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Drinking Water Issues and Options in Indigenous Households in Communities near Grande Cache, Alberta

By

Jennifer Chih-Yi Chen

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Abstract

Reliable access to clean drinking water remains a complex challenge for many rural Indigenous communities across Canada. This project engaged selected households in a group of non-status Indigenous communities who live on land settlements near Grande Cache, Alberta, to understand their water issues and barriers to sustainable solutions. Many household members live with well water on the land that has high hardness and iron levels, but use purchased water for drinking and cooking. Based on community data available in public sources and interviews with the household members, the findings show a lack of current water quality data to determine if the water is safe to use and broken governance for clean drinking water access. The study recommends developing i) a thorough water testing program to understand the current state, and ii) a clear information management plan for community knowledge building and information sharing to move towards a sustainable water solution.

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Chapter 1. Introduction

Safe drinking water supply has been declared a fundamental need and human right by the World Health Organization in 2011. It is Goal #6 in United Nations' Sustainable Development Goals to be achieved. In Canada, we also recognize that drinking water quality and access directly impact human health and wellbeing; however, there has been disproportional effort and outcomes for the Indigenous communities in fulfilling this essential need.

This chapter will address the purpose, objectives, and research question of this study.

1.1 Canada's Drinking Water Supply and Safety

Canada's freshwater supply can be found in lakes, rivers, groundwater, snow, and ice. Water, in general, is not a scarce resource in Canada; however, this fact does not warrant the quality and reliability of drinking water for all Canadians. From sourcing, collection, treatment to distribution, the system for water supply requires significant resources, energy, and personnel. Small water systems are common in rural Canada, where population densities are low. Small system owners or operators must comply with the same drinking water standards as traditional municipal treatment facilities with much limited financial and human resource capacity (Bereskie et al., 2017).

Moreover, water and wastewater management in remote Indigenous communities face further challenges with existing social, economic and geographic realities. The strategic planning of water and wastewater management is often criticized for inadequate consultation (Black & McBean, 2017). As of the end of August 2021, there were still 51 long-term drinking water advisories in effect in 32 First Nations communities across Canada (Government of Canada, 2021). The number does not include private wells or the smaller decentralized systems that are often being treated as private systems.

1.2 Research Question and Objectives

This project focuses on a small group of households near Grande Cache, Alberta, in the Indigenous communities. The families experiencing drinking water challenges come from the settlement of the Mountain Metis and the Aseniwuche Winewak Nation. Many of them have no reliable drinking water source, as their current groundwater wells contain high levels of metals and filtration systems were thought to be not cost-effective. As a result, the members routinely drive to Grande Cache to purchase drinking water in gallon jugs (W. Delorme, personal communication, December 2, 2020). Based on the input and request, the community wishes to determine options for sustainable water management. This capstone project serves as the first step towards identifying appropriate solutions.

The objective of this project is to understand the current state of drinking water realities for those households, and the research hopes to shed some light on the question of what are the barriers and options to provide sustainable drinking water to the households belonging to the Indigenous communities near Grande Cache, Alberta?

The project's outcome may provide an understanding and a consultative approach for Indigenous community engagement that can be used for small water system projects. Data collected through the project may also be helpful for other rural and remote non-Indigenous residents that do not belong to any water entity and rely on alternative governance and finance solutions or self-funding. Finally, the study hopes to inform the communities and directly contribute to their decision for the next step should any project funding opportunity become available.

1.3 Interdisciplinary Aspect

The project assessment considers geographical (environmental), sociopolitical governance, and economic dimensions related to energy development. The project covers at least two UN SDGs goals: #6 Clean Water and Sanitation and #3 Good Health and Well Being, and potentially contribute to #11 Sustainable Cities & Communities.

Chapter 2. Literature Review

2.1 Safe Drinking Water in Indigenous Communities

In 2010, UN General Assembly and the Human Rights Council first recognized access to safe drinking water and clean sanitation as human rights, for they are fundamental in every person’s daily life (The Human Right to Water and Sanitation, 2010). In 2013, Canadian’s federal Safe Drinking Water for First Nations Act (SDWFNA) came into force (Government of Canada, 2013), in spite of significant push-back from First Nations. Criticism of the Act included that it is inconsistent with First Nations’ governance, insufficient alone to be effective in ensuring safe drinking water, and results in significant liability to Nations without commitment to sustainable funding to support (Assembly of First Nations, 2017a, 2017b). In addition to the $2.5 billion dollars announced before the Act was passed, $1.5 billion was committed in late 2020 for new investments to accelerate work to remedy long-term drinking water advisories on reserves (Indigenous Service Canada, 2020). However, despite the financial commitment from the federal government, efforts to provide Indigenous communities with safe drinking water continue to appear inadequate when dealing with this complex topic (Brown et al., 2016). To help address the issue effectively, Black and McBean (2017) recommended that an Indigenous water strategy be established. At the national level, an Indigenous water strategy should focus on reducing boiling water advisories, developing a collaborative-cooperative process, and forming a Water Commission with primarily Indigenous members to accomplish long-term goals and to address technical, policy, governance, management, and reporting elements. At the community level, a water strategy should focus on capacity building with meaningful consultation to develop the community's physical, social, and human capital. Eventually, the community will be able to assume full control of the water system and gain self-sustainability (White et al., 2012).

Collaboration between the Indigenous communities and the water governance systems facilitates trust-building, which has a better chance of finding sustainable solutions for the communities. Williams assessed the treated town water quality in Fort Chipewyan, Alberta, against the national standards outlined in the Guideline for Canadian Drinking Water Quality (GCDWQ) for the years 2006 to 2011 (2014). It was concluded that the treated town water is safe to drink; however, the public did not have such perception with the issues around the transparency and the reliability of the water quality data and reporting. The study recommended a shared responsibility between the municipality and the remote community for water quality monitoring and reporting, and it is equally important to establish acceptable protocols for risk communication to the community members in order to gain public trust and build confidence to the water system.

2.2 Water Management and Financial Funding for Indigenous Communities

Significant effort and financial commitment have been allocated towards ensuring clean water access for Indigenous communities in Canada. The Environmental Stewardship Unit (ESU) under the Assembly of First Nations (AFN) has mandates to support First Nations on protecting their waterways, advocating their water rights and allocations, source water protection, and improving access to sufficient quality and quantity of safe drinking water. The ESU works closely with the AFN Housing and Infrastructure Secretariat to help improve First Nations’ access to sufficient quantities of high-quality, safe drinking water. The ESU has also been closely following the development of the new Canada Wide Wastewater Effluent Strategy, advocating for First Nations' concerns throughout its development (Assembly of First Nations, n.d.).

In addition, an Indigenous Guardians Pilot program gained ground with an initial investment of $25 million over four years in Budget 2017 and another $100 million over five years (2021-2026) in Budget 2021 (Government of Canada, n.d.). The program builds capacity and leadership network for the Indigenous initiatives that include their relationship with lands and water and supports activities in water management for First Nations, Inuit, and Metis.

In late 2020, Indigenous Services Minister Marc Miller pledged to spend more than $1.5 billion in additional investment to finish the work to lift all long-term drinking water advisories in First Nations, which was promised by the federal government in 2015 to reach that goal within five years. At the time, there were 93 communities under 133 different boil-water advisories (Stefanovich, 2020; The Canadian Press, 2015). Much of the money is planned to support the daily operation and maintenance of water infrastructure and training.

2.3 Roles and Responsibility for Water Management

In Canada, the responsibility of ensuring Canadians have safe drinking water is shared and coordinated among multiple government levels. Health Canada's Water and Air Quality Bureau leads in science and research and develops Guidelines for Canadian Drinking Water Quality as the basic requirement for all Canadians. Provinces, territories and municipalities take on the daily operational responsibility of supplying safe drinking water and overseeing the treatment facilities (Government of Canada, 2018). Across Canada, drinking water from the municipal treatment facilities served 32.5 million people in 2019 (Statistics Canada, 2021a). Among the remainder of the Canadians, over 91% got water from their private wells and the rest from surface sources (Statistics Canada, 2021b). For private well owners, it is the responsibility of the owner to properly operate, maintain, test, and monitor their wells to ensure the drinking water is safe and reliable (Government of Alberta, 2019; Government of Canada, 2019a).

2.4 Water Access for Rural Low-Density Populations

Rural users have a choice to develop a household water supply and treatment program (i.e. individual wells, individual trucked in water with household cisterns, Point of Entry Treatment, Point of Use Treatment) or join a communal drinking water system such as water co-ops.

A remote communal drinking water system could fall under the regulated size of the "Very Small" system, serving a population of fewer than 500 people (Alberta Environment and Parks, 2011). These small or very small drinking water systems typically face challenges due to their small user base, remote location, and higher capital and operational unit cost. Small communities usually lack the ability to meet regulations, policies or standards established, nor do they have the technical skills or knowledge to deal with water treatment and quality monitoring. Furthermore, they are likely to experience high financial burden resulting from an inability to acquire adequate funding, and potentially social barriers such as lack of trust and differences in values with little public awareness and constrained community support (Janzen et al., 2017; McFarlane & Harris, 2018; Minnes & Vodden, 2017). Therefore, selecting a water source with the best water quality and the least treatment allows very small systems to reduce the operational complexity and cost.

As summarized by Irwin in 2018, shown in Table 1, there is currently no dedicated provincial funding program to support rural homeowners or even water co-ops.

Table 1 Alberta water infrastructure grand programs based on project

Project Type	Applicable Provincial Government Grant Program	Potential Funding Coverage
The municipal water treatment plant	Alberta Municipal Water/Wastewater Partnership	75%
Regionalization of a small municipality (e.g., a town)	Water for Life	100% WTP upgrade 90% of the new pipeline
Regionalization of rural homeowners or water co-op	No dedicated provincial program	0%

(Note: Irwin, 2018)

Chapter 3 Case Study

Grande Cache is a hamlet located in the northern part of the Rockies, northwest of Jasper, along Highway 40 in the river valley of Smokey River. In the 2016 Census, it has a population of 3,571 people, surrounded by the Municipal District of Greenview that has a population of 5,583 in the same year (Statistics Canada, 2019).

The studied households belong to indigenous Metis communities spread out in small areas near Grande Cache, as far as ~40 kilometres from the town. Many households in these communities do not have clean running drinking water, and many drive to Grande Cache to buy water for drinking and cooking. In the hamlet of Grande Cache, there is a water treatment plant that takes raw water from Victor Lake, southeast of the town centre. The water in Victor Lake is also connected to Grande Cache Lake and Peavine Lake to the east.

3.1 History

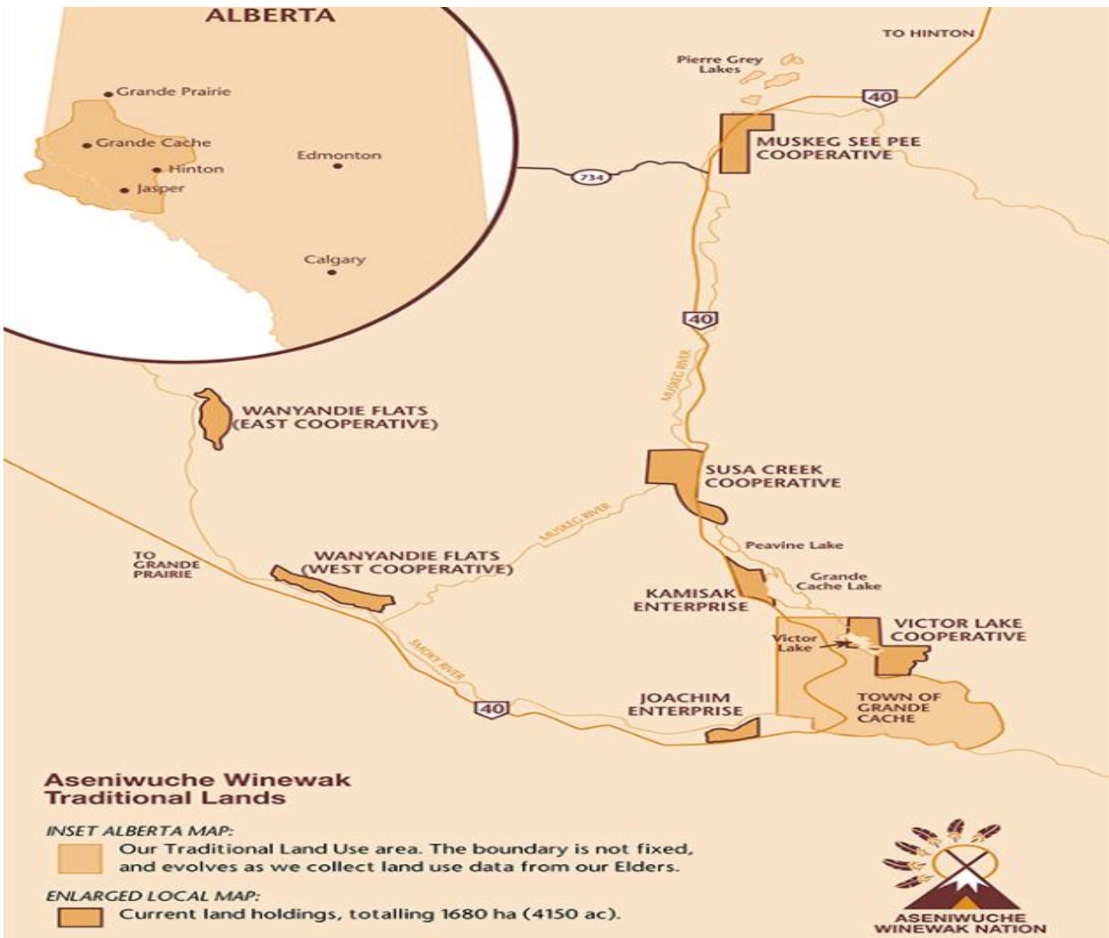
Before the 1900s, there were many Metis families living in the mountainous areas in the Jasper Valley. When Jasper National Park was created in 1907, they were forced to leave their land and settle in the Grande Cache and Smokey River areas. These land settlements later became 5 Co-operatives and 2 Enterprises, as shown in Figure 1. Even though the area is part of Treaty 8, the communities were not represented during the treaty's signing, and these members do not have Indigenous status (Aseniwuche Winewak Nation, 2021). Without being recognized as an Indigenous group under the Government of Canada's Indian Act, they do not share the same rights as recognized Indigenous communities across Canada. Up to today, they are still fighting for their assertion of Indigenous rights and claimed land. In the meantime, it also leads to loss of opportunities to access programs and fundings offered by Indigenous Services Canada.

In the land settlements, many of the community members continued to live the Cree traditional way of life, hunting, fishing, trapping and harvesting plants, until the 1960s. Their lives were further disrupted with the discovery of coal that brought coal mine development and the establishment of the Town of Grande Cache in 1969 (Aseniwuche Winewak Nation, 2021). With the loss of the traditional way of life and the culture shock, they have a fair share of socioeconomic issues that arose from systemic discrimination, lack of education and economic opportunities. Substance abuse and suicide became prevalent issues in the eighties and nineties (Aseniwuche Winewak Nation, 2021).

The community effort was seen in the establishing of the Aseniwuche Winewak Nation (AWN) of Canada in 1994 to launch land claim and indigenous assertion, but it has not been granted as of the time of this report. Another community organization, the Mountain Metis under the Metis National of Alberta, is also experiencing the same struggle.

As part of community assertion and improvement, housing programs to place mobile trailers on the land were done by the AWN in the 1980s, but ongoing upkeep remains a burden to the community with difficulties in accessing fundings.

Figure 1 Co-operatives and Enterprises near Grande Cache, Alberta



(Note: Aseniwuche Winewak Nation, 2021)

3.2 Area Development

In the area, prospecting for coal started in the 1920s. In the late 1960s, the coal mine was opened near Grande Cache, which led to the town's establishment in 1969. Infrastructure and roads were built to support the town's growth that relied heavily on the coal industry. As part of the Peace River Watershed, Smoky, Little Smoky, and Muskeg River flow across the land. The area later saw oil and gas exploration, and the development of Talisman gas pipelines allowed conversion of the coal power generation plant to be fueled by natural gas.

Coal was mined from the Smoky River Coalfield from late 1969 to early 2000. Underground and surface mine extraction allowed the transport of metallurgical coal to be exported to the Pacific Rim, South America, and Europe at 2 to 4 metric tonnes a year. The coal discovery led to the establishment of the town of Grande Cache. With the approval of the Grande Cache Coal Project in 2002, the industry was further developed and collaborated with a local electrical power producer (the H.R. Milner generating station) to convert the tailings into power and dispose of the ashes. The environmental impact assessment completed during the project approval process indicated the environmental effects could be managed within acceptable limits, and the incremental effects of the project on cumulative impacts were considered relatively minor (Cain & Martens, 2002)

On the land outside of the Co-operatives and Enterprises, most of the area is categorized as crown land. As such, the area also sees logging as part of the forest management plan under the provincial jurisdiction (Land Use Bylaw No. 18-800, 2019).

3.3 Water Access and Options

In Grande Cache, the Environmental Services department under the MD of Greenview manages and operates the town's water treatment plant and delivers the water to the communities via a water distribution system (Municipal District of Greenview, 2020a). A new water point is expected at the edge of the town that allows residents to fill and purchase at the same price ($3.50 per m^3) as the distributed water. However, the Co-operatives and Enterprises do not have a direct connection to the town's treated water. The households' choices in water access rely on the water wells on the land, surface water (streams or lake water), driving to town to purchase water jugs or from the water point when it is completed (Municipal District of Greenview, 2020c; Utilities Bylaw No. 21-873, 2021).

In the past, there had been a water program done by the MD that brought treated water to the households at $7 per m^3, but it was short-lived due to lack of participation. This was suspected that the program communication was insufficient and had apparent high pricing.

Chapter 4. Methodology

The study collected data from two approaches. First, publicly available information was summarized for the studied community, including their population and household data, drilling reports for the drinking water wells in the area, and past water quality testing data in open sources. Secondly, interviews with household members in the Co-operatives and Enterprises near Grande Cache, Alberta, were conducted. Results were analyzed qualitatively to understand the current state of the households in getting and using the drinking water.

4.1 Community and Water Data

Housing and population data were collected by accessing the online map system and databases with the Municipal District of Greenview (2020b). Under the same website, one can obtain information such as the number of residential houses, mobile trailers, and land use zoning and planning.

Domestic well water quality was accessed from the Alberta Environmental Public Health Information Network (AEPHIN) under Environmental Health Data (Government of Alberta, 2020). Drilling reports were accessed from Alberta Water Wells (Government of Alberta, n.d.).

4.2 Household Interviews

To understand the current state of household water access, data were collected via interviews with selected households in the communities. The project adhered to the ethical guidelines set out by the Conjoint Faculties Research Ethics Board (CFREB) at the University of Calgary to ensure the research had appropriate ethical oversight and accountability. For Indigenous research, information control is critical to ensure the use and the sharing of the information will benefit the community while minimizing harm.

Even though the households are not members of the First Nations nor have their data management framework, this work followed the protocols as defined by First Nations principles of Ownership, Control, Access, and Possessions (OCAP®) on information collected, protected, used, and shared. In keeping with OCAP® guideline, there would be no identifying information collected through data gathering tools. All data documents were stored in password-protected

UCalgary folders, and only information that is necessary to achieve the project objectives was collected. Identifying information such as audio interview recordings that were stored on portable devices was transferred, encrypted and stored in password-protected UCalgary folder. As soon as that happened, the data stored on the portable recorder were deleted. Participants' information would not be identified in other publications or research output. Transcripts of the interview and research outcome will be reviewed with the community members or representatives prior to release. The results of the study will be shared with the participating households in the form of a capstone project report.

The contact was made through the intermediary, Councillor Winston Delorme from MD of Greenview Ward 1, as the author had no previous relationship with the community and was grateful to rely on his Indigenous connection. The snowball technique was employed, where interested participant such as Councillor Delorme identified others to take part in the discussion. This practice was deemed appropriate as the researchers have no prior relationship with the community. All participating members were ensured that the interviews were done voluntarily without being coerced during the research.

Only Elders and adult household residents were involved in the interview process, and the engagement followed the community protocols. The interviews were conducted in person with the aid of a translator where necessary. Before the interview started, the participants were informed of the background, purpose, and objective for this study using a Community One-Pager (Appendix C), and verbal consent was obtained.

After obtaining ethical approval by CFREB (Appendix D), Councillor Delorme engaged with the community first to plan for the interviews for a small number of participants. These participating household members have spent significant time in the community and are familiar with the water issues in the community. The audio recordings from the interviews were transcribed and analyzed, along with field notes taken during the interviews.

The interviews were held in the residents' homes on July 7 and 8th, 2021. The interview questions were open-ended and designed to address key topics on water quality, past experiences with getting and using water from the land, and current usage/management practices. The interview questions included:

- How do you get your water from the land?
    - From groundwater, or surface water, or dugouts, or others?
    - How is the water quality and how much water do you take?
    - What do you use the water for?
- What were your past experiences of getting drinking water from the groundwater well on your land?
    - Metals? Concerns about microbial? Any record of analysis?
    - History? Did water quality deteriorate over time, and if so, why do you think that happened?
- What is your idea of “good” or “clean water”?
- What does “enough water” mean to you?
- Do you currently, or recently, buy water? If yes,
    - How much and often?
    - Where?
    - How much do you pay for it?
    - What do you use it for?
- Wherever you get your drinking water, do you know who is in charge of that, and what they do to make sure the water is clean?
- How much would you be willing to pay to connect your household to the clean water system that you trust?
- In your household, who is responsible for getting water?

Chapter 5. Results & Analysis

5.1 Community Data

Community data were gathered from the mapping system and its associated databases provided by the Municipal District of Greenview (2020b). Table 2 summarizes the households of the 7 Co-operatives and Enterprises.

Victor Lake Co-operative is the largest community with the highest number of residential units and presumed number of residents. Without the actual number of occupants in each house, an assumption was made that 4 persons live in a house, 2 persons in a mobile trailer, and 2 persons in a cabin. On the land, there are 19 active wells, and 90% were drilled before 2006. Along Highway 40, east of the Town of Grande Cache, Kamisak Enterprise is located right by Grande Cache Lake. The Enterprise consists of 11 houses, 10 trailers and 1 cabin. There are 10 active wells, with 2 that have unknown status, and only 2 of which were drilled after 2010.

Susa Creek Co-operative, with the largest land among the 7 land settlements, consists of 15 houses, 19 trailers and 1 cabin. There are 23 active wells, with 95% of those drilled before 2007. Musket Seepee Co-op, the east most settlement along Highway 40, consists of 10 houses and 6 trailers. There are 11 active wells, and other than 2 wells that were drilled around 2005 and 2006, the rest were done prior to 1990.

To the north of Grande Cache, Joachim Enterprise consists of 3 houses, 6 trailers and 1 cabin. There are 4 active wells, 2 were drilled around 2006, and the other 2 were before 1984. Wanyandie West Co-operative consists of 4 houses and 4 trailers. There are 5 active wells, and all of there were drilled before 2005. Wanyandie East Co-operative, located further east and upstream of the Smoky River, consists of 1 house, 1 trailer and 1 cabin. There are 5 active wells, and all of there were drilled before 2005.

Table 2 Summary of households in the Co-operatives and Enterprises

	Joachim Enterprise	Wannyandie East Coop	Wannyandie West Coop	Kamisak Enterprise	Meskeg Seepee Coop	Susa Creek Coop	Victor Lake Coop
House	3	1	4	11	10	15	19
Trailer	6	1	4	10	6	19	22
Cabin	1	1	0	1	0	1	0
Area (Acres)	257	373	465	305	776	1,058	808
Distance to Grand Cache (km)	8.5	34	19	8.5	35.5	12	2.5
Assumed Occupants*	26	8	24	66	52	100	120
***4 occupants in a house, 2 in a trailer, and 2 in a cabin**							

(Author, 2021)

5.2 State of Drinking Water Wells

The state of the water wells is suspected to be highly correlated to their age since limited monitoring and maintenance had been done to the wells. Table 3 summarizes the number of active water wells on the land in all seven Co-operatives and Enterprises. More details on the drilling reports can be found in Appendix A.

Table 3 Age of the active drinking water wells in Co-operatives and Enterprises

Year Drilled	Number of Wells	% Total
1970-1979	16	21.1
1980-1989	19	25.0
1990-1999	7	9.2
2000-2009	30	39.5
2010-2019	4	5.3
Total	**76**	**100**

(Author, 2021)

The data suggested that over half of the active wells are more than 20 years old, and very few new wells were drilled in the past decade – only about 5% of all. With all Co-operatives and Enterprises spreading out in the foothills and river valley of Smokey River, different geological features of each settlement can be observed, and they were documented in the drilling reports, as summarized in Table 4. This information could be used to shed some light on the impact of water quality and quantity from each well, depending on the drilling depth.

Table 4 Summary of Lithological Features at Different Areas

Co-ops/Enterprises	Lithological Main Features	Well Depths (ft)
Wanyandie East/West	Sandy Clay, Gravel	<40
Joachim	Boulder, Clay, Gravel	60 - 90
Grande Cache Lake	Sandstone, Shale	40 - 360
Victor Lake	Boulder, Clay, Gravel	30 - 200
Susa Creek	Gravel, Shale	30 - 140
Muskeg Seepee	Silty Clay, Gravel	40 - 180

(Author, 2021)

5.3 Water quality

By matching the water test report found in Alberta Environmental Public Health Information Network (AEPHIN) with the corresponding location, only 18 test reports were available (Government of Alberta, 2020; D. Gill, personal communication, July 27, 2021). The most recent test from the public record was done on a well in Victor Lake Co-operative in 2015. These test reports only listed test values for some of the chemical and physical parameters and none from categories of microbiological or radiological contaminants. All results showed very high hardness, 2 to 3-fold over the range of 180 mg/L, with most test results having exceeded the Aesthetic Objective (AO) limit on the iron level of 0.3 mg/L under the Guidelines for Canadian Drinking Water Quality established by Health Canada (Government of Canada, 2019b). More details on the water quality from the collected records, along with comparisons from the recent results from Calgary and Edmonton water treatment plants, can be found in Appendix B.

5.4 Findings from the Interviews

11 interviews, including 7 Elders, were conducted across Co-operatives and Enterprises, except Joachim Enterprises. At Victor Lake Co-operative, there were 4 interviews with 2 Elders

and 2 residents. 2 of them have no issues with the water from the wells on their land; however, the third interviewee, who is a close relative to one of the mentioned interviewees, commented that she is not comfortable drinking her relative's water because the water doesn’t taste good. Some of the quotes from the residents:

"I take water from the lake every day when I need it. The house is not connected to running water." – Victor Lake Co-op Resident.

“We use the creek water (that was fed by an underground stream) for drinking. We go twice a week, fill six bottles." – Victor Lake Co-op Resident.

“Before putting in the softening system in the house, I have to use the toilet bowl cleaner to get rid of the orange rust in the bathtub.” – Victor Lake Co-op Resident.

We conducted 2 interviews in Susa Creek Co-operative. The residents told us that they use the well water for cleaning and watering the plants, but they buy water for drinking and cooking. Both of them share their well with another household. The Elder living in one of those households told us that AWN had recently replaced the pump in the well they used. The watering jug and the old pump were seen to be covered with rust and scale (photos are included in Appendix E). She buys 5 jugs of water, 1 gallon per jug, every two weeks and pays for the cost of the water and someone to take her to town to get the water.

“We share (the well) with our neighbour(ing household)… The old one used to give money, but the new one didn't. But if there is (any) problem, the neighbour comes to you!" – Susa Creek Co-operative Elder.

One interview was conducted in Wanyandie West Co-op. The Elder we interviewed takes his water from the well that is being shared by five households. He told us that if he leaves the water out for a little, it forms a layer of oily film on the water surface. Wanyandie West is located close to the coal mine (then Grande Cache Coal, now CST Coal). The coal company put in the water well and the pump house as part of coal dust mitigation in the valley. Since the well was put in, the coal company has looked after its cost and maintenance.

"The water from the well used to be better, but not as good now… don't know why… The railway was built in 1965, and the coal mine started in 1969." – Wanyandie West Co-op Elder.

We conducted 1 interview in Wanyandie East Co-operative. The interviewed household has been there for 40+ years and had commented on the visible sediment in the water due to ongoing mining operations. The well water goes through a filtration system and has had good quality (after the filtration). The filters are changed by the household member at the frequency of about twice a month. When the coal mine nearby was blasting, more sediments were found in the water.

We conducted 2 interviews in Kamisak Enterprise, and both interviewees were Elders. The water quality from the wells was considered okay, but both of them bought water from town for drinking and making coffee. One Elder commented that he has mobility issues and has to rely on others to drive him to town to purchase water. Both households share their wells with one or two other households.

The Elder we interviewed in Musket Seepee Co-op told us that he takes the water from the well not far from the house. They use the water for everything, even though it has a rusty colour and tastes like sulphur in the springtime. Occasionally, he buys water from the town's car wash; the water there is further processed after the town's water treatment system.

Unfortunately, we did not interview any households in Joachim Enterprise. Based on the 11 interviews and field observations, some common findings among the households include ownership and responsibility being unclear; general lack of water management information; many have accessibility and financial concerns to water access; lack of trust on current water management and development.

5.4.1 Ownership and Responsibility

Wells at Wanyandie West households are serviced and paid for by the nearby coal company, used to be Grande Cache Coal and later taken over by H.R. Milner in 2018 (Grande Cache Coal, 2018); however, it is not clear if a service contract between the company and the community exists.

Households from other Co-operatives and Enterprises were not clear on whether the government, the Co-operatives & Enterprises, or individual households own the well and responsibilities for the maintenance or testing of the wells. For households that share a well with multiple other houses (5 out of 11 interviewees), only one of the households takes on the electricity cost of the submersible pump. Aseniwuche Winewak Nation (AWN) has been providing some repairs or replacement if pumps were broken, but AWN has not addressed other issues such as power splitting or deteriorating well integrity over time. Ultimately, the Co-operatives and Enterprises were established as land settlements, but the individual household does not consider themselves owning the land or water.

5.4.2 Lack of Information and Support

Almost all interviewees commented that their water contains high iron and it coated pots and sinks with rust and scale. Some have noticed an oily film on the water and deteriorating water quality, in tastes and smell, over time but do not understand what the cause was. Most were uncomfortable using the water for drinking and cleaning as current water was perceived unsafe and unhealthy. The seasonal changes (metallic or sulphuric smell in the spring seasons) also cast doubt on the water quality by the residents. When asked about his view on clean water, the Kamisak Elder only said, "it runs clear and cold". Without a common understanding or differentiation of clean, good, safe, and contaminated water, the perception of poor water quality may scare many residents to use the water on the land.

Most households were not aware of some water management steps on testing or maintaining the well. They had many questions but did not know where they could get answers from. 2 residents commented that they couldn't understand why on the same piece of land, the water qualities were so different among the wells nearby.

Furthermore, some wells were drilled as part of the government housing program in the '70s. There had not been any support as part of program implementation. Over the years, a few wells were capped by the local Public Health Unit due to poor water quality and lack of usage. However, no alternative was provided after the well was capped.

5.4.3 Accessibility and Financial Burden

Many of the ongoing costs to access clean water put an additional financial burden on the interviewed households in the Co-operatives and Enterprises. Without a water well close to the household on their land, 2 of the Elders interviewed needed help to get drinking water from town. They do not have a vehicle nor be able to drive. They have to pay for the water and an additional $20 per trip for the help and have to rely on others to fill and carry the heavy water jugs. For one resident in Victor Lake Co-op who takes drinking water from the underground stream, she buys water jugs at $10 each as containers to fill water. However, the quality of the water jugs from the store in town during the recent years had been poor and they broke easily, so more cost was expected to replace the water jugs. The cost of water jugs also applies to those who buy water. In addition, some of the indirect costs included extra-strength cleaners to remove the rusty stain on sinks or toilets or replacement of the household items due to the shorter lifespan caused by the water quality.

For options of water treatment, the Elder in Susa Creek Co-op commented that an initial cost of $800 was quoted for putting in a filtration system to reduce hardness and iron. The household chose against it, considering there will also be further costs associated with ongoing filter changes. Drilling a new well was not considered due to its high initial cost and uncertainty on the water quality from the past experiences.

5.4.4 Trust

It was also observed that some interviewees had less trust in government and outsiders from the community. The government housing development and the contractors used for drilling the wells in the past had come to their land, lay down the infrastructure without consultation nor pre-testing. One of the interviewed households in Victor Lake Co-op does not have the line connection from the well to the house, and another one suspected her line connection was damaged due to improper placement in the ground.

Similarly, the area around Grande Cache had been developed without meaningful engagement from the communities. Activities of energy development from the establishment of Grande Cache with connecting roads and supporting infrastructure, the railroad construction, coal mining and logging, more recent oil and gas exploration, impact the natural environment that directly affects the land and water system. The Elder in Wanyandie East had noticed that in the springtime or when the coal mine was blasting, there would be more sediment in the water from his well. There also had been stories of land contaminations from the mismanagement of waste during railroad construction and gas exploration, which they also believe had changed the water quality.

The household members are resilient and have lived collaboratively in the community. They are open to different water solutions from others, but they also express a strong desire to build their own capacity and decide the best solution for their water issues.

Chapter 6. Conclusions

When comparing the data found from public sources about the community and the area against the feedback from the interviews, there are some key issues echoed from both study methods.

Based on the available water quality survey and drilling report, 95% of water wells were drilled prior to 2010, and ~22% of the wells are more than 40 years old. There were only 17 water quality analyses that were publicly accessible, and most were over 15 years old. While some records exist, the lack of recent data also reiterates the interview responses that the water wells were mostly not tested nor monitored, and the residents did not know the conditions of the well and the equipment in the water system.

On the same land of the Co-operatives and Enterprises, the local geological differences may require the wells in the area to be drilled at different depths and receive different water treatment methods. Without proper pre-testing or area survey, there is little trust by the residents that these wells would yield clean and abundant water. With rapid area development in the past few decades, many residents believe the quality of the water wells on the land has been negatively impacted and continues to be affected.

As the communities were structured in the forms of Co-operatives and Enterprises, the responsibility of water ownership is not apparent to the households. The wells were considered private wells, but the households were collective living in the land settlements. This confusion was present when the author reviewed the government policies and listened to interviewers.

6.1 Recommendations

The first next step is recommended to conduct a well inventory in the area and a thorough water testing to get up-to-date information on raw water quality and quantity yield. This will allow the household members to know the present state of their water. The result may also help understand the oily film formed when the water sat stagnantly; whether the water had been contaminated by hydrocarbon inorganics or harmful bacteria. The knowledge of the water quality can then be used to determine if there is a health impact and or to trace back the causes to find mitigation.

Secondly, a clear information management plan is to be developed that focuses both on community knowledge sharing and communication of the results. Further study on details of the current water practice and desired water practices (also known as the needs assessment) will also complement the management plan. The execution could take the form of workshops or individual household visits. The sharing allows firming up the knowledge base on water quality guidelines, water treatment processes, well health and maintenance. The transparency will lead to a better understanding of safe water and allow residents to make informed choices if they continue to buy water. By reporting the current state from the first step openly to the residents, it will gain trust from the communities and encourage engagement on further monitoring plans and evaluating options for individual or collective households. Access to clean drinking water options for residents should be on a case-by-case scenario, as a central watering point in the community may be suitable for some, clean water delivery or household filtration system with training and filter subscription, or even a new well may be better for those who have access issues. It is important to recognize self-determination is a critical consideration when collaborating with Indigenous households.

Thirdly, a water strategist specific for the Co-operatives and Enterprises could act as a facilitator to drive water projects with consultation with community members. This role, ideally a trusted member from the Co-operatives and Enterprises, can be the voice for the non-status communities to voice concerns and seek funding from the governments or other collaborating agencies such as universities or other organizations.

6.2 Research Limitations

Based on the first set of interviews, this research has only been able to identify some issues with the drinking water access in the Co-operatives and Enterprises. However, the limitations of the results are recognized as the following:

- Interview results were qualitative, and they were subject to interpretation from a western perspective. Some responses will require further clarifications.
- The interviews may not represent all households from the same community, as they were not randomly chosen.

- Records of water analysis and drilling reports found in the public domain may not reflect all that were available. There may be individual water testing results taken later that we are not aware of; however, this does not change the conclusion or recommendation on drinking water testing/monitoring.

6.3 Conclusions

Clean water access for Indigenous communities in Canada has been a high-priority topic for its ties to the health and wellbeing of one's daily life. The clash between Canadian and Indigenous governance with insufficient planning of funding support renders the effort to reach sustainable management. This study looked into the Indigenous water issues faced by a group of household members in Co-operatives and Enterprises near Grand Cache. They are still living without clean running water in their house. This small group faces an additional challenge for their non-status with unclear ownership and responsibility under current water governance. The water quality from the ageing wells on their land has not been monitored, and the communities have limited knowledge and funding support to improve their water system. They are resilient and content, citing that their ancestors have lived on the land under much harsher conditions. Unfortunately, they have little trust in the governments and non-community members from past experiences.

The recommendation for the next steps is first to establish a good database of the water wells in the area and survey water quality and quantity from those wells. Second, in conjunction, an information management plan is to be developed and executed so the communities can build a knowledge base and receive clear communication on results and options. Third, a water strategist from and for the communities can drive water projects and become the voice of Co-operatives and Enterprises on the water issues to build trust and ensure engagement and proper consultation for future project implementation or development activities that will impact the water. The community members seek self-determination, and it is more achievable when they are well informed and have the supporting resources in their hands.

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Appendix A: Drilling Records for the Drinking Water Wells in Co-operatives and Enterprises

Count	Coop/Ent	Well ID	Year	Depth (ft)	Static Water Level (ft)	Lithology
1	Joachim	441988	1973	61	41.2	8 Grown Till, 9 Shall & Gravel, 10 Brown Till, 21 Clay & Gravel, 41, Till & Rocks, 61 Gray Gravel
2	Joachim	1106145	2007	96	73.5	96 Gravel
3	Joachim	1006049	2006	73	59.8	10 Boulders 73 Sandy Gravel
4	Joachim	441984	1984	85	42	15 Gravel & Boulders, 25 Sandy Clay, 85 Gravel
5	Wanyandie East	394464	1994	38	17.4	7 Sandy Clay, 38 Gravel
6	Wanyandie East	394470	1994	40	17.6	21 Sany Clay, 40 Gravel
7	Wanyandie East	389026	1994		17.6	20 Sany Clay, 40 Gravel
8	Wanyandie East	439398	1973	40	16.3	3 Silt, 22 Gravel & Boulders, 25 Till, 40 Gravel
9	Wanyandie West	439220	1975	30	10	8 Sany Topsoil, 19 Rocks, 20 Brown Clay, 25 Gravel, 30 Sand
11	Wanyandie West	1105026	2005	28	11.2	13 Clay, 28 Gravel
12	Wanyandie West	439324	1984	20	10	10 Sand, 20 Gravel
13	Wanyandie West	439230	1984	30	10	10 Sand, 30, Gravel
14	Wanyandie West	439214	1971		10	5 Gray Silt, 10 Sadn & Gravel, 11 Boulders, 19 Sand & Gravel, 20 Black Shale
22	Grande Cache Lake	441941	1984	40	23	5 Sand, 21 Sand & Gravel, 26 Shale, 40 Sandstone
23	Grande Cache Lake	441940	1984	80	17	2 Clay, 10 Shale, 26 Sandstone, 29 Shale, 33 Sandstone, 41 Shale, 80 Sandstone
24	Grande Cache Lake	1106146	2007	135	17.8	35 Gravel, 110 Gray Sandstone, 135 Shale
25	Grande Cache Lake	1106147	2007	60	16.1	8 Sand & Gravel, 20 Shale, 40 Gray Sandstone, 52 Shale, 60 Gray Sandstone
26	Grande Cache Lake	1106149	2007	60	25	20 Gravel, 39 Shale, 45 Gray Water Bearing Sandstone, 60 Shale
27	Grande Cache Lake	1106148	2007	220	39.2	18 Gravel, 80 Shale, 94 Gray Hard Sandstone, 220 Gray Shale & Sandstone Ledges
28	Grande Cache Lake	441944	1984	40	15	15 Sandy Clay, 40 Gravel
31	Grande Cache Lake	1375276	2011	200	2	6 Clay & Gravel, 54 Sand & Gravel, 126 Shale, 128 Coal, 200 Shale
32	Grande Cache Lake	441952	1973	40	23.2	11 Till, 29 Sand & Gravel, 40 Black Shale
37	Grande Cache Lake	441955	1984	86	50	4 Till, 26 Gravel, 32 Shale, 34 Sandstone, 40 Shale, 43 Sandstone, 46 Shale, 50 Sandstone, 60 Shale, 62 Sandstone, 68 Shale, 71 Sandstone, 73 Shale, 83 Sandstone, 86 Shale
39	Muskeg Seepee	441875	1987	42	30	15 Gravel, 37 Slt & Rocks, 42 Gravel
40	Muskeg Seepee	441914	1971	120	0.1	10 Gravel, 21 Silt, 27 Sand & Silt, 92 Silt, 96 Sand & Gravel, 110 Silt, 114 Gravel, 120 Silt
41	Muskeg Seepee	441874	1975	100	27	17 Clay & Boulders, 33 Sandy Clay, 35 Boulders, 48 Sandy Clay, 57 Sand & Gravel, 100 Clay & Boulders
42	Muskeg Seepee	441871	1975	80		10 Sand, 14 Gravel & Boulders, 33 Soft Clay, 38 Gravel, 56 Blue Clay, 60 Sand, 80 Gravel
43	Muskeg Seepee	441869	1984	42		4 Sany Clay, 15 Sand & Gravel, 21 Clay, 26 Gravel, 30 Clay, 42 Gravel
44	Muskeg Seepee	441868	1984	50		4 Sany Clay, 15 Sand & Gravel, 30 Clay, 31 Sandstone, 45 Clay, 50 Gravel
47	Muskeg Seepee	441866	1975	140	30.29	8 Sand, 11 Gravel & Boulders, 36 Blue Clay, 40 Sand & Gravel, 96 Blue Clay, 126 Clay & Rocks, 140 Gray Shale
49	Muskeg Seepee	1106051	2006	65	16.7	15 Sand & Rocks, 20 Muskeg, 63 Silty Clay, 65 Gravel
50	Muskeg Seepee	1105028	2005	81	10.58	17 Boulders, 62 Silty Clay, 75 Clay, 81 Gravel
56	Muskeg Seepee	441896	1984	70	15	15 Gravel, 62 Silt, 70 Gravel

(Author, 2021)

Count	Coop/Ent	Well ID	Year	Depth (ft)	Static Water Level (ft)	Lithology
59	Muskeg Seepee	2059306	1971	183		3 Silty Clay, 9 Gravel, 64 Sray Silty Clay, 66 Brown Rocks, 75 Gray Silty Clay, 76 Loose Gravel, 79 Hard Sandstone, 95 Gray Clay, 106 Clay & Gravel, 135 Gray Clay, 138 Shale & Gravel, 145 Gray Clay, 178 Shale & Sandstone, 183 Brown Shale
60	Susa Creek	1106071	2006	63	22.7	44 Sandy Gravel, 63 Silty Gravel
61	Susa Creek	1106077	2006	45	14.7	10 Boulders, 45 Gravel
62	Susa Creek	1106152	2007	39	23.3	39 Water bearing Gravel
63	Susa Creek	1105032	2005	30	9.83	5 Losse Topsoil, 30 Gravel
64	Susa Creek	1106075	2006	35	4.6	5 Boulders, 32 Sandy Gravel, 35 Gravel
65	Susa Creek	1105033	2005	54	34.47	52 Gravel, 54 Fractured Shale
66	Susa Creek	1106151	2007	100	25.9	30 Sand & Gravel, 60 Shale, 65 Gray Sandstone, 100 Gray Water Bearing Shale
67	Susa Creek	1106076	2006	28	23	15 Sandy Gravel, 20 Silty Gravel, 28 Sandy Gravel
68	Susa Creek	1106150	2007	120	8.8	20 Gravel, 90 Shale, 95 Gray Water Bearing Sandstone, 120 Shale
69	Susa Creek	441958	1983	88	38	3 Clay, 78 Rocks, 88 Gravel
70	Susa Creek	1106393	2012	90	18.2	18 Sandy Gravel, 35 Silty Sand & Gravel, 42 Brown Crumbly Sandstone & Rocks, 90 Gray Hard Sandstone
71	Susa Creek	441970	1975	100	31.9	2 Sandy Clay, 57 Clay & Gravel, 68 Sand & Gravel, 100 Gravelly Clay & Sand
72	Susa Creek	1106050	2006	63	46.4	2 Topsoil, 32 Gravel, 40 Silty Clay, 63 Gravel
77	Susa Creek	1106070	2006	63	47.4	5 Topsoil, 63 Sandy Gravel
78	Susa Creek	1106073	2006	45	10.9	20 Sandy Gravel, 23 Gravel, 42 Silty Gravel, 45 Shale
79	Susa Creek	441977	1984	68	45	68 Gravel
81	Susa Creek	441979	1989	140	24	6 Sand, 88 Shale, 92 Sandstone, 98 Shale, 140 Sandstone
82	Susa Creek	441978	1984	65	35	5 Sand, 20 Gravel & Boulders, 32 Gravel, 44 Sandstone, 51 Shale, 65 Sandstone
83	Susa Creek	1106130	2007	110	66.7	15 Boulders 110 Sand & Gravel
84	Susa Creek	441967	1975	39	34	3 Sandy Clay, 28 Gravel, 32 Sandy Clay, 36 Hard Sandstone, 47 Caving Sand, 49 Hard Sand
85	Susa Creek	1105027	2005	42	33.05	10 Muskeg, 18 ??, 37 Clay, 42 Gravel
86	Susa Creek	441976	1984	80	50	4 sand, 20 Gravel & Boulders, 80 Gravel
89	Susa Creek	441961	1983	60	7	10 Boulders, 14 Sand, 30 Gravel, 32 Till, 60 Gravel
91	Victor Lake	394456	1994	50	28.3	
92	Victor Lake	441819	1987	140		140 Clay & Gravel
93	Victor Lake	441817	1973	58	34.2	18 Till, 29 Gravel, 58 Gravel & Boulders
94	Victor Lake	441818	1987	56	37	56 Gravel
95	Victor Lake	1106764	2014	32	22.27	8 Boulders, 33 Sand & Gravel, 34 Shale
96	Victor Lake	1106493	2013	80	7.93	35 Gravel, 48 Shale, 74 Gray Sandstone, 80 Shale
97	Victor Lake	441822	1971	180	16.5	10 Till & Gravel, 16, Till, 95 Hard Shale, 119 Silty Sandstone 102, 119 Shale, 123 Coal, 131 Shale, 140 Fined Grained Sandstone, 180 Shale
98	Victor Lake	394458	1993	30	16	1 Topsoil, 30 Gravel
99	Victor Lake	441820	1973	40	22.4	5 Till & Rocks, 40 Gravel
100	Victor Lake	1106053	2006	80	36.4	4 Sand, 15 Rocks, 80 Shale
101	Victor Lake	1106052	2006	47	36.7	42 Rocks, 47 Gravel

(Author, 2021)

Count	Coop/Ent	Well ID	Year	Depth (ft)	Static Water Level (ft)	Lithology
102	Victor Lake	1105030	2005	87	50.1	35 Boulders, 87 Gravel
103	Victor Lake	1105031	2005	75	57.38	10 Boulders, 77 Gravel
104	Victor Lake	1105051	2005	77	43.36	8 Boulders, 75 Gravel
105	Victor Lake	1106054	2006	200	74.2	5 Rocks, 12 Sand, 43 Gravel, 60 Silt, 62 Gravel, 73 Clay & Rocks, 200 Shale
108	Victor Lake	441811	1973	65	48.6	47 Gravel & Boulders, 65 Corase Grained Sand & Gravel
109	Victor Lake	1105029	2005	84	52.3	30 Boulders, 84 Gravel
111	Victor Lake	394461	1994	50	32	50 Gravel
112	Victor Lake	498208	1999	70	19	70 Sand & Gravel

(Author, 2021)

Appendix B: Water Quality

Guideline		none	AO	none	CDWG	Very hard	AO	none	AO	AO	AO	AO	
Limit			<250		MAC 1.5	>180	7.0-10.5		<0.3	<200	<500	<500	
Description	Date Tested	Alkalinity	Chloride	Conductivity	Fluoride	Hardness	pH	Potassium	Iron	Sodium	Sulphate	TDS	Comments
UOM		mg/L	mg/L	uS/cm	mg/L	mg/L		mg/L	mg/L	mg/L	mg/L	mg/L	
5	06-Mar-06	361.4	58.1	870	0.1	428.50	7.85	1.86	8.04	13.97	18.1	454.79	Susa Creek
6	06-Mar-06	398.2	5.8	731	0.2	266.26	8.26	1.95	1.55	66.78	BDL 1	398.40	Susa Creek
7	06-Mar-06	300.8	7.0	588	0.1	299.13	7.94	0.93	2.99	14.12	12.3	316.12	Susa Creek
8	06-Mar-06	363.8	13.7	723	0.1	360.03	7.86	1.39	0.17	18.66	14.4	390.85	Grand Cache Lake
9	13-May-14	278.1	5.4	512	0.2	267.54	8.32	1.05	3.12	33.55	7.3	304.43	Grand Cache Lake
10	20-Dec-10	306.9	3.2	561	0.2	243.76	8.14	1.60	4.53	17.65	BDL 1	291.19	Victor Lake
11	06-Mar-06	320.0	11.1	648	0.1	334.51	8.00	3.55	0.07	10.20	16.6	348.68	Victor Lake
12	10-Mar-15	449.4	1.2	797	0.5	227.43	8.17	0.79	0.64	112.84	5.5	469.23	Victor Lake
13	06-Mar-06	318.9	4.8	603	0.2	301.26	7.95	2.36	1.52	16.77	4.2	321.59	Victor Lake
14	06-Mar-06	289.3	5.3	533	0.2	271.43	8.06	2.48	0.14	15.64	2.9	291.14	Victor Lake
15	06-Mar-06	316.7	13.5	651	0.2	334.75	8.01	2.86	0.01	13.62	14.8	349.24	Victor Lake
16	06-Mar-06	290.1	11.4	568	0.2	277.51	8.06	2.54	1.63	18.89	4.1	302.08	Victor Lake
17	21-Jun-05	411.6	BDL 1	762	0.4	378.18	8.01	1.26	0.10	29.07	21.0	424.94	Joachim maybe
18	21-Jun-05	198.5	24.5	646	0.1	324.11	8.12	0.77	0.02	10.34	108.8	377.57	Joachim maybe
19	13-Jan-03	403.2	1.3	920	0.1	531.18	8.07	2.43	2.58	14.87	136.1	560.28	half way between Joachim and WA West
20	22-Jun-03	396.0	BDL 1	733	0.4	369.44	8.44	1.23	0.06	35.73	37.3	436.65	Victor Lake maybe
21	21-Jun-05	241.4	BDL 1	500	0.2	243.13	8.15	1.06	1.31	16.05	30.3	278.02	Wanyandie West maybe
22	17-Apr-19	306.9	3.2	561	0.2	243.76	8.14	1.60	4.53	17.65	0.0	291.19	Victor Lake, not included in AEPHIN
Edmonton WTP	Dec-20	135	5.99	377	0.7	184.00	8.00	0.76	<0.005	7.82	50.0	224.00	Monthly average
Bearspaw WTP	2019	122	4.7	343	0.1	173.00	7.60	0.50	<0.01	4.60	52.0	200.00	Annual average
Bow River	02-Mar-21	160	n/a	341	2.0	190.00	7.34	0.50	n/a	2.30	53.0	220.00	BOW RIVER AT COCHRANE
Elbow River	02-Mar-21	210	n/a	686	n/a	250.00	7.34	1.70	n/a	47.00	70.0	410.00	ELBOW RIVER AT 9TH AVE BRIDGE
Victor Lake	19-Oct-11	172	10.4	331	0.2	174.00	8.28	1.20	n/a	15.30	L3	185.00	VICTOR LAKE - COMPOSITE
Grande Cache Lake	20-Oct-11	168	7.7	316	0.1	173.00	8.33	0.90	n/a	12.50	5.0	182.00	GRAND CACHE LAK

(Author, 2021)

Appendix C: Community One-Pager

Sustainable Drinking Water Options for Remote Indigenous Communities

Project Objective

- To understand the current drinking water realities and the barriers in your community
- The outcome of the study can be used to assist the community in taking a more active and meaningful role in the physical development of the drinking water system.

Procedures

1. Winston Delorme will be conducting an ~1 hour interview session with you under your consent.
2. He will ask for your permission to audio-record the conversation. This makes it easier to remember the details of the conversation.
3. The questions will include the following topics:
   - How do you get your water from the land, and what do you use the water for?
   - What were your past experiences of getting drinking water from the groundwater well?
   - What is your idea of "good" or "clean water"?
   - What does "enough water" mean to you?
   - Do you currently, or recently, buy water?
   - Wherever you get your drinking water, do you know who is in charge of that, and what they do to make sure the water is clean?
   - How much would you be willing to pay to connect your household to the clean water system that you trust?
   - In your household, who is responsible for getting water?
   - If there is a drinking water treatment system near you, do you trust yourself (or members of your community) to keep it running safely?
4. The information collected will be adequately stored and managed. To ensure confidentiality, we will get your approval first before use and publish the information you provided during the interview.
5. Your consent is critical to this study. You are free to withdraw at any time before, during or even after the interview (within two weeks of the interview for purposes of data collection).

Please let us know if you have any questions or concerns. Thank you for taking part in this study!

Researchers: Dr. Kerry Black, Assistant Professor, Dept. of Civil Eng., U of Calgary (403-210-7400)
Aaron Janzen, Drinking Water Operations Specialist, Alberta Environment and Parks
Jennifer Chen, Master's student in School of Public Policy, U of Calgary

The University of Calgary Conjoint Faculties Research Ethics Board has approved this study (REB21-0567).

Appendix D: Ethics Approval Certificate

UNIVERSITY OF CALGARY

Conjoint Faculties Research Ethics Board
Research Services Office
2500 University Drive, NW
Calgary AB T2N 1N4
Telephone: (403) 220-4283/6289
cfreb@ucalgary.ca

CERTIFICATION OF INSTITUTIONAL ETHICS REVIEW

The Conjoint Faculties Research Ethics Board (CFREB), University of Calgary has reviewed and approved the below research. The CFREB is constituted and operates in accordance with the current version of the *Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans* (TCPS).

Ethics ID:	REB21-0567
Principal Investigator:	Kerry Black
Co-Investigator(s):	
Student Co-Investigator(s):	Jennifer Chen
Study Title:	Assessment of current drinking water realities and barriers that would need to be overcome to provide sustainable drinking water to the households in the Indigenous rural communities near Grande Cache, Alberta.
Sponsor:	

Effective: 28-Jun-2021 **Expires:** 27-Jun-2022

Restrictions:

This Certification is subject to the following conditions:

1. Approval is granted only for the research and purposes described in the application.
2. Any modification to the approved research must be submitted to the CFREB for approval.
3. An annual application for renewal of ethics certification must be submitted and approved by the above expiry date.
4. A closure request must be sent to the CFREB when the research is complete or terminated.

Approval by the REB does not necessarily constitute authorization to initiate the conduct of this research. The Principal Investigator is responsible for ensuring required approvals from other involved organizations (e.g., Alberta Health Services, community organizations, school boards) are obtained.

Approved By:	**Date:**
Jenny Godley, PhD, Chair , CFREB	28-Jun-2021

Note: This correspondence includes an electronic signature (validation and approval via an online system).

Appendix E: Photos taken at Co-operatives and Enterprises

(Author, 2021)