



LBMI YEAR 1 STATE OF KNOWLEDGE REPORT

# Community Summary



Fort Nelson First Nation  
Liard Basin Monitoring Initiative



This community report summarizes the Liard Basin Monitoring Initiative Year 1 *State of Knowledge Report*.

The full report is available from the FNNF Lands and Resources Department.

## **COMMUNITY SUMMARY** Year 1 State of Knowledge Report Fort Nelson First Nation Liard Basin Monitoring Initiative

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Thanks and acknowledgements first go to Fort Nelson First Nation elders, knowledge holders, land users, staff, and leadership who contributed. This report could not have been completed without their support and expert knowledge.

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*We are the Dene and Cree people of the Fort Nelson First Nation (FNFN). We have lived and relied on our traditional lands since time immemorial. We use the land for harvesting our food, for gathering our medicine, for moving from place to place, for habitation, for our cultural and spiritual practices, and for a final resting place for our loved ones past. We have a right to manage and plan for the use of our land. We also have a responsibility to future generations to ensure that our lands will continue to sustain our people into the future, long after resource industries have gone. We envision a future when our community works together to care for our land, air and water.*







# INTRODUCTION

**THE LIARD BASIN MONITORING INITIATIVE (LBMI)** is a three-year pilot initiative led by Fort Nelson First Nation to develop a cumulative effects monitoring program for the Liard Watershed based on FNFN cultural and ecological values. We are focusing on the Liard Watershed because it is our homeland; nearly all of FNFN territory is in the Liard Watershed.

The LBMI is funded by Natural Resources Canada's Cumulative Effects Monitoring Initiative. The over-arching goals of the LBMI are:

- To better understand the state of the environment (baseline conditions) in the Liard Watershed in FNFN territory using traditional knowledge (TK) and science;
- To develop a monitoring framework that will allow the FNFN to monitor and respond to changes in the environment over time, including impacts from industrial development, in the Liard Watershed and FNFN territory;
- To help make informed decisions about human activities and land use in FNFN territory so that the long-term values of the FNFN are maintained while ensuring an appropriate level of resource use and development.


The oil and gas industry is currently in a downturn, however, industry pressure is likely to increase again in the future. The LBMI is an effort to be proactive instead of reactive. By developing our own baseline data collection and monitoring systems, we are getting out in front of development to better position the FNFN to protect our values in the future.

In 2017, FNFN completed the first phase of the LBMI, which included two main tasks:

- Identifying FNFN values and key issues of concern; and
- Conducting a baseline assessment of current conditions, change from past conditions, and threats to FNFN values, based on existing information.

The LBMI is an effort to be proactive instead of reactive. By developing our own baseline data collection and monitoring systems, we are getting out in front of development to better position the FNFN to protect our values in the future.





We completed Year 1 work for the project in June 2017, and the results of this milestone are summarized in this community report. A full report is available from FNFN's Lands and Resources Department.

## Summary of Year 1 Highlights

The focus in Year 1 was on identifying priority FNFN values on its traditional territory, which is nearly all within the Liard Watershed in BC.

Once values were established, existing information on those values was examined by looking at community information (for example, from prior traditional use and knowledge studies) and publicly available scientific information sources. Candidate indicators of the health of each value were developed, their status assessed, gaps in monitoring information, and priority locations for future community-led monitoring activities identified.

Some of the priority values identified by FNFN members include:

- Large intact landscapes (large natural areas undisturbed by industry)
- Water quality (especially near FNFN village sites and water transport corridors)
- Water quantity
- Moose (which are reported to be in decline and which are critical food sources)
- FNFN member health and well-being

Results indicate a variety of gaps in both the state of knowledge of the health of the Liard Watershed, especially in the “at risk” areas in the Taiga Plains in the eastern portion of the Liard Watershed, where industrial activity has increased pressures on water, wildlife, habitat, and treaty rights practices.

This State of Knowledge Report is a foundation of knowledge against which future change can be measured, and upon which community-led monitoring planning can occur. Year 2 (2017-18) will see the development of an FNFN Liard Basin Monitoring Plan, complete with training requirements, priority sub-watersheds and specific monitoring locations, and the development of monitoring plans to be used in the field by FNFN monitors. Year 3 will see the pilot monitoring program initiated and the results reported out to the community and government.

FNFN plans to use this 3-year pilot program to create an ongoing, community-led Liard Basin Monitoring Initiative, to support informed community decision-making on future land and resource development.





# YEAR 1 HIGHLIGHTS

## OUR HOME, OUR STUDY AREA: THE LIARD WATERSHED IN BC

The primary study area for the LBMI is the Liard Watershed in BC, as shown below.

The Liard Watershed is bordered by the Yukon, Stikine, Peace and Hay River Watersheds. It includes all parts of BC that drain into the Liard River that flows north into the NWT.

Within the Liard Watershed in BC, there are 52 sub-watersheds (shown in map on page 8). The names of these match many of the names of our village sites, and the main river systems we travel when moving between them or to our harvesting areas, including Snake River, Fort Nelson River, Petitot River, and Kotcho River, and many others.

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## Pressures on, and Current Protections in, the Liard Watershed

The main pressures/threats to FNFN values in the Liard Watershed are industry (mostly oil and gas, but some forestry and mining), climate change, and over-hunting. Forestry was active in the 1980s, and significantly altered the forests in some portions of the territory at that time. Oil and gas development has had the greatest recent impact on FNFN ecological and cultural values in the Liard Watershed. As of 2012, of the areas tenured to oil and gas interests in the Horn River and Cordova Embayment shale basins, about 72% was already disturbed by industrial activity. A somewhat smaller disturbance footprint exists in the Liard Gas Basin currently.









Key environmental impacts of industrial activity in the Liard Watershed include:

- Impacts on wildlife, including habitat loss and vehicle collisions on roads, and impacts on health caused by reduced air and water quality (contamination);
- Impacts on habitat and vegetation, including removing forests and vegetation;
- Impacts on soil (from land clearing), including increased erosion;
- Air quality and climate effects, including greater greenhouse gas (GHGs) and toxic emissions, and dust in air and on plants;
- Impacts on water and aquatic ecosystems, including removing water from lakes and rivers for fracking, and contamination risks for ground and surface water;
- Impacts on fish and fish habitat, including habitat loss and degradation at pipeline and road crossings, changes in water temperature due to plant removal along lakes and rivers, increased fishing pressure, and water quality impacts;
- Impacts on human health and well-being, including chemical spills affecting drinking water quality and quantity, and contamination of traditional foods; and
- Impacts on FNFN cultural practices (land use and harvesting), including alienation from the land and water, contamination concerns in wild food and water, population declines in important food animals, which all contribute to a reduction in the amount of time members spend on the land practicing culture.

One way to avoid or reduce industrial pressures and impacts is to protect large and representative areas from development. Current protection designations in the Liard include Protected Areas and ecological reserves, the Muskwa-Kechika Management Area, Caribou Resource Review Areas, Ungulate Winter Range, and Wildlife Habitat Areas. These types of 'protection' contain very variable measures for actual protection of cultural and ecological values, and the LBMI is exploring their effectiveness in relation to key values of interest.

Currently, only 11% of the Liard Watershed is fully protected from development, which is well below the 35-50+% level ecologists have identified is needed to conserve ecosystems over the long-term. Only four of the sub-watersheds in the Liard Watershed have total protections (of all kinds) equalling over 30% of their land base. These watersheds are primarily in the western mountain region (the Boreal Cordillera zone). All watersheds in the muskeg region (Taiga Plains) have less than 10% protected area, and overall there is less than 1% protected in these lands. At the same time, the muskeg areas also face the greatest pressure from industrial development.

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# FNNF Values

The health and well-being of FNNF members depends on the land and waters within our territory. The LBMI is being designed to monitor changes to “what matters most” to FNNF. The LBMI team<sup>1</sup> first identified the most important FNNF ecological and cultural values, based on prior community studies and community engagement. Values include physical realities such as clean water, fresh air, and traditional foods. But they also include perceptual values. In other words, believing that the water is clean, that the air is fresh, and that traditional foods are safe to eat.

Most monitoring initiatives in the past have focused solely on scientific values. In recognition of the critical role of traditional knowledge and cultural values, the LBMI has generated separate ecological and cultural values and indicators associated with different critical measures of the health of the Liard Watershed. Both types of indicators will be integrated into the community-led LBMI.

The main report outlined the state of knowledge for the following priority values:<sup>2</sup>



- 1 The LBMI Team included FNNF Lands and Resources Department staff Lana Lowe, Katherine Cabot Blanc, and Bobby Concepcion, ecologists Rachel Holt, Susan Leech and Sonja Leverkus, hydrologist Martin Carver, and environmental assessment expert Alistair MacDonald. In Year 2, the LBMI Team will be expanded to FNNF environmental monitors.
- 2 Ground stability, shorelines and fish, and air quality state of knowledge information is included in the main report.



# STATE OF KNOWLEDGE ON PRIORITY VALUES

The emphasis in Year 1 (2017) of the LBMI was to identify what we know about each of the FNFN's priority values by examining past and ongoing studies and monitoring programs relevant to the Liard Watershed in BC.

## Large Intact Landscapes

The Liard Watershed is the backbone of our culture. In our seasonal rounds, we travelled across the landscape, often by river or overland trails, to harvest plants and animals in different areas at different times of year. All of our villages — for example, Fontas, Snake River, Nelson Forks — were connected by trails and rivers. The land was undisturbed and allowed us to live this way. In recent years, industrial activity has degraded and fragmented many parts of our territory, reducing the areas caribou, moose, and other animals have to roam and to protect themselves from predators. In the Liard Watershed, the main threats to large intact landscapes are linear disturbances (long lines) such as roads, pipeline right-of-ways, seismic lines, and areas that create disturbance and contamination such as well pads and water storage ponds.

Large intact landscapes (large areas where there is natural vegetation and no signs of industry) allow the natural cycles of wildlife and plant life to continue, and allow FNFN members to peacefully enjoy our territory away from the noise and impact of industrial development. The natural diversity of ecosystems such as old growth forests, black spruce forests, wetlands and muskeg, lakes and rivers provides healthy habitat for the animals and plants FNFN members rely on for food, economic and cultural purposes. Understanding what is happening to the large landscapes in FNFN territory is key to ensuring FNFN members can continue to meaningfully exercise their treaty rights.

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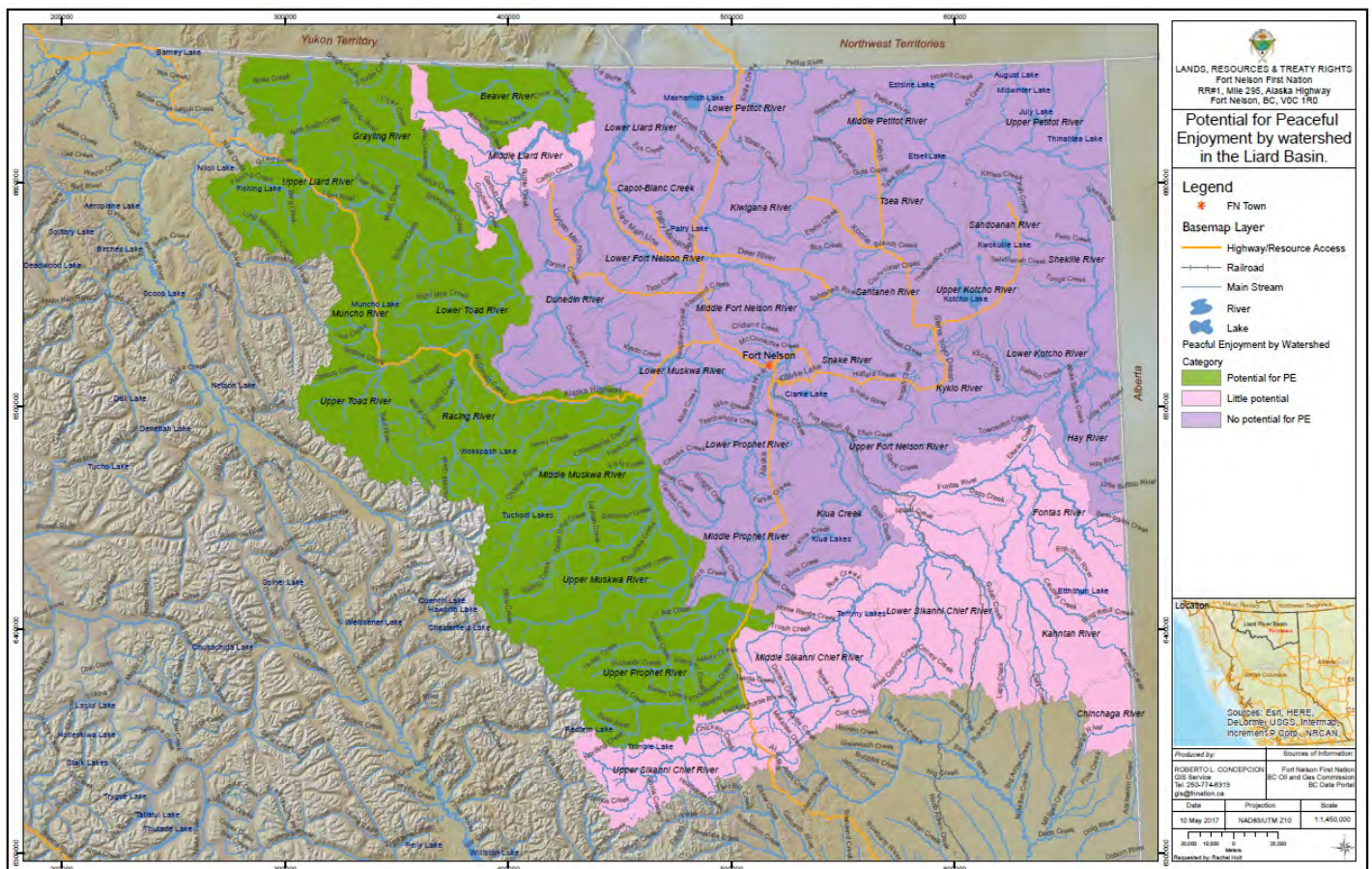
The following indicators were assessed in the State of Knowledge report:

**LINEAR DISTURBANCE DENSITY:** Linear features such as roads and seismic lines cause direct disturbance (such as road-kill), and also affect the surrounding ecosystems, sometimes by many kilometers away from the roadway, depending on the species of concern. A minimum density of roads known to affect wildlife populations is  $0.6\text{km}/\text{km}^2$ .<sup>3</sup> In the Liard Watershed, 19 of the 52 sub-watersheds assessed already have a road density of greater than  $1\text{km}/\text{km}^2$ , and 10 of them were above  $2\text{km}/\text{km}^2$ .

The LBMI team found that in 45% sub-watersheds in the Liard Watershed there is some opportunity for the potential for peaceful enjoyment of treaty rights, while in 55% there is no current potential.

SEE MAP: POTENTIAL FOR PEACEFUL ENJOYMENT IN GREEN, LITTLE POTENTIAL IN PINK, AND NO POTENTIAL IN PURPLE.

**PEACEFUL ENJOYMENT:** While we know that FNFN members still use their territory for traditional activities, the “peaceful enjoyment” indicator is a measure of the amount of interference with their ability to enjoy these activities in relative peace and isolation in different locations. Existing research shows that the ability to enjoy time on the land peacefully increases with distance from roads, motor vehicles, development, and other people. Using a mixture of distance from a road and size of an uninterrupted natural area, the LBMI team found that in 45% of the sub-watersheds in the Liard Watershed there is some opportunity for the potential for peaceful enjoyment of treaty rights, while in 55% there is no current potential. The ability to have peaceful enjoyment decreases in the sub-watersheds as you move from west to east. The greatest remaining potential is in the Northern Rockies, as shown in the map below. Within the Taiga Plains ecosystem we found no area larger than approximately 20 hectares that is more than 5km from a mapped road.



3 This measure is of how many kilometres of cleared lines there are within a given square kilometre of territory.

The mapping of areas where peaceful enjoyment is possible does not reflect whether our people continue to use this landscape. However, it does show that in much of the east of the territory, the quality of the experience possible on the land may be significantly impacted by the presence of industrial and other disturbances. Currently, large landscapes are not being monitored from either a cultural or ecological perspective. Moving forward, FNNF is developing and will implement a set of cultural and ecological indicators to measure whether the trends for large intact landscapes are improving or worsening over time. FNNF's work in Years 2 and 3 of the LBMI will focus on determining the degree to which community members are able to enjoy the land, identifying areas that FNNF members no longer use or are alienated from, as well as identifying old growth forests and large landscapes that should be priority protected areas.

## Water Quantity

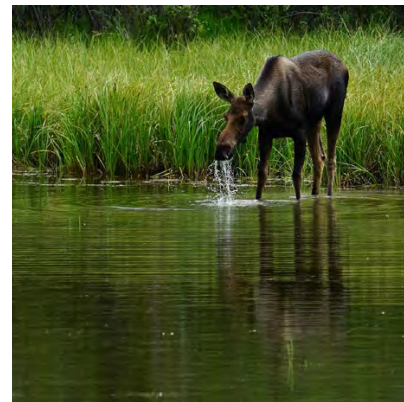
Water in all its many forms (e.g. rivers, lakes, wetland, groundwater) and seasonal timings (e.g. winter snowpack, spring freshet, permafrost) are the lifeblood of the FNNF culture. Water provides nourishment to FNNF members, plants, fish and animals, and connects all life within the territory. The major valley-bottom rivers provide transportation opportunities for seasonal rounds including gathering and hunting that vary through the year. Water systems such as Fontas, Tthekekeh Deh, Tlu Tue, Sahteneh, Kotcho, Ekwan, Klua, Mehdsi Deh, Kantah, Mbeh cho lia, Lidli, and Eh tha te'ke ha dehe, bear the names of the FNNF members they have served for thousands of years. The rivers, lakes and muskeg are home to moose, beaver, muskrat, caribou, swans, geese, ravens, and ducks, all of which are essential to surviving as healthy Dene and Cree peoples. Water also provides spiritual health and many rivers and lakes are important for ceremony and hold memories of births, deaths, lessons learned and stories told and passed on among families and between generations.

The LBMI's focus on water quantity includes both surface and groundwater. Overall, available information is relatively limited — most monitoring that has occurred is industry-led and project-specific. Often those data are not even made available to our community.

Climate change and industry, especially gas development, are the two leading pressures on Liard watershed water quantity, and both are significant. Climate change is affecting the behaviour of surface water throughout the watershed, while industrial impacts are more localized and focused in the eastern areas. Climate station data shows that annual temperature has increased by 2 degrees Celsius during the twentieth century.

Climate change is expected to continue to impact surface and groundwater in the Liard Watershed. FNNF members can expect to observe:

- Increased winter flows in rivers and a decrease in summer flows and an earlier spring freshet (high river flow caused by melting snowpack in spring).
- Decreased snowpack accumulation.
- Changes in winter-season surface ice that could impact FNNF traditional practices requiring travel on river ice surfaces.



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Many climate change-water quantity relationships have not been studied extensively in the Liard Watershed, and will be the focus of the LBMI in the future.

- In the limited areas where permafrost (ground ice) occurs in FNFN territory, permafrost thaw will increase soil infiltration (more rain will be stored in the ground), and contribute more groundwater to stream flows.

Many of these climate change-water quantity relationships have not been studied extensively in the Liard Watershed, and will be the focus of the LBMI in the future.

In the eastern portion of the Liard Watershed, climate change impacts on water quantity are amplified by shale gas development, which consumes large volumes of surface and groundwater for fracking and other industrial activities. In smaller river systems, large water withdrawals and borrow pits affect nearby aquatic habitat for fish and other animals (e.g. amphibians, waterfowl, beavers and muskrats), impact wetlands and the animals that depend on them, and reduce stream flows downstream. Ground disturbances, such as the removal of trees and plants along seismic lines, reduces the ground's water storage capability and increases permafrost thaw.

Overall, surface and groundwater monitoring is not adequate across the Liard Watershed. Some monitoring of larger rivers (by Water Survey of Canada hydrometric stations) is occurring, but there is poor monitoring coverage for rivers and smaller surface water systems in the east. The lack of groundwater monitoring across the region is a significant gap. As pressures on water quantity are increasing, a monitoring program needs to be implemented as soon as possible to improve our understanding of how water quantity is changing.

Potential cultural indicators to monitor the status of water quantity include:

**OPEN-WATER ACCESS AND SAFE NAVIGABILITY:** Seasonal changes in water quantity (e.g. low summer flows) can affect FNFN members' ability to travel to and from critical cultural areas. This indicator is not currently measured. We need to monitor our ability to navigate important river routes used for cultural activities and connection to land.

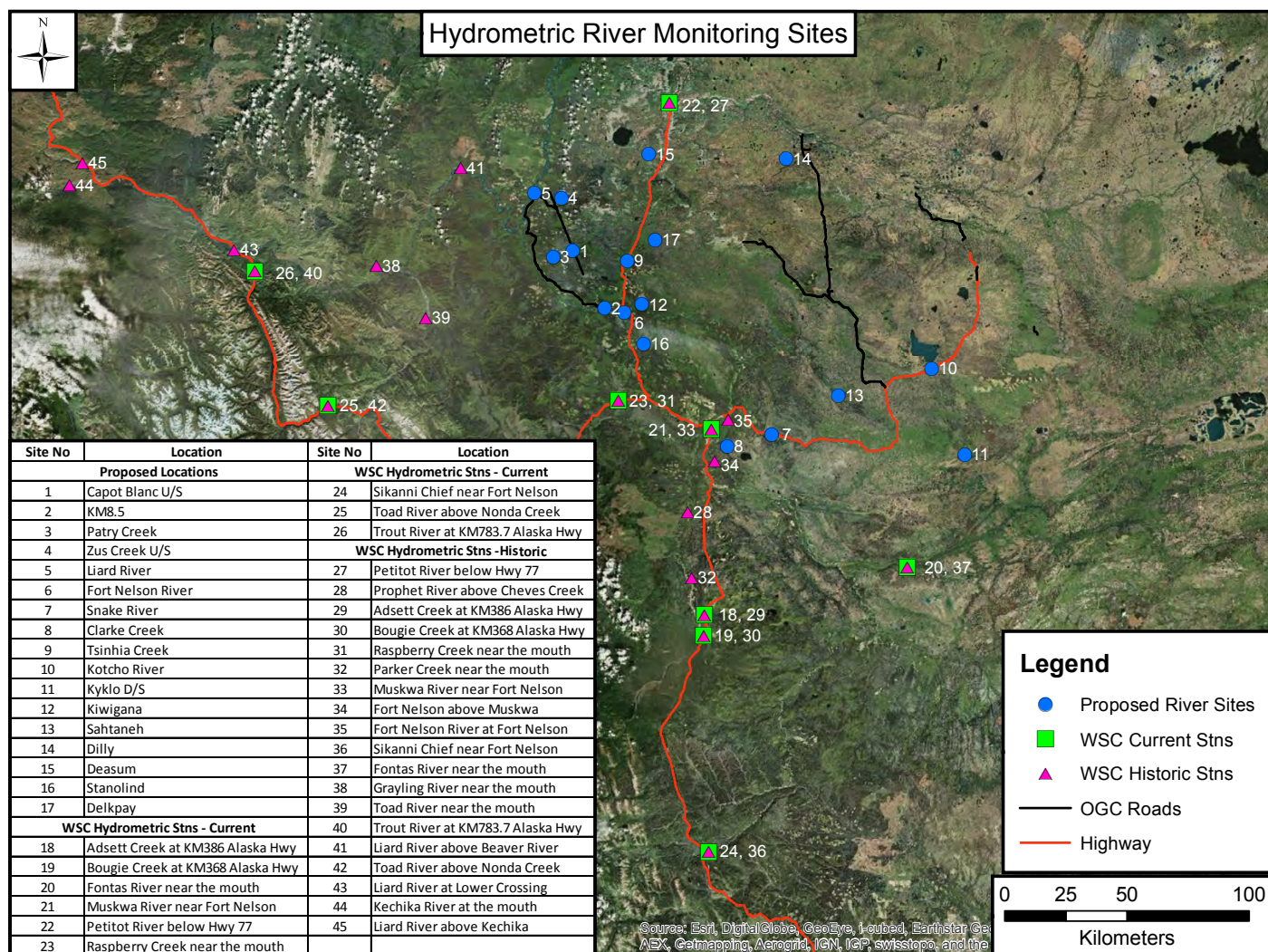
**RIVER-ICE INTEGRITY:** Thick ice cover has always allowed FNFN members to travel along the rivers and lakes during the winter months for trapping and other uses. To track this ability, we will need to track how often FNFN members encounter ice surfaces unsafe for winter travel, and where this is happening.

Potential ecological indicators for monitoring water quantity include: water withdrawal volumes; environmental flow needs; the number of borrow pits in an area; lake level change; and snowpack change. With the help of FNFN members, we have identified specific sites that should be monitored due to their cultural importance or because we are already seeing changes.

In addition, lakes being considered for monitoring programs include: Kotcho, Clarke, Two Island, North Tsea, Komie, Patry, and Tooga.

In Year 2, the FNFN LBMI team will focus on improving our understanding of the baseline water conditions in the Liard Watershed, industrial water impacts, shallow groundwater, and environmental and cultural flow needs (water quantity and the timing of flows needed to maintain healthy ecosystems and FNFN cultural practices) in important river systems.

#### FNFN-priority additional hydrometric monitoring sites (blue circles)







## Water Quality

Clean water maintains the meaningful practice of treaty rights for FNFN members as they travel the land to hunt, fish, trap, gather, and take part in other spiritual and ceremonial activities.

Available clean water is a cornerstone of FNFN culture and livelihood. Clean water is essential for humans, animals and plants, in all seasons. Clean water maintains the meaningful practice of treaty rights for FNFN members as they travel the land to hunt, fish, trap, gather, and take part in other spiritual and ceremonial activities. Until recently, drinking water was traditionally gathered without hesitation or fear from plentiful sources (streams, lakes, muskeg) as one travelled on foot, by boat, horse, or dog team.

The main concerns for water quality are climate change and industrial activities such as shale gas development. Activities like fracking and the transport, storage and disposal of contaminated wastewater have the potential to expose fresh surface and groundwater to contamination through well casing failures and groundwater connections, spills and other releases of water into the environment. When land is cleared for development sediment runs off the land and into rivers and rivers, increasing turbidity (cloudiness).

Climate change has been identified as a main driver of the increasing number of landslides occurring in the Liard Watershed, which are triggered by high rainfall events as precipitation increases with warming winters. Landslides wash large amounts of sediment into waterbodies and negatively affect water quality.

Overall, there is very little water quality information available, as few studies have been done in the Liard Watershed. Some data was collected in the 1980s and 1990s for the Liard River itself, but this study did not extend into tributaries. Opportunities for acquiring new water quality information do exist. Since 2010, several monitoring stations have been installed in the Liard watershed as part of the Canadian Aquatic Biomonitoring Network program. Analysis from these sites, and the province's Environmental Monitoring System database, will be integrated into the LBMI reporting.

Potential cultural indicators to monitor the status of water quality include:

- **CONFIDENCE IN WATER QUALITY FOR HUMAN AND WILDLIFE CONSUMPTION:** FNFN members are avoiding collecting drinking water from specific lakes and rivers, because it is not trusted and is seen as a risk to their health (often due to the presence of industry and contamination concerns). Similarly, FNFN members generally do not consider the water fit to drink by wildlife if it is not fit to drink by humans and lose confidence in wild foods in areas where water quality is not trusted. Therefore, a valuable indicator of water quality is FNFN member confidence that the water is fit for consumption.
- **SNOW QUALITY:** Snow quality, especially around waterbodies, is a useful indicator of water quality. Factors that influence FNFN members' confidence in snow quality include distance to industrial facilities and other man-made impacts, the health of fish and wildlife, and the snow's visual appearance, taste and smell.

Potential ecological indicators related to water quality include: density of stream crossings, length of linear corridors (roads, seismic lines, etc.), sediment sources and quality, wastewater disposal, industrial spills, water quality standards for drinking water, among others.

There is a need for a coordinated and focused monitoring effort for surface and groundwater. Some of the major gaps in current water quality monitoring that future monitoring efforts should seek to address include: lake monitoring; monitoring at important FNFN cultural sites and areas; monitoring at sites to detect industrial impacts; snow quality monitoring; shallow groundwater quality monitoring; observation wells (groundwater monitoring); monitoring of sediments in rivers; and monitoring in smaller river systems.

The FNFN LBMI Year 1 full report makes several recommendations to address these gaps and improve our understanding of water quality. The FNFN, with input from members, have already identified priority places where monitoring should occur for baseline water quality, aquatic ecosystem health, and sedimentation.



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## Caribou

Boreal caribou (*medzih* in Dene) have an important role in FNFN cultural identity. Caribou are an important food animal that was abundant in the boreal and muskeg forests of FNFN territory. We have both a right and responsibility to protect boreal caribou for their wellbeing, and the health and wellbeing of our people and the ecosystem. The boreal caribou population has plummeted in ranges across the Liard Watershed and we have voluntarily suspended our right to hunt them for several years. Despite the fact that boreal caribou are recognized both provincially and federally as a critically threatened species, governments have been slow to implement any real action to prevent further decline. As a result, FNFN is taking our own action to protect caribou in our territory. We recently released the *Medzih Action Plan: Fort Nelson First Nation Boreal Caribou Recovery Plan*, based on FNFN traditional knowledge and western science (contact FNFN Lands and Resources Department to learn more).





Across the Liard Watershed, the high density of roads, seismic lines and other disturbances allows predators — especially wolves — to access caribou.

Boreal caribou choose habitat based on available food supply, cover, and predator and pest (e.g. mosquitoes) avoidance. They use a variety of landscapes for different purposes at different times of year, including small lakes and wetlands for calving in spring, and large spruce stands in upland areas in winter for cover.

Industrial disturbance (especially long lines — roads, seismic, pipeline right of ways) is understood as the primary factor resulting in boreal caribou population decline. Across the Liard Watershed, the high density of roads, seismic lines and other disturbances allows predators — especially wolves — to access caribou. For a boreal caribou population to have a reasonable chance (60%) of being self-sustaining, a maximum of 35% of their range should be disturbed. The table below shows the disturbance levels and linear densities for the boreal caribou ranges in FNFN territory. This maximal disturbance level has been far exceeded in every range. A linear density of 1.6 km/km<sup>2</sup> in caribou ranges is also considered a threshold beyond which there is a high risk of caribou population decline.

Range	Disturbance level (%) (EC 2012) (recommended maximum is 35%)	Linear density (km/km <sup>2</sup> ) (threshold of impact ~ 1.6km)
Calendar	61%	1.9
Chinchaga	76%	1.2
Maxhamish	58%	3.4
Snake-Sahtaneh	87%	6.3
Westside Fort Nelson	58%-77%	1.1 — 3.1

Of the potential cultural indicators for boreal caribou, population size and trend (increasing, decreasing, or stable) is the most important as it determines whether caribou can withstand harvesting by FNFN members. Other potential indicators include: the extent of historic range within FNFN territory inhabited by boreal caribou today (i.e. are caribou being isolated into smaller areas of the territory?), and the proportion of caribou in an FNFN member's traditional food diet.

Potential ecological indicators include: cow/calf ratios; disturbance levels within ranges; number of cows reaching breeding age; amount of protected habitat; and amount of intact important habitat types — for example, spruce forests, wetlands.

The data collection and monitoring that has occurred — mostly limited radio collar data — is not enough to accurately determine how boreal caribou populations are actually doing. The FNFN LBMI team identified several monitoring and data gaps identified by scientists and FNFN cultural knowledge, including: wolf abundance; calf mortality; seasonal habitat selection by caribou in each range; current condition of habitat (forage, disturbance); scale of habitat restoration required; and the role of other prey species (e.g. beaver) in the moose/wolf/caribou relationship. Addressing these gaps will allow FNFN members to better understand what is happening with caribou in the Liard Watershed.

## Moose

FNFN members rely heavily on moose (*Golo* in Dene; *mooswa* in Cree) for sustenance, clothing, and crafts. Moose represent the bulk of harvested meat for FNFN, especially as other food animal populations like caribou have declined. Hunting and processing moose brings family and the community together. Moose meat is shared with elders and others in the community who are unable to hunt. Every part of the moose is eaten or used for other cultural purposes.

Moose use every ecosystem type in the Liard Watershed, from the high alpine to the valley bottoms. Moose browse on shrubs and deciduous trees found in recently burned and disturbed areas, and use aquatic/wetland areas and mineral licks during the spring and summer. In the winter, moose will use forests with older, larger trees for warmth and to avoid deep snowpacks.

FNFN members have been observing moose population decline in their territory for roughly 40 years, and moose are no longer present where they were once plentiful. This is driven by habitat loss from the cumulative effects of industry, increased predation from wolves and bears, over-hunting aided by increased roads and linear corridors, increased hunting pressure on large bulls, and impacts to moose health, including increased tick loads and contamination from feeding/drinking water near industrial sites. A 2015 provincial report indicates that moose populations have declined across the province by approximately 27,500 moose since 2011. Within the Liard Watershed itself, moose population trends are unclear and there is a need to conduct more regular surveys, especially in key hunting areas informed by FNFN knowledge.



Moose represent the bulk of harvested meat for FNFN, especially as other food animal populations like caribou have declined.





**FNFN members value and respect the role of all wildlife within the larger ecosystem. Information on bison, fish and birds is available in the full report from the Lands and Resources Department.**

Potential cultural indicators of moose population trends in the Liard Watershed include: number of moose harvested by FNFN members in key moose hunting areas; percentage of successful hunting trips; number of FNFN families getting moose meat; level of non-Indigenous hunting competition; presence of disease and other moose health concerns; level of potential contamination from unfenced industrial sites; level of herbicide spraying in key hunting areas; and number of actively-used mineral licks.

Potential ecological indicators for moose include: population trends in local areas; population distribution; intact movement corridors; and predation rates.

Some moose monitoring is occurring in the Liard Watershed by the province and university researchers, but there are important information gaps: population trends and reproductive success and calf survival; moose distribution and habitat condition; causes of moose death and population declines; and the effects of road density on First Nations subsistence hunting and potential strategies for managing road access.

## Other Wildlife

FNFN members value and respect the role of all wildlife within the larger ecosystem. Information on bison, fish and birds is available in the full report from the Lands and Resources Department.

### Predators (Bears and Wolves)

FNFN community members have been harvesting wolves for many decades for the purposes of selling fur and wildlife management. FNFN members believe wolf pack sizes and overall numbers have increased as industrial development has opened up the land and made it easier for them to hunt moose, caribou, and other animals. Bears were also harvested for food by some members, and bear grease was an important winter food and used for ceremony.

Bears and wolves have important roles within the predator-prey systems in the Liard Watershed. Wolves are highly adaptive, opportunistic predators who adjust their diets to local conditions. Wolves can put significant pressure on their prey animal populations, but this is influenced by several factors including: the number of different prey animals and their populations; the presence of other predators; human interactions with predator and prey species; habitat productivity; and snow conditions. As several factors influence wolves' impact on their prey, the long-term effects of removing wolves from an ecosystem are uncertain. Hunting and trapping are the primary pressures on wolf populations in BC. Other causes of wolf mortality are starvation, conflict or competition with other wolves, and disease.

Grizzly bears and black bears use a wide variety of habitats in different seasons; generally, they select habitat based on food availability (prey animals and plants). Grizzly bears are very sensitive to habitat loss and are considered useful indicators of ecosystem integrity.



Grizzly bears are known to prey on caribou, especially as they leave calving grounds. Black bears are known to prey on juvenile ungulates (moose, deer, caribou, elk). Both bear species are capable of hunting moose and caribou at high enough levels to have a negative influence on their populations.

Black bear populations are not considered at-risk or threatened; however, grizzly bear populations in BC are of special concern as their ranges have decreased by 50% since the 1800s. Grizzly bears occur at low densities in the Liard Watershed. Grizzlies are sensitive to human disturbance, including habitat loss due to development, and road density. Legal hunting, poaching, and vehicle collisions are common causes of mortality.

Potential cultural indicators of predator populations from a FNFN perspective include: watershed-wide population trend; population trends in local areas (e.g. trapping areas); abundance and trends of primary prey species (e.g. moose); number of predators harvested by resident hunters and trappers; health and quality of predators harvested; and level of human/predator interaction (influenced by road/linear disturbance density).

While some monitoring of wolf and bear populations already occurs, the FNFN LBMI team recommends that all wolf sightings, mortalities, and activity should be reported by hunters, trappers and other citizens, and that all harvested wolves be tested for diseases harmful to ungulates. The FNFN LBMI team also makes several recommendations for more research on the effects of wolf removal, alternative (non-lethal) strategies for wolf management, wolf and bear diets, and interactions with ungulates, especially caribou.

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Beaver are known as 'ecosystem engineers' because their dam building has a significant impact on the ecosystem and species around them. Similarly, a decrease in population or local level changes in beaver presence also have a big effect.



## Beaver

The beaver (*Tsá* in Dene and *amisk* in Cree) is a critically important food and cultural species for the people of FNFN and beavers feature prominently in FNFN/Dene creation stories and oral history. Hunted and trapped beaver were eaten, sold commercially, used as saddle bags for horses, and for clothing and crafts.

FNFN has collected and analyzed information on beaver use of the Liard Watershed. Based on where lodges are located, FNFN found that beavers prefer streams and lakes over muskeg. 12.4% of the Liard Watershed provides potential beaver habitat; most of which is located in the east on the Taiga Plains. Beaver are known as 'ecosystem engineers' because their dam building has a significant impact on the ecosystem and species around them. Similarly, a decrease in population or local level changes in beaver presence also have a big effect. Beaver ponds keep standing water on the landscape, which supports high levels of plant, wildlife and fish biodiversity.

Overall, beaver populations in the Liard Watershed are not thought to be at risk. However, FNFN members are concerned about the impacts of industry on local beaver colonies, especially the effects of water withdrawals, changes in the waterways caused by roads, and beaver trapping and killing to manage their impact on roads and other infrastructure. With high road and linear disturbance density in beaver habitat in the Liard Watershed, the potential for human conflict is high. The map below shows that areas of high beaver habitat suitability — in purple — are also mostly in the highly industrial Taiga Plains portion of the territory. This map is from recent work by the FNFN that identified 146,962 potential human-beaver conflict locations. FNFN is in the process (December 2017) of finalizing a *Beaver Management Policy*, informed by the findings of Year 1 of the LBMI and other FNFN projects, that will provide additional guidance to proponents on respectful and FNFN-engaged beaver management options.







Currently there is little or no monitoring of beaver populations in the Liard Watershed; however, FNFN has recently conducted two beaver density surveys.

Potential cultural indicators of beaver populations from an FNFN perspective include: population trends in local areas where beaver management is implemented; health of trapped beavers; beaver mortality caused by industry's lethal beaver management; and potential beaver-development conflict zones in FNFN-held trapline areas.

In the Year 1 report, FNFN's LBMI team makes several recommendations for improving the state of knowledge of beaver populations in the Liard Watershed, including seeking opportunities for beaver monitoring pilot projects, conducting additional lodge location surveys to improve our understanding of beaver habitat preference, and identifying priority areas for management where beavers, FNFN traditional use of beavers, and development, are in conflict.



Harvesting and all other cultural practices help maintain traditional skills, share knowledge, and maintain connection to land.

## FNFN Members' Health and Well-being

The physical and mental health and wellbeing of FNFN members is influenced by factors related to both "life in the community" and "life on the land". As a land-based monitoring initiative, the LBMI is focused on "life on the land", assessed via three separate but connected elements:

### Cultural Continuity and Connection to Land

FNFN remains a strong and re-emerging Dene and Cree Nation, whose traditions, customs and practices have revolved around large game, fur-bearers and freshwater fish since time immemorial. Most FNFN families still practice traditional lifestyles — hunting, trapping, gathering, and fishing — and make at least some part of their living off the land. Harvesting and all other cultural practices (dances, songs, preparing hides, making crafts and clothing, gathering plants, preparing food, collecting drinking water, etc.) help maintain traditional skills, share knowledge, and maintain connection to land.

Potential indicators to measure FNFN cultural continuity and connection to land include:

- **KNOWLEDGE OF AND PARTICIPATION IN CULTURAL PRACTICES:** How frequently and intensively are members taking part in cultural practices such as arts and crafts, dance, hand games, or songs. This could be measured for different age groups.
- **"SUFFICIENCY" OF RESOURCES:** Cultural continuity and connection to land requires sufficient (quality and quantity) access to lands and resources. For example, it requires safe transportation routes, health water quality and navigable rivers, healthy populations of game, berries, traditional medicines, and feelings of safety and security when on the land. It is important to understand the degree to which these conditions are being met, and where on the land this is or is not achieved.



- **TIME SPENT ON THE LAND:** Measured, for example, by the frequency and duration of harvesting trips.
- **LEVEL OF ENGAGEMENT IN HARVESTING, AND HARVESTING SUCCESS:** This indicator would measure how often FNFN members are out on the land harvesting, and how often hunting is successful. Success indicators include distance travelled and cost savings associated with harvesting, as these influence their ability to exercise treaty rights.

These indicators could provide a useful way of measuring cultural continuity and connection to land to track pressures as well as positive contributions to the FNFN's land-based Dene and Cree cultures.

Developing a system where FNFN members report their own traditional activities and observations on the land would be a valuable way of collecting data and monitoring the conditions that sustain cultural continuity and connection to land. The FNFN Lands and Resources Department already has a large database of traditional use data from over 120 members, that shows where FNFN members have harvested, stayed on the land, identified cultural and spiritual values, among other types of information. This database is an excellent tool that can be applied in many ways, including mapping. However, there are many areas where these data still have not been collected.

To better position the FNFN to monitor cultural continuity and connection to land, the LBMI team recommends addressing several gaps, including: gathering more traditional use information from FNFN members, focusing on areas not yet surveyed; begin systematically collecting information from FNFN members on their harvesting success, time spent on the land, and environmental observations; and finding ways to increase opportunities for elders, youth and all members to be on the land together, doing monitoring and learning from each other.

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## Food Security

Food security is an important determinant of the health of Indigenous people. Traditional foods are central to food security, as well as health and culture. Food security is the ability to have the physical, social and economic means to access enough safe and nutritious food to maintain a healthy diet and an active life. Before contact, and until the Alaska Highway was built in the 1940s, FNFN members' acquired virtually all of their food from wild sources in the Liard Watershed. As this wasn't always easy, Dene and Cree harvested as many types of food as possible, did not waste food, dried meat for storage and transportation, shared with each other in times of need, and travelled across the territory to harvest different foods from different areas in different seasons.



Before contact, and until the Alaska Highway was built in the 1940s, FNFN members' acquired virtually all of their food from wild sources in the Liard Watershed.

Food security, like cultural continuity and connection to land, also requires sufficient access to lands and resources, including favourite wild foods. The First Nations Food, Nutrition & Environment Study (FNFNES) noted that the FNFN's traditional diet included well over 150 kinds of wild fish, birds, game and plants. While this and other studies show that as recently as 2009, FNFN were still harvesting and eating high levels of traditional foods compared to other First Nations communities, the proportion of wild foods in FNFN diets is still far less than the near 100% reliance of less than a century ago. In terms of traditional food security, at the time of the FNFNES in 2008/2009, more than half of the participating households indicated that their traditional food supplies ran out and that they would not be able to access more that year, and 27% of FNFN families were rated food insecure.

The FNFNES study confirmed that some of the main barriers to achieving wild food security for Indigenous communities included the loss of animal habitat and harvesting areas, higher costs of travel and time to more remote areas, decreasing local abundance and populations of food animals, over-hunting and competition for limited resources from non-First Nations harvesters. Moose, for example, was the most frequently consumed game species in 2008/2009, but moose populations have declined across BC and the Liard Watershed and FNFN members are finding it more and more difficult to get moose.

A useful cultural indicator of food security is FNFN members' degree of reliance on traditional foods. This could be measured, for example, by documenting how much of a particular traditional food is consumed, and how many times a year is the food eaten? This information can be collected through surveys conducted by FNFN members.

Overall food security indicators (not necessarily specific to traditional foods) could also be collected in the same survey. These results could be compared to the 2008/2009 FNFNES data to identify important food security trends. Given the recent downturn in the oil and gas industry, it is very possible that FNFN families are now less food secure.

Currently, there is no ongoing monitoring of FNFN food security. Key gaps include the lack of post-2009 data on FNFN food security and traditional food consumption, and a lack of post-2009 data on potential exposure to chemical contaminants through food.

## Healthy Landscape

FNFN elders teach that without the land, First Nations people have nothing. All components of the landscape — plants, animals, water, soil, air, and people — are in relationship and deeply connected; if one component is not healthy, others are impacted as well. The ability of FNFN members to practice culture and exercise treaty rights safely and fully depends on a healthy and accessible river system and land base. Knowing that a landscape or resource is safe and healthy provides a sense of security that is integral to life on the land.

Until recent decades, which have brought more non-Indigenous people and industrial activity into the Liard Watershed, the watershed was relatively pristine, but this is no longer true in many areas. The key changes negatively affecting FNFN members' connections to land include the cumulative effects of resource development, habitat loss and degradation, and the decline in the numbers of food animals and other culturally important species. A key impact of concern for FNFN members is the presence of contaminants in the environment, and their personal exposure to contamination through air, water, wildlife and plants. Shale gas, the dominant industry in FNFN territory, is widely known for its risks for freshwater. FNFN members have expressed that they are no longer as confident that harvested plants and animals are safe and healthy, and have fears related to their personal exposure, health and safety. Relatively recent human and environmental health studies focused on northeast BC confirm that FNFN members' concerns are indeed, though poorly studied, causes of concern.

There is currently no monitoring occurring that focuses on healthy landscapes and human health in the Liard Watershed. Potential indicators to measure landscape health from an FNFN perspective include:

- **CONFIDENCE IN QUALITY OF TRADITIONAL FOODS:** Potentially measured through community surveys, confidence in food quality is directly linked perceptions of landscape health.
- **CONFIDENCE IN DRINKING WATER FROM THE LAND:** Are members gathering water from muskeg sources, or streams? These were once accepted as safe practices.
- **TRADITIONAL FOOD ABANDONMENT AND TESTING:** Have FNFN members chosen to not eat a harvested traditional food due to contamination concerns? Such incidents could be documented by surveys, and the results of wild game and plant tissue sampling could help indicate contamination and exposure.
- **AREAS ALIENATED FROM HARVESTING:** If members have stopped harvesting from certain areas because the plants and animals in that area are no longer seen as healthy and safe, this could indicate areas of concern and the causes of alienation (e.g. influence of industrial facilities).
- **NOISE AND LIGHT POLLUTION LEVELS:** Industrial noise and light have real effects on wildlife and enjoyment of the land; this can be recorded by technological means (e.g. decibel levels, and/or as FNFN member observations of variation from natural conditions).



The key changes negatively affecting FNFN members' connections to land include the cumulative effects of resource development, habitat loss and degradation, and the decline in the numbers of food animals and other culturally important species.





# KEY FINDINGS AND NEXT STEPS

The next step for the LBMI is to determine which values and indicators are the highest priority and most effectively collected in a community monitoring system.

**THE STATE OF KNOWLEDGE WORK** completed in Year 1 of the LBMI is hugely valuable. It allows FNFN to identify where to focus Liard Watershed monitoring efforts moving forward. As a set of potential indicators was identified for each value, we have a good sense of how we can begin to measure and monitor these values. Year 2 and 3 will see FNFN setting up a member-led data collection and analysis program that will use both scientific methods and traditional knowledge. The data collected will help FNFN make more informed decisions related to stewardship and land management. Equally important, the very act of monitoring will connect FNFN members to their territory more often.

The next step for the LBMI is to determine which values and indicators are the highest priority and most effectively collected in a community monitoring system. The LBMI team has conducted an initial review of the importance, status, degree of existing monitoring, and need for additional monitoring, for each value, as shown in the table on the next page (red items are major gaps or high priorities; yellow are secondary).

Based on their current status, as determined through the LBMI Year 1 analysis and a community survey, priority values to focus on in the LBMI are:

1. Large Intact Landscapes
2. Water Quality
3. Water quantity
4. Wildlife — Moose
5. FNFN Members' Health and Well-being.

# Summary of State of Knowledge on FNFN Values in the Liard Watershed

	Level of Importance	Current Knowledge	Pressures on Value	Existing Monitoring/Reporting	Monitoring/Reporting: Additional Needs
Large Intact Landscapes	Critical	Moderate	Significantly negative	Low	Critical
Water quantity	High	Very low to moderate	No change to moderately negative	Low to moderate	High to critical
Water quality	Critical	Very low to moderate	No change to moderately negative	Low to moderate	Moderate to very high
Hydro-riparian/fish	High	Low to moderate	Moderately negative	Low to moderate	Moderate
Wildlife (caribou)	Critical	Moderate	Significantly negative	Moderate	Moderate
Wildlife (moose)	Critical	Low to moderate	Moderately negative	Low to moderate	Moderate to high
Wildlife (bison)	Low to moderate	Moderate	Moderately positive	Moderate	Low to moderate
Wildlife (predators)	Moderate	Moderate	Variable	Low	Moderate
Wildlife (beaver)	High	Moderate	Moderately negative	Low to moderate	Moderate to high
Wildlife (birds)	Moderate	Low	Variable	Low to moderate	Moderate
Ground stability	Low to moderate	Low to moderate	Moderately negative	Moderate	Moderate
Air quality	Moderate	Low	Unknown	Low	Moderate
Health/well-being (cultural continuity and connection to land)	Critical	Moderate to high	Moderately to significantly negative	Moderate	Moderate to high
Health/well-being (food security)	High to critical	Low to moderate	Moderately to significantly negative	Low to moderate	Moderate to high
Health/well-being (healthy landscape)	Critical	Low to moderate	Moderately negative	Low	Moderate to high





As a result of the work completed in Year 1, the LBMI Team has a much better understanding of cumulative effects in the Liard Watershed, and the work that needed to monitor cultural and ecological values in the interest of protecting FNFN treaty rights and stewardship rights and responsibilities.

Secondary, but still notable values include caribou, beaver, fish, and riparian (stream and river bank) areas. These too will be subject to monitoring plan development. Based on the results and a linked community survey, dedicated monitoring of bison, birds, predator populations, and air quality is not envisioned as part of the LBMI in the immediate future, but the FNFN will continue to report observations by members, and will work to enhance the existing community observations collection and reporting system.

## Lessons Learned from the State of Knowledge Work

To be successful and fill existing gaps, the Liard Basin Monitoring Initiative must:

- Embrace the challenge of gathering ecological and TK for all high priority values, and use community members to collect as much of the data as possible.
- Seek to integrate information collected by industry and government when it can help inform land and resource planning for the long-term in FNFN territory.
- Collect information that allows FNFN to understand the risks and values at the sub-watershed level, rather than just monitoring individual projects' effects.
- Identify thresholds of acceptable change at the regional and sub-regional scales beyond which protective action is required, and work with government and industry to ensure these thresholds are not exceeded.
- Focus monitoring on the areas of greatest concern, the Taiga Plains region in the eastern portion of the Liard Watershed, while not ignoring the mountains.

## Conclusions and Next Steps

As a result of the work completed in Year 1, the LBMI Team has a much better understanding of cumulative effects in the Liard Watershed, and the work that needed to monitor cultural and ecological values in the interest of protecting FNFN treaty rights and stewardship rights and responsibilities.

The priority in Year 2 of the LBMI is to develop the main elements of a pilot monitoring program that will be tested in Year 3. The first step will be to narrow down the list of candidate cultural and ecological indicators to pilot indicators to use in actual FNFN monitoring activities. Year 2 will focus on critical and high priority values; values that are under pressure and more at risk; values and scales that are feasible for on-the-ground monitoring and data collection by FNFN members; and lower cost activities, given the limited funds for monitoring at this time.

In Year 2, the LBMI team will also identify the most suitable areas in the Liard watershed to do testing for each of the priority values. We will focus on areas that have high ecological and cultural value to FNFN, poor existing data, and high industry pressure. Whether the areas are already protected will also factor in to our decision.

FNFN will continue this work towards an FNFN-led monitoring program for the Liard Watershed based on our vision and understanding of stewardship, responsible development, and the connections between all components (air, land, and water) on the landscape. We will continue to update members as we reach milestones in our work for the FNFN Liard Basin Monitoring Initiative.

