaminated because the water trucks travel over the “*dusty gravel road*” and take in “*debris that comes with the transport*”. Households with cisterns in need of a cleaning or repair were other commonly expressed reasons why households with cisterns perceived their tap water unsafe. Households with cisterns

described that the water tank cleaning people are “*constantly busy*” [with other households] and “*the water tank guys need more equipment.*” [to keep up with the demand] [Community C, cistern household].

Table 2.5 Number of households with piped versus cistern water that showed concerns in the open-ended questions about the safety, sufficiency and acceptability of tap water, and the impact of tap water on human health.

Community	System	Safety	Sufficiency	Acceptability	Health
A	Piped	12	6	19	17
	Cistern	34	50	24	16
B	Piped	3	4	38	6
	Well	6	2	8	3
C	Piped	2	1	5	6
	Cistern	38	47	19	13
	No running water	0	22	1	8

Sufficiency: Sufficiency problems households reported described running out of water at the household, never having enough water, rationing water, or not being able to shower, complete laundry or cleaning due to lack of water. One hundred and nineteen households with cisterns or no running water described experiencing times when they did not have sufficient water to meet their personal and domestic needs at their household (Table 2.5). In households without running water, families have to “*sponge bathe. It’s been a while for us to have a bath. We use a barrel to bath in.*” [Community C]. Households without running water reported experiencing shortages every day and coped by leaving the household to access water, such as washing up in a “*public building*” or in the home of “*a relative*” or “*neighbor*”; or by hauling water back in buckets from these locations, the water treatment plant, or the community standpipe. Accessing water outside of the household caused economic concerns: “*We have to go grab a tub and go get water. This means sometimes we have to hire a taxi to get water. That’s a lot of money to go get water.*” [Community C, no running water].

Households with cisterns frequently expressed concerns about running out of water and needing to ration water; for example, “*When we run out of water, can’t shower, cook or clean*” [Community A]. Others reported limiting showers and laundry to preserve water. Some households need to preserve water to protect water pumps in cisterns from burning out: “*I always*

check my water level. I know if I run out of water I'm in trouble. I have to run around and shut everything off so my water pump doesn't break" [Community C]. Some households indicated saving an emergency bucket of water. Households with cisterns often discussed the importance of having available enough "water trucks"; for example, *"when the truck breaks down, I don't have enough water"* [Community A], and *"in our community it takes a long time to get water. We only have three water trucks. In the winter we sometimes have to wait a week to get water. We need to plow the driveways a lot."* [Community C]. Some households with cisterns reported the need to accessing water outside of the home, and used similar strategies as described above for the households classified as "no running water".

In contrast, households with piped water almost always had access to sufficient water and they indicated that this was very important. One Community C household described living in a home with no heat and no flush toilet and stated that, *"the only reason I'm staying here is because this house has running tap water from the main line."* Another household with piped water was concerned for those that have not: *"Every house should have running water, and not those tanks, because that sucks."*

Acceptability: Households with acceptability concerns described something wrong with the colour, clarity, taste or smell of their water. About one-third (34.2%) of the reported acceptability concerns were related to chlorine concentrations in tap water such as: *"When I run the taps it smells stale and like chlorine. It is slimy, smells bad and has a bad taste."* [Community A, cistern]. The types of acceptability concerns did vary between households with differing water delivery systems; for example, chlorine accounted for about one-half of the acceptability concerns expressed by households with piped water, but only for about one-quarter of the acceptability concerns expressed by households with cisterns. Households with cisterns reported some acceptability concerns that were unique to them such as the water having a *"moldy taste"*, *"too much chlorine right after they delivered it"*, *"cloudy, [but] only when I'm about to run out"* or *"when the weather is really warm the water gets white cloudy"*.

Human Health: Health concerns households perceived to be caused by household water included gastrointestinal illnesses (62%) or skin infections (32%); for example, to “*get diarrhea if I drink it. This only happens when I drink tap water.*” [Community A, piped] and “*My little one gets eczema from it*” [Community C, cistern]. Several households from Community C described their water becoming unsafe after sitting in their cistern for too long which caused someone in their household to get sick as this household described: “*The water has been in the tank for a period of time. They get sick. Sometimes at night a child cries for water at night. They get water from the tap and get sick. But what can I do? They need water.*” In general, households in Community A and C were more likely to report gastrointestinal illnesses, and households in Community B were more likely to report skin infections.

2.6 Discussion

The key finding of this study is that two-thirds of the First Nations households surveyed are unable to fully access water as defined in the United Nation’s General Assembly Resolution 64/292, *The Human Right to Drinking Water and Sanitation and Sanitation*, A/RES/64/292 (28 July 2010). Even though the communities were not under a drinking water advisory (DWA) at any time during the duration of this study, 67.6% (Table 2.4) of households reported at least one general water safety concern. Moreover, households reported experiencing negative health effects because of their drinking water, most often described as gastrointestinal illness symptoms. The impact of poor drinking water quality on the health of First Nations people has been reported by other studies (Hennessy, et al., 2008; Bradford, et al., 2016; Waldner, et al., 2017). Indigenous communities in Canada are 26 times more likely to experience gastrointestinal infections than other communities in Canada (Bradford, et al., 2016). Although there is a current commitment by the Federal Government of Canada to end all long-term boil water advisories by March 2021, this commitment will not end the water safety problems that the households in this study are facing.

The perceptions households had about the safety and sufficiency of their household water was dependent on the type of water delivery system available in the home. Households with cisterns reported significantly greater safety and sufficiency concerns than households with piped water. There is strong evidence that cistern water is indeed less safe than piped water in First Nations reserves. Specifically, a range of recent studies have shown that the tap water from households with cisterns (water tanks) were significantly more likely to contain total coliforms, including *Escherichia Coli*, than households relying on piped tap water (Fernando, et al., 2016; Farenhorst, et al., 2017; Bradford, et al., 2018; Mi et al. 2019). Among all the water concerns reported (table 2.5), households with piped water or wells reported more acceptability concerns than safety, sufficiency, or health. Households with piped water or wells were concerned about water acceptability; for example, half of the reported acceptability concerns from households with piped water included concerns about the (large) chlorine content in their household's water. As expected, concerns about water sufficiency was expressed by households classified as no running water. Households with no running water (4.4% of our sample) did not report safety concerns. Based on the responses, it is also clear that households with no running water, obtain water from a variety of sources, including bottled water, and each source may carry a different perception of "safety". The households with no running water did express concerns about the negative health effects caused by their water, particularly gastrointestinal infections that can be caused by water-borne pathogens. In a drinking water quality study that involved a fly-in First Nation reserve the storage buckets in homes with no running water were sampled and the water in these buckets showed alarming high levels of total coliforms, including *Escherichia Coli* (Farenhorst, et al., 2017).

Households most impacted by insufficient water were households with cisterns or no running water. Insufficient water impacted household hygiene, community members' access to education, and had negative social consequences. Children and those employed by the school were impacted as "*they shut the school down when the water has a problem.*" Households with no running water reported their children being socially impacted: "*My kids have been bullied. I have six children [sic] sometimes they go to school with dirty clothes. It's hard to keep up with laundry when I don't even have running water.*" Economists O'Gorman & Penner (2018) also

found that First Nations children were missing school due to the school closing due to insufficient water, or because their household did not have enough water to keep up with laundry. They calculated that increasing the proportion of First Nations households with piped water would substantially decrease health care costs associated with water borne illnesses (O’Gorman & Penner, 2018). In an engineering assessment, (Neeagan Burnside, 2011a) reported that to accommodate future growth, the life cycle costs of extending piped water and wastewater servicing for households in First Nations would be more cost effective than the costs of using cisterns and individual wells (Neeagan Burnside, 2011a).

There is an urgent need for improved water services to households on First Nations reserves, as there is evidence that the health and well-being of families living in homes with cisterns or no running water are negatively impacted by the (lack of) quantity and quality of household water. It is not surprising that it was these household with cisterns or no running water described how their households dealt with mitigating the stress of poor household water quality. Mitigation strategies discussed included not drinking household’s water, access water elsewhere (i.e. neighbour’s household’s water, lake, water standpipe, water treatment plant), or buying bottled water. Community C is a fly-in community and the survey results clearly indicated that its members experience economic hardship in relying on bottled water as an alternative drinking water source. Some respondents in Community C “*only drink bottled water during the winter months, and no tap water*”, because the winter roads allow for cheaper transportation of bottled water into the community [than at other times of the year that requires travel by boat and plane].

With respect to safety concerns most often expressed by respondents living in households with cisterns, households are seeking routine tap water testing and cistern cleaning. Households that had not received water testing tended to have lower trust in the safety and acceptability of their household’s water compared to households that had their water tested. As this household noted, “*My tap water has never been tested. How would you know if it's safe to drink if no one tells you?*” Indeed, some respondents have had their water tested and this gave them confidence, “*I'm really confident in my water. I had a health professional come in and test my water...The health professional said our water was better than other communities.*” [Community C, cistern]

Households explained that it is difficult for their First Nation's band workers to clean all the cisterns each year because, "*there [are] only so many people that work for the band, they can't keep up*", and "*Chief and Council have limited resources given to them*". Another household explained that "*the water tank [workers] need more equipment*". Water testing and resources for cleaning and repairing cisterns are necessary in order to protect the health of First Nations and could help decrease the widening gap in health status between First Nations on non-First Nations people in Manitoba (Katz, et al., 2019).

Canada is not fulfilling the human right to drinking water and sanitation for many of the First Nations households surveyed in this study. Rather, 60.8% of the First Nations households surveyed were unable to fully access water as defined in the United Nation's General Assembly Resolution 64/292, *The Human Right to Drinking Water and Sanitation and Sanitation*, A/RES/64/292 (28 July 2010). Furthermore, the human right to drinking water and sanitation has yet to be fulfilled for First Nations across Canada (Busby, 2016; Human Rights Watch, 2019). Canada's response to recommendations from the 2018 United Nations Human Rights Council review was that they have already partially implemented the Human Right to Drinking Water and Sanitation in First Nations by recognizing the right in 2012, enacting an engagement process regarding the *Safe Drinking Water for First Nations Act* in 2017, by working with First Nations, and by intending to eliminate all long-term drinking water advisories by March 2021 (UNHRC, 2018). Unfortunately, recognizing the right has not changed the daily realities First Nations face regarding their household's water. The *Safe Drinking Water for First Nations Act*, that the federal government uses as a reference to their commitment to realizing the Human Right to Drinking Water and Sanitation, used a poor engagement process that did not properly engage First Nations during its creation, imposes provincial laws onto First Nation lands, allows Aboriginal and Treaty rights to be overridden "*to the extent necessary to ensure the safety of drinking water on First Nations land*" (Indigenous Bar Association, 2011); and lacks any commitment to federal funding to close the infrastructure gap (Busby, 2016). In addition, while eliminating long-term drinking water advisories will benefit some First Nations households, it will not change anything for the households involved in this study. Perhaps the reason why Canada is not quick to fully realize the Human Right to Drinking Water and Sanitation is because States (e.g., federal governments) have the obligation to show *progressive realization* of

the right which leaves room for governments to decide what is reasonable or appropriate (Belinskij & Kotze, 2016).

The slow progress of realizing the human right to drinking water in First Nations is also affected by the lack of financial (Parliamentary Budget Officer, 2017) and human support from Non-Indigenous Canadians (Neufeld, et al., 2019); the absence of a regulatory framework led by First Nations, with the Government of Canada supporting the decision-making processes; as well as the lack of clarity regarding roles and responsibilities of governments (Bakker & Cook, 2011).

2.7 Conclusion

This study assessed whether or not the First Nations households in three Manitoba First Nations were fully accessing water as defined in the United Nation's General Assembly Resolution 64/292, *The Human Right to Drinking Water and Sanitation and Sanitation*, A/RES/64/292 (28 July 2010); and whether the perceptions households had about their tap water was dependent on the type of water distribution system available in the household. Results indicate that households in First Nations in Manitoba are not fully realizing their Human Right to Drinking water. Nearly one third of households in this study were not accessing water as described in the Human Right to Drinking Water. Households with cisterns and piped water reported the same amount of acceptability concerns, but differed in the types of acceptability concerns they described. Significantly more households with cisterns reported safety and sufficiency concerns compared to households with piped water. Households with no running water also described sufficiency problems. The First Nations with the most reports of gastrointestinal symptoms caused by their households water were the two First Nations that had households that used cisterns or had no running water, indicating the urgent need to increase water services for First Nations that have households with cisterns or no running water.

2.8 References

- Baird, J. M., Summers, R., & Plummer, R. 2013.** Cisterns and safe drinking water in Canada. *Canadian Water Resources Journal*, **38(2)**: 121-134.
- Bakker, K., & Cook, C. 2011.** Water governance in Canada: innovation and fragmentation. *Water Resources Development*, **27(2)**: 275-289.
- Belinskij, A., & Kotze, L. J. 2016.** Obligations arising from the right to water in Finland and South Africa. *Aquatic Procedia*, **6**: 30-38.
- Bernstein, C., Mckeown, I., Embil, J., Blanchard, J., Dawood, M., Kabani, A., Kliewer, E., Smart, G., Coghlan, G., Macdonald, S., Cook, C., and Orr, P. 1999.** Seroprevalence of helicobacter pylori, incidence of gastric cancer, and peptic ulcer-associated hospitalizations in a Canadian Indian population. *Digestive Diseases and Sciences*, **44 (4)**: 668-674
- Boyd, D. R. 2011.** No taps, no toilets - First Nations and the constitutional right to water in Canada. *McGill Law Journal*, **57(1)**: 81-134.
- Bradford, L. E., Bharadwaj, L. A., Okpalauwaekwe, U., and Waldner, C. L. 2016.** Drinking water quality in Indigenous communities in Canada and health outcomes: a scoping review. *International Journal of Circumpolar Health*, **75(1)**: doi: 10.3402/
- Bradford, L., Waldner, C., McLaughlin, K., Zagozewski, R., and Bharadwaj, L. 2018.** A mixed-method examination of risk factors in the truck-to-cistern drinking water system on the Beardy's and Okemasis First Nation Reserve, Saskatchewan. *Canadian Water Resources Journal*, **43(4)**: 383-400.
- Busby, K. 2016.** Troubling waters: recent developments in Canada on international law and the right to water and sanitation. *Canadian Journal of Human Rights*, **5(1)**: 1-26.
- Canada. 2017.** Safe Drinking Water for First Nations Act (S.C. 2013, c. 21). Retrieved November 28, 2017, from Justice Laws Website: <http://laws-lois.justice.gc.ca/eng/acts/S-1.04/page-1.html>

Canada. 2017a. United Nations Declaration on the Rights of Indigenous Peoples. Retrieved March 14, 2020, from Indigenous and Northern Affairs Canada: <https://www.aadnc-aandc.gc.ca/eng/1309374407406/1309374458958>

Canada. Parliament. 2019. Bill C-262 United Nations declaration on the rights of Indigenous Peoples an act to ensure that the laws of Canada are in harmony with the United Nations Declaration on the Rights of Indigenous Peoples. Third reading June 11, 2019, 42 Parl, 1st Sess, Bill C-262 (Historical). Retrieved from <https://openparliament.ca/bills/42-1/C-262/>

Dewis, G. 2009. Drinking water decisions of Canadian municipal households. Environment Accounts and Statistics Analytical and Technical Paper Series. Ottawa: Statistics Canada.

Dupont, D., Waldner, C., Bharadwaj, L., Plummer, R., Carter, B., Cave, K., and Zagozewski, R. 2014. Drinking water management: health risk perceptions and choices in First Nations and non-First Nations communities in Canada. *International Journal of Environmental Research and Public Health*, **11**: 5889-5903.

EKOS Research Associates Inc. 2009. Water quality on-reserve quantitative research. Final Report, Health Canada, Ottawa, Ontario.

Embree, J. 2010. Pandemic 2009 (A)H1N1 influenza (swine flu) — the Manitoba experience. *Biochemistry and Cell Biology*, **88**: 589-593.

Farenhorst, A., Li, R., Jahan, M., Tun, H.M., Mi, R., Amarakoon, I., Kumar, A., and Khafipour, E. 2017. Bacteria in drinking water sources of a First Nation reserve in Canada. *Science of the Total Environment*, **575**: 813-819.

Fernando, D., Tun, H., Poole, J., Patidar, R., Li, R., Mi, R., Amarawansa, G., Fernando W., Khafipour E., Farenhorst, A., and Kumar, A. 2016. Detection of antibiotic resistance genes in source and drinking water samples from a First Nations community in Canada. *Applied and Environmental Microbiology*, **82(15)**: 4767-4775.

First Nations Information Governance Centre. 2018. National report of the First Nations regional health survey phase 3: Volume 1. Ottawa.

Hennessy, T. W., Ritter, T., Holman, R. C., Bruden, D. L., Yorita, K. L., Bulkow, L., Cheek, E., Singleton, R., and Smith, J. (2008). The relationship between in-home water service

and the risk of respiratory tract, skin, and gastrointestinal tract infections among rural Alaska Natives. *American Journal of Public Health*, **98(11)**: 2072-2078.

Howard, G., and Bartram, J. 2003. Domestic Water Quantity Service Level and Health. Geneva, Switzerland: World Health Organization.

Human Rights Watch. 2019. The human right to water: a guide for First Nations communities and advocates. Retrieved May 3, 2020, from https://www.hrw.org/report/2019/10/23/human-right-water/guide-first-nations-communities-and-advocates#_ednref64

Indian and Northern Affairs Canada. 2003. National assessment of water and wastewater systems in First Nations Communities. Government of Canada. Retrieved January 7, 2020, from https://www.aadnc-aandc.gc.ca/DAM/DAM-INTER-HQ/STAGING/texte-text/watw_1100100016374_eng.pdf

Indigenous Bar Association. 2011. Position paper on bill s-11 - safe drinking water for First Nations Act. Retrieved September 18, 2019, from www.indigenousbar.ca/pdf/IBA%20Submissions%20on%20Bill%20S11%20Drinking%20Water.mar%203%202011.pdf

Jones, N. L., Chiba, N., Fallone, C., Thompson, A., Hunt, R., Jacobson, K., and Goodman, K. 2012. *Helicobacter pylori* in First Nations and recent immigrant populations in Canada. *Canadian Journal Gastroenterol*, **26(2)**: 97-103.

Katz, A., Avery, K., Star, L., Taylor, C., Koseva, I., Lavoie, J., Burchill, C., Urquia, ML., Basham, A., Rajotte, L., Ramayanam, V., Jarmasz, J., and Burchill, S. 2019. The health status of and access to healthcare by registered First Nation Peoples in Manitoba. Retrieved September 4, 2019, from http://mchp-appserv.cpe.umanitoba.ca/reference//FN_Report_web.pdf

Lofland, J., Snow, D., and Lofland, L. H. 2006. *Analyzing social settings- a guide to qualitative observation and analysis-fourth edition.* Toronto, ON: Nelson.

McKeown, I., Orr, P., Macdonald, S., Kabani, A., Brown, R., Coghlan, G., Dawood, M., Embil, J., Sargent, M., Smart, G., and Bernstein, C. 1999. *Helicobacter pylori* in the Canadian arctic - seroprevalence and detection in community water samples. *The American Journal of Gastroenterology*, **94(7)**: 1823-1829.

- Mi, R., Rakesh, P., Farenhorst, A., Zhangbin, C., Shadi, S., Khafipour, E., & Kumar, A. 2019.** Detection of fecal bacteria and antibiotic resistance genes in drinking water collected from three First Nations communities in Manitoba, Canada. *FEMS Microbiology Ecology*, **366(6)**.
- Neegan Burnside. 2011a.** National assessment of First Nations water and wastewater systems - national roll-up report. Retrieved from https://www.aadnc-aandc.gc.ca/eng/1313770257504/1313770328745#chp3_3_1
- Neufeld, K., Funk, L., Starzyk, K., Gorea, M., & Dansereau, L. 2019.** Barriers to and strategies for engaging Non-Indigenous Canadians in First Nations water rights: a qualitative inquiry. *The International Indigenous Policy Journal*, **10(3)**.
- O'Gorman, M., & Penner, S. 2018.** Water infrastructure and well-being among First Nations, Metis and Inuit individuals in Canada: what does the data tell us? *Environmental Science and Pollution Research*.
- Parliamentary Budget Officer. 2017.** Budget sufficiency for First Nations water and wastewater infrastructure. Ottawa, Canada: Office of The Parliamentary Budget Officer.
- Pett, M. A., Lackey, N. R., & Sullivan, J. J. 2003.** Making sense of factor analysis. Thousand Oaks: Sage Publications.
- StatsCanada. 2017.** Aboriginal peoples in Canada key results from the 2016 census. *The Daily*. Retrieved from: <https://www150.statcan.gc.ca/n1/daily-quotidien/171025/dq171025a-eng.htm>
- Stelmach, R. D., & Clasen, T. 2015.** Household water quantity and health: a systematic review. *International Journal of Environmental Research and Public Health*, **12(6)**: 5954-5974.
- Thomas, T. K., Ritter, T., Bruden, D., Bruce, M., Byrd, M., Goldberger, R., Dobson, J., Hickel, Smith, J., Hennessy, T. 2016.** Impact of providing in-home water service on the rates of infectious diseases: results from four communities in Western Alaska. *Journal of Water and Health*, **14(1)**: 132-141.
- Thorton, R. 1987.** American Indian holocaust and survival: a population history since 1492. Norman, Oklahoma: University of Oklahoma Press.

UNHRC. 2018. Universal periodic review - Canada. Retrieved from United Nations Human Rights Council: <https://www.ohchr.org/EN/HRBodies/UPR/Pages/CAIndex.aspx>

United Nations. 2011. United Nations Declaration on the Rights of Indigenous Peoples. Retrieved from https://www.un.org/development/desa/indigenouspeoples/wp-content/uploads/sites/19/2018/11/UNDRIP_E_web.pdf

United Nations. 2014. October 2. The human right to safe drinking water and sanitation. A/HRC/RES/27/7. United Nation General Assembly. Retrieved from UN WATER: <http://www.unwater.org/water-facts/human-rights/>

United Nations Human Rights. 2010. The Right to Water. Geneva, Switzerland: Office of the United Nations High Commissioner for Human Rights.

Waldner, C. L., Alimezelli, H. T., Mcleod, L., Zagozewski, R., Bradford, L. E., & Bharadwaj, L. A. 2017. Self-Reported effects of water on health in First Nations Communities in Saskatchewan, Canada: results from community-based participatory research. *Environmental Health Insights*, **11**: 1-13.

3. OVERALL SYNTHESIS

3.1 Summary of the Research

This thesis examined the impact of the type of household water delivery on the self-reported assessment whether tap water is safe, sufficient, acceptable, affordable and/or accessible. In addition, the thesis examined if the Human Right to Drinking Water and Sanitation, as recognized by the United Nation's General Assembly 64/292, is being realized in households within First Nations in Manitoba.

The strength of this study is the community-based participatory methods used, which facilitated collaboration and capacity building among all partners while addressing community concerns, ensuring local relevance, and generating results that were understandable and useful for each of the three First Nations involved. The three First Nation reserves included in this study are located in the Province of Manitoba and had each at least two types of water distribution systems per community (e.g., piped and cisterns). As such, this M.Sc. research expanded on previous studies in Manitoba that had only focused on household perception of water in one First Nation (O'Gorman & Penner, 2018), or had focused on monitoring the microbiological quality of tap water in homes (Fernando, et al., 2016; Farenhorst, et al., 2017; Mi, et al., 2019). By including households with a variety of water distribution systems in three communities, this M.Sc. research generated a broad household perspective on drinking water in First Nations homes.

This study found that six in every ten respondents had at least one concern about their households drinking water with concerns related to the categories safety, acceptability, sufficiency or human health. Since the water distribution systems in the First Nations included in this study are representative of that occurring in other First Nations reserves in Manitoba, these survey results suggest that a substantial portion of First Nations households in Manitoba lack the Human Right to Drinking Water and Sanitation. As such, this study provides direct and indirect evidence of Human Rights neglects in Canada for Indigenous peoples. Canada has the fiduciary

duty and international obligations to respect, protect, and fulfill the Human Right to Drinking Water and Sanitation. Therefore, Canada is neglecting their duties and obligations.

The households represented in the study had a variety of water distribution methods. Household responses relied on piped water (34%) or cisterns (66%) in Community A, on piped water (87%) or private wells (13%) in Community B, and on piped water (18%), cisterns (67%), or had no running water (15%) in Community C. The type of water distribution had a significant impact on the frequency of safety and sufficiency concerns as well as the type of acceptability concerns. Specifically, many of the safety concerns came from households with cisterns, emphasizing that when relying on water delivery by a truck and storage in cisterns, conditions need to be met to ensure safe water; however, there is evidence that at least for a range of households, these conditions are lacking. For instance, households indicated that their First Nation needed more resources (i.e., workers and equipment) to be able to keep up with cleaning and maintenance requirements. Sufficiency concerns were also greatest among households with cisterns, as well as no running water. Some households described never having enough water to keep up with their household member's hygiene needs. Households with no running water also struggled financially when accessing sufficient water due to the cost of hiring a vehicle to carry the water back to their household. Furthermore, although participants across all four delivery systems expressed that their household water has had a negative impact on the health of those accessing it, the expression of the negative impacts of household water on human health was greatest among households with cisterns (Community A and C) or no running water (Community C). The water distribution systems included in this study are typical of water distributions systems in First Nations reserves across the Canadian prairies and the Yukon. Therefore, the concerns expressed by the survey participants in this study are likely the same concerns experienced by other Indigenous Peoples living in small communities like First Nations reserves in the Prairies, or communities in the Yukon who rely heavily on cisterns (Neegan Burnside, 2011a).

3.2 Practical Implications

This thesis provides a valuable analysis of household drinking water perceptions in three First Nations in Manitoba, and the data can be used to advocate for the full realization of drinking water as described in the Human Right to Drinking Water and Sanitation. Since this study found that households with cisterns or no running water have substantial safety and sufficiency concerns, it is evident that First Nations in Manitoba need increased resources to be able to support additional water delivery trucks, workers, and cleaning equipment to meet the needs of all households in providing the human right to drinking water in Canada. The results of this thesis outline the concerns of First Nations households and would be useful evidence for local leaders to use when advocating for clean and safe drinking water at the social and political levels.

As First Nations are not experiencing the fulfillment of their human right to drinking water, there are steps First Nations could take to advocate for this Human Right, as well as steps the Federal Government is obligated to take. First, the neglect and absence of urgent and meaningful action from the Federal Government is unlawful. The in-action of the Federal Government goes against Canada's fiduciary duties and international human rights obligations. Therefore, it is the duty and obligation of the Federal Government to take special measures when it comes to ensuring the human right to drinking water and sanitation for First Nations, adopt action plans that facilitate the realization of the right to drinking water, encourage the participation of First Nations, ensure transparency and accountability, and enable that effective remedies are in place (United Nations, 2010).

Second, First Nations in Manitoba could take control of their water delivery systems from the government by creating a First Nation's owned water utility to take charge of First Nation's water systems. An example of such a utility exists in Atlantic Canada where participating First Nations will be serviced, by 2022, by the Atlantic First Nations Water Authority (AFNWA) (AFNWA, 2020). AFNWA is the first authority of First Nation's owned and operated water utility in the country. The AFNWA will manage both water systems and assets allowing

AFNWA autonomy to make their own decisions on water system design, long-term budgets, procurement practices, and upgrades (TheChronicleHerald, 2020).

Another step First Nations could take would be to take the federal government to court. Indeed, in Manitoba, this is already being done. As of November 2019, Chief Spence of Tataskweyak Cree Nation filed a proposed class-action lawsuit. The lawsuit alleges that the First Nation has spent decades without access to clean drinking water as a result of sustained failure of the Federal Government to act (TheGlobeAndMail, 2019). Other First Nations could file a claim in Canadian court by using international rights instruments such as the International Covenant on Economic, Social and Cultural Rights or through domestic constitutional law by asking for an interpretation of the scope of essential public services protected under Section 36 of the Canadian Constitution (Busby, 2016).

3.3 Limitations of the Research and Recommendations for Future Studies

In this study, the households surveyed were all from First Nations in Manitoba. Future studies could assess how water distribution systems impacts household perceptions of water in First Nations in other parts of Canada. Chapter 2 of this thesis identified that 60.8% of First Nations households had at least one safety, acceptability, sufficiency or negative health effect concern from using their households drinking water. Due to the uniqueness of each survey that ensured that the needs of each of the three communities were met, this M.Sc. research did not have questions on affordability and accessibility in all five surveys developed and administered. Future studies could more strongly examine how First Nations households are affected by the affordability and accessibility of drinking water.

The techniques used for inductive analysis were sourced from grounded theory analysis, but the lack of probing questions or saturation of concepts meant that our data could not undergo the full grounded theory analysis (Corbin & Strauss, 2008). Although the techniques used for inductive analysis in this research produced highly valid data that complemented the quantitative analysis,

future studies could be designed to carry out full grounded theory analysis, for example by allowing for probing questions through interviews.

Each statement in the qualitative analysis was coded and the main themes were tallied. Some respondents may have made the same statement across different questions, and we were not able to limit this overrepresentation in the tallies.

The research would have benefitted from more regular Chief and Council and/or community meetings with the community researcher, students and professors involved in the study. Future studies could create a workplan with the communities at the beginning of the research study that outlines milestones and mandatory meetings and treat the workplan like a contract. This would help keep students, and their supervisors accountable to the community.

Community-based participatory engagement was important to this study. It allowed for each survey to be customized by community researchers to ensure the surveys were relevant to the community's situation and needs. However, this also reduced the amount of questions that could be compared during the data analysis (Waldner, et al., 2017). Working with local community researchers increased participation rates and allowed for greater collaboration between the Community and other members of the research team (Waldner, et al., 2017). However, this method of research also requires taking sufficient time for the process to occur. In this study, the research process took four years, while a similar study in Saskatchewan took more than five years (Waldner, et al., 2017). Community relevant reports were written for each participating community. Each report held the complete set of survey results while ensuring respondent anonymity. This allows the community to be able to use the data in their own work and drinking water advocacy. This research was initiated because of community needs and similar studies in the future should also utilize community-based participatory engagement while recognizing the additional time that this would take in completing a M.Sc. program. Most universities in Canada, but particularly the U15, are aggressively pursuing protocols to have graduate students complete

their studies in a shorter time, for example one or two years for M.Sc. studies. However, that is not conducive for working with First Nations communities.

There was a direct involvement of the communities in the survey design, however a drawback to this thesis is that communities did not play a substantial role in the data analysis and interpretation. Using a Human Rights lens was entirely my idea, and I may have missed other important ways of framing the work. The right of First Nations communities to own, control, access, and possess information about their peoples is fundamentally tied to self-determination and to the preservation and development of their culture. Although these principles were an explicate part of the study design, future studies should explore strategies to ensure a greater involvement on communities in data analysis and interpretation.

3.4 References

AFNWA. 2020. Atlantic First Nations Water Authority. Retrieved from Atlantic Policy Congress of First Nations Chiefs: <https://www.apcfn.ca/water/>

Busby, K. 2016. Troubling waters: recent developments in Canada on international law and the right to water and sanitation. *Canadian Journal of Human Rights*, **5(1)**: 1-26.

Farenhorst, A., Li, R., Jahan, M., Tun, H.M., Mi, R., Amarakoon, I., Kumar, A., and Khafipour, E. 2017. Bacteria in drinking water sources of a First Nation reserve in Canada. *Science of the Total Environment*, **575**: 813-819.

Fernando, D., Tun, H., Poole, J., Patidar, R., Li, R., Mi, R., Amarawansa, G., Fernando W., Khafipour E., Farenhorst, A., and Kumar, A. 2016. Detection of antibiotic resistance genes in source and drinking water samples from a First Nations community in Canada. *Applied and Environmental Microbiology*, **82(15)**: 4767-4775.

Israel, B. A., Eng, E., Schulz, A. J., & Parker, E. A. 2012. Introduction to Methods for Community-Based Participatory Research for Health. In *Methods for Community-Based Participatory Research for Health* (pp. 1-11). John Wiley & Sons, Incorporated.

Mi, R., Rakesh, P., Farenhorst, A., Zhangbin, C., Shadi, S., Khafipour, E., & Kumar, A. 2019. Detection of fecal bacteria and antibiotic resistance genes in drinking water collected from three First Nations communities in Manitoba, Canada. *FEMS Microbiology Ecology*, **366(6)**.

O'Gorman, M., & Penner, S. 2018. Water infrastructure and well-being among First Nations, Metis and Inuit individuals in Canada: what does the data tell us? *Environmental Science and Pollution Research*.

TheChronicleHerald. 2020. First Nations water authority on tap to operate in 15 Atlantic communities. Retrieved from The Chronicle Herald:
<https://www.thechronicleherald.ca/news/provincial/first-nations-water-authority-on-tap-to-operate-in-15-atlantic-communities-465490/>

TheGlobeAndMail. 2019. *Manitoba First Nation seeking class action over long-term boil water advisories.* Retrieved from The Globe And Mail:
<https://www.theglobeandmail.com/canada/article-manitoba-first-nation-seeking-class-action-over-long-term-boil-water-2/>

United Nations. 2010. The Right to Water Fact Sheet No.35. Geneva, Switzerland: Office of the United Nations High Commissioner for Human Rights. Retrieved February 22, 2019, from United Nations: <https://www.ohchr.org/Documents/Publications/FactSheet35en.pdf>

Waldner, C. L., Alimezelli, H. T., Mcleod, L., Zagozewski, R., Bradford, L. E., & Bharadwaj, L. A. 2017. Self-Reported effects of water on health in First Nations Communities in Saskatchewan, Canada: results from community-based participatory research. *Environmental Health Insights*, **11**: 1-13.

APPENDICES

I. Consent form used in Community A



UNIVERSITY
OF MANITOBA

Faculty of Agricultural
and Food Sciences

Department of Soil Science
362 Ellis Building
Winnipeg, MB
Canada R3T 2N2
Telephone: 204-474-8153
Fax: 204-474-7642

A Household Water Survey to Qualitatively measure several issues regarding drinking water in your house and community

This consent form, a copy of which will be left with you for your records and reference, is only part of the process of informed consent. It should give you the basic idea of what the research is about and what your participation will involve. If you would like more detail about something mentioned here, or information not included here, you should feel free to ask. Please take the time to read this carefully and to understand any accompanying information.

Research Project Title: Drinking Water Health and Safety Perceptions in a Manitoba First Nation community.

Student Leader conducting survey:

1. Kristy Anderson
Master student
Department of Soil Science
University of Manitoba
286 Ellis Building
13 Freedman Crescent
Winnipeg, MB R3T 2N2
Phone: (xxx) xxx-xxxx
Email: anders74@myumanitoba.ca

Research supervisor:

1. Annemieke Farenhorst, Ph.D., P.Ag.
Professor of Soil Science
Department of Soil Science
University of Manitoba
380 Ellis Building
13 Freedman Crescent
Winnipeg, MB R3T 2N2
Phone: (xxx) xxx-xxxx
FAX: (xxx) xxx xxxx
E-mail: annemieke.farenhorst@umanitoba.ca

Sponsor: Natural Sciences and Engineering Research Council of Canada under its Collaborative Research and Training Experience Program.

Who we are: We are students in the Department of Soil Science at the University of Manitoba. Kristy Anderson is the main student working on this survey. She will also have one or two CREATE H2O summer students helping hand out and collect surveys. We are enrolled in the CREATE H2O program for First Nations Water and Sanitation Security at University of Manitoba. About one-third of the 70 students enrolled in the program since 2013 are Indigenous and all students working in the program aim to work in collaboration with First Nations communities and peoples. The website <http://create-h2o.ca> provides general information about the CREATE H2O program. The CREATE H2O program for First Nations Water and Sanitation security is designed to address research science and training gaps that are preventing effective, culturally appropriate investments in water and sanitation security on First Nations reserves. The program stands to advocate for the fact that access to clean, running drinking water is a human right.

Conducting the survey: We would like your agreement to start this survey we have brought. We have two surveys available. One is short and one is longer. The longer survey will take you approximately 20 minutes to complete and will ask you a series of questions about water, particularly your tap water. The shorter survey will take approximately 10 minutes and ask you a small amount of questions about your water. The longer survey will provide us with much more detailed information about how we can advocate for clean, running drinking water as a human right for First Nations reserves in Canada, but the short survey would also provide important information to us for advocating for this right. Hence, we appreciate any of your time that you are willing to provide to us. We are conducting this survey to particularly assist Community A in helping to improve drinking water quality distribution, and build on an ongoing collaboration between the University of Manitoba and Community A that was initiated in 2014.

If you agree to a survey, we will assist you in filling out the survey. We can read the questions out loud for you and record your answers, or you can choose to fill out the survey yourself. During the survey you can choose not to answer a question, or can end the survey at any time and we will not ask why. You can also withdraw your survey after we leave by contacting us afterwards. If you want to withdraw your survey we ask you to contact us before October 31, 2017. You can contact Kristy Anderson on the phone by calling x-xxx-xxx-xxxx, or email at anders74@myumanitoba.ca. After October 31, 2017 we will be start to use all the survey results to prepare a collective answer to each questions. Please indicate either the code on the top of this survey, or your address so we know which survey to remove. The survey code and your address are recorded on a master list that will be kept secure. This master list will be destroyed no later then by September 30, 2019. The surveys will be destroyed no later then by January 2025.

Your survey results will never be reported on an individual basis, meaning that we will never use your name or address in reporting information. For a questions asked, we will combine all the results and then report on the collective answers. For example, we will report 90% of the participants in the survey said “yes” to the question; and 10% of the participants said “no” to the question. We may say, “a participant said no because [and then give the reason that you may have provided without your name or other ways by which you could be recognized].

Why is this study being done: In this study we are conducting surveys from household to household with the main objective to help Community A to advocate for improved drinking water infrastructural resources. This could be done by providing information to Chief and Council that could be used in developing action plans, some of which may require negotiations with, and funding requests to, Aboriginal Affairs and Northern Development Canada. We also believe that this survey, that we are conducting in Community A, may help others to understand that access to clean, drinking water is a human right and how much still needs to be done in Canada to ensure this right is achieved for all. We are conducting this survey in various households such as homes served by piped water (from the treatment plant), or served by cisterns (from a water truck) in Community A, but are planning to conduct the same survey elsewhere such as in other First Nation communities, or in rural or urban location in Manitoba.

Photo of Tap Water

With your permission, we would like to take a photo of your household's tap water. We have brought a jar to take place the water in so we can take this photo. The photographs may be useful as additional evidence to support what concerns you and other community members may have with your tap water. The photo will be attached to the survey you fill out.

How are the surveys used and how can I get a copy of the results: The surveys will be used to create a representation of your community's perceptions and management of drinking water. This means that surveys will not be used individually, but all together. The individual surveys will be statistically analyzed at the University of Manitoba after we have collected all the surveys. After this analysis is done, the initial results will be made available through mail or other suggested ways. In the winter of 2017/18 we would like to hold a community gathering where we can answer questions about the survey results and give a presentation. There would be a feast afterwards.

Other written and Oral communications by the student: The student, Kristy Anderson, will also use the results in a thesis that she needs to complete in order to graduate from the University of Manitoba. The thesis will be available from the University of Manitoba website, probably in 2019 because it takes some time for her to complete the thesis. Prior to finalizing the thesis, the Chief and Council will be given an opportunity to review sections of the thesis for feedback. After being finalized, the community will receive a copy of the thesis to be held at the band office. Kristy will also present the results from this survey at conferences such as the annual CREATE H2O conference in 2018. At this conference, students typically present together with a community member.

Kristy will keep a copy of the results of individual homes on her computer until she graduates and then deletes the files. Her supervisor Dr. Annemieke Farenhorst will have a copy of the results as well so she can make sure that the student is interpreting the results correctly. Both Kristy Anderson's and Annemieke's electronic copies and paper copies of all survey material will be destroyed one year after Kristy Anderson graduates, but no later than by January 2025.

AS A TOKEN OF APPRECIATION

If you are interested, we would like to enter your household address into a draw for a grocery store gift card. You do not need to sign this consent form or fill out a survey to be entered into this draw. We will draw names at a community event after the surveys are finished.

WHAT IF YOU DO NOT WANT TO PARTICIPATE?

If you decide not to participate, you can let us know now and we will leave your home without collecting survey information and you may still enter your name in our draw.

PHOTO OF TAP WATER

Please check the box indicating if you would like us to take a photo of your tap water or not.

- Yes, you may take a photo of my tap water to use in this study
- No, you may not take a photo of my tap water to use in this study

WHAT YOUR SIGNATURE MEANS

The following is copied word for word by what is provided to us by the ethics board of the University of Manitoba. It explains what your signature would mean.

“Your signature on this form indicates that you have understood to your satisfaction the information regarding participation in the research project and agree to participate as a subject. In no way does this waive your legal rights nor release the researchers, sponsors, or involved institutions from their legal and professional responsibilities. You are free to withdraw from the study at any time, and /or refrain from answering any questions you prefer to omit, without prejudice or consequence. Your continued participation should be as informed as your initial consent, so you should feel free to ask for clarification or new information throughout your participation. The University of Manitoba may look at your research records to see that the research is being done in a safe and proper way. This research has been approved by the Joint-Faculty REB. If you have any concerns or complaints about this project you may contact any of the above-named persons or the Human Ethics Coordinator at 204-474-7122. A copy of this consent form had been given to you to keep for your records and reference”

Signature of Participants

Date

Signature of Student Researcher

Date

II. Consent form used in Community B



UNIVERSITY
OF MANITOBA

Faculty of Agricultural
and Food Sciences

Department of Soil Science
362 Ellis Building
Winnipeg, MB
Canada R3T 2N2
Telephone: 204-474-8153
Fax: 204-474-7642

A Household Water Survey to measure several issues regarding drinking water in your house and community

This consent form, a copy of which will be left with you for your records and reference, is only part of the process of informed consent. It should give you the basic idea of what the research is about and what your participation will involve. If you would like more detail about something mentioned here, or information not included here, you should feel free to ask. Please take the time to read this carefully and to understand any accompanying information.

Research Project Title: Drinking Water Health and Safety Perceptions in a Manitoba First Nation community.

Student Leader conducting survey:

2. Kristy Anderson
Master student
Department of Soil Science
University of Manitoba
286 Ellis Building
13 Freedman Crescent
Winnipeg, MB R3T 2N2
Phone: (xxx) xxx-xxxx
Email: anders74@myumanitoba.ca

Research supervisor:

2. Annemieke Farenhorst, Ph.D., P.Ag.
Professor of Soil Science
Department of Soil Science
University of Manitoba
380 Ellis Building
13 Freedman Crescent
Winnipeg, MB R3T 2N2
Phone: (xxx) xxx-xxxx
FAX: (xxx) xxx-xxxx
E-mail: annemieke.farenhorst@umanitoba.ca

Sponsor: Natural Sciences and Engineering Research Council of Canada under its Collaborative Research and Training Experience Program.

Who we are: Kristy Anderson is a masters student in the Department of Soil Science at the University of Manitoba. She is enrolled in the CREATE H2O program for First Nations Water and Sanitation Security at University of Manitoba. Dr. Annemieke Farenhorst is Kristy's advisor

and is also a professor in the Department of Soil Science. The website <http://create-h2o.ca> provides general information about the CREATE H2O program.

Conducting the survey:

We are conducting this survey door to door. We are trying to complete surveys in households that have different water delivery methods such as homes served by piped water (from the treatment plant) or served by wells in Brokenhead Ojibway Nation. We have already completed a set of surveys in one other First Nation community in Treaty 4 territory.

There are two surveys for you to choose from. One is short and one is longer. The longer survey will take you approximately 20 minutes to complete and will ask you questions about the water in your home. The shorter survey will take approximately 10 minutes and ask you a smaller amount of questions about your water.

If you agree to a survey, we can help you in filling out the survey. We can read the questions out loud for you and record your answers, or you can choose to fill out the survey yourself. During the survey you can choose not to answer a question, or can end the survey at any time and we will not ask why. You can also withdraw your survey before or after we leave. If you want to withdraw your survey after we leave, please contact us before December 31, 2018. You can contact Kristy Anderson on the phone by calling x-xxx-xxx-xxxx, or email at anders74@myumanitoba.ca. If you call or email Kristy and want to remove your survey she will ask for the code left at the top of this consent form. This way she knows what survey to take out. Then your survey will be removed and destroyed. After December 31, 2018 we will be start to use all the survey results and it will no longer be possible to remove surveys. The survey code and your address are recorded on a master list that will be kept secure. This master list will be destroyed no later then by January 2019. The surveys will be destroyed no later then by January 2026.

Your name and address will not be shared with Chief and Council or any other member of the band office. The only reason we need this information is so that you can call, email, or mail me instructions to remove your survey if you do not want me to include it in the project any longer. We will never use your name or address in reporting information. We will report on a questions answers and also use quotes from the answers you write down on your survey. For example, we could report that 90% of the participants in the survey said “yes” to the question; and 10% of the participants said “no” to the question. We may say, “a participant said no because [and then give the reason that you may have provided without your name or other ways by which you could be recognized].

We will do everything we can, but it may still be possible to identify who you are by what your responses are, even without saying your name or address. Please write down only what you feel comfortable sharing publicly.

Why is this study being done: We appreciate any of your time that you are willing to provide to us. We are conducting this survey to help Brokenhead Ojibway Nation to improve drinking water quality distribution by providing Chief and Council with a report on the level of water security your community has. Chief and Council can use this report in their own work and funding applications. The results from this study will also be used to assist others in advocating for the improvement of drinking water quality in all First Nation communities in Canada.

Photo of Tap Water

With your permission, we would like to take a photo of your household's tap water. We have brought a jar to take place the water in so we can take this photo. The photographs may be useful as additional evidence to support what concerns you and other community members may have with your tap water. The photo will be attached to the survey you fill out.

How are the surveys used and how can I get a copy of the results: The surveys will be used to create a representation of your community's perceptions and management of drinking water. This means that surveys will not be used individually, but all together. The individual surveys will be statistically analyzed at the University of Manitoba after we have collected all the surveys. After this analysis is done, the initial results will be made available to you. In the winter of 2018/19 we would like to hold a community gathering where we can answer questions about the survey results and give a presentation.

Other written and Oral communications by the student: The student, Kristy Anderson, will also use the results in a thesis that she needs to complete in order to graduate from the University of Manitoba. The thesis will be available from the University of Manitoba website, probably in 2021 because it takes some time for her to complete the thesis. Prior to finalizing the thesis, the Chief and Council will be given an opportunity to review sections of the thesis for feedback. After being finalized, the community will receive a copy of the thesis to be held at the band office. Kristy will also present the results from this survey at conferences such as the annual CREATE H2O conference in 2019. At this conference, students typically present together with a community member.

Kristy will keep a copy of the results of individual homes on her computer until she graduates and then deletes the files. Her supervisor Dr. Annemieke Farenhorst will have a copy of the results as well so she can make sure that the student is interpreting the results correctly. Both Kristy Anderson's and Annemieke's electronic copies and paper copies of all survey material will be destroyed one year after Kristy Anderson graduates, but no later than by January 2026.

AS A TOKEN OF APPRECIATION

If you are interested, we would like to enter your household address into a draw for a grocery store gift card. You do not need to sign this consent form, or fill out a survey to be entered into this draw. We will draw names after the surveys are finished.

WHAT IF YOU DO NOT WANT TO PARTICIPATE?

If you decide not to participate, you can let us know now and we will leave your home without collecting survey information and you may still enter your name in our draw.

PHOTO OF TAP WATER

Please check the box indicating if you would like us to take a photo of your tap water or not.

- Yes, you may take a photo of my tap water to use in this study
- No, you may not take a photo of my tap water to use in this study

WOULD YOU LIKE A COPY OF THE RESULTS?

- No
- I want to receive a copy of the results at my house
- I want to pick up a copy of the results at the Band Office
- Other: Explain_____

WHAT YOUR SIGNATURE MEANS

The following is copied word for word by what is provided to us by the ethics board of the University of Manitoba. It explains what your signature would mean.

“Your signature on this form indicates that you have understood to your satisfaction the information regarding participation in the research project and agree to participate as a subject. In no way does this waive your legal rights nor release the researchers, sponsors, or involved institutions from their legal and professional responsibilities. You are free to withdraw from the study at any time, and /or refrain from answering any questions you prefer to omit, without prejudice or consequence. Your continued participation should be as informed as your initial consent, so you should feel free to ask for clarification or new information throughout your participation. The University of Manitoba may look at your research records to see that the research is being done in a safe and proper way. This research has been approved by the Joint-Faculty REB. If you have any concerns or complaints about this project you may contact Kristy Anderson, Annemieke Farenhorst, or the Human Ethics Coordinator at phone number:204-474-7122 or email address: humanethics@umanitoba.ca. A copy of this consent form had been given to you to keep for your records and reference”

Signature of Participants

Date

Signature of Student Researcher

Date

III. Consent form used in Community C



UNIVERSITY
OF MANITOBA

Faculty of Agricultural
and Food Sciences

Department of Soil Science
362 Ellis Building
Winnipeg, MB
Canada R3T 2N2
Telephone: 204-474-8153
Fax: 204-474-7642

A Household Water Survey to measure several issues regarding drinking water in your house and community

This consent form, a copy of which will be left with you for your records and reference, is only part of the process of informed consent. It should give you the basic idea of what the research is about and what your participation will involve. If you would like more detail about something mentioned here, or information not included here, you should feel free to ask. Please take the time to read this carefully and to understand any accompanying information.

Research Project Title: Drinking Water Health and Safety Perceptions in a Manitoba First Nation community.

Student Leader conducting survey:

3. Kristy Anderson
Master student
Department of Soil Science
University of Manitoba
286 Ellis Building
13 Freedman Crescent
Winnipeg, MB R3T 2N2
Phone: (xxx) xxx-xxxx
Email: anders74@myumanitoba.ca

Research supervisor:

3. Annemieke Farenhorst, Ph.D., P.Ag.
Professor of Soil Science
Department of Soil Science
University of Manitoba
380 Ellis Building
13 Freedman Crescent
Winnipeg, MB R3T 2N2
Phone: (xxx) xxx-xxxx
FAX: (xxx) xxx xxxx
E-mail: annemieke.farenhorst@umanitoba.ca

Sponsor: Natural Sciences and Engineering Research Council of Canada under its Collaborative Research and Training Experience Program.

Who we are: Kristy Anderson is a masters student in the Department of Soil Science at the University of Manitoba. She is enrolled in the CREATE H2O program for First Nations Water and Sanitation Security at University of Manitoba. Dr. Annemieke Farenhorst is Kristy's advisor

and is also a professor in the Department of Soil Science. The website <http://create-h2o.ca> provides general information about the CREATE H2O program.

Conducting the survey:

We are conducting this survey in various households such as homes served by piped water (from the treatment plant), or served by cisterns (from a water truck) in or in homes that do not have piped water or a cistern in Community C.

The survey will take approximately 20 minutes to complete.

If you agree to a survey, we will help you in filling out the survey. We can read the questions out loud for you and record your answers, or you can choose to fill out the survey yourself. During the survey you can choose not to answer a question, or can end the survey at any time and we will not ask why. You can also withdraw your survey before or after we leave. If you want to withdraw your survey after we leave, please contact us before December 31, 2018. You can contact Kristy Anderson on the phone by calling x-xxx-xxx-xxxx, or email at anders74@myumanitoba.ca. If you call or email Kristy and want to remove your survey she will ask for the code left at the top of this consent form. This way she know what survey to take out. Then your survey will be removed and destroyed. After December 31, 2018 we will be start to use all the survey results and it will no longer be possible to remove surveys. The survey code and your address are recorded on a master list that will be kept secure. This master list will be destroyed no later then by January 2019. The surveys will be destroyed no later then by January 2026.

We will never use your name or address in reporting information. We will report on a questions total answers and also use quotes from the answers you write down on your survey. For example, we will report 90% of the participants in the survey said “yes” to the question; and 10% of the participants said “no” to the question. We may say, “a participant said no because [and then give the reason that you may have provided without your name or other ways by which you could be recognized].

I will do everything I can, but it may still be possible to identify who you are by what your responses are, even without saying your name or address. Please write down only what you feel comfortable sharing publicly.

Why is this study being done: We appreciate any of your time that you are willing to provide to us. We are conducting this survey to help Community C to improve drinking water quality distribution, and to assist others in advocating for the improvement of drinking water quality in all First Nation communities in Canada.

Photo of Tap Water

With your permission, we would like to take a photo of your household’s tap water. We have brought a jar to take place the water in so we can take this photo. The photographs may be useful as additional evidence to support what concerns you and other community members may have with your tap water. The photo will be attached to the survey you fill out.

How are the surveys used and how can I get a copy of the results: The surveys will be used to create a representation of your community’s perceptions and management of drinking

water. This means that surveys will not be used individually, but all together. The individual surveys will be statistically analyzed at the University of Manitoba after we have collected all the surveys. After this analysis is done, the initial results will be made available through mail or other suggested ways. In the winter of 2018/19 we would like to hold a community gathering where we can answer questions about the survey results and give a presentation.

Other written and Oral communications by the student: The student, Kristy Anderson, will also use the results in a thesis that she needs to complete in order to graduate from the University of Manitoba. The thesis will be available from the University of Manitoba website, probably in 2021 because it takes some time for her to complete the thesis. Prior to finalizing the thesis, the Chief and Council will be given an opportunity to review sections of the thesis for feedback. After being finalized, the community will receive a copy of the thesis to be held at the band office. Kristy will also present the results from this survey at conferences such as the annual CREATE H2O conference in 2019. At this conference, students typically present together with a community member.

Kristy will keep a copy of the results of individual homes on her computer until she graduates and then deletes the files. Her supervisor Dr. Annemieke Farenhorst will have a copy of the results as well so she can make sure that the student is interpreting the results correctly. Both Kristy Anderson's and Annemieke's electronic copies and paper copies of all survey material will be destroyed one year after Kristy Anderson graduates, but no later than by January 2026.

AS A TOKEN OF APPRECIATION

If you are interested, we would like to enter your household address into a draw for a \$100 grocery store gift card. You do not need to sign this consent form, or fill out a survey to be entered into this draw. We will draw names at a community event after the surveys are finished.

WHAT IF YOU DO NOT WANT TO PARTICIPATE?

If you decide not to participate, you can let us know now and we will leave your home without collecting survey information and you may still enter your name in our draw.

HOW WOULD YOU PREFER TO HAVE YOUR RESULTS GIVEN BACK TO YOU?

- Mail
- Band Office
- Health Office
- Other:_____

PHOTO OF TAP WATER

Please check the box indicating if you would like us to take a photo of your tap water or not.

- Yes, you may take a photo of my tap water to use in this study
- No, you may not take a photo of my tap water to use in this study

WHAT YOUR SIGNATURE MEANS

The following is copied word for word by what is provided to us by the ethics board of the University of Manitoba. It explains what your signature would mean.

“Your signature on this form indicates that you have understood to your satisfaction the information regarding participation in the research project and agree to participate as a subject. In no way does this waive your legal rights nor release the researchers, sponsors, or involved institutions from their legal and professional responsibilities. You are free to withdraw from the study at any time, and /or refrain from answering any questions you prefer to omit, without prejudice or consequence. Your continued participation should be as informed as your initial consent, so you should feel free to ask for clarification or new information throughout your participation. The University of Manitoba may look at your research records to see that the research is being done in a safe and proper way. This research has been approved by the Joint-Faculty REB. If you have any concerns or complaints about this project you may contact Kristy Anderson, Annemieke Farenhorst, or the Human Ethics Coordinator at phone number:204-474-7122 or email address: humanethics@umanitoba.ca. A copy of this consent form had been given to you to keep for your records and reference”

Signature of Participants

Date

Signature of Student Researcher

Date