INDIGENOUS RISK PERCEPTIONS AND LAND-USE IN YELLOWKNIFE, NT

by

© Amanda Degray

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ABSTRACT

For over 50 years, industrial gold mining in Wı̨ìlı̨ìcheh polluted and poisoned Dene bodies and lands with seemingly no care or concern for the First Nation's subsistence lifestyles, spiritual, or cultural practices. This thesis captures the voices, experiences, and memories of the Yellowknives Dene related to the legacy effects of industrial mining on their traditional territory. By intersecting the literatures of environmental justice, settler colonialism, and risk perception, this thesis creates a spatial narrative of environmental injustice based on the unique histories and experiences of Dene land-users living and engaging in one of Canada's most contaminant landscapes. By drawing on Indigenous land-use studies specifically, this thesis documents Dene lived experiences, perceptions of, and responses to locally sourced industrial pollution, and addresses Dene concerns and land-use practices beyond the borders of the Giant Mine Remediation Site (GMRP) site.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

CIRNAC – Crown-Indigenous Relations and Northern Affairs Canada

EJ – Environmental Justice

ER – Environmental Racism

GMRP – Giant Mine Remediation Project

INAC – Indigenous and Northern Affairs Canada

ILUOP – The Inuit Land Use and Occupancy Project

ITC - Inuit Tapirisat of Canada

LUOS – Land use and Occupancy Study

NT – Northwest Territories

NTS – National Topographic System

TEK – Traditional Ecological Knowledge

SSHRC – Social Sciences and Humanities Research Council

TLUOS – Traditional Land use and Occupancy Study

YKDFN – Yellowknives Dene First Nation

LIST OF WĮÌLĮÌDEH PLACE NAMES[1]

Akaitcho Bay – Ekécho Cheh

Baker Creek - Enda'deh

Gordon Lake - Homıìtì

Drybones Bay – Koti Deh Cheh

Tartan Rapids – Kwetaį lį

Gros Cap – Nècha Go Dò

Goulet Bay – Seh Ko Ke

Great Slave Lake – Tinde'e

Frame Lake – We'keh Dee'Om Ti

Wool Bay – Tadeh cho

Prelude Lake - Teètì

City of Yellowknife – Wag'we

Yellowknife River – Wįìlįìdeh

Yellowknife Bay – Wįìlįìcheh

Prosperous Lake – Wįìlįìtįì

[1] Yellowknives Dene place names were provided by DownNorth Consulting 2018, Fred Sangris (F. Sangris, personal communication, February 2018) and Weledeh Yellowknives Dene (1997)

LIST OF APPENDICES

PROLOGUE

During our first drive out to Detah, Yellowknives Dene Elder Fred Sangris brought me to the sacred site of *Tsi-wah cho* and told me about the creation of Wı̨ìlı̨ìdeh. A long time ago, he said, a giant beaver had built a dam at the mouth of the river, and consequently blocked the flow of the river into Tinde'e. For the Yellowknives Dene, who lived along banks of Wı̨ìlı̨ìdeh and Wı̨ìlı̨ìcheh, their years of prosperous fishing activities had come to a sudden stop. On numerous accounts, Dene ancestors tried pursuing the giant beaver only to have their canoes flipped over and be pulled underwater. One day, Yamozhà, a very powerful Dene medicine man, paddled towards the mouth of the river and struck his giant snow shovel[2] into the beaver's dam. The giant beaver, while trying to escape, pushed the dam to the east side of the mouth and escaped Yamozhà by swimming into Tinde'e. As the legend goes, the dam became stone *Kwe ka tzsoa* and Yamozhà's giant shovel became a giant spruce tree, *Tsi-wah cho*.

For generations, Dene have told their youth the story about the creation of the Wı̨ìlı̨ìdeh and Yamozhà. The giant spruce tree connects the First Nation's ancestry and identity to the Wı̨ìlı̨ìdeh and has become a sacred site for Dene spiritual, emotional, and physical healing. Importantly, it was one of the few remaining giant spruce trees in the Wı̨ìlı̨ìcheh area that had survived settler activities.[3] Similar to the legend of *Tsi-wah cho,* it is my intention throughout the course of this thesis to tell a story of Dene strength and resilience on the land despite colonial land appropriation and environmental degradation.

[2] As the Weledeh Yellowknives Dene (1997) describe, Yamozhà's giant snow shovel was similar to the smaller snow shovels traditionally used for ice fishing. The snow shovel looked like a snowshoe and was used to scoop pieces of ice out of fishing holes.
[3] The tree tragically fell in August 2018 due to a windstorm. Its spirit, however, lives on.

Through the voices and experiences of Dene land-users and Elders, I show how Dene of self and place continue to be deeply rooted in Wı̨ìlı̨ìcheh and continue to leave their footprints across the land.

Figure 1.0 Left: *Tsi-wah cho* Right: Offerings to *Tsi-wah cho* in the form of coins and rosaries
Photo Credit: A. Degray, 2016

CHAPTER 1

Introduction

1.1 Introduction

Beginning in the 1930s, gold mining activities in Yellowknife, NT, had profound effects on the local environment and on the Yellowknives Dene First Nation's (YKDFN) traditional land-use activities. The Giant Mine left a toxic legacy of 237,000 tonnes of buried arsenic trioxide and widespread environmental contamination, a product of fifty years of gold roasting operations. Mining operations ceased in the early 2000s but toxic contaminants still linger in surface soils and vegetation (Bromstad, 2011; Hocking et al., 1978; Koch et al., 2000a,b; St-Onge, 2007), surface waters and lake sediments (Andrade et al., 2010; Galloway et al., 2015; Palmer et al. 2015), and terrestrial and aquatic animals (Cott et al., 2016; de Rosemond, Xie, & Liber, 2008; Koch, Mace & Reimer, 2005; Amuno et al. 2017). For the Yellowknives Dene living at nearby Detah and N'Dilǫ, whose traditional livelihoods and cultural practices are dependent on the local environment, historic mining pollution and settler activities in present-day Yellowknife led to the dispossession and dislocation of the First Nation's land-use practices. Many sites that were traditionally used for fishing, hunting, collecting drinking water, berry-picking and harvesting medicinal plants are now either contaminated or fragmented.

Although a growing body of research is documenting the spatial distribution of environmental contamination around the Yellowknife region, there has yet to be a study that documents the ways in which historic mining contamination changed and continues to shape Dene traditional land-use activities. Importantly, during early discussions with

the Toxic Legacies Project,[4] the Yellowknives Dene asked for a study to document the impact of the Giant Mine and arsenic contamination on their land-use practices. In line with advancing geographic scholarship on Indigenous environmental justice (EJ), this research integrates risk perception research with that of EJ to understand how perceptions of industrial contamination manifest in the everyday land-use activities of Yellowknives Dene land-users. In particular, this study draws on Indigenous land-use methods to document land-use activities and avoidance behaviours near the abandoned Giant Mine site. Using this approach, this study explores the ways in which industrial mining pollution is understood and experienced by YKDFN land-users and documents the spatial extent of land-use displacement.

The purpose of my research is to document traditional land-use change in the vicinity of the Giant Mine and Yellowknife. The objectives of this project are twofold: (1) to produce YKDFN traditional land-use and avoidance maps, and (2) to explore Dene perceptions of risk. This study seeks to answer the following questions:

1) What are Dene traditional land-use activities in the vicinity of the Giant Mine and Yellowknife?

2) How do Dene perceive industrial contamination?

3) How did Dene perceptions of industrial contamination change land-use activities?

[4] The "parent" project of this research. It is a partnership between researchers at Memorial University, Lakehead University, and the YKDFN and was supported by a Social Sciences and Humanities Research Council Partnership Development Grant (890-2012-0100). For more on the project, see www.toxiclegacies.com.

1.2 Context and Study Area

This study engaged Yellowknives Dene members and land-users in the YKDFN communities of Detah and N'Dilǫ. The YKDFN communities of Detah and N'Dilǫ are located on the northern shore of Tinde'e in the Northwest Territories (Figure 1.1., YKDFN, 2018). Detah is located 6.5 kilometres from the city of Yellowknife by winter ice road and 27 kilometres by an all-season road (YKDFN, 2018). Detah, in Wı̨ìlı̨ìdeh, the local Dene language, translates to "charcoal" or "burnt point," and for generations was a popular summer fish camp for the YKDFN (YKDFN, 2018). N'Dilǫ is located at the end of Latham Island, adjacent to the City of Yellowknife, and translates to "end of the island." As the YKDFN (2018) describe, the area near N'Dilǫ has always been an important fishing and berry picking site with access to prime hunting areas.

Ecologically, Yellowknife is located south of the tree line and within the Taiga Shield Ecozone (TSE) (Galloway et al., 2012). It is in a region of extensive, discontinuous permafrost and generally associated with peat plateaus (Thienpont et al., 2016). The Yellowknife River is the principal drainage system and flows into Yellowknife River and Great Slave Lake, which in turn drains into the Mackenzie River system (Kerr & Wilson, 2000). Much of the vegetation in the region consists of lichen woodland dominated by black spruce (*Picea mariana*) with jack pine (*Pinus banksiana*), balsam poplar (*Populus balsamifera*) and paper birch (*Betula papyrifera*) mixed with marshes, fens, and peat bogs in low lying areas (St-Onge, 2007). The bedrock in the Yellowknife area constitutes part of the southwestern Slave structural province of the Canadian Shield and abundant gold deposits in the Yellowknife Supergroup led to the establishment of three gold mines in

the region: Con Mine (1938-2003), Giant Mine (1948-2004), and Negus Mine (1939-1952) (Figure 1.1., Kerr & Wilson, 2000).

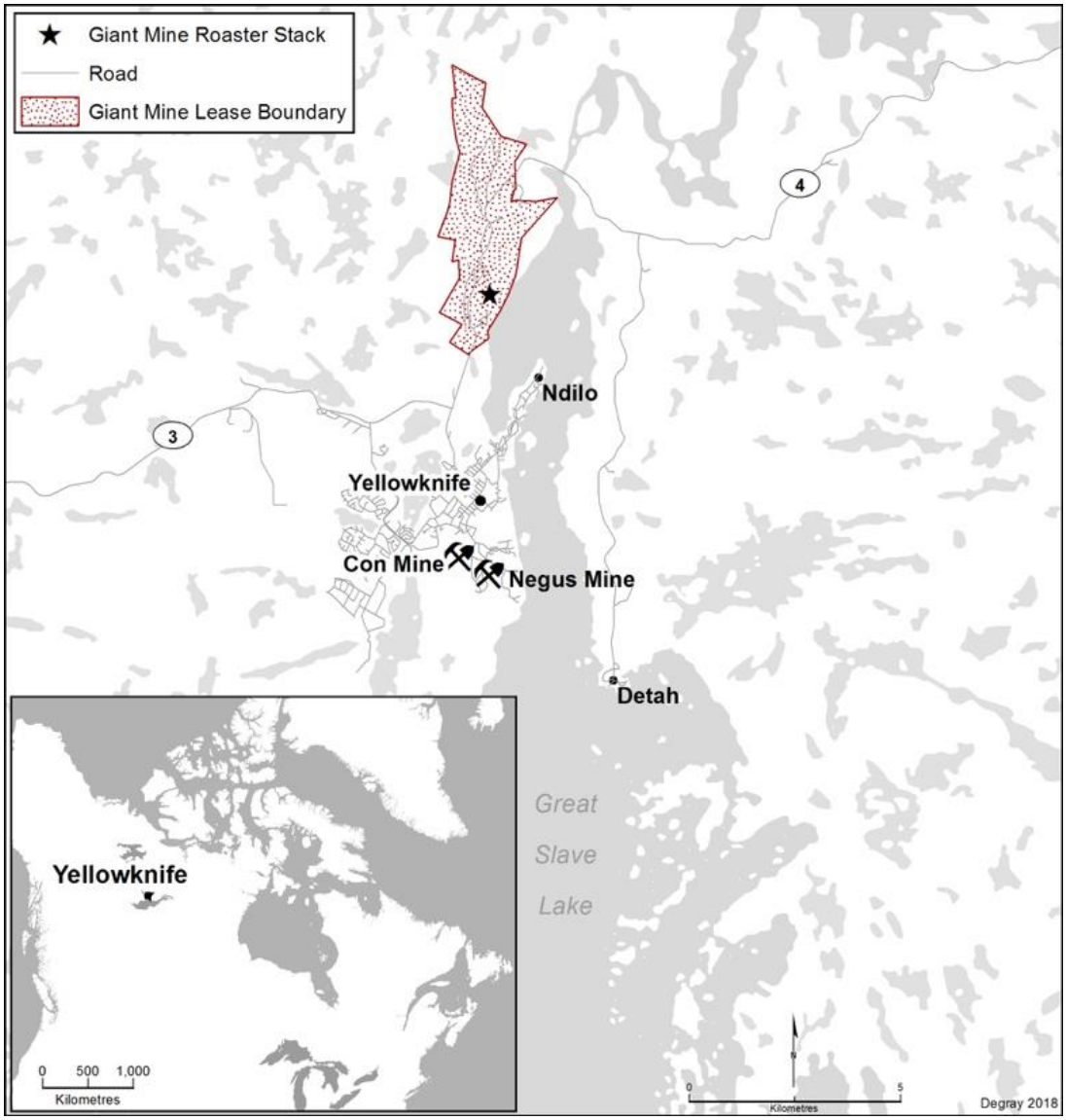

Figure 1.1 Map of the study area showing the location of Giant Mine, Con Mine, Negus Mine, and YKDFN communities, with inset showing location of Yellowknife, NT, Canada.

The YKDFN are descendants of Tatsǫ̀t'ıné ("copper or metal people"), Indigenous Chipewyan-related peoples who were known for the pots, knives, and other tools that they made from native copper collected throughout their territory (YKDFN, 2018). In early written records, Tatsǫ̀t'ıné were variously referred to as Copper Indians, Yellow-knives Indians, Red-Knives Indians, Dène Couteaux Jaunes, etc. (YKDFN, 2018). Some members of the Łutsel K'e Dene First Nation in Łutsel K'e and the Deninu K'ue First Nation in Fort Resolution are also descendants of the Tatsǫ̀t'ıné, and together with Smith's Landing First Nation, the five First Nations form the Akaitcho Territory Government (Akaitcho Treaty 8, 2019; GNWT, 2019).

Traditional ecological knowledge (TEK) and archeological evidence suggest that the YKDFN and their ancestors have lived in the area for at least 7,000 years (O'Reilly, 2015). Elders recall the story of Scottish explorer Alexander Mackenzie who named the river "Yellowknife" after what he thought the people were calling themselves, when they were most likely showing him their copper knives (Weledeh Yellowknives Dene, 1997). Before trapping for the fur trade, Tatsǫ̀t'ıné territory consisted of lands around Tinde'e north to the Coppermine River and east to the Thelon River (YKDFN, 2018). In 1786, the North West Company established one of the first trading posts on Yellowknives Dene traditional lands 15 kilometers south of Detah near Tadeh Cho. Old Fort Providence was primarily a provision centre for other posts and traded imported goods with the YKDFN in exchange for dry fish, caribou and moose meat. As Elders recall, it was not long after the establishment of Old Fort Providence that the YKDFN began to build permanent log homes, and villages stretched along the north shore of Tinde'e from Enodah in the North Arm to Łutsel K'e in the East Arm (YKDFN, 2018).

The Yellowknives Dene, on behalf of Chief Imeh (Emile) Drygeese, entered Treaty 8 at Fort Resolution on July 25, 1900. As the Weledeh Yellowknives Dene history (1997) describes, **"**Akaitcho's[5] peoples understood the Treaty to mean that they could go living their lives on their own land in their own way as long as the sun shines, the river flows, and the grass grows." In 1920, Treaty 8 was revised by Chief Joseph (Susie) Drygeese after Treaty violations by the Crown. Since 2000, Akaitcho Dene First Nations have been negotiating the Akaitcho Land Claim with the Government of Canada and the Government of the Northwest Territories (GNWT) with respect to land, resources, and self-government (GNWT, 2019).

Ever since the arrival of settlers on their traditional lands, the Yellowknives Dene have disproportionately borne health and environmental risks. Elders, to this day, continue to mourn the loss of those who fell victim to the 1928 influenza epidemic. The viral strain of influenza was brought over by non-Indigenous passengers on the Hudson's Bay flagship *S.S. Distributor* and killed an estimated 10 to 15 percent of the Indigenous population in the Northwest Territories (Freeman, 2010). The Yellowknives Dene were among other Dene and Inuvialuit communities to be infected and killed during the six-week epidemic. For those surviving families, many had fled to the barren lands fearing the return of the disease in Wı̨ìlı̨ìcheh. As former Chief of N'Dilǫ Fred Sangris told me:

> My grandfather grabbed his two-year-old son, fled to Yellowknife River and gone up where the Diamond mines are up in the north. Lac de Gras. He stayed there for two years with his son [Fred Sangris interview, May 24, 2016]

[5] Chief Akaitcho was a powerful Tatsǫ̨t'ıné chief who played an important role in protecting Tatsǫ̨t'ıné territory from competition during the early days of the fur trade (YKDFN, 2018).

In the years following the epidemic, while most Yellowknives Dene were in the tundra or recovering in Wı̨ìlı̨ìcheh, prospecting activities returned to Wı̨ìlı̨ìcheh. Prospectors had been drawn to the area since the time of the Klondike Gold Rush 1890s when traces of gold were found in the region, but full-scale prospecting and production only gained momentum in the 1930s (O'Reilly, 2015). In 1934, prospector Johnny Baker "discovered" gold on the north shore of Wı̨ìlı̨ìcheh and established a very small underground mine and camp at Burwash Point (across the bay from present-day Yellowknife) (Sandlos & Keeling, 2017). According to Yellowknives Dene oral history, their TEK played a pivotal role in the discovery of gold in the area. During her interview, Elder Madeline Beaulieu recalled the story of her grandmother, Liza Crookedhand, who had found a shiny rock in Enda'deh while picking for blueberries. A prospector had approached Liza and offered her a stovepipe in exchange for directions to where she found the rock, and "next thing you know, there is a bunch of (white) people coming around" (Madeline Beaulieu interview, May 19, 2016. Interpreter: Lena Drygeese). Yellowknives Dene Elders often tell this story to emphasize the lack of consultation between prospectors and the local people in relation to mining activities (Sandlos & Keeling, 2017).

By the late 1940s three gold mines were operating on the northern shore of Tinde'e: Con Mine (1939-2003), Negus Mine (1939-1952), and Giant Mine (1948-2004). Along with other small gold mines in the region, these mines became the major economic drivers and brought an influx of settlers to the area. Early Yellowknife settlement and commerce was located near the YKDFN community of N'Dilǫ in present-day Old Town. By the summer of 1938, Old Town was a bustling place with modern businesses and

services and an important hub for trapping, commerce, and transportation in the Northwest Territories (City of Yellowknife Heritage Committee, 2010). Once Giant Mine struck gold in 1944, and with no room for expansion in crowded Old Town (on and around Latham Island), urban development moved towards the present-day Yellowknife downtown core to the west and south. In the 1950s, the Yellowknives Dene, under a federal policy, were forced from their scattered camps to centralized settlements at Detah and N'Dilǫ. From the beginning of the mining era, few employment opportunities were available to members of the communities and the Yellowknives Dene received no revenues from the gold mines or settler development on their traditional lands (Sandlos & Keeling, 2017; O'Reilly, 2015).

In addition to economic marginalization, the YKDFN suffered disproportionate health and environmental impacts from gold mining activities. Much of the ore bodies at Giant and Con mines contained gold in arsenopyrite formations, which required roasting the ore prior to cyanidation (Thienpont et al., 2016). The roasting process resulted in the creation and emission of large quantities of arsenic trioxide (AS_2O_3), a form of arsenic known to be "the most toxic, water-soluble and bioavailable of solid arsenic compounds" (Thienpont et al., 2016: p.2; Jamieson, 2014). Between 1949 to 1953, Con and Giant mines released as much as 9.8 tonnes of AS_2O_3 in the environment per day with Giant Mine accounting for most of the emissions (7.26 tonnes per day) (Keeling and Sandlos, 2009; Sandlos & Keeling, 2016). The YKDFN communities of Detah and N'Dilǫ were particularly vulnerable to the arsenic emissions, not only because they were located downwind from the roaster stacks, but because they relied on spring snowmelt for their drinking water and used local berries and plants for their diet (Sandlos & Keeling, 2017).

Mitigation strategies at the Giant Mine only came into effect in 1951, after a two-year old Dene boy in N'Dilǫ died from arsenic poisoning caused by drinking snowmelt water (Sandlos & Keeling, 2012). As compensation, Giant Mine company officials offered the family $750 for the loss of their child and installed an electrostatic precipitator (ESPs) which decreased arsenic emissions to an estimated 5.5 tonnes per day between 1952 and 1953. In 1958, a baghouse[6] was installed which further decreased emissions to approximately 0.01-0.5 tonnes per day (Sandlos & Keeling, 2012). This technological fix, however, only moved the arsenic problem (Keeling & Sandlos, 2017). Instead of blowing arsenic dust into the atmosphere, Giant Mine Yellowknife Mines pumped the toxic material captured by the ESPS into 14 old mine chambers underground, which accumulated to 237,000 tonnes of buried arsenic trioxide by the end of the mine's lifecycle. Con Mine, on the other hand, had installed a wet scrubber[7] in 1949 to reduce emissions but continued dumping the arsenic contaminated water as a byproduct into local lakes (Sandlos & Keeling, 2017). Although emissions from the stacks gradually reduced over time, arsenic trioxide and arsenic-bearing iron oxides continued to be released at about 0.01–0.4 tonnes per day until roasting operations ceased at Giant Mine in 1999 (Wrye, 2008).

In 1999, the Department of Indigenous and Northern Affairs (INAC) assumed full responsibility for Giant Mine after Royal Oak Mines Inc., the owner since 1990, went into receivership (O'Reilly, 2015). The federal government contracted Miramar Mining

[6] A secondary treatment method to capture arsenic dust in a large filter (Sandlos & Keeling, 2017)
[7] A method that uses water to control particulate matter in the roaster stack (Sandlos & Keeling, 2017)

Corporation, owner of the adjacent Con Mine, to continue operations at the site.[8] As a condition of sale, Miramar was not responsible for the long-term environmental issues at the Giant Mine site, and its operations ceased in 2004. Today, the Giant Mine Remediation Project (GMRP), under CIRNAC[9], is tasked with containing and managing the arsenic waste stored underground and remediating the 875-hectare site which includes 95 hectares of contaminated mine tailings, eight open pits, and asbestos-laden buildings (INAC, 2019; De Guzman, 2012). The remediation is expected to cost at least one billion Canadian dollars, making it one of Canada's most expensive and most complex reclamation projects (INAC, 2019; O'Reilly, 2015; De Guzman, 2012). The GMRP has currently opted for the "frozen block method" as an interim solution to contain and manage the arsenic waste underground. This method consists of using thermosyphon technology which draws and expels heat from ground using pressured carbon dioxide, which in turn freezes the rock around the 13 arsenic chambers (INAC, 2019). Freezing the arsenic trioxide in situ has been criticized by Yellowknives Dene and the city of Yellowknife alike as this is method is inherently unstable, presents unknown risks, and does not actually deal with arsenic problem over the long-term (Sandlos & Keeling, 2015; Beckett, 2018).

[8] Ore processing shifted to the Con Mine site.

[9] In August 2017, the Trudeau government announced the dissolution of the department of Indigenous and Northern Affairs Canada (INAC) and replaced it with two new departments: Indigenous Services Canada (ISC) and Crown-Indigenous Relations and Northern Affairs Canada (CIRNAC). According to the Government of Canada (2020) website, CIRNAC "continues to renew the nation-to-nation, Inuit-Crown, government-to-government relationship between Canada and First Nations, Inuit and Métis; modernize Government if Canada's structures to enable Indigenous peoples to build capacity and support their vision of self-determination; and lead the Government of Canada's work in the North"

1.3 Literature Review

The story of Giant Mine and pervasive arsenic pollution reflects a legacy of environmental injustice and ongoing settler colonialism on Yellowknives Dene lands and bodies. In this section, I review and draw connections across the environmental justice, settler colonialism, and risk perception literatures in order to lay the foundations for this study's conceptual framework.

Over the last 50 years, increasing research and activism has revealed the unequal distribution of industrial pollution and hazardous waste sites near poor and racialized communities (Szasz & Meuser, 1997; Pellow, 2007). From mercury poisoning in the First Nation community of Asubpeeschoseewagong (Grassy Narrows), to PCB exposure at the Mohawk Nation at Akwesasne, to the Aamjiwnaang First Nation living next to Sarnia's Chemical Valley, both research inquiry and environmental activism have shown that environmental policies, practices or directives disproportionately disadvantage individuals, groups or communities (intentionally or unintentionally) based on race or color (Civic Laboratory for Environmental Action Research [CLEAR], 2017; Native Youth Sexual Health Network & Women's Earth Alliance, 2016). Environmental racism (ER) gained political and academic momentum in 1982 when civil rights activists organized to stop the state of North Carolina from dumping 120 million pounds of PCB-laced soil near a poor and rural African American community (Bullard, 1990). Although unsuccessful in stopping the construction of the hazardous landfill waste site, the Warren County demonstrations were among the first to raise public awareness about ER and helped mobilize the environmental justice (EJ) movement (Mohai, Pellow, & Roberts, 2009).

While ER and EJ are often used interchangeably in the literature, there is a distinct difference between the two (Cutter, 1995). The former relates to the "condition or problem" of disproportionality whereas the latter describes the "strategies for addressing the condition or problem" (Waldron, 2018). In addition to racial discrimination in policymaking and the unequal siting of polluting industries, ER refers to:

> the history of excluding Indigenous and Black communities from mainstream environmental groups, decision-making boards, commissions and regulatory bodies; the lack of political power these communities have to fight against the placement of industry in their communities; the negative impacts of environmental policies that result in the differential rate of cleanup of environmental contaminants in these communities; and the disproportionate access to environmental services (Waldron, 2018: p. 38).

EJ, on the other hand, rests on developing the tools, strategies, and policies to eliminate the unfair, unjust and inequitable conditions that contribute to and produce differential exposures to environmental hazards (Bullard, 1994). As a focus of academic study, early EJ research focused on the distributive dimensions of justice (Walker, 2009; Walker & Bulkeley, 2006). Quantitative methods were used to compare demographic markers (race, ethnicity, income, immigration status, housing values, etc.) with proximity to environmental exposure sites (polluting facilities) (Agyeman et al., 2009). The U.S. General Accountability Office (GAO) (1983) and the United Church of Christ (UCC) Commission for Racial Justice (1987) were among the first studies to demonstrate the unequal and discriminatory siting of toxic waste facilities across the United States. Today, hundreds of studies conclude that, in general,

> ethnic minorities, Indigenous persons, people of color, and low-income communities confront a higher burden of environmental exposure from air, water, and soil pollution from industrialization, militarization, and consumer practices (Mohai, Pellow, & Roberts, 2009: p. 406).

In recent years, EJ scholarship has expanded its geographical and theoretical scope. This gradual shift was largely in response to critiques stating that, "first generation EJ," with its exclusive focus on distributive inequity, narrowed the scope and dynamic of environmental justice (Walker, 2009). Specifically, increasing attention has shifted towards addressing different dimensions of EJ, including procedural justice and justice of recognition (Schlosberg, 2008, 2013). Procedural justice refers to the meaningful participation in environmental making decisions such as the siting of industry and toxic waste management, regulatory practices, evaluation criteria, and enforcement in hopes that this will help prevent inequitable siting and better involve affected communities in site cleanups (Waldron, 2018). Recognition, on the other hand, refers to the affirmation of group difference and identity or the overcoming of institutionalized harms to social status (Holified, 2012). Research into these different dimensions of justice have allowed us to examine the ways in which environmental policies and institutional racism uphold and sustain the spatial patterning of environmental pollution, rather than just documenting the spatial patterning of injustice itself.

Environmental justice in Canada, as a research discipline or as a platform for activism, has only emerged within the last two decades (Atari, Luginaah, & Baxter, 2011; Gosine & Teelucksingh, 2008; Jacobs, 2010; Waldron, 2018). This is not to say that environmental racism did not exist before academic inquiry. Indigenous peoples have indeed been articulating cases of environmental injustices for centuries in relation to loss of land, Indigenous titles, and devastation to their traditional territories. Their voices have just been dismissed, overridden, or ignored by settler ideologies and structures. As Zoltán

Grossman contends, “the most workable date for the founding of [North American] Native EJ movement is...1492” (Turner & Pei Wu, 2002) otherwise known as the year Christopher Columbus set foot on the land of the Taíno people, which Columbus later renamed San Salvador.

In “Speaking for Ourselves,” Haluza-Delay et al. (2009) outline five themes that have emerged out of Canadian EJ literature. First, much of the research is *about* Indigenous peoples. From unequal access to potable and safe water in hundreds of communities across Canada (Hanrahan, 2017) to climate change justice (Watt-Cloutier, 2015), research has shown the systemic patterns of environmental racism is prevalent in Canada especially among Indigenous peoples (Stefanovich, 2019). The second theme, and especially prevalent among Indigenous scholars, is the *recognition* of Indigenous difference. In other words, Indigenous peoples have different epistemologies and practices compared to that of Canadian settlers (Nadasdy, 1999; Cruikshank, 2005). The third theme is related to the *connection* of race with the physical and social landscape. The Canadian imaginary of the North “empty” and “barren,” for instance, historically facilitated the erasure of Indigenous occupations and livelihoods in the name of conservation initiatives or extractive industries. The fourth theme is associated with *health and safety*, often involving toxic contamination. From Nova Scotia’s Sydney tar ponds (Lambert, Guyn & Lane, 2006) to the Athabasca oil sands (Thomas-Müller, 2008) to the Port Radium mine (Blondin, 1990; Gordon, 2015), research has revealed the devastating effects of toxic exposure among workers and communities working in or living near hazardous waste facilities. Finally, the fifth EJ research theme has explored the interplay between local environmental social issues and broader economic processes

such as examining environmental effects through the lens of deregulation or "voluntary compliance" practices.

The settler-colonial discourse is also central to the EJ narrative in Canada. Settler colonialism refers to the ongoing territorial project that is centred on the elimination of Indigenous land and bodies (Wolfe, 2006). As settler-colonial theorist Wolfe (2006) writes, the organizing principle of the setter-colonial society is the "logic of elimination," which he refers to as the structural institutional tendency of eliminating Indigenous life in order to acquire "empty" Indigenous land for colonial expansion. Elimination does not only work through the outright murder of Indigenous peoples but also via cultural assimilation projects such as residential schooling and child abduction through child "welfare" programs, and the breaking-down of native title into individual freeholds (Wolfe, 2006). In other words, settler colonialism is a sustained structure and system premised on the dissolution and repression of Indigenous peoples and polities, and as Waldron (2018) recently argued, it is the same structure that allows allow racialized bodies to disproportionately bear the burden of environmental risks and pollution today. To use her words,

> The long history of assigning value to race in the Americas means that property is inherently inscribed with racial meaning, that whiteness has historically legitimized possession of property, and that the practice of placing polluting industries in Indigenous and Black communities is an example of white supremacist use of space (Waldron, 2018: p.39).

Another way in which the settler colonial structure continues to undermine and eliminate rights and relationship to land is by strategically undermining Indigenous collective continuance (Whyte, 2018). Collective continuance refers to a "society's

capacity to self-determine how to adapt to change in ways that avoid reasonably preventable harms" and was founded by Anishinaabe intellectual traditions of interdependence, systems of responsibilities, and migration (Whyte, 2018: p.131). Settler colonialism, Whyte (2018) argues, disrupts and violates Indigenous ecologies through vicious sedimentation and insidious loops. The former refers to "how constant ascriptions of settler ecologies onto Indigenous ecologies fortify settler ignorance against Indigenous peoples over time" whereas latter relates to "the complex feedback from ecological systems that is particularly harmful for Indigenous peoples" (Whyte, 2018: p.138). Both vicious sedimentation and insidious loops are forms settler colonial domination and environmental injustice as these two patterns actively work to remove or make invisible Indigenous life in the settler landscape, and silence Indigenous voices in environmental decision-making processes.

In relation to mining and extractive economies, scholars have argued that mining and extractive economies continue to be colonial because it is premised on the dispossession of Indigenous land and resources (Hall 2012; Hoogeveen, 2015; Keeling and Sandlos 2015; Bernauer, 2019). For instance, Hoogeveen (2015) argued the significance of settler colonialism and liberal ideologies of property in maintaining contemporary mineral property laws and undermining Indigenous claims to territory whereas Hall (2012) used Harvey's (2003) reworking of Marx's concept as "accumulation by dispossession" to examine the broader landscape of resource extraction in the North, specifically diamond mining in the Northwest Territories. Moreover, others have illustrated how mining creates

"sacrifice zones[10]," which disproportionately affect Indigenous land users by limiting access to territory, altering surface environments and habitats, and polluting lands and waters through the by-products of extraction (Horowitz et al., 2018). In her book, Traci-Brynne Voyles (2015) powerfully explored the processes of settler-colonial territorilialization and "wastelanding" in relation to uranium mining in Navajo territory. "Wastelanding," Voyles (2015) describes, is part of the settler-colonial process in which non-white lands are made to appear "uninhabited or unimportantly inhabited, [and] represented as worthless" which then provide legal justification to reconfigure Indigenous homelands into resource frontiers amenable to modern industrial exploitation and pollution. Landscapes of extraction and pollution, Voyles (2015) argues, are inherent features of settler-colonial structure and modern industrialism because, after all, "raw materials must come from somewhere, and toxic waste must go somewhere" (Voyles, 2015: p. 9).

Wastelands and sacrifice zones are prominent features across the northern Canadian landscape. From long-range persistent organic pollutants (POPs) to local sources of pollution such as mines, DEW[11] Line sites, and nuclear waste, research has revealed that the circumpolar North[12] has been colonized as a pollution sink for southern economic

[10] Lerner (2010) defines sacrifice zones as "fenceline communities" of low-income and people of color, or "hot spots" of chemical pollution where residents live immediately adjacent to heavily polluted industries or military bases (Lerner, 2010). Most times these communities receive unequal protection, if any protection at all, and contain locally unwanted land uses, or LULUs, such as hazardous waste repositories, landfills, and power plants that pose environmental or health risks.

[11] Distant Early Warning

[12] As many have noted, confusion arises when "the Arctic," "northern Canada," "the North," or "circumpolar region" are used interchangeably, and when perceptual, geophysical, and political delineations are taken into account (Bone 2009; Grimwood et al., 2012). Similar to Grimwood et al. (2012), this thesis defines the Canadian Arctic as a northern region distinguished by tundra vegetation or polar desert.

interests (Cassidy, 2007; Downie & Fenge, 2003; Keeling & Sandlos, 2016; Tsuji, Manson & Cooper, 2005). Industrial mining activities, in particular, have caused widespread environmental damage and pollution on adjacent Indigenous lands and bodies. Former mine sites such as the Port Radium mine exposed communities to chemical and radiological toxins, whereas others left behind a moonscape of toxic tailings and waste dumps such as the Cyprus-Anvil Mine (Sandlos & Keeling, 2015).

Within the environmental justice debate, however, Keeling & Sandlos (2009) argued that industrial mining and mineral development is not easily reducible to a siting issue. The reasons are twofold. First, the siting of mining activities near Indigenous communities is incidental rather than intentional: mining companies locate their operations near viable ore deposits. Second, Indigenous communities form the majority of the population in Northern Canada (85.9% in Nunavut, 50.7% in NT, and 23.3% in Yukon[13]). Therefore, it would be difficult to demonstrate the deliberate targeting of mining activities near Indigenous "minority" communities (Keeling & Sandlos, 2009; GNWT Bureau of Statistics, 2019). Nonetheless, it is clear to see, and as many scholars and activists have shown, mining can perpetuate legacies of environmental racism and settler colonialism through legitimized possession of property, forced displacement, dispossession and the widespread cultural, social, economic and political impacts (Horowitz et al., 2018)

To better situate mining conflicts within the EJ discourse, my research integrates EJ with that of risk perception research to better understand the ways in which

[13] Indigenous identity population as a percentage of the total Canadian population in 2016 Census.

environmental inequality and racism manifests in the everyday land-use activities of Indigenous communities living near industrial mining sites. Risk perceptions are defined as people's beliefs, attitudes, judgments, feelings, and the wider cultural and social dispositions they adopt towards hazards and their benefits (Pidgeon et al., 1992). Early studies of risk focused on understanding the difference between 'actual' risk measured by experts and 'perceived' risk experienced by non-experts (Jasanoff, 1998). The former was understood as an objective entity that could be detected, measured, and calculated, whereas the latter typically referred to misunderstandings or misperceptions of that 'objective' risk (Slovic et al., 1987; Bickerstaff, 2004). In other words, perceived risk was considered a distorted version of actual risk, shaped by the ignorance, prior beliefs, and subjective personal experiences of non-experts (Jasanoff, 1998). As the field evolved, however, studies demonstrated that determinations of risk do not reflect an objective reality but a social process instead. Rather than being a distortion of actual risk, public perceptions of and responses to risks and hazards are embedded within broader social, cultural and political contexts (Bickerstaff, 2004). As Friendship and Furgal (2012) write,

> the risks which individuals or communities choose to manage or avoid, are not only those things seen as threats to health, safety, or environment, but rather they are reflective of choices grounded in beliefs, values, social institutions, human nature, and moral behaviour (p. 71)

As research has shown, individual perceptions and concerns about environmental risks (such as contaminants) can be influenced by the voluntary or involuntary nature of exposure, personal experience with the risk, uncertainty about consequences of exposure, possible effects on the next generation, and the unequal distribution of risks and benefits within a population (Furgal & Rochette, 2007). Today, socio-cultural approaches to risk

perception have situated everyday understandings of climate change (Kempton, 1991; Bulkeley, 2000, 2001), urban air pollution (Bickerstaff & Walker, 1999; Bush et al., 2001a,b), and industrial pollution (Irwin et al., 1999; Walker et al., 1998; Bush et al., 2001a,b; Horlick-Jones et al., 2003). They also increasingly explore the role of social factors such as values, gender, race, emotions, trust, and stigma in shaping risk perceptions (Bickerstaff, 2004).

In Northern Canada, previous research demonstrates that Indigenous perceptions of contaminants and environmental risk differ from that of the scientific community, and are based on their particular worldviews, epistemologies, languages, practices on the land, and socio-political contexts (O'Neil et al., 1997; Poirier & Brooke, 2000; Tyrrell, 2006; Cassady, 2007). In the literature, Traditional Ecological Knowledge (TEK), Traditional Knowledge (TK), Indigenous Knowledge (IK), or Indigenous/Native Science are often used interchangeably (Usher, 2000; Assembly of First Nations, n.d.; Agrawal, 1995; Cajete, 2000). While it is beyond the scope of this thesis to provide a comprehensive review of each of these terminologies and their theoretical underpinnings, there is a general consensus that they reflect:

> A cumulative body of knowledge, practice, and belief, evolving by adaptive processes and handed down through generations by cultural transmission. [They concern] the relationship of living beings (including humans) with one another and with their environment (Berkes et al., 2000: p. 1252)

To use the words of Nadasdy (1999), "TEK is not so much knowledge, as it is a way of life" (p.4). For the remainder of this thesis, I use the term "TEK" which can be understood as knowledge about the environment, knowledge about the use of the

environment, values about the environment, and the knowledge system itself (Usher, 2000).

Within the broader literature, TEK has often been defined in restrictive terms and confined to matters of 'traditional' knowledge, such as knowledge of biotic and land-based resources (Nadasdy, 1999; Usher, 2000). Within the context of environmental remediation processes, specifically, Sandlos & Keeling (2015) have argued that, because these issues are typically framed within scientific modes of knowledge and understood as techno-scientific problems, they often marginalize Indigenous perspectives and TEK. Within an EJ framework, incorporating and acknowledging Indigenous perceptions of risk within processes like the GMRP, can help move towards addressing issues of procedural and recognition justice. Recognizing Indigenous risk perceptions within their TEK systems can not only reveal the experiential, value-based, and cultural aspects of risk but inform better decision-making processes and move towards effective and culturally relevant risk management strategies (Hoover, 2017). As Furgal & Friendship (2010) write,

> IK [Indigenous Knowledge] may contribute by providing context to the issue when framing the hazard and determining exposure, incorporating cultural and local perspectives and behaviours with respect to harvesting and consumption. IK may also provide insight on cultural conceptions of risk, informing risk communication strategies and approaches. Further, IK may provide insight on potentially effective modes of action and evaluation criteria for assessing the impact of decisions (p. 71)

Drawing on this conceptual framework, and in light of the ongoing GMRP, this thesis documents Dene perceptions, experiences, and knowledge of industrial mining pollution as a way to inform better environmental decision-making processes by incorporating Dene voices and experiences in the research and cleanup process. Not only does this

knowledge add contextual meaning to the techno-scientific measurements of industrial pollution in the Wı̨ìlı̨ìcheh area, but it also addresses the legacy effects of historic gold mining on Dene traditional land-use practices through the eyes of Dene themselves. In order to do this, I draw on Indigenous land-use studies, specifically the map-biography method. In Chapter 2, I provide an overview of Indigenous land-use studies in Canada and their respective methodologies, and discuss this study's novel adaptation of the map-biography method to document Dene risk perceptions related to land-use activities in Yellowknife, NT. In Chapter 3, I explicitly demonstrate the spatial extent of YKDFN land-use displacement as a result of industrial mining activities and settlement. Using the six traditional land-use maps produced from the collective map-biographies, I discuss the historical importance of traditional land-use activities. Using each map as evidence, I demonstrate the spatial extent of displacement of these activities, based on the information provided by Yellowknives Dene Elders and land-users. Building on Chapter 3's spatial analysis, Chapter 4 explores the qualitative and descriptive expressions of Dene risk perceptions and concerns related to land-use activities and demonstrates how Dene land-users, using their own "regimes of perceptibility" came to know and understand gold mining pollution in their environment (Murphy, 2006; Power & Keeling, 2015). Finally, in Chapter 5, and using the study's findings, I reflect on how risk perception research is integral to the EJ movement in Canada. I discuss the utility of the map-biography method in helping address and recognize Indigenous perceptions of risk and the legacy effects of pollution on land-use practices. Overall, this research contributes to the broader scholarly and public debates surrounding abandoned mines, and similar to Place & Hanlon (2011), shows that accommodating First Nations' environmental values

and perceptions of risks is a necessary first step to reclaim health and well-being in politically marginalized settings.

Finally, this study in not intended to become another "pain narrative." In "Suspending Damage: A Letter to Communities" Aleut scholar Eve Tuck (2009) describes "damage-centered research" as research that "documents peoples' pain and brokenness to hold those in power accountable for their oppression" (Tuck 2009: p. 409). While this approach might seem useful to help address the legacies of exploitation, domination, and colonization of Indigenous lands and bodies, Tuck (2009) argues that it actually perpetuates settler perceptions of Indigenous peoples as depleted, ruined, and hopeless. Therefore, instead of fetishizing damage, Tuck (2009) states that research needs to address the complexity, contradiction and the self-determination of lived lives, and celebrate Indigenous survivance. To use the words of Gerald Vizenor (1998), survivance means:

> a native sense of presence, the motion of sovereignty and the will to resist dominance. Survivance is not just survival but also resistance, not heroic or tragic, but the tease of tradition, and my sense of survivance outwits dominance and victimry (Vizenor, 1998: p. 93)

Using both survivance (Vizenor, 1998) and collective continuance (Whyte, 2018) as steppingstones to counter pain-narratives, this thesis intends to tell a story of Dene resilience, self-determination, and survivance on their traditional lands despite ongoing settler-colonial presence and persistent arsenic pollution.

1.4 Researcher Positionality

Scholars have described the power imbalances that exist between researcher and the "researched" noting that the former is in a position of power (Cahill et al. 2007). As my

personal experience reveals, and as other researchers have described (see Neely and Nguse, 2015), there are problems with viewing researcher-research relationship as a hierarchical binary. While viewing the relationship as a binary can reveal the power imbalances that exist between researcher and the "researched" on the global terrain of power, it assumes that our positionalities as researchers are stable (Rose, 1997). Rather than viewing positionality as fixed, feminist science studies call for a relational ontology in which identities and positionalities are formed through relationships, dependent on circumstance, and constituted at multiple scales (Haraway, 1991).

With regards to my research, the hierarchical binary may seem obvious. I am a young, white and privileged graduate student from the south "researching" an Indigenous community with a history of settler colonialism and cultural marginalization. While my positionality on the global terrain of power did at times influence my interactions, my research did receive the approval and support of the YKDFN Chiefs and Council. Specifically, during early discussions with the Toxic Legacies Project, the YKDFN had asked for a study to document the impacts of the Giant Mine and arsenic contamination on their land-use activities. Nonetheless, there were definitely some instances when my positionality as an outsider influenced my interactions. Some participants, for instance, upon meeting me were wary of my intentions. *Was I going to profit from documenting their struggles? Would they ever see me again?* These questions undoubtedly stemmed from previous experiences with southern, and most likely, white researchers. In these instances, I learned that by telling people about myself, the purpose of my research, and the wider implications of this study would help establish some trust between us.

Fisher River Cree scholar Winona Wheeler (2005) describes learning in the oral tradition not by "racing into Indian country with a tape recorder in hand and taking data" (p. 209) but through cultivating social relations. It was during my countless drives with Fred Sangris that I learned the most about Dene tradition and life. With a cup of Tims in hand, Fred would talk about Dene history, recall his life on the land, and his love for his sled dogs. For the record, I *did* make a fool of myself. I did not know at the time that, upon entering an Elder's home, it is customary to either keep your socks on or put on moccasins. It was only after a few interviews that Fred, while having a good chuckle, told me that I cannot be walking around barefoot! While this incident did highlight my ignorance as a white researcher, it also revealed that the relationship between Fred and I was not based on a hierarchical binary but instead, a relationship based on openness and reciprocity. In the next chapter, I continue to explore the dynamics of knowledge production and power in relation to Indigenous methodologies, the map-biography method, and the representation of grounded Indigenous expertise.

CHAPTER 2

Methodology and Methods

2.1 Introduction

To elucidate the complex relationships between Dene perceptions of risk, traditional ecological knowledge (TEK), and land-use activities in Wı̨ìlı̨ìcheh, my methodology drew on Indigenous land-use studies, specifically the map-biography method. In this chapter, I briefly trace the history of Indigenous land-use studies in Canada and describe how their methodologies have been adapted to examine the relationships between land-use activities and post-industrial landscapes. I then discuss my own adaptation and application of the map-biography method to document Dene risk perceptions related to land-use activities in Wı̨ìlı̨ìcheh.

2.2 Indigenous land-use studies

Once a tool used for claiming ownership over Indigenous lands, maps are now being used by Indigenous communities to challenge state authorities, and to (re)-claim sovereignty over traditional lands (Chapin et al., 2005). Known variously as counter-mapping (Peluso, 1995), participatory mapping (Chambers, 2006), and ethnocartography (Chapin & Threlkeld, 2001), Indigenous communities are working with scholars and activists to assert their histories on stolen lands and to (re)-claim their identities. The Indigenous mapping movement has helped fill in what was considered ‘empty’ and ‘blank’ space on early modern maps and address legacies of colonial violence and oppression of Indigenous peoples (Bryan and Wood, 2015; Herlihy & Knapp, 2003).

In Canada, traditional land-use studies (Honda-McNeil & Parsons, 2003), land-use and occupancy studies (Tobias, 2000), and subsistence mapping (Ellanna et al. 1985) have become the standard approach for documenting the extent and persistence of Indigenous land-use (Robinson et al., 1994; Tobias, 2000, Ellanna et al., 1985). The origin of cartography-based land-use studies dates back to the nineteenth century when anthropologist Franz Boas used sketch maps to document Inuit travel routes on Qikiqtaaluk (Baffin Island), Nunavut (Boas, 1964). The modern evolution and proliferation of traditional land-use studies, however, only began during the 1970s when Indigenous peoples began to resist state-imposed industrial development on their traditional lands and demand recognition of their Indigenous rights (Berger, 1977; Weinstein, 1976). The Canadian Government, in response, developed a northern development policy that recognized Indigenous title based on traditional use and occupancy prior to European colonization (Freeman, 1976; Morse, 1985). The policy, however, required Indigenous peoples to "prove"' their use and occupancy during land claims negotiations (McNeil, 1989). Traditional land-use studies were thus developed to collect use and occupancy data in order to provide "evidence' and "prove" Indigenous rights to land and resources in the settler court of law (Freeman, 2011).

Contemporary methods used in land-use studies are rooted in the Inuit Land-use and Occupancy Project (ILUOP) (Freeman, 1976a,b,c). Commissioned by the Inuit Tapirisat of Canada (ITC) for land claims negotiations, the ILUOP developed the map-biography method to document the "lands, waters, and resources upon which [Inuit] livelihoods, culture, and identity depended" (Freeman, 2011: p.21). As Tobias (2000) writes,

> First Nations peoples carry maps of their homelands in their heads. For most people, these mental images are embroidered with intricate detail and knowledge, based on the community's oral history and the individual's direct relationship to the traditional territory and its resources (p.2)

Therefore, instead of documenting Indigenous presence based on observations by others of where they were, the map-biography method identified land-use activities through the eyes of Indigenous peoples themselves (Usher, 2003). Using topographic maps, Elders and land-users identified sites traditionally used for hunting, trapping, fishing, travelling along with sacred areas and place names. (Tobias, 2009). To display the spatial extent of a community's land-use and occupancy, individual map-biographies were then combined to create a series of composite maps.

The Dene Mapping Project was an early land-use study to employ the map-biography method (Nahanni, 1974; Asch & Tychon, 1993). During the 1970s, the Dene Nation (formerly the Indian Brotherhood of the NWT) recorded traditional land-use and occupancy in the Mackenzie River basin to support land claim negotiations and to counter oil and gas natural development (Nahanni, 1974). Directed by Dene scholar Phoebe Nahanni, land-users recorded their traditional trails using colored pencils on large map mosaics (Nahanni, 1974; Andrews, 2017). Figure 2.1 illustrates an example of the Dene Mapping Project that shows Yellowknives Dene traditional canoe and portage trails in the Wı̨ìlı̨ìcheh region. While this map only uses traditional trails to demonstrate land-use activities, it does highlight the extent of Dene travel routes; ranging from the shores of Tinde'e (Great Slave Lake) to the northern barrens. In particular, this map illustrates Wı̨ìlı̨ìcheh as a being central "hub" for Yellowknives Dene land-users to access their traditional fishing and hunting grounds (Weledeh Yellowknives Dene, 1997).

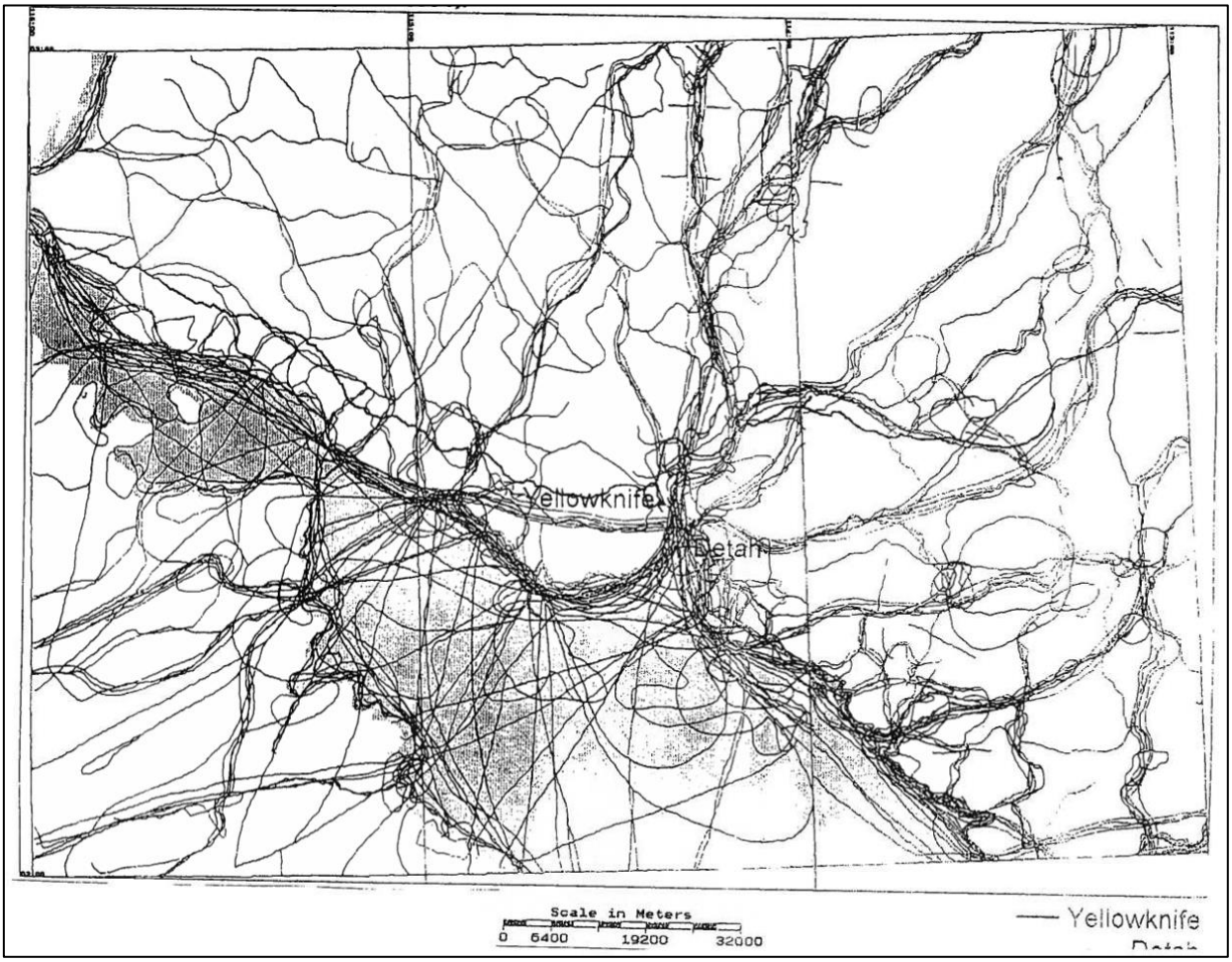

Figure 2.1 Map showing traditional Dene travel routes. Source*:* Weledeh Yellowknives Dene (1997)

A notable variation to the map-biography method is intensity mapping or mapping harvest geography (Weinstein, 1976; Tobias, 2009). Weinstein (1976) first employed this method to document the potential impacts of the James Bay Hydro-Electric Project on the subsistence activities of the Chisasibi Cree (formerly Fort George Cree). Rather than documenting land-use in living memory of Elders and active resource users, intensity mapping documents land-users' actual harvest sites, usually over a one-year cycle (Berkes et al., 1995). Using this approach, composite maps are created by summing up

individual harvesting sites according to community, species, or season (see Figure 2.2., Weinstein, 1976)

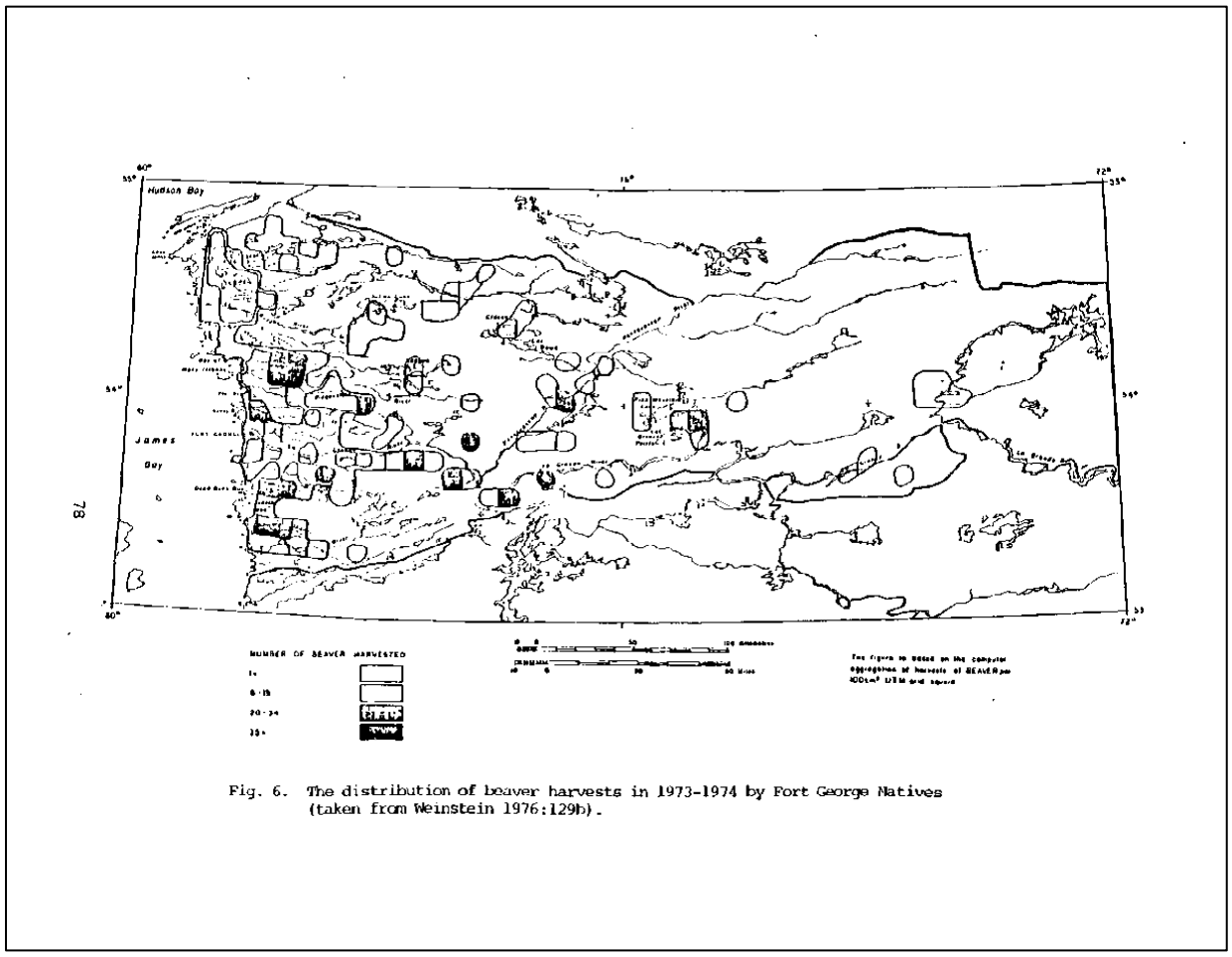

Fig. 6. The distribution of beaver harvests in 1973-1974 by Fort George Natives (taken from Weinstein 1976:129b).

Figure 2.2 Map showing the distribution of beaver harvests by Chisasibi Cree using Weinstein's (1976) intensity mapping method. Source: Weinstein (1976)

While no gold standard exists for measuring spatial data quality in land-use studies, Tobias (2009) outlines eight data quality standards that can be evaluated to identify whether land-use studies achieve quality outputs (Olson, Hackett, and DeRoy, 2016). These include objectivity, reliability, validity, precision, accuracy, integrity, auditability, and representativeness (see Table 2.1 for definitions) (Armitage and Kilburn, 2015; Tobias, 2009). In addition, the way in which data are marked and the way in which they

are coded are important to maintaining data quality standards (Tobias, 2009). Using a systematic approach, the map-biography method, collects and documents Indigenous use and occupancy data that fulfils these data quality standards (Tobias, 2009).

Table 2.1. Data-Quality Indicators for Indigenous land-use studies. Source: Tobias (2009) and Armitage & Kilburn (2015)

Data-Quality Indicators	**Definition**
Objectivity	Data documentation and analysis are independent of the personal feelings and opinions of researchers
Reliability	Data-collection methods are applied consistently from one interview to the next
Validity	Data and findings reflect the truth claimed
Precision	Descriptive Precision: level of detail with which mapped features are described on audio recordings Positional Precision: degree of fineness with which features are marked on maps during data collection
Accuracy	Measure of the closeness of fit between the locations of features as marked on a map and the real positions of the sites of the ground
Integrity	Traceability of data back to sources
Auditability	Research is transparent and accountable
Representativeness	Extent to which research findings represent the knowledge of the study population not just the knowledge of the people sampled

In his guide to best practices in land use and occupancy mapping, Tobias (2009) highlights the importance of collecting "data diamonds" during the map-biography interview. The data diamond, with its four points, is a mental image that reminds the interviewer to capture information about who (participant name), what (type of activity), where (spatial feature), and when (temporal data) (Tobias, 2009). When a participant identifies a land-use site on a map, the interviewer marks the spatial feature (where) with

a point, line or polygon, and writes the feature code next to it. The feature code contains a pair of letters that denotes the category feature (what) plus a feature number representing the order in which the feature is mapped. For instance, the feature code CA9 indicates that the ninth feature marked during an interview is a cabin. As for temporal data (when), which tends to be descriptive, it is generally captured on an audio recorder. Moreover, spatial features such as point data or small polygons are often preferred to that of large polygons in map biographies as they are considered to have more validity (Tobias, 2009).

While Tobias' (2009) data quality indicators have enabled land-use studies to support Indigenous and treaty rights within settler institutions and systems, Olson, Hackett and DeRoy (2016) argue that these quality indicators are rooted in positivism and do not represent Indigenous Knowledge (IK) or use and occupancy accurately. The authors, who are active practitioners of land-use studies, argue that temporal data is often dissociated from the spatial features on the map, which are "not only important to understanding knowledge and use of particular sites […] but can also contribute to a greater understanding of the potential impacts of disturbance on the Indigenous landscape" (p.351). To give more depth to the spatial features, and to better reflect IK, use and occupancy, the authors suggest transforming the "data diamond" into a "data star" (see Figure 2.3) in order to capture aspects of IK that are otherwise missed during the map-biography interview. These include, for example, relational data (how sites are connected to each other), kinship data (family participation in land-use activities), IK transfer (who taught the interviewee the practice), as well as observational ecological data (the quantity and quality of available resources).

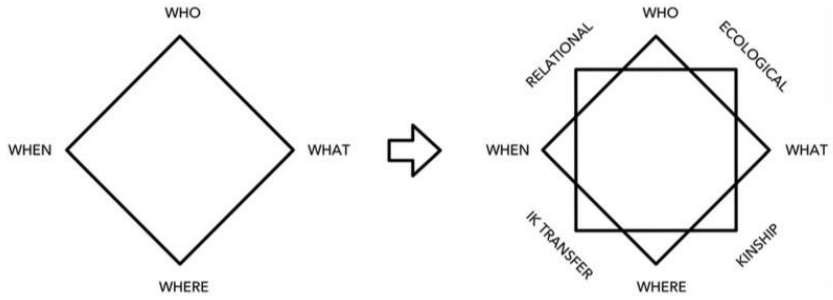

Figure 2.3. Transforming data diamond into data star. Source*:* Olson, Hackett, and DeRoy (2016)

These researchers also suggest shifting our understanding of use and occupancy data to "values" instead of sites (Olson, Hackett, and DeRoy, 2016). In traditional use and occupancy mapping, there is often a necessary step of eliminating "redundant data" (Tobias, 2000; Tobias, 2009). For example, if 50 informants identify the use of one particular cabin during interviews, the GPS location of that cabin is collected, and is used in lieu of the 50 individual points. The result, as Olson, Hackett, and DeRoy (2016) describe, is a more legible cartographic representation of IK and use and occupancy. Using a values-based approach, however, the repetition of the 50 points on a map indicate that the cabin is well-known and used within that community (Olson, Hackett, and DeRoy, 2016). Rather than eliminating the 50 points, the values-based approach keeps all the data, and includes a spatially accurate point. The use and occupancy data, then, become values associated with particular places rather than just spatially accurate sites (Olson, Hackett, and DeRoy, 2016). This approach helps move away from reductionism and become more in line with Indigenous epistemologies and understandings of space (Rundstorm, 1995; Wainwright & Bryan, 2009).

2.3 Indigenous land-use studies and post-industrial landscapes

In recent years, a few Indigenous land-use studies have started to explore the relationship between Indigenous land-use activities and post-industrial landscapes. Notably, Tsuji et al. (2001, 2005) and VanSpronsen et al. (2007) identified potential routes of exposure related to historic toxic waste. These studies used TEK to pinpoint and evaluate "sites of environmental concern," which were places deemed potentially problematic from an environmental health perspective (e.g., sites that were chemically contaminated or physically hazardous). For example, Tsuji et al. (2007), in collaboration with the Oujé-Bougoumou Cree First Nation, used a variation of Weinstein's (1997) intensity mapping method to document land-user spatial knowledge in relation to historic mine waste. Land-users were asked to identify their harvesting and gathering sites as well as sites of concern. By overlaying the collected land-use data with known sites of contamination, the study identified areas where land-use activities overlapped with known sites of contamination or areas that needed further investigation (i.e., potential sites of concern). Similarly, LeClerc & Keeling (2015) used an adapted version of the map-biography method to examine the legacy effects of the abandoned Pine Point mine on contemporary land-use activities in Fort Resolution, NWT. The researchers documented active land-users' experience and knowledge of hunting and trapping activities in a poorly remediated landscape. Using this approach, they demonstrated the complex interplay between contemporary Indigenous land-use activities, deindustrialization, and mineral development at the Pine Point mine in the Northwest Territories. Building on the same study, LeClerc & Wiersma (2017), also applied remote sensing and landscape ecology methods to further explore ecological changes brought on

by historic mining activities at the Pine Point mine and its effects on land-cover and configuration.

While these studies revealed the potential of using Indigenous land-use studies to document land-use practices near abandoned mine sites, none of them explored how land-users perceive, understand and make sense of industrial contaminants in their day to day practices. In Tsuji et al.'s (2007) study, for example, harvesters identified areas as being potentially hazardous but not *why* they were considered hazardous. As I described in Chapter 1, Indigenous perceptions of risk differ from that of the scientific or settler communities, and are based on their respective worldviews, epistemologies, languages, practices on the land, and socio-political contexts (O'Neil, Elias & Yassi, 1997; Poirier & Brooke, 2000). As studies have shown, the northern perspective on the environment, the importance of traditional/country foods to health and well-being, and the ways in which these are understood with TEK systems influence Indigenous perceptions and understandings of environmental risk (Furgal, Powell & Myers, 2004). The case of the Giant Mine and widespread arsenic contamination thus provides an opportunity to better understand Indigenous perceptions of risk related to mining contaminants, and to what extent these perceptions might (or might not) affect their relationship with the land and their hunting, fishing, and gathering activities. From a geographical perspective, mapping Dene risk perceptions within their TEK systems has the potential of demonstrating the gradual dispossession and dislocation of their traditional land-uses in Wı̨ìlı̨ìcheh.

With this in mind, this study tailored the map-biography method to collect Dene spatial knowledge and experiences on the land and to capture Dene understandings of risk. I modified Tsuji et al's (2007) "sites of environmental concern" to "sites of

avoidance," which I define in this thesis as areas that were formerly used for land-use activities but are now avoided. By identifying sites of continued use *and* sites of avoidance on the base maps, this project could identify areas that Dene land-users no longer frequent due to perceived risks, feelings of alienation, or environmental changes and thereby document the extent of impacts of gold mining activities and settlement on Dene land-use activities. Moreover, by asking participants to identify sites and explain *why* they avoided certain areas in Wı̨ìlı̨ìcheh, the semi-structured interview format could allow a broad range of responses and focus on the fundamental questions of Dene perceptions of risk and land-use change. By turning our attention to the lived experiences of Dene land-users and their own understandings of environmental contaminants associated with historic mining pollution, this methodology could reveal how widespread, landscape-scale contamination undermined a subsistence economy dependent on large tracts of land and waterways.

2.4 Pre-fieldwork

Prior to arriving in Yellowknife, I consulted remotely with former Yellowknives Dene Traditional Knowledge Specialist, Randy Freeman,[14] and former Chief of N'Dilǫ, Fred Sangris. Both Randy and Fred helped choose and revise the spatial extent of the map-biographies. We decided on a base map that would cover approximately a 20-kilometre radius around Wı̨ìlı̨ìcheh. This area was chosen for two reasons. First, YKDFN oral

[14] It should be acknowledged that, while Mr. Freeman has extensive knowledge of Dene TEK and has worked with Dene for years, he is not Dene nor an active land-user.

histories illustrate the cultural importance of the Wı̨ìlı̨ìcheh for hunting and fishing, and that land-use activities were most impacted within this area (Weledeh Yellowknives Dene, 1997). Second, increasing research is documenting elevated levels of contaminants around the City of Yellowknife (Amuno et al., 2017; Cott et al., 2015; Galloway et al., 2015). In particular, the Northwest Territories Cumulative Monitoring Program (CIMP NWT) have recently released an "arsenic hotspot" map identifying concentrations of dissolved arsenic in surface waters of lakes within a 30-kilometre radius of Yellowknife (Figure 2.4; Houben et al., 2016; Palmer et al., 2015).

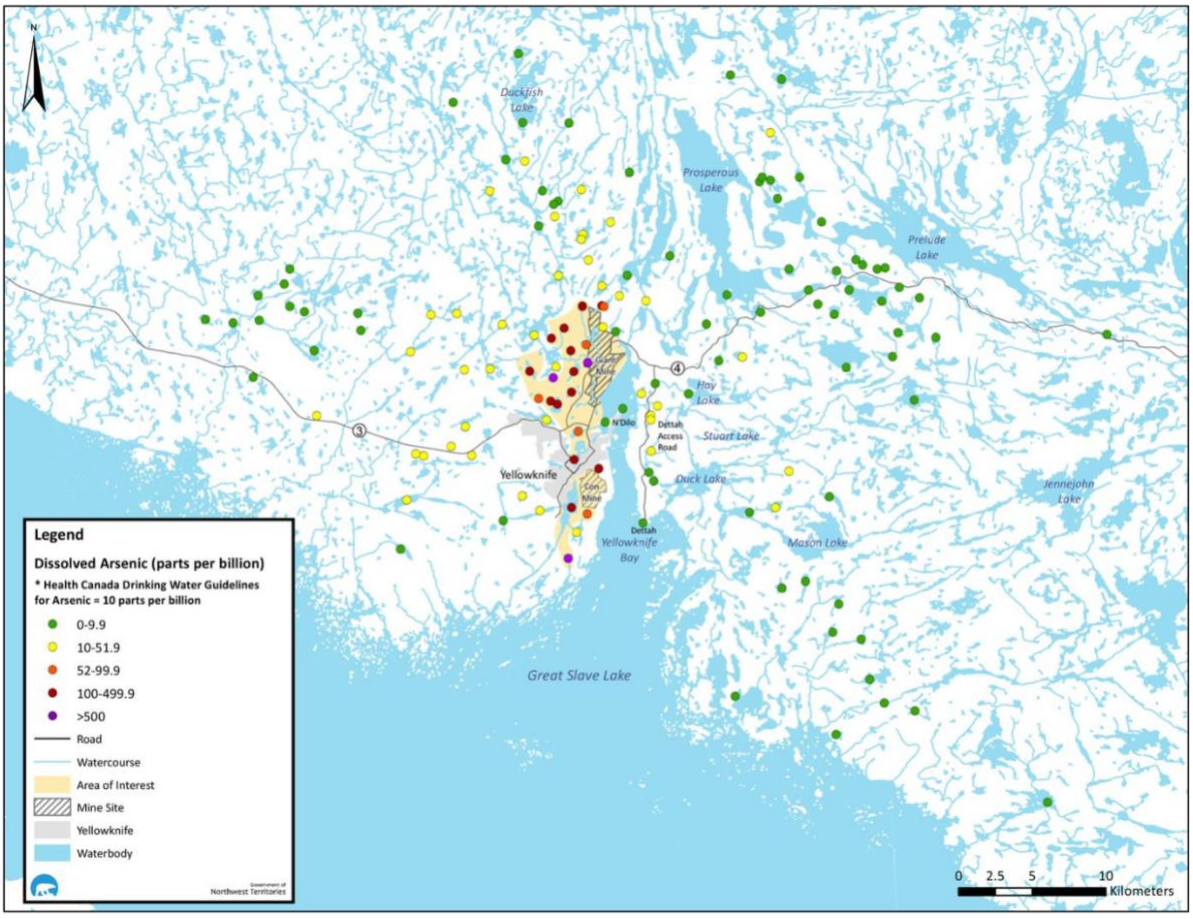

Figure 2.4 Map of Arsenic Concentrations in Water Bodies in the Yellowknife Area. Areas marked in orange, red, and purple contain arsenic concentrations that exceed Health Canada's drinking water guidelines. Source: Palmer et al. (2016).

Using CorelDRAW, four National Topographic System (NTS) base maps (85J7, 85J8, 85J9, 85J0) were stitched together to create a map centered on the Wı̨ìlı̨ìcheh area. Given the size of the printed map sheets (54inx24in), two separate base maps were created to cover the northern and southern extent of Wı̨ìlı̨ìcheh. For the marking conventions, I used existing categories and codes employed by TrailMark Systems, a cultural and environmental consulting form working with the YKDFN to develop a Land Use and Knowledge database for the First Nations. Using their coding conventions, the data collected in this land-use study would be consistent with their existing data and easily transferable into their database.

2.5 Fieldwork

I arrived in Yellowknife on May 8, 2016 with a suitcase in one hand and a box of rolled maps in the other. During the early days of my fieldwork, I came to realize that I was very dependent on Fred Sangris. Fred, being well-known in the communities, facilitated initial contact with land-users and Elders. Following his phone call, potential participants would decide whether they wanted to participate in the interviews. When participants lived out in Detah, Fred would often offer to drive me.

Before we began the map-biography interviews, participants read and signed the informed consent form. If they agreed to be audio-recorded, I turned on the recorder. Land-users and Elders were asked to identify on the base maps where they go fishing, hunting, trapping, collecting drinking water, harvesting medicinal plants and berry picking as well as their travel routes. Each land-use activity was marked using Staedler

Luminocolor Permanent Pen 0.6 mm and uniquely identified using a feature code. I then flipped the questions around and asked participants to identify sites that they avoid while engaging in land-use activities, and why.

During the first few interviews, I noticed that participants were getting tired and/or losing focus halfway through the interview (~35 mins), which was when we were shifting our focus from sites of ongoing land-use to sites of avoidance. Because sites of avoidance and perceptions of risk were integral to this project, I reframed the interview to begin with a discussion of sites of avoidance. This approach also helped retrieve more spatially explicit land-use information, since land-users were more likely to locate specific sites of avoidance compared to sites of ongoing land-use activities (which tended to be broad circles around a harvest area).

Most interviews took place in the Lands and Resources Office in N'Dilǫ or in the Imii Elders Home in Detah. When Elders preferred having the interview in Wı̨ìlı̨ìdeh, Fred or another member of the Yellowknives Dene would interpret or facilitate discussion. As is customary for research involving Indigenous communities in the Canadian North, an honorarium of $100 was given to each participant for their time and knowledge (Bear, 2012). In total, I interviewed 25 participants, including 14 active land-users (male=11, female=3) and 11 Elders (male=5, female=6). The average age among participants was 64 years (median: 59). Therefore, this thesis encompasses both Dene experiences with industrial mining during the operational (1948-2004) and post-closure (2004-) periods.

2.6 Post-fieldwork

Following my fieldwork, I transcribed all the interviews using ExpressScribe Transcription Software (v.5.82, NCH Software). In cases where the interviews were conducted in Wɨìlɨìdeh, only the interpreter's account was transcribed.

The base maps were scanned using HP DesignJet T2500 and converted into TIFF files. To simplify the georeferencing process, both base maps associated with each participants' land-use activities were stitched together using AdobePhotoshop. Using ArcGIS (v.10.3.1, ESRI), a personal geodatabase was created to store the collected land-use data. To georeference the base maps, 1:50,000 digital vector files covering map sheets 85J07, 85J08, 85J09, and 85J10 were downloaded from GeoGratis.

To convert the land-use data into digital vector features, I manually digitized each land-use feature. A dataset was created for each land-use activity (e.g., trapping) within which a feature class was created for each participant's land-use activity (e.g., A1_trapping). In many cases, participants used natural features as a frame of reference to identify land-use activities. Many trappers, for example, identified "Duck Lake" as a site for muskrat trapping. For instances like these, I digitized the perimeter of the natural features (e.g., Duck Lake). Attribute data collected from each participant were also entered into their respective attribute table. Once all the maps were digitized, the individual shapefiles including baseline vector data (e.g., rivers, toponyms) were projected to UTM Zone 11N, NAD83. This projection was selected because it is the most commonly used for this area.

Using the values-based approach (Olson, Hackett and DeRoy, 2016), all digitized land-use features, regardless of redundant data, were included in the composite maps. The

composite maps were created by merging and intersecting reported land-use activities and avoidance. For example, to create the *YKDFN Trapping Activities and Avoidance* map, all of the participants' current trapping sites and sites of avoidance were merged together, respectively. Then, using the Intersect tool, areas of overlap were identified (i.e., areas of both continued activities and avoidance). In total six composite maps were created: *YKDFN Travel Routes*, *YKDFN Hunting Activities & Avoidance, YKDFN Trapping Activities & Avoidance, YDKFN Harvesting Activities & Avoidance, YKDFN Change in Fishing Sites,* and *YKDFN Collecting Drinking Water & Avoidance.*

For the *YKDFN Change in Fishing Sites* map, the point density tool was applied to past and current fishing point data, respectively, which allowed me to represent the temporal and spatial changes in the density of fishing activities in Yellowknife Bay. The point density tool in ArcMap creates a raster where each cell contains the number of points there is within a specified search radius. For this study, I applied a 500-meter search radius. Each raster was standardized using the raster calculator to vary between 0-1. The difference between past and current raster datasets was then calculated to identify sites where 1) the density of fishing sites in the past was greater than today (red hotspot), and 2) the density of fishing sites today is greater than in the past (blue hotspot). Unlike the previous land-use maps, I chose to use the colours red and blue because heat maps generally employ warm (red-yellow spectrum) and cool (blue-green spectrum) colours to demonstrate how a particular phenomenon is clustered or varies over space (VWO, 2020). The caveat of using this point density tool, however, is that fishing areas that were not identified as point data (i.e., lines and polygons) were not included. If I had used the same methods applied for the other land-use and avoidance maps, then I would have created

what Tobias (2009) calls the "hodgepodge large polygon map[15]" which reduces spatial accuracy, precision, and reliability.

Finally, for the descriptive and qualitative portion of this thesis, I used NVivo (v.12.5.0), a qualitative data analysis computer software. I inputted all of the interview transcripts in the software and ran a query of the most frequent words. From there, I qualitatively grouped the words into descriptive categories, which then served as the basis for my thematic analysis. Thematic analysis is a method for identifying, analysing and reporting patterns (themes) across the data (Braun & Clarke, 2006). Through iterative coding and analysis of the transcripts, three key narrative themes emerged from the semi-structured map biography interviews: (1) sensory awareness and experience (2) trust in Traditional Ecological Knowledge and (3) perceived and direct health impacts. In line with Braun & Clarke's (2006) argument, this thesis does not subscribe to a naïve realist view of qualitative research, where the researcher simply "gives a voice" to their participants. As Fine (2002) argues, even a "giving voice" approach "involves carving out unacknowledged pieces of narrative evidence that we [researchers] select, edit, and deploy to border our arguments" (p.218). Therefore, I acknowledge and recognize that I, the researcher, played an *active* role in identifying the patterns/themes across the data and selected which were of interest for the purposes of this study.

[15] According to Tobias (2009), "large-polygon hodgepodge maps are the result of large-polygon thematic maps, which in turn, are the result of large-polygon biography maps […] which often don't provide the accuracy, precision, reliability and other attributes required for credibility" (p.381).

2.7 Challenges

There was an inevitable tradeoff when choosing map detail, coverage, and size for the base maps. While using a small map scale of 1:50,000 permitted participants to readily identify sites of land-use and avoidance within the vicinity of the Giant Mine and Yellowknife, it came at the expense of capturing the full extent of land-use activities. Similar to Laidler (2007), I was repeatedly reminded by the participants that the coverage of the base maps was inadequate in showing all YKDFN land-use activities or did not cover the areas that they wished to identify.

Further, given that both interpreters were themselves active land-users and have also experienced the effects historic industrial pollution, it was inevitable to have their voices and opinions heard during the interviews. Sometimes they would infer their own knowledge, assumptions and concerns when identifying sites of land-use or avoidance or ask leading questions to the participants such as (e.g., *you don't go fishing there anymore, eh*?). Rather than considering this a limitation of the study, we can view these instances as the co-production of knowledge between interpreter and participant which stimulated further discussion.

Few studies discuss the methodological challenges of mapping land-use activities. In *Living Proof,* Tobias (2009) notes that it is the researcher who decides whether kill sites are to be represented by points, lines (e.g., a trapline) or polygons (e.g., trapping area). In a personal communication, Peter Armitage, a practicing social scientist in the area of Traditional Knowledge research in Canada, wrote that "a major point in design is to reduce ambiguity, misunderstanding, and miscommunication to the greatest extent possible; therefore, the informant is obliged to pinpoint (indicate, point to, etc.) as

accurately as possible a traditional use feature" (P. Armitage, personal communication, August 2017; Armitage and Kilburn, 2015). In practice, however, I found that land-users' conceptualization of space could not be narrowed to a point, line, or polygon or that land-use activities were conceptualized differently among participants. When I asked participants to identify a specific harvesting site, for instance, some would make a sweeping, broad circle over the map indicating a large harvest area. As participant Darrel Beaulieu explained to me, "I mean you grew up here, you go everywhere, right? So how do you just pick a little place like this?" [Darrell Beaulieu interview, May 25, 2016].

Finally, it is important to note that, this thesis represents the voices, experiences, and land-use practices of 25 Dene participants, and, therefore, should not be understood or interpreted as a comprehensive representation of the land-use of risk perceptions of any individual or Yellowknives Dene as a whole. Moreover, the land-use and avoidance maps do not capture specific details about the temporal dimension of land-use change. When I asked people when they stopped going to a site, many would say "after Giant Mine," "during the 70s," or a "while ago." When I asked an Elder if they could provide an approximate year of when they started avoiding a fishing site, the interpreter replied, "Elders don't know like year by year 'cuz that's a white man's version." While these maps only depict a static image of land-use change, they do, however, illustrate broad shifts in traditional land-use activities.

2.8 Conclusion

Within the environmental justice (EJ) discourse, the issue of environmental contaminants extends well-beyond the politics of waste siting and distributive justice. For

Indigenous communities, pollution and EJ issues have historically been (and continue to be) bound up with critical issues surrounding land claims, sovereignty, and colonial dispossession. My methodology, rooted in Indigenous land-use studies and co-production of knowledge, helps the literature move beyond proximity measures, and towards documenting *how* environmental inequality plays into the social and the everyday of exposed communities. Using the voices and experiences of Dene land-users themselves via the map-biography method, this approach could document the legacies of colonial dispossession, through the eyes of Indigenous Elders and land-users themselves. Not only could this approach enable the collection of spatial land-use data but also document Dene perceptions of and responses to environmental risk within their TEK systems. As the following two chapters will show, this approach helped create a powerful story about the historical legacies of widespread arsenic contamination and settler colonialism on Dene livelihoods and land-use.

CHAPTER 3

Mapping Yellowknives Dene Land-use and Avoidance in Wı̨ìlı̨ìcheh

3.1 Introduction

Half a century of gold mining in Yellowknife fragmented and contaminated the lands and waters upon which the YKDFN depended for their traditional livelihoods and subsistence activities. Industrial mining at the Giant (1948-2004), Con (1938-2003), and Negus mines (1939-1952) resulted in environmental damage, widespread arsenic contamination, and acute health impacts on the Yellowknives Dene. While increasing research is documenting the spatial extent of environmental contamination in the Yellowknife area, no study to date has spatially documented the impacts of industrial mining and settlement on Dene traditional land-use practices. Using a methodology grounded in Indigenous land-use studies and TEK, this study documents Dene land-use activities and avoidance in the Wı̨ìlı̨ìcheh (Yellowknife Bay) area. Using this approach, this chapter explores Dene perceptions and understandings of risk based on their TEK and land-based activities. Specifically, by identifying sites of use and avoidance, this study spatially documents mining-induced land-use displacement in the vicinity of the Giant Mine and Yellowknife.

Mining impacted Dene land-use practices over a broad geographic area. Using the land-use maps as evidence, I reveal how Yellowknives Dene land-users perceived and experienced mining pollution over a much wider area than the Giant Mine site and the city of Yellowknife. As these maps show, Dene land-users have relocated the majority of their land-use activities from the Wı̨ìlı̨ìcheh area to the Tinde’e (Great Slave Lake) area

due to feelings of alienation, sense of danger, and uncertainty associated with using the lands and waters near the abandoned mines.

This chapter is divided into eight sections. In the first section, I will review the historical and contemporary context of industrial mining and contamination in Yellowknife, then briefly summarise this study's methodology and methods, which were previously described in Chapter 2. In the subsequent six sections, I turn towards this chapter's main focus, the six traditional land-use maps: *YKDFN Traditional Travel Routes, YKFDN Hunting Activities and Avoidance, YKDFN Trapping Activities and Avoidance, YKDFN Harvesting Activities and Avoidance, YKDFN Change in Fishing Activities, and YKDFN Collecting Drinking Water and Avoidance*. In each of the map sections, I discuss the historical importance of the respective land-use activity, and using each map as evidence, I demonstrate the spatial extent of displacement, based on the information provided by Yellowknives Dene Elders and land-users.

The purpose of this chapter is not to reduce Dene TEK to points, lines, and polygons, but rather to illustrate a spatial narrative of environmental injustice. In other words, the purpose of this chapter is not to compare Dene perceptions of contaminants to that of "actual" contamination, or to overlay the aggregated land-use data with recent spatial contamination data to provide a "potential routes of exposure"[16] map. An independent Human Health Risk and Ecological Risk Assessment (HHERA, 2018) has already been conducted elsewhere.[17] Instead, this research aims to show how the Yellowknives Dene used their own experiences and understandings of risk to modify their land-based

[16] See Tsuji et al (2007)
[17] See https://www.aadnc-aandc.gc.ca/eng/1524243246522/1524243595839

practices in Wı̨ìlı̨ìcheh, and to show how these perceptions, understandings, and concerns ultimately forced Dene land-users away from this area.

3.2 Historical and Contemporary Context

Beginning in the 1930s, gold mining activities had severe impacts on the Yellowknives Dene communities at Dettah and N'Dilǫ and their traditional lands (Figure 3.1). The gold found at Giant and Con was in the form of arsenopyrite, an iron arsenic sulfide mineral, which required crushing and roasting in order to access the precious yellow metal (Bromstad, 2011; Jamieson, 2014). As a result of roasting the metallic mineral, Giant Yellowknife Gold Mines, Ltd., created and released large quantities of arsenic trioxide (As_2O_3) and sulphur dioxide (SO_2) into the environment via the mines' roaster stacks (Canadian Public Health Association (CEPA), 1995; Hocking et al., 1978). Giant Mine accounted for the majority of the emissions (an estimated 7.5 tonnes per day between 1949-1953) because all of the ore processed was contained in arsenopyrite formations, while only 20 percent of the ore at Con required roasting. The majority of the As_2O_3 generated at Con mine was captured and treated on site, and either mixed with the tailings or sold and shipped to the south (Palmer et al., 2015; Sandlos & Keeling, 2012).

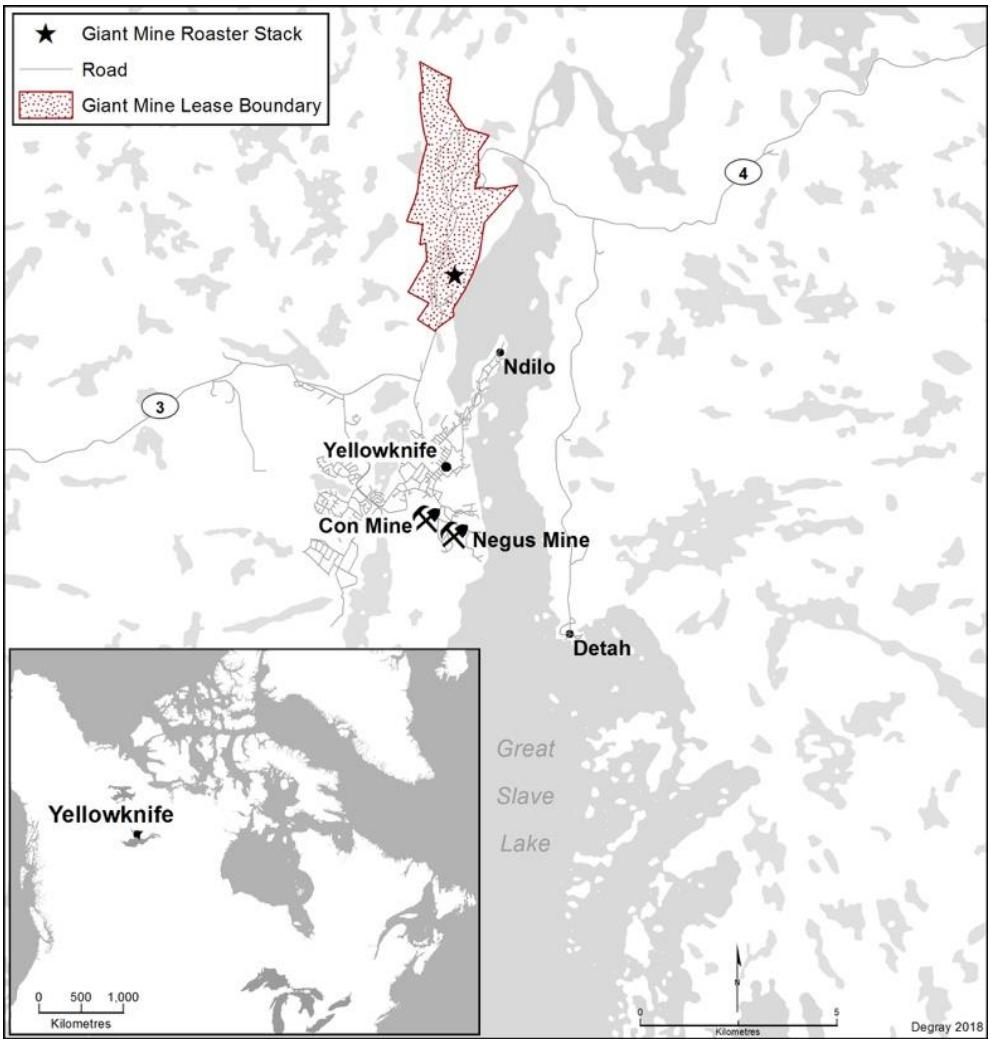

Figure 3.1 Map of the study area showing the location of Giant Mine, Con Mine, Negus Mine, and YKDFN communities, with inset showing location of Yellowknife, NT, Canada.

Arsenic trioxide is a non-threshold carcinogen that easily dissolves in water and bioaccumulates in the aquatic environment, but concentrations usually decrease with trophic levels[18] (Rust & Soignet, 2001; Cott et al., 2016). The toxic compound is

[18] Trophic level refers to "the position of a species or a group of species within a food chain or food web" (The American Heritage Dictionary of the English Language, 2020)

colourless and tasteless in its soluble form, and consolidates as a white dust at room temperature (O'Reilly, 2015). Therefore, in a geographical location such as Yellowknife, where small and large bodies of water dominate the landscape and the snow season extends from October to April, the risk of arsenic exposure was particularly high to human and nonhumans alike. During the early years of mining operations, and without pollution management controls in place, arsenic dust emitted from the Giant and Con smokestacks accumulated on the surrounding land and especially on the snow during the winter months (Sandlos & Keeling, 2016). During the spring snowmelt season, the accumulated arsenic was carried as contaminated runoff into local streams and lakes (Sandlos & Keeling, 2012).

The characteristics and movement of arsenic trioxide in the environment posed environmental and health risks to the Yellowknives Dene communities at Detah and N'dilǫ. Both communities were located downwind of the historic roaster stacks, and relied on local lakes, rivers, and streams for their drinking water needs, and harvested berries and medicinal plants in the vicinity of the mines (YKDFN LEC, 2005; Weledeh Yellowknives Dene, 1997). Despite the known health hazards, Giant continued to release As_2O_3 into the environment without pollution controls until a two-year-old Dene boy from N'Dilǫ died from acute arsenic poisoning caused by drinking snowmelt water in April 1951 (Sandlos & Keeling, 2012). As compensation, Giant Yellowknife Gold Mines paid the family $750 for the loss of their child, and installed pollution control equipment in form of Cottrell electrostatic precipitators (ESPs) at the mine site in October 1951 (O'Reilly, 2015; Sandlos & Keeling, 2012). While the installation of ESPs helped reduce arsenic emissions into the atmosphere, they did not eliminate the problem in its entirety.

According to Wrye (2008), an estimated 20,000 tonnes of As_2O_3 was released into the environment between 1949 and 1999, though by the 1990s, emissions were reduced to about four tonnes per year.

Ironically, the technological fix to air pollution created the current underground storage problem, since the captured toxic arsenic dust needed to be stored somewhere on site (O'Reilly, 2015). Today, Giant Mine sits on top of 237,000 tonnes of arsenic trioxide buried in underground chambers and mined-out stopes, which now represents Canada's second-largest environmental liability (INAC, 2018; Thomson, 2018). The federal government is tasked with containing and managing the arsenic waste stored underground and remediating the 875-hectare lease area, which includes 95 hectares of contaminated mine tailings, eight open pits, and asbestos-laden buildings (INAC, 2018; O'Reilly, 2015; de Guzman, 2012). The Giant Mine Remediation Project (GMRP) has opted for the "frozen block method" as an interim solution to contain and manage the arsenic waste underground (INAC, 2018). This method consists of using thermosyphon technology which draws and expels heat from the ground using pressured carbon dioxide, which in turn freezes the rock around the 13 arsenic chambers (INAC, 2018). Freezing the arsenic trioxide in situ has been criticized by Yellowknives Dene and the city of Yellowknife alike as this method is inherently unstable, presents unknown risks, and does not actually deal with arsenic problem over the long-term (Beckett, 2017; Sandlos & Keeling, 2015).

Although the YKDFN have decried the severity of mining impacts on their lands for decades, scientific studies are only now beginning to address and understand the spatial extent of environmental contamination. Recent studies have revealed that historic emissions from the Giant Mine site continue to be a source of arsenic in the surrounding

area, including: the aquatic food web (Cott et al., 2016; de Rosemond, Xie, & Liber, 2008), lake sediments and surface waters (Andrade et al., 2010; Galloway et al., 2015; Palmer et al. 2015), soils and vegetation (Bromstad, 2011; Environmental Sciences Group, 2011; Hocking et al., 1978; Koch et al., 2000a,b; St-Onge, 2007), terrestrial birds (Koch, Mace & Reimer, 2005), and snowshoe hares (Amuno et al. 2017). Further research has suggested that arsenic contamination extends well-beyond the 875-hectare site designated for remediation. In their study, Houben et al. (2016) identified elevated concentrations of dissolved arsenic in lakes within a 25-km radius of Yellowknife, ranging up to 136 µg/L in lakes within 4 km from the mine to 2.0 µg/L in lakes 24 km away (Figure 3.2). According to Canadian water guidelines, the maximum acceptable concentration (MAC) for arsenic in drinking water is 0.010 mg/L (10 µg/L) and 0.005 (5 µg/L) for the protection of aquatic wildlife (Health Canada, 2006).

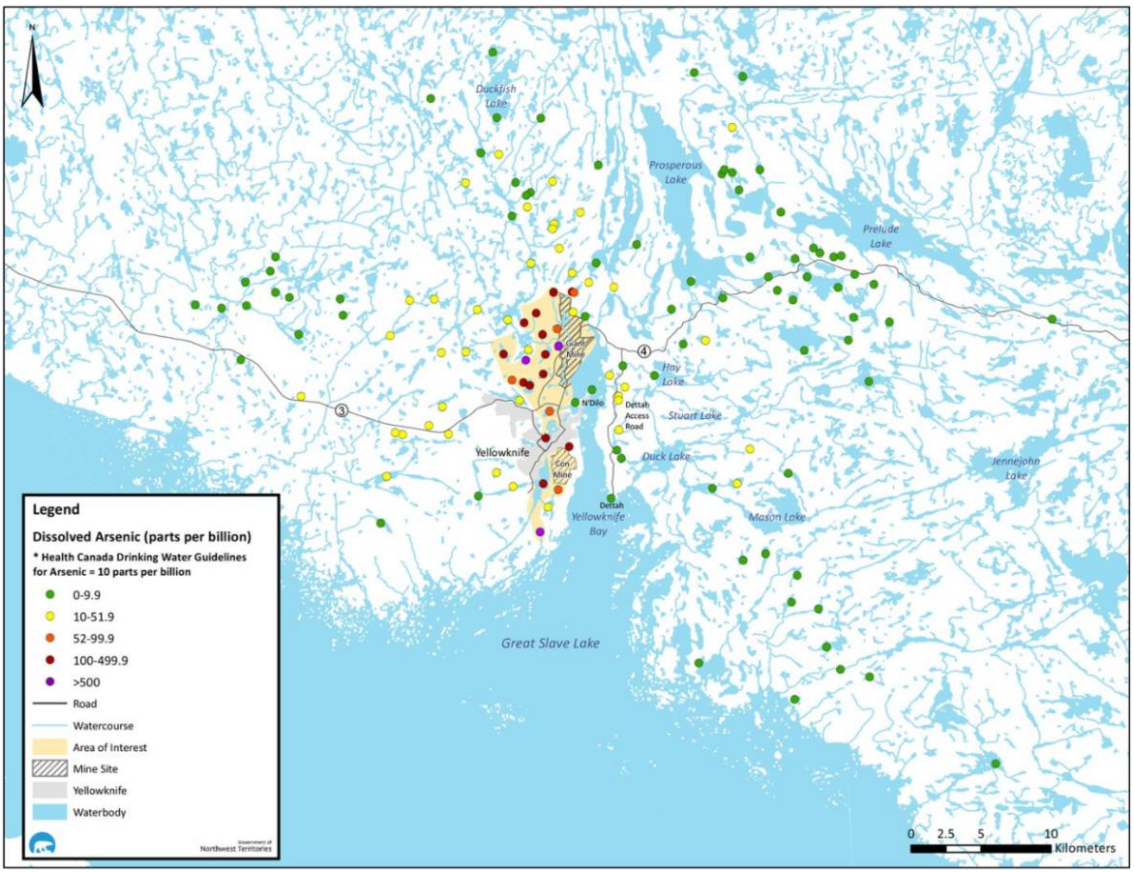

Figure 3.2 Map of Arsenic Concentrations in Water Bodies in the Yellowknife Area. Areas marked in orange, red, and purple contain arsenic concentrations that exceed Health Canada's drinking water guidelines. Source: Palmer et al. (2015).

Other studies have attributed high arsenic and sulfate concentrations in soils and vegetation up to 25 km westward of the Yellowknife area to historic mining emissions (Hocking et al., 1978). For the Yellowknives Dene that continue to depend on the local environment for subsistence activities, elevated concentrations of contaminants in mammal and fish tissues pose a risk to their health and sense of well-being.

As Sandlos and Keeling (2016) have argued, remediating the Giant Mine site is not only a matter of restoring the land but also of recognizing the historical injustices experienced by the communities. Historic mining is associated with painful memories of

sickness and death, and a profound feeling of alienation from the landscape. Dene oral histories and testimonies have repeatedly recounted the devastating effects of mining on the local environment and their traditional land-use practices (CEPA, 1995; Sandlos & Keeling, 2012). Historically, the communities used to travel, hunt, trap, gather berries and medicinal plants, and collect drinking water all around the Wı̨ìlı̨ìcheh area. As Elders recall, areas near the Giant Mine site and the city of Yellowknife used to be important areas for berry-picking and moose hunting, and the mouth of Baker Creek, which flows through the Giant Mine lease area, used to be a productive fishing site (Weledeh Yellowknives Dene, 1997; YKDFN LEC, 2005). Dene traditional travel routes were extensive on the west side of Wı̨ìlı̨ìcheh, especially near the Giant and Con sites (YKDFN LEC, 2005). During the early years of mining operations, however, sled-dogs that were travelling across the mine sites started to lose the fur on their paws, and in some cases died. According to Elders, the death and illness of their beloved sled-dogs were associated with the mines' tailings and arsenic-laden wastewaters (YKDFN LEC, 2005)

To date, both the federal and territorial governments remain undecided about who is responsible for off-site contamination, and the Giant Mine Oversight Board[19] has criticized the remediation project in its first two reports for failing to come to a decision (Gleeson, 2017; Thomson, 2018). In any case, there is no doubt that the displacement of Yellowknives Dene livelihoods and land-use activities, much like environmental contamination, cannot be reduced to an 875-hectare area. The Yellowknives Dene have

[19] The Giant Mine Oversight Board (GMOB) is an independent group tasked with providing objective, high-level advice on the management of the future of the Giant Mine site (EDGE North, 2017).

time and again argued that they want the GMRP to acknowledge the "full geographic extent of impacts on the environment by the mine over its lifetime," including impacts on their community health and land-based practices (Sandlos & Keeling, 2015: p.4; YKDFN, 2008). In light of their requests, this study documented mining-induced displacement in the vicinity of the Giant Mine and Yellowknife to address the historic and ongoing environmental injustices of industrial mining and settlement on Dene land-use activities. In the following sections, I discuss the findings gleaned from the Dene composite map-biographies. Using each of six land-use maps as evidence, I demonstrate the spatial extent of Dene land-use displacement and describe the historical importance Wı̨ìlı̨ìcheh for Dene cultural, social and land-use practices.

3.3 Yellowknives Dene First Nation Traditional Travel Routes

For millennia, the Yellowknives Dene have been using the traditional trail system developed by their ancestors to access their hunting, trapping, fishing, and plant gathering grounds (DownNorth Consulting, 2018). From the original Dene Mapping Project in the 1970s to the ongoing land-use mapping projects with Trailmark Systems Inc., the Yellowknives Dene have extensively documented their travels across their traditional lands (Weledeh Yellowknives Dene, 1997; Trailmark Systems Inc., 2019) This particular mapping project added to the richness of the existing travel route spatial data by specifically documenting travel route change in the vicinity of the Giant Mine and Yellowknife.

The map titled *Yellowknives Dene First Nation Traditional Travel* illustrates the extent and persistence of Yellowknives Dene traditional travel routes in Wı̨ìlı̨ìcheh (Figure 3.3).

The orange lines represent travel routes used in the past, whereas the green lines represent routes that continue to be used today. This map was derived from asking participants how they accessed their past or continued land-use sites and cabins. Both continued and past travel routes include summer and winter trails. For the purpose of this study, traditional travel routes were accessed by motorboat, snowmobile, snowshoes, canoe or by foot. Vehicles were limited to travel along the Ingraham Trail (Highway 4).

Fifteen participants (60%) identified continued travel routes and nine (36%) identified past travel routes across Wı̨ìlı̨ìcheh. Nine participants recalled four popular travel routes that were traditionally used to access their hunting, harvesting and fishing grounds west of the Wı̨ìlı̨ìcheh area. The first trail used to cut through Long Lake where Yellowknife airport now stands. The second and third trails used cut through present-day downtown Yellowknife, and either continue south towards Kam Lake or veer west towards Grace Lake. The fourth trail used cut across the current GMRP site. As some participants described, mining activities, along with non-Indigenous settlement, led to the gradual dispossession of these traditional trails west of Wı̨ìlı̨ìcheh. During mining operations, land-users travelling across the mine sites would find themselves coming face to face with a fence or be accused of trespassing on "private property." Elders Alfred Baillargeon and Jonas Noel, during their interviews, said that they used to travel northwest of the city by dog team to hunt caribou, but can no longer use the trail or hunt there because of increasing settler recreationalists and cabins in the area.

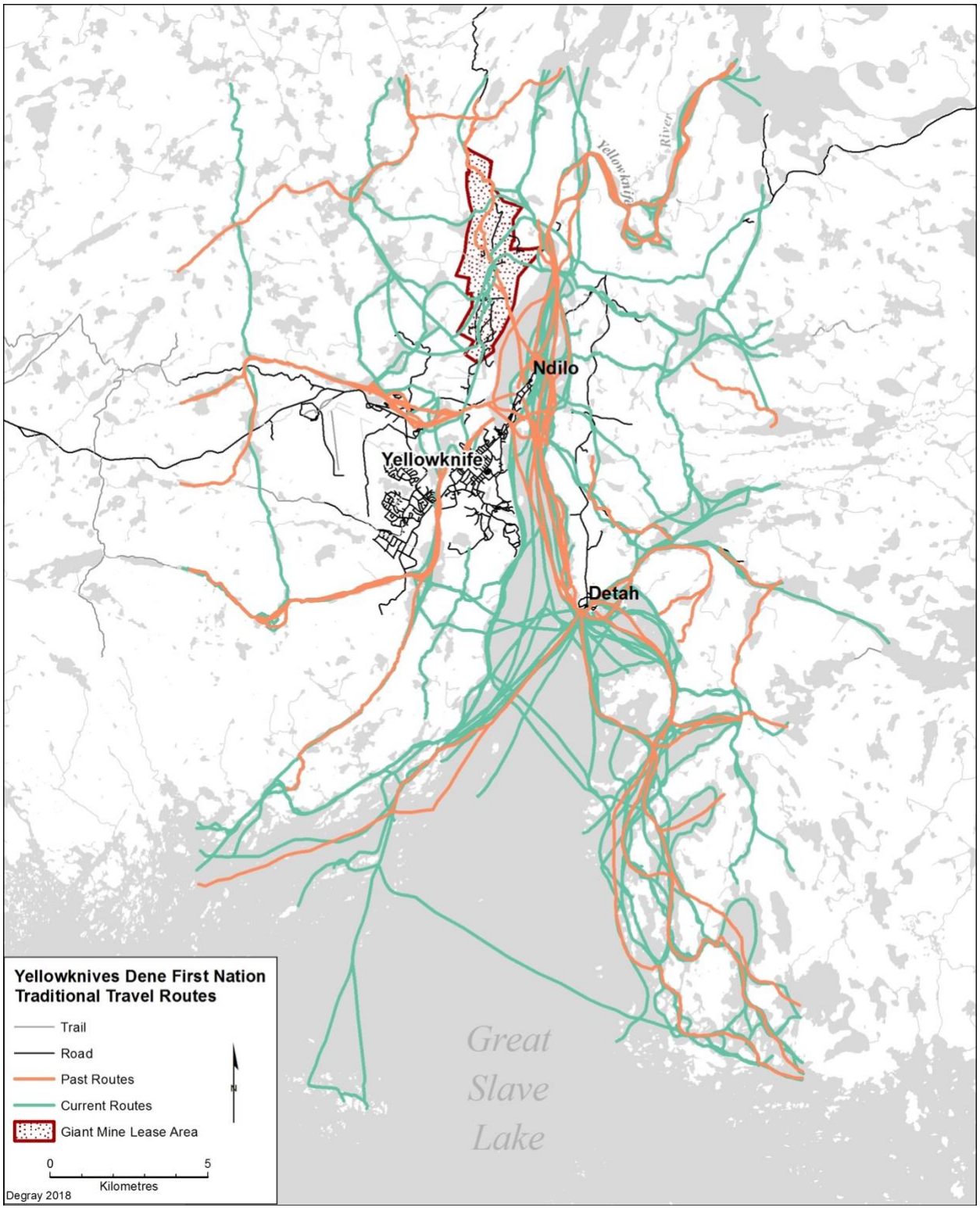

Figure 3.3 Map of Yellowknives Dene First Nation Traditional Travel Routes

Another important traditional Dene travel route is Wı̨ìlı̨ìdeh alàa tǫ.[20] In the past, Wı̨ìlı̨ìdeh alàa tǫ was the most popular travel route for the Yellowknives Dene and served as the gateway to hunting territories. This traditional canoe trail connected a vast network of trails converging near Courageous Lake, Ek'ati (Lac de Gras), and Mackay Lake (Weledeh Yellowknives Dene, 1997).

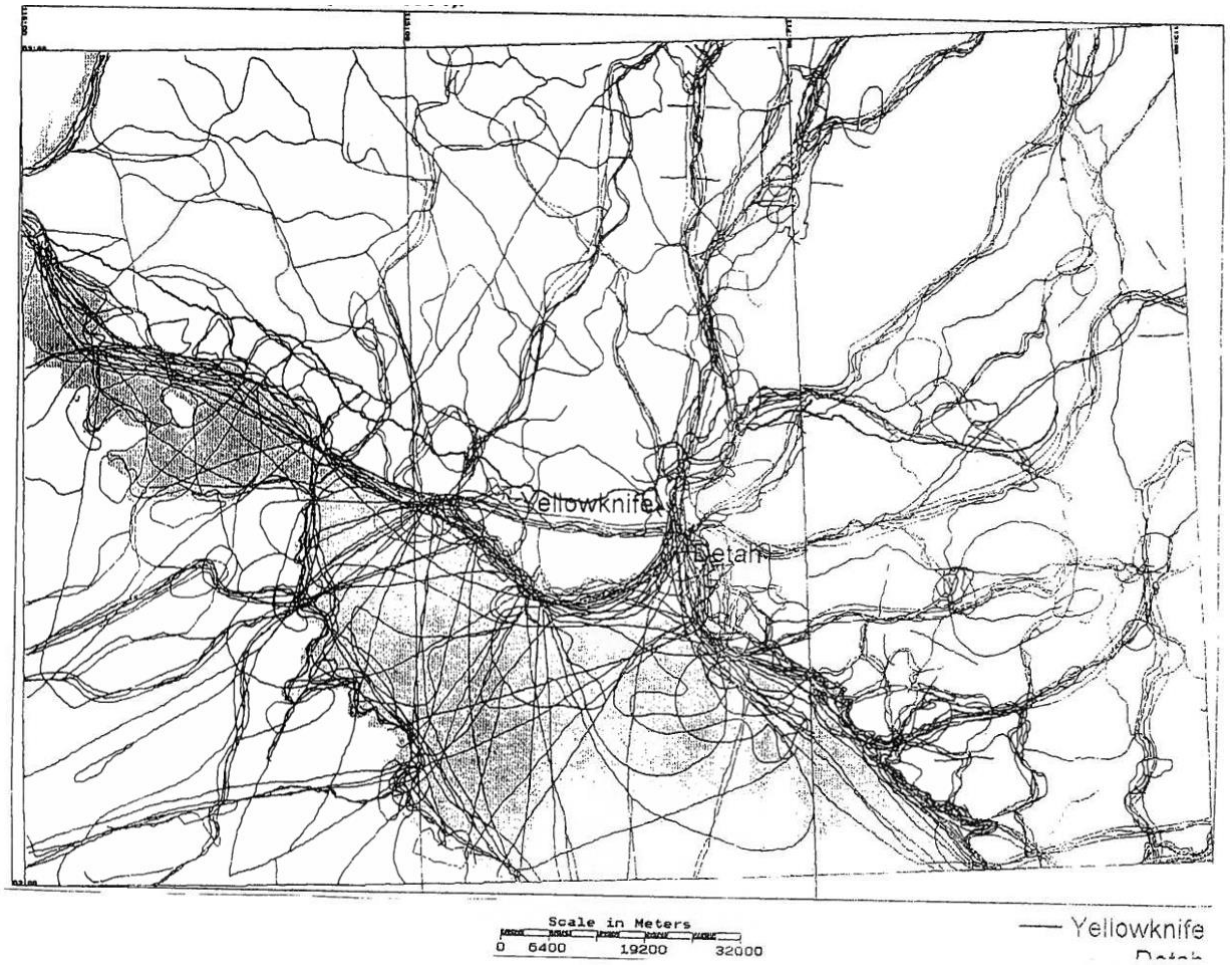

Figure 3.4 Map showing traditional Dene travel routes. Source: Weledeh Yellowknives Dene (1997)

As Dene oral histories describe, Dene families would leave their summer camps in

[20] Wı̨ìlı̨ìdeh = Yellowknife River. In Wı̨ìlı̨ìdeh, routes with portages are referred to as alàa tǫ whereas boat trails on big lakes are referred to alàa ti li (Weledeh Yellowknives Dene, 1997).

Wı̨ìlı̨ìcheh in the fall and travel north beyond the tree line to hunt the southward migrating caribou. Elder Isadore Tsetta, during his interview for the GMRP Traditional Knowledge Report, explained the importance Wı̨ìlı̨ìdeh alàa tǫ:

> If you follow the Yellowknife River System, as you go you will hit all the portages leading to Mackay Lake. These portages that lead to MacKay Lake were used by our ancestors for generations. It has always been there, and I have followed that route. (YKDFN LEC, 2005)

During the spring, Dene ancestors would return to Wı̨ìlı̨ìcheh by using the traditional dog team trail that traversed the length of Homıìtì (Gordon Lake) and then crossed Wek'ełeèdlı̨ Tì (Waite Lake), Łıgǫ̀ǫtì (Bliss Lake), and Teètì (Prelude Lake) (DownNorth Consulting, 2018).

Today, most YKDFN land-users travel by motorboats or snowmobile. Wı̨ìlı̨ìdeh alàa tǫ continues to be travelled by participants (n=10); however, the increased presence of settler recreationalists and other priorities such as employment make travelling up the river more difficult. Five land-users mentioned that they prefer travelling towards the southern islands rather then up the river because it is closer to their family cabins and away from settlers.

Although the YKDFN Traditional Travel Routes map is not evidence of contamination-related avoidance behaviours per se, it does indicate that historic mining activities and settlement continue to affect the movement of people across their territory, as represented by the density of orange lines. The map, however, also demonstrates that the Yellowknives Dene continue to leave their footprints across Wı̨ìlı̨ìcheh, and that a web of trails continues to give access to areas used for hunting, trapping, harvesting berries and medicinal plants, gathering firewood, and collecting drinking water. The majority of participants (n=15)

continue to travel on the lands and waters east of the bay especially towards the southeastern islands, Hay Lake, Duck Lake and Wı̨ìlı̨ìdeh to access their hunting, trapping, and harvesting grounds.

3.4 Yellowknives Dene First Nation Hunting Activities and Avoidance

The map titled *Yellowknives Dene First Nation Hunting Activities and Avoidance* shows primary areas of hunting activities and avoidance identified by participants (Figure 3.5). Areas on the map shaded in orange represent areas of avoidance whereas areas in green are areas of continued activities. The areas shaded in purple are areas of overlap where some land-users continue to hunt while others avoid. Although Tobias (2009) has argued that points are preferable to large polygons because the former provides the greatest degree of spatial accuracy and precision, this study opted for the use of polygons. The reasons are twofold. First, these maps are not intended to be used as evidence for land claim negotiations or land rights litigation, and therefore, spatial precision and accuracy related to hunting were not this study's main objective. Second, participants seemed to identify hunting areas more readily then specific kill sites. While the use of polygons may have reduced the "degree of fineness" of the marked features of the map, this study strived to maintain spatial reliability, credibility, and validity. In total, seven participants (28%) identified areas of continued use for moose hunting whereas four land-users (16%) identified areas of avoidance. For duck hunting, seven participants (28%) identified sites of continued use while five participants (20%) identified sites of avoidance. It is important to note, however, that some land-users that we spoke to avoid hunting in Wı̨ìlı̨ìcheh in its entirety or have never used Wı̨ìlı̨ìcheh for hunting activities,

and therefore no hunting spatial data were collected. The lack of data, however, should not be understood as a lack of activity, but rather suggestive of the drastic spatial extent of Dene land-use displacement around Wı̨ìlı̨ìcheh.

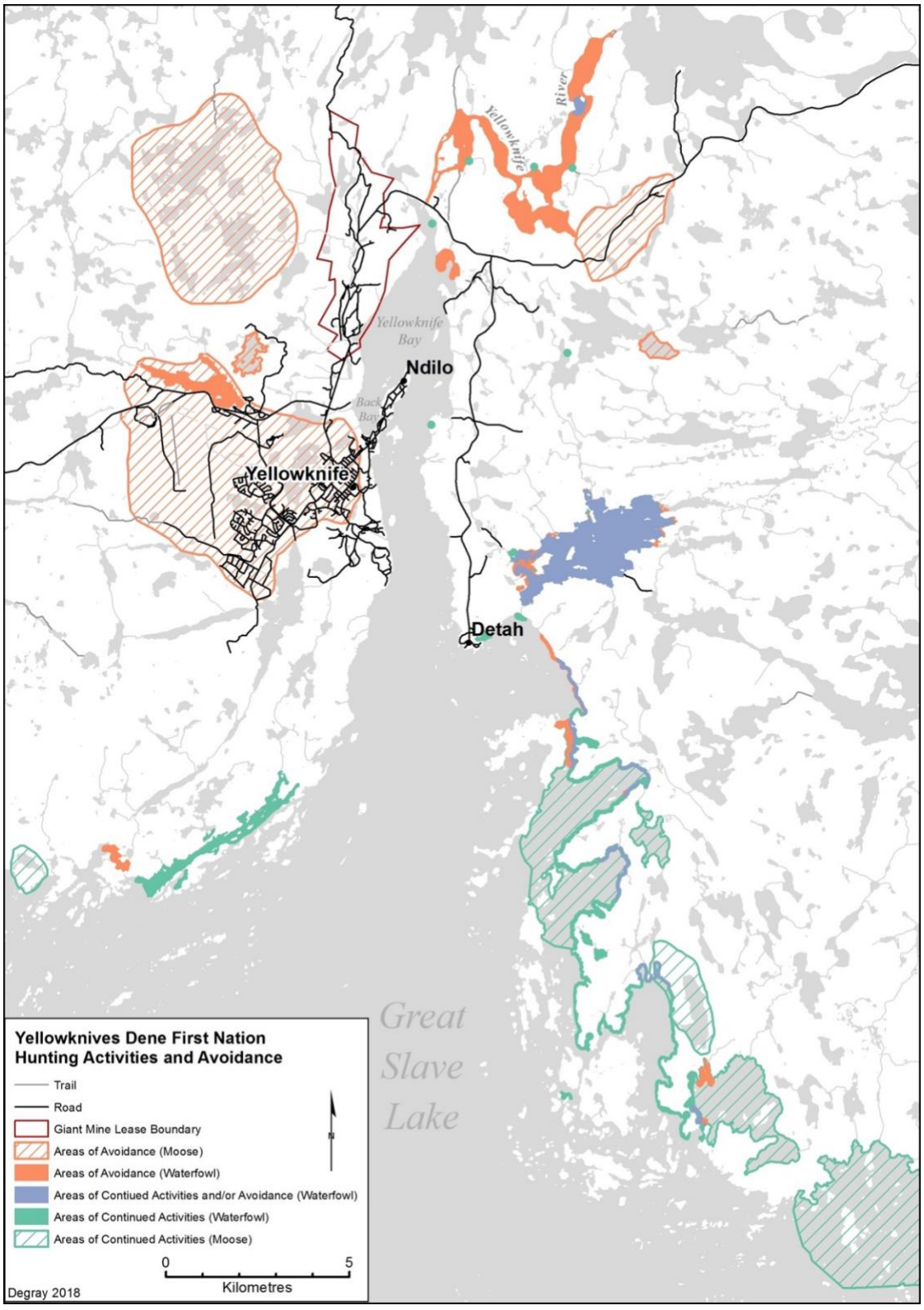

Figure 3.5 Map of Yellowknives Dene First Nation Hunting Activities and Avoidance

For Indigenous communities, hunting extends beyond the act of killing and forms an integral part of their material, social, and cultural practices (Nadasdy, 2007; Irlbacher-Fox, 2010). For generations, hunting *dendi* (moose) and *ek'wo* (caribou) were essential to Dene survival on the land, and these large mammals remain an important part of their hunting culture, diet, and health. In the late 1700s, Tatsǫ́t'ıné knowledge of the land and their skill at hunting caribou played a key role during expansion of the fur trade down the Mackenzie River. Records from the Northwest Company state that the trading posts built at "Old" Fort Providence,[21] Mountain Island,[22] and Old Fort Island[23] were purposefully built to trade with the Tatsǫ́t'ıné, who became the main suppliers of *etsìtłe*, a nutritious food made by mixing caribou fat with berries, for voyageurs travelling on the Mackenzie River (DownNorth Consulting, 2018). Hunting, at this time, became a commercial enterprise for the Dene and the desire for European manufactured goods brought an intensified fall harvest of caribou (DownNorth Consulting, 2018).

During one of our drives, Fred Sangris recounted the time his grandfather shot a moose on present-day Franklin Avenue, Yellowknife's main street. This was in the 1920s. He told me that, prior the settlement of Yellowknife, the Yellowknives Dene did not occupy the lands west of Wı̨ìlı̨ìcheh, and for a very good reason. Wag'we, he said, was a traditional hunting ground for *dendi* and *ek'wo* and used to encompass the City of Yellowknife, Yellowknife Airport, and Long Lake. He explained to me,

> Yea…Wag'we…So the Yellowknives leaders always told the young guys don't build homes here…Don't build anything…Just go across...go hunting and bring your food back…So the settlement for the Yellowknives were all the eastern

[21] Located adjacent to the mouth of Wı̨ìlı̨ìcheh
[22] Located in the North Arm of Great Slave Lake but is no longer an island and called Rae Point
[23] Located south of Whitebeach Point, 45 kilometers west of Yellowknife

> side of the bay…the western side was all wildlife…and it was like that until they discovered gold and they start putting up tents and tent frames…eventually the road…then this whole place here right up to the Tim Hortons today. That's what happened. So, we lost the ability to harvest and hunt in that area. [Fred Sangris interview, May 24, 2016]

According to the Elders, *dendi* used to travel on the extensive sandy plains west of Wı̨ìlı̨ìcheh because they preferred to travel on soft bottomed shallow bays or lakes or sandy areas (DownNorth Consulting, 2018). Those sandy plains, however, were eventually paved over to build the roads of downtown Yellowknife.

Traditionally, the Yellowknives Dene hunted *dendi* during the fall, and *ek'wo* during the winter. For those families that stayed in Wı̨ìlı̨ìcheh year-round, land-users would hunt *ek'wo* that migrated towards Tinde'e, especially near Frame Lake and Long Lake during the spring. Using ArcMap 10.6, I created a visual representation of Wag'we by intersecting polygons that were identified by five participants on the base maps. For some Elders, Wag'we used to extend north to Martin Lake. On the composite map, Wag'we is represented as the large polygon covering the majority of the City of Yellowknife, and the Martin Lake area is represented as the second polygon northwest of the city. Elder Alfred Baillargeon recalled his memories of travelling and hunting for caribou in Wag'we when he was a young boy:

> He was about 10 years old. He remembers travelling there with the parties and they were hunting caribou here, all these lakes they were hunting caribou. He was 10 years old he remembers. That's the time they were building the airstrip at the same time. He said there was a lot of moose in this (Yellowknife) river at one time, unlike today. But at one time it was a lot of moose habitat in this area, they were hunting moose all the time, drying fish and making moose dry meat. [A. Baillargeon interview, June 9, 2016. Interpreter: Fred Sangris]

Yellowknives Dene no longer hunt in Wag'we for the obvious reason that the city of Yellowknife now sits on top of their traditional hunting ground. Only one participant reported hunting moose southwest of Yellowknife city. As the YKDFN Hunting Activities and Avoidance map reveals, moose hunting activities were displaced from Wag'we towards the southeastern islands near Tadeh Cho (Wool Bay). Out of the 25 participants interviewed, only four land-users identified continued hunting areas on the base maps, and all of these areas were south of Detah. Three land users identified specific kill sites in the form of point data, however, were not recent and varied between the 1990s and late 2000s.

Avoidance behaviours for this subsistence activity are not the result of contaminant perceptions. Instead, they are influenced by anthropogenic and non-anthropogenic factors such as hunting regulations, declining caribou herds, and changes in caribou migration. According to the Dene, caribou stopped travelling towards Great Slave Lake during the 1940s because of blasting and operations at the mines as well as the growing settler population on the west side of Wı̨ìlı̨ìcheh (Weledeh Yellowknives Dene, 1997).

In terms of duck hunting, seven active land-users reported hunting near Duck Lake and along the southeastern and southwestern shores. *Dih* (grouse) continues to be hunted during the fall and *k'amba* (ptarmigan) during the winter. Specifically, no participant reported duck hunting west of Wı̨ìlı̨ìcheh. Both Wı̨ìlı̨ìdeh and Long Lake were remembered as popular sites for hunting ducks in the past but are now avoided. To use the words of the participants, there is just "too much traffic" on Wı̨ìlı̨ìdeh, and Long Lake now lies within Yellowknife city limits. Finally, Duck Lake and specific areas along the

southeastern shores were the only areas of overlap where some land-users continued to hunt waterfowl while others avoided.

Overall, the YKDFN Hunting Activities and Avoidance map provides visual evidence of Dene land-use displacement in relation to hunting in Wag'we and Wı̨ìlı̨ìcheh. Following the settlement of Yellowknife and mining operations on the west side of Wı̨ìlı̨ìcheh, the Yellowknives Dene lost access to their traditional hunting ground, and in turn, land-users incurred the cost of travelling further to hunt.

3.5 Yellowknives Dene First Nation Trapping Activities and Avoidance

The map *Yellowknives Dene First Nation Trapping Activities and Avoidance* shows primary areas of trapping activities and avoidance identified by participants (Figure 3.6). Areas on the map shaded in orange represent areas of avoidance while areas shaded in green represent areas of continued activities. The areas shaded in purple are areas of overlap where some land-users continue to trap while other land-users avoid. Twelve participants (48%) indicated areas where they had formerly or currently trapped, while nine (36%) respondents indicated areas that they avoided doing so. Similar to hunting activities, some participants explained to me that they avoided trapping in Wı̨ìlı̨ìcheh as a whole, or that the base maps needed to cover a much larger area in order to identify their traplines. In these cases, no trapping spatial data were collected.

For the purposes of this study, trapping refers to setting traps and snares to catch smaller game such as (but not limited to) *dzo* (muskrat), *tsa* (beaver) *nodah* (lynx), *gah* (rabbit), *nogha* (wolverine), and *whah* (martin). In Wı̨ìlı̨ìdeh, a trap line is known as *ehdzoo tili* and refers to a route or circuit along which a series of animal traps are set and

is used by a specific family. Historically, trapping in Wìlìicheh was integral to Dene subsistence activities and livelihoods. Dene relied on small game to feed and clothe their families, and during the fur trade, trading animal pelts for manufactured goods became a key component of Dene subsistence economies. According to the Weledeh Yellowknives Dene report (1997), Dene trappers who would stay in Wı̨ìlı̨ìcheh during the winters could make a reasonable living trapping *dzo*, *tsa*, and *whah* in the area.

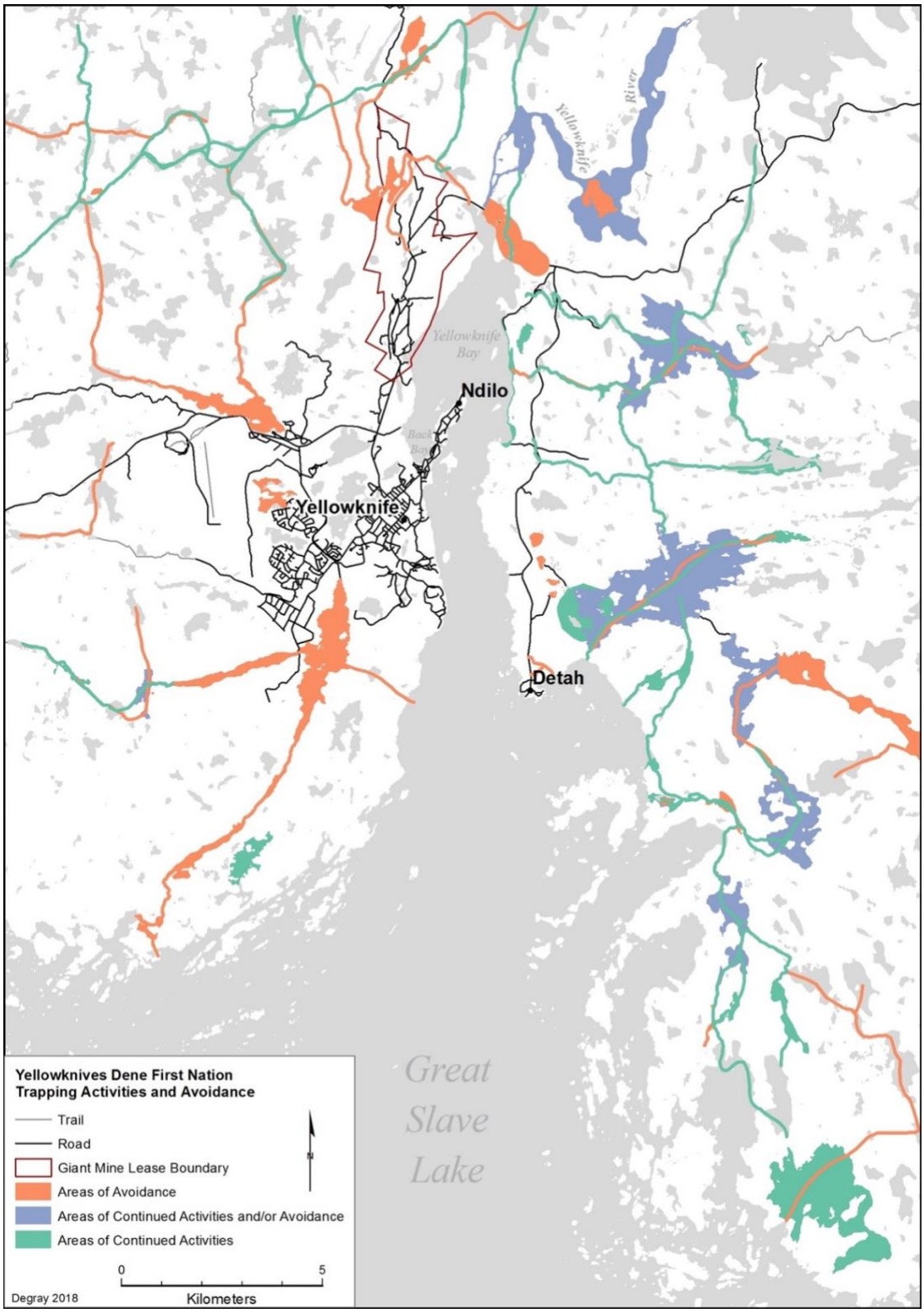

Figure 3.6 Yellowknives Dene First Nation Trapping Activities and Avoidance.

During their map-biography interviews, Elders and land-users told me that mining activities followed by the settlement of non-Indigenous people in present-day Yellowknife ultimately resulted in the erosion of the people's Treaty rights to trap in the area. Four Elders and land-users pointed out on the base maps where their old family traplines west of Wı̨ìlı̨ìcheh used to be. Traplines, as the map shows, were set along Long Lake, Grace Lake, Kam Lake, and lakes near the Giant Mine site. Although not included on the map, oral histories also describe that Dene land-users used to trap on the lakes along the present-day Ingraham Trail highway (Weledeh Yellowknives Dene, 1997). Most of these sites, however, can no longer be used because they are located within Yellowknife city limits and the GMRP site. Only three participants reported actively trapping on the west side of Wı̨ìlı̨ìcheh whereas 11 said that they continue to trap on the east side of Wı̨ìlı̨ìcheh, especially south of Hay Lake and Duck Lake. Muskrat and beavers continue to be the most prevalent animals trapped east of the bay.

Trapping avoidance in Wag'we is largely due to the fact that a city and two former mining sites sit on top of former trapping sites. While concerns of contamination in animals near the former mining sites are very real, especially with increasing scientific studies (see Amuno et al. 2018 and Koch, Mace & Reimer 2005), land-users reported no longer using this area because by law, they cannot set snares within Yellowknife municipal boundaries. Trapping avoidance behaviours beyond Yellowknife city limits, however, specifically southwest of the city, were associated with uncertainties and health risks of eating the animals. For instance, one participant spoke about the city's sewage that travels across 15 kms of wetland area before finally reaching Tinde'e while another land-user spoke of historic Con Mine tailings seeping down through Keg, Peg, and Meg

lakes. Perceptions of water contamination along with personal experiences of the change in quality of animal fur led these two participants to avoid trapping in these areas.

On the other hand, trapping avoidance on the east side of Wı̨ìlı̨ìcheh and on Wı̨ìlı̨ìdeh were largely associated with increasing settler recreationalists. Only one land-user reported trapping near Wı̨ìlı̨ìdeh while six others said that they avoided doing so. Land-users no longer trap in these areas because they fear that either a person or dog will get hurt by snares or traps or that people will steal their trapping equipment, which is reported to be very common. During an interview, a participant who preferred to stay anonymous said that snowmobilers primarily associated with the Great Slave Lake Snowmobilers Association (GSSA) are taking over Dene traditional trails especially from Mason Lake to Jennejohn Lake, and consequently infringing on Dene traditional rights to hunt and trap in these areas.

The YKDFN Trapping Activities and Avoidance map provides visual evidence of Dene land-use dispossession in relation to trapping west of Wìlìicheh. Following the settlement of Yellowknife and mining operations, the Yellowknives Dene lost access to their traditional trap lines specially along Long Lake, Kam Lake, and Grace Lake. This map, however, also shows continued Dene presence and trapping activities east of Wı̨ìlı̨ìcheh. Trapping continues to be part of Dene subsistence economies, and animal pelts are increasingly used to create Indigenous handicrafts to sell in local stores (Fred Sangris, personal communication, February 2018). In addition, as part of Dene resurgence on the land, increasing numbers of Indigenous youth are taking part in trapping activities. As Fred Sangris proudly told me, the Yellowknives Dene hold annual culture camps at

Mason Lake where youth are learning about and taking part in trapping, snaring, and dry-meat making activities.

3.5 Yellowknives Dene First Nation Harvesting Activities and Avoidance

The map *Yellowknives Dene Harvesting Activities and Avoidance* shows principal areas of harvesting activity and avoidance identified by participants (Figure 3.7). For the purposes of this study, harvesting activities included collecting medicinal plants, collecting berries, and gathering wood. Areas on the map shaded in orange represent areas of avoidance, while areas shared in green are areas of continued activities. The areas shaded in purple are areas of overlap where some land-users continue to harvest while other land-users avoid. Note of course that these are collecting areas and not specific harvest sites. During the map-biography interviews, 11 (44%) respondents indicated areas where they had formerly or currently harvested plants, while 12 (50%) respondents indicated areas that they avoided doing so. Given the map findings, most land-users today avoid the shores of Wı̨ìlı̨ìdeh and Wı̨ìlı̨ìcheh for collecting medicinal plants, berry picking, and gathering wood. The majority of land-users are travelling further towards the southern and southwestern islands especially towards Tadeh Cho to collect berries, medicinal plants, and firewood. Specifically, it appears that the areas located beyond Horseshoe Island and the small southwestern islands are considered safe to use for harvesting activities, at least for some land-users (n=10).

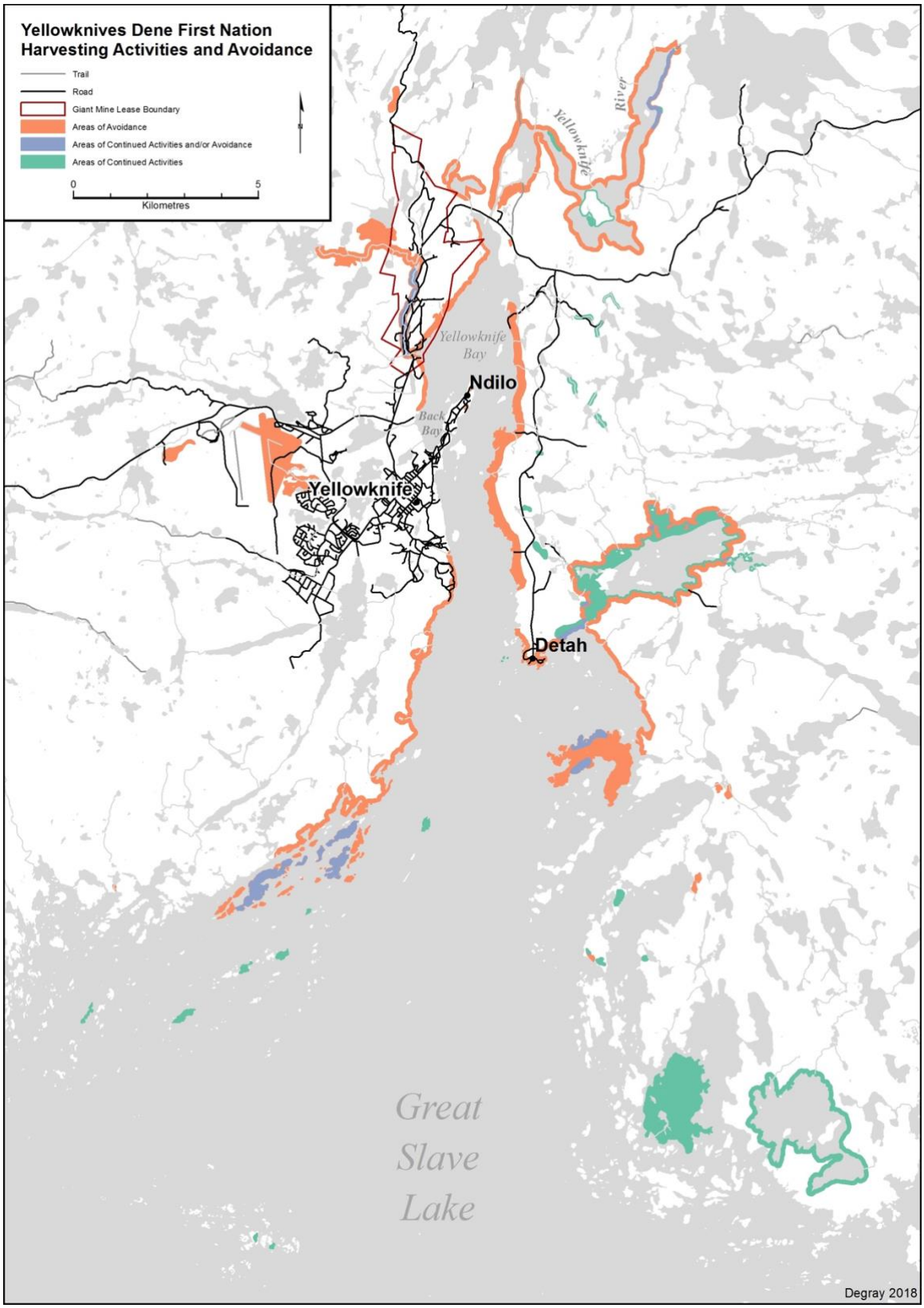
Yellowknives Dene First Nation
Harvesting Activities and Avoidance
Trail
Road
Giant Mine Lease Boundary
Areas of Avoidance
Areas of Continued Activities and/or Avoidance
Areas of Continued Activities
0
5
Kilometres
Yellowknife River
Yellowknife Bay
Ndilo
Back Bay
Yellowknife
Detah
Great Slave Lake
Degray 2018

Figure 3.7 Yellowknives Dene First Nation Harvesting Activities and Avoidance

Nine Elders described that, in the past, Enda'deh (Baker Creek) and the shores of Wı̨ìlı̨ìdeh and Wı̨ìlı̨ìcheh were filled with raspberries, cranberries, cloudberries, gooseberries, and blueberries. Participants explained to me that Enda'deh, which today is located within the Giant Mine boundary, used to look like a blanket of blueberries and was an important site for berry picking. As elder Therèse Sangris recalled,

> When there's no mine…nothing, all the trees used to be like really healthy…everything…and these people, our parents, they pick up berries…sometime they make like a jam or juice or something…sometime they do with the flour, they cook it with a bannock…in the fall time, they have lots at Giant…they used to be just huge and used to be lots of cranberries, really big ones, eh? Just huge and really big ones. [Therèse Sangris interview, May 17, 2017]

Further, many Elders described how spruce trees used to line the shores of Wı̨ìlı̨ìdeh down to Nècha Go Dò (Gros Cap). Indeed, the traditional name for the campsite on Ekécho Cheh, before it was named Dettah, was "Spruce Point" (Weledeh Yellowknives Dene, 1997). Yellowknives Dene used to harvest spruce trees around Wı̨ìlı̨ìcheh for firewood, for their medicinal properties, and to make fish caches and tent flooring. During her interview, Elder Mary Louise Sangris recalled collecting wood on the land when she was young,

> She said when you go out on the land…you see all this spruce trees and that…she said those branches they break that up and they carry it…and they kinda make it into a carpet…they put it in like that…and row by row like this until they fill up the flooring of the tent or the teepee (laughs). Yeah, she said if you ever have a chance to sleep on the flooring like that she said you are gonna like really love the smell of it [Mary Louise Sangris interview, May 31, 2016. Interpreter: Lena Drygeese]

Elders and land-users alike spoke about their experiences with arsenic contamination from the Giant and Con roaster stacks as reasons for avoiding berry-picking, gathering medicinal plants, and collecting wood along the shores of Wı̨ìlı̨ìdeh, Wı̨ìlı̨ìcheh, and Enda'deh. As participants explained to me, they no longer trust the berries in former harvesting areas. When I asked why she avoided Wı̨ìlı̨ìcheh in its entirety to collect berries, active land-user Julie Lynn said:

> Because contaminated...the arsenic. That time they used to have a big pipes…smoke come out at time they were melting that mined…the gold…All the dust you can see like ashes and…um…outside anywhere you could see it. [Julia Lynn interview, May 18, 2017]

In addition, participants often mentioned historic logging activities as a contributing factor for the displacement of wood gathering. Logging activities began during the 1930s to fuel mining activities at the Burwash Mine, and later to supply the Negus, Con, and Giant mines. Consequently, most of the area that was traditionally used for collecting wood was logged. For the trees that did survive logging activities, they too experienced a similar destructive fate, as arsenic dust from roaster stacks settled on their branches and leaves. Active land-user, James Sangris, explained to me why he avoids collecting firewood:

> You can tell…you go to land…you see the dry wood eh…you can see some dust on it…all this area…that's why people don't hardly use too much now…you look at…you see these little white…and you know it's already contaminated…Yeah when you cook something on it, it tastes different, you don't like it. So you don't wanna eat, cook anything anymore… Yeah it looks like light blue like you can see the color that smoke and everything…yeah we don't bother now [James Sangris interview, June 1, 2016]

Although almost all land-users avoid the shores of Wı̨ìlı̨ìcheh for harvesting activities, five participants reported collecting muskrat root (*Acorus calamus*) in Wı̨ìlı̨ìdeh and Duck

Lake. During their interviews, these participants described the continued importance of muskrat root for its healing properties and its spiritual significance. Muskrat root is used to treat headaches ("you light it up to get the smoke and then inhale it"), colds ("we skin and we chop it up and we boil it"), and sores ("you just bite off a little piece of the end and you chew on it and swallow"). The perennial herb also continues to be used as spiritual protection to ward off bad spirits from the unnatural world. Other traditional plants that continue to be collected on the east side of Wı̨ìlı̨ìcheh are Labrador tea (*Rhododendron groenlandicum*), birch syrup and spruce gum.

The prevalence of avoidance areas along the shores of Wı̨ìlı̨ìcheh, Wı̨ìlı̨ìdeh, and Enda'deh on the YKDFN Harvesting and Avoidance map highlights the devastating effects of industrial contamination on Dene harvesting activities. What was once a productive berry-picking site is now contaminated with toxic mining by-products, and out of fear, land-users now travel past Horseshoe Island to collect plants and berries. In addition to their own perceptions of contaminants, Dene land-users have received informal and formal warnings about eating berries within the vicinity of Giant Mine and Yellowknife. The following exchange between Fred Sangris and I demonstrate the complex interplay between Dene perceptions of risk, informal and formal warnings, and land-use change in the Wiìliìcheh area:

> So up to 24 kilometers from Giant Mine radius…we did a berry study. The berries in Yellowknife Bay is very high in contaminants...up to 24 kilometers uh arsenic traces in the berries…10 kilometers is danger. We were told not to pick berries 'cuz it's contaminated. It's not good for your health. Maybe eating a few won't harm you but I don't know. Like I wouldn't eat the berries here in Yellowknife Bay here.
>
> [AD]: So, when was the last time you did eat berries [in the area]?

> It was probably right off this point with my mother in 1975 (south of Ts'i Naìkwi Dah Kò commonly referred to as Burwash Point). My mom liked to go pick berries there. We have raspberries, blueberries, all kinds of berries. All grows in that whole place there. And a lot of people go there in the past. They all picked berries especially in July eh. Everybody goes there even bears they go there too they like they like berries there. But anyways we went camping there we had some berries there and it was probably 1975 the last time, I never pick berries there. I pick berries way out…have to because its 24km they said it can still be traced [Fred Sangris interview, May 24, 2016]

3.7 Yellowknives Dene First Nation Change in Fishing Activities

The map *Yellowknives Dene First Nation Change in Fishing Activities* shows how mining development affected YKDFN fishing activities in Wı̨ìlı̨ìcheh (Figure 3.8). During map-biography interviews, Elders and land-users were asked to identify on base maps sites of avoidance and sites of continued use in relation to fishing activities. In comparison to the land-use "data" collected for other activities (e.g., hunting and harvesting), which tended to be in the form of large areas or polygons, fishing sites were often identified by participants in the form of point data. With this data, I was able to use the point density tool in ArcMap 10.6 to produce the fishing map, which demonstrates the temporal and spatial change of fishing activities in Wı̨ìlı̨ìcheh. The red hotspots represent areas where the density of fishing sites was greater in the past then they are today, and the blue hotspots represent areas where the density of fishing sites are greater today than they were in the past.

In the Wı̨ìlı̨ìdeh dialect, Wı̨ìlı̨ìdeh, Wı̨ìlı̨ìcheh, and Wı̨ìlı̨ìti (Prosperous Lake) were all traditionally named after the Inconnu[24] (Wı̨ìlı̨ì), a large whitefish that used to travel up the Wı̨ìlı̨ìdeh, and spawn in Wı̨ìlı̨ìti. As former YKDFN Traditional Knowledge Specialist,

[24] Inconnu (trans. *unknown* fish) is also known as Connie and sheefish in the Northwest Territories.

Randy Freeman, described, “the fact that the River, Bay, and Lake were named after the resource indicates its historical importance to the Yellowknives Dene” (R. Freeman, personal communication, May 2016). Historically, the Yellowknives Dene would return to Wı̨ìlı̨ìcheh from the barrens in the spring and gather along the shores to set up their fish camps. According to the Elders, there were at least five villages along the eastern shore of Wı̨ìlı̨ìcheh, from the mouth of the Wı̨ìlı̨ìdeh to the islands south of the bay. *Ts’i Naìkwi Dah Kò* (Burwash Point) was the largest and most important village in Wı̨ìlı̨ìcheh during the 1800s. As Figure 3.9 shows, other traditional Tatsǫ́t’ıné fish camps were set along Edaala (Whitebeach Point), Enodah, Ekécho Cheh (Akaitcho Bay), Koti Deh Cheh (Drybones Bay), Kwetaı̨ lı̨ (Tartan Rapids), Nècha Go Dò (Gros Cap), Moose Bay, Seh Ko’Ke (Goulet Bay), and Tadeh Cho.[25]

[25] Yellowknives Dene place names were provided by Fred Sangris (F. Sangris, personal communication, February 2018)

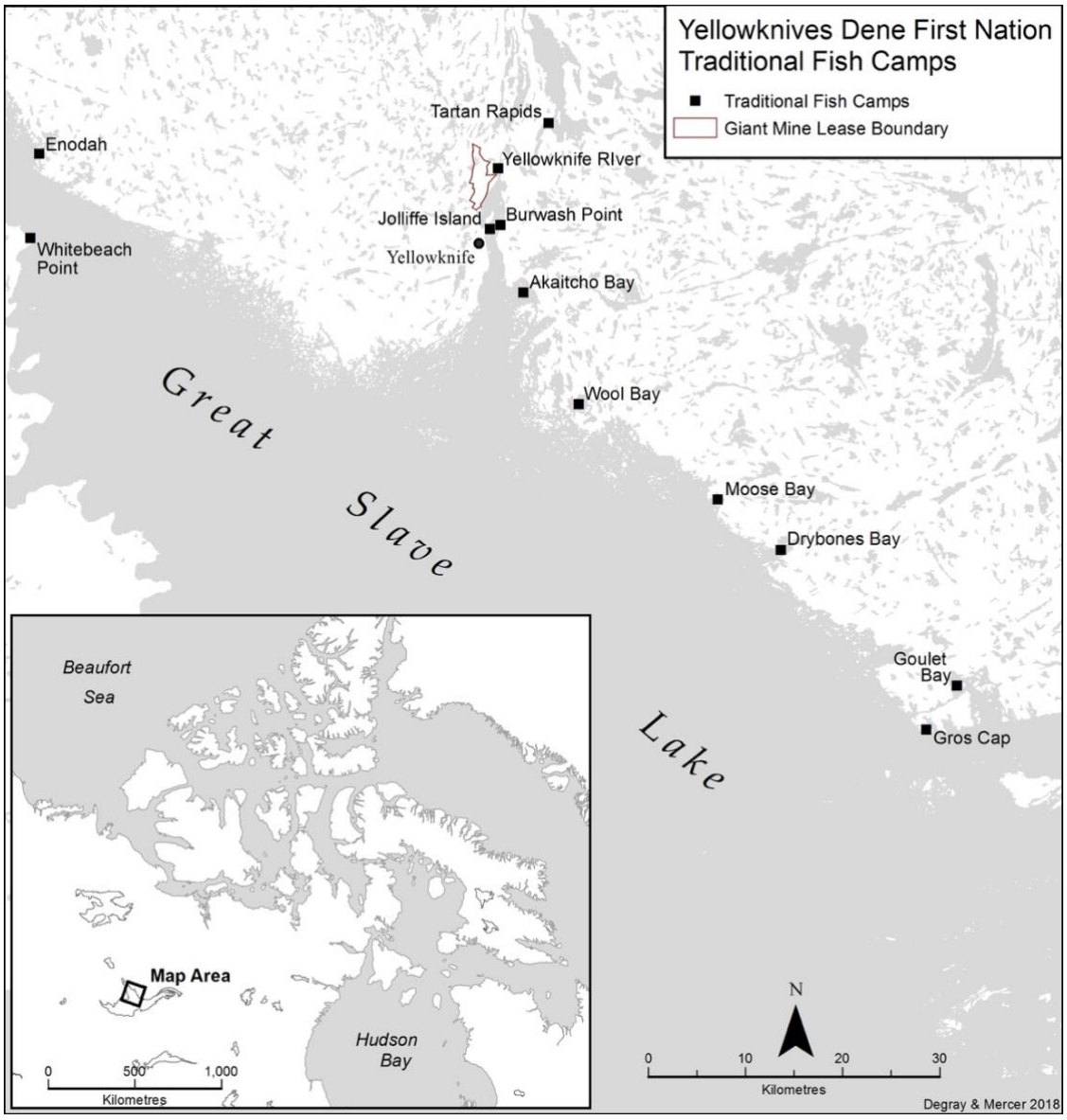

Figure 3.9 Yellowknives Dene First Nation Traditional Fish Camps with inset map of Northern Canada without political borders

In these villages, Tatsǫ̨t'ıné families would spend their days netting, drying and smoking fish. This resource, when dried and bundled, became a long-lasting food source which fuelled both sled-dogs and the Dene alike for their travels back to the barrens south of the tree line.

Elders Edward Sikyea and Rose Betsina described their memories of fishing in Wı̨ìlı̨ìcheh:

> From Burwash…all the eastern shore of… Yellowknife Bay…this is all fishing area…there is so much fish…so during the summer after the Treaty Days[26] Yellowknives Dene would spend weeks there making dry fish, preparing for winter. [Edward Sikyea interview, May 26, 2016. Interpreter: Fred Sangris]

> She remembers catching lake trout, coney, whitefish, and other fish…this was before the mine settlements…they couldn't leave nets overnight because there were too many fish being caught, and it would overflow. [Rose Betsina interview, May 30, 2016. Interpreter: Lena Drygeese]

Other Elders spoke about fishing in Enda'ti (Martin lake) and Enda'deh (Baker Creek), which in English, translates to "Pike Lake" and "Pike River," respectively. As Elder Alfred Baillargeon recounted,

> It was a popular fishing area for the community at one time…a long time ago. It was a fish habitat and…uh…he said these two lakes [Martin Lake, Landing Lake] people used to fish when they come with sled dogs and if the caribou is not around then they would fish for pike in these two lakes (Martin Lake, Landing Lake) and get all the fish that they can get. [Alfred Baillargeon interview, June 9, 2016. Interpreter: Fred Sangris]

Industrial mining activities at the Giant and Con Mines and the settlement of non-Indigenous peoples had severe impacts on Dene traditional fishing practices. As evidenced by the YKDFN Change in Fishing Activities map, fishing activities have shifted away from Wı̨ìlı̨ìdeh, Wı̨ìlı̨ìcheh and Ekécho cheh (red hotspots) towards the southeastern islands near Tadeh Cho (blue hotspots). The beige colour represents little to no change in the density of activity. In total, 18 participants (72%) said that they had

[26] As part of Canada's Treaty obligations, "Treaty Days" refer to payments that are paid annually on a national basis to Indigenous communities who have signed historic treaties with the Crown (Indigenous and Northern Affairs Canada, 2010)

formerly fished in Wı̨ìlı̨ìcheh while eight participants (32%) said that they continue to fish in the waters above Dettah. However, no participant reported fishing in Back Bay near the former Giant site today. The discrepancy in participant numbers between past and continued use (i.e., 8 and 18 when there is a total of 25 participants) is because some of the land-users mentioned that, at one point in time, had avoided Wìlìicheh but recently began to fish in the area again.

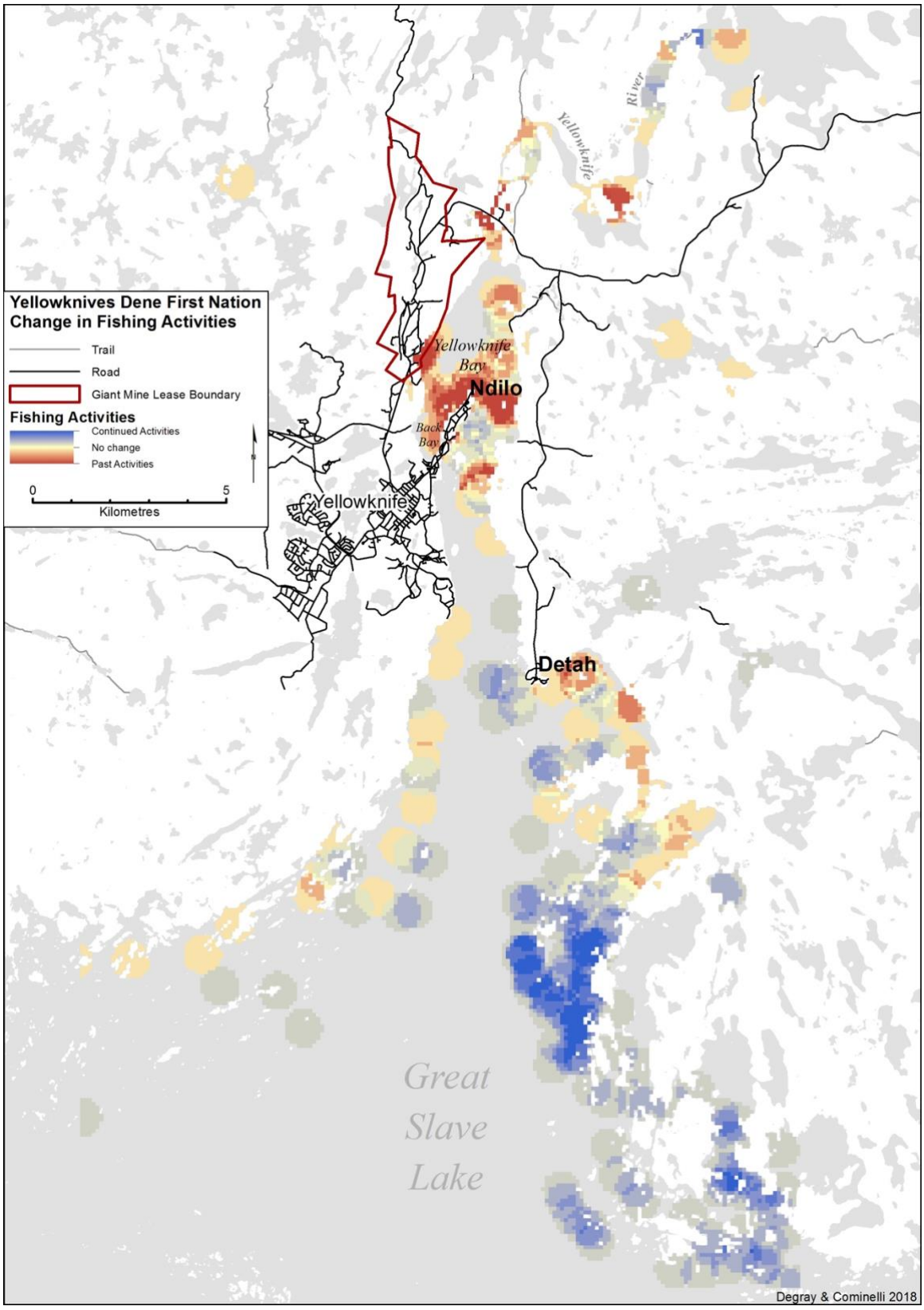
Yellowknives Dene First Nation
Change in Fishing Activities
Trail
Road
Giant Mine Lease Boundary
Fishing Activities
Continued Activities
No change
Past Activities
0
5
Kilometres
Yellowknife River
Yellowknife Bay
Ndilo
Back Bay
Yellowknife
Detah
Great Slave Lake
Degray & Cominelli 2018

Figure 3.8 Yellowknives Dene First Nation Change in Fishing Activities

Based on the evidence and testimony from land-users and Elders, it is clear that fishing activities for human consumption shifted from Wı̨ìlı̨ìcheh towards Tinde'e during the period between the late 1940s and 1970s when industrial mining activities at the Giant and Con mines were releasing large quantities of untreated arsenic dust and tailings into nearby streams and lakes. Some land-users continued to fish in the bay until the 1980s but only as a means to feed their sled-dogs. Participants described how the texture and taste of fish caught in Back Bay and Wı̨ìlı̨ìcheh changed after Giant Mine started operations, and for precautionary measures, land-users decided to avoid catching fish for consumption in the areas. Elder Madeline Beaulieu described her experience with contaminated fish, which ultimately led to her avoidance behaviors in Wı̨ìlı̨ìcheh:

> She was given a fish one time [from Yellowknife Bay], and she cooked it, and she was gonna eat it but when she had a little taste of it, it tasted like oil or something. It tasted funny just like fumes, gas and so she stopped eating fish from this area [Madeline Beaulieu, May 19, 2016. Interpreter: Lena Drygeese]

While some fishers continue to avoid Wı̨ìlı̨ìcheh in its entirety, others (n=8) feel that it is safe to fish on the eastern side of the bay because "the fish are coming back." The rise in fish population, specifically Wı̨ìlı̨ì and trout, within the last 10 years is associated with the closing of the Giant Mine in 2004 as well as the closure of the commercial fishing plant in Tadeh Cho in 2005. As Fred Sangris explained in his interview,

> The Giant Mine…blasting dynamite underground…on the surface ground…so the lake trout disappeared along with the coney…All the coney disappear…there was two of the most important fish in the bay disappear…There were gone for uh almost 70 years now…They're coming back. [Fred Sangris interview, May 24, 2016]

Further, many Elders recalled that their families used to set their nets at the mouth of the Wı̨ìlı̨ìdeh near the present-day highway bridge and Kwe Tàı̨lı̨ı̨. As the Weledeh Yellowknives Dene (1997) write, “the people set nets for smelt near the rapids, where the fish were so populous, they turned the water black. All summer, people ate fresh fish and fish soup” (p.43). The construction of the bridge, followed by the establishment of the Yellowknife River Territorial Park on the east side of the river during the 1950s and 1960s, led to increasing settler recreationalists at the mouth of the Wı̨ìlı̨ìdeh (Weledeh Yellowknives Dene, 1997). For some land-users (n=4), the increase in boat traffic along with increasing settler recreationalists ultimately drove them away from fishing in this area.

Fishing continues to be an important part of Dene subsistence activities and livelihoods. Fish not only provide vital nutrients and protein for the physical body, but create important ties between families and individuals, and connect the Indigenous communities to the land. The Yellowknives Dene had to rely on their personal experiences and knowledge of fish to discern what was safe or not to eat, and ultimately shifted their fishing activities towards the southern islands to make sure they weren’t compromising their health. While the declining fish catches associated with industrial mining and commercial fishing activities may have played a role in Dene fishing displacement, the comments from participants largely suggest that the change in fish quality (e.g., texture and taste) caught in Wı̨ìlı̨ìcheh were major factors and contributors for moving their fishing activities towards Tinde’e.

3.8 Yellowknives Dene First Nation Drinking Water Collection and Avoidance

The map *Yellowknives Dene Drinking Water Collection and Avoidance* shows primary areas of drinking water collection and avoidance identified by participants (Figure 3.10). Areas on the map shaded in orange represent areas of avoidance, while areas shaded in green are areas of continued activities. The areas shaded in purple are areas of overlap where some land-users continue to collect drinking water while other land-users avoid. During the map-biography interviews, eight respondents (32%) indicated areas where they had formerly collected or continue to collect drinking water, while 14 respondents (56%) indicated areas that they avoided doing so. The black line represents a "safe zone" boundary line that was identified by participants where drinking water collection was deemed unsafe above the line.

For millennia, the Yellowknives Dene used local streams, lakes, and rivers in Wı̨ìlı̨ìcheh and the surrounding area for collecting drinking water. Dene oral histories and testimonies have repeatedly stated that, before settlement and mining activities, the water in Wı̨ìlı̨ìcheh was fresh and the Dene could drink the water from the shores without boiling it (CEPA, 1995). Today, water pollution from historic industrial mining continues to be the number one complaint of the Yellowknives Dene, and for good reason: what was once a free resource is now polluted and has a price tag.

During the early years of mining, the Dene were forced to rely on polluted snow and lake water for their drinking water needs because neither the mine nor the city provided alternative options. Local officials did nothing to help the Yellowknives Dene other than post small advertisements in the back of the local paper and put signs around the area warning people to be cautious with their use of water (Sandlos & Keeling, 2012). As

Elders told me during their interviews, these warnings proved ineffective because at that time, many Yellowknives Dene could not read or speak English. Dene communities remained dependent on the local water supply until 1975 when trucked water delivery began in N'Dilǫ for a five-dollar fee, per delivery, and only those residents on welfare could apply for free delivery (Tataryn, 1978). For the YKDFN members who could not afford the delivery fee, there was no choice but to continue collecting drinking water from the local environment (Tataryn, 1978; Sandlos and Keeling, 2012). On the other hand, settlers in Yellowknife received free piped water from the municipality into their homes as of 1969. To this day, the Yellowknives Dene living in N'Dilǫ are required to pay for trucked water delivery and Giant Mine was never required to pay for trucked water delivery despite being the root cause of environmental contamination.

Ongoing concerns about historic arsenic contamination and the water quality of Wı̨ìlı̨ìcheh continues to be experienced among the Yellowknives Dene and Yellowknife residents alike. Prior to 1968, the City of Yellowknife obtained its drinking water from Yellowknife Bay, but the city's water source was switched from the bay to the river over concerns about arsenic contamination from Giant and Con mines (AECOM, 2017). According to Gleeson (2016), the city had drawn its water from the bay for 20 years before switching over to the river. Today, the City of Yellowknife continues to supply potable water to its residents using the original 8-km submarine pipeline, which carries water from Yellowknife River, through Yellowknife Bay, to a pumphouse in the city (AECOM, 2017). A 2017 report, however, found that the pipeline is "reaching the end of its useful life" and the city needs to either replace the pipeline or use Yellowknife Bay as an alternate water source (AECOM, 2017: p.1). Prior to the recent federal government

funding for replacing the ageing pipeline, both the Yellowknives Dene and Yellowknife residents expressed concerns about potential risks of arsenic exposure from drawing water from the bay, even though this option was deemed the most cost-effective by the city (ES&E, 2019; Gleeson, 2016).

In addition, until very recently, there were no formal health advisories in place for drinking water, fishing, and swimming around Yellowknife. In 2017, after increasing scientific evidence of arsenic contamination in the waters around Yellowknife, the NWT Chief Public Health Officer released a public health advisory along with an interactive map[27] showing arsenic concentrations in lakes (GNWT, 2018). Out of all the lakes identified within the 25-km radius of Yellowknife, none were deemed safe to drink. For the Yellowknives Dene, this advisory is, for lack of a better word, too little, too late. For at least 30 years after Giant Mine poured its first gold brick (and this is a conservative estimate), land-users had to rely on their knowledge of the land, and their personal and communal experiences to determine what was safe to drink and what was not.

The YKDFN Drinking Water Collection and Avoidance map vividly captures the spatial extent of water dispossession as a result of perceived industrial contamination. During their map-biographies, not a single land-user reported using the west side of Wı̨ìlı̨ìcheh to collect drinking water. As Fred Sangris told me, "if you drink water here (draws a circle around west of Wı̨ìlı̨ìcheh) …do it at your own risk." When I asked why the west side of Wı̨ìlı̨ìcheh was unsafe, participants spoke about seeing the arsenic dust spewing out of the historic roaster stacks, experiences with tailings spills and leaks into

[27] See interactive map https://www.hss.gov.nt.ca/en/newsroom/arsenic-lake-water-around-yellowknife

Yellowknife Bay from Giant and Con mines, and personal experiences with illness and deaths, especially the tragic 1951 incident.

In many cases, participants would draw a big circle around the Yellowknife area to indicate areas of avoidance rather than identifying specific lakes. The lakes in the vicinity, according to Elders and land-users, were "gone" or "contaminated" by industry and/or the city of Yellowknife. Some participants stated that water south of the boundary line (specifically in Tinde'e) was safe to drink. For others, the eastern side of the Wı̨ìlı̨ìcheh including Hay Lake, Duck Lake, and Wı̨ìlı̨ìdeh were deemed safe to collect drinking water. While some land-users drew a line, others specifically identified sites where they collect drinking water (e.g., southeastern bay or at the mouth of Wı̨ìlı̨ìdeh).

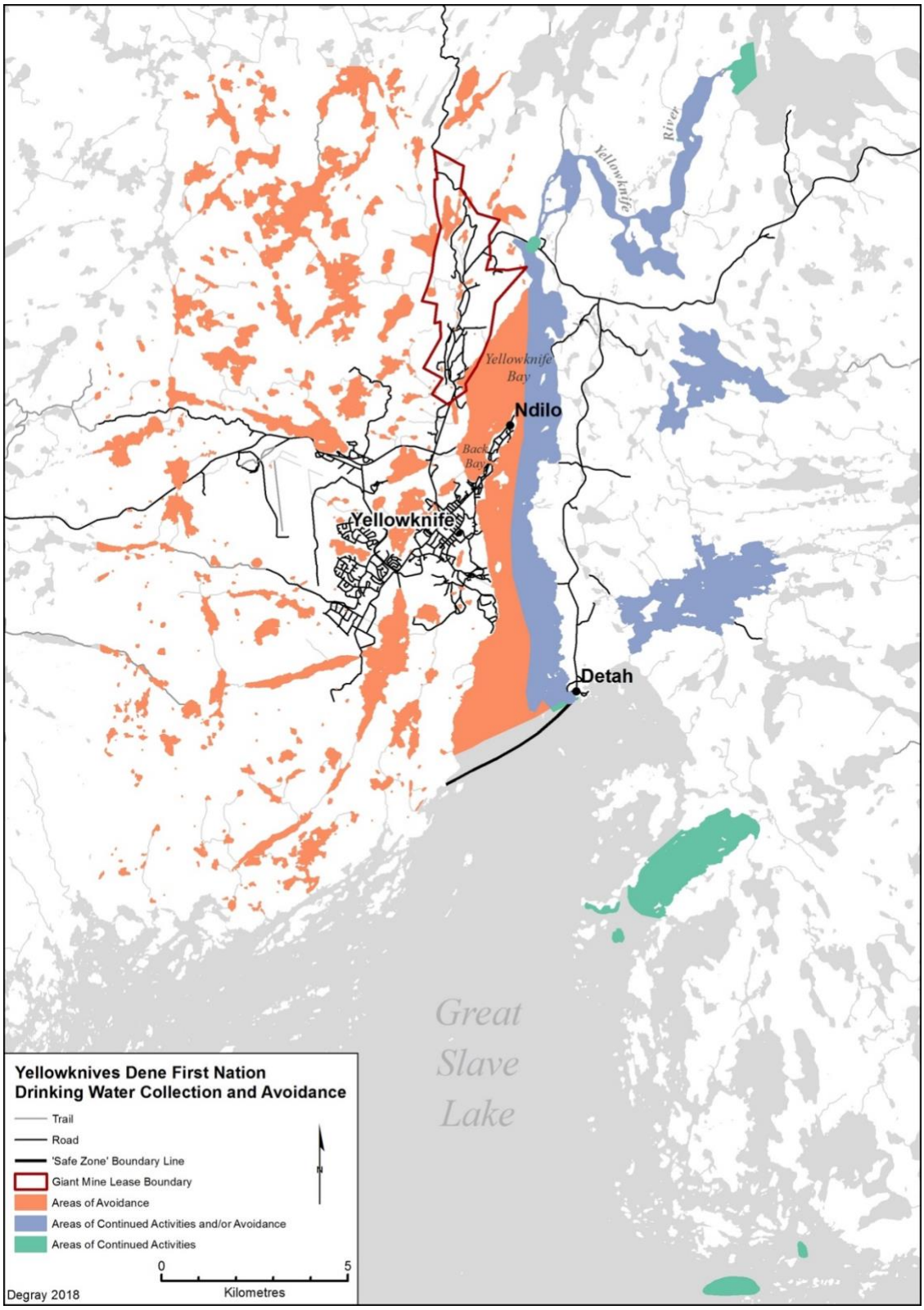

Figure 3.10 Yellowknives Dene First Nation Collecting Drinking Water and Avoidance

Similar to trapping activities, land-users spoke about the city's sewage for causing the gradual contamination of their collecting drinking water in the vicinity of Yellowknife. Until 1981, the city of Yellowknife discharged untreated sewage water into Niven Lake which drains into Back Bay and Wı̨ìlı̨ìcheh (Andrade et al. 2010; City of Yellowknife, 2018). During his interview, Frank Sangris pointed out the city's sewage system on the base map and described his experience with contaminated drinking water:

> We couldn't even drink any water from here (west side of Wı̨ìlı̨ìcheh) 'cuz…uh when they were dumping…the city was dumping all of the sewer over here…you can smell real bad right in there…couldn't drink no water. [Frank Sangris interview, May 24, 2016]

The YKDFN Drinking Water Collection and Avoidance map speaks volumes. For years, Dene communities had to rely on their traditional teachings and experiences of the land to discern which areas were safe to drink, and which were not. Arsenic trioxide, in its soluble form, is undetectable by taste and smell, and therefore the toxic compound posed a very real threat and danger to those land-users who continued to depend on the local water system for their drinking water needs. The feelings of uncertainty along with perceptions and increasing knowledge of contaminants in the area ultimately contributed to the gradual displacement and alienation of the Dene's local resources. To use the words of Lawrence Goulet, "It's not safe 'cuz it's still contaminated in the [Yellowknife] Bay so we don't go there no more". Today, there is a clear understanding among the Dene that you do not collect or drink water on the west side of Wı̨ìlı̨ìcheh. Even though there are mixed feelings about collecting drinking water on the east side of Wı̨ìlı̨ìcheh, those that collect water in these areas all agree that the water needs to be boiled first.

3.9 Conclusion

Mapping mining-induced displacement, using an adapted version of the map-biography method, can elucidate the ongoing harms and injustices faced by Indigenous communities living in a contaminated landscape. By identifying sites of continued use and sites of avoidance, I examined the complex relationship between perceived environmental risks and environmental changes associated with historic gold mining activities, and their influence on Dene traditional land-use change. The six-composite land-use maps, supported with the memories and lived experiences of Dene Elders and land-users, create a powerful spatial story of the widespread impacts of historic gold mining activities and settler colonialism on Dene land-based practices. As the maps reveal, mining impacts were perceived and experienced over a much wider area than the Giant Mine site and the city of Yellowknife. Yellowknives Dene Elders and land-users have displaced the majority of their harvesting, fishing, and collecting drinking water activities, away from the Wı̨ìlı̨ìcheh area to the Tinde'e area due to feelings of alienation, sense of danger, and uncertainties associated with using the lands and waters near the abandoned mines. Hunting and trapping avoidance behaviors, however, are largely due to the physical and environmental changes of Wag'we. The sandy plains of the Dene traditional hunting ground were replaced with a bustling city, an international airport, and two polluting gold mines. Elder Madeline Beaulieu's feelings of uncertainty and alienation towards the landscape, and her trepidations about using the land conveys the drastic impacts of industrial activity on Dene land-use activities in Wı̨ìlı̨ìcheh,

> The changes that we [Dene] have noticed is 'cuz of the Giant Mine…two mines and then the townsite, and then the pollution from the Giant Mine that contaminated the water, and the land, and we can't go berry picking, we can't

> set nets, and the smoke that came out of the stacks went all over so we don't know how far to go out to find something that's edible and that's not poisonous [Madeline Beaulieu, May 19, 2016. Interpreter: Lena Drygeese]

As previously described in the introduction, the purpose of this chapter was not to compare Dene perceptions of contaminants with that of "actual" contamination data. However, a quick glance at Palmer et al.'s (2015) "arsenic hotspot map" (Fig. 2), demonstrates that Dene avoidance and observations of environmental contamination are at least in part borne by the recent documentation of the persistence and distribution of arsenic in the environment. The spatial patterning of drinking water avoidance, specifically west of Wı̨ìlı̨ìcheh, parallels the NWT public health advisory map for drinking water.

Within the broader EJ discourse, mapping mining-induced displacement using the map-biography method helps advance geographical scholarship on EJ in two distinct ways. First, this approach helps capture the distributional aspects of environmental injustice at a local scale. By quantifying the inequities of industrial mining pollution on Indigenous land-use practices, this data-driven approach provides spatially explicit evidence of land-use dispossession and displacement. While I recognize that this mapping approach may reinforce settler-colonial ideologies of space (Cartesian coordinate system, north arrow, scale bar) onto Indigenous ontologies, it is important to reiterate that the intention of this approach is not to reduce Indigenous TEK to points, lines, and polygons, but rather to illustrate a case of environmental injustice through the eyes and experiences of the communities themselves, which then can be served to advance community claims of environmental injustice in settler institutions.

In addition to the spatial evidence of distributive injustice, this approach adds to the EJ body of literature by providing contextual and qualitative evidence of environmental racism. One of the most prolific examples environmental racism presented in this chapter, for instance, was that of water accessibility (or lack thereof). The lax environmental regulations at the height of mining activities along with the lack of recognition for Dene cultural, social, and land-use practices resulted in death among Dene members, widespread water pollution, and dispossession of local water sources. To add insult to injury, Dene communities remained unserviced long after sewerage and water supplies were provided to white settlers in Yellowknife in the 1940 and were forced to rely on polluted snow and lake water for their drinking water needs or pay a delivery service fee unaffordable to most members. Today, the "number one complaint" among Dene is water – their main water sources remains contaminated by settler and industrial activity and the communities are still required to pay for trucked water delivery (Randy Freeman interview, June 7, 2016)

Overall, the legacy of Giant Mine and settler activities on Dene land-use practices powerfully echoes Wolfe's (2006) assertion of the settler-colonial tendency: it is "a structure not event." As this chapter showed, over seventy years have passed since Giant Mine poured its first gold brick but its legacies of pollution along with settler-colonial activities continue to be experienced in the daily life of Dene especially in the form of widespread land-use dispossession.

Chapter 4
Yellowknives Dene Risk Perceptions in Wı̨ìlı̨ìcheh

4.1 Introduction

For many northern Indigenous peoples, the physical environment is an important source of food, medicine, cultural identity, and spiritual expression. The knowledge and presence of industrial contaminants in the Arctic food web have thus had significant impacts on their sociocultural, nutritional, and economic well-being (Arquette et al., 2002; Dewailly et al., 1992; Furgal, Powell & Myers, 2004). Importantly, research and activism have revealed that Indigenous understandings of contaminants and environmental risk differ from that of the scientific community, and are based on their respective worldviews, epistemologies, languages, practices on the land, and socio-political contexts (Cassady, 2007; Furgal & Friendship, 2010; O'Neil, Elias & Yassi, 1997; Poirier & Brooke, 2000). As studies have shown, the northern perspective on the environment, the importance of traditional foods to health and well-being, and the ways in which these are understood within traditional ecological knowledge (TEK) systems influence Indigenous perceptions and understandings of environmental risk (Furgal, Powell & Myers, 2004). While research on Indigenous risk perceptions related to trans-boundary contaminants in Northern Canada is significant, Furgal, Powell, and Myers (2005) argue that there is a need for greater understanding of Indigenous perceptions of risk. Indigenous perceptions, understandings, and concerns regarding contaminants, they argue, are complex and local conceptualizations of risk are not well understood (Friendship & Furgal, 2012; Place & Hanlon, 2009).

The case of the Giant Mine and widespread arsenic contamination provides an opportunity to better understand Indigenous perceptions of risks related to mining-induced environmental contaminants in a sub-arctic environment, and the ways in which these contaminants are understood within their TEK systems. For half a century, Royal Oak Mines (1938-2003) and Giant Yellowknife Gold Mines (1948-2004) emitted arsenic trioxide, a highly toxic by-product of gold-ore roasting, into the surrounding atmosphere and landscape (Sandlos & Keeling, 2012; INAC, 2018). During its first three years of operations, arsenic dust was pumped out of the mines' roaster stacks and dispersed across the traditional territory of the Yellowknives Dene, including the nearby settlements of N'Dilǫ and Detah (Sandlos et al. 2019). Although the Yellowknives Dene have been articulating the extent of pollution on their lands for decades, only recently has the scientific community began to address and understand the extent of environmental contamination in Wı̨ìlı̨ìcheh. Specifically, research has suggested that industrial contamination extends well-beyond the 875-hectare Giant Mine Remediation Project (GMRP) site; with traces of arsenic detected up to 25 kilometers away from the abandoned mine (Hocking et al., 1978; Galloway et al., 2015; Palmer et al. 2015).

As I illustrated in Chapter 3, the Yellowknives Dene continue to experience Giant Mine's toxic legacy and pervasive arsenic pollution in the form of widespread land-use displacement. Using the six-composite land-use maps, I showed how Dene land-users have displaced the majority of their land-use activities away from the Wı̨ìlı̨ìcheh area to the Tinde'e (Great Slave Lake) area due to feelings of alienation, sense of danger, and uncertainty associated with using the land. Building on Chapter 3's spatial analysis, this chapter explores the qualitative and descriptive expressions of Dene risk perceptions and

concerns related to land-use activities. Specifically, this chapter situates Dene perceptions of and responses to industrial pollution within their TEK systems to provide place-specific knowledge of and experience with toxicants and as a way to contribute to (and move beyond) increasing science-based narratives of contamination in Wı̨ìlı̨ìcheh, and answers previous calls for research to explore the relationship between Dene risk perceptions and land-use activities (Boyd, Furgal, & Jardine, 2010).

4.2 Conceptual Framework

Studies of risk and contaminants have mobilized Murphy's (2006) "regimes of perceptibility" concept to describe the politics of knowledge production and social practices related to industrial toxicants in the Canadian North (Bocking 2017; Sandlos & Keeling, 2015; Power & Keeling 2018). This regime is understood as the way a "discipline or epistemological tradition perceives and does not perceive the world via its assemblage of practices, instruments and institutions" (Murphy, 2006; Liboiron, Tironi & Calvillo, 2018). It involves obscuring awareness of certain things in order to make others more pronounced, known, and thus controllable, and through racialized privilege, allows dominant discourses to produce and promote certain forms of knowledge while dismissing or marginalizing others (Power & Keeling, 2018; Garrison, 2013).

Conventional risk assessments constitute such a regime. Grounded in technocratic definitions and measures of toxicity and risk, early conventional risk assessment practices privileged scientific determinations of exposure and risk over local and vernacular understandings of risk (Bocking 2017; Power & Keeling, 2018). As the controversial

cases of Qikiqtarjuaq (Broughton Island), Nunavut, and Salluit, Nunavik in the 1980s demonstrated, conventional risk assessments failed to adequately value cultural, social, subsistence, economic, and spiritual factors of the Indigenous communities (Kuhnlein & Muir, 1992; Poirier & Brooke, 2000; Wheatley, 1993). By ignoring, dismissing or overriding Indigenous voices, knowledge systems and values with dominant systems of knowing, these well-intentioned tools and efforts to mitigate the impacts of contaminants in the Arctic food system resulted in drastic sociocultural and health impacts among the exposed communities (Furgal, Powell, & Myers, 2005).

As later research and activism revealed, Indigenous peoples gather, understand and use information to make decisions about food and health differently than southern-based researchers (Furgal et al., 2005). The socio-cultural importance of traditional foods, and the social, cultural, and nutritional benefits associated with land-use activities have been shown to play an important role in shaping Indigenous perceptions of risk and understandings of contaminants (Furgal, Powell & Myers, 2004; Poirier & Brooke, 2000; Hoover, 2017). Tyrell (2006), for instance, described how Inuit in Arviat, Nunavut, interpret radiation risk in traditional foods through the physical condition of an animal, even though this method does not necessarily correlate with official scientific opinion while Cassady (2007) discussed how Iñupiaq communities in Alaska interpret the undetectable risk of radiation waste hazards within frameworks of both TEK and technical expertise (Power & Keeling, 2018). While these case studies helped understand perceptions of risk within Indigenous worldviews, the literature has shown that Indigenous perceptions of contaminants are diverse and complex. Each northern Indigenous community has their own unique set of knowledge systems, cultural values,

histories, and personal experiences with contaminants, and therefore perceptions of risk cannot be generalized across Indigenous peoples or communities and need to be framed within specific contexts.

Within the context of remediation, reclamation, and restoration projects at former industrial sites, Sandlos & Keeling (2015) have argued that, because these issues are often framed within scientific modes of knowledge, they inherently devalue and dismiss Indigenous perspectives, knowledge systems, and experiences with pollution. In their review of the politics of knowledge production at the GMRP, the authors described how the project's narrow focus on technocratic approaches and solutions, during the early stages of remediation planning process, resulted in the failure to effectively acknowledge and incorporate Dene TEK and their experiences with pollution in the process. The result, they write, echoes an "epistemic injustice", where "marginalized social groups cannot render intelligible their respective experience and perspectives on terms acceptable to the dominant culture" (Sandlos & Keeling, 2015 p.8; Fricker, 2007).

There is now widespread consensus that a new paradigm is needed to account for and assess the social, cultural, and spiritual values, beliefs, and practices that link Indigenous communities to their environment (Arquette et al. 2007; Furgal et al., 2005; Friendship & Furgal, 2012; Hoover, 2017). Specifically, Arquette et al. (2006) and Hoover (2017) argue for conventional risk assessments to move towards a more inclusive model that draws on community health, risk assessment, and environmental restoration to recognize a wider definition of toxicity and thus ensure more thorough remediation of contaminated sites. The use of community-specific, culturally informed definitions of health, risk, and restoration, they argue, offer a much more inclusive approach than just conceiving health

as the absence of disease or injury (Hoover, 2017: p. 258). With this in mind, and in light of the ongoing GMRP and the recent Human Health and Risk Assessment (HHERA), this chapter situates Dene perceptions of and responses to industrial pollution within their TEK systems to address Dene perspectives, concerns and fears related to local sources of industrial contamination in Wı̨ìlı̨ìcheh.

4.3 Yellowknives Dene Risk Perceptions in Wı̨ìlı̨ìcheh

In the following sections, I discuss three key themes related to Dene risk perceptions that emerged from the semi-structured map biography interview: (1) sensory awareness and experience (2) trust in Traditional Ecological Knowledge and (3) perceived and direct health impacts. Combined with the spatial land-use data in Chapter 3, these themes illustrate the ways in which Dene land-users drew (and continue to draw) upon their experiential and embodied knowledge to understand pollution and adapt their land- use activities in response to environmental pollution.

4.3.1 Sensory Awareness & Experience

Many researchers have explored how human bodies make sense of toxicants and pollution through their bodily knowledge and sensory epistemologies. Lyon (2018), for instance, uses the concept of "sentiactuar" (feeling-acting) to describe everyday material practices of Colombian farmers that exceeds state evidentiary regimes, while Calvillo (2018) uses "attuned sensing" to expand the ways in which toxicity can be sensed outside of quantitative data in relation to air pollution. Counter to the power-laden raced, classed, gendered scientific "regime of perceptibility," these alternative forms of knowing create

"domains of imperceptibility" (Murphy, 2006) where "alternative forms of self-care and self-understanding can be experimented with and perfected as coping regimes, outside of dominant regimes of knowledge" (Garrison, 2013).

Within the context of arsenic pollution in Yellowknife, arsenic trioxide has mostly been "discovered" through techno-scientific measurements (e.g., micrograms per litre or cubic meter). The material and physical properties of arsenic trioxide (i.e., tasteless and colorless in its soluble form) make the toxic compound imperceptible and undetectable, and therefore knowledge of its presence in the environment has been predominantly based on Western scientific practices. As science & technology studies (STS) scholars have argued, however, toxicity is not only about quantifiable concentrations embodied in bioscientific ways of knowing but is also about cultural understandings of it (Calvillo, 2018; Gugliotta, 2003; Liboiron, 2015). As this section will show, Dene understandings of pollution are embedded in their daily life and land-use practices through their senses and bodies.

During their map-biographies, land-users used primarily visual, olfactory, tactile, and gustatory evidence, to describe pervasive and persistent arsenic pollution in Wı̨ìlı̨ìcheh. Most notably, when sharing their historical memories of the Giant Mine smokestacks, participants used visual evidence to describe their experience with widespread arsenic dust. As participants (n=15) told me, the prevailing northwest winds combined with their communities' location downwind of the stacks placed the Dene in the direct path of pollution. Elders and land-users remembered seeing the "big cloud of smoke" or the "white haze" that used to loom over the Giant Mine property and travel towards N'Dilǫ an Detah when the "wind was right." In terms of language, it is interesting Dene used the

word “right” to describe a wind direction that directly placed the Dene communities in harm’s way. “Right” usually relates to being “in accordance with what is just, good, or proper” (Merriam-Webster, 2019) which in regards to Yellowknife Gold Mine Inc., was certainly not the case as the company unjustly exposed the Dene communities to environmental health risks and pollution.

In addition to visual evidence, participants (n=5) recounted the bad odours and “rotten egg” smell that used to accompany gold mining activities. The corporeal experience of smelling the sulfur in the atmosphere was one of the most pervasive ways in which industrial pollution imposed itself on Dene bodies: even if the mine was out of sight, it certainly was not out of mind. Importantly, the physical experience of smelling the smoke and fumes emitted from the smokestacks also served as a physical, olfactory reminder of the failure of the mines to respect the boundaries of Dene political, social or personal places. As former Traditional Knowledge Specialist Randy Freeman stated,

> It was a distinct awful smell, sulfury, you could taste it in the air, you could smell it, with the wind in the right direction, you know? A constant reminder that they [Giant Mine] were out there doing things that they probably would not get away with today in the way of emissions and stuff [Randy Freeman interview, June 7, 2016.]

Indeed, in comparison to today’s stricter environmental guidelines and legislative obligations such as Duty to Consult and Free and Informed Consent (FPIC), Giant Mine during its early years operated with lax environmental controls and released as much as 7.3 tonnes of arsenic trioxide per day[28] into the atmosphere (Thienpont et al., 2016; Wrye, 2008). In her review of pollution control (or lack thereof) at the Giant Mine, Western

[28] Between 1949 to 1951, specifically.

(2017) writes,

> Progress on the pollution issue at Giant Mine was inhibited by relaxed governance policies established in the 1980s, and territorial departments too economically focused to question Royal Oak's refusal to be regulated. The vagueness of Canadian environmental law in a territory with no air regulations further exacerbated the situation (Western, 2017: p.66)

In other words, capital interest and economic prosperity at both federal and territorial levels took precedence over Indigenous lands, bodies, and rights. Today, the result of this lack of governance and lax environmental regulations is represented by 237,000 tonnes of buried arsenic trioxide, widespread arsenic pollution, and a remediation project expected to cost over one billion Canadian dollars (Brockman, 2019; Cabin Radio, 2019).

Moreover, when describing their fishing activities, participants used gustatory (n=6) and tactile (n=10) evidence to discern the difference between healthy and unhealthy fish caught in Wı̨ìlı̨ìcheh. During the height of mining activities, participants described that the fish caught in Wı̨ìlı̨ìcheh felt "soft" and "mushy" and tasted "oily" and "gassy." The following exchange with Fred Sangris captures the many voices and experiences of land-users, and elucidates the complex interplay between Dene TEK, sensory awareness and land-use change:

> AD: And how to identify those that you want to use?
>
> FS: Well, first we look at the fish, right? Red means that there's something wrong with the skin, right? And we check it and touch it. Make sure that the texture is hard. In 1970s, when I was fishing by the [Latham] island here, a lot of the fish I was catching there, my fingers can go right through it that's how soft it was.
>
> AD: That was here in N'Dilǫ?
>
> FS: And it has a taste of gasoline and a taste of oil along with the fish. My

> fingers goes right through it, so soft. The fish way out here [Tinde'e] are solid and the texture is hard. So, when we catch fish in Yellowknife Bay, we will touch it, feel it, try to pressure it, and if it's solid meat, it's good, clean…no red on it then nothing wrong with it…You can tell just by looking at it, texture and so on, color everything else. When you take the gut out, you look at the liver and the kidneys, and everything else, right?
>
> AD: And what is it about the guts that you check?
>
> FS: We check the guts make sure there is no sores in there, sores or anything yellow…sometimes the fish has a parasite, you know?
>
> AD: And you've seen this before?
>
> FS: Oh yea. We've seen them in the fish. Some of the fish are not healthy and in the 80s it was really bad in the Yellowknife Bay because a lot of the fish had sores in their intestine, their skin and scale, eh? But some fish in Yellowknife Bay still might still be like that…but we fish out here [Tinde'e] now and so far it's been really good [Fred Sangris interview, May 24, 2016]

The absence or loss of positive smells in Wı̨ìlı̨ìcheh also formed awareness (n=1) of industrial contamination. Active land-user Lena Drygeese describe how the trees in the vicinity of Yellowknife and Giant Mine no longer had that "earthy" and fresh" smell to them:

> When we go out the land…about maybe 50 miles out…you see the trees just nice and dark green… it smells really fresh…you can just smell the earth…but when you go in that area [Yellowknife], you don't smell nothing. There is nothing. [Lena Drygeese interview, May 31, 2016]

Seven active land-users further described their vivid experience of a "blue-green" fire when burning firewood collected near the Giant Mine property. For these land-users, these "unnatural" fires were associated with the arsenic dust and sulfur dioxide emitted from the historic smokestacks. As Fred Sangris described,

> Spruce tree have lots of dust. When I was camping on the [Yellowknife] river, I went to cut a spruce tree and dust came down…lots of dust. Yea. And a hunter I was with said that's probably from the sulfur dioxide, the stove with the pipe [smokestack]. He said all that dust for generations has been piling up on the

> spruce tree…So, one of the Elders build a bonfire, and they throw that tree along with other trees that got lots of dust. Womb! It just light up…if you never ever seen a green flame before cut some trees around Giant Mine and burn them you are gonna see green-blue flames. It's unnatural. When you build a fire on the land, you see a red orange beautiful color but when we burn the trees that got dust on it, it's blue and green. So, as one of the Elders said, it might be poison. We ever see a blue flame, or a green flame on a fire it might be poison. It might be sulfur dioxide, it might be arsenic, it's contamination, it's pollution from the mines. That's why it's green and blue [Fred Sangris interview, May 24, 2016]

Overall, participants frequently mentioned the sensory experience of smelling sulfur in the air or seeing the arsenic dust emitted as a white haze form or as a blue-green fire as a cause for concern and as evidence that the mine had induced harm to the landscape, thus shaping Dene risk perceptions and land-use change. To use the words of Elder Jonas Noel, "All that smoke and sulfur and everything. Arsenic. Contaminated. Berries are no good to eat" [Jonas Noel interview, May 25, 2016].

4.3.2 Trust in Traditional Ecological Knowledge

Over millennia, Tatsǫ̀t'ınné developed an adaptive, dynamic, and intergenerational knowledge system that allowed them to live with and learn from the land. Through their teachings, learnings and experiences, Dene ancestors used their TEK systems to sustain and adapt their land-use practices in the face of environmental variability and change, as well as changes to their social, political, and economic environments. More recently, and as this section shows, Dene TEK and understandings of the environment were pivotal in helping the communities cope and adapt to 20th century industrial mining pollution.

During their map-biographies, seven participants said that it was mostly through their lived experiences, experiential knowledge, and word of mouth that they learned about

environmental contamination. As Mary Louise Drygeese explained,

> Yea, they didn't know nothing about it (pollution). Nobody knows because there's no advisories, no letters, no correspondence, no consultation. The way they found out is because of the fish that they were eating in the [Yellowknife] bay and as well as the sled dogs that were dying. They found out that it had to do with the Giant Mine tailings going into the water and the sulfur dioxide. And they understand that it was poison. So they were concerned and they made decisions on their own not to go near that area or use anything within that area cuz' it's destroying the land…Nobody advised them but they observe, their own observation and community talk and that's how they know [Mary Louise Drygeese interview, May 26, 2016. Interpreter: Fred Sangris]

Indeed, research has shown that experience is one of the most important factors for assessing risk in land-use activities (Friendship & Furgal, 2012). As any Indigenous land-user will tell you, Indigenous peoples and their ancestors have been assessing the health of their traditional foods for millennia and have great confidence and trust in their abilities to detect potential exposure or environmental risks in their food sources. Similarly, during their map-biographies, many Yellowknives Dene Elders and land-users, used their historical and orally transmitted knowledge, gained from experiences and practices out on the land and discussions among each other, to determine which areas were safe or unsafe to engage in their traditional land-use activities. It is important to note here that, during the early years of mining operations, Dene were forced to rely on their TEK and trust their observation-based assessment of wildlife health and behaviour, as Giant Yellowknife Gold Mines, Ltd. or Royal Oak Mines Ltd. did not provide Dene with alternative food sources or food options despite the mining companies being at fault for contaminating Dene traditional food sources (Sandlos & Keeling, 2017).

Dene observations, experiences, and teachings thus directly influenced their conceptual understandings of risk and their land-use activities, but also indirectly

influenced their reactions to governmental health advisories or dissemination of research findings. For instance, during their map-biographies, some Elders and land-users drew an invisible boundary line located south of Wı̨ìlı̨ìcheh to demarcate the "safe zones" to engage in land-use activities. According to these participants, all of the lakes and water systems north of the boundary line and south of Wìlìideh were "spoiled" or "contaminated." Randy Freeman described the genuine fears and concerns of Dene land-users related to collecting drinking water and fishing activities in Wı̨ìlı̨ìcheh, despite scientific evidence potentially showing the contrary:

> No matter how many scientists tell you that you can go out into this [Yellowknife] bay and dip your cup in it and you'll be fine, they [Dene] won't. That's the fear and there's kind of this invisible line, you know? If you're gonna go out on the land, and you're gonna drink the water, go south, go south out to the islands, that's still okay out there. Whether it is or not, I don't know, but certainly I've been scolded by people when I say, "I am gonna reach over for a glass, or cup of water," you know not too far off shore here. It's just the look of shock like you're gonna die…But when you get out past a certain point, it's kind of a magic line (laughs) that we're fine now, you know? You can go set your nets past there because the fish are gonna be fine [Randy Freeman interview, June 7, 2016]

In the literature, both socio-cultural and psychometric approaches have revealed that people's perceptions of environmental risk are strongly linked to concerns about the trustworthiness of controlling or regulatory institutions (Bickerstaff, 3004; Slovic, 1993; Walker et al., 1998; Wynne et al., 1993). Within the context of the Yellowknives Dene, their historical legacy of colonialism, land degradation, and marginalization have resulted in a cumulative mistrust of regulatory bodies and decision-makers. To use the words of Fred Sangris, "There is no trust with the governments and First Nation when they sit on table and talk about Giant Mine, there's no trust. And that's the way it's been" [Fred Sangris interview, May 24, 2016].

Relatedly, in their study of risk communication and trust associated with the GMRP, Jardine et al. (2013) revealed five primary themes related to trust that were identified by Dene participants, one of which was the historical legacy of mistrust between the communities and the government. As the study showed, Dene participants demonstrated a general distrust towards the government, which placed the government in a difficult position when trying to take action on environmental issues and consult with the public (Jardine et al., 2013). Similarly, some participants in this study expressed a lack of trust and confidence specifically in relation to scientific community and research dissemination. As Darrell Beaulieu, who served three terms as Chief of the Yellowknives Dene First Nation, explained:

> AD: Were there any other advisories?
>
> DB: I can't remember. Maybe newspapers or…Oh, I know Indian Affairs. I can't remember which years it was, mid 90s, I think. It's gotta be about 95, 95. Anyways, Jonas [Noel] was the Chief in Dettah and INAC contacted us and said they wanted to meet…so I drove there and Jonas and I met with two or three of them… and they had these water bottles and they had maybe about a dozen of them and…they showed us on the map where they took samples all along the lake and they said "we tested this water and the water it's good, it's healthy, you can drink it." So, Jonas grabbed one and said here if it's good you drink it. And they wouldn't drink it (laughs) [Darrell Beaulieu interview, May 25, 2016]

As Sandlos and Keeling (2015) write, it is hardly surprising to find that that Dene do not trust INAC, which has since evolved into CIRNAC, to regulate the GMRP project. Not only is the department the project proponent and de facto regulator, but is also the same department that failed to protect Dene health and Treaty lands during the early years of the mine. Thus, despite apparent engagement with the GMRP, Dene are still seemingly hesitant to fully trust scientific claims, which may be related to a history of mistrust and

confidence in the regulatory systems, economic marginalization and a lack of control over decisions that directly affected their health and well-being.

4.3.3 Health Impacts

The perceived and direct health impacts of historic mining pollution continue to play an active role shaping Dene risk perceptions and avoidance land-use behaviors near the Wı̨ìlı̨ìcheh area. Prior to mining activities, Elders recalled stories about how Dene used to live a long and healthy life out on the land. Elder Mary Louise Sangris shared her memories,

> Before, when we were out on the land, every time we stay out on the land in tents, we never got sick, nobody ever got sick, nobody had headaches, aching body or colds or anything cuz' everything was just natural, just everything from the land. It was natural, that natural smell of trees and anything that they did was just natural so nobody hardly ever got sick [Mary Louise Sangris interview, May 31, 2016. Interpreter: Lena Drygeese]

For the Yellowknives Dene, traditional foods are the anchor to their cultural and personal well-being, and essential to their nutritional and social health. The onset of industrial mining on their lands not only posed threats to their sociocultural, spiritual and economic well-being but also posed risks to their physiological health. As Mary Louise Drygeese earlier described, mining company officials did not consult or advise the Dene communities about the potential health risks associated with using the lands let alone tell them about widespread unregulated environmental contamination. Formal health advisories, such as warning signs and newspaper articles, only appeared following increasing demands from both settlers and Dene communities during the 1970s, but their effectiveness in reaching land-users and Elders remain questionable (Sandlos & Keeling,

2017). During their interviews, for example, only two Elders spoke of the warning signs (see Figure 4.1) posted near the Giant Mine Property and on Latham Island, and as playing a role in their land-use change. The same participants also described, however, that for many members of the communities, these warnings were fruitless because many Dene could not read or speak English, or more importantly, did not have alternatives for their food sources.

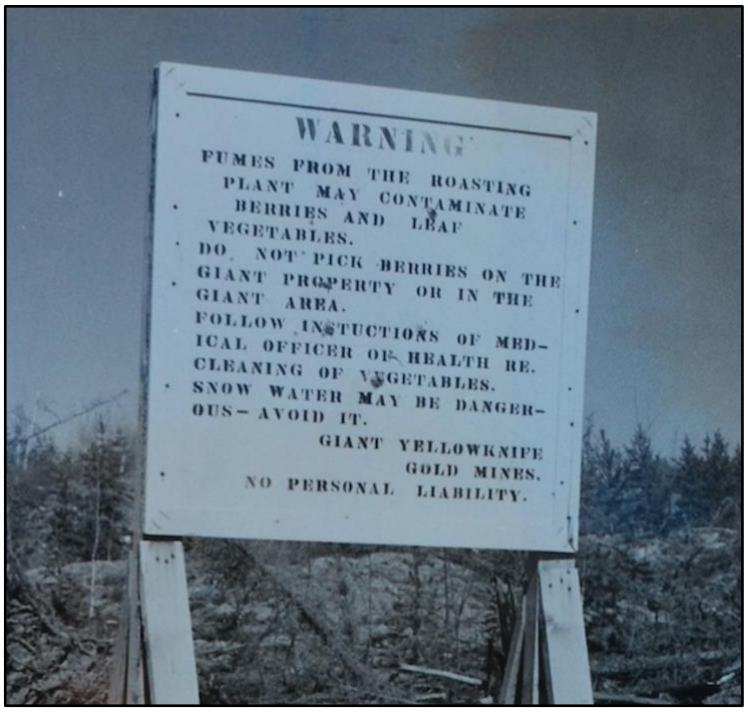

Figure 4.1 Warning Sign near Giant Mine Property ca. 1980s. WARNING: FUMES FROM THE ROASTING PLANT MAY CONTAMINATE BERRIES AND LEAF VEGETABLES. DO NOT PICK BERRIES ON THE GIANT MINE PROPERTY OR IN THE GIANT AREA. FOLLOW ISNTRUCTIONS OF MEDICAL HEALTH OFFICER OF HEALTH RE. CLEANING OF VEGETABLES. SNOW WATER MAY BE DANGEROUS – AVOID IT. GIANT YELLOWKNIFE GOLD MINES. NO PERSONAL LIABILITY. Source: Yellowknife Mining and Geological Museum (2016)

Given the interviews, it is clear that Giant Mine's toxic legacy had a profound impact on Dene sensibilities about health and illness, including cancer. Elders and active land-

users (n=10) spoke extensively about illnesses and deaths that overcame their family and community members especially during the early years of mining operations. As participants explained, the pollution combined with the Yellowknives' reliance on snowmelt for drinking water to result in one confirmed death of a two-year-old Dene boy from N'Dilǫ in April 1951. The little boy died from acute gastroenteritis, an intestinal infection, caused by drinking contaminated snowmelt water. Elders and land-users also suggested that at least two children died as well as several older community members during this period. While archival evidence is inconclusive, records do confirm at least one case of arsenic-related skin conditions such as keratosis (thickening of the skin), hyperpigmentation (black spots on the skin), and paresthesias (a burning sensation in the extremities) in a middle-aged patient from Dettah in 1954, as well as widespread sickness in the First Nations community (Keeling & Sandlos, 2016; Sandlos & Keeling, 2017)

In addition to human health impacts, other interviewees (n=6) attributed the risks of using the land with the deaths of animals. Elders recalled family sled dogs that died or lost their fur after stepping in or drinking arsenic-laden water while some recalled stories about non-Dene horses and cattle dying from arsenic poisoning. For Elder Peter Sangris, the health impacts resulted in his widespread fear of touching the vegetation near the Giant Mine property:

> PS: In this area now (Yellowknife/Giant Mine area), we know that we can't go out there on the land and we can't touch any of the trees or grass or anything. Any plants growing in that area without having gloves on. We know that now.
>
> AD: Did somebody say to put gloves?
>
> LD: No, just the people got afraid after what happened to the two horses and these two children and then the fish and the water and all that. So now people just avoid this area all together [Peter Sangris interview, May 19, 2016.

Interpreter: Lena Drygeese]

Altogether, the perceived and direct health effects of industrial pollution on both humans and nonhumans ultimately played a role in shifting Dene traditional land-use activities. Indeed, seven participants told me that they are scared or afraid of using the lands and waters east of Wı̨ìlı̨ìcheh because of health concerns. As both Elder Rose Betsina and Fred Sangris explained,

> In this community, there is still illness, there continues to be new cases of cancer, and no one is saying whether it's because of the fish from lake, or other sources of contamination on the land. It's devastating when a community hurts and when there are no answers. Nobody knows, no warning. [Rose Betsina interview, May 24, 2016. Interpreter: Fred Sangris]

> This whole mine impact my community of the Yellowknives Dene. Impact my village. Impact the whole surrounding area of land mass up to 24 kilometers. We can eat the game in there, but it'll be harmful to our health, we'll probably get sick. We are afraid to eat the berries, we are afraid to use to wildlife in that area, it had devastated our community in the past, with high cancer cases. So many of us don't fish in Yellowknife Bay, we have to go 20 miles or more out to go get our fish [Fred Sangris interview, May 24, 2016]

4.4 Conclusion

In conclusion, Dene sensory and bodily awareness as well as trust in their TEK play an influential role in forming their perceptions of risk related to land-use activities. Given my findings, Yellowknives Dene Elders and land-users continue to heavily rely on their experiential knowledge, observations and senses to detect the safety and quality of food items in Wı̨ìlı̨ìcheh. Not only did Giant Mine Yellowknife Ltd. and Royal Oak Mines Ltd.'s encroach their mining activities on Dene Treaty 8 lands, but also concealed the truth about widespread environmental pollution. Without proper information or consultation, the Dene community was forced to learn about and understand mining

contamination through their daily interactions with the environment. From the physical experience of seeing a white cloud of arsenic loom over their communities to the physiological effects on their bodies and traditional foods, Dene drew upon their own regimes of perceptibility to come to know and understand gold mining pollution. Dene traditional teachings, experiences, and social networks allowed land-users and Elders to cope and modify their land-use activities in the wake of unregulated mining pollution and ultimately shift their land-use activities towards the Tinde'e area (see Chapter 3).

It is important to note, however, that Dene risk perceptions are not solely bound up with sensory evidence and TEK but also with larger social networks and reported impacts on the wider environment. For instance, while there was a great deal of variation among participants regarding their awareness of previous research or increasing contaminants research in the area, many (n=6) often used a 10 or 25 mile benchmark to describe the spatial extent of contamination, and in turn the extent of Dene land-use displacement. Two land-users, during their map-biographies, pointed to an independent berry study conducted for the Dene during the 1970s to support their land-use avoidance behaviors near Wı̨ìlı̨ìcheh. As Fred Sangris described,

> So up to 24 kilometers from Giant Mine radius we did a berry study. The berries in Yellowknife Bay is very high in contaminants. The berries in Detah are very close and up to 24 kilometers arsenic traces in the berries. Not much but there's little traces up to 15 kilometers you can tell there is arsenic in them. 10 kilometers is danger. We were told not to pick berries 'cuz it's contaminated. [Fred Sangris interview, May 24, 2016]

Although I was unable to locate this specific berry study, recent studies, as I mentioned earlier, have indeed detected high levels of arsenic in surface soils and vegetation within 10-kilometers of the Giant Mine and Con Mine properties (Bromstad,

2011; Koch et al., 2000a,b; St-Onge, 2007). Earlier studies also suggested that pollution from the roaster stacks can be traced up to 25 kilometres westward of the Yellowknife area (Hocking et al. 1978). Therefore, while many land-users expressed that they lacked the effective information on the issue of contaminants, their perceptions of risk related to land-use activities were, whether directly or indirectly, influenced via scientific research. These perceptions could also possibly be by-products of increasing public awareness, news coverage of the GMRP, and recent public health advisories issued by the Government of the Northwest Territories.

Within the broader literature, this chapter helps move beyond dominant regimes of knowledge production related to industrial contamination and the environmental legacies of resource extraction in the Canadian North. It adds to northern Indigenous risk perceptions research by exploring how Indigenous land-users perceive, understand, and makes sense of widespread environmental contamination in their everyday land-use practices. Specifically, this chapter elucidates how Indigenous understandings of risk are complex and context-specific, and not only rooted in everyday experiences and land-use practices but also within their broader experiences of environmental racism and settler colonialism.

In line with Sandlos & Keeling (2015), this chapter shows and argues that Indigenous understandings of risk and knowledge of contamination should be given the same level of attention and recognition as scientific knowledge in remediation projects and risk assessments. As this chapter showed, Indigenous TEK systems are adaptive and dynamic systems that are collectively and continuously re-visited in light of new experiences, observations, and technologies (UNESCO, 2017). Through their experiential knowledge

and experiences on the land, Indigenous land-users can provide meaningful input in decision-making processes related to environmental assessments and other environmental issues affecting their communities.

If remediation practices continue to ground their approaches in settler-colonial ideologies and understandings of risk and contamination, they will continue to promote and exacerbate legacies of environmental injustice in historically marginalized landscapes. Specifically, these practices will continue perpetuate colonial violence through what Whyte (2018) calls vicious sedimentation and insidious loops. By excluding Indigenous participation in meaningful environmental making decisions or limiting Indigenous to TEK to matters of "traditional" such as pre-contact cultural history and knowledge of biotic resources, for instance, these processes will reinforce and strengthen settler ignorance against Indigenous peoples and their adaptive capacities (i.e. vicious sedimentation). Moreover, the looping effect of "superior" settler techno-scientific approaches to environmental remediation practices will continue to undermine and disregard Indigenous TEK systems and relationship to land (i.e., insidious loops).

As Place & Hanlon (2009) write, recognizing and acknowledging Indigenous environmental values, knowledge systems, and perceptions of risks is a necessary first step to help reclaim Indigenous health and well-being, In line with this argument and within the context of the Giant Mine, I argue that it is imperative that the GMRP recognize and incorporate Dene values, systems, and perceptions of risk within their processes if the goal is to achieve EJ.

CHAPTER 5
Conclusion

5.1 Conclusion

This thesis captured the voices, experiences, and memories of the Yellowknives Dene related to the legacy effects of industrial mining on their traditional territory. By intersecting the literatures of environmental justice (EJ), settler colonialism, and risk perception, I created a spatial narrative of environmental injustice based the unique histories and everyday experiences of Dene land-users living and engaging in one of Canada's most contaminated landscapes. For over 50 years, industrial gold mining in Wı̨ìlı̨ìcheh polluted and poisoned Dene bodies and lands with seemingly no care or concern for the First Nation's subsistence lifestyles, spiritual, and cultural practices. Giant Mine, in particular, left a toxic legacy of 237,000 tonnes of buried arsenic trioxide along with extensive surface contamination both within and well beyond the mine site. Today, the abandoned gold mine represents Canada's second largest environmental liability and its remediation project (GMRP) is expected to cost more than the total royalties ever received from the mine (Saxe, 2014).

For the Yellowknives Dene, remediation is not just a matter of restoring the land but of also addressing the communities' historical experience of environmental injustice and the cumulative impacts of the mines on their lives, lands, and land-use practices. As the Dene repeatedly argued during the GMRP impact assessment review, the project needs to consider the "full geographic extent of impacts on the environment by the mine over its lifetime" including impacts on local community health and land-use (Sandlos & Keeling, 2015: p.8). Recent critiques have also suggested that the GMRP's orientation toward

technical solutions and scientific modes of knowledge have failed to adequately involve or integrate Dene perspectives, experiences and TEK within the remediation process, and thus continue to perpetuate Dene experience of colonialism and marginalization (Sandlos & Keeling, 2015; Beckett, 2017). With respect to the legacies of Giant Mine, in particular, much of the attention and research response has (rightly) focused on the mine remediation itself, including the storage and containment of 237,000 tonnes of buried arsenic trioxide. On the other hand, relatively little attention paid to the broader landscape and environmental changes wrought by Giant mine. This study, therefore, emerged from the concerns of Dene themselves and as part of a broader community and research response to the legacies of Giant Mine. Building off of the work of the Toxic Legacies project, this study documented Dene lived experiences, perceptions of, and responses to locally sourced industrial pollution in Wı̨ìlı̨ìcheh. Specifically, it addressed Dene concerns and land-use practices beyond the borders of the GMRP site.

To do so, I drew on Indigenous land-use studies, specifically the map-biography method. In collaboration with 25 Dene land-users and Elders, I identified sites of continued use and sites of avoidance in the Wı̨ìlı̨ìcheh region. In doing so, I documented the spatial extent of Dene land-use displacement and identified areas that Dene land-users no longer frequent due to perceived risks, feelings of alienation, or environmental changes. As the six-composite land-use maps showed in Chapter 3, Dene perceived and experienced mining impacts over a much wider area than the Giant Mine site and the city of Yellowknife. Specifically, Dene Elders and land-users displaced the majority of their harvesting, fishing, and collecting drinking water activities, away from the Wı̨ìlı̨ìcheh area and southwards towards the Tinde'e area due to feelings of alienation, sense of

danger, and uncertainties associated with using the lands and waters near the abandoned mines.

Moreover, using Murphy's (2008) notion of "regime of perceptibility" in Chapter 4, I situated Dene perceptions of and responses to historic mining pollution within their TEK systems to provide place-specific knowledge of industrial contamination. By drawing on the qualitative and descriptive component of the map-biography interviews, I demonstrated how Dene, using their TEK, came to know and sense industrial pollution on their traditional lands. From the physical experiences of pollution such as seeing or breathing in fumes from the historic roaster stacks to detecting sores and abnormalities in animals, to the direct health impacts among community members, Dene land-users drew and continue to draw upon their experiential and embodied knowledge to understand pollution and adapt their land-use practices in response to industrial pollution. As Chapter 4 elucidated, Dene still have reservations and mistrust towards scientific and regulatory systems. If one of the goals of the GMRP is to truly reconcile relationships and build trust between Dene communities, then it is imperative that Dene perspectives, TEK, and experiences with industrial pollution become an integral, valuable, and equal component to the entire process rather than just an "add-on" or "tick off the list." One of the ways in which the GMRP can effectively and actively engage Dene experience and TEK within the process, for instance, is to work with land-users to pinpoint and locate areas of potential concern in Wı̨ìlı̨ìcheh. These are areas or sites deemed chemically contaminated or physically hazardous from an environmental health perspective (Tsuji et al., 2007). By overlaying this study's land-use data with known sites of contamination, future research could identify and test *all* land-use sites that have a spatial proximity to known (or

potential) sites of concern as a way to help identify potential receptors of contamination and routes of exposure.

Moreover, it is important to address this study's limitations. First, this thesis only represents the voices, experiences, and land-use practices of 25 Dene participants, and, therefore, is not representative of all Dene risk perceptions and land-use activities in Wı̨ìlı̨ìcheh. Some land-use activities, such as collecting firewood and medicinal plants, were not well documented in this study. Second, the composite land-use maps only offer a static image of land-use change and do not capture the temporal dimension of land-use displacement (see Chapter 2 for discussion). Third, it is important to note that, while perceptions of risk played a role in Dene land-use displacement, Dene avoidance behaviors in Wı̨ìlı̨ìcheh were also influenced by anthropogenic and non-anthropogenic factors. From forced Dene settlement to urban/industrial development and deforestation, to conflicts with recreational users and cultural change, changes in Dene lifeways and land-use are multi-causal and complex. Given this study's finding, however, it is clear that for many, industrial contamination is a key part of the broader colonial history of Yellowknife.

5.2. Conceptual advancement

This thesis has shown that Indigenous risk perception research is uniquely placed to advance Indigenous geographies of EJ in what is now known as Canada. By incorporating Indigenous risk perception research within the EJ literature, this framework moves beyond dominant narratives of injustice and towards one that is founded on Indigenous perspectives, systems of knowledge, and environmental values. More specifically, this approach moves beyond matters of distributive inequities and towards a community-

specific and culturally informed approach of how environmental racism and inequality manifests in the everyday lives of Indigenous peoples and their land-use practices. By using a methodology that is grounded and informed by Indigenous understandings of risk and spatial knowledge, this approach not only reveals the distributive inequities of pollution through the eyes of Indigenous land-users themselves, but also captures qualitative dimensions of ER at the community level.

In relation to northern risk perception research, this study builds on and contributes to the literature by exploring Indigenous risk perceptions and environmental knowledge as they relate to persistent and pervasive mining pollution in Treaty 8 Territory. The majority of risk perception research in northern Canada has focused primarily on Inuit perceptions of contaminant issues, and therefore this study adds to the literature by situating Indigenous perceptions of risk within a different geographical and contextual area. In addition, this study contributes to the literature by adding a spatial component to that of risk perception research. As this thesis illustrated, this component is useful for understanding and showing the extent to which Indigenous perceptions of risk affect relationships with the land and subsistence activities.

Moreover, this framework offers a much more inclusive and holistic approach to remediating, reclaiming, and restoring former industrial sites on Indigenous land. By capturing a culturally informed and community specific understanding of risk, this framework can complement if not deepen scientific determinations of contamination related to industrial pollution. Within the context of the Giant Mine, for instance, this study shows how Dene TEK systems are as critical and important as science-based epistemologies in addressing widespread arsenic contamination in Wı̨ìlı̨ìcheh. Taken

together, both systems of knowledge illustrate the need to incorporate "off-site" contamination as part of the GMRP. By employing a framework such as this one, remediation projects such as the GMRP can move beyond dominant scientific regimes of knowledge, and towards processes that engage and incorporate Indigenous knowledge, risk perceptions, and environmental values.

In relation to EJ and northern extractive industries, this study further illustrates how environmental issues on Indigenous land cannot be dissociated from broader themes of settler colonialism and sovereignty over Treaty lands (Keeling & Sandlos, 2009; Voyles, 2015). By building on the work of Sandlos & Keeling (2016) and Voyles (2015), this study illustrates the complex interplay and intersections between environmental justice, mining, and settler colonialism as they relate to Indigenous land-use dispossession. Specifically, this study contributes to the discussion by explicitly showing how processes of mining and mining culture results in the forceful dispossession of Indigenous subsistence and cultural practices in their traditional homelands.

Overall, this study contributes to and continues Dene longstanding efforts to document traditional land-use in their territory. Combined with previous land-use studies such as the Dene Mapping Project and recent TEK studies undertaken by the YKDFN, this study supports Dene claims to their ancestral land in Treaty 8 Territory (Nahanni, 1974; Trailmark Systems Inc., 2019; Weledeh Yellowknives Dene, 1997). Specifically, this thesis provides spatial evidence of Dene presence in and around the Wı̨ìlı̨ìcheh area, both historically and contemporarily. Moreover, the six traditional land-use maps coupled with Dene voices and memories in this thesis anchor Dene long-standing claims of the widespread impacts of industrial mining and settler activities on their subsistence

livelihoods. This work, in particular, adds a spatial component to Dene oral histories and testimonies of land-use displacement in their communities. The fishing map, for instance, reveals the drastic change in fishing density in Back Bay and Wı̨ìlı̨ìcheh as result of perceived mining pollution. These findings further push forward the idea that the Federal Government needs to acknowledge and compensate the Yellowknives Dene for the *full* geographic extent of mining impacts on the First Nations' traditional land use practices because, as this study showed, the damages and losses extend far beyond the Giant Mine remediation site.

Finally, and in relation to pain-narratives (Tuck, 2009), I have indeed told a story of pain and loss in order to address the colonial legacies of mining on Dene lands and bodies. I have shared Dene experiences and memories of suffering and displacement to hold the federal government accountable for the widespread destruction and disrespect of Dene lives, lands, and bodies. On the other hand, however, Dene have also shared their stories of their survivance and resurgence on the land. I have shown how Dene, through their experiential knowledge, sensory awareness and trust in their traditional teachings, were able to and continue to cope and modify their land-use practices in spite of colonial land appropriation and environmental degradation. As the six land-use maps showed, not only do Yellowknives Dene continue to leave their footprints across their traditional lands in Wı̨ìlı̨ìcheh but continue to challenge the ongoing, destructive forces of colonization. It is therefore my hope that this study will be used as a tool to not only support and advance long-standing Dene claims related to compensation but to also tell a story of Dene survivance, strength, and resilience.

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APPENDICES

Appendix I: Sample Informed Consent Form

Informed Consent Form

Title: Mapping Memories of Mining Pollution in Yellowknife, NWT

Researcher(s): Amanda Degray, MA Candidate, Memorial University, Department of Geography, amd453@mun.ca, (514)-605-5774

Supervisor(s): Dr. Arn Keeling, Memorial University, Department of Geography, akeeling@mun.ca, (709)-864-8990). Dr. John Sandlos, Memorial University, Department of History, jsandlos@mun.ca, (709)-864-2429

You are invited to take part in a research project entitled *"Mapping Memories of Mining Pollution in Yellowknife, NWT"*

This form is part of the process of informed consent. It should give you the basic idea of what the research is about and what your participation will involve. It also describes your right to withdraw from the study. In order to decide whether you wish to participate in this research study, you should understand enough about its risks and benefits to be able to make an informed decision. This is the informed consent process. Take time to read this carefully and to understand the information given to you. Please contact the researcher, *Amanda Degray* if you have any questions about the study or for more information not included here before you consent.

It is entirely up to you to decide whether to take part in this research. If you choose not to take part in this research or if you decide to withdraw from the research once it has started, there will be no negative consequences for you, now or in the future.

Introduction

I am a graduate student in the Department of Geography at Memorial University. As part of my Masters thesis, I am conducting research under the supervision of Dr. Keeling and Dr. Sandlos. My research aims to document past and present traditional land-use in the Yellowknife region, and how these activities were impacted by gold mining pollution. I am interested in learning more about how the YKDFN perceived and understood environmental contamination.

Purpose of study:

This purpose of this study is to document past and present land-use in the traditional territory of the YKDFN, and to demonstrate how environmental contamination changed YKDFN traditional land-use activities over time.

What you will do in this study:

If you wish to take part in this study, you will be asked to participate in an interview with me. During the interview, I will ask you questions about your experience and knowledge of past and present land-use patterns in the Yellowknife region.

Using a printed map of the Yellowknife region, I will ask you to identify and mark areas where you used to go hunting, trapping, and fishing and where you used to collect medicinal plants and berries. Then, I will ask you if mining pollution (e.g. air pollution from roaster stacks, physical disturbances to landscape, and water contamination from tailings discharge) changed these activities, and if so how. For example, are there sites where you used to go and no longer go because you believe the land to be contaminated? These can be sites on land and or in the water.

Length of time:

I will be staying in Yellowknife for a total of 45 days. I will be conducting interviews that are approximately one to two hours each. However, if you wish to expand on the topic or talk about related ideas, you are more than welcomed to do so.

Withdrawal from the study:

a) You may stop participating during the interview, for any reason, if you so decide. Your decision to stop participating, or to refuse to answer particular questions, will not affect your relationship with the researchers, Memorial University, or any other group associated with this project.
b) In the event you withdraw from the study after the data has been collected you can approach me personally, call me directly at 514-605-5774, or email me at amd453@mun.ca and your data will be destroyed as soon as possible, no later than two weeks after request.
c) It will be impossible to withdraw from the study after March 17th, 2017, once I will have analyzed the data for the publication of my thesis.

Possible benefits:

Your participation in this study will have potential benefits to:

a) **Your community and other northern Canadian communities that have been affected by large scale development.** Importantly, the maps that will be produced from these interviews will illustrate YKDFN traditional land-use patterns, and how these changed over time as a result of mining pollution in the area.

b) **The scientific/scholarly community and/or society as a whole.** Your participation will contribute to that of the Toxic Legacies Project and Northern Exposures at Memorial University, and also to scholarly and public debates around abandoned mines in northern Canada.

Possible risks:
I am asking you to share with me some very personal and confidential information, and you may feel uncomfortable answering some of my questions. Given that this interview is about your personal experience and knowledge about land-use and mining pollution, there is a possibility that some questions will be upsetting or distressing. Please remember that if you do not wish to answer any of the questions during the interview, you may say so and I will move on to the next question.

Confidentiality

All information you supply during this study will be confidential and unless you specifically indicate your consent, your name will not appear in any report or publication of the research. Your identity, personal information, and data obtained from this interview will be safeguarded from unauthorized access, use or disclosure.

Your personal information will be recorded separately from data collected (field notes, interviews and survey) and your identity will be coded (i.e., your personal information will be replaced by code, which allows to re-link your actual name with code name if necessary).

Anonymity:

You may consent to have your name to used in publications or you may choose to remain anonymous. If you choose to remain anonymous, you will be identified generically or through a pseudonym, and other personal identifiers (such as gender) will be avoided.

After your interview, and before the data are included in the final product (e.g. direct quotations), you will be able to review the transcript of your interview, and draft paper, and to add, change, or delete information from the transcripts or draft as you see fit.

The shared history and close-knit nature of your small community may create a situation where you can be identified through the stories you share, but I will make every possible effort to protect requests for anonymity and for information to be kept confidential.

Recording of Data:
During the interviews, I will use audio recording which will be later transcribed. For the purpose of identifying past and current land-use in the Yellowknife region as well as

'sites of concern' I will provide a printed map of the Yellowknife region for you to mark and identify traditional land-use activities.

A translator will be available to facilitate the interview if you prefer speaking in Weledeh. The translator will be required to sign a confidentiality agreement to ensure that all information shared by participants during the interviews remain confidential, and that they will not share information with anyone other than myself.

Storage of Data:

The data obtained from the study will be used for the purposes of this research. Spatial data will potentially be provided to:

1) The Cumulative Impacts Monitoring of Aquatic Ecosystem Health of Yellowknife Bay, Great Slave Yellowknife project led by Dr. John Chetelat. This research team is assessing the quality of water and sediment in Yellowknife bay.
2) Dr. Palmer, an environmental scientist in the NWT Department of Environment and Natural Resources. Dr. Palmer's research is collecting and identifying concentration levels of arsenic in local lakes in Yellowknife.

The data that will be given to Drs. Chetelat and Palmer will only be in form of aggregate spatial data (i.e., personal information and identification will not be given). Access to recorded interviews will be restricted to myself, and/or my supervisors Drs. Arn Keeling and John Sandlos. All interviews will be stored on encrypted computers. The information gathered will be kept for a minimum of 5 years as required by Memorial University policy on Integrity in Scholarly Research, after which I will be destroy all electronic files and shred any paper material that contains primary data (interview transcripts, field notebooks, etc.)

The Yellowknives Dene First Nation may wish to retain and archive copies of audio interviews, or transcripts, as a means to maintain valuable sources of your community's history. Should this be the case, you will be informed, and you will have permission to opt out of the final repository should you desire.

Reporting of Results:

Interview data files and interview transcripts will not be distributed, sold, or disseminated in any way, though selected quotes and composite traditional land-use maps may be used in a published essay, *with permission.*

Sharing of Results with Participants:

All participants will be sent transcripts of interviews, along with their map-biographies at which point they may indicate deletions or refuse permission for use of the transcript. Results of this research will be reported to the community through workshops and public dissemination of all research products (i.e., research publications). Finally, a copy of your map biography will be provided to you upon completion of the study.

Questions:
You are welcome to ask questions at any time during your participation in this research. If you would like more information about this study, please contact: Amanda Degray at amd453@mun.ca If you wish to contact my supervisors directly, they can be reached at akeeling@mun.ca and jsandlos@mun.ca

ICEHR Approval:
The proposal for this research has been reviewed by the Interdisciplinary Committee on Ethics in Human Research and found to be in compliance with Memorial University's ethics policy. If you have ethical concerns about the research, such as the way you have been treated or your rights as a participant, you may contact the Chairperson of the ICEHR at icehr@mun.ca or by telephone at 709-864-2861.

Consent:
Your signature on this form means that:

- You have read the information about the research.
- You have been able to ask questions about this study.
- You are satisfied with the answers to all your questions.
- You understand what the study is about and what you will be doing.
- You understand that you are free to withdraw from the study without having to give a reason and that doing so will not affect you now or in the future.
- You understand that data collected from you will be used for the research study and if you decide to withdraw, all your data will be destroyed, no later than two weeks after request.

If you sign this form, you do not give up your legal rights and do not release the researchers from their professional responsibilities.

Your signature:

__ I have read what this study is about and understood the risks and benefits. I have had adequate time to think about this and had the opportunity to ask questions and my questions have been answered.

__ I agree to participate in the research project understanding the risks and contributions of my participation, that my participation is voluntary, and that I may end my participation.

I agree to take part in the map-biography interview	__ Yes __ No
I agree for the use of my map-biography interview material for research & publication purposes related to the topic of the study	__ Yes __ No
I agree to be audio-recorded during the interview	__ Yes __ No
I agree to the use of quotations.	__ Yes __ No
I agree to share spatial data collected during my interview in the form of aggregate spatial data with Drs. Chetelat and Palmer	__ Yes __ No
I allow my name to be identified in any publications resulting from this study.	__ Yes __ No
I agree to be photographed	__ Yes __ No

A copy of this Informed Consent Form has been given to me for my records.

_____ _____

Signature of participant Date

Researcher's Signature:

I have explained this study to the best of my ability. I invited questions and gave answers. I believe that the participant fully understands what is involved in being in the study, any potential risks of the study and that he or she has freely chosen to be in the study.

_____ _____

Signature of Principal Investigator Date

APPENDIX II: Sample Interview Questions

Section 1: Interview questions for active land-users

Biographical Information

What is your name?
When were you born?
Where do you live/grow up?

Land-use Status: **Active**

1) **What areas do you go 1) fishing 2) hunting 3) berry-picking/gathering plants 4) collecting drinking water?**
   Note: For each activity informant will be asked:
a. Can you identify on the map these locations?
b. How do you access these locations? Can you identify on the map these travel routes?
c. Have you always used these areas?
d. If no, when did you start using these areas?

2) **Are there areas that <u>you avoid</u> to go 1) fishing 2) hunting 3) berry-picking/gathering plants 4) collecting drinking water?**
   Note: For each activity informant will be asked:
a. If yes, can you identify on the map where these locations are?
b. <u>When</u> did you stop using/going to this areas? Is this recent or have you not been going for a long time? Can you tell me more?

3) **<u>What</u> led you not to use these areas? (i.e., why did you stop going?)**
   Note: Guiding questions will be:
a. Official warnings/ health advisories?
b. Personal experience/observations or experiences (past or present) from other land-users?
c. What type of information do you tend to use to decide where to (or not) go hunting, fishing, berry-picking? (i.e., Health advisories/warning signs or personal observations to decide)

Section 2: Interview questions for past land-users

Biographical Information

What is your name?
When were you born?
Where do you live/grow up?

Land-use Status: **Past**

1) **When did you start going out on the land to hunt, fish, gather plants, and collect drinking water?**

2) **During this time, where did you go a) fishing b) hunting c) berry-picking/gathering plants d) collecting drinking water?**

a. Can you identify on the map where you used to go for each of these activities?
b. How did you access these locations?

3) **During this time, are there areas that you tended to avoid to go 1) fishing 2) hunting 3) berry-picking/gathering plant 4) collecting drinking water?**
Note: For each activity informant will be asked:

c. If yes, can you identify on the map where these areas are?
d. Why?

4) **Over the years, did you start avoiding other areas for a) fishing b) hunting c) berry-picking/gathering plants d) collecting drinking water?**

i. If yes, can you identify on the map where?
ii. When did you stop going and why?

5) **<u>What</u> led you not to use these areas? (i.e., why did you stop going?)**
Note: Guiding questions will be:

d. Official warnings/ health advisories?
e. Personal experience/observations or experiences (past or present) of other land-users that you knew of?
f. What type of information did you tend to use to decide where to (or not) go hunting, fishing, berry-picking? (i.e., Health advisories/warning signs or personal observations to decide)