

Exploratory Assessment of Drinking Water Management in the Southern Interior of British Columbia: A First Nation Story



Final MLWS White Paper

Destiny Allen-Green

2018

Executive Summary

Like other small communities, First Nation communities face challenges as a result of changing population demographics, as the younger generation leaves to pursue opportunities, the community loses its future and valuable expertise. By way of a reconnaissance, this report presents an evaluation of some of the challenges pertaining to drinking water access and availability in small First Nation communities in B.C.'s southern interior. Representatives from two groups were approached, Lytton First Nation and Esh-kn-am, and through informal meetings, an assessment of local drinking water concerns in the region was conducted.

The Lytton First Nation had recently installed a new water treatment system and were not concerned about their drinking water due to their 'end of the pipe' solution. The communities represented by Esh-kn-am had challenges with water shortages and some sporadic 'Boil Water Advisories' (BWAs). Despite the Lytton First Nation being content, the current water management does not provide long-term solutions and as such potable water will always need to be treated if further actions are not taken. Esh-kn-am, on the other hand, did express concerns about their drinking water security.

As a result, a holistic approach to drinking water management has been recommended for both community groups. The use of watershed-level management by way of the multi-barrier approach and/or integrated watershed management more effectively protects water at its source and ensures the quality of the water at the tap. Additionally, these holistic methods generate more collaboration and require that adequate data be gathered, both of which are needed in addressing drinking water concerns. Despite watershed level management of drinking water sources being a viable solution, the communities have little control over local governance, especially within their traditional territory, which hinders the more holistic approaches.

Terms

Boil Water Advisory

An advisory placed when water is contaminated by organisms which are indicators of the presence of fecal pollution (e.g. *E. coli*) or when the water system is not operating effectively and the water quality is impacted (e.g. under chlorination) (Health Canada, 2008).

Drinking Water Advisory

A warning placed on water as a preventative measure was taken in order to protect the population against suspected or confirmed chemical or microbiological contamination. It is an overarching term including *Boil Water*, *Do Not Use*, and *Do Not Consume* advisories (Health Canada, 2008).

Multi-Barrier Approach

An integrated approach which takes into account drinking water origin (source) and the full extent of its journey through the system to make it to the tap. This approach aims at preventing or reducing drinking water contamination and thus the subsequent reduction in human health risks (CCME, 2004).

Source Water Protection

Implementing protections and safeguards for drinking water at its natural source (e.g. lake, river, groundwater) (Eledi et al., 2017).

Traditional Territory

Areas of land which have been used traditionally for hunting, migration, spiritual, cultural, and ceremonial purposes among other uses (Malone & Chisholm, 2016).

Abbreviations

BWA: Boil Water Advisory

CIRNAC: Crown-Indigenous Relations and Northern Affairs Canada

DNCA: Do Not Consume Advisory

DNUA: Do Not Use Advisory

DWA: Drinking Water Advisory

INAC: Indigenous and Northern Affairs Canada

ISC: Indigenous Services Canada

SDG: Sustainable Development Goal

SWP: Source Water Protection

Table of Contents

Executive Summary	2
Terms	3
Abbreviations	4
Introduction	6
Background	6
First Nation Water	6
Potable Water	8
Water Management	9
Objective	10
Study Site	10
Methods	12
Results	13
Lytton First Nation	13
Esh-kn-am	14
Governance	18
Discussion	19
Lytton First Nation	19
Esh-kn-am	19
Governance	20
Recommendations	22
Data Record Keeping	22
Collaboration	23
Water Protection	23
Conclusions	24
References	25
Appendices	28
Appendix 1	28
Appendix 2	29
Appendix 3	30

Introduction

Background

First Nation communities face challenges as a result of population dynamics or demographics, heavy economic dependence on the primary resource sector, and few employment opportunities. As a result, younger generations often leave their community in search of opportunity, and rarely return. These realities threaten the future survival and resilience of these communities because a lack of expertise is retained in the region. A resilient community is one which is able to retain its functions and systems in the face of impacts inflicted by internal or external factors (Salvia & Quaranta, 2017). In order to foster the development of resilient small communities able to adapt to stress such as climatic, demographic, and social changes, basic needs must first be met if the community is to turn their attention towards securing the future. An important primary human need and right is access to safe and reliable drinking water (United Nations et al., 2010). Water is essential to life and securing clean reliable sources of drinking water currently, and securing sources for the future, is a critical first step to maintaining healthy and resilient communities.

The importance of drinking water access for all is highlighted by the recently released Sustainable Development Goals (SDGs) developed by the United Nations (UN). This global agenda has been developed with water access and availability as one of its primary concerns. SDG number 6 is “to ensure availability and sustainable management of water and sanitation for all” and in order to achieve this goal, action must be taken at various scales for all countries (Sustainable Development Knowledge Platform, 2018). Nationally, water-rich countries like Canada are no exception, and the availability and access to clean reliable drinking water is a human right that is not met, or narrowly met for all Canadians.

First Nation Water

Maintaining drinking water availability and quality is a priority for the Canadian government, and as such there are a number of regulations, guidelines, and standards in place to ensure health risks are not inflicted. As a result, severe water contamination events have occurred, and when they do occur, they gain a huge amount of media attention (Patrick, 2011).

An example of this was seen in Walkerton, Ontario after contaminated water resulted in fatalities (Black & McBean, 2017; Patrick, 2011). Legislation such as *the Safe Drinking Water Act* and the *Clean Water Act*, to name a few, are some of the regulations implemented which have improved drinking water supplies over time thus making contamination events relatively few and far between (Walters et al., 2012). However, small rural communities, particularly First Nation communities in Canada, struggle to maintain adequate safe drinking water supplies for their population, due to water quantity and quality challenges and do not benefit from the same water security as other Canadians (Water Policy and Governance Group, 2010; Walters et al., 2012). First Nation communities have some of the most inadequate water supplies in the country, with numerous long-standing drinking water advisories being one of most apparent concerns (INAC, 2018). Currently, over 100 First Nation communities across Canada are under drinking water advisories and have been for extended periods, some of which have lasted at least a decade (INAC, 2018). BWAs are also issued 2.5 times more frequently in First Nation communities than in non-First Nation communities in the country and based on risks to drinking water from source to tap outlined by Indigenous and Northern Affairs Canada (INAC), inequality is further apparent (Patrick, 2011; Walters et al., 2012). First Nation communities in Canada have faced issues for decades for example, Table 1 shows that First Nation communities have far more incidences of risk, and far more severe drinking water risks than non-First Nation communities (Walters et al., 2012). The stark differences between the water available to non-First Nation

A.				B.			
Risk Categories	Low	Medium	High	Risk Categories	Low	Medium	High
Source water	16	55	72	Source water	16	34	4
Design	72	22	49	Design	52	2	0
Operation	60	51	32	Operation	52	0	2
Reporting	65	48	30	Reporting	54	0	0
Operator	112	19	12	Operator	54	0	0
Overall	55	62	26	Overall	54	0	0

Table 1. Drinking water risk rankings based on INAC risk categories; A. Risk rankings for First Nation communities, B. Risk rankings for non-First Nation communities (Walters et al., 2012).

communities versus what is available to First Nation communities lend to the notion that measures must be taken to bridge the gap if equality is to be a priority.

In order to address this, the federal government has pledged to take action, however, government action alone may not be able to fully address the issue due to the complexity of

water challenges and numerous stakeholder groups. Despite efforts made to introduce legislation acknowledging First Nation rights, like the *Safe Drinking Water for First Nations Act*, nuanced language and a lack of understanding of Native perspectives has resulted in limited success and a lack of collaboration amongst the two groups (Plummer et al., 2013; Walters et al., 2012; Water Policy and Governance Group, 2010). The four major stakeholders/rightsholders often associated with the First Nation water concerns are the following: *First Nation Band Chief and Councils*, *Environment Canada*, the *departments of Indigenous Services Canada (ISC) and Crown-Indigenous Relations and Northern Affairs Canada (CIRNAC)* (formerly INAC), and *Health Canada* (Walters et al., 2012). These groups often have different strategies, views, and priorities and without a delicate balance, the chance for collaboration and success may be squandered.

Potable Water

Potable water is water which is suitable for drinking based on the Guidelines for Canadian Drinking Water as determined by the Federal-Provincial-Territorial Committee on Drinking Water and released by Health Canada (Health Canada, 2017). The guidelines are based on chemical, physical, microbiological, and radiological parameters which should not be exceeded for a viable drinking water source (Health Canada, 2017). Some chemical parameters include arsenic, asbestos, and lead, while physical parameters include total dissolved solids, and taste (Health Canada, 2017). A few microbiological parameters include total coliforms, *Escherichia coli* (*E. coli*), and turbidity, and some radiological parameters include tritium, lead-210, and radium-226 (Health Canada, 2017). When these and other parameters are exceeded, adverse health effects, poor water aesthetics, and water system damage can result (Health Canada, 2017).

When water does not meet the required guidelines or potential health risks are suspected, drinking water advisories (DWA) are put in place. DWAs are warning messages placed on water with confirmed or suspected chemical and/or microbiological contamination which can cause public health threats (Environment and Climate Change Canada, 2018). It is an overarching term which includes ‘Do Not Consume’, ‘Do Not Use’, and ‘Boil Water’ advisories (Environment and Climate Change Canada, 2018). Do Not Consume Advisories (DNCAs) and Do Not Use Advisories (DNUAs) makeup approximately 2% of Canadian DWAs and result from hazardous

contaminants like lead and chemical spill residues being found in drinking water (Environment and Climate Change Canada, 2018; Health Canada, 2008). A Boil Water Advisory (BWA) is placed when water quality is poor as indicated by the presences of *E. coli*, and other microbiological parameters, additionally, challenges with the water system such as water main breaks and under chlorination can result in these advisories (Environment and Climate Change Canada, 2018; Health Canada, 2008). BWAs are the most common advisory placed on drinking water sources, and over 80% of them result primarily from challenges with water system equipment and the processes used for water treatment (Environment and Climate Change Canada, 2018).

Water Management

In order to ensure safe and reliable drinking water sources, two main methods are employed, water treatment via water treatment plants, and source water protection via integrated watershed management. Water treatment plants are often used to treat water in order to remove harmful contaminants once the water has already been contaminated; it addresses the symptom of the issue. Water treatment is a solution for the present which must continue into the foreseeable future, as treatment plants are designed to mitigate existing problems. Since this method does not take into consideration the source of the contamination or the overall health of the watershed in the area; it does not address the cause of the contamination and the problem may persist and compound over time.

A more holistic approach to drinking water management is source water protection (SWP) which focuses on the protection of drinking water at its source, whether it be surface (lake, river) or groundwater (Islam et al., 2013). Unlike water treatment, SWP is a preventative strategy designed to protect drinking water now and into the future by addressing the causes of water contamination (Eledi et al., 2017; Islam et al., 2013). This approach utilizes the watershed as the base unit and considers all of the sources of point and non-point source pollution that can influence the quality of the drinking water (Eledi et al., 2017). By delineating the watershed, identifying contaminants of concern and the susceptibility of the water to said contaminants, safeguards can be implemented to maintain the water quality (Alberta Environments and Parks, 2015). For example, in New York state, source water protection has been used in lieu of

traditional water treatment to supply 9 million New Yorkers with clean drinking water (NYC Environmental Protection, 2013). By purchasing land surrounding reservoirs and headwaters in the upstate region, improving waste and storm water management, informing and educating locals, and working in partnership with local governments, as an example, SWP was successfully utilized (NYC Environmental Protection, 2013).

SWP uses an integrated approach similar to integrated watershed management which uses collaborative governance to manage environmental, social, and economic components within a watershed to maintain ecosystem viability and function (CCME, 2016). SWP is also an important component of the multi-barrier approach used to maintain safe drinking water (Alberta Environments and Parks, 2015; CCME, 2004; Collins et al., 2017). This approach utilizes methods of source water protection, water treatment, water quality monitoring, legislation, and distribution and emergency response management in order to improve drinking water quality (Alberta Environments and Parks, 2015; CCME, 2004; Walters et al., 2012). This approach uses several components to ensure that an imperfection in an individual component does not automatically impact water quality and subsequently human health (Gullick, 2014).

Objective

The purpose of this report is to evaluate the current water conditions and concerns of First Nation communities in British Columbia's southern interior. It is intended to be utilized as a preliminary document which can be referenced when considering collaborative approaches to integrated watershed management in small communities in the future.

Study Site

British Columbia as the second highest occurrences of DWAs after Ontario and approximately 80% of the advisories within the province are for communities in the interior region (Forrest, 2018). Additionally, longstanding BWAs lasting more than a year and a half are a particular challenge in the region (Edwards et al., 2012). As a result, this exploratory study examined First Nation communities of interest located in the Southern Interior region of British Columbia (Figure 1). These communities are located in a semi-arid region of the province which experiences hot dry summers with temperatures often ranging from 30-40°C, with mild spring



Figure 1. Map of British Columbia's major regions include the southern interior region (B.C. Ministry of Transportation and Infrastructure, 2018).

and fall, and snowy winters with temperatures below freezing (HelloBC, 2018). These communities are found primarily in the Interior Douglas-fir and Bunchgrass biogeoclimatic zones which are marked by some of the hottest and driest conditions in the province (Appendix 1) (B.C. Ministry of Forests, Lands and Natural Resource Operations, 2016). These communities are located in relatively isolated regions which makes them more vulnerable to drinking water security challenges. In fact, more water advisories are issued in this region than in the other regions of the province combined (Edwards et al., 2012). Unlike major urban centres, the availability of potable water in small rural communities is less reliable and faces more challenges (Edwards et al., 2012). In particular, more DWAs are issued in small communities with 77% of the BWAs issued between 2010 and 2017 having been issued for communities with a population of 500 people or less (Environment and Climate Change Canada, 2018). Such small populations also result in inadequate government representation and a small economic tax base.

The First Nation communities approached for this report have a small population living on reserve, much like many other First Nation communities in Canada, these communities are susceptible to similar water challenges. In addition, differences in governance pertaining to First Nation land can cause further complexity; in particular, the difference in the governance of First Nation reserve land and traditional territories. As expressed in the Indian Act, reserves are tracts of land that benefit bands and are held exclusively for band use (the Indian Act). Reserves have rigid boundaries which were affixed upon the communities and presently they have their own governance systems along with some federal government influence (Malone & Chisholm, 2016). Traditional territories, on the other hand, do not have affixed boundaries and are defined by First Nation communities and refers to a larger area of land that has been used for generations (Malone & Chisholm, 2016). Traditional territories or Indigenous territories are areas of land which have been used traditionally for hunting, migration, spiritual, cultural, and ceremonial purposes among other uses (Malone & Chisholm, 2016). Both reserves, and traditional territories have delineated boundaries which do not necessarily correspond to watershed boundaries.

Methods

To obtain information regarding First Nation perspectives regarding potable water issues and concerns, two cases (Lytton and Esh-kn-am) in the southern interior of B.C. were selected, and visit and informal meetings were held (Figure 2). Lytton First Nation is a 205 home

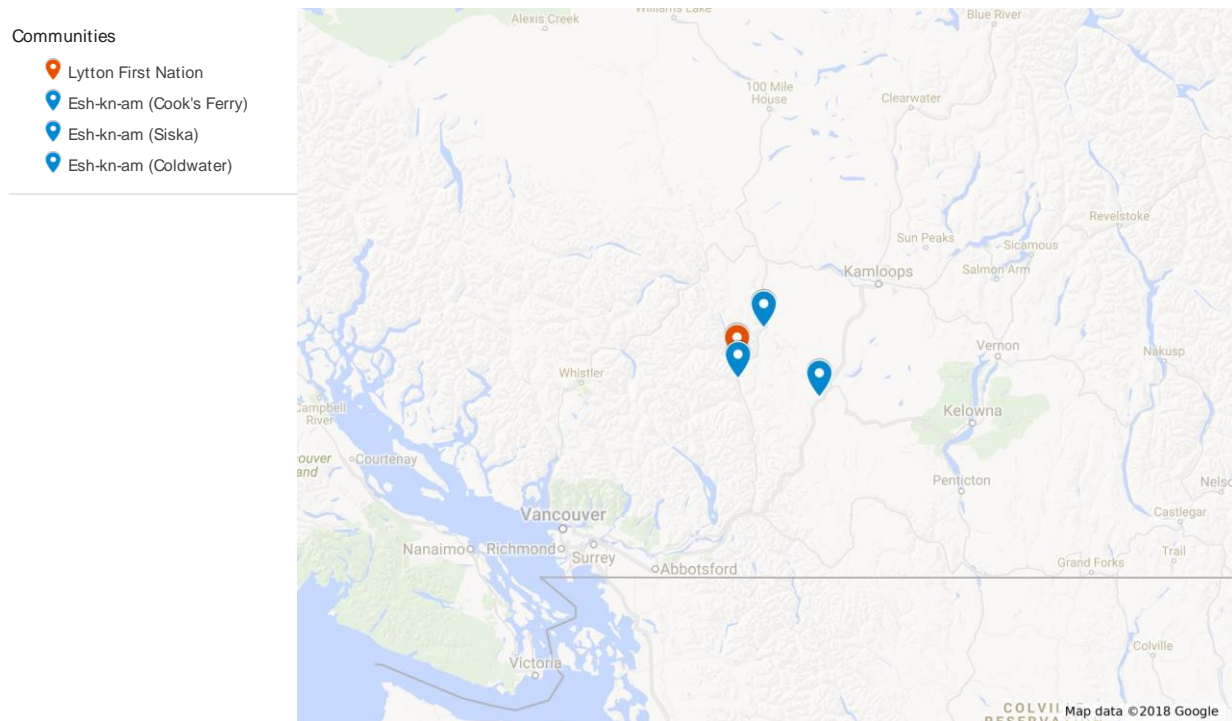


Figure 2. Map of First Nation communities in the southern interior approached.

community consisting of 56 reserves on both sides of the Fraser River along the Trans-Canada Highway between Hope and Cache Creek (Lytton First Nation, 2018). The Lytton Band has recently introduced an innovative water treatment system in partnership with RES'EAU-WaterNET, IC-IMPACTS, and the government to address their concerns (IC-IMPACTS, 2018; Fountaine, 2017). In contrast a second organization that had not introduced centralized water treatment, the Esh-kn-am Cultural Resources Management Services, in Merritt B.C. with representatives of three First Nation Bands (Coldwater, Siska, Cook's Ferry) was approached. The first to ascertain the Bands evaluation of the 'end-of-pipe' approach, while the second to gather information of perceived issues and concerns regarding local potable water security.

Results

Lytton First Nation

Through consultation with representatives of the Lytton First Nation in regards to current drinking water challenges, limited concerns were brought forward. Due to the recent installation of a water treatment system, and the use of Point of Entry water treatment, the community is not concerned with their drinking water availability. Currently, Lytton First Nation uses a

combination of surface and groundwater sources for drinking water and focuses predominantly on 'end of the pipe' water treatment as a means to maintain water quality. Despite some efforts to control the upstream reaches of the watershed found within their traditional territory, logging, forest fires, and recreational vehicle use impact the areas from which their drinking water is sourced. Despite intermittent BWAs in the community, often related to spring runoff, the Lytton First Nation does not currently have any overwhelming drinking water concerns.

Esh-kn-am

Esh-kn-am was approached in order to get a sense of the water concerns within the Coldwater, Siska, and Cook's Ferry Bands it represents. The three bands have their own specific concerns pertaining to water security and are all impacted by uncertainty due to major threats such as forest fires, logging, flooding and a lack of influence in local governance. Before meeting with Esh-kn-am it was assumed that the vast majority of the water concerns within the three bands were related to water quality particularly long-standing DWAs. However, the primary drinking water challenges and concerns expressed within the three bands relate to water quantity. Given the semi-arid region and the hot dry summers, drinking water shortages are a pressing issue likely to persist.

The Siska Band has 301 band members with those living on-reserve residing in approximately 80 homes within 11 reserves along the Fraser River south of Lytton (Figure 3) (Nicola Tribal Association, 2018). The primary drinking water concern for the band is long-standing water shortages. Due to the long history of shortages, personal and community gardens

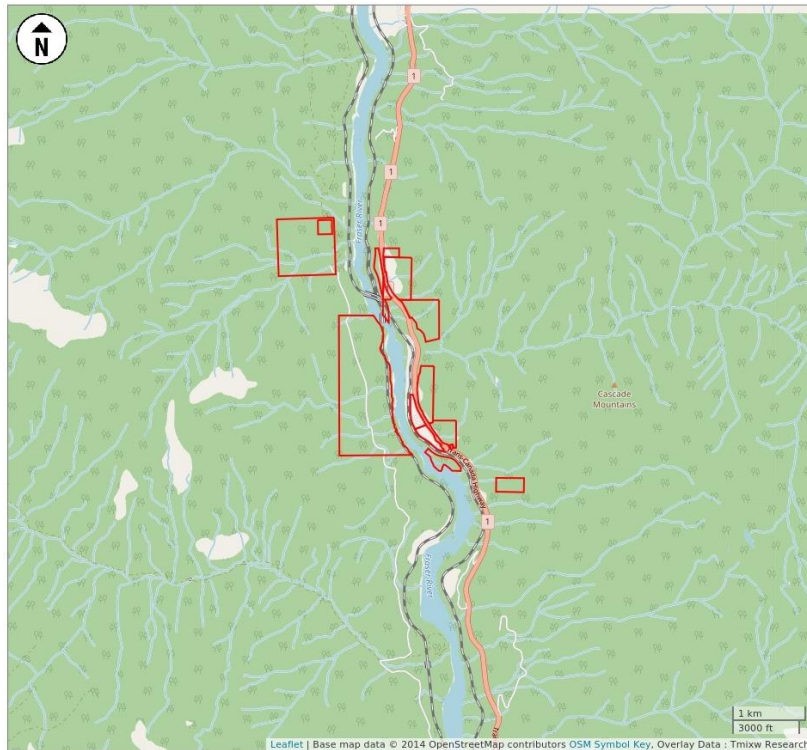


Figure 3. Siska Band reserves (https://nta-maps.lightship.works/#/map/b9_vVA8jTKWJDE-KpZWkPA/details).

and further residential land development is not possible within the community. In addition, the band has been heavily impacted by logging in the region which has repercussions for the hydrological cycle.

The Cook's Ferry Band has 347 Band members, 15% of which live on reserve within one of the 24 reserves between Spences Bridge and Ashcroft (Figure 4) (Cook's Ferry Band, 2018; Nicola Tribal Association, 2018). Currently, the Cook's Ferry community does not have many severe concerns with their drinking water reliability as they have recently put in a community water treatment system. This system services the town of Spences Bridge and the reserves in Spences Bridges and responsibility for maintaining drinking water supplies for the community system is shared between the band and the Thompson-Nicola regional district (Cook's Ferry

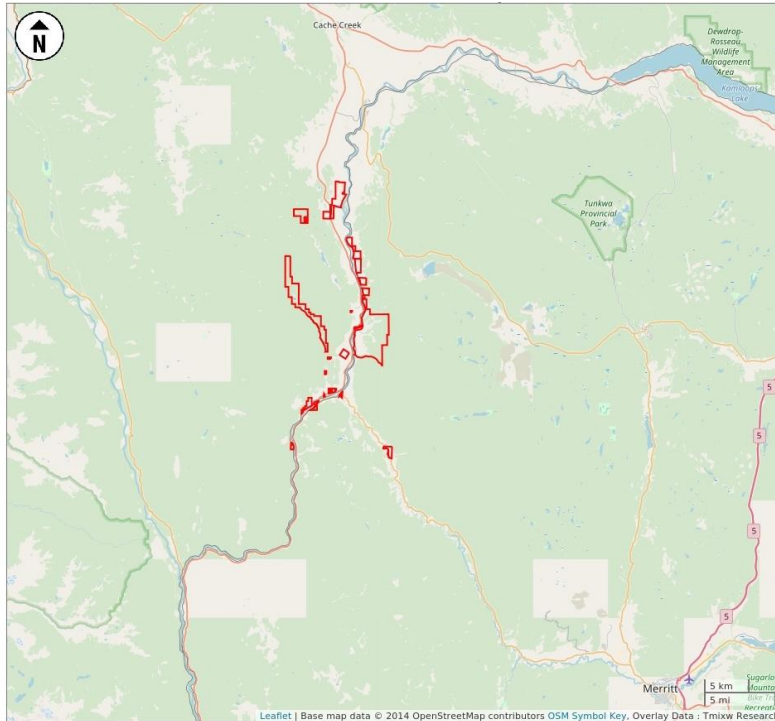


Figure 4. Cook's Ferry Band reserves (<https://nta-maps.lightship.works/#/map/ep0IPm9sTjm-WmBiSXC2aw/details>).

Indian Band, 2018). Since the installation of the community water system the remaining water challenges have to do with sediment in the water, infrastructure, and like the Siska Band, water shortages. Before the installation of the community water system, drinking water for Cook's Ferry was sourced from groundwater sources which were directly influenced by river water and challenges pertaining to turbidity and BWAs existed (Cook's Ferry Indian Band, 2018).

The Coldwater Band has a population of approximately 813 band members with approximately 344 living on reserve in approximately 200 homes in 2 populated reserves south of Merritt (Figure 5) (Nicola Tribal Association, 2018; Coldwater Indian Band, 2018). The community uses groundwater sources of drinking water from both deep and shallow wells. Deep wells have aquifers at a depth greater than approximately 8 meters and shallow wells have aquifers anywhere above 8 meters. Within the community, there are three main deep water wells which service the majority of the homes. Homes that are more isolated, have individual wells which are primarily shallow and fed by stream water recharge from channels like the Kwinshatin

Creek and the Coldwater River. Drinking water quality in the Coldwater community is primarily of good quality and reliable, however, there is a long history of sporadic BWAs. In particular,

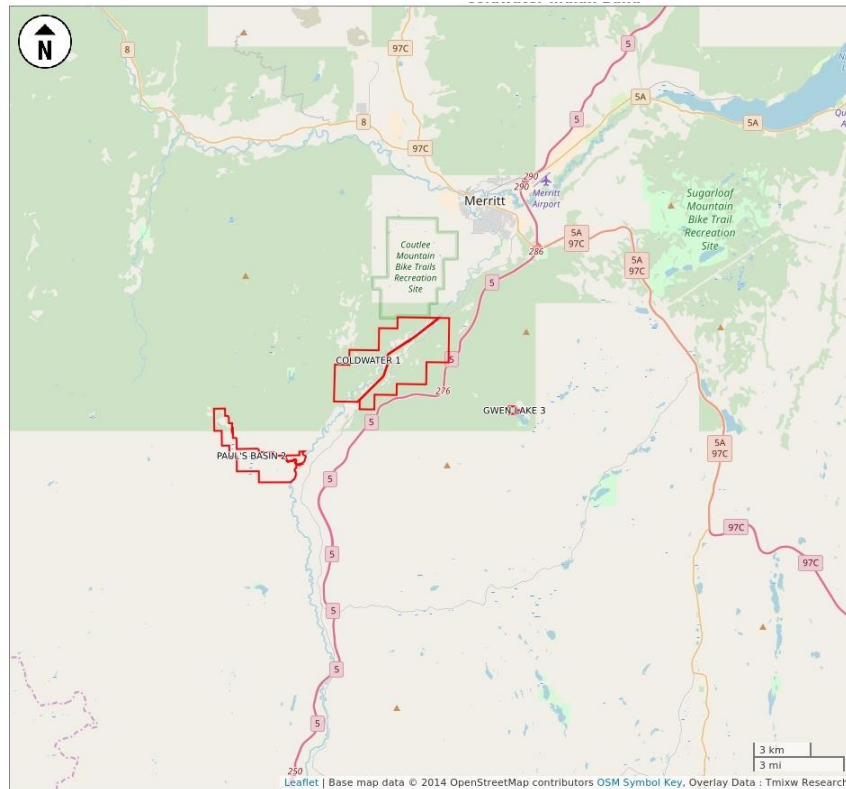


Figure 5. Coldwater Band reserve (<https://nta-maps.lightship.works/#/map/PBFldi3BQRqpVRGxCTIXFg/details>).

there have been some challenges with elevated concentrations of total coliforms and fecal coliforms in some drinking water wells; the source of the contamination is unknown. However, activities which are prevalent within the watershed such as cattle grazing, forest fires and logging likely contribute E. coli, ash, and sediment to water sources, respectively. In addition, one of the individual wells is known to have a consistently high iron content thus giving the water an unappealing colour. Currently, the Band's main mode of ensuring water quality is to periodically shock the systems with chlorine. A more significant concern to the community is water quantity as summer stream flows decline, shallow stream fed wells, in particular, suffer from low flows with water level drops of over approximately 3.7 meters having been observed. Seasonal times of low flow in September and October have also become more severe and like other communities Esh-kn-am represents, the Coldwater Band is also impacted by alterations to the hydrologic cycle as a result of logging, recreational activities, and transportation corridors within their traditional territory.

Governance

Representatives of Esh-kn-am mentioned challenges pertaining to governance and control of their land in some capacity. They expressed that they lack a real and impactful influence within their traditional territory and subsequently they can not implement the results they envision for their community. The consultation process is a means of reconciliation between the government and First Nation communities, and when industry is involved, some of the governmental responsibility to consult is assigned to the industry since they know the details and inner workings of the proposed development/resource extraction (Building Relationships with First Nations, n.d.). However, legally, industry does not have a duty to consult or accommodate First Nations likely to be impacted by proposed projects as that is the government's role and responsibility (Building Relationships with First Nations, n.d.). The government consultation process includes the following four phases: preparation/pre-consultation, engagement/consultation, accommodation, and decision and follow-up, however, the depth and extent of the consultation conducted is dependent on the status of treaty rights, and aboriginal title for the First Nation communities (Aboriginal Consultation and Accommodation, 2011; Building Relationships with First Nations, n.d.). The consultation process was discussed with Esh-kn-am and in some cases, industry representatives will approach the community with a plan for development or extraction of resources and the community will return with counter suggestions to the plan that would better maintain the integrity of their traditional land. Whether it be for drinking water sources, wildlife habitat, or cultural significance, these counter suggestions are made, however, in some cases industry is able to go forward with their original agenda by utilizing legislative loopholes and maneuvers to circumvent the desires of the local community. This is particularly a concern when dealing with drinking water as reserve boundaries are not the same as watershed boundaries. Without proper authority over traditional territory land, First Nation communities can essentially lose all control over the protection and management of their drinking water sources. Appendix 2 shows the drinking water wells utilized by the Coldwater community, all of which are found on reserve land. However, the larger watershed from which the water is sourced is clearly outside of reserve boundaries (Appendix 3). As a result, local governance is compromised and local engagement and community resilience are difficult to foster and maintain. Another example of governance challenges is exemplified in

the Siska community wherein some community members were forced to switch drinking water well sources in order to reduce the number of water systems needing to be maintained. Although increasing maintenance convenience may be economically attractive, this decision resulted in people moving from a clean drinking water source to one which has frequent BWAs. Thus, both internal and external governance challenges exist and can hinder progress.

Discussion

Lytton First Nation

Lytton First Nation utilizes a number of systems which treat drinking water for their population. This method does not utilize the principles of integrated watershed management, as it does not utilize the watershed as the basis for management and maintenance of ecosystem function and viability (CCME, 2016). Furthermore, this method ignores source water protection entirely since measures are not implemented to protect water at its source before contamination occurs. By using different sources of funding and partnerships the Lytton First Nation has been able to put in costly water treatment systems that have ended the majority of drinking water concerns in the community. However, this course of action does not take a holistic watershed view as it relies exclusively on the water treatment aspect of the multi-barrier approach and does not provide a long-term solution (CCME, 2004). As a result, drinking water treatment will always be necessary.

Esh-kn-am

Esh-kn-am represents the Siska, Cook's Ferry, and Coldwater bands, which all have challenges with adequate drinking water quantity. Despite familiarity with the challenge, presently there are no measures in place for rainwater harvesting or water storage and despite a long-standing history of water shortages in the Siska community, for example, there have been few actions taken towards watershed-level planning, water budgeting, and seeking alternative water sources for the future. This is primarily due to a lack of funds and influence in governance across the entirety of the watersheds from which drinking water is drawn. Challenges with high amounts of sediment in the water in the Cook's Ferry community, for example, is largely a factor of local geography and geomorphology. The steep mountainous terrain is naturally very

susceptible to wind and water erosion, however, an integrated watershed management approach would pick up on any vegetation and land use changes in the area which could further exacerbate the problem thus leading to a partial solution. The Coldwater community, in particular, has had a long history of sporadic BWAs and in order to address these fluctuations in water quality, there must be an understanding of the root cause. To get to the cause, a holistic assessment of the watershed via integrated watershed management would be beneficial. To that end, a thorough understanding of land use and subsurface stratigraphy within the watershed is needed. Such an approach would reveal the causes of BWAs and the future reliability of drinking water sources in the community, and subsequently, measures could be put in place to improve water security. Once current watershed conditions are determined, source water protection alone, or as a part of the multi-barrier approach could be implemented to safeguard future water quality. This approach does, however, require a lot of expertise, funds, significant regional land use and management influence, and resources in order to be conducted well which may prove to be difficult in such a small community.

Governance

The governance structure in First Nation communities can be complicated and the combination of invested parties and governing authority figures can result in several different perspectives, positions, and strategies. Without a doubt, various stakeholder responsibility and involvement is key to tackling water security challenges from a holistic watershed approach making local governance of the utmost importance. For instance, if major Canadian government stakeholders such as ISC and CIRNAC (formerly INAC), Health Canada, and Environment Canada were to come alongside local First Nation communities to address drinking water security challenges while respecting First Nation rights, success may result. Government adherence to its fiduciary responsibilities to provide basic services to First Nation communities, and local First Nation communities having real influence in governance, particularly at the watershed scale within their traditional territory would be of value. Figure 6 demonstrates a

possible breakdown of responsibilities for primary government stakeholders and First Nations

Multi-barrier Protection	Standards	Shared Responsibilities
Source water	<i>Guidance Materials on Source Water Protection Plans</i>	INAC and Environment Canada ¹
Treatment & Distribution	<i>Protocol for Safe Drinking Water in First Nations Communities</i>	INAC ¹
Monitoring	<i>Guidelines for Canadian Drinking Water Quality</i>	Health Canada ¹
Management	<i>First Nations Water and Wastewater Action Plan</i> <i>Water and Wastewater Policy and Level of Services Standards</i>	INAC and Health Canada ¹

} First Nations ²

¹ Public Works and Government Services Canada provide technical support to departments

² First Nations Technical Advisory Group provide technical advice to First Nations

Figure 6. Multi-Barrier Approach for improving First Nation drinking water with the responsibilities of the main stakeholders outlined (Adapted from Walters et al., 2012).

within the scheme of the multi-barrier approach (Walters et al., 2012). If local First Nations are involved in all stages of the approach and the appropriate government stakeholders are involved in pertinent stages, then there can be a reasonable expectation of improvements to drinking water security.

Challenges may also arise among different First Nation communities sharing traditional territories and within bands themselves. Due to a general lack of resources, or an abundance of more pressing concerns than future water availability within a region, different First Nation bands may have different priorities and agendas as it pertains to their traditional territory. In this case, the benefits which come from small communities bannning together collaboratively to find solutions and share knowledge may be lost. Additionally, within bands changes in governing families and a lack of communication may also result in disruptions; recall the two wells in the Siska community. With enhanced communication within the community, the quality of governance stands to improve.

In small rural communities, it is important that the local population be a primary voice in governance as they live in the area and often times have a great wealth of knowledge.

Particularly First Nations should be the major voice in governance and have their concerns considered seriously by outside industry and government in matters pertaining to their lands as they have such a long history with the land and have a wealth of insight within their own community and are nations in and of themselves.

Recommendations

Despite differences in water management strategies and drinking water concerns, all the communities have room to improve their current or future drinking water security. Presented below are recommendations which could contribute to the improvement of drinking water quality and quantity in First Nation communities in the region.

Data Record Keeping

Having data for the region is a necessary first step in order to understand the condition of water resources. Representatives were not able to pinpoint the origin of their drinking water challenges, and data accumulation and synthesis would contribute to developing local understanding. In particular, to address water quality and quantity concerns it is important to have the adequate land use, subsurface stratigraphy, and groundwater data. The land surrounding water sources has a direct impact on what debris and contaminants can make their way into water sources. The geology of the area can further determine what substances impact the water, for instance, carbonate-rich rocks like limestone can produce hard water when the water interacts with the rock. Additionally, since groundwater is an important source of drinking water for some of the communities, it is important to understand where the groundwater is sourced, what the capacity of the groundwater aquifer is, and the flow paths that the groundwater takes, this is especially important in understanding the extent of contamination when it occurs. Data accumulation can be quite resource intensive and require a lot of monitoring and sampling staff which is likely not feasible for the communities Esh-kn-am represents, in particular. As an alternative, residents and other volunteers could be utilized to gather relevant data, and through the use of professionally developed workshops, and blogs, information can be disseminated through the community. In addition to being less economically taxing, this strategy allows for

community involvement which will inevitably better the local understanding of the water system and what is needed to safeguard it for the future.

Collaboration

A notable challenge pertaining to improving water availability and security expressed by the communities had to do with funds and expertise. In most cases, addressing long-standing water challenges such as water shortages and sporadic BWAs are difficult to resolve without large influxes of funds. This is because building water treatment facilities and reservoirs can be quite costly, especially in remote areas with complex terrain. As a result, small communities are less able to fund development projects to improve water security in the area. Lytton First Nation, demonstrates a good example of improvements which can result from large capital investments in drinking water solutions, however, it is not yet the norm for other First Nation communities. Lytton First Nation also provides a good example of the need for collaboration between small communities and other entities such as universities who can provide expertise, government, and NGOs like RES'EAU-WaterNET who can provide funding and further access to expertise. The Siska, Cook's Ferry, and Coldwater Bands could also stand to benefit from similar collaboration for their drinking water. By collaborating, the communities may be able to begin using rain barrels and reservoirs to address water quantity concerns.

Water Protection

In order to address the water quantity and quality concerns, an integrated management approach could prove quite successful. Research has begun to show that an integrated approach termed the Multi-Barrier Approach is effective to ensure water quality, and an assessment of source water capacity at a watershed scale could reveal a way forward for water quantity (Islam et al., 2011; Patrick, 2011; Plummer et al., 2013; Walters et al., 2012). This management strategy may reveal that new drinking water sources need to be explored for the future due to inadequate supplies, it will also allow for further water contamination to be avoided by way of source water protection. Taking a more preventative approach would not only aid in pinpointing current drinking water vulnerabilities but also provide a strategy for long-term water security. An additional benefit to this approach is it's cost effectiveness, as is it often an economically beneficial alternative to water treatment costs (Ainsworth & Jehn, 2005; Islam et al., 2011). Despite the foreseen benefits of this approach, a careful reexamination of local governance and

government involvement will be needed to achieve success. However, New York state provides an example of the success which can result when a diligent focus is placed on collaboration and proper local governance.

Conclusions

This report serves as a preliminary evaluation of the current water conditions and concerns in First Nation communities in British Columbia's southern interior. Despite a need for more data to further assess drinking water challenges and concerns for the various communities, the results presented above, point towards water quantity and sporadic water quality challenges within the region. 'End of the pipe' water treatment is one of the easiest methods of providing safe potable water however, it does not ensure long term water supply. In order to secure drinking water sources, adoption and widespread use of holistic watershed management has been recommended along with increased collaboration, data record keeping and dissemination at the community level. If the appropriate stakeholders are prepared to collaborate, assume some responsibility and get involved while respecting First Nation rights, this approach could be successful. Despite the prudence of implementing an integrated watershed management approach, without control in local governance success will be difficult. Since, watershed boundaries and reserve boundaries do not align, drinking water security challenges are truly governance challenges which need to be addressed by First Nation communities in collaboration with the government and other stakeholders. The availability of drinking water is a contentious global concern and water-rich countries are not immune and if small First Nation communities do not have the required authority to influence local governance, particularly in their watershed region, drinking water security will remain uncertain.

References

- Aboriginal Consultation and Accommodation – Updated Guidelines for Federal Officials to Fulfill the Duty to Consult – March 2011. *Indigenous and Northern Affairs Canada*. Retrieved from: <http://www.aadnc-aandc.gc.ca/eng/1100100014664/1100100014675>
- Ainsworth, S., & Jehn, P. (2005). Source water protection: What's in it for you? *Ground Water Monitoring and Remediation*, 25(2), 44-44. doi:10.1111/j.1745-6592.2005.0043.x
- Alberta Environments and Parks. (2015). Draft - *Guide to Source Water Protection Planning in the South Saskatchewan Region (Alberta)*.
- B.C. Ministry of Forests, Lands and Natural Resource Operations. (2016). *Biogeoclimatic zones of British Columbia* (Map). Retrieved from: <https://www.for.gov.bc.ca/hre/becweb/resources/maps/CurrentVersion.html>
- B.C. Ministry of Transportation and Infrastructure. (2018). *British Columbian Regions* (Map). Retrieved from: <https://www2.gov.bc.ca/gov/content/transportation/funding-engagement-permits/highway-event-permits/regional-district-contacts>
- Building Relationships with First Nations: Respecting Rights and Doing Good Business. (n.d). *Natural Resource Stewardship – Government of British Columbia*. Retrieved from: <https://www2.gov.bc.ca/gov/content/environment/natural-resource-stewardship/consulting-with-first-nations>
- Canadian Council of Ministers of the Environment (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.
- Canadian Council of Ministers of the Environment (CCME). (2016). *Summary of Integrated Watershed Management Approaches Across Canada*.
- Coldwater Band Indian Band. (2018). Retrieved from: <https://www.coldwaterband.com/community>
- Collins, L., McGregor, D., Allen, S., Murray, C., & Metcalfe, C. (2017). Source water protection planning for Ontario first nations communities: Case studies identifying challenges and outcomes. *Water*, 9(7), 550. doi:10.3390/w9070550
- Cook's Ferry Indian Band. (2018). Retrieved from: <http://www.cooksferryband.ca>
- Edwards, J., Henderson, S., Struck, S., & Kosatsky, T. (2012). Characteristics of small residential and commercial water systems that influence their likelihood of being on drinking water advisories in rural British Columbia, Canada: A cross-sectional study using administrative data. *Journal of Water and Health*, 10(4), 629-649. doi:10.2166/wh.2012.046

Eledi, S., Minnes, S., & Vodden, K. (2017). Source Water Protection in Rural Newfoundland and Labrador: Limitations and promising actions. *Water*, 9(8), 560. doi:10.3390/w9080560

Environment and Climate Change Canada. (2018). *Canadian Environmental Sustainability Indicators: Drinking water advisories*. Retrieved from: www.canada.ca/en/environment-climate-change/services/environmental-indicators/drinking-water-advisories.html.

Fontaine, T. (2017, March 22). *B.C First Nation latest to take control of water problem*. CBC. Retrieved from <http://www.cbc.ca/news/indigenous/lytton-first-nation-water-system-fixing-1.4036018>

Forrest, M. (2018, May 12). *More drinking-water advisories for B.C. than any other province, report finds*. The Globe and Mail. Retrieved from: <https://www.theglobeandmail.com/news/british-columbia/more-drinking-water-advisories-for-bc-than-any-other-province-report-finds/article23488553/>

Gullick, R. W. (2014). Source water protection: Perspectives of the past, present, and future. *Journal (American Water Works Association)*, 106(8), 164-174. doi:10.5942/jawwa.2014.106.0111

Health Canada. (2008). *Procedure for Addressing Drinking Water Advisories in First Nations Communities South of 60°*. Retrieved from: <https://www.canada.ca/en/indigenous-services-canada/services/first-nations-inuit-health/reports-publications/health-promotion/procedure-addressing-drinking-water-advisories-first-nations-communities-south-60.html>

Health Canada. (2017). *Guidelines for Canadian Drinking Water Quality—Summary Table*. Water and Air Quality Bureau, Healthy Environments and Consumer Safety Branch, Health Canada, Ottawa, Ontario.

IC-IMPACTS. (2018). Retrieved from: <https://ic-impacts.com/about/>

INAC. 2018. *Ending long-term drinking water advisories in First Nation communities*. Retrieved from: <http://www.aadnc-aandc.gc.ca/eng/1506514143353/1506514230742>

The Indian Act (1985, c. I-5). Retrieved from: <http://laws-lois.justice.gc.ca/PDF/I-5.pdf>

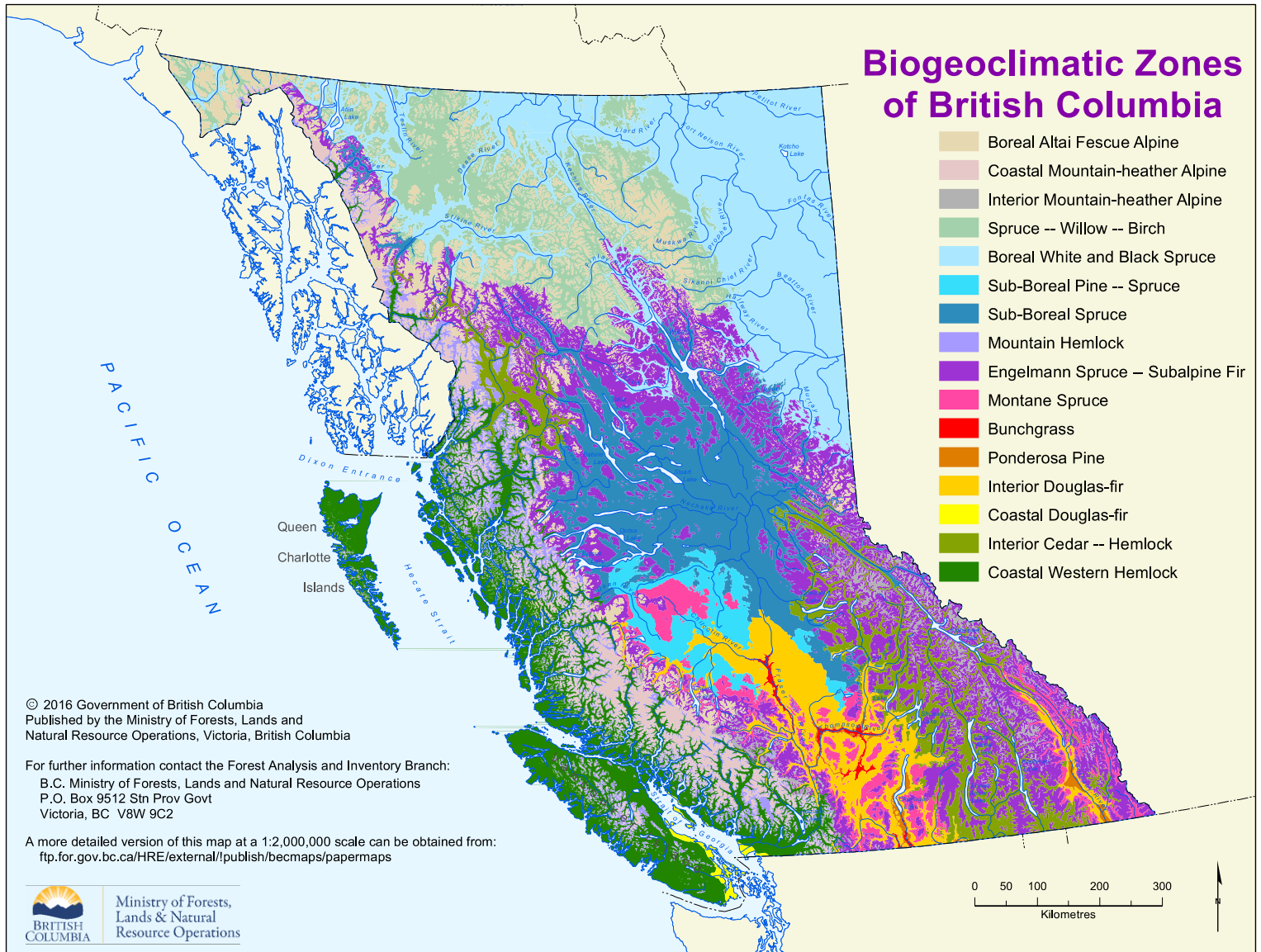
Islam, N., Sadiq, R., Rodriguez, M. J., & Francisque, A. (2011). Reviewing source water protection strategies: A conceptual model for water quality assessment. *Environmental Reviews*, 19(NA), 68-105. doi:10.1139/a11-001

Islam, N., Sadiq, R., Rodriguez, M. J., & Francisque, A. (2013). Evaluation of source water protection strategies: A fuzzy-based model. *Journal of Environmental Management*, 121, 191-201. doi:10.1016/j.jenvman.2013.02.022

- Lytton First Nation. (2018). Retrieved from: <http://www.lyttonfirstnations.com>
- Malone & Chisholm. (2016). *Indigenous Territory*. Retrieved from: <https://www.thecanadianencyclopedia.ca/en/article/indigenous-territory/>
- Nicola Tribal Association. (2018). Retrieved from: <http://nicolatribal.com/member-bands.html>
- NYC Environmental Protection. (2013). *New York City to Receive Source Water Protection Award from American Water Works Association*. Retrieved from: http://www.nyc.gov/html/dep/html/press_releases/13-027pr.shtml#.W1OdbK3My1u
- Patrick, R. J. (2011). Uneven access to safe drinking water for first nations in Canada: Connecting health and place through source water protection. *Health and Place*, 17(1), 386-389. 10.1016/j.healthplace.2010.10.005
- Plummer, R., de Grosbois, D., Armitage, D., de Loe, R. (2013). An integrative assessment of water vulnerability in first nation communities in southern Ontario, Canada. *Global Environmental Change-Human and Policy Dimensions*, 23(4), 749-763. 10.1016/j.gloenvcha.2013.03.005
- Salvia, R., & Quaranta, G. (2017). Place-based rural development and resilience/ A lesson from a small community. *Sustainability*, 9(6), 889. doi/http://dx.doi.org/10.3390/su9060889
- Sustainable Development Knowledge Platform. (2018). *Sustainable Development Goal 6*. Retrieved from: <https://sustainabledevelopment.un.org/sdg6>
- United Nations, Office of the High Commissioner for Human Rights (OHCHR), United Nations Human Settlements Programme (UN-Habitat), & World Health Organization (WHO). (2010). The Right to Water. Factsheet No. 35 Retrieved from: <https://www.ohchr.org/Documents/Publications/FactSheet35en.pdf>
- Walters, D., Spence, N., Kuikman, K., & Singh, B. (2012). Multi-barrier protection of drinking water systems in Ontario: A comparison of first nation and non-first nation communities. *The International Indigenous Policy Journal*, 3(3), 8.
- Water Policy and Governance Group. (2010). *Water Challenges and Solutions in First Nation Communities*. Retrieved from: https://uwaterloo.ca/water-policy-and-governance-group/sites/ca.water-policy-and-governance-group/files/uploads/files/vonderporten_and_deloe_2010_0.pdf

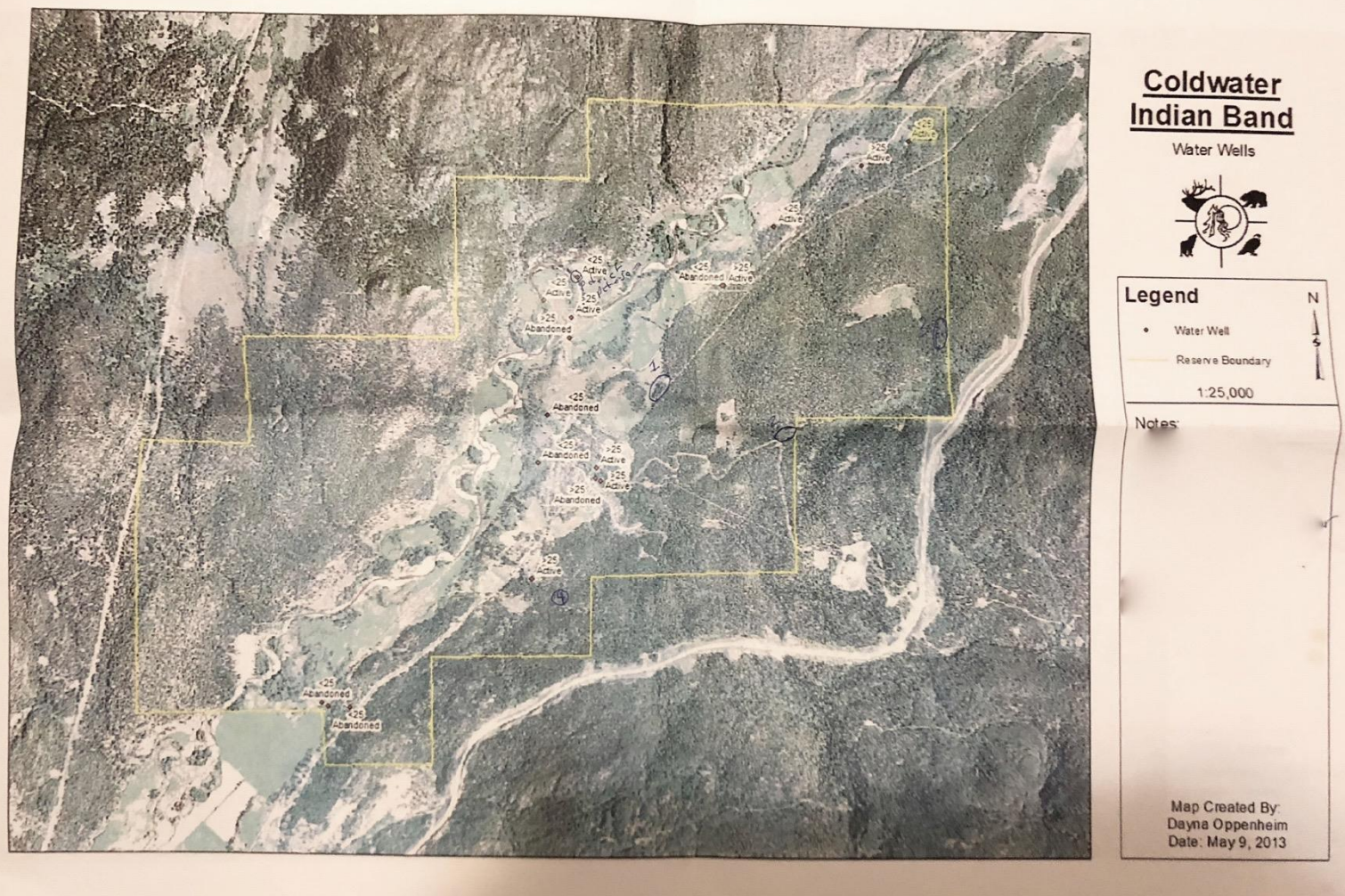
Appendices

Appendix 1



B.C. Ministry of Forests, Lands and Natural Resource Operations, 2016

Appendix 2



Appendix 3

