

**First Nations Information Gathering on Kokanee, Bull Trout and Arctic Grayling**

Project Number: PEA-F19-F-2866

Prepared for Fish and Wildlife Compensation Program

**TSE'KHENE FIRST NATIONS  
McLEOD LAKE INDIAN BAND**

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## **Statement of Consultation for Sensitive Data**

Traditional ecological knowledge (TEK) refers specifically to all types of knowledge about the environment derived from the experience and traditions of a particular group of people. The TEK documented in this report is the intellectual property of the knowledge holders who shared it.

The contents of the interviews are complimented with site specific information for kokanee, bull trout and arctic grayling, which could potentially cause harm to individuals, families and First Nations if released to the public. This information is private and belongs to the knowledge holders; therefore, site-specific information is not available in this report, and further use of the information beyond this study requires permission from the particular First Nation that owns it.

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## Executive Summary

The goal of this project was to record First Nations knowledge, concerns and priorities related to kokanee (*Oncorhynchus nerka*), bull trout (*Salvelinus confluentus*) and arctic grayling (*Thymallus arcticus*) in the tributaries of the Williston Reservoir to guide priorities for future Fish and Wildlife Compensation Program (FWCP) projects, monitoring, conservation and enhancement actions. The project responds to a high priority research need identified by the First Nations Working Group and aligns with FWCP Action: 2a-1 in the Reservoirs Action Plan: "undertake a kokanee assessment study to summarize status, trends, and aquatic and terrestrial ecosystem impacts and potential risks of kokanee introductions and develop appropriate recommendations for actions, as needed." In addition to kokanee, the FWCP is also interested in gathering First Nation people's knowledge, concerns and priorities related to bull trout and arctic grayling and their habitat in the region to inform the bull trout directed project (Action: 1c-1 in the Streams Action Plan). **This report focuses on the knowledge, concerns and priorities of Tse'khene Elders from the McLeod Lake Indian Band.** The main findings are:

- Non-native kokanee populations are believed to be increasing in number and spatial distribution since the Government stocking efforts in 1990.
- Tse'khene are concerned about the presence of kokanee in the watershed. There is concern that kokanee are affecting other fish species like bull trout and arctic grayling, and predator behaviour as bears and wolves have been observed feeding on dead kokanee on the shore of the reservoir.
- Bull trout have decreased in number and size in all rivers and tributaries from the reservoir. More injured and diseased fish have been caught and the quality of the meat, in terms of taste, has declined.
- There has been a dramatic decrease in arctic grayling numbers since the flooding of the reservoir and few arctic grayling have been caught in the territory in the past 30 years.
- Tse'khene are concerned about mercury levels in all fish, particularly bull trout, and are uncertain what fish are safe to eat. It is important to Tse'khene to have ongoing monitoring of mercury levels in fish and waterways that involve Tse'khene members and share the findings with the Nation in relevant and culturally appropriate ways.
- Tse'khene are very concerned about the impacts of herbicide spraying, logging, mining and natural gas development on fish spawning habitat and the broader ecosystem. Monitoring and regulating these activities is needed and should involve Tse'khene members.
- Every lake, river and stream in the Tse'khene territory is important. Tse'khene have a holistic, integrative view of the environment and consider individual fish species as part of a broader complex web of relationships.

Taken together with ongoing input and involvement from Tse'khene, these insights could guide priorities for future FWCP projects, monitoring, conservation and enhancement actions on Tse'khene territory.

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## 1.0 Background

The Fish and Wildlife Compensation Program (FWCP) is a partnership between BC Hydro, the Province of B.C., Fisheries and Oceans Canada, First Nations and Public Stakeholders to conserve and enhance fish and wildlife in watersheds impacted by BC Hydro dams. FWCP's vision is to have thriving fish and wildlife populations in watersheds that are functioning and sustainable. Their objectives are: **conservation** - maintain or improve the status of species or ecosystems of concern. Maintain or improve the integrity and productivity of ecosystems and habitats; **sustainable use** - maintain or improve opportunities for sustainable use, including harvesting and other uses. Harvesting includes First Nations, recreational, sport and commercial harvests. Other uses may include cultural, medicinal, or non-consumptive uses; and **community engagement** - build and maintain relationships with stakeholders and aboriginal communities. The objective stems from BC Hydro's social responsibility policy and the Province of B.C. shared stewardship objective.

The W.A.C. Bennett Dam is a large hydroelectric dam built by BC Hydro and completed in 1968 on the Peace River in northern B.C. The dam blocks the Finlay, Parsnip and Peace Rivers, feeding them into Williston reservoir, which runs 250km north-south, 150km east-west and flooded approximately 350,000 acres of former forest land (Stanley 2010). The flooding of the reservoir was done with little, if any, consultation with local First Nations and resulted in the loss of traditional lands including plants and wildlife biodiversity and social displacement (Loo 2007). Indeed, a BC Hydro consultant admitted in 1977 that the "isolation imposed by the reservoir had severe impacts on Ingenika society and culture" (Mitchell 1994).

In 1990, the B.C. Ministry of Environment with funding from Peace/Williston Fish & Wildlife Compensation Program, began a kokanee stocking program for Williston Reservoir in an effort to create a self-sustaining kokanee recreational fishery. Two native kokanee populations occur in headwater lakes in the Finlay (Thutade Lake) and Parsnip (Arctic Lake) drainages (Langston and Zemlak 1998). Stream-spawning kokanee from Arrow Reservoir (Hill Creek) and Kootenay Lake (Meadow Creek) were stocked extensively in tributaries of Williston Reservoir from 1990 to 2005 (2005 cumulative total of 1.7 million in tributaries to the Peace reach; 2.1 million in tributaries of the Parsnip reach; and 75,000 in the Finlay reach) (Langston and Murphy 2008). Reservoir creation has favoured kokanee populations as they are a pelagic lake-dwelling species (Euchner 2011).

Since their introduction in the mid-1990s, kokanee have been gradually increasing in abundance, and they have recently overtaken Lake Whitefish as the most abundant species in Williston Reservoir. It has been predicted that kokanee numbers would continue to increase due to favourable conditions in the reservoir (Sebastian *et al.* 2009). In 2000, it was estimated that kokanee comprised up to 14% of the pelagic fish abundance in Williston Reservoir. Captures from the Peace reach in 2008 revealed that

kokanee may comprise up to 90% of all pelagic species in this region of the reservoir. In 2000 the estimated Williston Reservoir kokanee population was 0.8- 1.3 million fish, and more recent estimates (2008) have been as high as 9 million (Sebastian *et al.* 2009).

Understanding the influence of non-native kokanee has been identified as a high priority for First Nations, and the FWCP has identified the need for a kokanee assessment study that will “*summarize status, trends, and aquatic and terrestrial ecosystem impacts and potential ecological risks associated with kokanee introductions. This study would also develop appropriate recommendations for actions, as needed*” (Action: 2a-1 in the Reservoirs Action Plan)<sup>1</sup>. In addition to kokanee, the FWCP is also interested in gathering First Nation people’s knowledge, concerns and priorities related to bull trout (*Salvelinus confluentus*) and Arctic Grayling (*Thymallus arcticus*) and their habitat in the region to inform the bull trout directed project (Action: 1c-1 in the Streams Action Plan).<sup>2</sup> First Nations people are recognized as key knowledge holders and including First Nations people’s knowledge, concerns and priorities related to kokanee and bull trout is necessary for the success of the projects and a core objective of the FWCP. It is important to ensure First Nations people’s concerns and priorities are addressed, especially when making recommendations for future actions.

### 1.1 Goal

To record Tse'khene First Nations knowledge, concerns and priorities related to kokanee, bull trout and arctic grayling in the tributaries of the Williston Reservoir to guide priorities for future FWCP projects, monitoring, conservation and enhancement actions.

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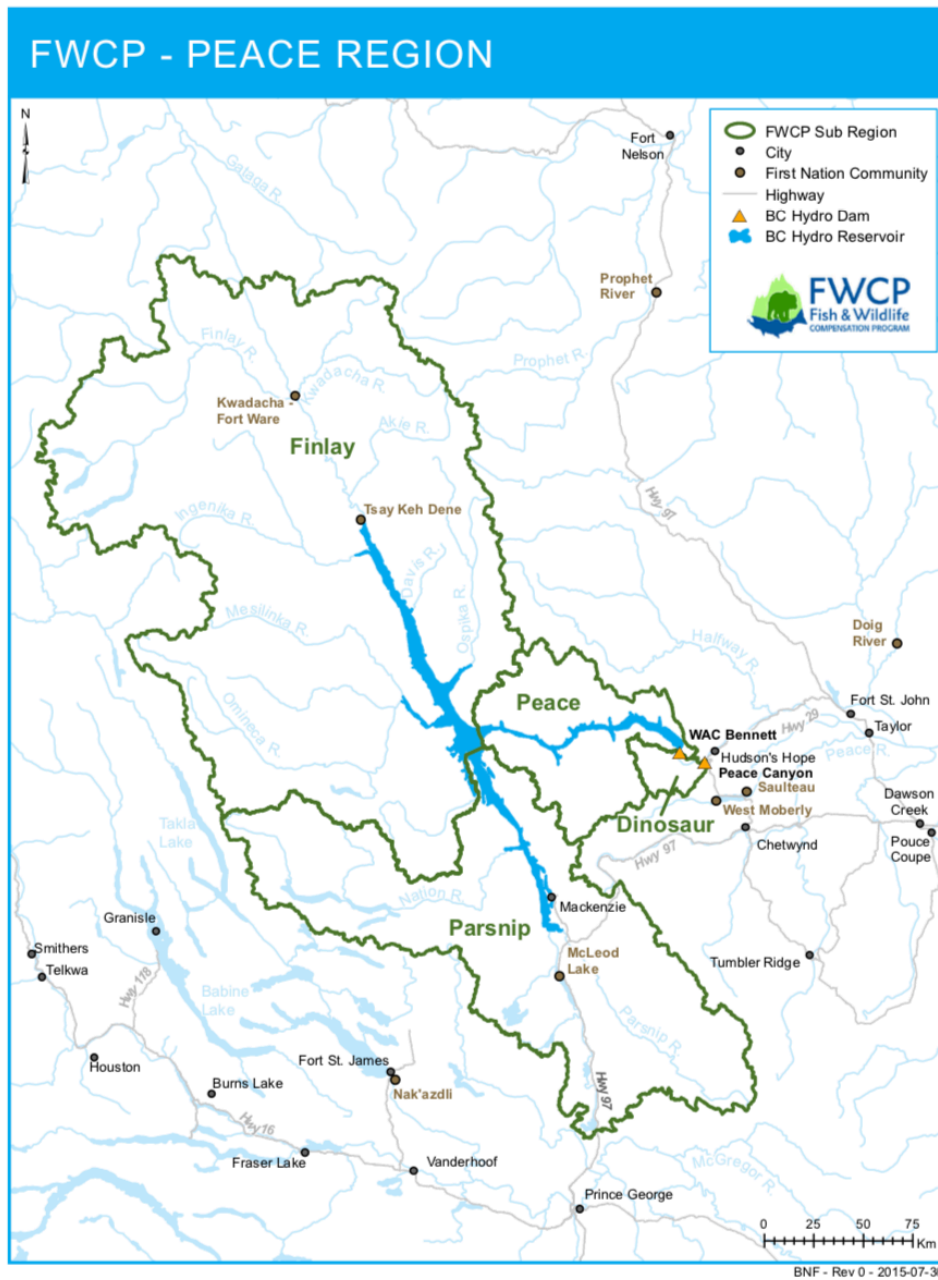
<sup>1</sup> <http://fwcp.ca/app/uploads/2015/07/fwcp-peace-reservoirs-action-plan-march-31-2014.pdf>

<sup>2</sup> <http://fwcp.ca/app/uploads/2015/07/fwcp-peace-streams-action-plan-march-31-2014.pdf>



## 1.2 Study Area

The project focuses on the tributaries to the Williston Reservoir and surrounding habitat. This includes the territories of the Sekani people represented by Tsay Keh Dene Nation, Tse'khene (McLeod Lake) and Kwadacha Nation as well as parts of non-Sekani peoples including the Nak'azdli Whut'en, Saulteau and West Moberly.



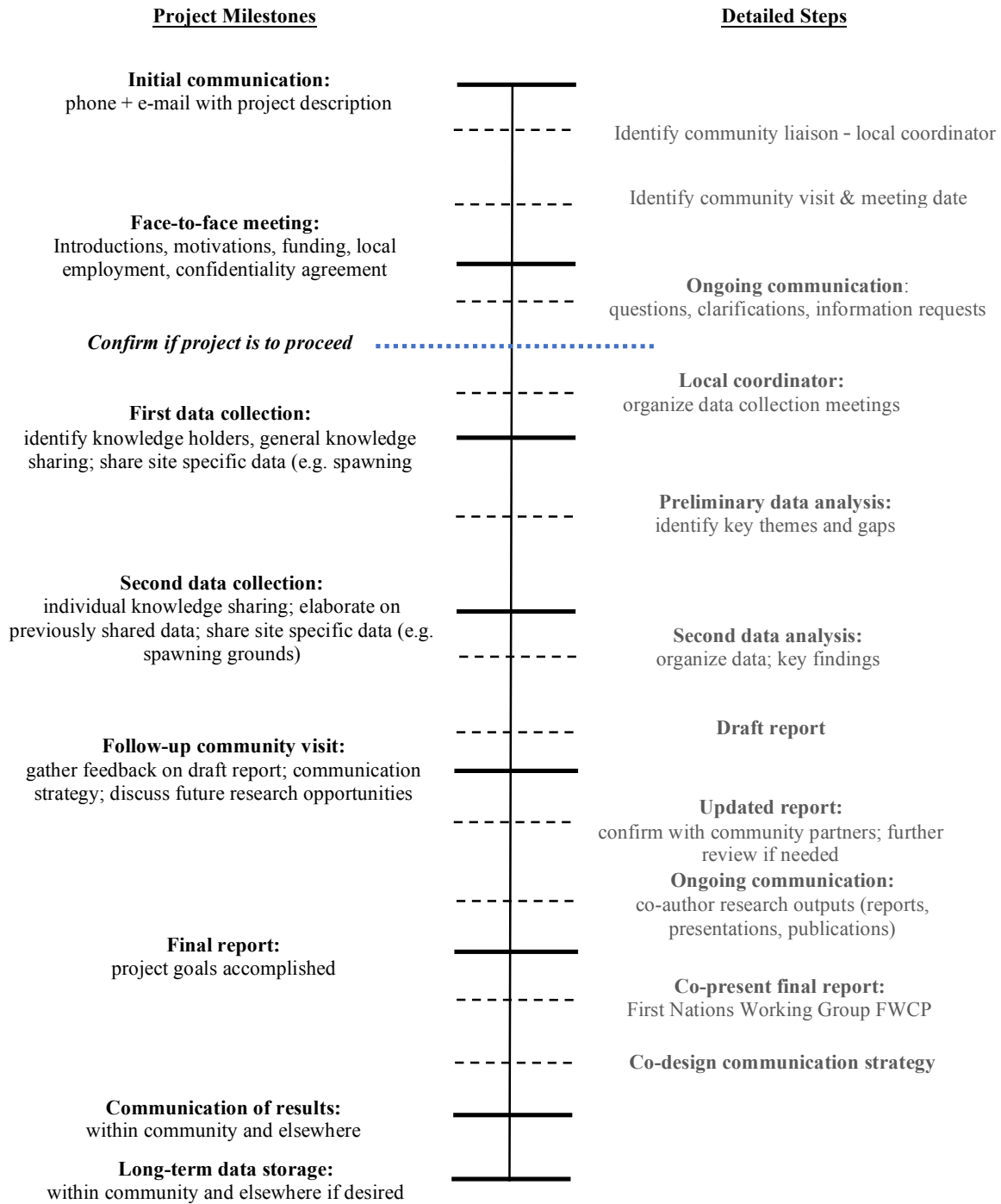
**Figure 1.** Map showing the Williston Reservoir, surrounding tributaries and lands, BC Hydro dams, the location of First Nations communities and cities, and the FWCP sub-region, in B.C., Canada.

## **2.0 Research Approach**

*FWCP Objective: build and maintain relationships with stakeholders and aboriginal communities.*

Accomplishing the project aim necessitates working closely with First Nations people in communities and building relationships with knowledge holders. Relationship building is critical to the success of the project; studies that fail to build relationships may never get started and for those that do, the information collected may not represent the most rigorous knowledge available, with potential deleterious outcomes for end-users. Efforts are needed to build equitable, mutually beneficial relationships between communities and researchers to facilitate the sharing and documentation of First Nations knowledge.

The following approach is offered as a consideration for how First Nations could be involved in research to share their knowledge, concerns and priorities related to their lands, fish and wildlife (see Figure 2). The approach is flexible and iterative, and will be adapted to the specific context of each research project and the First Nations involved. This includes following local protocols and guidelines for working with people and their knowledge, and designing the research together with the people who are the focus of the study. The amount of time and effort needed to accomplish the research goal depends on the amount of time it takes to build mutually beneficial, trust-worthy community-researcher relationships. This will be determined by First Nations who will govern the research process, including the collection, analysis, sharing and storage of results.



**Figure 2.** Considerations for working with First Nations people to record their knowledge, concerns and priorities related to their lands, fish and wildlife

## 2.1 Tse'khene, McLeod Lake Indian Band Communication and Outreach Timeline

### Initiate communications:

- e-mail communication between Tristan Pearce (researcher) and Arlene Solonas (FWCP First Nations Working Group member for McLeod Lake, 26-SEPT-2018
- phone discussion about project goals, motivations, funding, opportunities for local employment, confidentiality, etc., 11-OCT-2018

*Confirm project is to proceed:* Arlene confirms that the McLeod Lake Indian Band supports the project to proceed, 23-OCT-2018

### First data collection:

- meeting at McLeod Lake band office in McLeod Lake: eleven Tse'khene Elders, three researchers (T. Pearce, S. Lieske, J. Gordon) and one local coordinator (Arlene Solonas), 10:00am-4:00pm, 13-NOV-2018

### Second data collection:

- meeting at McLeod Lake band office in McLeod Lake: ten Tse'khene Elders, three researchers (T. Pearce, S. Lieske, J. Gordon) and one local coordinator (Arlene Solonas), 10:00am-2:00pm, 14-NOV-2018

### Follow-up community visit:

- meeting at McLeod Lake band office in McLeod Lake: eight Tse'khene Elders, one researcher (T. Pearce), 10:00am-2:00pm, 04-DEC-2018

*Review draft report:* updated draft report shared with three Tse'khene Elder reviewers (Alec Chingee, Andrew Solonas, Georgina Chingee), 2-JAN-2019

*Reviewer feedback received and integrated into new draft,* 22-JAN-2019

### **Ongoing communications:**

- confirm updated report, co-author research outputs, co-present final report to FWCP First Nations Working Group.

*Feedback received from John Hagen & Chelsea Codie (FWCP); updated report,* 12-FEB-2019

### Final report:

- project goals accomplished
- spatial data uploaded to FWCP databases and kept as "secured status" with permission of Tse'khene First Nation

### Communication of results:

- copies of the report shared with the McLeod Lake Indian Band
- in-person presentation in McLeod Lake by FWCP of project findings

### Long-term data storage:

- McLeod Lake Band Office and FWCP

## 2.2 Tse'khene Names of Fish Species

**Table 1.** Tse'khene and English names for fish species

<b>Tse'khene</b>	<b>English</b>
lhoowe	fish
taloo'azi	kokanee
duk'ayi	lake trout
dusk'ihje	arctic grayling
sa'ba	bull trout
lhooh'tuz'se	white fish
daltsi	peamouth / chub
toosdlozi / tsin'tail	ling cod
goos'bai	sucker
duskduli	sucker (red)
tse'tso tse	small bottom feeders (look like lingcod)

### 3.0 Methods

#### 3.1 Participants

This report draws on face-to-face conversations and participatory mapping with 23 Tse'khene Elders (60+ years of age) to document knowledge, concerns and priorities related to kokanee, bull trout and arctic grayling in the tributaries of the Williston Reservoir and the reservoir itself. We sought people with experience fishing in the tributaries of the Williston Reservoir and who live in the area (tables 2).

**Table 2:** Tse'khene Elders who participated in the project

1. Veronica Seymour	9. Boris Boyko	17. Anita Vallie
2. Albert Chingee	10. Agnes Solonas	18. Doris Leclair
3. Marilyn Isadore	11. Lawrence Solonas	19. Elizabeth Solonas
4. Jane Inyallie	12. Albert Isadore	20. Georgina Chingee
5. Andrew (Andy) Solonas	13. Gracie Solonas	21. Zepheria Isadore
6. Arlene Solonas	14. Seraphine Inyallie	22. Patrick Prince
7. Doris Solonas	15. Julie Cooper	23. Alec Chingee
8. Sharon Solonas	16. Doreen Isadore	

#### 3.2 Participatory Mapping & Interviews

Participatory mapping involved participants being asked to express and spatially identify on a map, their knowledge, concerns and priorities related to kokanee, bull trout and arctic grayling in the tributaries of the Williston Reservoir and the reservoir itself (see Appendix I: interview guide). Data collection started by having all participants contribute to a group discussion and then moved into smaller groups, each who worked with one of the three researchers to record their information. Data were audio, video, and/or written recorded (including on digital and hard-copy maps of the study area).

#### 3.3 Data Analysis

Interviews data were analysed using latent content analysis. Information shared during focus groups and interviews were transcribed and then coded based on common and recurring themes related to the project foci: kokanee, bull trout, arctic grayling, concerns, and management priorities. Site specific spatial data for each fish species were presented on a Google Earth platform.

## 4.0 Results and Discussion

The findings presented here are complemented with site specific spatial data for kokanee, bull trout and arctic grayling documented in a Google Earth kmz file. The Google Earth file is stored at the McLeod Lake Band Office and with FWCP.

**Google Earth Spatial Data:** [Tse'Khene Nation McLeod Lake Kokanee, Bull Trout and Arctic Grayling Information.kmz]

### 4.1 General findings

General findings that provide context to the information shared about individual fish species include:

- a notable decline in the abundance and health of fish, wildlife and wild food sources (e.g. berries) over the past 50+ years since the Williston Reservoir was flooded, with accelerated changes observed in the last 20 years; and
- a shift in fishing activity away from the Parsnip River to waterways further south of the reservoir since its flooding.

Participants have a holistic, integrative perspective of the environment and consider individual species of fish as part of a broader complex web of relationships. In conversations about fish, participants often spoke about other changes in the environment, which may influence fish population health. In general, participants described there being less of everything: less wildlife (moose, bear, porcupine, grouse, song birds, frogs etc.), less fish (and smaller size), less berries, and less snow. It was reported that there is less abundance in the environment generally compared to when participants were growing-up pre-reservoir (50+ years ago) and this has become more pronounced in recent years: porcupine and grouse have become scarce and trappers report catching fewer marten; there are fewer moose and the body condition of those harvested has declined; frogs have all but disappeared from the local waterways; and bull trout (*Salvelinus confluentus*), a preferred fish of many participants, are now more difficult to catch and they are generally smaller in size. The snowpack has decreased, extreme forest fire events have increased, and water levels in McLeod Lake and area rivers and streams were at their lowest in memory in the fall of 2018. These, and other changes, interact to negatively affect fish and their habitat.

Participant's fishing activities have changed since the flooding of the reservoir. A large portion of the Parsnip River was lost to flooding and with it many tributaries that were once important to participants and their families for fishing. Since the flooding of the reservoir, people have shifted their fishing activities from the Parsnip River to areas further south of the reservoir in the McLeod Lake area (e.g. Pack River, McLeod Lake) and particularly waterways that are further removed from the reservoir

watershed (e.g. Carp Lake). This is in part due to the direct loss of fishing areas but also because of concerns about the health of fish, notably mercury and other pollutant levels, in the reservoir and its tributaries.

#### 4.2 Kokanee, *Talo'azi*, (*Oncorhynchus nerka*)

Participants do not actively fish for kokanee. Apart from a few lakes where natural populations of kokanee are found, Salmon Lake (54.8773°, -123.823°), Tacheeda Lakes (54.7006°, -122.5435°) and Fishhook Lake (54.6341°, -122.6053°). kokanee populations in Tacheeda Lake and Fishhook Lake are considered stable and unknown in Salmon Lake. Elsewhere, kokanee populations are believed to be increasing since the Government's stocking efforts. Since 1990, participants have caught kokanee (non-target species) in the southern reach of the Williston Reservoir between approximately Scott Creek (66) to the north and Cut Thumb Creek (71) to the south, and in the Finlay River (23) and Nation River (1) watersheds (see Appendix II for river and stream numbers). Participants shared concerns that introduced kokanee might out-compete other species of fish like bull trout and arctic grayling, and suggested prioritizing streams that flow directly into the Williston Reservoir for kokanee spawning surveys with a specific focus on streams within the Parsnip River (76), Omineca (9) and Nation River (1) watersheds (Table 3).



**Table 3.** Watershed names and stream sections where Kokanee and/or Bull trout are spawning, concerns and priorities (numbers correspond with Appendix II)

<b>Watershed name</b>	<b>Stream section</b>	<b>First Nations Name</b>	<b>Kokanee spawning</b>	<b>Bull Trout spawning</b>	<b>Concerns</b>	<b>Priorities</b>
Parsnip (76)						
	Weston C (67)		?		kokanee may be spawning; competing with other species of fish	kokanee spawning survey
	Misinchinka R (77)		?		kokanee may be spawning; competing with other species of fish	kokanee spawning survey
	Colbourne C (78)		?		kokanee may be spawning; competing with other species of fish	kokanee spawning survey
	Reynolds C (79)		?		kokanee may be spawning; competing with other species of fish	kokanee spawning survey
	Anzac R (80)		?		kokanee may be spawning; competing with other species of fish	kokanee spawning survey
	Wooyadilinka C (81)		?		kokanee may be spawning; competing with other species of fish	kokanee spawning survey
	Tacheeda C (82)		?		kokanee may be spawning; competing with other species of fish	kokanee spawning survey
	Table R (83)		?		kokanee may be spawning; competing with other species of fish	kokanee spawning survey
	Hominka R (84)	<i>Hi'eme ga'h</i>	?		kokanee may be spawning; competing with other species of fish	kokanee spawning survey
	Missinka R (85)		?		kokanee may be spawning; competing with other species of fish	kokanee spawning survey
	Wicheika C (86)		?		kokanee may be spawning; competing with other species of fish	kokanee spawning survey
	<b>Arctic Lake outlet (87)</b>		?	✓	<b>kokanee may be spawning; competing with other species of fish</b>	<b>High priority kokanee and bull trout spawning surveys</b>

	<b>Arctic Lake inlet (88)</b>		?	✓	<b>kokanee may be spawning; competing with other species of fish</b>	<b>High priority kokanee and bull trout spawning surveys</b>
Omineca (9)	Wolverine L outlet (10) (Manson R trib.)	<i>No'wameghe</i>			Kokanee have been observed in Omineca River and tributaries	kokanee spawning survey
	<b>Upper Manson R (11)</b>				Kokanee have been observed in Omineca River and tributaries	<b>High priority kokanee and bull trout spawning surveys</b>
	<b>Big (Omineca R trib.) (14)</b>				Kokanee have been observed in Omineca River and tributaries	<b>High priority kokanee and bull trout spawning surveys</b>
	Germansen R (Omineca R trib.) (15)				Kokanee have been observed in Omineca River and tributaries	kokanee spawning survey
Nation (1)	<b>Manson R (5) (Reservoir to Manson Lakes)</b>		?	✓	Kokanee have been observed in Manson River and tributaries	<b>High priority kokanee and bull trout spawning surveys</b>
	Ciarelli C (6) (Manson R trib.) aka Donna		?		Kokanee have been observed in Manson River and tributaries	kokanee spawning survey
	Gaffney C (7) (Manson R trib.)		?		Kokanee have been observed in Manson River and tributaries	kokanee spawning survey
	Munro C (8) (Manson R trib.)		?		Kokanee have been observed in Manson River and tributaries	kokanee spawning survey
Crooked River (89)			?	✓	Important fishing area for community members and concerns about declining numbers, size and health of bull trout	<b>High priority bull trout spawning surveys</b>
Pack River (118)			?	✓	Important fishing area for community members and concerns about declining numbers, size and health of bull trout	<b>High priority bull trout spawning surveys</b>

#### 4.3 Bull Trout, *Duk'ayi*, (*Salvelinus confluentus*)

Participants fish in the lakes, rivers and tributaries connected to the Williston River (e.g. mouths of the Pack and Parsnip Rivers) but seldom fish in the reservoir itself. They shared that the Pack River (118) and Crooked River (89) watersheds and McLeod Lake (54.928, -122.977) and Carp Lake (54.764, -123.344) are particularly important to Tse'khene for fishing. When asked what watersheds and streams they would prioritize for bull trout spawning surveys, participants identified (Table 3):

- Arctic Lakes (outlet 87 and inlet 88)
- Upper Manson River (11)
- Big (Omineca River tributary) (14)
- Manson River (5)
- Pack River (118)
- Crooked River (89) (upstream to Summit Lake)

Participants shared that the number of bull trout in the waterways that they fish are decreasing, they are smaller in size, there are more diseased and injured fish, and the meat tastes different than in the past (pre-reservoir). "Now there is less of everything," says Boris Boyko about the decline in fish populations including bull trout since the flooding of the reservoir. "What concerns me the most is that there is not abundance anymore...even with the fish, we get our fish from our friends who go fishing for salmon" (Georgina Chingee). Bull trout have gone from a couple pounds to less than a pound and it is increasingly difficult to catch bull trout that are over the legal size (<30cm length).

"After the lake (Williston Reservoir) it just tasted weird some of them tasted like uh, I don't know, it's just because of the way I ate fish all my life and as soon as the lake changed and came in I could tell the difference. It just had a really bland taste. An also another thing I noticed is the fish, you know, they look awkward, like they have been injured or they have growth on them, and they seem to have more fish lice." - Georgina Chingee

Participants attribute changes in the population and health of bull trout to the cumulative impacts of the flooding of the reservoir (e.g. loss of the Parsnip River and many of its tributaries to flooding), logging and herbicide spraying, more people fishing at fewer streams and lakes (First Nation and non-First Nation), climate change, mining, and natural gas development (discussed in section 4.5).

#### 4.4 Arctic Grayling, *Dusk'ihje*, (*Thymallus arcticus*)

Participants report catching arctic grayling infrequently in the following rivers and creeks:

- Parsnip River (76) from Arctic Lake to the reservoir. In particular, between Arctic Lake and Tacheeda Lakes (54.7006°, -122.5435°).
- Reynolds Creek (79)
- Finlay River (23). In particular, at the north end of the reservoir.
- Nation River (1)

When asked "what changes have you observed in the distribution and abundance of arctic grayling since flooding?" the common response was that everywhere on the Parsnip River and every tributary used to be good for arctic grayling. Since the flooding of the reservoir, the population of grayling has significantly declined.

"Grayling used to be in this watershed, they were in the Parsnip River and any tributary that has this fresh, it was like mountain water, it was green water, it was all green rivers, and they were cold, and arctic graylings would live in this kind of environment, and all the rivers like the Finlay River, the Mesilinka, Osilinka, the Ospika, Parsnip River, the Nation River, the Manson River, and all these rivers flowed in and down the Peace Arm. And from where the dam is now there used to be a canyon there and on this side of the dam there were arctic grayling and they were plentiful. When I was young, I remember my dad, we used to always have a river boat, and we'd be coming from the trap line, and my dad would stop anywhere along the river to have lunch or something and you would cast a line out and every second catch you would catch a grayling and now there are no graylings left. Because of this lake [reservoir], it warmed up the temperature of the water and the fish couldn't survive in this environment, they needed that fresh mountain water and so they pretty much now are depleted. The last grayling I caught was probably about 15-20 years ago and I don't see anyone catching any anymore." - Boris Boyko

Alec Chingee explains that arctic grayling no longer use the reservoir to migrate from stream to stream because the water temperature in the reservoir has become too warm. Consequently, there are fewer, if any, grayling in rivers and tributaries where they were before the flooding.

## 4.5 Concerns

Direct impacts of the Williston reservoir on fish and fish habitat are being experienced together with a suite of cascading effects, which also negatively affect fish, their habitat and Tse'khene who depend on them for food. Some of these effects can be directly or indirectly attributed to the flooding of the reservoir whereas others are the result of broader changes.

### *4.5.1 Increased access to ancestral lands by industry as a result of the reservoir*

Increased access to ancestral lands has resulted in damage to fish spawning habitat, herbicide spraying of forests, which leaches into rivers and lakes and harms fish, and logging old-growth in parts of the watershed important for fish spawning. There is ongoing worry about the impact of natural gas exploration and extraction, notably fracking, on the amount and quality of water in the watershed. Some participants have observed fish bearing creeks damaged and cut-off from other tributaries by logging activities and recent salvage logging for beetle infected trees has come too close to some streams and lakes with suspected negative impacts on fish habitat.

Participants spoke about logging companies spraying herbicide (glyphosate formulations) on regenerating forests as a major concern affecting ecosystem health. There is consensus that spraying is harming fish and wildlife and consequently the health of people who depend on them for their livelihoods. Zepheria Isadore shares her dismay with the spraying.

"One time when I went to Anzac [River], and they were spraying that thing there, I say why are you guys spraying that thing here? I said that is why you guys kill all those berries, everything, soap berries, everything we eat. Even chicken [grouse], even chicken eat those willows too and those moose eat willow too, those red willow, there I tell them why you guys spraying that thing there for, I told them, they said forestry tell us to do it. You guys you better quit now, I said get away from our land I said if we did that to your land, if we ruined all what you live off in this land like that, if you got cow and we did that to your cow, if your cow dying off like that, then you going sue us I said, but of course we don't say nothing we're Indian, that is why you guys walk over us I told them right in their face." - *Zepheria Isadore*

An immediate and pressing threat to critical fish spawning habitat identified by some participants is the logging of old-growth forests. Some participants are concerned that logging companies are moving further into the watershed in search of marketable trees without regard for the broader ecosystem services that old growth provide. Andy Solonas shares his frustration:

"they always talk about future generations but what do they do about it? Take away all their resources, mine everything, fall everything, that includes the trees and you know, in the end what are the children, how are they going to live?"

He goes on to say that protecting old growth forest will require the Band enforcing its treaty rights and working with the Government to identify and protect remaining old growth before it is all gone.

#### 4.5.2 Increased access to the watershed by other First Nation and non-First Nation fishers putting pressure on a limited fish stock

There is concern that more fishers, non-First Nation and First Nation from other nations, are fishing in Tse'khene territory. This increased fishing pressure has participants concerned that some lakes and streams are being fished-out and many of the larger fish are being removed from the system. For example, Carp Lake (54.764, -23.344) is a favourite fishing place for rainbow trout for many participants because, "there the fish seems to taste better" (Georgina Chingee). In recent years, however, participants have observed a decrease in the size of rainbow trout caught in Carp Lake.

"We used to catch some nice trout here, like a couple pounds, they all went down to just small little pan fries and they are not even worth fishing for. They don't have enough time to grow, people are catching them so there are less and less fish, it is being out-fished." - *Boris Boyko*

River boats are also an issue, especially at spawning time, and participants report river boats driving irresponsibility with the wake eroding shoreline spawning grounds and disturbing traditional fishing activities. High priority rivers include, but are not limited to, the Pack River (118) and Crooked River (89).

#### 4.5.3 Mercury levels in fish

There is concern and uncertainty among participants about the level of mercury in fish since the flooding of the reservoir and the safety of fish for human consumption. Participants also point to the Mackenzie pulp mill as another source of pollution that they believe is affecting local waterways and fish. Participants shared that scientists have conducted studies on mercury levels in fish but they were unclear as to what the studies recommend for consuming fish. This uncertainty has created fear and some participants no longer eat fish from the local waterways because they are unsure if it is healthy to do so. Despite previous efforts to communicate the findings of mercury studies in fish with Tse'khene, it is apparent that more needs to be done to ensure that Tse'khene have up-to-date and accurate information about the health of their fish in ways that are appropriate to them. Boris Boyko shares his concern about mercury levels in fish.

"I found out now that there is mercury in these char. They are coming from the Williston lake, which is getting mercury infested from the dead trees and also from the pulp mill in Mackenzie, so all these, the fish have mercury in it, and the bigger the fish the older the fish, the more mercury they have. So that kind of deterred me from going after Dollyies<sup>3</sup> now so now I don't even bother fishing." - *Boris Boyko*

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<sup>3</sup> In the Williston Reservoir watershed, the fish that people sometimes call "Dollies" are actually bull trout (*Salvelinus confluentus*).

#### *4.5.4 Kokanee as an introduced species*

Participants expressed dissatisfaction with the Government's kokanee stocking program. They are unhappy when they find kokanee in streams and rivers where they are not naturally occurring and fear that kokanee are affecting native fish populations. Participants have observed changes in wolf and bear behaviour since the introduction of kokanee and wonder what this means for the broader ecosystem. Wolves and bear have been observed feeding on dead kokanee on the northwest shores of the Williston Reservoir and participants shared their concerns that this could disrupt the natural feeding and movement patterns of large carnivores.

#### *4.5.5 Climate change*

Observed changes in the climate include warmer temperatures in the winter, warmer water temperatures in rivers and lakes, thinner ice cover on lakes and rivers, changes in precipitation (less snow), less predictable weather, and very low river levels. "The water is so low it is ridiculous, I have never seen it so low before." Georgina Chingee shares referring to water levels in the local rivers in September 2018. In some instances, water levels in some creeks and rivers has gotten so low that they are no longer suitable for fish. Participants are concerned that the temperature of the water in some streams has become too warm for arctic grayling and bull trout to spawn. For example, the glacier that once fed into Arctic Lake is gone and participants surmise that the water temperature has risen. The water levels in rivers is very low and there is concern that large rivers like the Crooked River are too shallow for some fish to travel and spawn, whereas some smaller creeks have dried up preventing any fish movements.

#### 4.6 Management priorities - Recommendations

Participants offer recommendations for addressing concerns affecting fish and fish habitat (Table 4). Recommendations that are within the FWCP's mandate include: (1) communicate the findings of studies on mercury levels in fish with Tse'khene in relevant and culturally appropriate ways. Communication should be clear and ongoing to ensure that people are confident in the health of the fish they eat; (2) study and monitor fish and fish habitat in different locations and at different times of the year and involve youth. Priority should be given to bull trout as they are a preferred fish to eat and arctic grayling because Elders used to fish for them and would like to know more about their status in the watershed. Some priority streams for future studies and monitoring are identified in section 4.3 and Table 3; (3) conduct stream surveys to study and monitor the effects of kokanee in the ecosystem. High priority streams for kokanee and bull trout spawning surveys are documented in Table 3; (4) develop a Tse'khene led monitoring program to track changes in the land, fish and wildlife; and (5) develop educational curricula to teach in local schools about the impacts of BC Hydro dams on the land, fish, wildlife and people, and skills needed to address these impacts.

Recommendations outside the FWCP's mandate include: (1) educate non-Tse'khene fishers about the area and limit the number of non-Tse'khene fishers using the area. Ban river boats on some rivers and enforce regulations on other rivers. Priority rivers are the Pack River (118) and Crooked River (89); (2) stop herbicide spraying, protect areas that have yet to be logged or sprayed, and study and rehabilitate areas that have been sprayed; (3) protect remaining old-growth forest and focus logging activities on second growth; and (4) stop fracking and enhance monitoring and enforcement of forestry practices code. Taken together with ongoing input and involvement from Tse'khene, these insights could guide priorities for future FWCP projects, monitoring, conservation and enhancement actions on Tse'khene territory.



**Table 4.** Summary of concerns, observed effects and management priorities identified by Tse'khene Elders that are within and outside the FWCP's mandate

Concerns	Observed effects	Management Priorities within FWCP Mandate	Management Priorities outside FWCP Mandate
Mercury levels in fish	<ul style="list-style-type: none"> <li>• Uncertainty about what species of fish are healthy to eat, at what quantity and frequency, and from which rivers and streams</li> </ul>	<ul style="list-style-type: none"> <li>• Communicate the findings of studies on mercury levels in fish with Tse'khene in relevant and culturally appropriate ways.</li> <li>• Communication should be clear and ongoing to ensure that people are confident in the health of the fish they eat</li> </ul>	
Increased access to ancestral lands by industry as a result of the reservoir <ul style="list-style-type: none"> <li>⇒ herbicide spraying</li> <li>⇒ natural gas development</li> <li>⇒ logging</li> <li>⇒ logging old-growth</li> <li>⇒ mining</li> </ul>	<ul style="list-style-type: none"> <li>• Poisoning vegetation and waterways, fish and wildlife</li> <li>• Damage to critical fish spawning habitat</li> <li>• Concerned about impacts of fracking on water quantity and quality</li> <li>• Logging has damaged fish-bearing streams</li> </ul>	<ul style="list-style-type: none"> <li>• Study and monitor fish and fish habitat in different locations and at different times of the year and involve youth.</li> <li>• Priority should be given to bull trout as they are a preferred fish to eat and arctic grayling because Elders used to fish them and would like to know more about their status in the watershed.</li> </ul>	<ul style="list-style-type: none"> <li>• Stop herbicide spraying</li> <li>• Protect areas that have yet to be sprayed</li> <li>• Study and rehabilitate areas that have been sprayed</li> <li>• Protect remaining old-growth forest and focus logging activities on second growth</li> <li>• Stop fracking</li> <li>• Enhance monitoring and enforcement of forestry practices code</li> </ul>
Kokanee as an introduced species	<ul style="list-style-type: none"> <li>• Kokanee present in rivers and tributaries that they are not native to</li> <li>• Observed changes in wolf and bear behaviour; feeding on dead kokanee</li> </ul>	<ul style="list-style-type: none"> <li>• Conduct stream surveys to study and monitor the effects of kokanee in the ecosystem</li> </ul>	
Increased access to the watershed by other First Nation and non-First Nation fishers putting pressure on a limited fish stock. <ul style="list-style-type: none"> <li>⇒ river boats, shoreline erosion, spawning and disturbance</li> </ul>	<ul style="list-style-type: none"> <li>• Increased fishing pressure on local waterways</li> <li>• River boats operated irresponsibly damage shoreline spawning grounds and disturb traditional fishing activities</li> </ul>	<ul style="list-style-type: none"> <li>• Develop a Tse'khene led monitoring program to track changes in the land, fish and wildlife. <i>(relates to all concerns)</i></li> <li>• Develop educational curricula to teach in local schools about the impacts of BC Hydro dams on the land, fish, wildlife and people, and skills needed to address these impacts. <i>(relates to all concerns)</i></li> </ul>	<ul style="list-style-type: none"> <li>• Educate non-Tse'khene fishers about the area and limit the number of non-Tse'khene fishers using the area</li> <li>• Ban river boats on some rivers and enforce regulations on other rivers</li> </ul>
Climate Change	<ul style="list-style-type: none"> <li>• Warmer water temperatures and lower water levels in some creeks and rivers negatively affecting fish</li> </ul>	<ul style="list-style-type: none"> <li>• Study and monitor fish and fish habitat in different locations and at different times of the year and involve youth.</li> <li>• Develop a Tse'khene led monitoring program to track changes in the land, fish and wildlife. <i>(relates to all concerns)</i></li> </ul>	

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## APPENDIX I

### Interview Questions - First Nations Information Gathering on Kokanee and Bull Trout

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#### **Background:**

The Fish and Wildlife Compensation Program (FWCP) has identified the need for a kokanee assessment study that will summarize status, trends and ecosystem impacts, and develop recommendations for actions. The FWCP also has an ongoing bull trout directed project that will review existing information, summarize status and trends, undertake actions that lead to the development of conservation and enhancement, and develop a cost-effective monitoring program.

This project will work with First Nations in the area to record knowledge, concerns and priorities related to kokanee and bull trout in the tributaries of the Williston Reservoir to guide priorities for future FWCP projects, monitoring, conservation and enhancement actions.

#### **Questions:**

##### **Part 1: Background**

1. first and last name:
2. e-mail and phone #:
3. First Nation:
4. how long have you fished these waters?

##### **Part 2: Fishing**

5. which fish species are important to you and why?
6. do you catch all these species now? If not, why not?
7. what streams and rivers are important to you for fishing?

##### **Part 3: Fish Species**

##### ***Bull trout***

8. what is the local name for Bull trout?
9. which streams are most important to Bull trout for spawning and why?
10. where is the best place to catch Bull trout and why?
11. what size are they when you catch them?

12. are the numbers of Bull trout increasing, decreasing or stable and why?
13. are Bull trout healthy? If not, why not? For how long has this been a problem?
14. what changes have you observed in the distribution and abundance of Bull trout since flooding?

***Arctic Grayling***

15. what is the local name for arctic grayling?
16. which streams are most important to arctic grayling for spawning and why?
17. where is the best place to catch arctic grayling and why?
18. what size are they when you catch them?
19. are the numbers of arctic grayling increasing, decreasing or stable and why?
20. are arctic grayling healthy? If not, why not? For how long has this been a problem?
21. what changes have you observed in the distribution and abundance of arctic grayling since flooding?

***Kokanee***

***(specify if speaking about non-native stocked Kokanee from the 1990s or native Kokanee)***

22. what is the local name for Kokanee?
23. which streams are most important to Kokanee for spawning and why?
24. where is the best place to catch Kokanee and why?
25. what size are they when you catch them?
26. are the numbers of Kokanee increasing, decreasing or stable and why?

**Part 4: Concerns and Priorities:**

27. are you concerned about the health of the fish and/or their habitat? If so, please describe these concerns and what stream, rivers and fish species are affected.
28. what could be done to address your concerns? What actions could be taken?
29. which streams would you like to see priority given to?

**Part 5: Thank you**

30. is there anything that you would like to add that we haven't already discussed?

## APPENDIX II

List of streams where kokanee spawning surveys were previously performed (2002 - 2010)			
#	Name	#	Name
1	Nation R	29	Spinel C (Finlay R trib.)
2	Philip C (Nation R trib.)	30	Cutoff C (Finlay R trib.)
3	Rainbow C (Nation R trib.)	31	Bower C (Finlay R trib.)
4	Sylvester C (Nation R trib.)	32	Unnnamed trib #1 (Finlay R trib.)
5	Manson R (Reservoir to Manson Lake)	33	Fox R (Finlay R trib.)
6	Ciarelli C (Manson R trib.) aka Donna	34	Kwadacha R (Finlay R trib.)
7	Gaffney C (Manson R trib.)	35	Paul R (Finlay R trib.)
8	Munro C (Manson R trib.)	36	Russel C (Finlay R trib.)
9	Omineca R	37	Stelkuz C (Russel C trib.)
10	Wolverine L outlet (Manson R trib.) <i>No'wameghe</i>	38	McGraw C (Finlay R trib.)
11	Upper Manson R (above lakes)	39	Del C (Finlay R trib.)
12	Jackfish C (Omineca R trib.)	40	Blanchard C (Finlay R trib.)
13	Porter C (Omineca R trib.)	41	Truncate C (Finlay R trib.)
14	Big (Omineca R trib.)	42	Tsaydiz C (Finlay R trib.)
15	Germansen R (Omineca R trib.)	43	Akie C (Finlay R trib.)
16	Nina/ Echo C (Omineca R trib.)	44	Pesika C (Finlay R trib.)
17	Discovery C (Omineca R trib.)	45	Rubyred C (Finlay R trib.)
18	Twenty Mile C (Omineca R trib.)	46	Hydro C (Ed Bird Lake outlet)
19	Indian Meadow Creek (Omineca trib.)	47	Mesilinka R <i>Me'desl'e ga'h</i>
20	Duckling C (Omineca R trib.)	48	Gopherhole C (Mesilinka R trib.)
21	Silver C (Omineca R trib.)	49	Prospector C (Mesilinka R trib.)
22	Ogden C (Omineca R trib.)	50	Carina C (Mesilinka R trib.)
23	Finlay R	51	Lay C (Mesilinka R trib.)
24	Firesteel R (Finlay R trib.)	52	Tutizika C (Mesilinka R trib.)
25	Delta C (Finlay R trib.)	53	Osilinka R
26	Toodagone R (Finlay R trib.)	54	Thayne C (Osilinka R trib.)
27	Thudaka R (Finlay R trib.)	55	Tenakihi C (Osilinka R trib.)
28	Obo R (Finlay R trib.)	56	Wasi C (Osilinka R trib.)

57	Dead Bear C (Osilinka R trib.)	89	Crooked R
58	Clearwater R	90	Angusmac C (Crooked R. trib.)
59	Point C (Clearwater R trib.)	91	Altezege C
60	Nabesche R <i>Na'be dez'le</i> (otter tail)	92	Redrocky C (Crooked R trib.)
61	West Nabesche R	93	Weedon C (Crooked R trib.)
62	Schooler C	94	McLeod R (Crooked R trib.) <i>Me'ghe nu'jezi</i> (used to be called Long Lake)
63	Aylard C	95	Mischinsinlika C
64	Dunlevy C	96	Gagnon C
65	Carbon C	97	Chichouyenily C
66	Scott C	98	Ingenika R
67	Weston C	99	Cutbank C (Ingenika R trib.)
68	Six Mile C	100	Pelly C (Ingenika trib.)
69	Lamonti C	101	Tucha C (Pelly C trib.)
70	Patsuk C	102	Wrede C (Ingenika R trib.)
71	Cut Thumb C	103	Swannell R (Ingenika R trib.)
72	Tony C	104	Ravenal C (Swannel R trib.)
73	Tutu C	105	Chowika C
74	Mugaha C	106	Davis R
75	Morfee C	107	Bruin C
76	Parsnip R	108	Collins C
77	Misinchinka R	109	Lafferty C
78	Colbourne C	110	Ospika R <i>Us'bi ga'h</i> (Goat River)
79	Reynolds C	111	Gauvreau C (Ospika R trib.)
80	Anzac R	112	Stevenson C (Ospika R trib.)
81	Wooyadilinka C	113	Aley C (Ospika R trib.)
82	Tacheeda C	114	Bevel C
83	Table R	115	Nation Trib 1
84	Hominka R <i>Hi'eme ga'h</i>	116	Unnamed C #2(Omineca R trib.)
85	Missinka R	117	Unnanmed Ospika Arm trib.
86	Wichcika C	118	Pack R <i>Keh'sus Desli</i>
87	Arctic Lake outlet		
88	Arctic Lake inlet		

### APPENDIX III

#### *Story 1 - shared by Georgina Chingee*

Our people (Tse khene) did lots of hunting, fishing, camping, gathering medicinal plants, picking berries, seasonal trapping, basically living off the land wherever we could survive. We traded with other First Nations when times were simple, had a lot of interaction with other tribes, and we used the water ways for transportation. In the 1960s everything started to change: residential school, W.A.C. Bennett Dam, more vehicles, land claims, and less and less traditional and cultural stuff happening. Everything was becoming too commercialized, so many laws came in, which prevented us First Nation people to do our cultural thing. Also, a lot of logging came in and also those pine beetle that killed the pine trees. There have been so many changes, but we still do our own traditional cultural things in our home. All my children still do hunting, fishing and trapping, which we taught them. They were also taught by their grandparents how to survive off the land.

#### *Story 2 - Wind Cave (Ihtsi da'ghe) - shared by Georgina Chingee*

- somewhere in the Peace River closer to Finlay Forks

This is a story about how the wind cave came to be. It was the home for the wind until they flooded the Finlay River/Peace River. When the wind cave got flooded it had nowhere to go. This is why to this day Mackenzie and area get so windy and the wind is strong. This story was told to me by my grandma.

#### *Story 3 - Man Went Across (Dene Iya'stut) - shared by Georgina Chingee*

- Between Weeton Creek and Finlay Forks

This story is about a man who was travelling from across the mountains. He came to the Parsnip River and he didn't have a way to get across, so after his tiring journey he made himself some tea and went to sleep. He was a powerful medicine man who used his dreams for healing and he also used them to get across the river. The piece of ground he went across in his dream was the shape of a man. I have seen the place and that piece of ground is in the shape of a man. That was how he went across the Parsnip River and continued his journey.