



STATE OF KNOWLEDGE

Watersheds Report Card



Fort Nelson First Nation Liard Basin Monitoring Initiative

May 2019

ACKNOWLEDGEMENTS

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. Overall, our members are the experts:

"[w]e are stewards of the lands and our teachings guide the ways we control, manage and protect our territory. The health of the territory relies on our voice and our actions."

Our thanks also go to Natural Resources Canada, which has provided financial support for the Liard Basin Monitoring Initiative from 2016 to 2019.

STATE OF KNOWLEDGE: **WATERSHEDS REPORT CARD**

May 2019

Prepared and authored by Fort Nelson First Nation and the Liard Basin Monitoring Initiative Team.

Full results on a watershed by watershed basis, and source data details, are housed in the FNNF Lands and Resources Department.

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Disclaimer: The information contained in this report is based on Indigenous and Western scientific research conducted by Fort Nelson First Nation, as well as published works and archival research. It is not intended to be a complete depiction of the dynamic and living system of use and knowledge maintained by FNNF members. It may be updated, refined, or changed as new information becomes available. Mapped cultural information is based on interviews with FNNF knowledge holders conducted within constraints of time, budget and scope. Base map data originate from the National Topographic System and Natural Resources Canada.

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About the LBMI, FNFN Lands Guardian Program, and State of Knowledge Series

THE FORT NELSON FIRST NATION (FNFN) Liard Basin Monitoring Program (LBMI) State of Knowledge series of documents are designed to provide FNFN, the public, industry and government with information about conditions on the land and waters in FNFN territory, and to the extent possible, how these have changed over time and may in the future change further.

This information constitutes a meaningful current conditions set — a baseline — against which future change can be compared, to see if the health of FNFN territory is improving or getting worse. Identifying existing priority cultural and ecological values and risks to them also helps plan for their monitoring, management and lands, waters and resources protections.

Part of FNFN's mandate as stewards of the land is not merely to collect Indigenous and scientific knowledge, but to disseminate it in appropriate ways, to inform our decision-making and that of other parties like our Treaty 8 neighbours, industry, and government. State of Knowledge documents published to date or forthcoming are:

- The LBMI Year 1 State of Knowledge Report, published in 2017, including information up to 2016 on seven key FNFN values (shown at right);
- Beaver State of Knowledge Report (August 2018);
- Moose State of Knowledge Report (March 2019);
- Caribou State of Knowledge report (forthcoming 2019); and
- This FNFN Watersheds Report Card (May 2019).



Each of these documents is available on the web or can be accessed by contacting the FNFN Lands and Resources Department.

Starting in 2019/2020, responsibility for the FNFN State of Knowledge series will transfer over to FNFN's new Guardian Program. Additional State of Knowledge themes, including a greater focus on water quality and quantity, will be forthcoming in coming years. Existing State of Knowledge reports will be updated on an as-needed basis, to track change over time.



BACKGROUND

FORT NELSON FIRST NATION MEMBERS are Dené and Cree People of the Land and Rivers. We have lived in north-eastern British Columbia since time immemorial. Our community members have actively retained our cultures, including our languages and our connection to and knowledge of the land. FNFN joined Treaty 8 with the Crown in 1910, an agreement that affirmed FNFN's rights to use our territory and pursue our ways of life.

We envision a future in which FNFN and our members are re-established as the primary stewards of our lands and resources, empowered to protect our rights and ecological and cultural values, and where our territory sustains future generations with healthy air, land, food, and water. The Liard Basin Monitoring Initiative, the FNFN Guardian Program, and this Watersheds Report Card all have a role to play in achieving this vision.

Between 2016 and 2019, the FNFN Lands and Resources Department, with support from Natural Resources Canada, completed the three-year pilot Liard Basin Monitoring Initiative (LBMI). The focus in Year 1 of the LBMI was on identifying priority FNFN values in our territory, which covers all of the Liard and Hay River Watersheds in BC. An image of northern BC Treaty 8 territory and the 52 sub-watersheds in it is provided in Figure A on the next page.

Identifying and monitoring the values, and risks/pressures on them, within these sub-watersheds has been a focus of Years 2 and 3 of the LBMI. FNFN territory is extremely large; breaking units of data collection and analysis down to smaller, manageable units is critical within this massive area. Sub-watersheds make the most sense for this categorization.

We seek to better understand the baseline conditions and trends-over-time in the health of the ecosystems and watersheds that sustain our way of life on the land, so that we can monitor change from increasing industrial development against a more accurate benchmark.

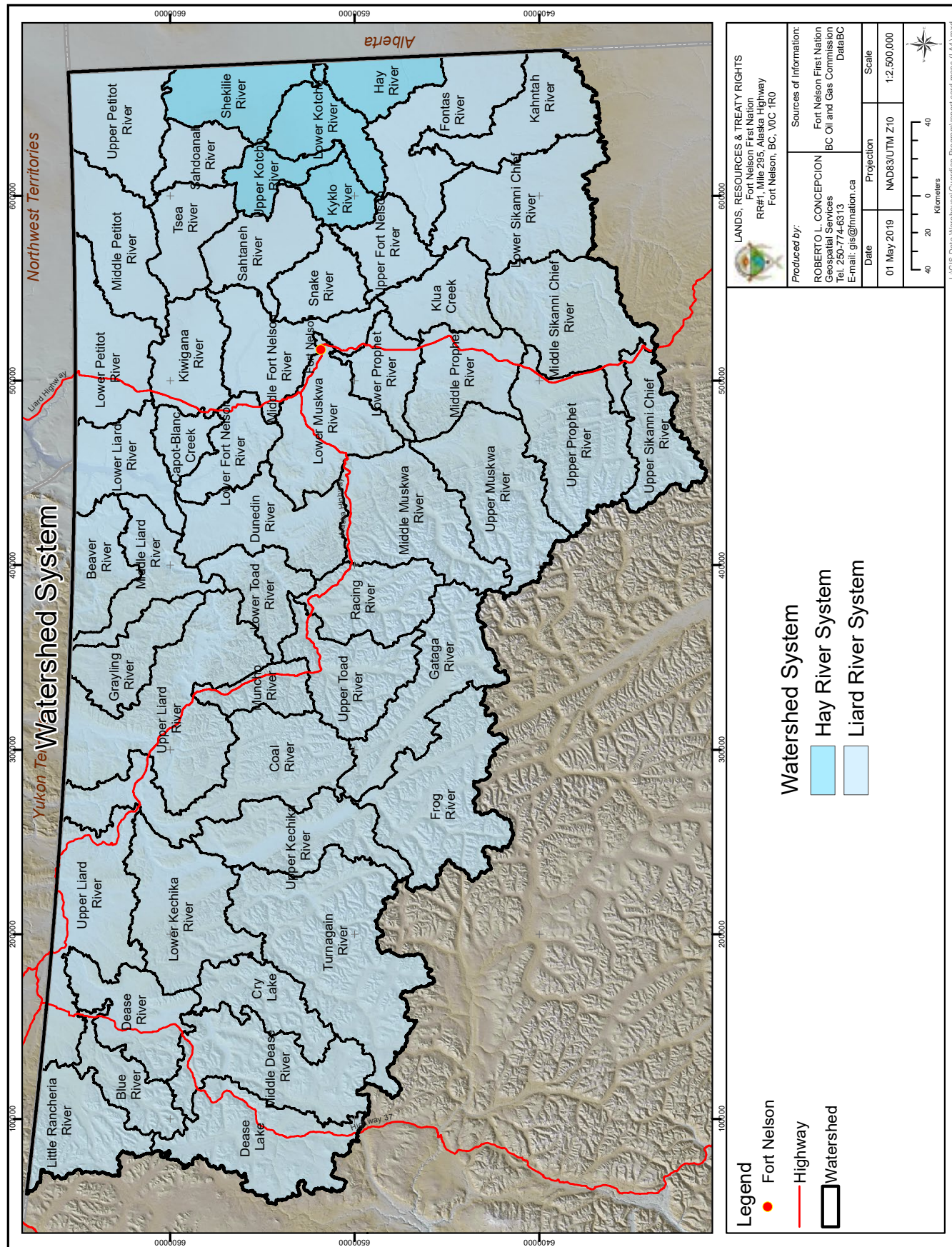
The results of this work to find and analyse the status of 16 indicators of sub-watershed health and use are provided herein.

Monitoring work related to watershed health continues to be developed as part of FNFN's Guardian Program. Together with industry and other levels of government, FNFN seeks to work together with other levels of government and industry to promote continued healthy sub-watersheds throughout our territory where they exist, and promote recovery where conditions have been in decline.

We seek to better understand the baseline conditions and trends-over-time in the health of the ecosystems and watersheds that sustain our way of life on the land, so that we can monitor change from increasing industrial development against a more accurate benchmark.

PHOTO: RYAN DICKIE

Figure A: Liard River and Hay River Basin Sub-watersheds in the Northern BC Treaty 8 Territory



Large format digital map is available from FNFN Lands and Resources Department



Fort Nelson First Nation Guardian Program

FNFN's Guardian Program is a community-based monitoring program for FNFN's territory. The program is founded on FNFN cultural and ecological values, incorporating our Indigenous and Western scientific methods for the purpose of protecting our territory against all threats to our pristine air, land, food, and water.

GUARDIAN PROGRAM VISION:

We envision a future in which FNFN and our members are re-established as the primary stewards of our lands and resources, empowered to protect our rights and ecological and cultural values, and where our territory sustains future generations with healthy air, land, food, and water.

GUARDIAN PROGRAM GOALS:

- To better understand the current state of and trends of our cultural and ecological landscape;
- To re-establish FNFN members as stewards of the land by making them the primary developers and implementers of this monitoring and stewardship program;
- To understand and respond to ecological change and its causes (including climate change and industrial development) in time to make a difference; and
- To enable informed decisions about human activities and land use in our territory.

Starting in 2019, the FNFN Guardian Program will be actively sending FNFN Guardians out on territory for dedicated monitoring and management activities, guided by priorities set by the FNFN community.

INTRODUCTION



Access to healthy watersheds with abundant harvestable resources is a critical part of FNFN culture, continuity of our way of life and practice of Treaty rights.

FNFN'S MEMBERS ARE DENÉ AND CREE PEOPLE, with cultures that are centred on a deep connection to the Land. Our members have actively retained our cultures over time, against many obstacles. Many generations of FNFN men, women, and children have lived and thrived in the Liard and Hay River watersheds of north-eastern BC. Our members have always been, and continue to be, hunters and gatherers from the rich muskeg in the east to the mountains in the west of our territory. Our members' knowledge of our territory developed as generations moved around the land with the seasons and animals that sustained our way of life and livelihood. We are the "People of the Land."

Access to healthy watersheds with abundant harvestable resources is a critical part of FNFN culture, continuity of our way of life and practice of Treaty rights.

FNFN has a commitment and obligation to care for and protect and honour the Treaty, lands, waters, animals, and whole ecosystem for future FNFN generations. FNFN members have been observing changes to much of our territory for roughly 40 years. During this time period, ecological values like moose and caribou populations and population health have declined, and there has been increased industrialization of our landscape that have reduced the ability for our members to peacefully enjoy their lands and waters.

In particular, the increase since the early 2000s in industrial development in FNFN territory due primarily to oil and gas development, hunting and predation pressure, and anticipated landscape level effects of climate change, raise concerns about future conditions in several of the watersheds that FNFN relies upon. There is a critical need to protect wildlife, waters and lands for current and future generations.

This report is part of a broader initiative by FNFN to use its Guardian Program to monitor and promote the health of watersheds in FNFN territory over the long term. This report card provides critical information to help understand existing indicator conditions along with what gaps exist in our knowledge about watershed health in FNFN territory from Indigenous and Western scientific perspectives, which in turn becomes critical information to inform monitoring and management planning.

In this report card, FNFN has used the available data on a variety of indicators to identify watersheds that are the most at risk and which have the highest recorded values that merit protection. The indicators will be compared across each sub-watershed, and in the findings of this report we mix risk and values to identify sub-watersheds of the highest priority for monitoring and management. This first Watersheds Report Card also creates the foundation — the baseline — against which future change can be assessed.



FNFN WATERSHEDS

WHEN NON-INDIGENOUS fur traders and settlers arrived in what has since become north-eastern BC starting in the 1800s, it was (and remains) the home of Dené and Cree people who lived on the land, pursuing a primarily subsistence economy. The land and waters sustained our people, and we managed our livelihoods and relationships to maintain this fine balance.

Much of FNNF territory is situated in the northern boreal forest — the most extensive terrestrial biome on the planet. FNNF territory is also dominated by water. The Liard River is a dominant landscape feature — rising in the western mountains and shaping canyon and plateau country. The eastern portion of FNNF territory is dominated by wetland ecosystems — these are vast and varied, and have shaped the ecology and cultural use of this entire landscape over time.

FNNF territory has two very different regions. In the west are the mountainous Boreal Cordillera or Northern Boreal Mountains, and in the east, the sub-Arctic climate lowland of the Taiga Plains/Muskeg region. For the purposes of the FNNF Watersheds Report Card and related studies, FNNF has added a third, transitional, region where the two meet — the “Mountains and Muskeg” region. Figure B on the next page shows these three main regions and the sub-watersheds¹ that are within each, as well as the locations of FNNF ancestral village sites.

Of the 52 overall sub-watersheds within FNNF territory, the 34 sub-watersheds classified as “Muskeg” or “Mountains and Muskeg” are the focus of this Watersheds Report Card. Overall, these 34 sub-watersheds represent 65 per cent of FNNF sub-watersheds, and cover 58 per cent of northern BC Treaty 8 territory.

The “Mountains” sub-watersheds are not included in this report, because they are a greater distance from and under less pressure from industry and currently less developed and less impacted than other watersheds; and they have higher proportions of existing protected areas than the “Muskeg” watersheds.

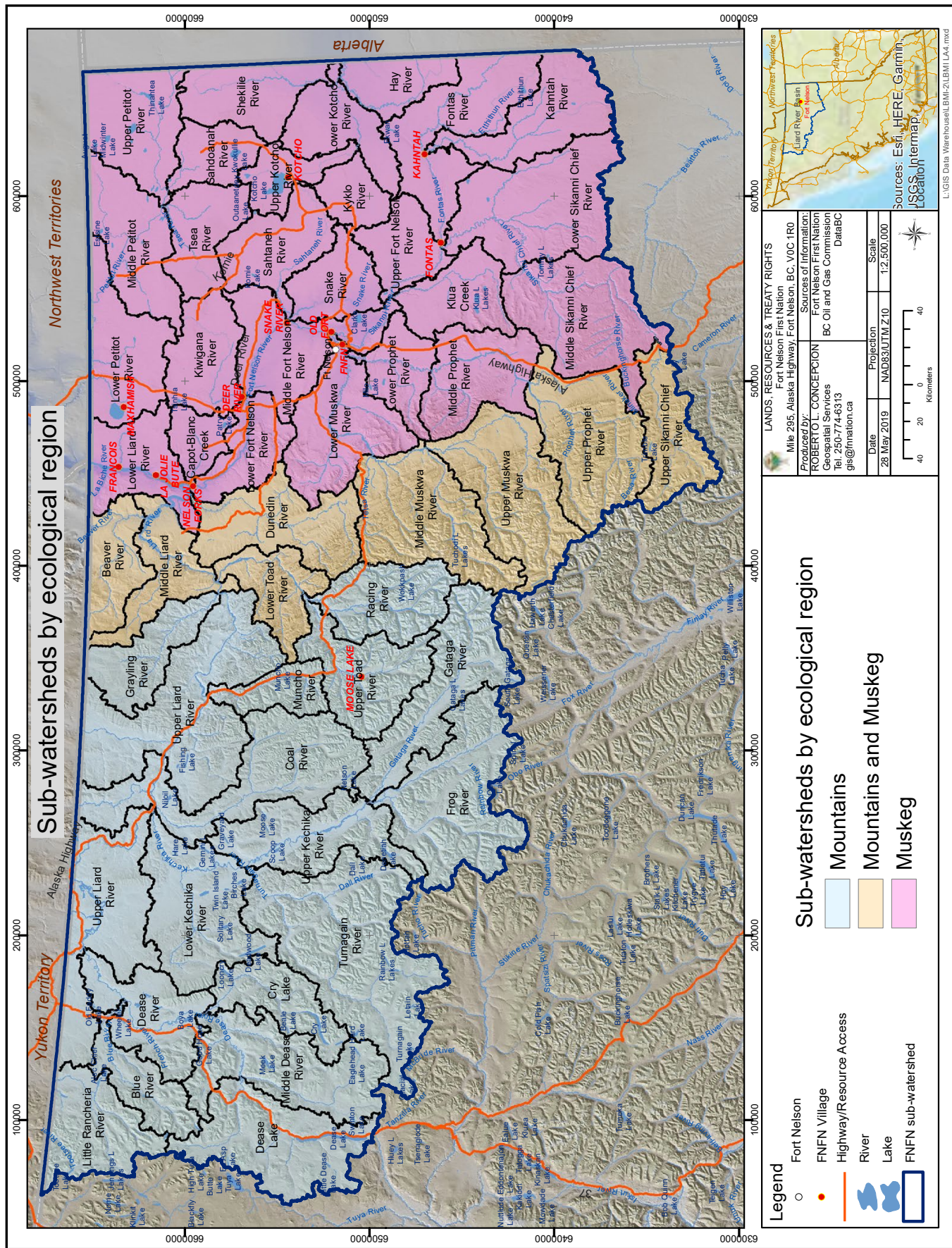
In addition, 10 of FNNF’s 11 village sites are within the Taiga Plains/Muskeg region. Given these factors, the Muskeg and Muskeg and Mountains regions are the sole focus of this FNNF Watersheds Report Card. Combined, they are referred to as the “FNNF Study Area” herein.²

Of the 52 overall sub-watersheds within FNNF territory, the 34 sub-watersheds classified as “Muskeg” or “Mountains and Muskeg” are the focus of this Watersheds Report Card. Overall, these 34 sub-watersheds represent 65 per cent of FNNF sub-watersheds, and cover 58 per cent of north BC Treaty 8 territory.

¹ The terms sub-watersheds and watersheds mean the same thing in this report.

² Notwithstanding this, there remain several very significant areas critical for ecological and cultural values within the “Mountains” such as Moose Lake, which may merit specific monitoring efforts.

Figure B: FNFN Sub-Watersheds by Broad Ecological Region





METHODS AND INDICATORS USED IN THE REPORT CARD

RESEARCH QUESTIONS

The research behind the Watersheds Report Card was designed to answer questions like:

- Which watersheds have the most recorded values from an FNFN cultural perspective?
- Which watersheds have higher or lower current ecological values?
- Which watersheds are best protected?
- Which watersheds are most affected by and at risk from industrial development?
- What happens when you combine the answers to the above questions? For example, are areas of high cultural and ecological values among the best protected?
- What are the implications of these findings for future monitoring, management and lands protection in FNFN territory?

INPUTS

FNFN gathered data from multiple publicly accessible databases for 15 of the 16 indicators used in this Watersheds Report Card. BC Government data are the primary inputs. FNFN used its own confidential internal Traditional Land Use and Occupancy database to generate the “High recorded cultural value” indicator. For most indicators data is current up to early 2018.

INDICATORS

Indicators were identified from FNFN community member input, the expertise of the FNFN Lands and Resources Department, and data availability. For each watershed, FNFN gathered data on indicators for each of four categories that provide information to assess the comparative status or “health” of each watershed (see Figure C).

Indicators were identified from FNFN community member input, the expertise of the FNFN Lands and Resources Department, and data availability. For each watershed, FNFN gathered data on indicators for each of four categories that provide information to assess the comparative status or “health” of the watershed.

PHOTO: MATHEW
MURRAY/FIRELIGHT

Cultural Values

- 1. Per cent [of sub-watershed] with highest recorded FNFN cultural use values
- 2. Per cent covered by FNFN-held registered traplines
- 3. Per cent covered by areas which have potential for peaceful enjoyment of territory

Figure C: FNFN’s Four Indicator Categories for the Watersheds Report Card



Ecological Values

- 4. Per cent further than 500 metres from a road
- 5. Per cent covered by forests greater than 140 years in age
- 6. Per cent within an FNFN Caribou Protection or Restoration Zone
- 7. Per cent that is suitable beaver habitat

Protection

- 8. Per cent covered by parks and park-like protections

Pressures/Risks

- 9. Average road density (km/km²)
- 10. Per cent with active petroleum and natural gas tenure
- 11. Density of oil and gas facilities
- 12. Density of permitted “changes in or about a stream” (e.g., water crossing density)
- 13. Density of permitted surface water withdrawal points
- 14. Per cent that has high potential for beaver-industry conflict
- 15. Forestry: hectares harvested to date
- 16. Forestry: hectares in the current timber harvesting land base

High, Moderate, and Low Ratings

For each indicator—except for cultural value, where only sub-watersheds with the highest recorded use values are identified—each of the 34 FNFN sub-watersheds is given a colour-coded “high”, “moderate”, or “low” status rating. Green means the sub-watershed has high value or low risk (is in relatively good shape/ healthy condition in relation to that indicator versus other FNFN sub-watersheds); yellow sub-watersheds suggest moderate state or pressure values that may merit attention in the future; and red sub-watersheds have low values for that indicator or are at high risk.

PRIORITY SUB-WATERSHEDS = SOME COMBINATION OF
(HIGH INDUSTRY PRESSURE) + (HIGH ECOLOGICAL VALUE + CULTURAL VALUE)
/(LOW EXISTING DEGREE OF PROTECTION)

This is a relative rating system, meaning FNFN’s sub-watersheds’ health, values and risks are being compared against each other. As a result, for most indicators, approximately one third of sub-watersheds— 10 to 12 of the 34— are given a high (green) rating, one third are yellow, and one third are red. Where specific indicator thresholds are used that change this distribution, they are identified in the text.



CULTURAL VALUES

THE LANDS AND WATERS of the Liard, Fort Nelson and Hay River Basins continue to sustain FNNF members who have always lived on the land, traveling the river corridors between our homes and family villages, and seasonal harvesting areas in order to survive and stay connected to our territory. FNNF's physical footprint on the land has been very small, though our presence across the land has been very strong. Trails bisecting critical harvesting areas and leading from village to village, gathering place to gathering place, are widely distributed across the cultural landscape and have low levels of linear disturbance and minimal tree removal.

Historically, the places that FNNF people chose to live seasonally or semi-permanently, or travel to for harvesting purposes at certain times of year, were selected because they were ecologically productive; areas where people could find good quality wild foods and medicines in sustainable quantities. In this way, the ecology of FNNF territory is inextricably linked to the Dené and Cree who continue to live on the land and rely on it for sustenance and livelihood.

FNNF's High Cultural Use Value watersheds are those with higher proportions of their basin area representing areas identified by FNNF members as especially important for the practice of Treaty rights and culture, and maintenance of land-based relationships.

PHOTO: FNNF LANDS DEPARTMENT

Indicator 1: Sub-Watersheds with the Highest FNNF Recorded Cultural Use Values

Cultural use value, determined through examining existing FNNF data, is the first indicator applied in this assessment. FNNF's High Cultural Use Value watersheds are those with higher proportions of their basin area representing areas identified by FNNF members as especially important for the practice of Treaty rights and culture, and maintenance of land-based relationships.

There are some important limits to this indicator. FNNF's stewardship and territorial connection extends to all areas and ecosystems in FNNF territory, and all parts of the territory are culturally important. Also, some places of high cultural importance are not used very often; this does not diminish their cultural importance. As a result, FNNF does not publicly share maps of its recorded cultural use values. These records are confidential and Figure 1 is not included in the public copy of this report.

This indicator is based on data from FNFN’s community Indigenous knowledge database, housed in the Community Information System housed in FNFN’s Lands Department. It is based on data from Traditional Use and Occupancy studies and from community observations of places, features and experiences that FNFN members reported valuing. FNFN has developed a “cultural heat map” tool that converts members’ observed spatial data into a map that identifies areas of higher reported use and occupancy. The cultural heat map is a confidential, internal tool developed by FNFN to help identify areas of highest use and values to members, but data is primarily collected only where a specific study has been undertaken. Therefore, absence of stated cultural value about an area does not imply that this location has little value.

Overall, the vast majority of sub-watersheds with high recorded cultural value are “Muskeg” watersheds.

Figure 1: Sub-watersheds showing highest FNFN recorded cultural use and occupancy



Indicator 2: Sub-watersheds by FNFN-Held Trapline Coverage

FNFN members hold Treaty, aboriginal, and commercial rights to trap game for food and fur. Many FNFN members continue to actively trap; this is a critical way for families to connect to the land, pass down Indigenous knowledge, and for some members an important part of making their living.

FNFN considers information about registered traplines not to be fully representative of FNFN members' trapping rights, which can by right be practiced anywhere in Treaty 8 territory. As a result, Figure 2: Sub-watersheds by FNFN-Held Trapline Coverage, is not included in the public version of this document.

Figure 2: Sub-watersheds by FNFN-Held Traplines Coverage

Removed from public document

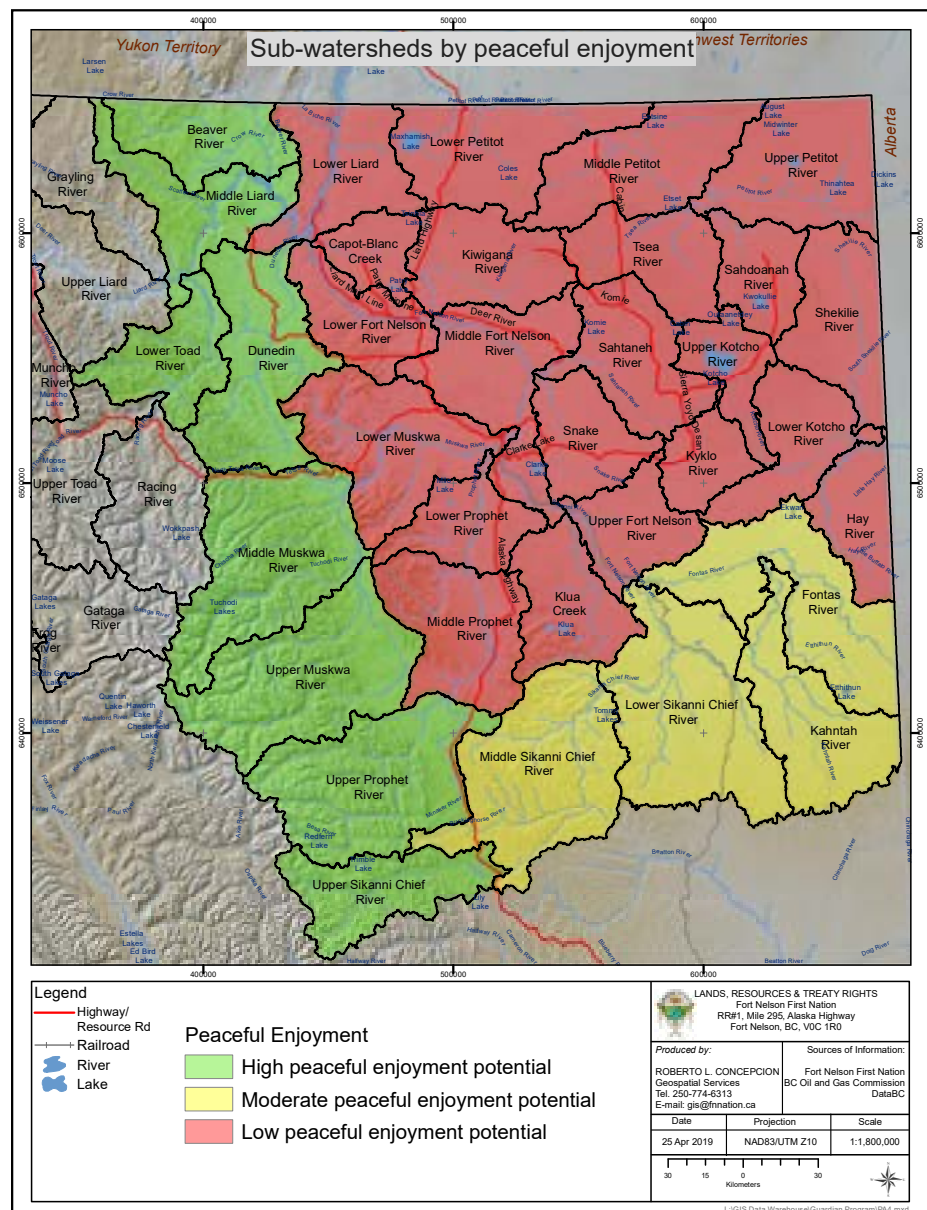
Indicator 3: Potential for Peaceful Enjoyment

FNFN members have historically, and to the present day, continue to rely on large intact natural areas in FNFN territory to practice our rights, and provide for our families. Today, cumulative effects in FNFN territory are so large in some areas that escaping development and achieving feelings of isolation and “Peaceful Enjoyment” while using the land is no longer possible; in many areas large intact landscapes no longer exist. Recent FNFN studies with our members confirmed that their practice of Treaty rights and culture can be negatively affected by unnatural intrusions such as industrial traffic, noises, and smells (e.g., diesel fumes). Sometimes just knowing that an area nearby is being actively developed for oil and gas, for example, can undermine FNFN members’ confidence in the quality and health of foods and medicines in the area, and/or the sense of remoteness or isolation that many FNFN members hope to experience when out on the land.

Peaceful Enjoyment of the land is a concept designed to capture the essence of what it means to be able to enjoy privacy and solitude when out on the land, and identify areas where this can still occur. Large intact landscapes provide a higher likelihood of Peaceful Enjoyment for FNFN members, and the likelihood of Peaceful Enjoyment decreases as surface disturbance — especially roads — increases. In contrast, landscapes with less surface disturbance and more representative habitat allow ecological processes to occur more naturally and thus are more functionally intact from an ecological perspective, making them better spaces to exercise cultural and Treaty rights practices.

To assess the ability for our members to have Peaceful Enjoyment in their territory, FNFN developed maps based on physical criteria that measure the degree of change to the landscape from natural conditions. BC’s Ministry of Forests used the Peaceful Enjoyment concept to develop BC’s Recreational Opportunities Spectrum, which calculates remoteness and the degree of naturalness of an area.³ The Recreational Opportunities Spectrum is based predominantly on a calculation of the amount of intact habitat in an area that is at

Figure 3: FNFN Sub-watersheds by Potential for Peaceful Enjoyment



3 For more information on BC’s Recreational Opportunities Spectrum, see section 6.3 in chapter 6 (Recreation Inventory) of the BC Ministry of Forests’ Recreation Manual: for.gov.bc.ca/hfp/publications/00201/chap06/chap06.htm#s6.3



least a certain distance from a roadway. The spectrum, for example, asserts that an area situated less than one km from a road, has little to no potential for Peaceful Enjoyment.

The Recreational Opportunities Spectrum tool was used as a proxy for “Peaceful Enjoyment”, to generate Figure 3 on the previous page. Data was accessed from the Province of BC’s Hectares BC website — hectaresbc.org.

In Figure 3, green areas reflect sub-watersheds that have higher potential for Peaceful Enjoyment, yellow areas reflect moderate to lower potential for Peaceful Enjoyment, and red areas reflect low to no potential for Peaceful Enjoyment.

Only eight of FNFN’s study area watersheds are rated as green (healthy), meaning more than 50 per cent of their area is rated “primitive” (BC’s term)—greater than 8 km from a road, within an intact natural landscape greater than 5,000 hectares. These “healthy” sub-watersheds represent all of the “Mountains and Muskeg” region; no “Muskeg” sub-watersheds are deemed healthy using this indicator.

Four additional sub-watersheds are rated yellow, meaning at least half of their area is covered by lands rated “semi-primitive/motorized” (farther than one km from a road, within an intact forest landscape of 1,000 hectares or larger).

The remaining 22 sub-watersheds, all of them in the “Muskeg” region, are all deemed to have lower potential for Peaceful Enjoyment, due to their relatively higher amount of roads and disturbed forest areas.

In summary, the Peaceful Enjoyment indicator suggests significant pressure on large intact landscapes is almost exclusively within the “Muskeg” region of FNFN territory. The values that support Peaceful Enjoyment of the land, critical to FNFN cultural practices, remain strong in the mountainous areas west of Fort Nelson.

Peaceful Enjoyment of the land is a concept designed to capture the essence of what it means to be able to enjoy privacy and solitude when out on the land, and identify areas where this can still occur.

Cultural Values Summary

How healthy is the FNFN cultural landscape? Unfortunately, it is least healthy where FNFN members prefer to practice our culture on a regular basis.

While spatial data on Indicators 1 and 2 are both held in confidence by FNFN, some generalizations can be made. The very same watersheds that have the highest recorded cultural use values and FNFN-held traplines are among those watersheds with the lowest potential for Peaceful Enjoyment of the land. Almost all of the sub-watersheds with the highest recorded cultural use values are also within the “red” zone for peaceful enjoyment, meaning that they have low potential for peaceful enjoyment of territory by FNFN members. The five sub-watersheds that had the highest ratings for both previous indicators of current cultural use and value are all also areas with lower Peaceful Enjoyment potential.

This reality, and what we hear from FNFN members, tells us two things:

1. FNFN members still use their preferred cultural areas, despite reduced conditions in terms of isolation, quiet, freedom from real and perceived contamination, and intact forest landscapes; and
2. There is an urgent need to improve the conditions related to Peaceful Enjoyment within this “high cultural use” area, reducing the impacts of industry and increasing the number of areas in the “Muskeg” where Peaceful Enjoyment can be attained. Stated another way, simply increasing the protection of areas to the west (in particular in the “Mountains and Muskeg” region), which still retain strong ability for peaceful enjoyment, would miss the point that FNFN members need stronger protections and conditions within their preferred, local use and occupancy areas in the “Muskeg.”

There is an urgent need to improve the conditions related to Peaceful Enjoyment within this “high cultural use” area, reducing the impacts of industry and increasing the number of areas in the “Muskeg” where Peaceful Enjoyment can be attained.





ECOLOGICAL VALUES

THE SELECTION OF INDICATORS used below was informed by their relevance to ecology and culture in FNFN territory, and also based on data availability. Some ecological indicators are useful for assessing the relative naturalness of individual sub-watersheds; some are good for assessing their habitat values for important species. Large areas of intact habitat away from human disturbances such as roads and other developments, are often preferred by wildlife, and are more able to maintain balanced and healthy ecological processes (e.g., predator-prey relationships). Likewise, mature forest habitat is generally more bio-diverse and productive than more recently disturbed habitat.

The chosen indicators are grounded in FNFN priorities related to habitat protection and culturally important and keystone species, boreal caribou and beaver in this case. Other important FNFN ecological indicators, such as moose habitat, were not available for this Watersheds Report Card due to data gaps (see the “Next Steps” section at the end of this report).

Large areas of intact habitat away from human disturbances such as roads and other developments, are often preferred by wildlife, and are more able to maintain balanced and healthy ecological processes.

This first ecological indicator provides insight into the relative levels of habitat fragmentation and access based on road density within sub-watersheds. Figure 4 shows FNFN watersheds, rated by the proportion of each that is further than 500 metres from a road.

- Lower Muskwa River (61%);
- Klua Creek (59%);
- Fontas River (57%); and
- Lower Petitot River (54%).

Sub-watersheds by % of area > 500m from road

Legend

- Highway/Resource Rd
- Railroad
- River
- Lake

% of area > 500m from road

- High % of area > 500m from road
- Moderate % of area > 500m from road
- Low % of area > 500m from road

LANDS, RESOURCES & TREATY RIGHTS
Fort Nelson First Nation
RR#1, Mile 295, Alaska Highway
Fort Nelson, BC, V0C 1R0

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Sources of Information: Fort Nelson First Nation
BC Oil and Gas Commission
DataBC

| Date | Projection | Scale |
|-------------|---------------|-------------|
| 25 Apr 2019 | NAD83/UTM Z10 | 1:1,800,000 |

30 15 0 15 30
Kilometers

Eleven sub-watersheds with between 43 and 52 per cent of their area further than 500 metres from a road were ranked as moderate (yellow), and the 11 sub-watersheds with less than 43 per cent of their area further than 500 metres from a road were ranked low (red). All of the yellow and red sub-watersheds were within the "Muskeg" region.

However, it is also worth noting that 18 of 34 watersheds had at least half of their area further than 500 metres from a road, and 28 of 34 had at least 40 per cent. This suggests there are still relatively undisturbed areas within the FNFN study area, even in the high industrial activity “Muskeg” areas, where some form of peaceful enjoyment is at least theoretically possible, and where ecological integrity may be higher than in more industrialized areas. In other words, there are still areas where greater protection could make a difference to retention of natural values.

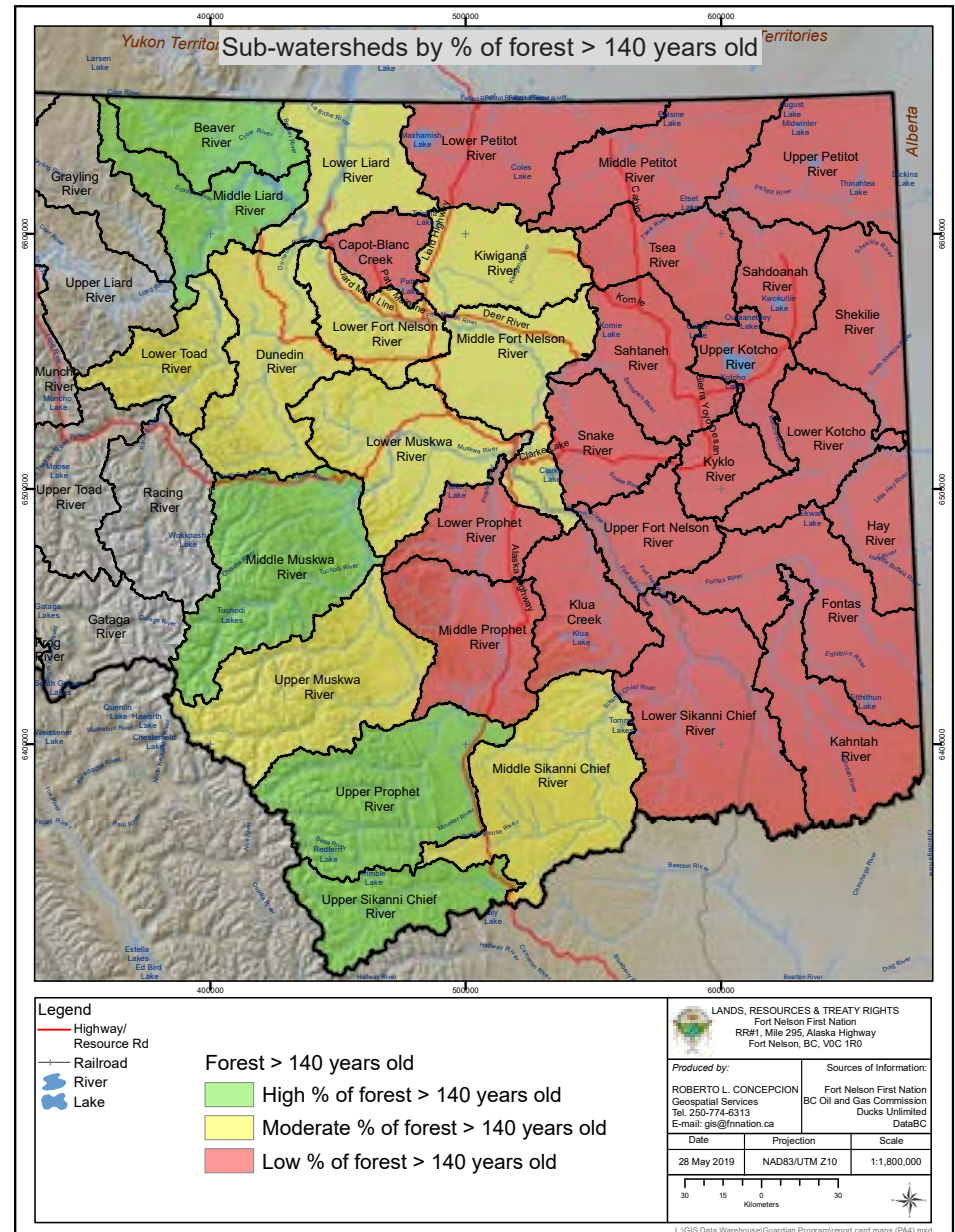
Indicator 5: Per Cent of forest in Sub-Watershed Covered by Older Forest

Older forests are critical habitat and high value cultural and Treaty rights practice areas. Figure 5 rates watersheds by how much of their forested area is covered by older forests (any forest estimated to be over 140 years old).

Only five watersheds, all in the western “Muskeg and Mountains” region, are rated healthy for older forest, with more than one-third of their forested land base considered older forests. Twenty out of 34 sub-watersheds have less than 16.4 per cent of their forested land base considered older forest (red in Figure 5). In some of these areas, there have been extensive natural fires, which have removed the amount of older forest in local areas. These are primarily in the eastern portion of FNFN territory. In other areas, primarily in the central and western portion of the Muskeg region closer to Fort Nelson, older forests have been reduced by timber harvesting operations over the last 30 years.

The BC Forest Practices Code of 1995 identified a provincial policy to spatially locate Old Growth Management Areas across the landscape, to ensure widespread distribution of older forests. As of 2017, there are still no spatially identified Old Growth Management Areas in FNFN territory. Instead, BC has developed “old growth targets” for the Muskeg region and other regions of FNFN territory. Only five of the 26 “Muskeg” sub-watersheds exceed BC’s already low target of 17 per cent for older forests. This suggests that, especially in the eastern sub-watersheds (but also in Cabot-Blanc Creek, Lower Prophet River, Middle Prophet River, and Klua Creek), increased efforts to protect older forest values may be required.

Figure 5: Sub-watersheds by Per Cent Older Forest Cover



Indicator 6: Boreal Caribou Habitat

Boreal caribou habitat is an important indicator for the FNFN because caribou are a threatened culturally important species that we are putting considerable effort and resources towards monitoring and habitat and species recovery planning. Boreal caribou are a lowland species that use a variety of habitat types in the Taiga Plains/Muskeg region, including old forests, muskeg, and other low-lying areas. It is an important cultural species hunted by Dené and Cree people for generations and used for food, clothing, making snowshoes and bedding, and utensils and other tools. The vast majority of boreal caribou in BC are found in northern BC Treaty 8 territory, and all herds have experienced large population declines.

FNFN elders and harvesters report that caribou are increasingly rare in the territory and that sightings have declined over the last three decades. FNFN elders express concern about caribou populations and health. Many of them talk about the effects of seismic lines, roads, and industrial sites and make it easier for wolves and black bears, their main predators, to access caribou habitat and locate prey. Protecting remaining high quality boreal caribou habitat, and restoring damaged core habitat in support of population recovery, are ongoing priorities for FNFN as communicated in the Medzih Action Plan: Fort Nelson First Nation Boreal Caribou Recovery Plan (fortnelsonfirstnation.org/uploads/1/4/6/8/14681966/2017-sept-29_fnfn_medzih_action_plan_final_medres.pdf).

The indicator used is the proportion of each watershed that is either in an FNFN Caribou Protection Zone or Restoration Zone; in other words, the percentage of each sub-watershed identified by FNFN as a zone to either protect or restore caribou habitat.

Figure 6 on the next page shows FNFN study area watersheds rated by the per cent of their area covered by FNFN caribou protection or restoration zones. The distribution of FNFN caribou zones across FNFN territory is also shown in Figure 6.

All watersheds with greater than 55 per cent of their area covered by an FNFN caribou zone are in green; those with 10 to 54 per cent caribou zones are yellow, and less than 10 per cent are red.

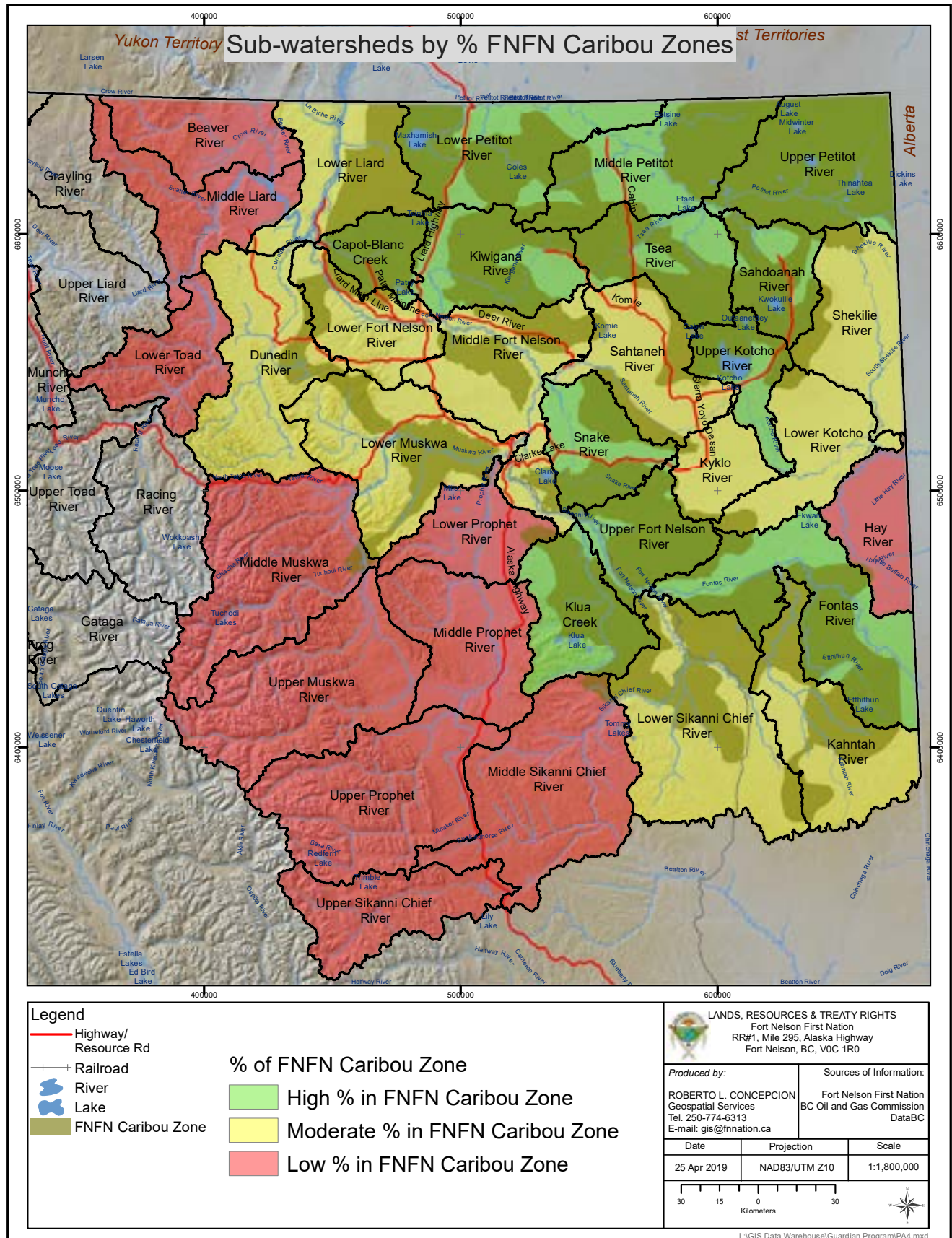
The 20 highest ranked watersheds for FNFN caribou protection and restoration value are all “Muskeg” watersheds. FNFN caribou zones occur predominantly in the eastern part of FNFN territory, surrounding Fort Nelson, extending north and northeast to the NWT and Alberta border, and southeast into the Chinchaga area. The top 12 watersheds for this indicator each have more than 54 per cent of their area covered by caribou zones, with the Upper Petitot River ranking the highest at 96.6 per cent of its area. The next highest rated watersheds are:

2. Capot-Blanc Creek (94 per cent coverage);
3. Upper Fort Nelson River (85 per cent coverage);
4. Sahdoanah River (77 per cent coverage); and
5. Tsea River (69 per cent coverage).

It is important to keep in mind that boreal caribou habitat is not the only type of habitat that has value. It differs from habitat needs of moose and beaver for example, two among many other critical species. Boreal caribou habitat alone is not a replacement for overall ecological value. However, boreal caribou, given their high vulnerability to industrial disturbance, can be seen as a “canary in the coal mine” species, an early warning device of the effects of industrialization on a natural landscape.

Please also note that simply having an FNFN caribou zone within a watershed does not guarantee the current quality of that habitat or the health of caribou within that watershed. As we shall see later in this report, many of the same areas where caribou habitat are located are subject to higher industrial pressures that threaten the quality of the habitat and the viability of the species in the area.

Figure 6: Sub-watersheds by Per Cent Within FNFN Boreal Caribou Zones



Indicator 7: Suitable Beaver Habitat

The beaver, known as tsá in Dené and amisk in Cree, is a culturally important species to FNFN. Beaver have always been abundant in FNFN territory, and FNFN members have long hunted and trapped this furbearer for food, cultural, and economic purposes. Our members have a close relationship with the beaver that is characterized by respect and gratitude for the cultural and ecological integrity it helps to sustain across the landscape. As “ecosystem engineers”, beaver help maintain the integrity of the land, in part through creating valuable wetland and aquatic habitat for other culturally important species (and food animals), such as moose, caribou and waterfowl.

Beaver play a key role in the FNFN hunting and trapping economy, with all parts of the beaver being used for clothing, craft, ceremony and food—beaver tails, for example, are considered a special delicacy. The spring hunt remains an important annual activity that facilitates knowledge sharing and spending time on the land with family. Beaver is one of the primary furs that are still sold and traded, providing income for FNFN trappers.

FNFN members wish to see more protection for beaver across our territory to reduce pressure on the ecologically and culturally valuable animal.

Publicly available datasets allowed FNFN to map beaver habitat based on typical habitat requirements including proximity to waters or wetlands and deciduous woody land cover. For more detail, see FNFN’s Beaver State of Knowledge Report.

Overall, suitable beaver habitat covers 12.4 per cent of FNFN territory. The majority of suitable beaver habitat is located in the eastern “Muskeg” region.

Figure 7: Sub-watersheds by per cent Covered by Suitable Beaver Habitat

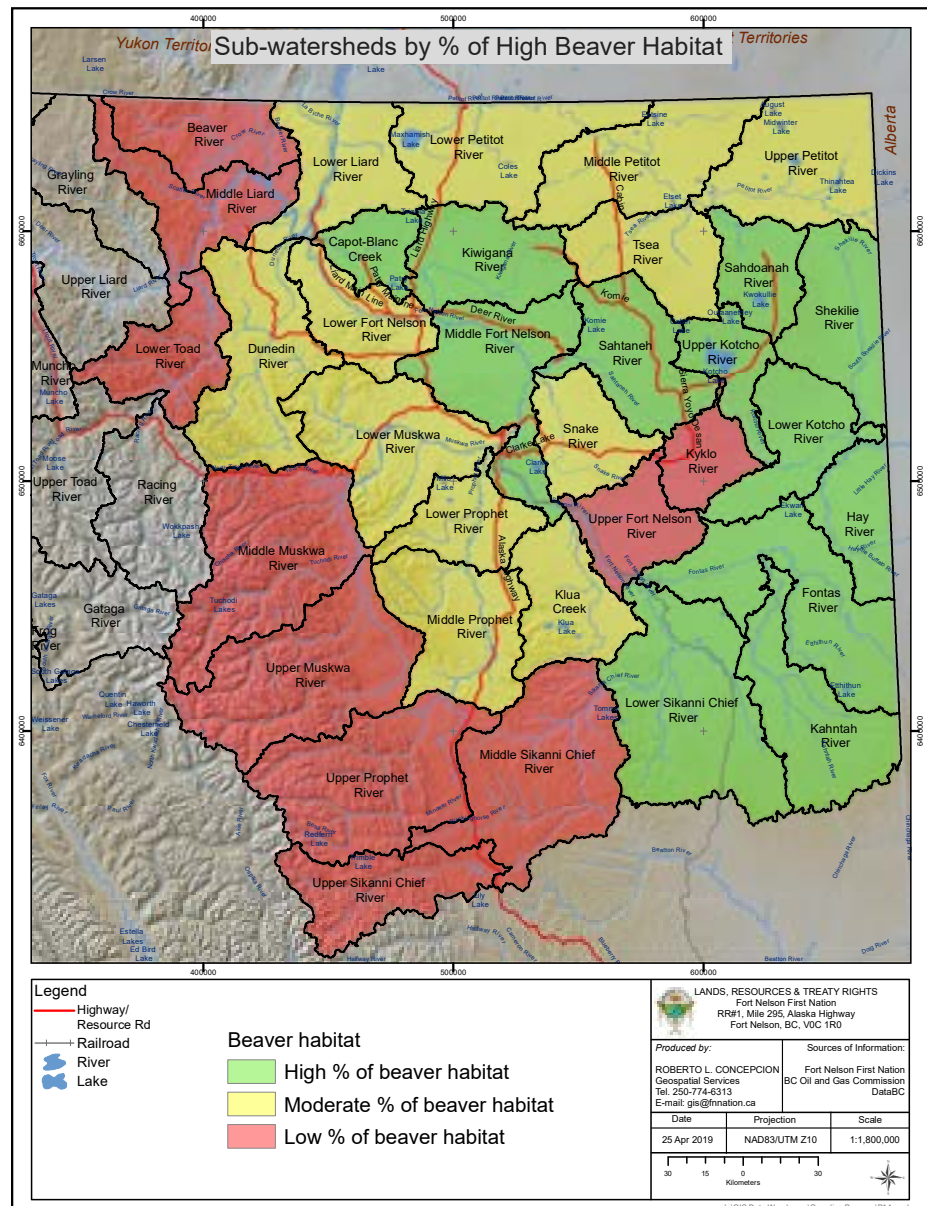


Figure 7 shows which FNFN watersheds have the highest per cent of their total area that is suitable beaver habitat. Green sub-watersheds have suitable beaver habitat covering between 32 and 63 per cent of their area; yellow (moderate value) are between 15 and 31 per cent suitable beaver habitat; and red (lower value) is below 15 per cent.

The five watersheds with the highest proportion of area that is suitable beaver habitat are:

- Shekilie River (63 per cent);
- Hay River (57 per cent);
- Upper Kotcho River (50 per cent);
- Sahtaneh River (49 per cent); and
- Kiwigana River (47 per cent).

Overall, central and south-eastern “Muskeg” watersheds tend to have higher beaver habitat values; the increasingly mountainous areas to the west have lower habitat values for beaver.

Ecological Values Summary

Of the available ecological values data, the following generalizations can be made:

- With some minor exceptions (Klua Creek, Fontas River and Lower Petitot River), the “Muskeg” watersheds have lower amounts of intact landscapes with minimal road intrusions, than the more mountainous watersheds to the west;
- The entire eastern portion of FNFN territory has lower amounts of older forest than areas to the west — older forest increases as you move west towards the mountains;
- There are strong caribou habitat values in the north-eastern and south-central portion of the “Muskeg” zone, which lower as you move west towards the mountains; and
- There are strong beaver habitat values throughout all but the furthest western and northern reaches of the “Muskeg” zone, which lower again as you move west into the mountains.

Again, it is important to note that this is not a statement of judgement about what ecological values are more or less important. Intact forests that don’t have high caribou or beaver habitat values are arguably just as important to protect as those that do. What the available data does tell us is that in the areas FNFN members use the most, in the Muskeg region, there are generally fewer intact forest landscapes and less old forest, meaning the benefits those ecological characteristics bring are reduced. And this may be problematic for many species of high cultural and ecological value, including but not limited to moose, caribou and beaver, that otherwise prefer for the type of values the Muskeg has.

We have also seen that each sub-watershed has some remaining relatively “untouched” areas, making them stronger candidates for meaningful protection, the subject of our next section.



This summary of ecological values data is not a judgment about what ecological values are more or less important. Intact forests that don’t have high caribou or beaver habitat values are arguably just as important to protect as those that do.

PHOTO: MATHEW MURRAY/
FIRELIGHT GROUP



PROTECTION LEVELS

Some types of protections are more effective than others at conserving land for wildlife, the meaningful practice of Treaty rights, and other ecological and cultural values.

ONE MEANS TO AVOID or reduce human-caused pressures on cultural and ecological values is to protect certain important areas from development. Ecologically, meaningfully protecting certain areas removes them from the industrial development grid, maintaining their natural ecosystem functions. From a cultural perspective, protected areas have the potential to provide greater opportunities to maintain cultural ties, “Peaceful Enjoyment” and Treaty rights practices.

Indicator 8: Proportion of Area with Park or Park-Like Protection

What is adequate protection? Some types of protections are more effective than others at conserving land for wildlife, the meaningful practice of Treaty rights, and other ecological and cultural values. Provincial designations such as Ungulate Winter Range and Wildlife Habitat Area still allow intensive resource development such as oil and gas. In contrast, Protected Areas designations such as Provincial Parks and Ecological Reserves have stronger ecological prescriptions that help maintain more park-like settings and usually exclude industrial resource extraction. As a result, this assessment of watershed protection only includes “park and park-like” designations.

The quantitative measure for what constitutes an adequate overall level of protection has evolved significantly since the Fort Nelson Land and Resource Management Plan, a regional planning process of the provincial government, set a Protected Areas target for the plan area of 11.4 per cent.⁴ In contrast, the Government of Canada has committed to protect at least 17 per cent of the country by 2020⁵. Given that many scientists feel that the number should be much higher, FNFN has identified a higher preferred protection threshold of 22 per cent for the purposes of this Watersheds Report Card.

⁴ The boundaries of the Fort Nelson LRMP area were defined by the boundaries of regional forest districts, not watersheds. However, the LRMP area appears to encompass nearly all of the BC portion of the Liard Basin, and consequentially, the vast majority of FNFN territory. FNFN was not involved in the Fort Nelson LRMP process.

⁵ Globe and Mail article, “Canada lags in conservation efforts” at: theglobeandmail.com/news/politics/canada-lagging-behind-on-commitment-to-protect-lands-and-fresh-water-reportsays/article35779173/.

Applying these thresholds to the Watersheds Report Card, any watershed with a proportion of its area that is less than 17 per cent Protected Area would be deemed to have inadequate protection, 17-22 per cent considered to be somewhat protected, and watersheds above 22 per cent deemed as having adequate protection. However, these categorical breaks led to only three “healthy” (green) sub-watersheds, only one “moderate” (yellow) sub-watershed, and 30 “unhealthy” (red) watersheds. For the purpose of communicating which watersheds have at least some form of meaningful protection, and without reducing FNFN’s expectations for meaningful protection levels, the following boundaries were adopted for this indicator:

- Green (healthy protection) was given to all watersheds with more than 22 per cent of their area under park or park-like protections;
- Yellow (moderate protection) was given to all watersheds between 5.7 and 22 per cent; and
- Red (low or unhealthy protection) was given to all watersheds below 5.7 per cent.

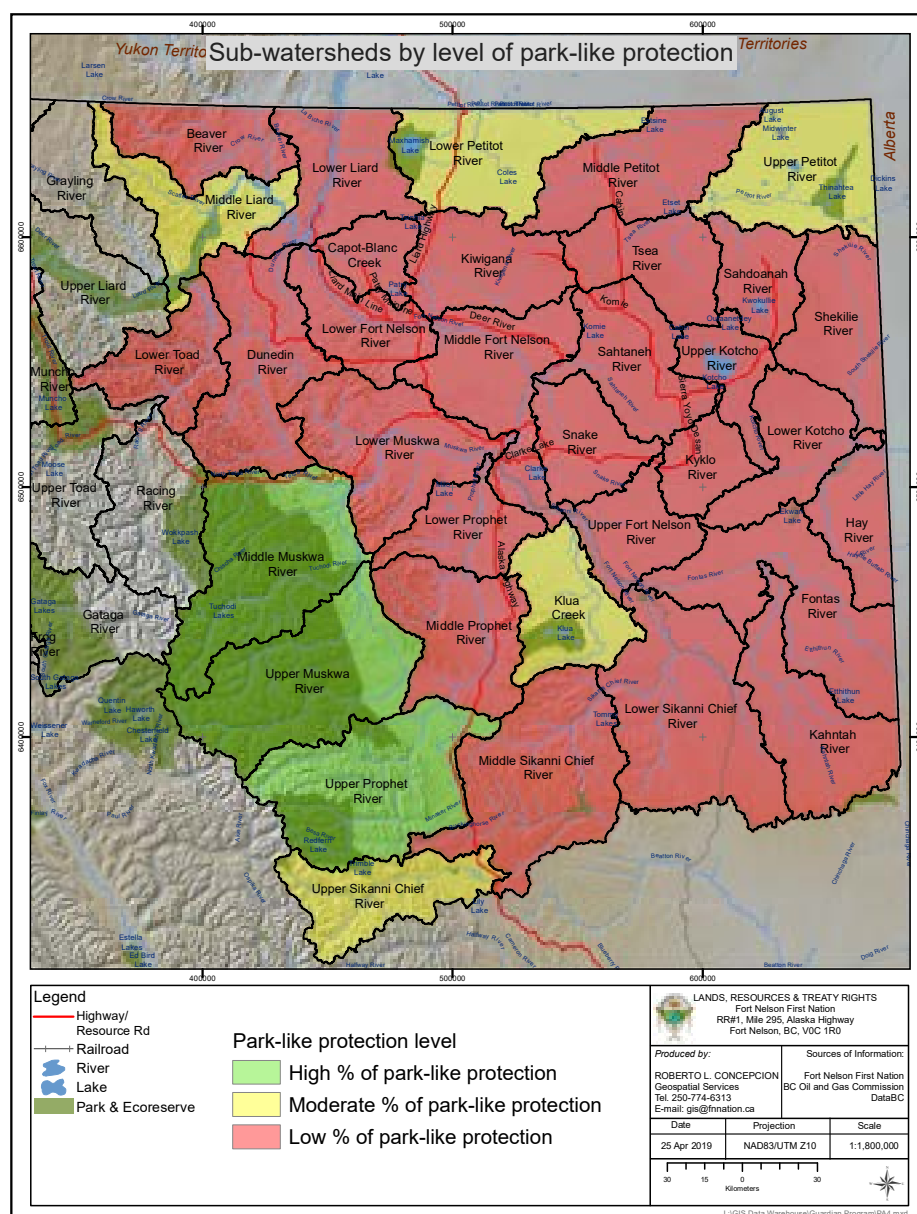
Figure 8 shows the FNFN study area watersheds with greater or lesser coverage by park-like protections, and shows the location of specific protected areas. Only three sub-watersheds are deemed “healthy” in the amount of protection in place — Middle Muskwa River, at 78.9 per cent; Upper Muskwa River, at 72.7 per cent; and Upper Prophet River, at 44.3 per cent.

An additional five watersheds are rated yellow for having some substantive level of protection — Middle Liard River, at 20.2 per cent; Klua Creek, at 13.7 per cent; Lower Petitot River, at 8.4 per cent; Upper Petitot River, at 6.8 per cent; and Upper Sikanni Chief River, at 5.7 per cent.

Below this, all of the other 26 sub-watersheds, fully half of all watersheds in FNFN territory and more than three-quarters of the watersheds in the FNFN study area, have lower than 2.8 per cent protection. Protection levels are especially low in the north-central and eastern portion of the Muskeg region.

Overall, for the 34 “Muskeg” and “Mountains and Muskeg” sub-watersheds in FNFN territory, the average level of protection is low at 11 per cent, and this low percentage is skewed upward by three sub-watersheds which account for much of the protected land:

Figure 8: Sub-watersheds by Park-like Protection Level



Upper Muskwa River, Middle Muskwa River, and Upper Prophet River. When these watersheds are removed from the equation, the remaining 31 sub-watersheds have an average level of protection of less than 2.1 per cent. In the 21 least protected sub-watersheds, less than one per cent of their area is protected, and in 11 of these, there are no protected areas whatsoever.

Examining the levels of protection inside major shale gas basin in FNFN territory, the Liard Basin is the most protected (10.8 per cent), followed by the Cordova Embayment (5.1 per cent) and the Horn River Basin (vanishingly small at 0.03 per cent).⁶ As we will discuss further in Indicator 10, “Muskeg” watersheds overlapping the Cordova Embayment (e.g., Sahdoanah River) and the Horn River Basin (e.g., Kiwigana River) remain the most tenured by oil and gas companies in FNFN territory. As these watersheds also have the lowest levels of protection, they are among the most vulnerable and least protected from potential future petroleum and natural gas (PNG) development impacts.

Protection Summary

Overall, the levels of protection in the FNFN study area are low to very low. Applying both the FNFN (22 per cent) and Government of Canada (17 per cent) desired protection thresholds, the current levels of protection of 12.4 per cent in northern BC Treaty 8 territory overall, and 11 per cent within the FNFN study area, is inadequate by both measures. Only three of 34 “Muskeg” and “Mountains and Muskeg” sub-watersheds meet FNFN’s preferred protection threshold of 22 per cent: Middle Muskwa River, Upper Muskwa River, and Upper Prophet River. Just these three sub-watersheds, plus the Middle Liard River (20.2 per cent), would be considered adequately protected as defined by the Government of Canada’s 17 per cent commitment. The thirty remaining watersheds — 88 per cent of all study area watersheds — fail to meet either standard.

Overall protection is significantly lower than the federally supported target, FNFN expectations, and any science-based estimates of what is needed to maintain fully functioning ecosystems.

The “Muskeg” portion of FNFN territory, in particular, is not well represented in protected areas. Ecologically, this reduces the probability that there are or will be representative large landscapes maintained in natural condition. This gap is further exacerbated in the “Muskeg” watersheds, where the existing pressures and future risks on the landbase from industry are highest.


The lack of protection in the “Muskeg” region is a big issue for FNFN. For most of our members, “Muskeg” sub-watersheds represent the villages where they lived or their family before them lived, or their family trapline areas, or the places that are closest to home and most easily accessible today. However, based on their proportion of protected areas, parks, and ecological reserves, the majority of “Muskeg” watersheds in FNFN territory with high recorded cultural use values are among the least protected and thus most vulnerable.



Overall protection is significantly lower than the federally supported target, FNFN expectations, and any science-based estimates of what is needed to maintain fully functioning ecosystems.

PHOTO: SNAKE RIVER VILLAGE,
KATHERINE CAPOUT BLANC

⁶ See Figure 10 under Indicator 10 below for the geographic location of these gas basins.

An aerial photograph showing a lush green forested area with a winding river. In the upper right, there is an industrial facility with several long, rectangular buildings and a large, dark blue pond or reservoir. The text 'PRESSURES/RISKS TO FNNF WATERSHEDS' is overlaid in large white letters on the left side of the image.

PRESSURES/RISKS TO FNNF WATERSHEDS

THERE ARE MANY DIVERSE human-caused and natural pressures acting on FNNF's cultural and ecological values. For example, natural disturbances such as forest fires and insect outbreaks continue across the landscape. Before the arrival of settlers, our Dené and Cree ancestors living in and moving through the Liard, Fort Nelson and Hay River Basins also exerted pressure on the land, and we still do today. We have always been and still are active hunters and harvesters. For generations, we have used controlled burning techniques to create early seral habitats and new growth to support berry picking and hunting, an activity that we continue to the present day.

While influential for ecological processes at local scales, these alterations and uses of the natural environment are a part of the Dené/Cree way of life. They are far different in scale and impact than industrial pressures and are thus not a subject of investigation in this Watersheds Report Card. The focus here is on industrial pressures in FNNF territory introduced since settler communities and extractive resources-driven economic systems arrived in the region. These pressures include existing and cumulative impacts from the decades of resource development (forestry, mining, oil and gas) that occurred, especially from the 1980s to present. Potential for future development is also assessed.

The ecological productivity of a watershed generally decreases as habitat impacts increase. Pressure/risk indicators measuring existing and potential future terrestrial ecosystem disturbance (e.g., linear density, facility numbers and density, industry tenure levels on the landbase), help identify sub-watersheds where ecological productivity might be most impacted or under pressure.

The focus here is on industrial pressures in FNNF territory introduced since settler communities and extractive resources-driven economic systems arrived in the region. These pressures include existing and cumulative impacts from the decades of resource development.

PHOTO: KATHERINE CAPOT BLANC

Indicator 9: Average Linear Disturbance Density (Road Only)

Figure 9 on the next page shows how the study area watersheds rank in terms of the density of roads through them. As mentioned previously, roads fragment natural landscapes into smaller and smaller pieces. They also introduce more hunters, workers, and vehicle traffic, with the impacts they bring, into natural areas. Higher linear disturbance density has been associated with increased wildlife mortality and morbidity, for species like boreal caribou, moose and bears.

Ten watersheds were considered healthier (green) if they had less than 0.73 km of road per square kilometre (km/km^2). Eight of these sub-watersheds are in the “Muskeg and Mountains” in the west; only Klua Creek ($0.63 \text{ km}/\text{km}^2$) and Lower Petitot River ($0.72 \text{ km}/\text{km}^2$) are within the “Muskeg” region.

Thirteen watersheds were considered moderate (yellow) if they had road density between 0.73 and $1.12 \text{ km}/\text{km}^2$.

Eleven watersheds with road density between 1.16 and $2.44 \text{ km}/\text{km}^2$ were considered less healthy (red). The highest road density is in the Sahdoanah River watershed. The next four highest road density watersheds are:

2. Kyklo River ($1.73 \text{ km}/\text{km}^2$);
3. Sahtaneh River ($1.57 \text{ km}/\text{km}^2$);
4. Middle Sikanni Chief River ($1.47 \text{ km}/\text{km}^2$); and
5. Middle Fort Nelson River ($1.38 \text{ km}/\text{km}^2$).

Generally speaking, we see the now predictable pattern that road density is lowest in the “Muskeg and Mountains” watersheds in the west, and higher in the active gas basins of the south, central and north-eastern “Muskeg” region. Oil and gas sector roads represent the bulk of roads within the FNFN study area.

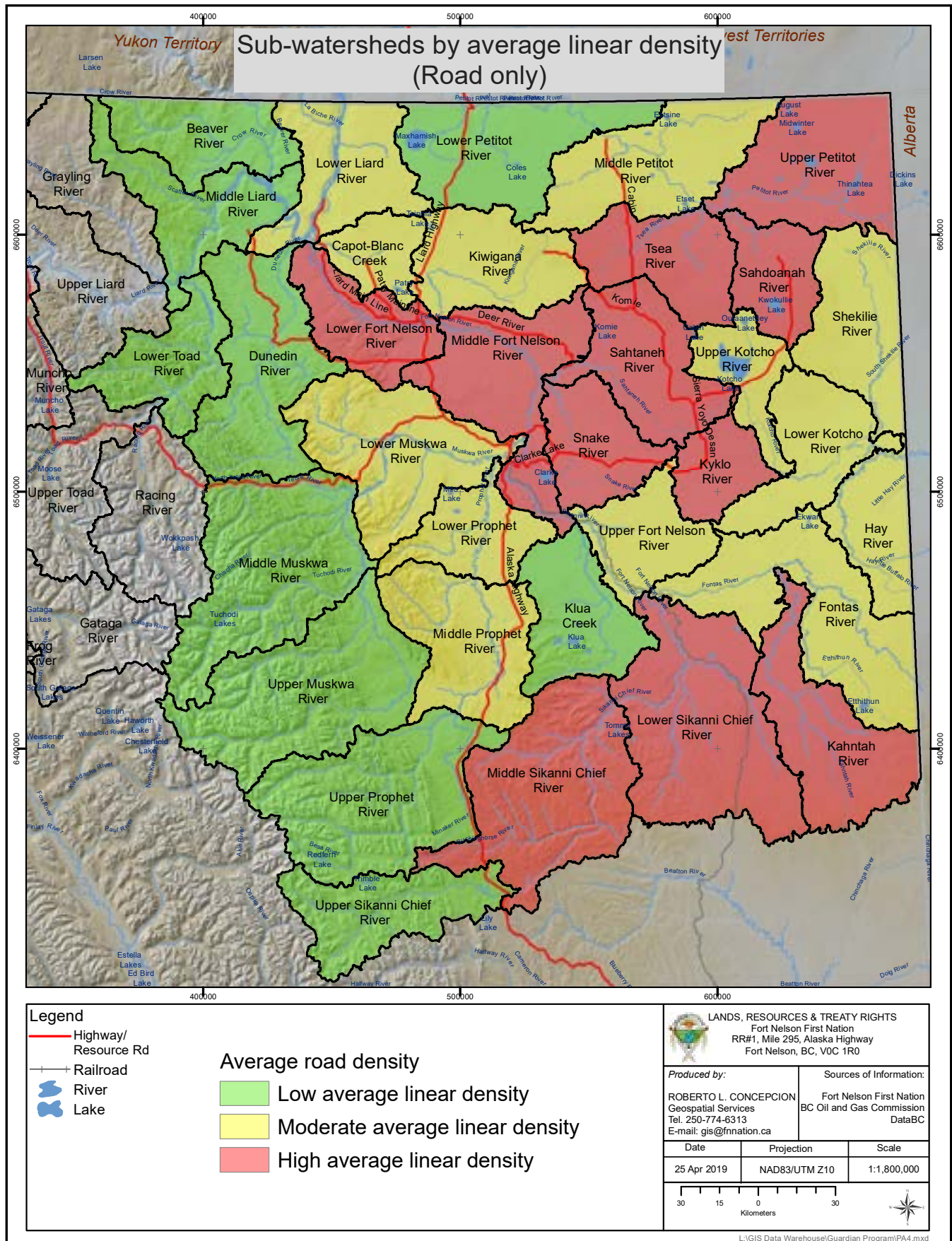
Data on linear disturbances should be treated with caution. Roads are always being built, improved, and decommissioned. It is also critical to remember that roads are not the only linear disturbances in FNFN territory. There are large networks of pipelines and, in particular, existing and past seismic lines, cut through the forests. These actually represent the vast bulk of linear disturbances in FNFN territory, especially in areas with oil and gas activity. According the most recently available data from the BC Oil and Gas Commission, three FNFN sub-watersheds exceed an average of nine km/km^2 of total linear disturbance: Upper Fort Nelson River ($14.1 \text{ km}/\text{km}^2$), Kyklo River ($10 \text{ km}/\text{km}^2$), and Sahtaneh River ($9.1 \text{ km}/\text{km}^2$). FNFN has not used this metric, however, because it is difficult to determine which seismic lines are still having strong ecological effects (including how wide and how old they are). Roads are wider, have more easily estimable and likely greater effects on a per square kilometre basis. By using a “roads only” metric, FNFN has chosen a conservative indicator that is far lower than the total linear disturbance in FNFN territory. Future monitoring and updating of the FNFN Watersheds Report Card may include more detailed total linear disturbance measures.



Roads are not the only linear disturbances in FNFN territory. There are large networks of pipelines and, in particular, existing and past seismic lines, cut through the forests. These actually represent the vast bulk of linear disturbances in FNFN territory, especially in areas with oil and gas activity.

PHOTO: KATHERINE CAPOT BLANC

Figure 9: Sub-watersheds by Average Linear Disturbance Density (Roads Only)



Indicator 10: Active Oil and Gas Tenure

Figure 10 shows FNFN sub-watersheds by the proportion of their respective areas that are subject to active oil and gas tenure (as of early 2018), according to data from BC Oil and Gas Commission. Oil and gas tenure is when a company has purchased a right from the BC Government to explore for and potentially extract oil and gas from a specified area. The four main shale gas basins in FNFN territory are also shown on Figure 10.

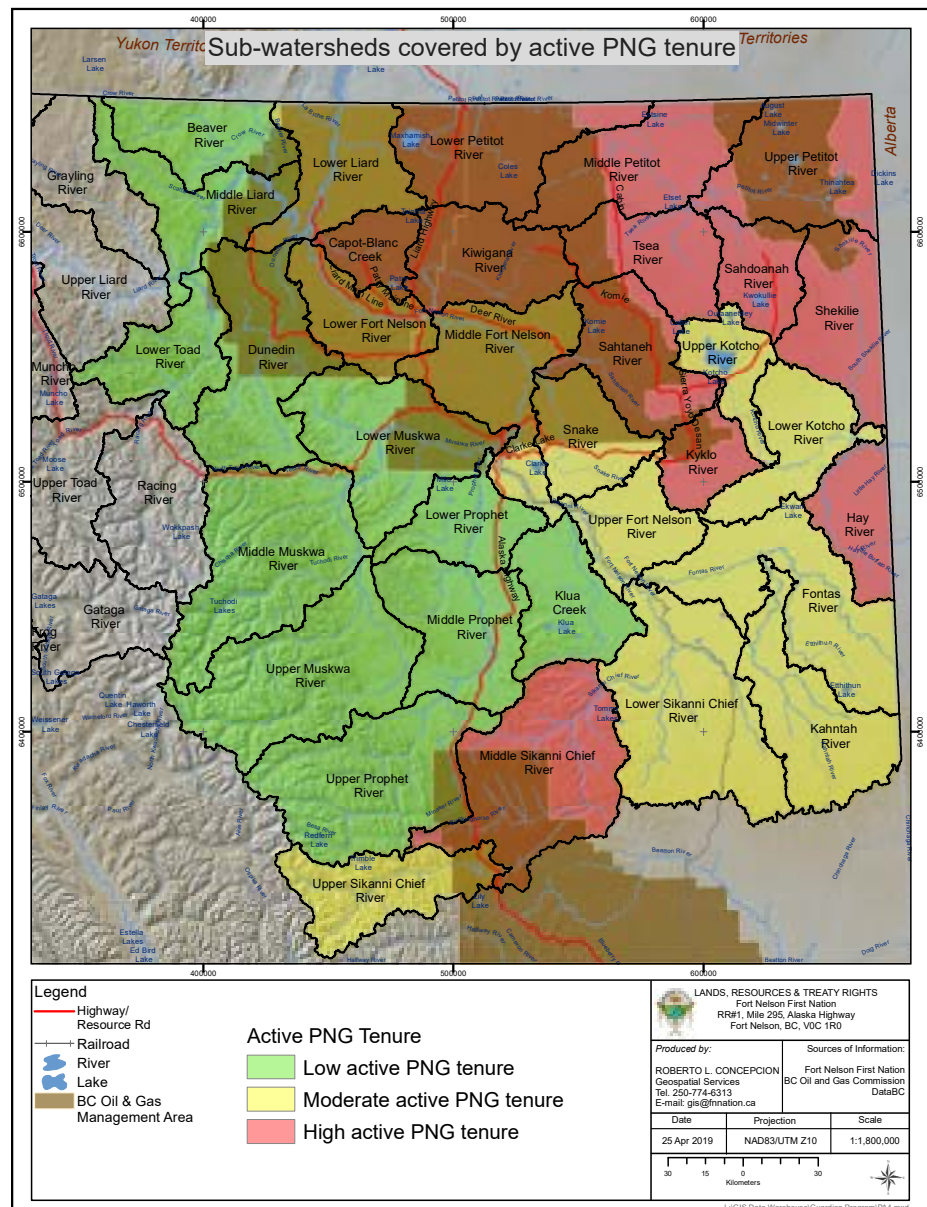
Eleven sub-watersheds, all within the western portion of the study area (including all of the “Mountains and Muskeg” watersheds except for Upper Sikanni Chief River), are lower than 16 per cent covered by oil and gas tenure, and are rated as “at lower risk” (green).

Eleven sub-watersheds have between 18 and 49 per cent of their area covered by active PNG tenure, and are rated as “at moderate risk” (yellow). These include sub-watersheds in the Liard gas basin and in the central and south-eastern part of the FNFN study area.

Twelve watersheds, primarily in the north-eastern corner of FNFN territory, and associated with the most active gas plays (Horn River, Cordova, and the North Montney), have between 50 and 86 per cent of their territory covered by active PNG tenure. They are rated as “at greater risk” (red). The six watersheds at greatest risk under this indicator are:

- Sahdoanah River (86% tenured);
- Kiwigana River (85%);
- Kyklo River (72%);
- Middle Sikanni Chief River (69%); and
- Sahtaneh River and Shekilie Rivers (65 per cent each).

Figure 10: Sub-watersheds by Per Cent Covered by Active Oil and Gas Tenure



While it is useful as a risk characterization tool, oil and gas tenure should not be confused with actual activity on the ground. Large portions of oil and gas tenure may not have any physical signs of industrial activity and may not be developed now or in the future. As a result, additional indicators focused on the actual physical footprint of the oil and gas sector were used as well, starting with Indicator 11, the comparative density of permitted oil and gas facilities.

Indicator 11: Density of Permitted Oil and Gas Facilities

Figure 11 rates FNFN study area watersheds based on the current density of permitted oil and gas facilities per square kilometre. This indicator is one way to develop a more detailed understanding of the actual physical presence of the oil and gas sector within each watershed.

Oil and gas facilities include but are not limited to gas plants, well facilities, compressor stations, LNG facilities, dehydrators, injection stations, battery sites, disposal stations, tank terminals, and sales meters. The number of liquefied natural gas (LNG) facilities can be extensive: both the Middle Sikanni Chief River (1498) and Sahtaneh River (1083) have more than a thousand permitted facilities.

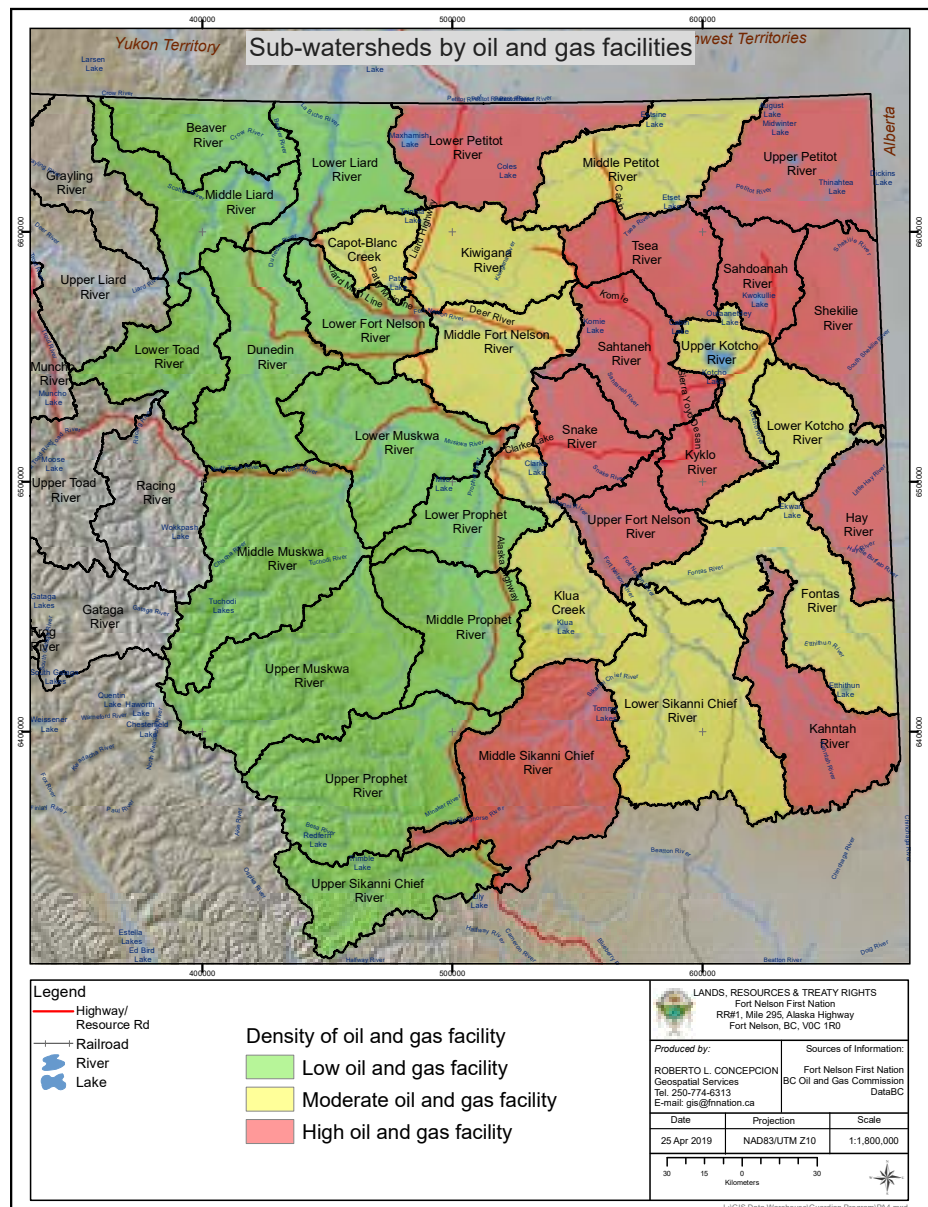
Thirteen sub-watersheds, covering the entire western portion of the study area, have oil and gas facilities density of lower than 0.05/km². These are rated as “at low risk/pressure” (green).

Nine sub-watersheds distributed throughout the central and eastern portion of the study area, have oil and gas facility densities of between 0.07/km² and 0.14/km². These are rated as “at moderate risk/pressure” (yellow).

Twelve watersheds, primarily but not exclusively in the central (Horn River) and northeast (Cordova Embayment) regions, have oil and gas facility density greater than 0.2/km², and are rated as “at higher risk/pressure” (red). Kyklo River, at 0.67 facilities/km², or 67 facilities per each 100 square kilometres, has the highest risk rating for this indicator. The next four “highest pressure” watersheds are:

2. Hay River (0.60 oil and gas facilities/km²);
3. Sahdoanah River (0.52 facilities/km²);
4. Sahtaneh River (0.46 facilities/km²); and
5. Middle Sikanni Chief River (0.35 facilities/km²).

Figure 11: Sub-watersheds by Density of Oil and Gas Facilities



Indicator 12: Density of “Changes in or About a Stream”

The BC Oil and Gas Commission also issues permits for “changes in or about a stream”, separate from permits for oil and gas facilities. According to the Commission, common examples of these permits are for “the construction, maintenance and removal of watercourse crossings and crossing structures”⁷, making this indicator the best example we currently have for the density of industrial water crossings in FNFN watersheds. Figure 12 shows FNFN study area watersheds with higher or lower density of permitted “changes in or about a stream”, including roads crossing rivers and creeks. The greater the density of water crossings, the higher the potential for damage to riparian and aquatic ecosystems and fish and wildlife habitat from erosion, contamination, and beaver/industry conflict, to name a few considerations.

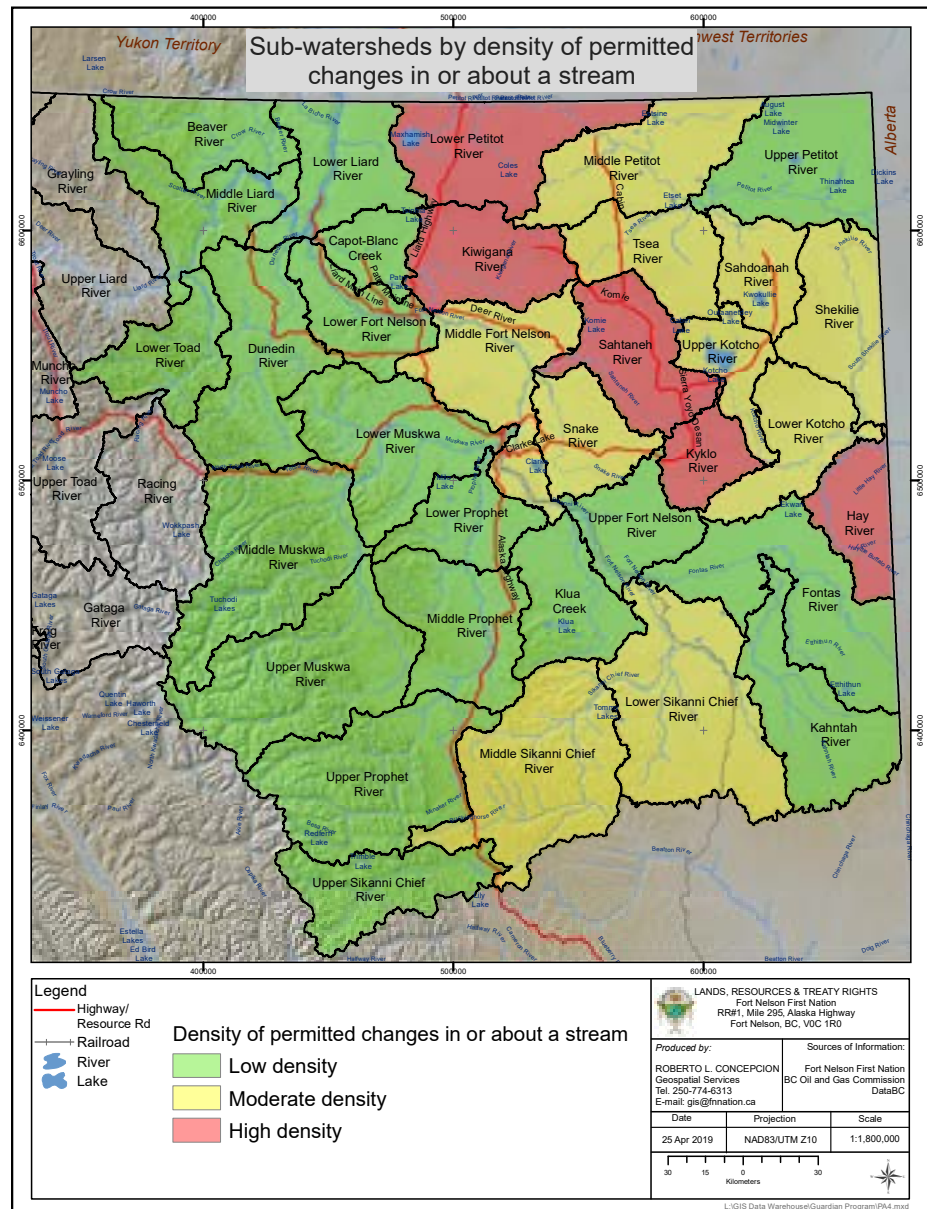
Nineteen of the study area watersheds have densities of permitted “changes in or about a stream” lower than 0.1/km²; each of these was rated as “at lower risk/pressure” (green). Ten of the sub-watersheds have densities between 0.1 and 0.22/km²; these were rated as “at moderate risk/pressure” (yellow).

Only five FNFN sub-watersheds have “changes in or about a stream” densities of 0.28/km² or higher, suggesting they are “at higher risk/pressure” (red). They are:

- Lower Petitot River – 0.79 permitted “changes in or about a stream” per km²;
- Sahtaneh River – 0.66/km²;
- Hay River – 0.31/km²;
- Kyklo River – 0.31/km²; and
- Kiwigana River – 0.28/km².

At densities more than twice as high as any other sub-watersheds, the Lower Petitot River and Sahtaneh River are clearly at the highest risk/pressure in relation to this indicator.

Figure 12: Sub-watersheds by Density of Permitted “Changes in or About a Stream”



7 <https://www.bcogc.ca/node/13287/download>

Indicator 13: Density of Permitted Surface Water Withdrawal Points

Figure 13 compares sub-watersheds by their density of permitted surface water withdrawal points, based on BC Oil and Gas Commission data. Physical works that can be considered “surface water withdrawal points” include water storage dugouts, lakes and ponds, streams and rivers, and other water withdrawal sites. Oil and gas industries need access to water for well drilling, camp operations, and other development-related activities. Well site operations, especially in hydraulic fracturing, is the highest use of water, and is highly important to accessing the shale gas deposits under much of the eastern and central part of FNFN territory.

Surface water withdrawals have the potential to impact on water quality and (especially) quantity from lakes, river and creeks, with attendant spin off effects on aquatic and riparian dependent wildlife and wildlife habitat.

Twelve watersheds have fewer than one permitted surface withdrawal locations per 100 square kilometres ($<1/100 \text{ km}^2$); these were estimated to be at lower risk. Many of these are in the “Mountains and Muskeg” to the west, but Lower Kotcho River, Fontas River, and Lower Sikanni Chief River in the southeast are also in this “at lower risk” (green) category.

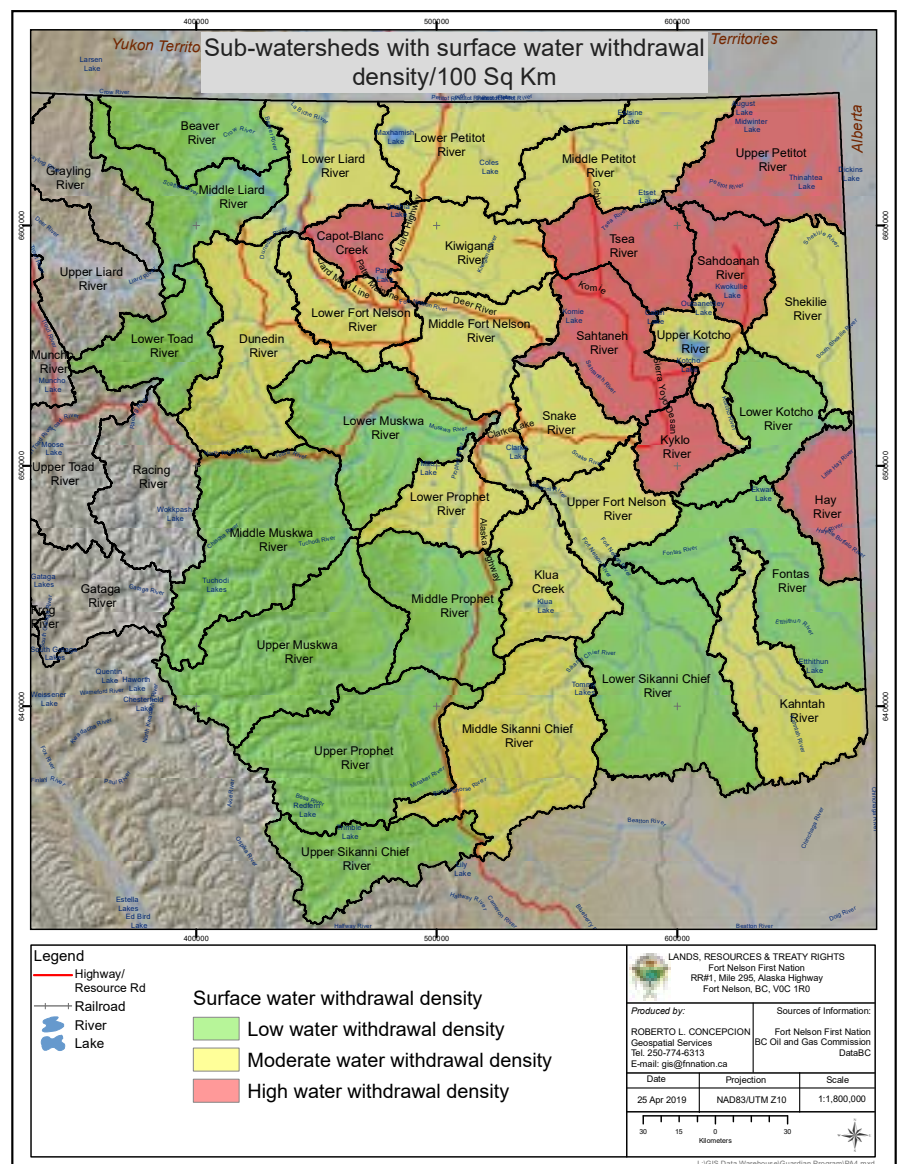
Fifteen sub-watersheds with between 1.17 and 3.85 permitted surface withdrawal locations/100 km^2 , are deemed to be “at moderate risk” (yellow).

Finally, seven sub-watersheds with surface water withdrawal location density of $5.23/100 \text{ km}^2$ or greater are considered to be “at higher risk” (red). The Capot-Blanc Creek watershed, in the northwest of the FNFN study area, has the highest density of surface water withdrawals, at $8.89/100 \text{ km}^2$, followed by:

2. Sahdoanah River ($8.27/100 \text{ km}^2$);
3. Kyklo River ($7.63/100 \text{ km}^2$);
4. Hay River ($7.58/100 \text{ km}^2$); and
5. Tsea River ($5.73/100 \text{ km}^2$).

This indicator does not reflect the amount of water withdrawn or estimate its effects on the high and low flows of the specific rivers and creeks, and levels of lakes, drawn from. Future Watersheds Report Card investigations may focus in more closely on these water quantity and waterbody and shore/bank health impacts.

Figure 13: Sub-watersheds by Density of Permitted Surface Water Withdrawals



Indicator 14: Potential For Beaver-Industry Conflict

Contamination of beaver habitat and beaver population health has been a subject of concern for FNNF in recent years. Our members have also become concerned about the management of beaver-human conflict, as industrial development has increased. Current management of beaver-human conflict by government and industry often involves industry staff killing beaver; this is viewed as both ineffective and culturally inappropriate by FNNF. FNNF members have observed and brought forward complaints related to the destruction of beaver and beaver dams and lodges by industry workers, broken dams and contaminated ponds as a result of development (e.g., in the SYD Road area), and evidence of contaminated beaver habitat and beaver (e.g., white fluid in meat) in areas with high gas well densities.

There is a critical need to develop strategies to protect wildlife for current and future generations. The primary pressure on beaver in FNNF territory is habitat loss and degradation and human-beaver conflict associated with industrial development. Pollutants released through accidental spills at oil and gas sites can reduce water quality, exposing beaver and other aquatic organisms to contaminants that affect overall ecological health. Water withdrawals by industry are another potential pressure on beaver habitat that has yet to be closely studied.

The beaver's ability to create and expand wetland habitats often puts them in conflict with humans when this activity floods roads and other infrastructure. Culverts, for example, are an ideal location for damming activities by beaver; flooding by blocked culverts becomes an on-going maintenance issue for infrastructure owners. Beaver foraging of trees and shrubs can also damage or remove treed areas used for forestry, recreational or residential purposes. As a result of these interactions, beaver are often seen and managed by government and industry as a nuisance species.

FNNF has performed an analysis to quantify the number of potential conflict sites in FNNF territory by comparing suitable beaver habitat (Indicator 7 previously in this report) and existing infrastructure and other industrial land uses. In total, the analysis identified nearly 147,000 potential conflict sites in FNNF territory, which suggesting beaver management will continue to be a significant issue, especially in the "Muskeg" region. Figure 14 on the following page shows watersheds with higher or lower potential for beaver-industry conflict.

The 14 sub-watersheds in green in Figure 14 are those that are not estimated to be at heightened current risk of beaver-industry conflict. Each has less than 6.9 per cent of its area covered by zones of potential conflict.

The 11 sub-watersheds in yellow are those estimated to have moderate risk of beaver/industry conflict. Each has between 8.4 and 15.3 per cent of their total area within potential conflict zones. These sub-watersheds are primarily in the far north and far south of the study area.

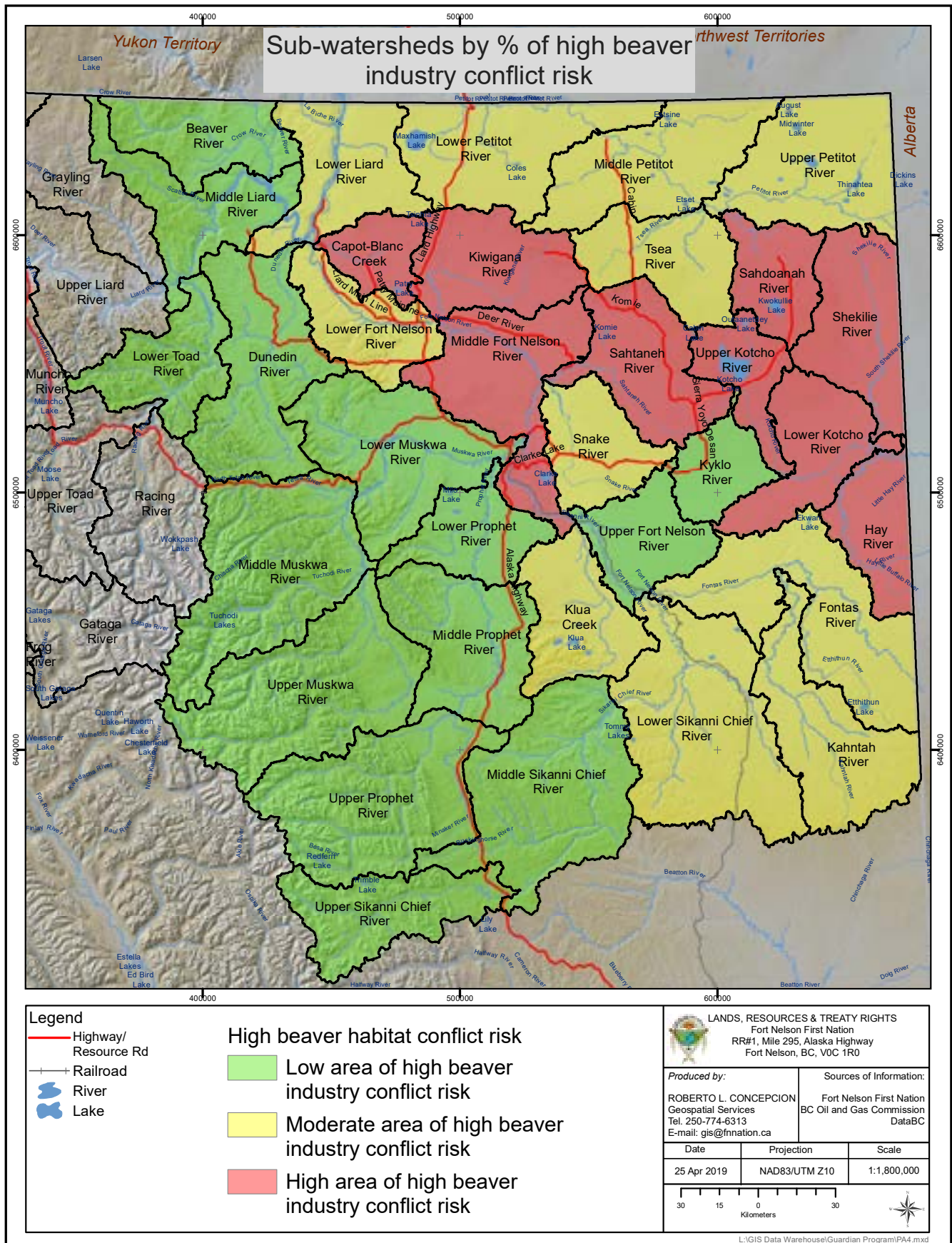
The nine sub-watersheds in red are those estimated to have the highest risk of beaver/industry conflict. They have between 20 and 39.7 per cent of their area in potential conflict zones. Much of the Horn River gas basin and the east-central portion of FNNF territory have high intersections of oil and gas activities and high quality beaver habitat. The five watersheds with the highest risk of beaver-industry conflict are:



There is a critical need to develop strategies to protect wildlife for current and future generations. The primary pressure on beaver in FNNF territory is habitat loss and degradation and human-beaver conflict associated with industrial development.

PHOTO: RYAN DICKIE

Figure 14: Sub-watersheds by Proportion of Area with High Beaver-Industry Conflict Risk



- Sahtaneh River (39.7 per cent);
- Hay River (31.2 per cent);
- Shekilie River (30.1 per cent);
- Sahdoanah River (27.2 per cent); and
- Kiwigana River (26.0 per cent).

Indicator 15: Forestry — Areas Harvested to date

Peak timber harvesting in FNNF territory occurred over the 30-year span from 1977 to 2007. During this period an average of 4400 hectares were harvested each year. Timber harvesting declined after 2008, though there is rising potential in the near future for reinvigoration of the forestry sector in FNNF territory (see Indicator 16).

Figure 15 rates watersheds by how many hectares of trees have been harvested to date for commercial forestry. It also shows the locations of cutblocks harvested red.

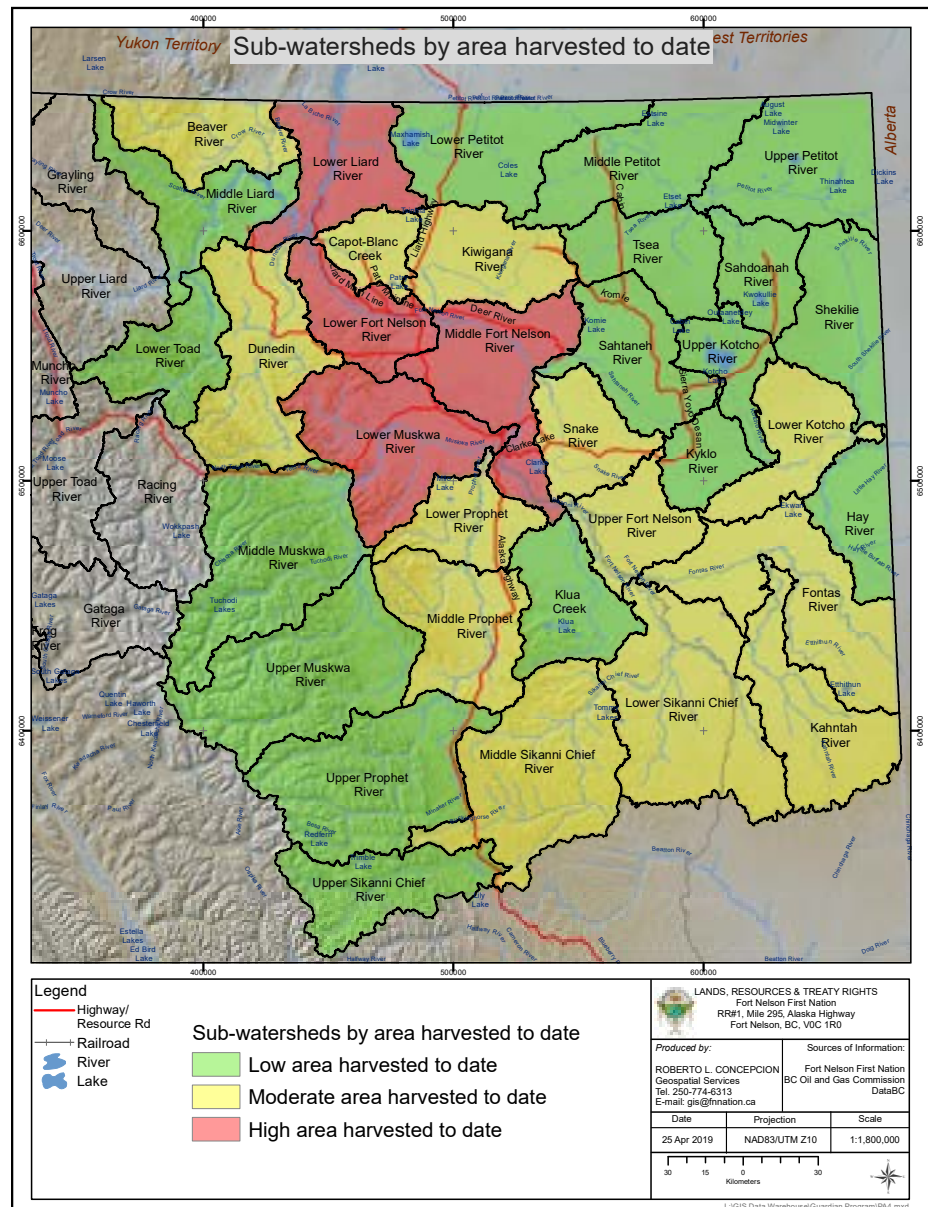
Figure 15 shows that many of the watersheds have seen minimal to no timber harvesting pressure, even during the 1977 to 2007 peak years. This is especially the case in the southwest and northeast of the FNNF study area. In 17 watersheds less than 2,000 hectares of harvesting has occurred to date, and these are rated as having had low pressure (green in Figure 15).

Thirteen watersheds have seen between 2,000 and 10,000 hectares of total harvest to date and are rated as facing moderate pressure to date (yellow on Figure 15).

Four watersheds have had relatively high timber harvest pressure to date (red on Figure 15):

- The Lower Liard River has seen the largest amount of harvesting at 24,310 hectares;
- The Middle Fort Nelson River has had 20,674 hectares harvested;

Figure 15: Sub-watersheds by Area of Timber Harvested to Date



- The Lower Fort Nelson River, at 18,639 hectares; and
- The Lower Muskwa River, at 15,404 hectares.

Where harvest occurs is determined by two major factors: Distance by road the mill where the wood is going (e.g., Fort Nelson or Fort St John), and productivity and age of the trees.

Indicator 16: Forestry — Future Harvest Potential

The potential future timber harvesting area is also distributed unevenly. Figure 16 shows the timber harvesting land base (THLB) in the Fort Nelson timber supply area. Areas with a large amount of THLB, particularly closer to Fort Nelson, are the most likely focus of future harvesting.

Fifteen sub-watersheds have low future timber harvesting pressure (green). These low risk sub-watersheds each have lower than 13,792 hectares of potentially merchantable timber.

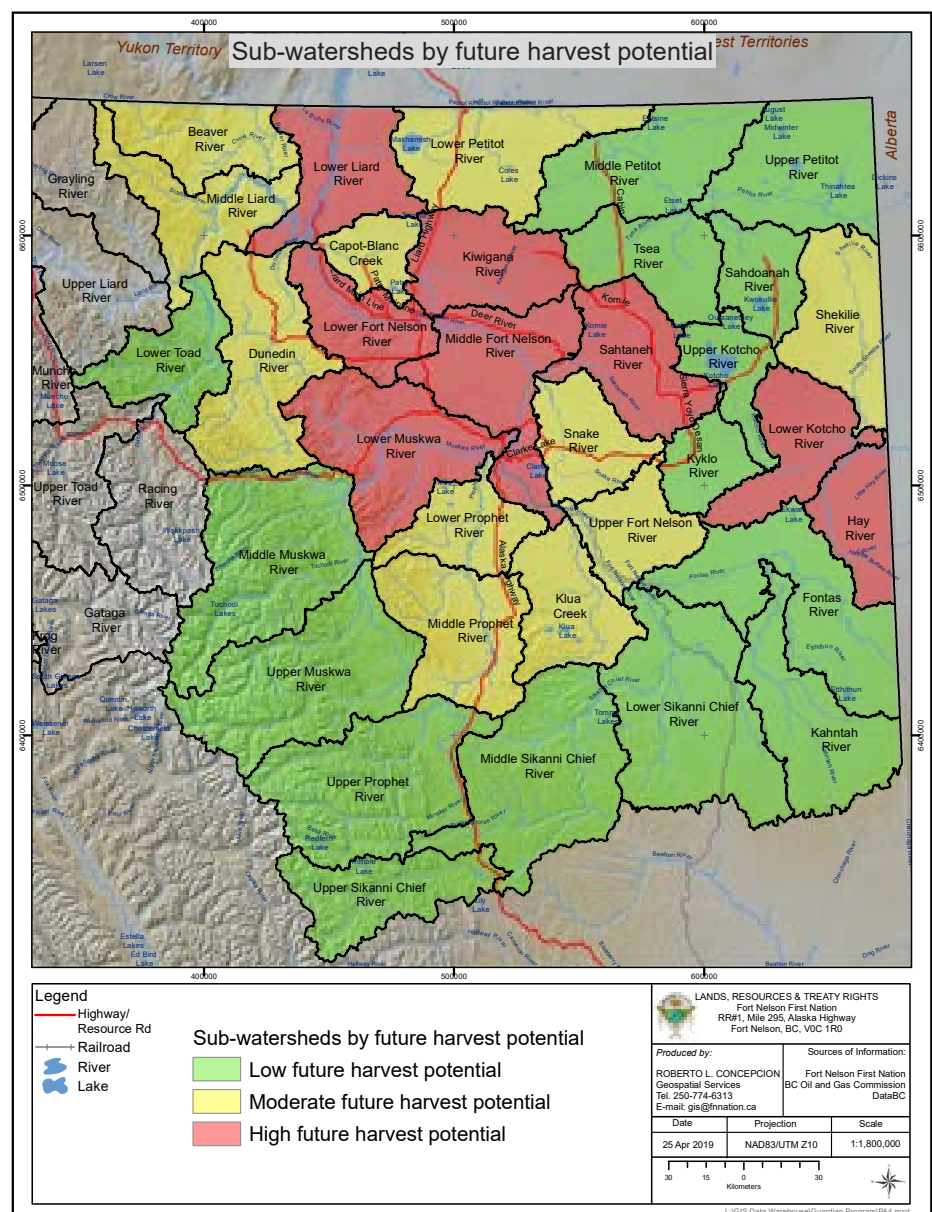
Eleven sub-watersheds with between 13,792 and 42,000 hectares of merchantable timber each are ranked as having a moderate future timber harvesting pressure.

Eight sub-watersheds with between 42,000 and 102,241 hectares of merchantable timber are ranked as being at higher pressure (red). At over 102,000 hectares, the Lower Liard River has the largest potential timber harvest base.

Of the watersheds that have relatively little historic harvest (i.e., green and yellow watersheds from Figure 15), the following have most potential for extensive future harvest:

- The Sahtaneh River and Hay River sub-watersheds may see the highest increase, moving from green (low pressure) to red (higher pressure);

Figure 16: Sub-watersheds by Current Timber Harvesting Land Base



- The Lower Kotcho River and Kiwigana River could jump from moderate to higher pressure sub-watersheds;
- Each of the following may move from a low pressure to a moderate pressure on their forest resources:
 - o Shekilie River;
 - o Lower Petitot River;
 - o Middle Liard River; and
 - o Klua Creek.

Industrial Pressures/Risks Summary

What degree of industrial pressures and risks is the FNFN study area under overall? There is an ebb and flow of industrial pressure from the primary resources sector, tied in large part to commodity prices and national and international demand trends. Immediate industrial pressures in FNFN territory are lower than they were five to ten years ago, due primarily to a downturn in the gas sector. There remains potential for significant future development (dependent upon gas markets, federal and provincial politics) and many watersheds have substantial areas still under active oil and gas tenure. Forestry potential has also increased recently.

Overall, the degree of industrial pressures in FNFN territory remains substantially concentrated in the oil and gas basins of the Taiga Plains/Muskeg region. These areas were rapidly industrialized during the gas boom between 2005 and 2012. Industrial forestry has occurred in the region since the mid 20th century, though market and supply-driven mill closures have limited recent local logging opportunities in FNFN territory. Both FNFN and the Northern Rockies Regional Municipality are exploring new forestry opportunities to increase local economic activity. It is therefore feasible that forestry could again act as a pressure on ecological and cultural values across non-protected landscapes in FNFN territory. FNFN is not opposed to responsible, sustainable development balancing currently much needed jobs and proper protection of the always essential resources in the natural environment.

In terms of oil and gas development, limited new development or tenure sales have occurred in FNFN territory following the 2005 to 2012 unconventional (shale) gas boom. However, the physical marks of that boom in many areas remain significant. Oil and gas roads, linear disturbances (e.g., seismic lines, pipeline right of ways), and other landscape alterations (e.g., clearings for well sites, plants and processing facilities, disposal wells, borrow pits) continue to influence ecological processes (e.g., predator-prey relations), and the exercise of Treaty rights and other cultural practices. These industrial features, while not as actively used by industry as in the past, represent existing cumulative impacts in FNFN territory. In many watersheds in the FNFN study area, these impacts are large scale. For example, road density in eight of the “Muskeg” sub-watersheds has already surpassed the peer-reviewed disturbance threshold for boreal caribou habitat ($>1.2 \text{ km/km}^2$ = high risk), beyond which caribou populations are at serious risk of population declines. And it is important to remember that FNFN has conservatively included only clearings for roads in this indicator; seismic



Oil and gas roads, linear disturbances, and other landscape alterations continue to influence ecological processes, and the exercise of Treaty rights and other cultural practices.

lines, pipeline rights-of-way, and other linear disturbances add to the total linear impact. In addition, 14 of 34 sub-watersheds (all “Muskeg”) each have more than 300 oil and gas facilities within their boundaries.

Aquatic ecosystems also face industrial pressure in FNFN territory. Where roads cross rivers, streams, and wetlands, these waterbodies and fish habitats are exposed to notable impacts such as bank erosion, increased sediment loads from runoff, and contamination from vehicle emissions and fuels, larger spills of toxic substances, and chemical compounds added to roadways to reduce dust in summer. The use of water by oil and gas producers is also a major pressure, especially on smaller waterbodies.

While the oil and gas development scenario is far different today than five to ten years ago, like forestry it could very easily ramp up again if gas prices increase. Many oil and gas companies retain tenure in the shale gas basins in FNFN territory. Eighteen of the 34 sub-watersheds have greater than 40 per cent of their basin area under active oil and gas tenure. It is feasible that an increase in natural gas prices could restore activity levels closer to those of the recent past. In such a scenario, it is likely that watersheds with higher existing oil and gas tenure would be the most immediately under pressure, including potentially increased activities in previously less developed areas such as the Liard shale gas basin.

What watersheds are subject to lower pressures and risks? It is clear that “Muskeg” watersheds are more under pressure than “Mountains and Muskeg” watersheds. For example, no “Mountains and Muskeg” watershed is among the top eight “watersheds at risk” for any of our eight pressures/risks indicators.

Of the “Mountains and Muskeg” sub-watersheds, Dunedin River, followed by Beaver River, are the sub-watersheds most under industrial pressure/risk. If the Liard gas basin heats up again, those watersheds as well as the Middle Liard River may see increased pressures from the gas sector, but those risks are currently far below those faced in the Muskeg watersheds to the east. Most development has and will likely continue to occur in the Taiga Plains/Muskeg region of FNFN territory.

What watersheds are subject to higher pressures and risks? Some sub-watersheds appear in the “top ten” lists of multiple pressure/risk indicators. Table 1 on the next page shows the 11 sub-watersheds that rank within the top ten for four or more of the eight pressure/risk indicators.

The seven sub-watersheds that have high pressure/risk ratings for five or more of the eight indicators are considered at the highest risk and are shown in red in Table 1 (check marks indicate the watershed is in the top ten for that indicator) and in Figure D.

An additional four watersheds ranked within the “top ten” for four or more pressure/risk indicators. These are deemed to be at moderate risk and shown in yellow in both Table 1 and Figure D.



While the oil and gas development scenario is far different today than five to ten years ago, like forestry it could very easily ramp up again if gas prices increase.

PHOTO: KATHERINE CAPOT BLANC

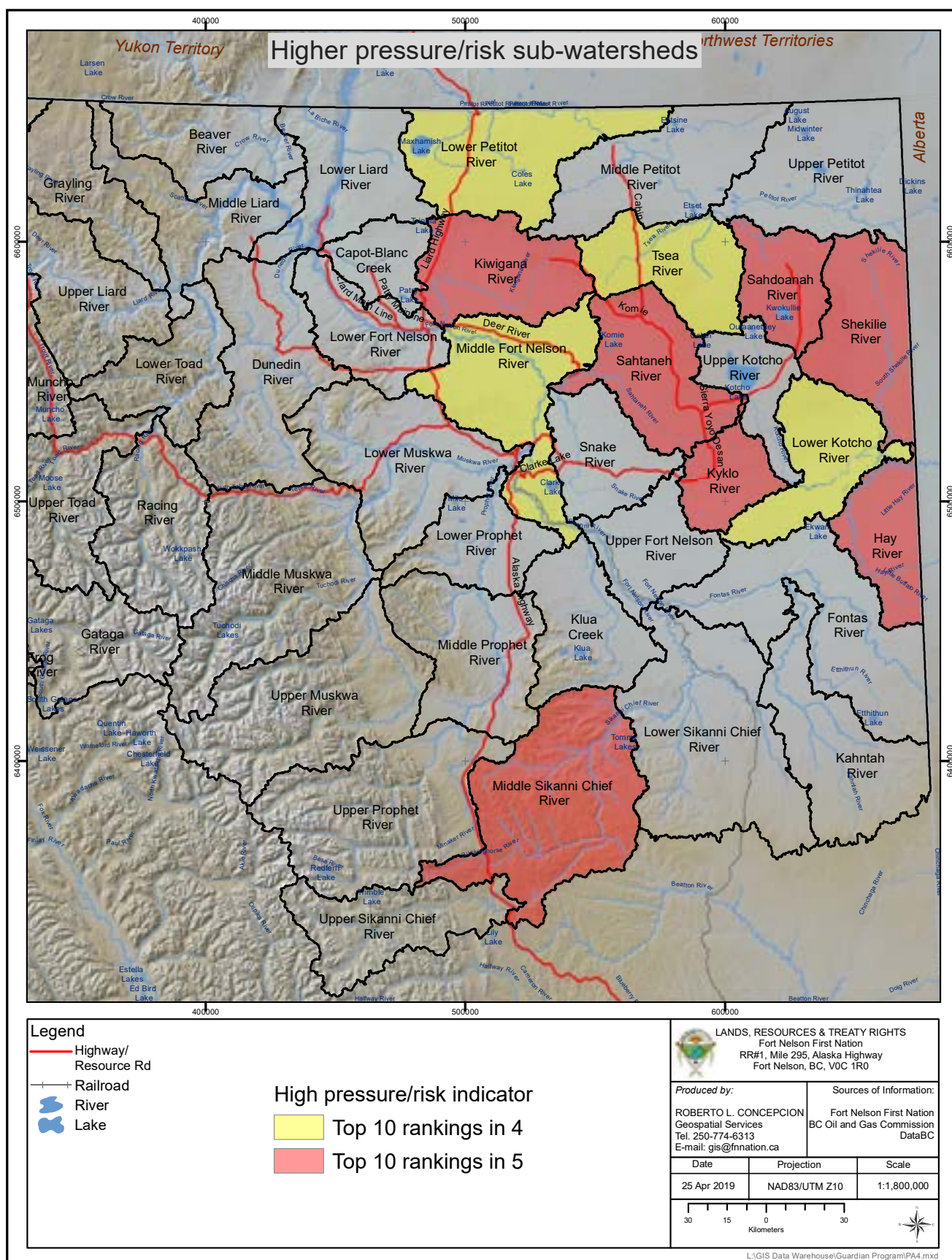
Where there are pressures from both oil and gas (generally indicators 9 through 14) and from future forestry (Indicator 16), these watersheds are estimated to be at higher current pressure/future risk, as noted in Table 1.

This is a summary metric only, used to highlight general pressure/risk characteristics. Just being in a large number of “top ten” rankings for pressure/risk factors does not tell us the absolute or relative risk a watershed faces, now and into the future. It also does not imply that any or all of the other watersheds in FNFN territory do not face industrial pressures and risks. That is why no green “at lower risk” colouring is provided in Figure D. Nor is it assumed that all indicators are equal to one another in importance. Future work within watersheds deemed “higher risk” will be required to identify specific areas and degrees of impact/pressures; this is a diagnostic tool only at this time.

Table 1: FNFN Study Area Watersheds in the Top Ten for High Pressure/Risk Indicators

| Watershed | 9 Road density | 10 Oil/gas tenure | 11 Oil/gas facilities | 12 Water crossings | 13 Water withdrawals | 14 Beaver conflict | 15 Timber harvest | 16 Future Harvest | Total (out of 8) |
|-------------------------|----------------------|-------------------------|-----------------------------|--------------------------|----------------------------|--------------------------|-------------------------|-------------------------|-------------------------------|
| Sahtaneh River | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | X | ✓ | 7 (oil/ gas and timber) |
| Sahdoanah River | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | X | X | 6 |
| Hay River | X | ✓ | ✓ | ✓ | ✓ | ✓ | X | ✓ | 6 (oil/ gas and timber) |
| Kiwigana River | X | ✓ | X | ✓ | X | ✓ | ✓ | ✓ | 5 (oil/ gas and timber) |
| Middle Sikanni Chief | ✓ | ✓ | ✓ | ✓ | X | X | ✓ | X | 5 |
| Kyklo River | ✓ | ✓ | ✓ | ✓ | ✓ | X | X | X | 5 |
| Shekilie River | X | ✓ | ✓ | ✓ | ✓ | ✓ | X | X | 5 |
| Lower Petitot River | X | ✓ | X | ✓ | ✓ | X | X | ✓ | 4 (oil/ gas and timber) |
| Lower Kotcho River | X | X | X | ✓ | X | ✓ | ✓ | ✓ | 4 (oil/ gas and timber) |
| Middle Fort Nelson | ✓ | X | X | X | X | ✓ | ✓ | ✓ | 4 (oil/ gas and timber) |
| Tsea River | ✓ | X | ✓ | X | ✓ | ✓ | X | X | 4 |

Figure D: Sub-watersheds with the Most “Top Ten” Pressure/Risk Characteristics





SUMMARY AND NEXT STEPS

The amount of current meaningful lands protection within the study area overall, but most critically within the “Muskeg” region, is far below the amount required to protect natural ecological function across a variety of different ecosystems. This is a critical gap that needs addressing in the near future.

THE FOLLOWING general statements can be made about the FNFN study area:

- The “Mountains and Muskeg” region is lower in both current use and occupancy value and in industrial pressures and risk, in comparison with the “Muskeg” region. This western portion of the study area is also more ecologically intact than much of the east, which has much higher fragmentation from linear and areal industrial development. In addition, the “Mountains and Muskeg” region is subject to comparatively higher protections than the “Muskeg” region. Thus, the “Mountains and Muskeg” region does not have the same degree of urgency as the “Muskeg” region for near future protection and monitoring efforts under the FNFN Guardian Program.
- The “Muskeg” region has very high habitat values for caribou and beaver, while the “Mountains and Muskeg” region has higher proportions of older growth forests and a larger number of large intact landscape units, free from development activity. The “Mountains and Muskeg” is more ecologically intact than the “Muskeg” region overall.
- The amount of current meaningful lands protection within the study area overall, but most critically within the “Muskeg” region, is far below the amount required to protect natural ecological function across a variety of different ecosystems. This is a critical gap that needs addressing in the near future.
- The “Muskeg” region in general has very high cultural use and ecological values that FNFN members continue to rely upon to practice their Treaty rights and way of life on the land on a regular basis.
- Several of these high recorded cultural use value watersheds are also among those most at risk from industrial pressures. Sahtaneh River, Kyklo River, and Kiwigana River are three of the seven sub-watersheds with the most industrial pressure/risk factors (Figure D), and among the sub-watersheds with the highest recorded cultural values. In addition, the Lower Petitot River and Middle Fort Nelson River are high cultural value sub-watersheds with moderate industrial pressure/risk factors. Overall, five of the 13 sub-watersheds with the highest recorded cultural values are also among those most at risk from existing and future industrial development. None of these high value/high risk sub-watersheds have much if any meaningful protected areas in place to reduce these risks.



- There are some positive signs that cultural and ecological values can be maintained, if actions occur soon. There is a current lull in industrial development, in both the forestry and oil and gas sectors that has reduced immediate pressures on the landbase from highs seen between 2005 and 2012. And there are still areas with high value that are comparatively less developed. The following, non-exclusively, are among the watersheds that are heavily used by FNFN members that are not among the 11 FNFN watersheds deemed to be at the highest current risk from industry:
 - o Lower Liard River;
 - o Middle Liard River;
 - o Cabot-Blanc Creek;
 - o Lower Fort Nelson River;
 - o Upper Kotcho River;
 - o Snake River; and
 - o Upper Fort Nelson River.

Ensuring that the currently limited pressures on these high value watersheds remains low, especially by protecting more large intact landscapes and older forests, is critical to protecting ecological function and FNFN cultural practices.

- Even within sub-watersheds with both high recorded cultural use value and high pressure from industry, there are some areas that still have a semblance of natural values that increase the ability for FNFN members to peacefully enjoy their cultural landscape. It is key for the FNFN Guardian Program, in collaboration with industry and government, to identify additional areas to protect and enhanced protective measures in areas where industrial development is allowed to occur, that reduce overall and site-specific pressures on the many valuable eco-cultural areas in the “Muskeg” region.

It is key for the FNFN Guardian Program, in collaboration with industry and government, to identify additional areas to protect and enhanced protective measures in areas where industrial development is allowed to occur.

NEXT STEPS

The FNFN Lands Department, leadership and the community will use the data developed herein when looking at:

- Land use planning initiatives;
- Setting up of FNFN Guardian Program monitoring activities;
- Proposals from industry for specific land use activities;
- Determining which areas should be protected through park-like settings; and
- Assessing cumulative effects on individual watersheds and FNFN territory overall.

Industry and government will be expected to review the Watersheds Report Card results prior to any of the above as well, and engage FNFN on dialogue on how to protect high value sub-watersheds and reduce pressures on watersheds at risk.

From Baseline to Trend-over-Time: Replicating the Watersheds Report Card

This FNFN Watersheds Report Card is the first of its kind. It sets a baseline against which future change can be assessed for all watersheds, and identifies high value and high pressure/risk watersheds that merit focus now. Funding dependent, FNFN will update the Watersheds Report Card every five years. FNFN Guardians will be involved in collecting additional data, both at the regional and “priority sub-watersheds” level, to augment publicly available data. And FNFN’s Community Information System will be re-mined to identify changes in land use and occupancy and overall cultural value patterns for future Watersheds Report Cards.

Potential Future Indicators for the Watersheds Report Card

As the first initiative of its type, there were inevitably gaps in this FNFN Watersheds Report Card. Ecologically speaking, there is inadequate secondary data available at this time to estimate the “health” of each — or any — of FNFN’s watersheds. Data on water quality and quantity and moose, in particular, needs bolstering. This is one of the primary reasons why FNFN is developing a more extensive primary data collection system through the FNFN Guardian Program. As the FNFN Guardian Program is developed, and depending on FNFN community priorities, funding availability, among other factors, indicators that may be added to future versions include:

- **CULTURAL INDICATORS**, like sub-watersheds which have creeks and rivers that do or do not meet Indigenous user needs (e.g., “Indigenous base flows and Indigenous minimum flows”).
- **ECOLOGICAL INDICATORS**, including a variety of potential water quantity and quality metrics, moose habitat suitability, invasive species, riparian (shoreline) intactness and health, measures of fish abundance and population health, and lake water levels.
- **PRESSURE/RISK INDICATORS**, such as total linear disturbance density, per cent of low flow rates from major creeks and rivers subject to surface withdrawals, density of measurable seismic incidents per sub-watershed (which may be causally related to hydraulic fracturing activity levels), and reportable industrial incidents in a sub-watershed, including spill events, permit violations, and wildlife collisions.



This FNFN Watersheds Report Card is the first of its kind. It sets a baseline against which future change can be assessed for all watersheds, and identifies high value and high pressure/risk watersheds that merit focus now.



PHOTO: MATHEW MURRAY/FIRELIGHT

