Klappan Strategic Initiative

Technical Report

Final

March 6, 2015

Klappan Strategic Initiative: Technical Report

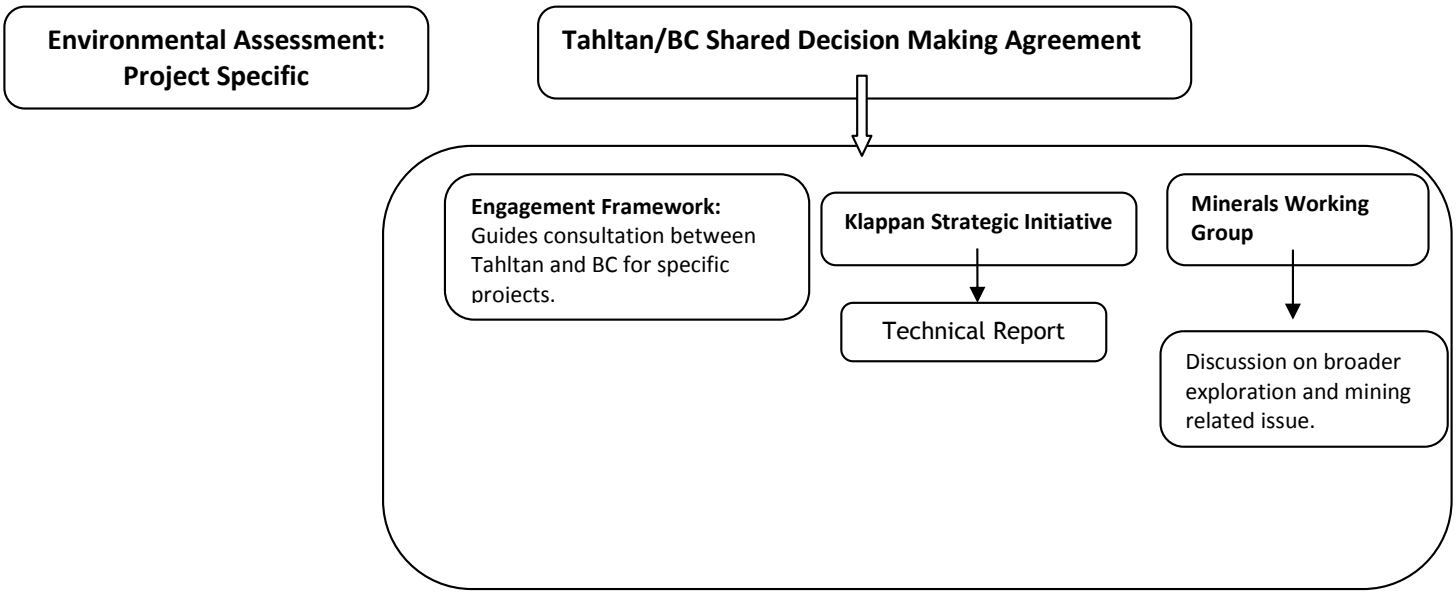
Background:

In September 2013, the Tahltan and the Province of British Columbia formed the Klappan Strategic Initiative (KSI) to address ongoing issues in the Klappan Area, an area of significant environmental, economic, cultural, traditional, spiritual and values.

This initiative is an element of the BC-Tahltan Government-to-Government relationship, formalized through the Shared Decision Making (SDM) Agreement, which was signed by Tahltan and B.C. on March 14, 2013. Under the SDM Agreement, the Province and the Tahltan have engaged on land use and management of the unique values in the Klappan area.

Scope of the Klappan Strategic Initiative and Technical Report:

The focus of the Klappan Strategic Initiative is on the broad Klappan Area, which is defined in the report. It is not meant to address specific projects, and is not a substitute for engagement on specific projects. Other forums exist for discussion on specific projects – including Working Groups established under the Shared Decision Making Agreement, and the Environmental Assessment Process.



Technical Report:

To help guide the discussion and inform the development of recommendations, the parties jointly developed the technical report.

The report includes input from both the Tahltan and the Province's perspectives and provides a summary of values important to both parties. Tahltan knowledge has been included in the report, as has the Province's perspective on the economic values in the Klappan.

This report is not a land use recommendation. It is a summary of values within the Klappan study area from both parties' perspectives and will help facilitate an informed government to government discussion, ensuring the consistent and mutual understanding of information. The report is broad in nature, and is not intended to focus on individual tenures or projects. Moving forward, the Tahltan or the Province may draw upon information presented in this report, as well as the management considerations and information gaps, when reviewing activities and considering future information gathering in the Klappan. The technical report is just one piece that will be used to form recommendations. In addition to the information presented in the technical report the Tahltan and the Province will also draw upon input from communities and stakeholders.

Acknowledgements

We would like to thank the entire Klappan Strategic Initiative Technical Report Team for the all work they put into developing this report. From the Tahltan: Nalaine Morin, Richard Erhardt, Norm MacLean, Patrick Hudson, Vera Asp, Dwayne Day, Peter Jakesta, and Duncan Mclaren. From the Province: James Cuell, Ben Heemskerk, Kathie Wagar, James Robinson, Fred Oliemans, Katie von Gaza and Cheryl MacKenzie.

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Executive Summary

The goal of the Klappan Strategic Initiative Technical report is to provide a summary of the values that are distinct to the Klappan Technical Report Area in order to facilitate a discussion regarding long-term planning within the Klappan. In order to achieve this goal, a team was assembled, comprised of Tahltan and Provincial representatives. Then, through a collaborative back-and-forth effort, values were documented, with both management considerations and information gaps identified for consideration when planning for development in the Klappan area.

A summary of both the management considerations and information gaps can be found at the end of the report.

Introduction

Purpose

The purpose of this report is to provide a summary of the values that are distinct to the Klappan Technical Report Area (TRA) in order to facilitate a discussion regarding long-term planning within the Klappan. Map 1 provides an overview of the area under discussion. It is intended to present a visual and textual representation of these values using the most current information available from both Provincial and Tahltan sources, as well as providing a historical and cultural context of the region. It does not address specific proposed projects, which are addressed through other processes. Additionally, the technical report is not intended to be used as a guide or provide direction on land use – it is a summary of values to help facilitate discussion and ensure consistent and mutual understaning of currently available information.

The sharing of this resource information is considered an essential step towards developing a common understanding of the land and its resources and bringing together disparate groups for a constructive dialogue. This report is an integral part of the Klappan Strategic Initative,a government-to-government process between the Tahltan and the Province under the Shared Decision Making Agreement.

History and Status of Current G2G Relationship

On March 4, 2011 the Province and the Tahltan signed a Framework Agreement entitled the "Government-to-Government and Northwest Transmission Line Negotiation Framework Agreement." Under this agreement the Parties negotiated a Shared Decision Making Agreement (SDM Agreement) regarding the utilization of lands and resources in the Territory.

This Shared Decision Making Agreement was concluded and signed on March of 2013. Its purpose is to foster an effective, respectful and enduring government-to-government relationship that allows the Parties to collaborate on land and resource issues. The SDM agreement also spells out the differing views on sovereignty held by the respective parties. Those views apply to this technical report in its entirety, and are included in Box A for clarity. As a jointly produced document, both Provincial and Tahltan perspectives are presented throughout the document; specifically, the sections on Tahltan History and Cultural Values are reflective of the Tahltan prespective.

As part of the SDM agreement a Government-to-Government (G2G) Forum was created to ensure agreement implementation and to be the venue for government-to-government discussions. The Forum is collaborative and members discuss and solve many difficult issues within Tahltan territory. It is this collaborative relationship that has created the Klappan Strategic Initiative (KSI). The KSI has been structured to develop land use direction and management for the Klappan, and to present them as joint recommendations to G2G decision makers for their consideration and implementation.

Box A: Tahltan and the Province of British Columbia Perspectives on Lands and Resources

A. Tahltan have Aboriginal Rights within Tahltan Territory.
B. The Tahltan Declaration was originally signed on October 18, 1910 and was re-affirmed by the Tahltan community on its 100th anniversary (October 18, 2010). This declaration clearly states Tahltan's view with respect to its Territory as follows, *"We claim the sovereign right to 01/ the country of our tribe-this country of ours which we have held intact from the encroachments of other tribes, from time immemorial, at the cost of our own blood. We have done this because our lives depended on our country. We have never treated with them, nor given them any such title. (We have only very lately learned the B. C. Government makes this claim and that it has for long considered as its property all the territories of the Indian Tribes in B.C.)."*
C. The position of the Province is that the lands, waters and resources of British Columbia, subject to certain private rights and interests, are Crown lands, waters and resources subject to the sovereignty of Her Majesty the Queen and the legislative jurisdiction of the Province of British Columbia.
D. Without prejudice to their differing views with regard to sovereignty, jurisdiction, title and ownership, the Province and Tahltan intend to work collaboratively and are committed to engaging across a spectrum of land and resource issues to reconcile interests and improve business relationships and their government-to-government relationships and to fulfill their respective legal obligations.

Provincial Interim Measures

Deferral Area

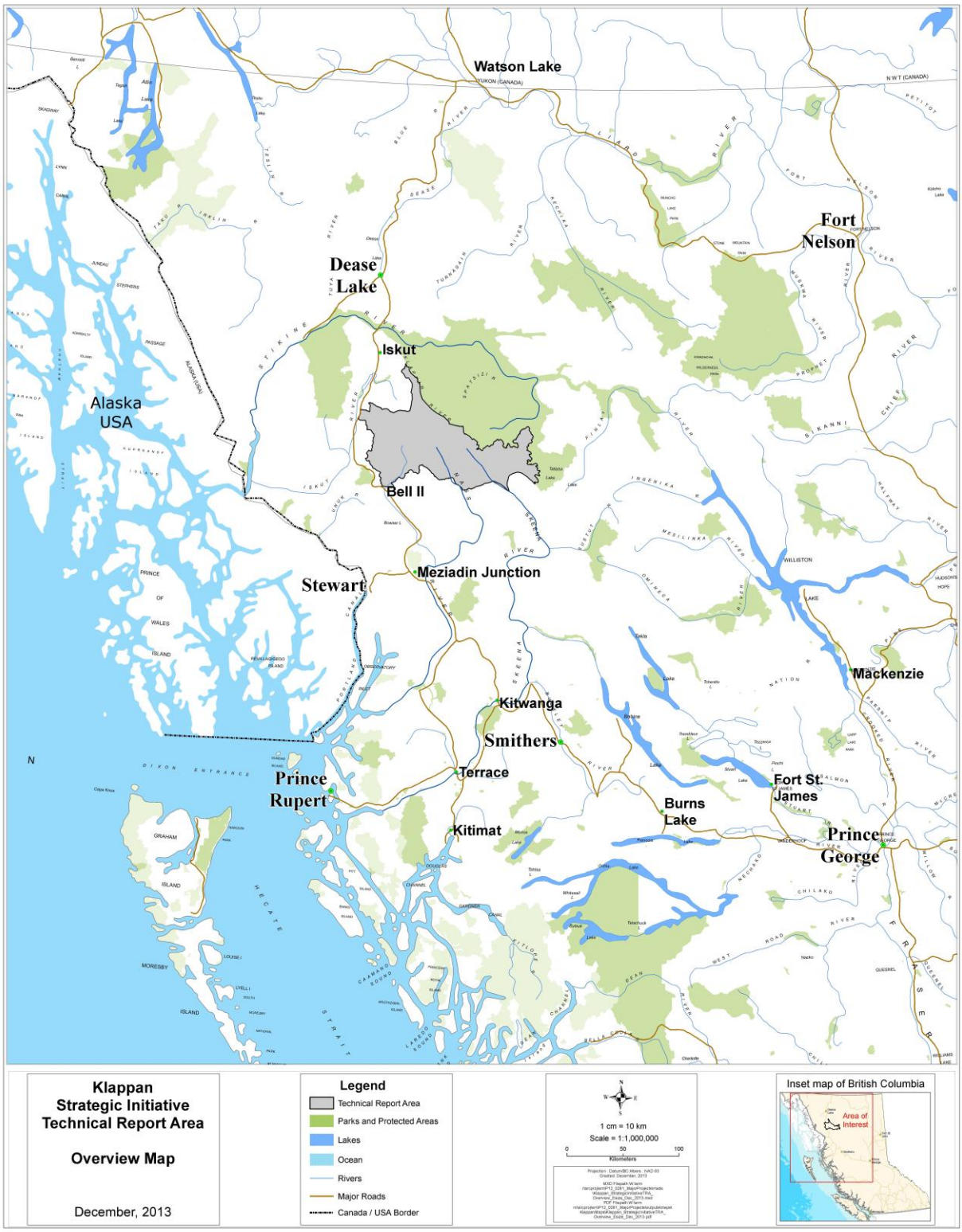
A temporary order has been issued under the Environment and *Land Use Act*, deferring decisions on permits and permit amendments on existing coal tenures in the Klappan until March 31, 2015, as well as on new coal tenures in the Klappan until December 1, 2015. The deferral area covers approximately 255 000 hectares and there are 62 coal licence applications affected. This deferral applies to pending applications only, and does not defer any of the active tenures in the area. The deferral will allow time for the KSI Technical Working Group to engage in discussions regarding strategic planning, without the pressures of legislative timelines and due processes, as they relate to coal licences.

The full press release can be viewed here:
http://www.newsroom.gov.bc.ca/2014/11/temporary-hold-on-coal-tenures-in-klappan-extended.html

Technical Report Area

The KSI Technical Report Area (TRA) covers 7 489 km^2 centred around the headwaters of the Nass, Stikine and Skeena Rivers. It is a remote area, 150 kilometres south-east of Dease Lake; rich in cultural and spiritual values, natural resources, biological and species diversity (Map 1).

Photo 1. Klappan Tall Grass. (Asp photo)



Map 1. Klappan Technical Report Area.

Tahltan History

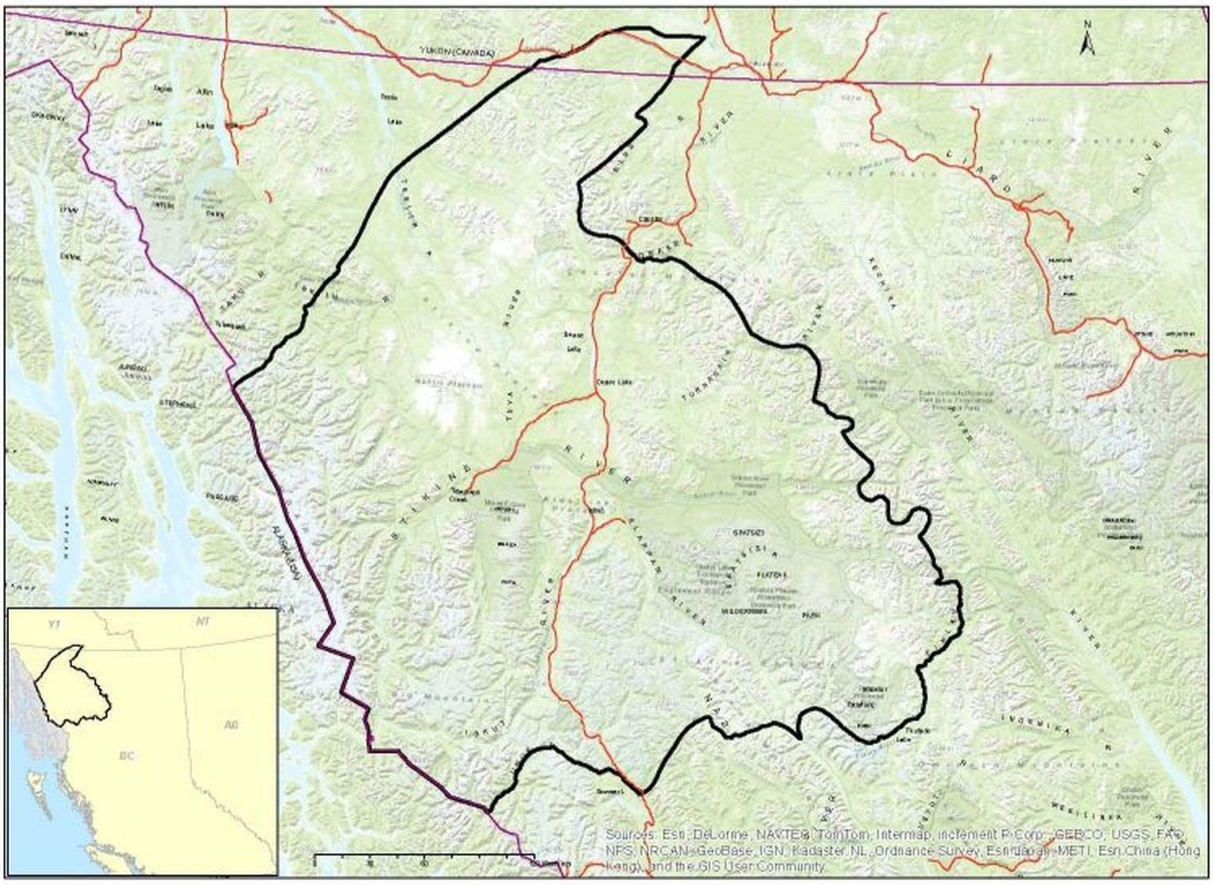
Tahltans declared sovereignty over all their lands in the Tahltan Declaration of 1910. The Tahltans who had the foresight to make this declaration stand as role models of sovereignty to the people today, and these principles and values still hold; that only Tahltan speak for Tahltan.

The following excerpt from this declaration is clear:

> "We, the undersigned members of the Tahltan tribe, speaking for ourselves, and our entire tribe, *Firstly* – We claim the sovereign right to all the country of our tribe—this country of ours which we have held intact from the encroachments of other tribes, from time immemorial, at the cost of our own blood. "

Photo 2. Nannock, Chief of the Tahltan, Signator of the 1910 declaration. (Teit Photo)

Tahltan territory encompasses approximately 94,500 km^2 (**Map 2**). The north and western borders run parallel to the Alaskan – Canadian border and include part of the Yukon Territory. The southern and eastern borders encompass the upper Nass tributaries and the western half of the Stikine plateau, and include the sacred headwaters of the Stikine, Nass and Skeena rivers. There are three Tahltan communities today; Luwe Chon (Iskut), Talh'ah (Dease Lake) and Tlegohin (Telegraph Creek). Much of Tahltan country remains essentially pristine wilderness, and the Klappan is a sacred and vital place within it.



Map 2. This map represents the general boundaries of the Tahltan territory based on the information available and reviewed of the date of its creation. It does not represent a definitive or final statement of the areas to which the Tahltan Aboriginal title and rights apply (Tahltan Central Council 1996).

Tahltan oral data provides a link to the voices of their ancestors; voices which have provided valuable and insightful knowledge of their sophisticated past. Their knowledge showed that Tahltans extensively used every inch of their territory, every resource provided by the land and that they did so with the utmost connection and respect for their land. Tahltan territory encompasses rugged wilderness; forests, mountains, canyons, glaciers and rushing rivers. Tahltan people inherited the skills to thrive in these landscapes, including the abilities to engineer and build bridges across steep and dangerous canyons. This land and these resources have shaped Tahltans and provided them with a high quality life.

Management Context

The Cassiar Iskut-Stikine Land and Resource Management Plan (CIS-LRMP) was completed between 1997 and 2000, and was a multi-stakeholder, consensus based planning process that included representatives from approximately 20 different organizations. At the time, the Province and the Tahltan established a Government-to-Government relationship which allowed the Tahltan to participate as a Government and not as a stakeholder. The CIS-LRMP was approved in October of 2000, and it included a special management zone for the Klappan. The Klappan was identified as a high-ranking area of interest by the Regional Protected Areas Team, noting that it was ecologically sensitive and provided high-value habitat for both grizzlies and ungulates. Due to these concerns, all commercial timber harvesting opportunities were deferred for 15 years, to allow time for these values to be properly studied. The LRMP also recognized that the Klappan was an area of high cultural significance for the Tahltan that needed to be maintained. Finally, it recognized the potential to develop long term coal projects, and provided general management direction for mining and access should it be developed, acknowledging that no development was expected in the near future. Management objectives and strategies were created to address each of the values mentioned in the LRMP document. The LRMP was intended to utilize adaptive management. where implementation of the plan was to be monitored and the plan updated eight years after approval (BC Government 2000, pgs. 1 and 151).

In 2007, a Tahltan-ILMB Joint Planning process was initiated in response to concerns from the Tahltan about the scope and pace of industrial development within their territory, and the Klappan in particular. It was intended to provide groundwork for future land use planning within the Klappan and included a methodology for assessing the impact of development on cultural and environmental values (Tahltan-ILMB Joint Planning Information Package). However, due to a variety of circumstances which altered the viability of the study, it was never published.

At the same time, Environmental Non-Government Organizations, along with the Klabona Keepers (a group of Tahltan: youth, elders, etc), were publically active in the Klappan and launched a campaign opposing Shell and their coal bed methane tenures in the area. In December of 2008, the Province declared a two year moratorium on oil and gas development in the Klappan, which was then extended to 2012. As a result of a series of discussions with the Province and the Tahltan, Shell agreed to voluntarily relinquish their tenures in exchange for a provincial tax credit. Furthermore, the Province of British Columbia agreed not to issue any future petroleum or natural-gas tenures in the area.

This agreement did not extend to the 95 existing coal licences, nor to the 62 pending coal licence applications. In the summer of 2013, a group of people which included some Tahltan citizens, engaged in a protest against Fortune Minerals and their exploration drilling related to the Environmental Assessment process for their proposed coal mine. Protesters blockaded the camps and seized the drill rigs. After discussing their options with the Province, Fortune

stepped back until 2014, "to allow the BC and Tahltan Governments the space they need to engage in a constructive mediation process that peacefully resolves the issues that have impacted work in and around our Arctos project site"(Fortune Minerals 2013).

Between April 2012 and March 2013, the Ministry of Forests, Lands and Natural Resource Operations (FLNRO) and the Ministry of Environment (MOE) completed the Northwest Cumulative Effects Demonstration Pilot Project for the Cassiar/Iskut and Upper Nass area. This was a demonstration project, intended to support the development of a provincial cumulative effects framework. It looked at current conditions of water quality and quantity, as well as moose, grizzly and fish habitats at a landscape level. Through modeling, it was determined, that access associated with new development had the highest potential to reduce the viability of the aforementioned values (MFLNRO & MOE 2013).

Meanwhile, in March of 2011 a Framework Agreement was signed between the province and the Tahltan outlining the basis for a Shared Decision Making Agreement regarding the utilization of lands and resources within the Klappan.

In an effort to resolve the land use issues in the Klappan, upon direction from Cabinet and under the British Columbia/Tahltan Shared Decision Making Agreement; an agreement was negotiated with the Tahltan to "look at options for the future of the Klappan and address the economic interests and values important to both the Tahltan and the Province" through the formation of the Klappan Strategic Initiative (KSI) (BC Min. Envir. 2013). The KSI terms of reference was signed by both parties on September 4, 2013, and established a government-to-government Technical Working Group (TWG). This group was charged with engaging with Tahltan and stakeholders, developing a technical report and exploring options around long term land use planning in the Klappan including protection.

Guiding Documents

The following documents were used to guide and inform the preparation of the technical report.

- Cumulative Effects Assessment & Monitoring Framework in Support of Integrated Natural Resource Decision Making – 2013
- Atlin-Taku Land Use Plan – 2011
- Tahltan-ILMB Joint Planning Information Package – 2008
- Cassiar Iskut-Stikine LRMP – 2000
- Tahltan Central Council Resource Development Policy – 1987
- Tahltan Land Stewardship plan
- Tahltan Knowledge Study – 1980
- Report of the Royal commission on the B.C. Railway - 1977
- 1910 Tahltan Declaration

Regional Area Description

At this time, the area surrounding the Klappan TRA includes the communities of Dease Lake, Telegraph Creek and Iskut. These communities provide basic amenities such as food services, accommodations, general stores and gas stations. In the 2006 Census, the population of these communities was estimated to be 865, in 2011 that estimate had dropped to 724. In addition to these communities, there are also a number of small settlements along Highway 37 and the Telegraph Creek road.

Both the local economies and the social fabric of these communities are tied to the natural resources within the region. The continued success of these communities and general quality-of-life can be significantly affected, both positively and negatively, by the development of major projects. Therefore project planning must make an effort to assess the impact that such activities will have on the surrounding communities. Development has the potential to inject cash into the local economy, both through the creation of local jobs and the purchase of goods and services. However, it can also put pressure on the community for things like housing, infrastructure (i.e. schools, hospitals and roads) and services. These pressures include the possible effect of an influx of transient workers, which could place a further strain on community infrastructure and general health.

One of the key cultural characteristics of this region is the strong attachment that most of the population has to the land: either as means to earn their livelihoods, a place to pursue recreational opportunities or where they have formed a spiritual connection (B.C. Gov. CIS LRMP 2000). The Klappan therefore provides for a variety of users, on many different levels.

Tahltan believe that Tahltan Territory is sacred, and that the Klappan is an intricate part of this sacred whole. “We are from this land” said Benny Frank (86), at the 1976 founding meeting of Tahltan central government in Telegraph Creek. The Territory has sustained Tahltan people from time immemorial, as has been documented by Tahltan ancestral oral data.

Summary of Values

The Klappan is a region that embodies many disparate values: it has a range of spiritual, social, economic and environmental values that are important to the Tahltan, the Province and to all the peoples living in B.C.. It is precisely because this area is considered so valuable, that it has become the source of much conflict, as interest groups argue over which values are more significant.

Photo 3. High elevation Buckbrush within the Klappan. (Asp photo)

Cultural Values

Tahltan Oral Data provides a link to the voices of their ancestors; voices which provide valuable and insightful knowledge of their sophisticated past. Their knowledge indicates that the Tahltan extensively utilized all areas of their territory, as well as every resource provided by the land; and that they did so with an incredible connection and with the utmost respect for their land. The land and resources provide a high quality life for Tahltans, and the Klappan was an intricate part of this system of Tahltan economics and lifeways.

Tahltan Oral Data provides a rich insight into Tahltan land use and lifestyle. It imparts a comprehension and appreciation of how the land equipped the people with a multitude of resources from which to prosper in their Territory.

An extensive cultural knowledge study was conducted in the 1980s by the Tahltan Central Council, and this information continues to be gathered. The information collected evidenced that the land provided, and continues to provide Tahltans with a means to make a good living and to thrive. The high elevation alpine landscapes, such as the Klappan, provided the primary subsistence resources. The high country landscape is rich with isbā (mountain goats), dediye (hoary marmot or groundhog) and khoh (grizzly bears). In this study, Dora Williams stated that: "*All they could get is what they get on the mountains.*" Mrs. Williams was speaking of a time when the moose and caribou were not as abundant and the resources from the mountains provided Tahltans with what the needed to survive.

More recently, when the Tahltan Elders were asked about these landscapes, their reply was "*look for goat, grizzly bear and groundhog habitat and you will find archaeology or evidence of past land use by our people right below this.*" When speaking with the Tahltan members who have worked on archaeology studies within the high elevation landscapes, this was precisely where obsidian and other archaeological data were located; thus demonstrating the elder's knowledge of high elevation land use and resources. The archaeological data, although yet to be radio-carbon dated in the Klappan, provides data of continuous human use and occupancy in Tahltan Territory.

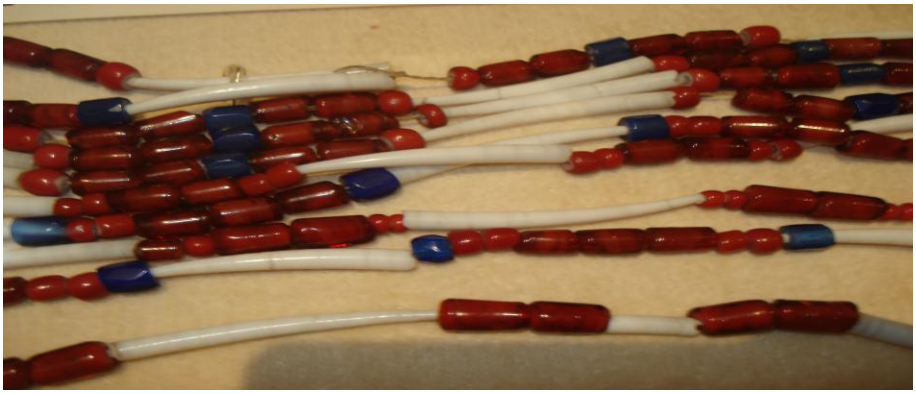


Photo 4. Tahltan Trade Beads, Museum of Anthropology UBC (Asp photo).

Tahltan know there is a continuum between the ancient, contact or historic times, contemporary times, and the future, because the continuum is in their blood (Figure 1). They are descended from those noble, brilliant and efficient peoples; and though it is an honour, it also carries a heavy responsibility to continue, especially when sovereignty, lifeways and land are pressured. They left Tahltan with a legacy of the systems of nationhood: Nation to Nation relations, language, spiritual beliefs, culture and values, governance, economics, education, justice and peace making, technology, land and resource management, cultivation and communications to name a few.

Figure 1. The Tahltan Continuum.

Each of these aspects of Tahltan usage are important, but it must also be recognized that together they support and nourish the continued vitality of Tahltan culture, including its practices, languages and knowledge transmission from elders to youth. The value of the Klappan to Tahltan is not simply hunting for food; it is the role the Klappan plays in ensuring the continuing cultural strength of the Tahltan Nation.

> Please note that Tahltan knowledge and perspectives have been integrated throughout the entirety of this report.

Tahltan Teaching and Tahltan Places

Tahltan have had systems of sovereignty from time immemorial. One such system that has stood the test of time is the system of passing on Tahltan knowledge. Tahltan know they are not the first to walk the Territory. They also know that it is because of the deliberate, conscience efforts of their Ancestors to pass on their story, their knowledge, and their skills that present-day Tahltan people are privileged to be provided for by their Territory. Today, the Klappan, and other places in the whole Territory, provide Tahltan people the resources and opportunity to continue to teach by doing and passing on many Tahltan cultural ways of knowing so that the land can continue to provide hunting, trapping, fishing, medicines, spiritual teachings and practices to Tahltan.

Archaeological Values

The Tahltan Archaeological Standards (2011) speak to the rich and great potential of the ancient and archaeology within Tahltan Territory. The archaeological record shows that obsidian, an extremely valued and tradable commodity in ancient times, has been traded and moved from its origins at Mt Edziza, over the past 10 000 years. Considering the size and scale of the Tahltan Territory, the amount of archaeological research that has been conducted provides little baseline archaeological data, and this holds true for the Klappan area as well. The research specific to the Klappan is in a preliminary phase of study and further fieldwork has the potential to provide much to the archaeological baseline for the Tahltan Territory.

Summary of Archaeological Research Results From Work Conducted on Klappan Mountain

Archaeological inventory work has been conducted on Klappan Mountain as a part of two impact assessments (Aresco 1986; Baseline 2008). A total of 31 archaeological sites were recorded in the Mount Klappan Region. A number of sites were recorded in the surrounding valleys, including 11 sites in the headwaters of the Klappan Rivers, at the base of Klappan Mountain. All of the archaeological sites recorded on Klappan Mountain were lithic scatters ranging from isolated finds to large surface scatters, many of which included a significant subsurface component. Additional site types were found in the Diden Creek valley, including cemeteries and cache pits.

During inventory and impact assessment work conducted in 2005 and 2006, a total of 3296 artifacts were collected (Baseline 2008). All of the artifacts collected were lithic objects. A comprehensive analysis of these materials was undertaken, and very little variation in raw material usage was noted, with 98.5% of the objects collected being fashioned from obsidian.

To determine where the obsidian was derived from, 11 different artifacts were subjected to X-ray fluorescence analysis at the SFU XRF Laboratory in Burnaby, B.C. (Baseline 2008). This analysis found that all of the samples were derived from obsidian flows on Mount Edziza, 100 km the northwest of Klappan Mountain. These results, combined with the high frequency of obsidian in the collections, revealed a definite connection existed between those who used Mount Edziza and those who used Klappan Mountain; these travel routes can be seen in Map

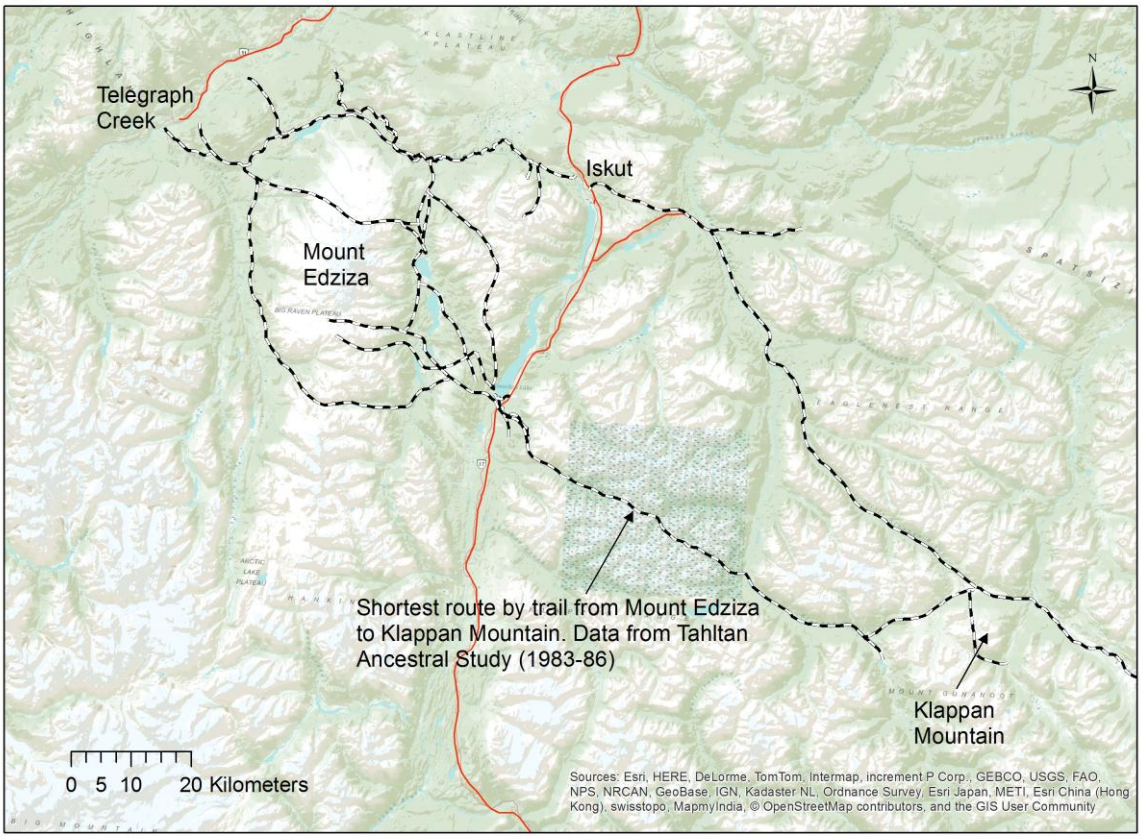
3**Error! Reference source not found.**. This relationship was the result of trade and travel. The depth of time during which this relationship occurred is unknown, as none of the archaeological sites considered here have been radiocarbon dated.

According to the report authors (Baseline 2008), the results of their analysis of materials from Klappan Mountain found that the patterns of sites on the landscape were comparable with the ethnographically documented seasonal rounds of the Tahltan:

> In mid-August families dispersed from the large village sites in the major river valleys to smaller seasonal camps in alpine areas. These camps were located near the heads of the many small tributary valleys of rivers such as the Tahltan, Klappan, and Mess Creek. Each extended family of about 25 people occupied a separate camp for a period of two to four weeks. From these camps located at timberline, at the ecotone between alpine meadows and subalpine forest, several kinds of resources were exploited. At this time of year, when several important resources were abundant and available at the same time, small work groups formed along sexual lines. Women and children were involved in snaring marmots, ground squirrels, and ptarmigan, as well as gathering large quantities of berries, during daily trips in the vicinity of the camp. Small groups of four to six men and boys made expeditions to hunt larger game animals such as sheep, goats, and caribou, in alpine areas where temporary camps of one to several days duration were made (Albright 1984:88).

Management Considerations

- *Mt Klappan archeological surveys and assessments are considered incomplete*



Map 3. Map showing select trails locations recorded during ethnographic interviews. The trails selected show routes between Mount Edziza and Klappan Mountain and are likely the routes by which obsidian was transported from the source on Edziza to the Klappan.

Economic Values

Northwestern B.C. is currently in the midst of an economic boom. Since 2000, coal and mineral exploration and development and subsequent mining and other resource development activities have increased substantially due to rising metal and energy prices (Tahltan-ILMB Joint Planning 2008). Some hydroelectric power generation projects are in development, and it is an area of high mineral and coal potential.

Presently, there are six major mine and energy projects that are under construction within the Iskut region. They are the Red Chris Mine (*Porphyry Copper, Gold*), three independent power producer run-of-river hydroelectric projects (Forrest Kerr, McLymont Creek and Volcano Creek), the Northwest Transmission Line (NTL) and the Iskut Extension. According to the Ministry of Jobs Toursim and Skills Training's quarterly report, the BC Major Projects Inventory, these identified projects have an estimated capital construction cost value of nearly $2.4 billion and will employ approximately 3,650 individuals during the construction period and may provide over 300 jobs during operation (BC Min. Jobs, Tour. Skills 2014).

At this time, the Galore Creek (*Gold, Silver, Copper*) proposal has obtained its Environmental Assessment (EA) certificate, but it has not started construction, additionally, there are five metal and coal mining projects in the region that are currently in the EA process. These projects and their corresponding mineral deposits are: Arctos (*Anthracite coal*), Bruce Jack (*Gold*), KSM (*Gold, Copper*), and the Schaft Creek mine (*Porphyry Copper-Gold*). The Groundhog (*Anthracite coal*), and the Turnagain (*Nickel*) mine proposals are currently in the advanced exploration stages, and the Kutcho Creek (*Copper, Zinc, Silver, Gold*) has removed itself from the EA process. These planned mine projects have a combined estimated capital construction cost value of over $16.1 billion and would create an estimated 9,400 jobs during the combined construction and operations phases.

Highway 37 is at the heart of this development, travelling a north-south axis through the northwest. Running parallel to the highway, the Northwest Transmission Line (NTL) is currently under construction, and it is expected to be completed in the summer of 2014. This 344-kilometre 287 kV transmission line will connect the Skeena substation near Terrace to a new substation built near Bob Quinn Lake. It is charged with bringing electrical power to communities and industrial projects along this corridor, as well as facilitating new development opportunities.The Iskut extension, running from the Bob Quinn substation to Tatogga Lake, is also being constructed, with an anticipated completion in the fall of 2014.

In addition to these major projects, there are other sectors of economic significance to the region. Guide-outfitting, resident angling, hunting, recreation, and adventure tourism all bring visitors to the area, providing both local and regional economic and employment benefits. The area's remoteness from major population centres is considered to enhance the remote wilderness experience, and makes the area an attractive destination for clients throughout the province,

across Canada and from around the world. As well, trapping is an ancient and commercial activity that continues to contribute to the local and regional economies.

It can be difficult for industrial and nature-based endeavours to co-exist. Without proper consideration during exploration, planning, and extraction, the social ecological values that nature-based activities depend upon can be lost. Industrial development in the Klappan has the potential to significantly impact these activities by increasing human activity levels that can alienate habitats, remove habitat or create barriers to migration by fragmenting the landscapes. Also, the development of new road access can result in increased hunting and fishing pressure. It is therefore critically important that land use decisions in the Klappan reflect and balance industrial usage, traditional use and non-industrial values, inclusive of consideration of key environmental values.

Tahltan Subsistance Economy

The entire Tahltan Territory has sustained Tahltans since time immemorial, with a complex and culturally sustainable economy. The Klappan area in particular, has provided a rich, complex and sophisticated means of subsistence, both materially and culturally. Tahltans rely on these subsistence lifeways, both as a means of providing their traditional diet, and perpetuating their culture from generation to generation. This subsistence economy remains highly valued by the Tahltans: for of the provision of Tahltan foods, the continuation of related cultural activities and as a buffer against the ups and downs of the money economy.

The Tahltan subsistence economy, or food harvested from the land is integral to the family well-being as it supports a healthy lifestyle as well as displaces food that would otherwise be purchased, creating savings for Tahltan families. The high cost of store bought foods, trucked in from far away poses food security issues for traditional, subsistance economies, which can only be offset by the provision of locally available traditional foods. Given the socio-economic profile of the communities in the territory, this savings can make a measurable contribution to household economic and social stability and serves as a time tested buffer against the fluctuations of the money economy. Wild food is also shared, traded and bartered between families and neighboring Nations, enabling harvesters expanded access to food sources and, again, saving the costs of store bought foods. Continued exercise of subsistence economic activities is also critical to the growth and survival of Tahltan culture.

However, in a land use planning context such as the KSI, value comparisons of the competing subsistance and monetary economic land uses are made. This can be problematic because current economic land uses are most often described in terms of their dollar value as part of the feasibility assessment process, while subsistance activities are valuated both in terms of their monetary value, and in terms of their cultural and spiritual value. Thus, since the subsistence economy is an entire process of living, it cannot be readily assessed and analyzed by cost-benefit and supply and demand analyses. (Bista 1974) It is also important to note that a secondary complication in the valuation of these economies is a temporal one. The current monetary land uses typically have a finite period of return on the scale of decades, and are typically consumptive whereas the subsistance economy has an infinite period of return occurring on the millennial scale and relies on sustainable harvesting to ensure the perpetual availability of resources.

To the Tahltan, the economic value of the Klappan includes far more than the market value of the natural resources it contains. The Klappan supports a strong local subsistence economy that has direct economic and cultural value to the Tahltan people. In an unpublished Tahltan study, it was determined that a high level of reliance on traditional food stuffs harvested within the territory, including the Klappan, is a distinctive feature of Tahltan culture.

Continued exercise of subsistence economic activities is also critical to the growth and survival of Tahltan culture. As stated elsewhere in this report the Klappan is much more than a place; it is the source for life and continuance of Tahltan.

Coal and Mineral Exploration and Mining

In 2002, the province of B.C. introduced a two zone land use system, whereby all land outside of legislated Protected Areas is available for mineral exploration and development. This system is intended to provide certainty to developers for reasonable access to land within British Columbia. It clearly establishes that mineral exploration and development may be considered anywhere, subject to all applicable laws, except in a park, ecological reserve, protected heritage property or an area where mining has been prohibited under the *Environment and Land Use Act*. Under its legislation, the two zones are defined as follows:

Mineral Zone: Land open to mineral and coal exploration, tenure acquisition and mine development, including suitable access required to undertake these activities, subject to appropriate legislation

Protected Zone: Crown land closed to mineral development through either legislation or order-in-council, as identified in Section 14(5) (a) through (c) of the *Mineral Tenure Act*.

Although available for mineral and coal exploration and development, mineral zone lands may include many different designations: special, general or enhanced resource management zones; old growth management areas; riparian management zones; wildlife habitat areas; forest ecosystem networks; access management areas; wildlife management areas; and wilderness areas.

History of Coal Exploration in the Klappan

Observations and exploration for coal in the Skeena Mountains began in the late 1800s and led to increased exploration activity between 1903 and 1912. Exploration activities included intensive prospecting, surveying, trenching and drifting on coal exposures. In 1948, Buckham and Latour, of the Geological Survey of Canada, conducted mapping and data collection in the area, and they documented 192 coal occurrences (Buckham 1950). Further exploration activities were limited, and continued until roughly 1970. From the late 1970s through to the early 1980s, renewed exploration interests were investigated by several companies: Gulf Canada, Esso Minerals, Imperial Metals Corp., Suncor Resources Inc., Groundhog Coal Ltd., Skeena Metals, Petro Canada and BP Canada.

Gulf Canada conducted the longest and most regional examination. They were focusing on the Mount Klappan Project in the 1980s, including the Lost Fox, Summit and Hobbit-Broach sites. In total, Gulf drilled over 24 860 metres of diamond drilling in 159 holes, 1517 metres of rotary drilling in 23 holes, 1669 metres of hand trenching, 2047 metres of mechanical trenching, detailed geological mapping, 64 measured sections and two exploration audits (Gulf Canada 1988). The majority of this work was focused on the Lost-Fox area. A 119 000 tonne bulk sample was mined from the I-seam in an open pit at Lost Ridge over the winter of 1986. It was processed at an on-site temporary wash-plant along with a smaller bulk sample (21 000 tonnes) from a pit opened the previous winter at the Hobbit-Broach prospect. 80 000 tonnes of anthracite was produced and shipped in 1986 (B.C. Min Ener., Mines & Pet. Res. 1989). In the 1990s, Gulf completed several iterations of preliminary assessments, pre-feasibility and feasibility studies on the project. Over 20 years, Gulf Canada spent about $65 million in the Mount Klappan area.

Conoco acquired Gulf Canada's property through an acquisition in 2001. Fortune Minerals Limited acquired the property in July 2002 from Conoco, and reported new resource figures based on the earlier work by Gulf Canada Properties Limited (Fortune Minerals Ltd 2002). In July 2004, Fortune contracted Marston Canada to prepare a feasibility study for production of anthracite from the Lost-Fox area based on exploration data from the Gulf Canada projects of the 1980s.

Over the past decade coal related exploration has increased in the Klappan, due to high commodity prices and the prospective deposits within the area (Tahltan-ILMB Joint Planning 2008). There has also been considerable interest in coalbed methane development, and Shell Canada drilled several coalbed gas exploration wells in the Klappan area in 2004. However as of October 2012, the provincial government has committed to not issuing any further petroleum or natural-gas tenures within the Klappan.

The Arctos Anthracite Joint Venture (Arctos) is the most advanced coal project in the Klappan. It is a joint venture between Fortune Minerals and POSCAN (the Canadian subsidiary of POSCO). Arctos is currently in the pre-application stage of the Environmental Assessment process. The other notable development in the region is Atrum's Groundhog Project, which is

located 60 kilometres south of Arctos. Atrum is ramping up their exploration activities to include a bulk sampling program in 2014. The proposed Arctos and Groundhog mines could provide the province with substantial benefits if successful in their regulatory approval processes. The benefits from these mining operations are based on preliminary financial-economic analyses, therefore due to market conditions, end results can vary.

Table 1 and Table 2 show the current status of coal licences and coal licence applications within the Klappan TRA as of April 2014. A temporary Coal Licence Deferral Area Order has been issued for 2014, and will expire in December. This deferral will allow time for the KSI technical working group to engage in discussions regarding strategic planning, without the pressures of legislative timelines and due processes as they relate to coal licences. This applies to pending applications only, and does not affect any of the active tenures in the area.

Table 1. Coal Licences in the Klappan TRA

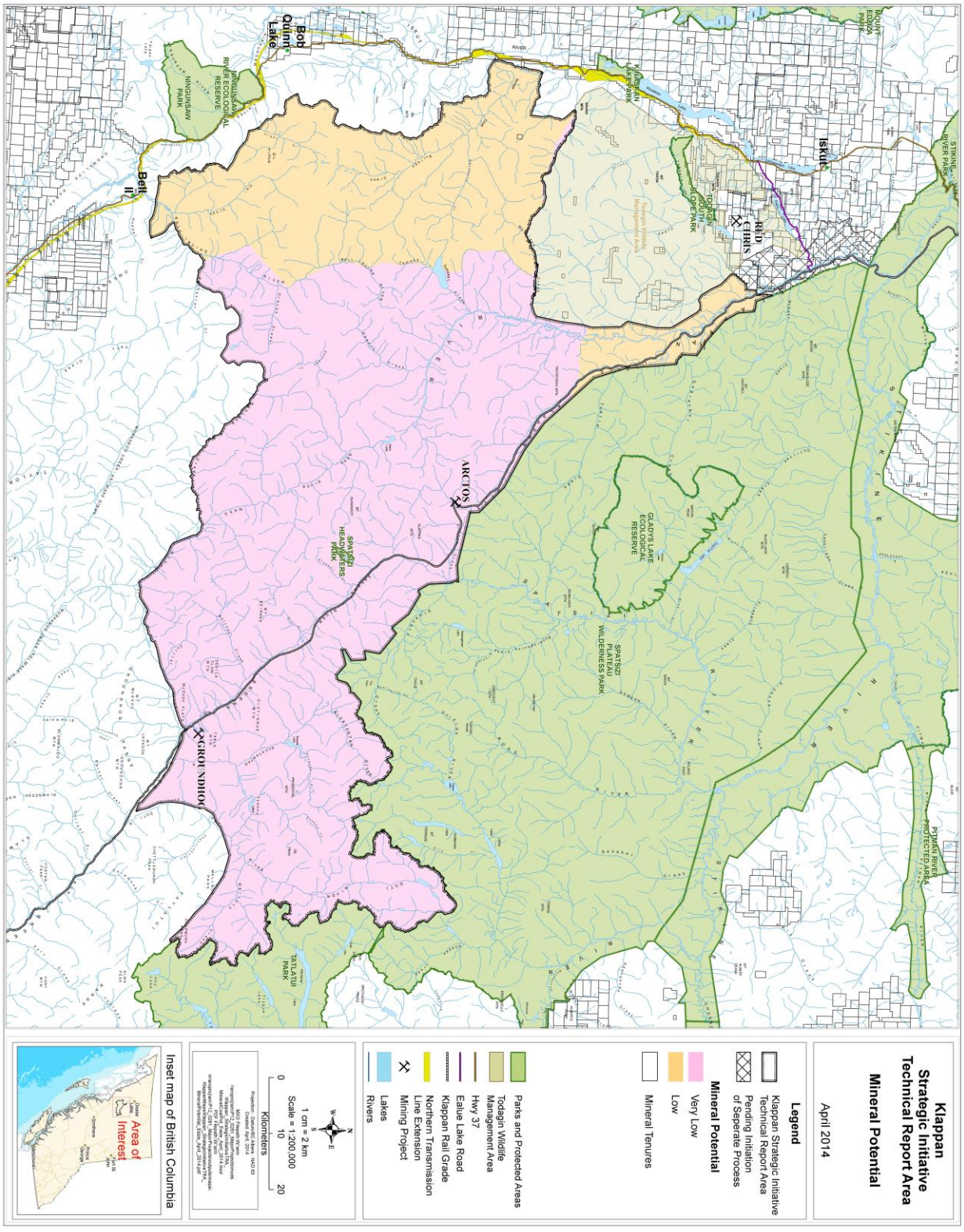
Company Name	Number of Licences
Panorama Coal Corp.	18
Atrum Coal Groundhog Inc.	18
Fortune Coal Limited	61
Total	**97**

Table 2. Coal Licence Applications in the Klappan TRA

Company Name	Number of Applications
Marino Specogna	1
Canadian Dehua International Mines Group Inc	57
Atrum Coal Groundhog Inc.	15
Panstone Mines and Minerals Inc.	9
Clive Brooks	6
Richsource Energy Limited	1
Pacific North Resources Limited	11
Delta North Energy Resources Ltd.	19
Total	**119**

Mineral Resources

Mineral potential maps have been generated for the entire province of British Columbia, with the most recent mapping completed in 2003. These maps show precious and base metal mineral potential based on 1:50 000 scale geological mapping as well as regional geochemical and geophysical surveys. It is acknowledged as technology and demand associated with mineral resources changes over time, as too may the mineral potential. The primary objective of the mineral potential mapping is to identify the most, and the least economically prospective areas for regional and sub-regional land-use planning (Kilby 1995). The precious and base metal mineral resource potential in the Klappan TRA is considered to be low. Map 4 has been included to show while there are lots of mineral prospects in the Stikine Arch, the area surrounding the Klappan, there is very negligible potential for precious and base metals within the Boswer Basin (Klappan) due to unfavorable host rock types for precious and mineral base metals. In contrast, the rock types surrounding the Bowser Basin are favorable hosts to precious and base metals, and are actively being evaluated, as depicted by the existing mineral claims.



Map 4. Precious and Base Mineral Potential in the Klappan.

Coalbed Methane

The presence of, and associated value of coalbed methane, is correlated to the coal potential of an area. The retention of methane within coal deposits depends upon the depth (pressure), temperature, coal composition and water saturation. The adsorption capacity of coal initially expands with depth and increasing coal ranking. However as coal moves deeper underground, the increasing temperatures outweigh the higher pressures, and eventually adsorption capacity decreases with increasing depth. Anthracite coal is better at retaining gas at low pressures and shallow depths, which means less expensive drilling and development costs. The Groundhog coalfield contains a potential coalbed-methane resource of 230 billion m^3, although the recoverable reserve would be significantly less. While this coalbed-methane resource seems relatively large, the complex structure could make recovery difficult and the potential for development is lower than in other areas of B.C. (Ryan 1993)

It should be noted that as of October 2012 the Province has committed to not issuing any further petroleum or natural-gas tenures within the Klappan.

Coal Resources

Coal is formed from the remains of non-marine vegetation buried millions of years ago and subjected to tremendous heat and pressure in a process called coalification. It is primarily composed of carbon and the quality varies from deposit to deposit. Deposit characteristics depend upon the types of vegetation the coal originated from, as well as the temperatures, pressures and duration at which those conditions persisted on the deposit. Coals are classified according to their constituent plant materials (Coal Type), degree of metamorphism as shown by the ratio of fixed carbon content to volatile matter (Rank), and the amount of impurities such as ash and sulphur present (Grade) (Collins Dictionary definition). Figure 2 shows the four main coal types: anthracite, bituminous, sub-bituminous and lignite.

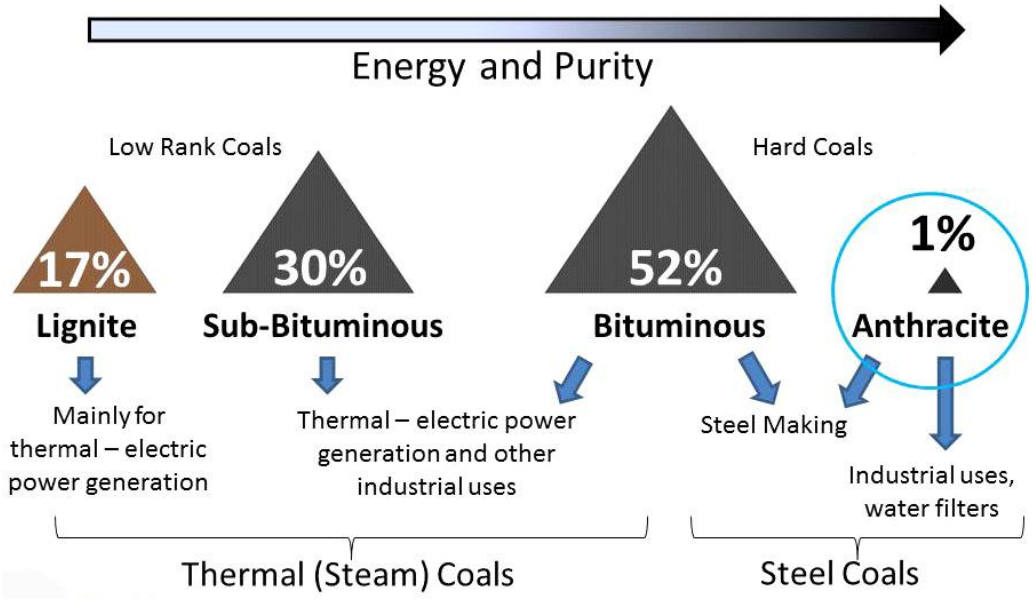


Figure 2. Varieties, Usages and Relative Global Abundance of Coal.

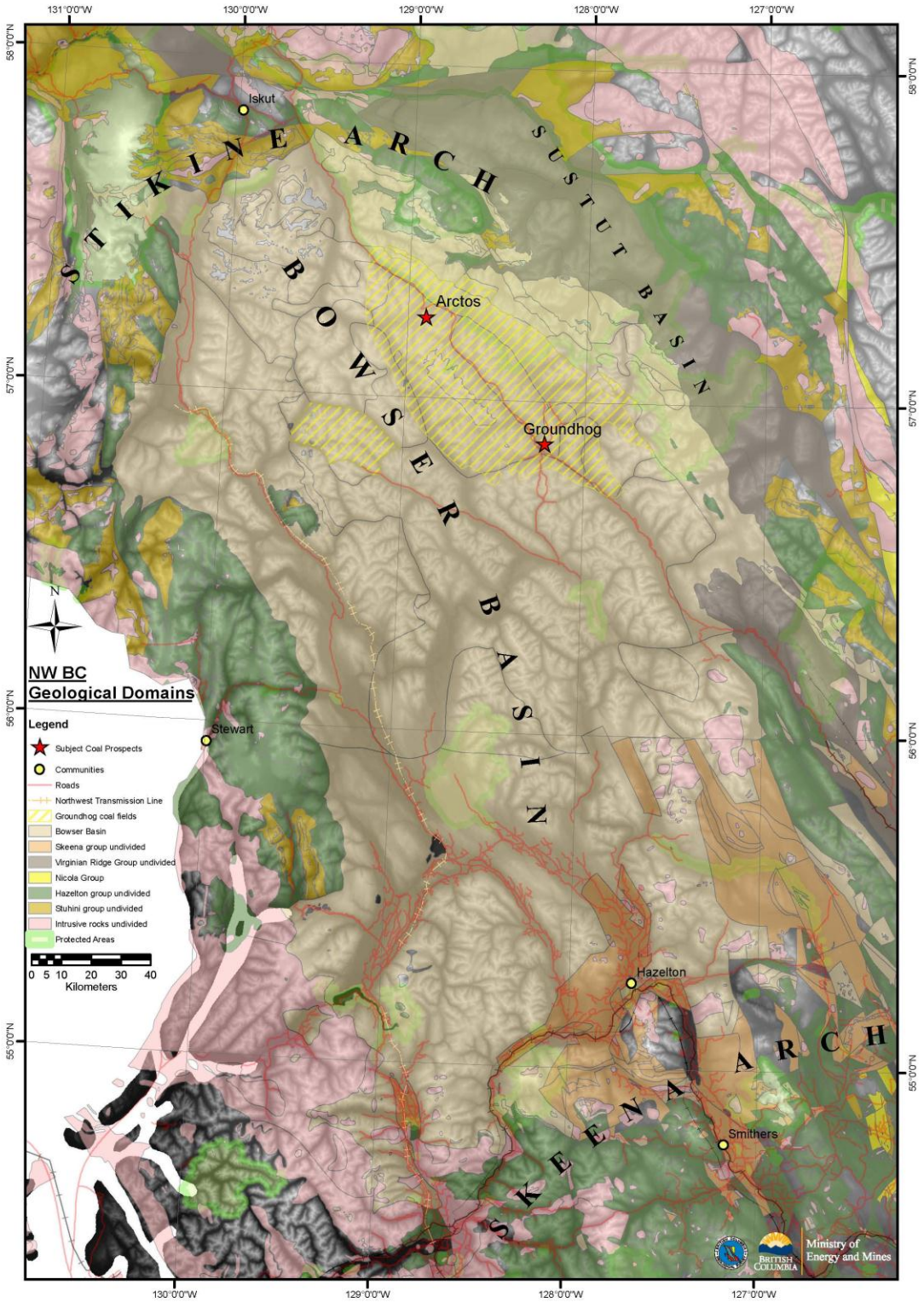
Coal is the world's most plentiful fossil fuel, and it is found in various concentrations and grades around the globe. Canada currently holds 8.7 billion tonnes of proved resources of coal-in-place: which are the resources in known deposits that have been carefully measured and assessed, ninety percent of this is located in the western provinces. Of the total proven coal reserves, 6.6 billion tonnes are deemed recoverable, using existing technology under current and expected local economic conditions (NRCan 2014). In 2011, Canada exported approximately 33.6 million tonnes (Mt) of coal, of which, 27.6 Mt was steel-making metallurgical coal. The majority of B.C.'s coal exports were sent to Asia, with small percentages travelling to Europe, US and the Middle East. In 2012, sixty percent of all of B.C.'s mining revenue came from coal, which amounted to approximately $4.6 billion (NR Can 2014).

Anthracite coal deposits are rare and account for 1% of global coal reserves. Due to its high calorific values, or heat capacity, anthracite is considered the highest rank of coal. When burned, it provides the greatest amount of heat per unit, with lower emissions relative to other types of coal. The major market for anthracite is as PCI (pulverized coal injection) coal product, used to increase the efficiency of steel-making. Anthracite coal can also be used for a variety of metallurgical, thermal, water purification and composite products, ranging from water filters and urea fertilizers, to barbeque briquettes.

The major coalfields in B.C. follow the northwest belt of Jurassic to Cretaceous age rocks, paralleling the Rocky Mountain foothills. Canada's only known anthracite resources are located in northwestern B.C.'s Bowser Basin. The Bowser Lake Group (Map 5) is a Middle Jurassic to Lower Cretaceous sedimentary sequence sourced from the northeast and in-fills the area between the Stikine Arch and the Skeena Arch. It consists of nine different sedimentary rock packages, or assemblages; of which five are known to be coal bearing and three of those five are deltaic facies containing high ranking anthracite coal. Exploration interests in all coal bearing stratigraphy of the Bowser Lake Group have been renewed due to the advancement of existing coal projects in the region.

The Groundhog-Gunanoot Assemblage lies almost entirely within the Klappan TRA and is the only known anthracite deposit in Canada. The coalfield is a 30 by 80 kilometre oblong area extending southeastwards from the headwaters of the Klappan and Little Klappan rivers down to Groundhog Mountain in the Skeena Ranges. The coal-bearing sequences of the Groundhog coalfield reach approximately 1100 metres in thickness, with 33 identified coal horizons up to 12 metres thick. Coal seams are interbedded with various sedimentary rocks consisting of mudstone, siltstone and sandstone.

There are nine rock packages (lithofacies assemblages) within the Bowser basin as mapped by Carol Evenchick in 2002 and applied to the Coal Potential Mapping presented in Map 6. The most prospective assemblages for coal include the Groundhog- Gunnanoot, Skelhorne and Jenkins Creek. Detailed descriptions of the five coal-bearing assemblages can be found in Appendix 3. The coal potential in the Klappan is high, as can be seen in Map 6, shows the trends in coal prices for the various rankings of coal, and Table 3 shows the estimated resource of indicated and inferred coal deposits within the Klappan TRA. The differences in resource categories are determined by Canadian Institute of Mining (CIM Canada) or Joint Ore Reserves Committee (JORC Australia) standards. Measured, Indicated and Inferred are estimates calculated with decreasing levels of confidence as defined by CIM and JORC. The Reserves on the other hand, demonstrate either *Proven* or *Probable* minable resources that have been defined in a feasibility study (Britton 2014).



Map 5. Bowser Basin

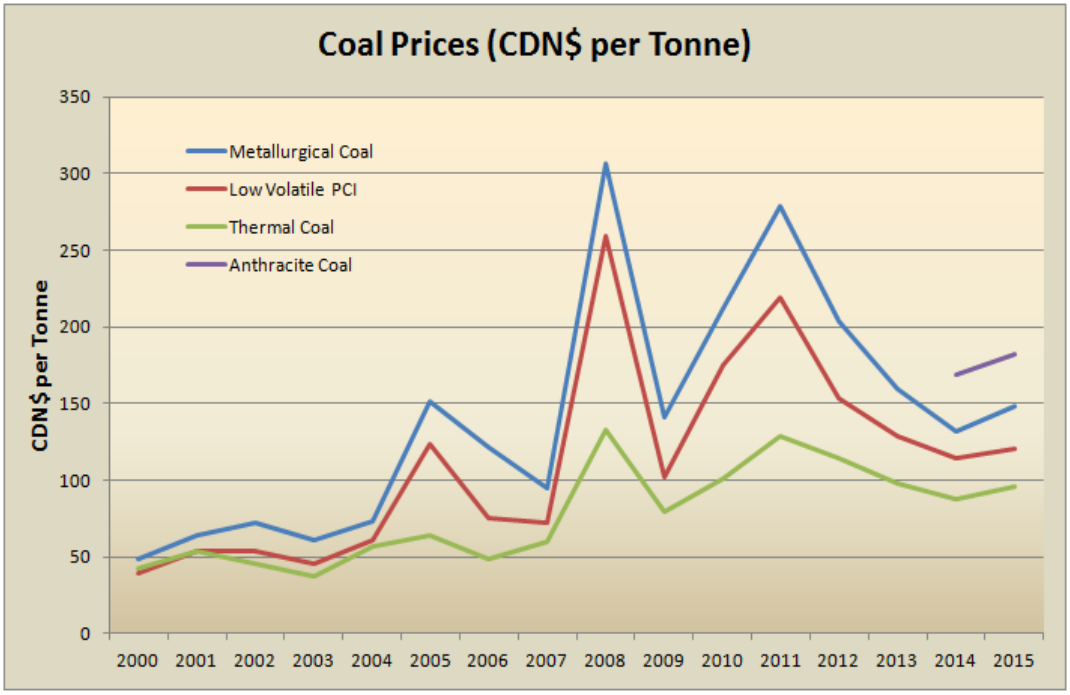


Figure 3. Average prices of all coal types mined in B.C. (Includes Anthracite price forecasts based on research completed by the Wood Mackenzie consulting group

Table 3. Klappan Area Coal Resources and Approximate Values

Company	Project Name	Deposit Name	Resource Category	Resource Amount (Millions of Tonnes)	Coal Type	~Value per tonne (Jan 2014)	Estimated in-ground Value
Fortune Minerals	Arctos	Lost Fox	Reserve	124.9	Anthracite		
			In Current Mine Plan	75	Anthracite	$ 145.00	$ 10.9 billion *In-ground value. Does not take into account any of the mining costs.
		Hobbit Broach	Indicated	13.5	Anthracite		*Cannot put a value on these as they are estimates only
		Hobbit Broach	Inferred	258.4	Anthracite		
		Summit	Inferred	9.6	Anthracite		
Atrum	Groundhog	Groundhog	Measured	13	Anthracite		
		Groundhog	Indicated	553	Anthracite		
		Groundhog	Inferred	998	Anthracite		

How Mineral Reserves are Quantified

Probable Mineral Reserve

A Probable Mineral Reserve is the economically mineable part of an Indicated and, in some circumstances, a Measured Mineral Resource demonstrated by at least a Preliminary Feasibility Study. This Study must include adequate information on mining, processing, metallurgical, economic, and other relevant factors that demonstrate, at the time of reporting, that economic extraction can be justified.

Proven Mineral Reserve

A Proven Mineral Reserve is the economically mineable part of a Measured Mineral Resource demonstrated by at least a Preliminary Feasibility Study. This Study must include adequate information on mining, processing, metallurgical, economic, and other relevant factors that demonstrate, at the time of reporting, that economic extraction is justified.

Inferred Mineral Resource

An Inferred Mineral Resource is that part of a Mineral Resource for which quantity and grade or quality can be estimated on the basis of geological evidence and limited sampling and reasonably assumed, but not verified, geological and grade continuity. The estimate is based on limited information and sampling gathered through appropriate techniques from locations such as outcrops, trenches, pits, workings and drill holes.

Indicated Mineral Resource

An Indicated Mineral Resource is that part of a Mineral Resource for which quantity, grade or quality, densities, shape and physical characteristics, can all be estimated with a level of confidence sufficient to allow the appropriate application of technical and economic parameters to support mine planning and evaluation of the economic viability of the deposit. The estimate is based on detailed and reliable exploration and testing information gathered through appropriate techniques from locations such as outcrops, trenches, pits, workings and drill holes that are spaced closely enough for geological and grade continuity to be reasonably assumed.

Measured Mineral Resource

A Measured Mineral Resource is that part of a Mineral Resource for which quantity, grade or quality, densities, shape, and physical characteristics are so well established that they can be estimated with confidence sufficient to allow the appropriate application of technical and economic parameters, to support production planning and evaluation of the economic viability of the deposit. The estimate is based on detailed and reliable exploration, sampling and testing information gathered through appropriate techniques from locations such as outcrops, trenches, pits, workings and drill holes that are spaced closely enough to confirm both geological and grade continuity.

Processing and Mining

The process of coal mining includes multiple industrial activities including: the stripping of overburden; the removal and processing of coal seams; and the storage of waste rock and tailings. All mining operations produce tailings of some sort, as by definition tailings are: "the residues separated out in the preparation of various products" (Merriam-Webster 2014). However there is a significant difference between tailings generated from metal mining versus the tailings produced from coal mining. The residue generated by coal mines consists primarily of water and any additives, silt and sand sediment, very fine unrecovered coal and any impurities located within. The important distinguishing factor in coal mine tailings is the lower dependence, if any, of chemical reagents. The primary reagent here is water, as opposed to the abundant chemical reagents used to separate metallic minerals in metal mines. To separate coal from inter-layered sediments, crushed rock is washed with water and separated using screens and gravity. The wash water is recycled and stored in sedimentation ponds to prevent silty water from entering the surrounding environment, and these ponds remain after mine closure. Waste rock consists of sandstone, siltstone, as well as argillaceous varieties of these, all of which can be replaced into the mine area upon completion of mining. A 1993 study of the Bowser Basin coalfields identified the sulphur content of the coal seams as low and the sulphur as organic, not pyritic, suggesting that acid rock drainage from coal mining would not likely be a problem (Ryan 1993).

Photo 5. Open pit mining operations at Trend Mine (Tumbler Ridge)

Proposed Projects

Fortune Minerals Arctos Anthracite

The Arctos Anthracite Project (Arctos) is a proposed anthracite coal mine in northwestern British Columbia. The site is about 90 kilometres southeast of Iskut, 160 kilometres northeast of Stewart and 240 kilometres north of Hazelton. Arctos is owned by the Arctos Anthracite Joint Venture (AAJV) as an unincorporated joint venture of Fortune Coal Limited and POSCAN Klappan Coal Limited. The AAJV has 61 contiguous coal licences located on Crown land on and around the north side of Mount Klappan. The proposed mine is anticipated to produce 3 million tonnes per year of clean anthracite coal over a mine life of approximately 25 years. The final, end-of-mine areal extent of the open pit mine and other mine infrastructure disturbances is expected to be about 4,000 hectares. The proposed mine plan includes backfilling portions of the open pit with mined rock concurrently with on-going operations and to engage in progressive reclamation as sites become available (Arctos 2014). As part of this project, AAJV also proposes to finish 147 km of partially built rail line between the proposed mine and Minaret, where the existing CN rail line terminates. Completion of this rail line will enable Arctos to tie into the existing CN rail line for transport of coal to Ridley Terminals in Prince Rupert, B.C., as well as to supply the mine with equipment and other necessary materials. Both project components, the proposed mine and completion of the rail line, require review under the *British Columbia Environmental Assessment Act* (BCEAA) and *Canadian Environmental Assessment Act* (CEAA). Because the two Project components are interdependent and cannot proceed without each other, a single environmental assessment under both the CEAA and BCEAA is being conducted (Arctos 2014).

Photo 6. Overview of Arctos Anthracite project area

Atrum Coal – Groundhog Project

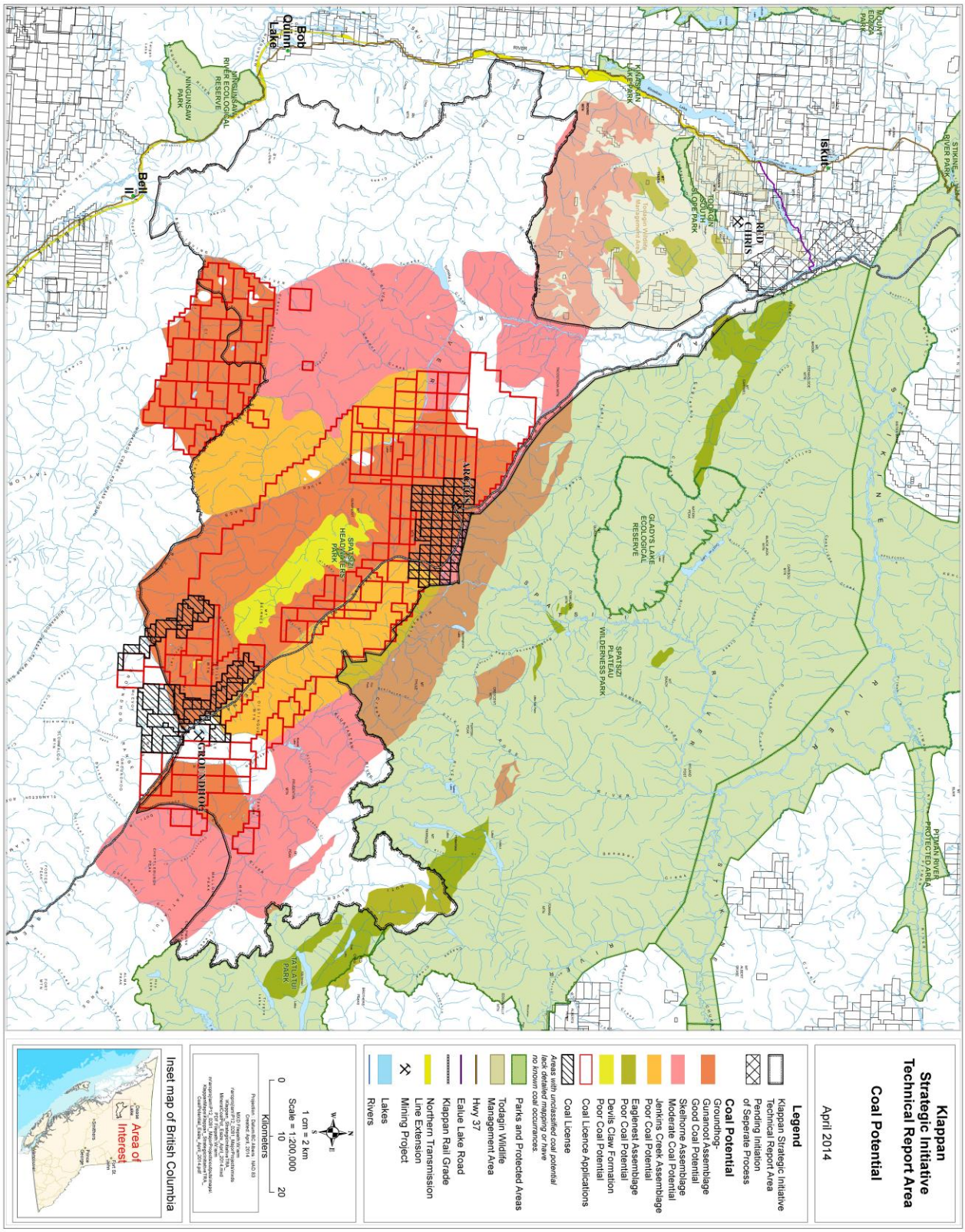
The other proposed coal project in the region is owned by Atrum Coal. Located approximately 60 kilometres southeast of the Arctos Anthracite Project, Atrum Coal has been evaluating coal resources at the Groundhog deposit. Multiple thick, near surface, flat lying, continuous, high ranking anthracite coal seams have been identified and a pre-feasibility study is underway. Atrum has completed a definition drilling program, which was aimed at achieving a more complete picture of reserve definition and to acquire material for advanced material testing, including bulk sampling. An updated JORC (Joint Ore Reserves Committee) compliant resource estimate, which incorporates both historical and 2012 drilling results, increased the measured plus indicated resources up to 569 million tones, with additional inferred resources totaling 998 million tonnes. This was using cut-off parameters of 0.3 m coal thickness and 100 m setbacks from rivers. A scoping study released in August focuses on the northwest zone and a 1.8 million tonnes per year run-of-mine operation. Atrum Coal is currently planning a 10,000 tonne bulk sample, as well as off-take agreements and environmental baseline monitoring. They plan to transport the coal samples by truck to Stewart Bulk Terminals, where storage and shipping arrangements have been made. They have recently acquired another 11 coal licence applications, as well as 4 more coal licences. Therefore they now have 22 licences and 15 applications for a total area of 38 369 hectares (Atrum 2014).

Management Considerations

- *The Klappan TRA contains a rare and significant quantity of high quality anthracite coal, if developed it would generate significant economic benefits*
- *Access management needs to be considered for acceptable endeavours/projects within and beyond the Klappan TRA*
- *Coalbed methane reserves are to be managed consistent with other resource reserves*

Information Gaps

- *The coal in the Klappan TRA has limited exploration and resulting quantification*



Map 6. Coal Potential in the Klappan.

Fishing

Salmon and steelhead are vital economic components of the Skeena and North Coast regions of B.C.. The Skeena drainage supports very strong salmon fishing opportunities and world class steelhead angling. Skeena salmon and steelhead sport fishing is estimated to generate revenues of $16.5 million, and about 70% of fishing lodge clients and guides return every year. The total direct, indirect and induced economic impact of the sport fishery is approximately $52.8 million (Counterpoint 2008).

In the commercial global markets, Skeena salmon have a world class reputation for being a quality product. Between 2004 and 2007, the average annual commercial harvest of Skeena bound salmon was 967,533. The commercial harvesting and processing of Skeena salmon is estimated to generate revenues of $14.1 million annually, with the total economic impact for the Skeena salmon commercial fishery estimated at $15.2 million (Counterpoint 2008).

There are approximately 8 First Nations within the Skeena drainage who utilize salmon for food, social and ceremonial purposes. Between 2002 and 2006, the average annual First Nations harvest of Skeena salmonids was estimated at 225 000 pieces. In addition, the economic and market fisheries on escapement that is surplus to spawning requirements has averaged about 200 000 pieces over the long term (Counterpoint 2008).

The 2003-2012 average annual Canadian commercial and assessment catches of Stikine salmon are: 7 525 Chinook, 55 447 sockeye and 3 268 coho. Within the same term, the average annual Tahltan First Nation salmon harvests were 897 Chinook and 5 390 sockeye (TTC 2013).

In terms of these fishing derived economies, there are no commercial fisheries within the Klappan TRA. Most sport fishing activities, whether guided or not, occur in other areas of the three river drainages. However, fish production of migrating species within the TRA does contribute to the overall downstream fish productivity and associated fishing economies. Thus, industrial development within the TRA could have significant effects upon both the downstream environment and fish productivity.

Management Considerations

- *Possible downstream effects of development on commercial, sport and aboriginal fisheries*

Guide Outfitting

Guide outfitting has long been a key economic activity for the local communities, providing both local and regional economic and employment opportunities. The Tahltan people have been foundational in the development of the thriving, multi-generational business of guide outfitting that draws international clients. Hunting, fishing and trapping formed the material basis of Tahltan economies, social lives and cosmologies (Peyton 2011). Historically, Tahltan hunters have been characterized within the hunting industry as experts, particularly so during the Klondike era where their knowledge of the territory and game within it, facilitated the origins of the market hunting trade. The evolution of that professional hunter role through the generations, has today firmly established the Tahltan as owners, operators, guides, and assistant guides for other companies. Thus, the Tahltan method of providing for their families, utilizing the knowledge and skills from their Ancestors, naturally grew into the international business of outfitting. Guide outfitters cater predominantly to non-resident hunters and destination tourists wanting a chance to hunt big game. The longevity and success of guide outfitters within the Tahltan territory and specifically the Klappan, speaks to the quality of the area as a big-game hunting destinations in North America.

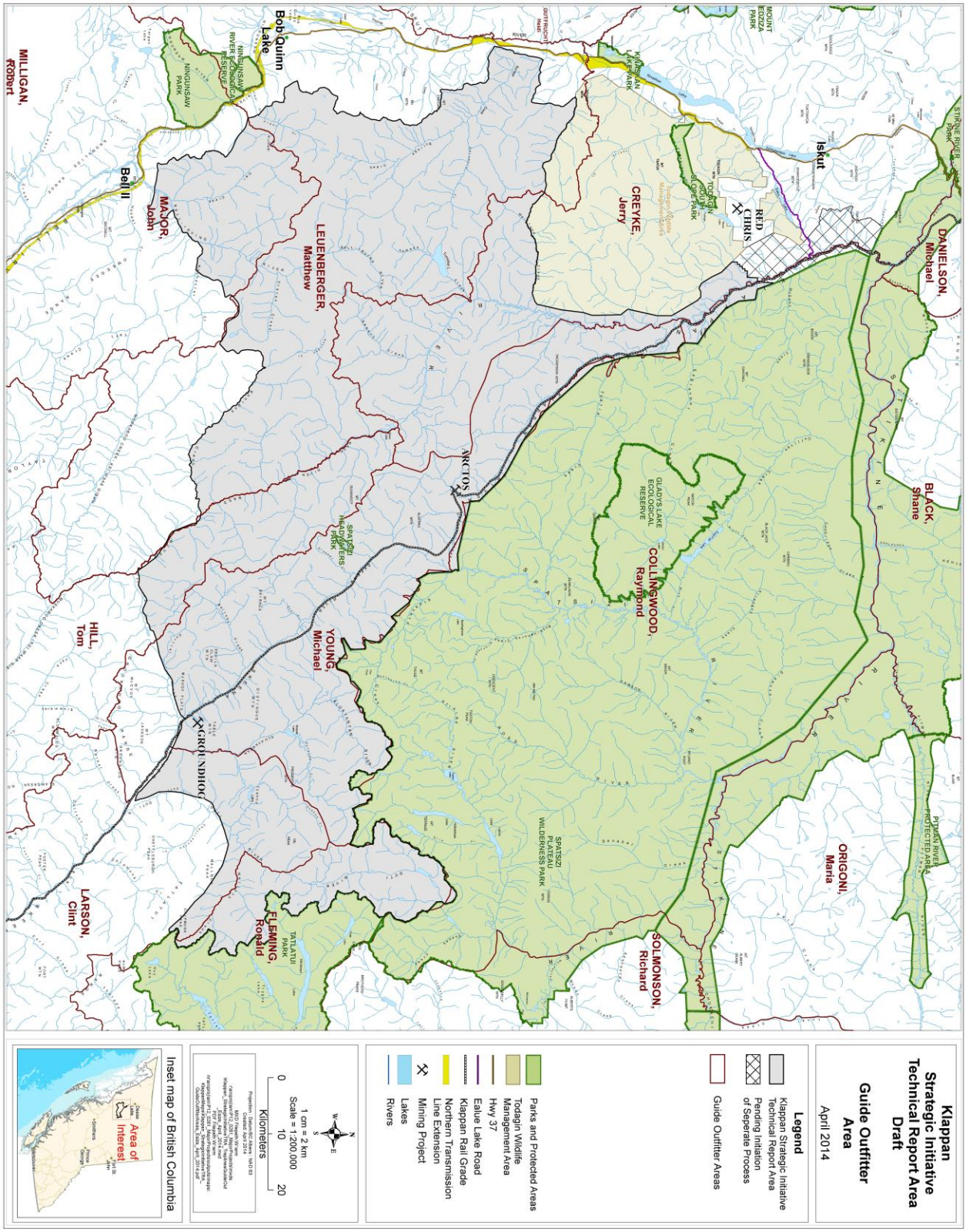
As shown in Table 4, there are currently eight guide outfitters with tenures that overlap the TRA. These long-standing commercial enterprises are dependent upon the efficient management of healthy wildlife populations such as Stone's sheep, mountain goat, moose, grizzly bear, black bear, wolf and caribou; and upon their ability to provide clients with a positive wilderness experience. Outfitters also provide clients with non-consumptive services such as wildlife viewing, and photography

Table 4. Guide outfitters within the Klappan

Guide Outfitter	Total Tenure Area (ha)	Tenure Area in TRA (ha)	% of Tenure within TRA	Tenure as a % of TRA
COLLINGWOOD, Raymond	769 517	7 550	1%	1%
CREYKE, Jerry	641 139	100 191	16%	13%
FLEMING, Ronald	314 834	44 514	14%	6%
HILL, Tom	327 934	55 849	17%	7%
LARSON, Clint	935 333	44 986	5%	6%
LEUENBERGER, Matthew	460 029	227 424	49%	30%
MAJOR, John	366 133	49 847	14%	7%
YOUNG, Michael	242 982	218 460	90%	29%

Management Considerations

- *Identify locations of guide outfitting territories and potential conflicts (temporal and spatial) when resource planning or permitting resource development.*
- *Major projects should provide an assessment of the implications of resource development on guide outfitting and wildlife abundance and distribution.*
- *In terms of global significance, 99% of the world's population of Stone's sheep and approximately 50% of the world's population of mountain goats occur in British Columbia. The existence of these unique species of wildlife in British Columbia and within the TRA, supports a global responsibility for the sustainable management of those species and the economic opportunities that sound management approaches provide.*



Map 7. Guide Outfitting Territories in the TRA.

Timber Values

The B.C. Ministry of Forests, Lands and Natural Resource Operations (MFLNRO) regularly reviews the timber supply for all timber supply areas (TSA) and tree farm licences (TFL) in the province. This review examines the impacts of current forest management practices on timber supply, the economy, the environment and the social conditions within the local area and the province. Based on this review the chief forester determines a new annual allowable cut (AAC), which is the permitted rate of timber harvest within the Timber Harvesting Land Base (THLB), expressed in terms of cubic metres of wood per year.

Of the 13 million hectares in the Cassiar TSA, only 210 686 hectares, or 1.6%,[1] is available for harvesting as the THLB. The THLB is determined by first removing all non-contributing parks, alpine tundra and any identified non-forested areas from the landbase. Then all recreation sites, certain wildlife habitat areas and other areas considered unsuitable for harvest such as inaccessible areas, low value stands, and steep terrain are also removed. Whatever area remains is considered the THLB.

Currently, the AAC for the Cassiar TSA is set at 305 000 m^3/year, and this has been partitioned into three geographically-defined areas: Iskut/Boundary (120 000 m^3/year), Dease-Liard (153 000 m^3/year), and Atlin (32 000 m^3/year). Over the past decade, harvesting levels have rarely exceeded 10% of the total AAC.

New AAC calculations for the Cassiar have been prepared and are currently being reviewed. It is anticipated that the chief forester will release the new AAC determination in the summer of 2014. The Minister of FLNRO may subsequently apportion the AAC to the various forms of agreement that may be issued under the *Forest Act* in consideration of government objectives for the area, the timber quality, existing commitments and other relevant information. Currently, the Minister has apportioned the full Iskut/Boundary AAC to one non-replaceable 10-year, 120 000 m^3/year forest licence (FLA64561), issued to the Cassiar Forest Corporation. This licence expires in 2017.

The 237 000 hectare Klappan Resource Management Zone (RMZ), which comprises the greater and little Klappan drainages largely falls within the Klappan TRA. It has approximately 74 000 ha of forested landbase. Of this, 43% is in spruce-leading stands, 8% in pine-leading stands, 38% in subalpine fir-leading stands, and 11% in deciduous-leading stands. Approximately 13 000 hectares of the forested landbase is in the THLB, and is primarily located along the Little Klappan River, with portions along the Klappan River between its confluences with the Little Klappan and Stikine Rivers.

A 15 year deferral of commercial timber harvesting was instituted by the 2000 Cassiar Iskut-Stikine LRMP within the greater Klappan drainage. The intent of the deferral was to provide time to study high ecological values, such as low elevation winter habitat for ungulates and

[1] Source: September 2013 *Cassiar Timber Supply Area Timber Supply Review Data Package*

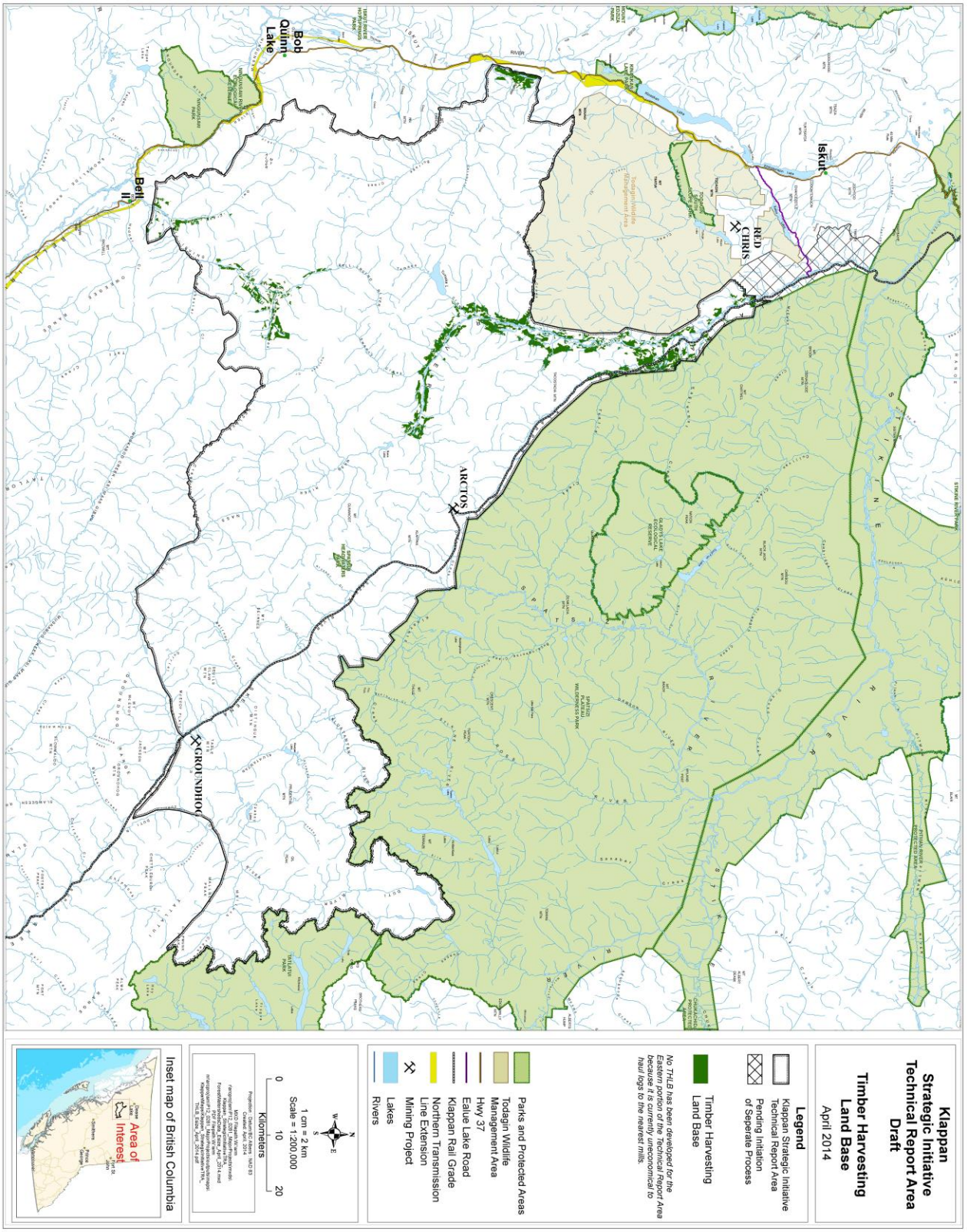
grizzly in the Spatsizi predator-prey ecosystem, and time to assess the effectiveness of LRMP objectives and strategies. However, the LRMP t has been only partially implemented, and it has not been updated. While this deferral terminates in 2015, the Klappan RMZ is located in the Iskut/Boundary area, and due to the 15 year harvest deferral, the THLB within the Klappan RMZ was not permitted to contribute to the current Iskut/Boundary AAC determination. The degree to which the chief forester will consider the contribution of Klappan RMZ THLB in determining a new AAC for the Iskut/Boundary area is presently uncertain. The Tahltan communities have recommended this area be removed from the THLB and not contribute to the available annual timber volume.

The forest industry does not play a significant role in the Cassiar economy. Although there are some small, portable mils that occasionally supply lumber for local project use, there are currently no major processing facilities within Cassiar TSA, and most harvested timber is either processed outside of the TSA or is exported out of B.C.

Opportunities for commercial forestry within the Klappan are limited due the small THLB area, the lack of roads into the area, the distance to markets and the inclement climate. There is a possible opportunity for this timber to support a small, local industry, such as the portable sawmills. Therefore, some factors that must be considered are: the spatial or temporal impacts of competing resource uses, the cumulative effects of these uses, and downslope or downstream implications.

Managements Considerations

- *Consider avoiding areas of high cultural or environmental values*
- *Consider aligning with other resource deferrals in the Klappan*
- *Consider seasonal timing to avoid vulnerable periods for wildlife, sensitive periods for fish and to minimize soil and water impacts.*
- *Visual quality of an area and the impact it will have on the outdoor recreational experience.*



Map 8. Timber Harvesting Land Base

Tourism

The majority of the Cassiar region is blanketed by remote wilderness areas, scenic vistas, rivers, lakes and abundant wildlife. That, together with the rich culture of local First Nation and the dynamic pioneer history, attracts visitors from around the world. They come to enjoy the excellent back-country recreation opportunities and the local, nature-based tourism industry. The bulk of this tourism activity occurs in the summer months, with a smaller volume arriving in the winter to take advantage of the amazing back-country skiing opportunities. Due to access constraints, and a lack of infrastructure available to the public within the Klappan, these tourism and recreation opportunities largely occur as back-country activities. Commercial back-country tourism plays a valuable role in the both the regional and provincial economy.

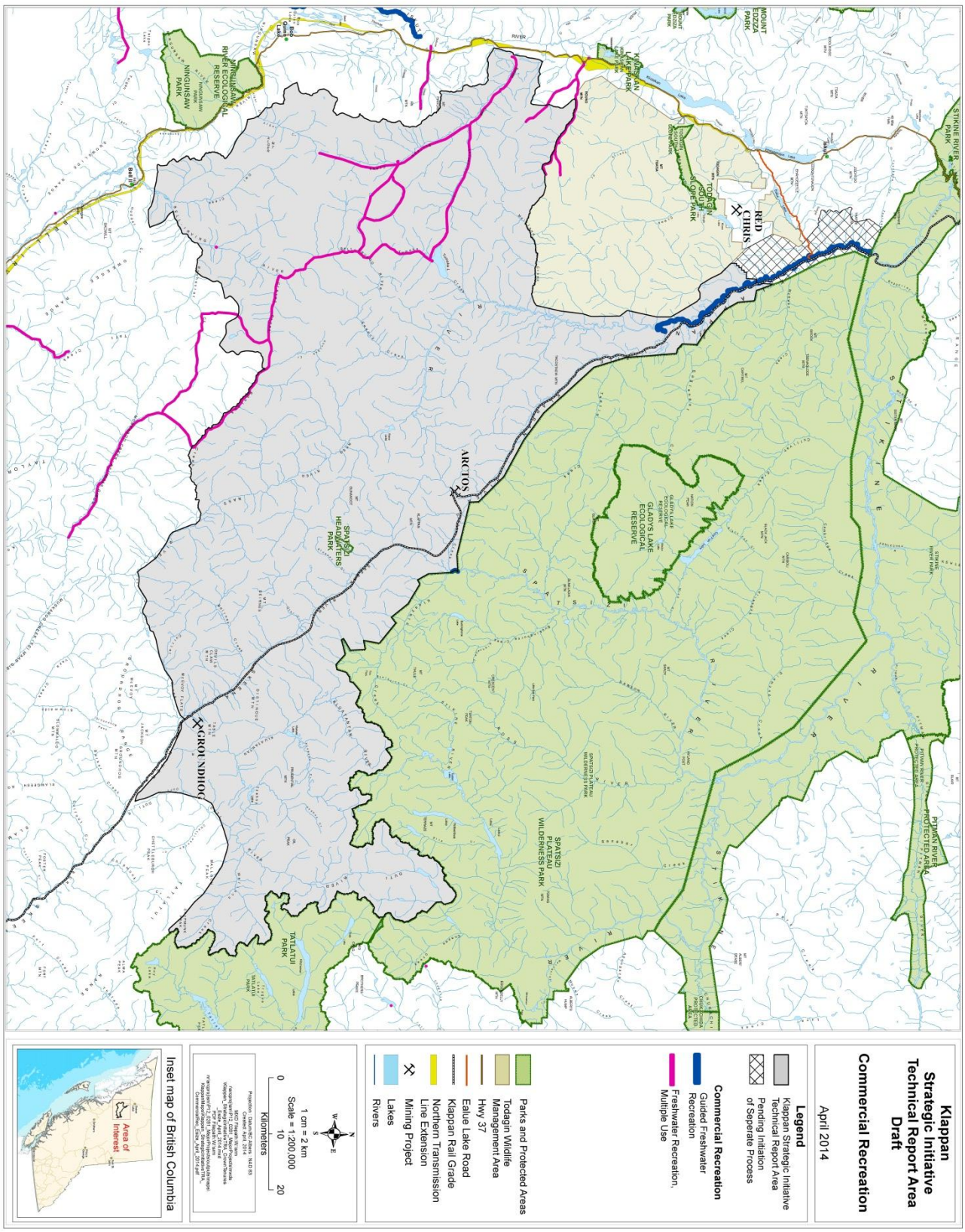
The Klappan is located between two internationally renowned parks and a wildlife management area of provincial significance. The Spatsizi Plateau Wilderness Park, Mount Edziza Park and the Todagin Wildlife Management Area (WMA), furnish the area with both spectacular scenery, as well as a rich and diverse range of fish and wildlife species. Spatsizi Plateau Wilderness Park is the second largest park in B.C., with more than 650 000 hectares. It boasts over 160 kilometres of trails, with a historic guiding camp available for the public at Cold Fish Lake. However, neither the Spatsizi nor the Edziza parks are readily accessible, with access primarily by plane, helicopter, packhorse or trekker. Similarly, due to its ruggedness, and despite its proximity to the highway corridor, the Todagin WMA often hosts only the most ardent hikers and hunters.

As can be seen on Map 9, within the TRA, there are a number of parks, recreational sites and trails, with either roaded or non-roaded access. These sites provide opportunities for hiking, paddling, biking, wildlife viewings and back-country horse trips. Consequently, the visual quality along these travel corridors is highly valued. Commercially however, the Klappan has limited adventure tourism opportunities compared to the rest of the Cassiar. There is one heli-ski operation overlapping the southwestern corner of the TRA, and some guided freshwater rafting operations.

The backcountry tourism sector depends upon secure access to Crown land as well as the maintenance of land and resource quality. Planners need to be aware that development tends to have a cumulative effect upon backcountry tourism. As the volume of activities increase, impacts may increase proportionally.

Management Considerations

- *Managing access to 4-wheel use into peatlands and alpine areas*
- *Identify possible areas for resource overlap when planning, including access, camp sites, and visual quality.*
- *Maintain current recreational access points, such as for Dideene Portage, Eaglenest Trail and Mcewan Creek Trailhead.*
- *The backcountry tourism sector depends upon secure access to Crown land as well as the maintenance of land and resource quality. As the volume of activities increase, impacts may increase proportionally.*



Map 9. Commercial Recreation Tenures and Parks.

Trapping

Trapping has been an ancient activity for the Tahltan people for generations, and as such, it has important cultural, and at times economic, significance. Historically the Tahltans trapped all of the furbearing species using snares or constructing complex deadfall traps. These activities were supported by an extensive web of camping sites linked by Tahltan trails. Marten, fisher, mink, lynx, river otter, coyotes, fox, wolves and especially beaver, were the main species trapped, and they traded these with the Russians, Americans and other First Nations, while also supplying furs to the European fur trade. These activities still play an important role as part of their culture, and the Tahltan continue to be sustained by the land.

Considerable portions of 9 trapping territories overlap the Klappan TRA (Table 5**Error! Reference source not found.**). However the number of trappers actively using these territories is much more difficult to determine. This is due to the fact that some of the lines may currently be inactive, or because each territory may have several registered users who are actively trapping but who do not process those furs through the provincial fur sales. As well, if they have permission from the registered trapline holder, any number of assistant trappers may also be using the area.

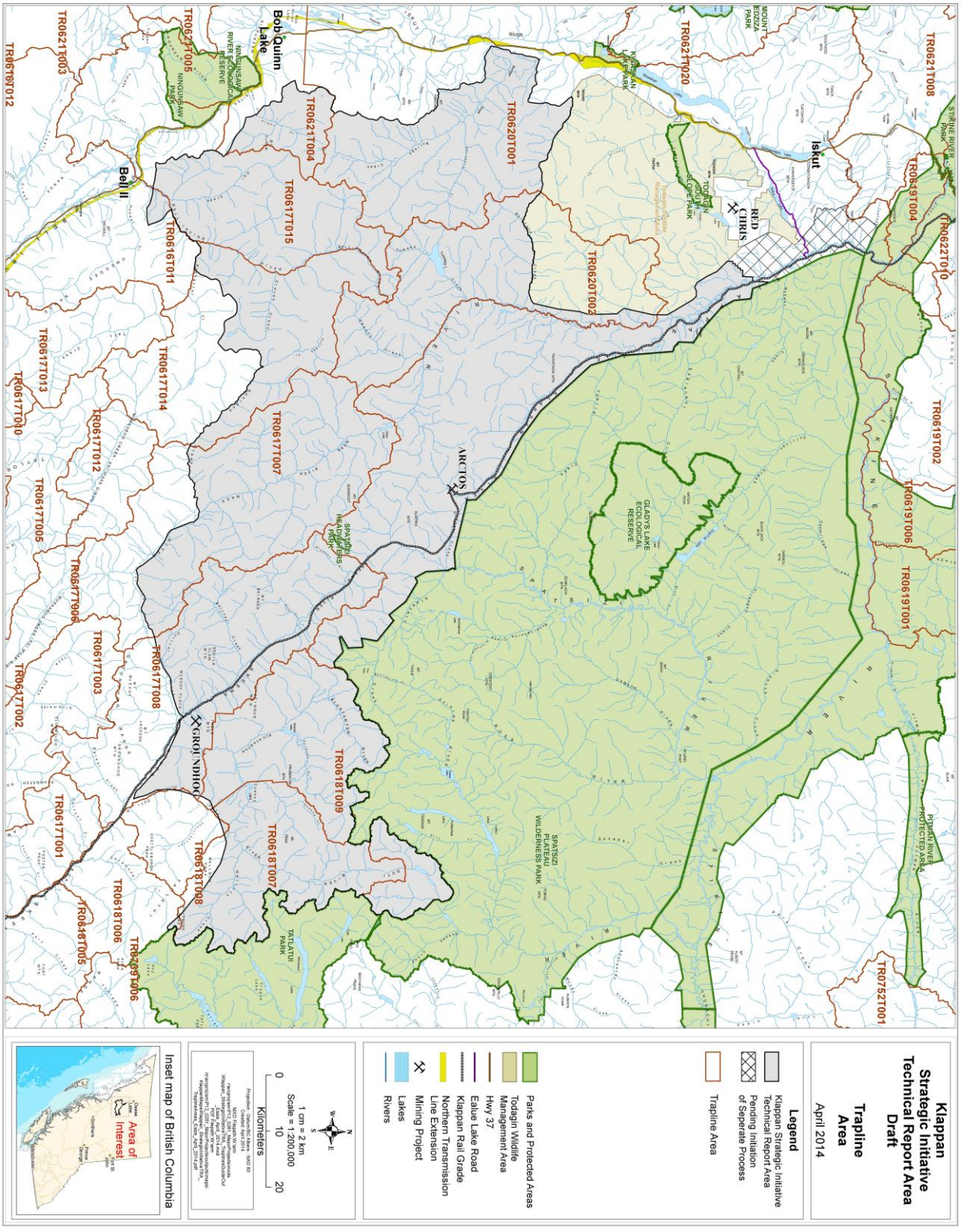
According to the B.C. Fur Harvest data, trapping levels have declined significantly in the last decade. With regards to this data, marten has been the most heavily trapped species, with weasels and squirrels coming in a distant second. Trappers are only required to report their fur harvest when they sell the furs, so if furs are kept for personal use, there little data available to complete a harvest summary. An exception can be for licenced hunters and trappers, where a compulsory reporting requirement exists for certain species, such as wolverines taken in Region 6, if the fur is to be sold or traded.

Table 5. Traplines within the Klappan

Trapline	Tenure Area (ha)	Tenure in TRA (ha)	% of Tenure in TRA	Tenure as a % of TRA
TR0617T007	132 000	96 856	73%	13%
TR0617T008	117 465	80 095	68%	11%
TR0617T014	99 817	53 972	54%	7%
TR0617T015	105 518	61 581	58%	8%
TR0618T007	62 696	58 817	94%	8%
TR0618T008	20 779	313	2%	0%
TR0618T009	62 952	62 554	99%	8%
TR0620T001	2 330 993	247 619	11%	33%
TR0620T002	101 313	68 002	67%	9%
TR0621T004	60 376	16 999	28%	2%

Management Considerations

- *Identify locations of trapping territories and potential conflicts (temporal and spatial) when resource planning or permitting resource development.*
- *Resource development should provide an assessment of the implications of the development that considers habitat supply, forest succession/seral stage distribution and linkages/fragmentation, and temporal disturbance.*



Map 10. Tenured Traplines in the Klappan.

Regional Infrastructure

The 2000 LRMP document identified insufficient infrastructure as one of the key constraints preventing economic development in the region. The three greatest disadvantages were listed as: primary reliance on diesel-generated electricity, little communication infrastructure, and current highway conditions. Since then, significant changes have been made on all three areas.

Highway 37

Highway 37 is a 727 kilometre, two-lane highway, travelling north from the Highway 16 Junction at Kitwanga, all the way to Watson Lake, Yukon.

According to the CIS-LRMP, in 2000, Highway 37 was a combination of asphalt, seal-coating and gravel, and was considered a significant hindrance to effective transportation systems along the route. An upgrade of the highway was considered necessary to improve opportunities for resource development, local manufacturing and tourism. The Highway 37 North Corridor Strategy was created to address these issues. Its primary goal was to provide a safe, well-maintained, two-lane, hard-surface transportation corridor within 15 years.

As of 2014, the highway is now paved or seal-coated for its entire length, with the exception of a 1km stretch on the Stikine Hill. It provides the Cassiar area with a vital link to the rest of the province, as there is no rail travel to the region, and air traffic is limited. Highway 37 is currently the dominant route for the transportation of goods and people, and all resource development is dependent upon it. If the road is closed due to events such as rockslides or avalanches, the region can only be accessed through the Alaska Highway in the Yukon, significantly increasing travel distances. Some residents have indicated they are uncomfortable with the current volume of industrial traffic on the highway, feeling that it is unsafe at times. They have a greater concern for their safety in the winter, when winter conditions prevail.

Due to the development of major projects in the area, there is potential for a greater volume of heavier vehicles using the highway. In response to this, the Ministry of Transportation and Infrastructure (MOTI) has recently published a Traffic Assessment Report, which includes an analysis of increased industrial traffic along the northwest corridor and the potential impacts to a variety of values. With respect to the highway corridor, the assessment illustrates: an analysis of collision frequency and severity; impacts to wildlife movements and mortality; and as impacts to fish and aquatic habitat. The assessment report has incorporated input from local, provincial and federal government agencies, as well as various First Nations. One of the conclusions of the report indicates that, while localized issues may arise, MOTI feels that the traffic capacity exists to accommodate these vehicles (MOTI 2014).

Also, in 2013 MOTI formed Highway 37-37A working group comprised of First Nations, local government, industry and other stakeholders, to address issues and ideas specific to the highway. MOTI facilitates quarterly meeting with the group and it is a forum to gather information and input for future investment decisions.

MOTI has invested more than $80 million along the Highway 37 corridor in the past 10 years, and will continue to invest in and maintain the highway network for the benefit of all users, while recognizing that safety is of paramount importance.

Ealue Lake Road

This road provides access to the Klappan as well as to Spatsizi Provincial Park. It is a highly-used road throughout the year by vehicles including trucks, ATV's and snowmobiles.

Northwest Transmission Line

Up until 2000, when the Dease Lake Generating Station was completed, most of the electrical power in the region was provided by diesel generators. The station is a high-head alpine plant, drawing water from Tsenglode and Hluey Lakes with a 3MW capacity. The facility provides energy for the entire community of Dease Lake, and all the energy is sold under a long-term contract to BC Hydro. For Dease Lake, it has relegated diesel-generated power to a backup source only. However, the remainder of the regional population is still reliant on diesel fuel.

In 2012, after several years of discussion and planning, construction began on the Northwest Transmission Line (NTL), one of the largest projects undertaken by BC Hydro in 60 years. The NTL is 344 kilometres long, 287 kV transmission line stretching from the Skeena Substation, located near Terrace, to a newly constructed substation near Bob Quinn Lake. The impetus for this project was to be able to provide clean, reliable power to the region; to connect communities to the grid, reducing their dependence on diesel fuel, and to encourage the development of industrial projects. It is also expected to provide a connection point to the grid for new sources of clean electricity developed by independent power producers (IPPs).

The estimated cost for completion of the NTL is $736 million, and so far, it has created approximately 800 construction-related jobs. The federal government provided $130 million through the Green Infrastructure fund, AltaGas contributed $180 million, and BC Hydro funded the remainder (BC Hydro 2014). The scheduled completion date is May 2014, and many in industry consider it to be a positive sign of economic opportunities in the region, leveraging billions of dollars of local investment. Additionally, Red Chris is building a NTL extension to their property with a scheduled completion date also in May 2014. Once completed, BC Hydro will then purchase the extension for $52 million. This extension could then be expanded to other potential developments. The Northwest Labour Market Partnership Program has conducted studies which estimates the possible industrial development facilitated by the NTL is likely to create at least 4000 direct and indirect jobs and could create as many as 12 000. The new Northwest Labour Market Partnership (NLMP) program, which has been sponsored by BC Hydro and funded by grants from the Ministry of Jobs, Tourism and Skills Training, is helping to ensure that local workers are ready to take advantage of the growing job opportunities in the area (Northern Development Initiative 2011).

A major investor in the NTL is AltaGas. AltaGas is currently constructing a $725 million, run-of-river clean energy project at Forest Kerr. Forrest Kerr is a 195 MW hydroelectric project, located on the Iskut River, and is likely to be the first power project to connect to the NTL via the Bob Quinn substation. Constructed almost entirely underground, once it is completed it will have a relatively small surface footprint, minimizing impacts to terrestrial ecosystems. As a run-of-river project, it also ensures continual movement of water and materials downstream, while minimizing potential impacts to aquatic resources. At the peak of its construction, it is estimated that approximately 400 jobs were created. Although fewer permanent jobs are expected in the long term, due to the highly automated operating system, it is expected to act as a catalyst for other development in the region. Forrest Kerr should be operational by 2014, and it will contribute to B.C.'s goal of achieving energy self-sufficiency by 2016. (AltaGas:Forest Kerr 2014) AltaGas is also constructing run-of-river projects at McLymont and Volcano Creeks.

Communications Infrastructure

In 2000, a satellite earth station with wireless telephone and internet access was installed in Telegraph Creek. Similar set-ups were installed in Dease Lake and Iskut. This communications technology was initiated to help overcome some of the barriers to conducting business in a remote location.

Environmental Values

Water Values

Water is a central issue in land use planning because of its fundamental usefulness. It is a requirement of healthy ecosystems since all forms of life require water as part of their metabolism or life history. Ecosystems adapt to the seasonal and geographical abundance of water as a primary driver of their growth and evolution. Water shapes everything in the Klappan: from the broad floodplain valleys and river channels; to the migration patterns and habitat of fish; and the mosaic of vegetation blanketing the landscape. It is difficult to overstate the importance of the water dependent ecosystem services that the area has provided to the Tahltan over thousands of years.

Photo 7. The view from the ridge top above Kluakaz Airstrip looking towards the Skeena/Spatsizi watershed divide. The lighter green, non-forested valley-bottom area is a complex of fen-dominated peatlands, other wetlands, and shrub-carr ecosystems.

Water is also a valuable input for industrial use as it is often used in resource processing, as a conveyor of effluents, as potable water for industrial camps and for many other industrial applications. Water management also becomes a priority of industrial land-use because of the erosive effects it can have on infrastructure like tailings dams and roads, and because of the need to direct or manage flows around industrial spaces.

Hydrographic Description

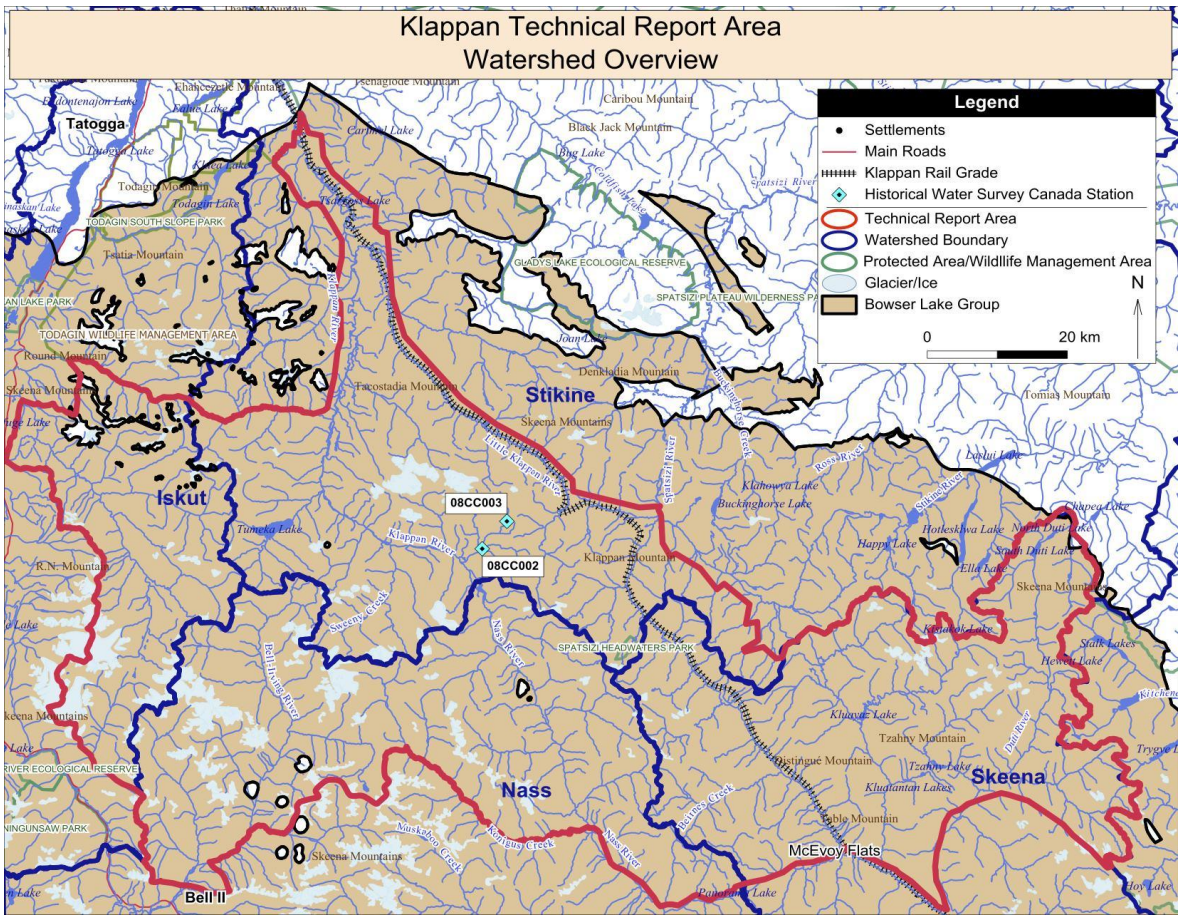
The Klappan TRA encompasses much of the extensive headwater contributing areas of the Nass, Skeena and Stikine Rivers. Table 6 is a summary of the contributing areas of the three TRA watersheds. The table shows that the Skeena, Nass and Stikine watersheds each comprise about 30% of the TRA. The Iskut watershed has been broken out from the Stikine, despite the fact that it is a lower Stikine tributary, because of its markedly different hydrology and much wetter climate. Map 11 is a watershed overview map of the TRA. The hydrology of the TRA area is reflective of its mountainous headwater location, lack of appreciable lake storage, moderately high glacial coverage and the unique eco-hydrologic association between groundwater reservoirs and blanket peatlands. Located in the north/south oriented Intermontane Belt of the Cordilleran mountain ranges, the topography varies from west to east.

Table 6. The total area and percentage area of major watersheds in the TRA

Watersheds Areas Within the TRA		
Watershed	**Area (km^2)**	**% of TRA**
KTRA	**7489**	**100**
Skeena	**2172**	**29**
Stikine	**2170**	**29**
Nass	**2130**	**28**
Iskut	**1017**	**14**

At the south-western edge of the TRA, draining west to the Upper Iskut River, and south to the Bell Irving River, a right bank tributary of the Nass, is the Klappan Range. The Klappan Range has precipitous, tightly-folded mountains with high glacial and permanent snowpack coverage that drains into a network of narrow valleys and mountain streams. The Klappan Range trends northwest to the more subdued terrain of the Todagin Plateau at the north-west corner of the TRA.

Moving east from the Klappan Range the topography opens into the first of several wide piedmont alluvial plain valleys. The most westerly of these valleys is a north/ south trending trough that traverses the entire TRA and drains the Klappan watershed north to the Stikine and south to the Nass watershed. In the center of the TRA the Klappan/Nass trough opens east toward Klappan Mountain and the Spatsizi drainage. East of mount Klappan is the north/south trending Spatsizi/Skeena trough, a wide valley system thank links the Little Klappan, Spatsizi and Skeena valleys. East of the Spatsizi/Skeena trough is the Eaglenest Range of the Spatsizi Plateau Wilderness Provincial Park. At the extreme south east of the TRA is the Kluatantan watershed, a third order tributary of the Upper Skeena River. Map 12 is a more detailed ortho-map of the Headwater Troughs area.



Map 11. An overview map of the TRA watersheds.

At the heart of the TRA is the contiguous headwater area of the Headwater Troughs. This area of wide, interconnected valleys joins the headwaters of the Skeena, Nass and Stikine watersheds. The Skeena, Nass, and Stikine Rivers within the TRA are considered misfit rivers, small headwater rivers located on the river beds of much larger ancient rivers. This means they are situated on top of extensive, deep alluvial gravel and sand deposits and their associated alluvial aquifers. The surface water divides between the three watersheds are topographically subtle, without any pronounced bedrock features.

One of the most striking features of the TRA is the extensive valley-bottom complex of peatlands, which are mostly classified as fens, and other non-forested wetland and shrub-carr ecosystems. Peatlands that blanket large areas of the valley floor and lower slopes are groundwater dependent wetland ecosystems found in cool humid climates across northern North America and Northern Europe. The peatlands of the Klappan TRA appear to be largely minerotrophic, or relatively nutrient-rich fens in contrast to the nutrient-poor, acidic bogs occurring extensively in other boreal and coastal regions in B.C. These fens have developed over thousands of years and have accumulated extensive peat deposits. Peatlands have been

demonstrated to have a strong influence on hydrology and water quality due to their ability to augment low flows and moderate peak flows (Ruppel et al. 2013, and Querner et al., 2010).

Photo 8. View north from Kluakaz Airstrip to the Skeena/Spatsizi watershed divide. The broad peatland (fen)/shrub-carr watershed divide is subtle with no major topographic break.

Geomorphology

During the late stages of the last glacial episode, approximately 10 000 years ago, the Stikine River was dammed by ice that covered much of the landscape. A massive lake, called Glacial Lake Stikine, formed in behind the ice dam, and covered the current extent of the Stikine watershed (Spooner and Osborne, 2000). As water levels rose, massive ancient rivers formed at spill points around the edge of Glacial Lake Stikine. One of the spill points was the major north/south trending Klappan Troughs (Map 12). The Klappan Troughs provided a path for Glacial Lake Stikine outflows that linked it to the Nass and Skeena watersheds. While they flowed, these massive ancient rivers brought with them huge volumes of gravel and sand bedload, which accumulated along the way, forming deep alluvial deposits. Evidence of these ancient channels can still be seen today along the Klappan Troughs and in the headwaters of the Kluatantan at Fire Flats.

At this time, the ice has largely disappeared and the surface water flow paths in the Klappan have resolved themselves between the Klappan, Spatsizi, Nass and Skeena watersheds. What remains is a network of small misfit rivers, nested on the floodplains of much larger pre-historic rivers. The deep alluvial river beds and peatlands store and slowly release groundwater and provide providing gravels to downstream reaches of the rivers they serve. This is a huge advantage since groundwater and gravel are both key ingredients contributing to the fisheries and water quality ecosystem services that we enjoy today from these watersheds.

Many mountainous watersheds have small headwater basins draining steep terrain with shallow soils. These headwater systems respond quickly to snowmelt and rainfall events but flows recede quickly. These fast-response basins tend to limit the ecologic stability of downstream reaches as they create aquatic habitats that dewater or freeze during the frequent periods of low flow. By contrast, the rivers within the TRA provide a stable flow regime that contributes to a productive downstream aquatic environment. In addition, flow in this near surface hydro-system is augmented by groundwater contributions from the underlying geology of the Bowser sediments.

Hydrology

The hydrology of the TRA is driven by precipitation moving onshore from the Pacific Ocean. Precipitation amounts decrease in the easterly direction, as the mountains intercept snow and rain from onshore Pacific storms. The TRA spans two B.C. Hydrologic Subzones (5 and 9). A distinction that is driven by the high total precipitation observed in the western Klappan Range and the relatively lower annual precipitation on the east side of the TRA. Long, cold winters put much of the annual precipitation into snowpack storage which is released in the spring freshet. The annual hydrograph is dominated by this spring snowmelt peak. Secondary peaks also occur associated with thermally driven summer peaks of glacial melt, and fall rainstorms and rain-on-snow events. The TRA has a moderately high glacial coverage which produces base-flow runoff over much of the year, but has a particularly pronounced effect during the summer when glacial melt is highest. Table 7 is a breakdown of the percentage cover of glacial ice in the TRA, and it shows 357 km^2 of ice cover in the TRA, representing 4.8% of the total watershed area (TRIM/Watershed Atlas). With 147 km^2, the Nass watershed subunit has the greatest total glacial coverage of the TRA sub-watersheds, corresponding with the higher precipitation of Hydrologic Subzone 9. Glacial coverage is an important component of the overall hydrology in mountainous terrain because it provides base flow augmentation during low flow periods and can serve to recharge groundwater reservoirs.

Table 7. Summary of the glacial ice coverage for the TRA watershed subunits

Percent of Area of Glacial Ice Within the TRA		
Watershed	**Area (km^2)**	**% of each Watershed in the TRA**
Total Ice	**357**	**5**
Nass	**147**	**7**
Iskut	**94**	**9**
Stikine	**88**	**4**
Skeena	**27**	**1**

Figure 4 is an annual hydrograph for the WSC hydrometric station "Spatsizi River Near the Mouth". This is the closest WSC hydrometric station to the TRA that drains mostly hydrologic Subzone 5 and thus is representative of the east -central part of the TRA. The station has records

from 1980 to 1995, when it was abandoned. The plot shows the typical annual discharge pattern for the upper Stikine with a major spring snow melt peak and secondary late summer and fall peaks. The average annual timing of the snowmelt peak is in early June, with an annual average freshet peak of 411 cubic meters per second as measured at a point just above the confluence of the Spatsizi and Stikine Rivers.

The surface hydrology of the TRA is shaped by its multi-headwater character. Headwater systems are characterized by having the majority of their stream length in small channels. These smaller channels have a high degree of contact with saturated soils which source most of the flow. The TRA is the main stem headwaters of the Skeena, Nass, Spatsizi and Klappan watersheds and these headwater areas can exert an important influence on downstream flows and water quality (Alexander *et al. 2007*).

Headwater streams receive flow from a variety of sources: glacial melt-water, direct precipitation, surface runoff and groundwater. The relative proportion of these contributing sources determines how stable the flow regime is throughout the year and between successive years. Groundwater is the most stable source, so streams with significant groundwater flow tend to have more balanced flow regimes. Stable flow regimes often support more diverse and productive aquatic ecosystems since they don't freeze in the winter or dry up in the summer (Winter 2007); they also have a more stable thermal regime. The Klappan TRA headwater has strong groundwater flow due to its complex multilayered groundwater system, glacial coverage and extensive peatlands.

Peatland hydrology is not well understood in western Canada, largely because many of the most extensive interior peatlands are limited to cool northern temperate areas, where the land use record is relatively short. Much of the research and experience around peatland hydrology comes from Northern temperate Europe, where there is a long history of peatland based land-use, and recognition of the impacts that occur when they are drained for agriculture, forestry or peat mining (Querner *et. al.* 2010). Peatlands in Ireland are protected as Groundwater dependant terrestrial ecosystems (EPA 2013) legislation, designed to protect aquatic and terrestrial ecosystems dependent on groundwater inflow. The peatland experience in Northern temperate Europe has resulted in significant impacts to ecosystem hydrology, necessitating major efforts to restore lost wetland function and the hydrologic benefits they have previously provided. In the Klappan, the peatlands are extensive, although the exact quantitative benefits cannot be defined due to the lack of baseline data and basic research. Nonetheless, it can be assumed that Klappan peatlands provide many of the same hydrologic benefits that have been recognized in Northern Europe around augmentation of low flows and flood mitigation. The Federal Policy on Wetland Conservation (Government of Canada 1991) lists the following as important wetland ecosystem services:

- water recharge, providing natural purification and storage of freshwater for humans and wildlife;
- natural flood reduction and control, through water storage and retention;
- important source of oxygen, and a vital element of the natural evapotranspiration and climatic cycles;
- habitats for a wide range of waterfowl, flora, furbearers, reptiles and fish;

- refugia for rare and endangered species;
- preservation of biodiversity and vitality of species;
- natural storage base for carbon;
- natural sinks for pollutants such as sulphur from acid rain and heavy metals;
- nutrient source for connected waters;
- soil and water conservation.

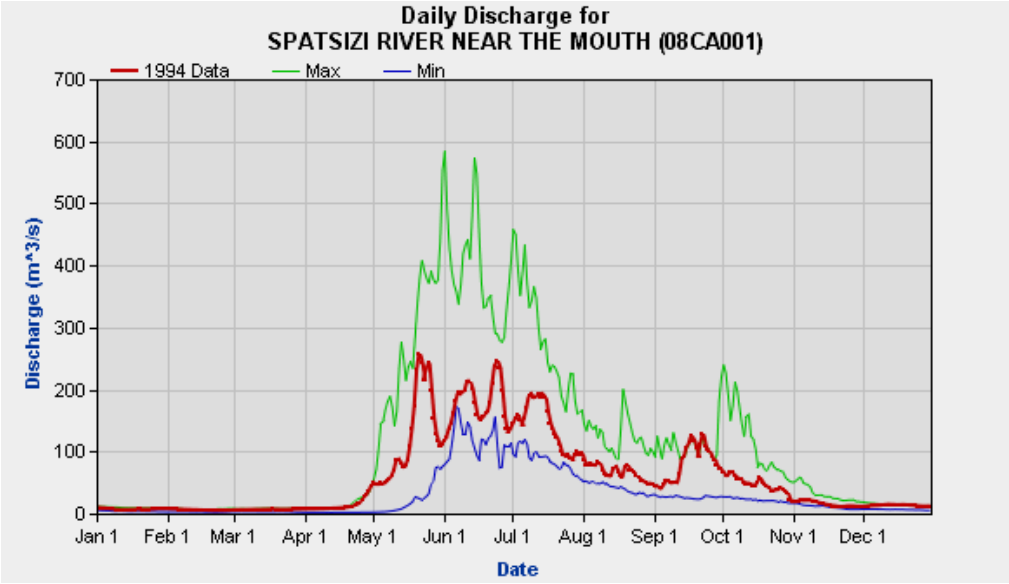


Figure 4. Annual hydrograph summary for WSC station 08CA001 including the 15 year data set from 1980 to 1995. The station was discontinued after 1995.

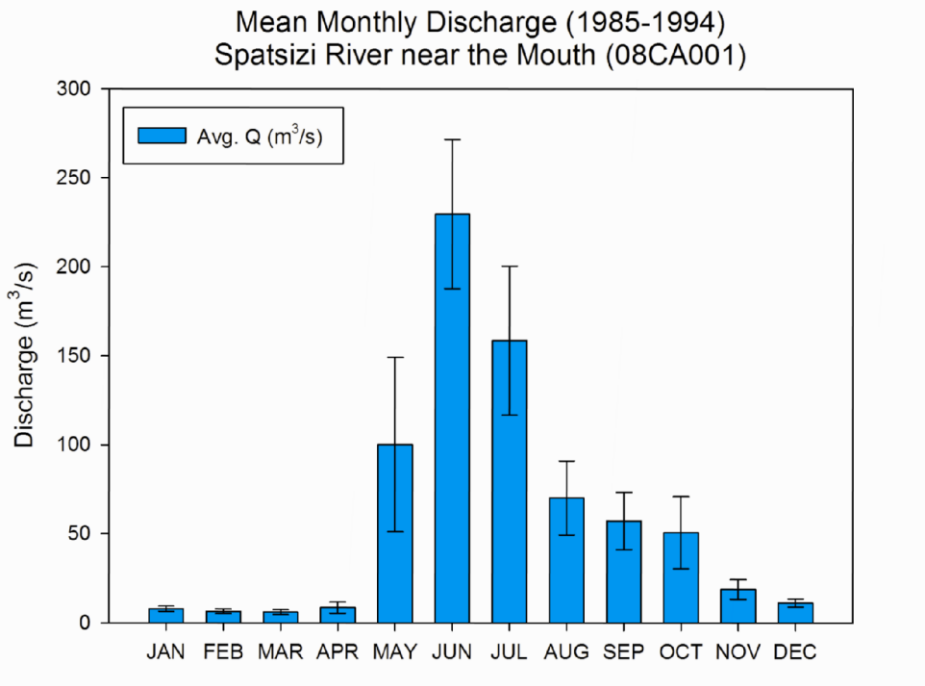


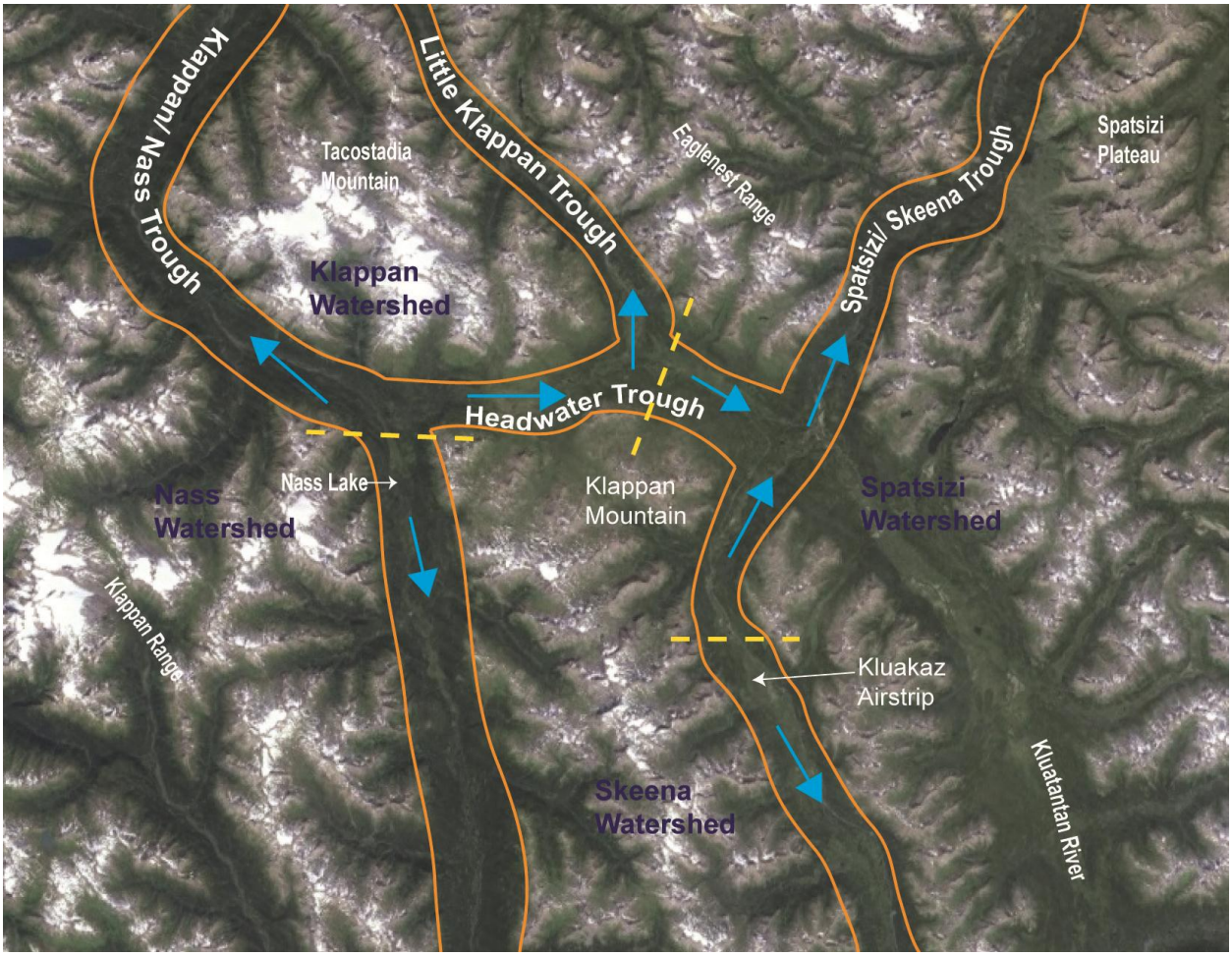
Figure 5. Mean monthly discharge for the Spatsizi River near the mouth.

Groundwater

The regional groundwater system in the Klappan is poorly understood and sparsely examined. Many geological and hydro-geological studies have been conducted in the area, but they have focused on resource extraction and energy production. A reconnaissance surface water/groundwater study was conducted in 2013 (Erhardt and Hudson 2014), and proposed a conceptual groundwater model for the Klappan based on field indicators and a review of peer reviewed research. The proposed groundwater conceptual model is:

> **Layer 1:** The lowest layer of the groundwater hydro-system where, deep groundwater is stored in the sedimentary bedrock of the Bowser Sediments Group. Bedrock aquifers in the Bowser Sediments make up the lowest stratigraphic aquifers in the system, storing regional scale water and transmitting it to upper aquifer layers through fracture networks and porous sedimentary rock. The TRA is almost completely underlain by sedimentary rocks of the Bowser Sediments group;
>
> **Layer 2:** Overlying the Bowser Sediments is a layer of alluvial sediment in the main valleys, deposited during multiple glacial episodes;
>
> **Layer 3:** Above the massive alluvial sediment is a spatially discontinuous layer of water bearing glacio-fluvial sediments, eskers, kames and fans, deposited at the end of the last glacial episode;
>
> **Layer 4:** At the top of this sequence are the discontinuous peatland deposits, developed since the end of the last glaciations and serving as a locally confining layer for the underlying aquifer units.

The peatlands of the TRA play a key role in the groundwater hydro-system. Peatlands are groundwater dependant, meaning they require stable, near surface water tables to grow. Peatlands in the Klappan have developed slowly since the last glaciation, adding a layer of sedge/moss peat each year. As the peats develop, they create a dense layer that expands to cover surrounding areas of high water table. As the peatland area develops the groundwater table tends to rise, resulting in increased groundwater storage and a more stable groundwater flow regime. In the headwater context of the Klappan, the groundwater hydro-system provides flow to stabilize and enhance the flow regime for the downstream contributing areas in the Skeena, Nass and Stikine watersheds.



Map 12. An overview map of the Klappan Troughs at the heart of the TRA. Arrows indicate the modern surface water flow directions of the major basins and the potential direction of the regional groundwater system.

Groundwater systems can be defined as either confined or unconfined systems. Confined aquifers are subsurface reservoirs largely contained within closed systems and can therefore be under pressure. This is called formation pressure. This is both an advantage and a disadvantage when considering the ecosystem services provided by groundwater. Advantageous because formation pressure can increase the storage of water by pushing it up valley sidewalls and store it against the force of gravity. It can be disadvantageous, as formation pressure makes confined aquifers vulnerable to drawdown if the confining layer is damaged or perforated, resulting in a reduction of pressure. Unconfined aquifers, also known as water table aquifers, have no overlying confining layer and therefore water is not stored under formation pressure. They simply store water under gravity pressure, with a water table that fluctuates according to the balance of inputs and outputs. Unconfined aquifers have a different set of vulnerabilities than confined aquifers. Their vulnerabilities result from the fact that they are often intimately associated with surface water systems, so water quantity and quality effects that occur in surface streams can be transferred to the subsurface.

Given that the TRA watersheds all overlie the Bowser Sediments, it is likely they share a common groundwater system, with linkages between fracture networks, and porous sedimentary layers and the surface hydrologic network. The groundwater flow field of the area has been sparsely monitored and consequently is not well understood. The extensive peats and other wetland soils of the TRA form a confining layer over top of the paleo-channel alluvial gravels and sands creating confined aquifer conditions in the unconsolidated gravels aquifers. While this creates a unique headwater situation, of large headwater confined aquifers contributing the overall multi-headwater character of the TRA, it also generates a vulnerability to aquifer draining if the peaty confining layer is disturbed.

Management Context

For thousands of years, Tahltan land use has relied on the environmental services provided by the local integrated surface water/groundwater hydro-system. As a mainstem headwater area for three major northwest B.C. watersheds, the TRA also provides ecosystem services to downstream river reaches outside of the boundaries of the TRA related to hydrologic integrity, ecological sustainability and water quality protection. The underlying mechanics of exactly how these ecosystem services are generated is not well understood.

Tahltan land use relies on the maintenance of stable environmental and hydrologic conditions in the TRA to ensure future food security, among a number of other priorities. Stable environmental conditions, within a natural range of variation, are key to the provision of aquatic and terrestrial natural foods. In any food security based impact assessment this puts a priority on ensuring that there is a solid understanding of the local hydrology and ecology. That level of understanding is not currently possible in the TRA given the lack of baseline hydrology, fisheries, water quality and climate data across the area. The assessment of potential impacts on a dispersed network of food sources requires a different set of monitoring and assessment tools than is needed to assess point source or linear impacts from proposed coal mining and railway construction.

Management Considerations

- *Existing and ongoing hydrologic impacts in the TRA resulting from the construction and subsequent abandonment of the Dease Lake connector rail grade. There has been no comprehensive assessment of those impacts and therefore it cannot properly inform land use. Learning from the past is a hallmark of good land use planning.*
- *Lack of baseline information means there is currently no way to assess the value of, or potential impacts to ecosystem services provided by the TRA to downstream reaches of the Skeena, Nass and Stikine Rivers.*
- *Maintenance of the integrity of the peatland/aquifers*
- *Rail grade construction and coal mining have the potential to lower groundwater levels in the Klappan with potential impacts to peatland and wetland function. This has many potentially adverse outcomes to fish habitats but may also affect the carbon storage function of the peatlands by reducing the amount of atmospheric carbon that is annually sequestered and increasing the carbon footprint of land use.*
- *Wetlands, including peatlands, often support clear water tributaries that act as refugia for fishes during periods of high flow and turbid water. This is particularly important for clear water tributaries in the Klappan and Spatsizi where there is a prolonged turbid water period. The Skeena also has extensive areas of clear water tributary that serve as clear water refugia.*
- *Potential land use hydrologic impacts to the Klappan TRA include the following;*
  - *Dewatering coal seams during mining poses the potential to alter the groundwater regime in the area and reduce peripheral groundwater flow;*
  - *Inter basin transfers from surface water diversions pose a risk to hydrology and the potential for inter basin transfer of organisms;*
  - *Shallow ground water interception by the rail grade can potentially alter the storage function of the shallow aquifers and reduce low flow augmentation and flood mitigation.*

Information Gaps

Hydrometric Data*: Lack of hydrometric station data for the Upper Skeena, Nass and Stikine watersheds reduces the ability to accurately estimate the baseline hydrologic regime and to estimate impacts to those regimes from any proposed land uses;*

- *Installation of hydrometric stations would be targeted following identification of sensitive areas of groundwater/surfacewater interactions (e.g., as-built railgrade survey and eco-hydrological characterization)*

Peatlands and Eco-hydrology*: Uncertainty around peatland extent and hydrologic function exist at all scales. There is a need for peatland/wetland mapping and research into their hydrologic function. Studies need to include:*

- *Mapping of vegetative communities in association with the railgrade;*
- *Introduced species survey;*
- *Use the eco-hydrology studies as a hydrological indicator as it is a cost effective and practical method to understand hydrologic processes;*
- *Eco-hydrology approaches provide valuable tools for looking at impacts and predicting future effects;*
- *Shallow groundwater mapping is crucial for access planning;*
- *Field studies to understand movement of water within the peatlands, (groundwater/surface water interactions);*
- *Field studies to understand the degree of communication between deep and shallow aquifers and issues around aquifer vulnerability.*

Rail Grade Impacts*: There is uncertainty around historic and ongoing hydrologic impacts resulting from the Dease Lake Connector rail grade. There needs to be an as-built survey of the existing infrastructure and research into the associated impacts.*

Regional Groundwater Flow System: *The regional ground water flow field in the TRA is not well understood. A study of the regional flow field is necessary to assess the vulnerability of existing groundwater resources. This work needs to be coupled with studies of surface water / groundwater interactions in the area to understand the degree of linkage between aquifers components and the surface flow system and to understand the degree of influence that groundwater has on the aquatic and terrestrial ecosystems of the area. Characterization of the headwater aquifers should include studies to determine the nature, extent and variability of groundwater divides.*

Water Quality: *Studies should include a sediment source survey along the rail grade to determine the degree of sediment delivery from the grade and baseline water quality to estimate any effects due to disturbance of the peatlands and to establish baseline water quality and thermal regime.*

Peatland hydrology of the Klappan TRA is therefore a topic of considerable relevance in the assessment of impacts and potential impacts. There is a lack of baseline information on the extent and ecological properties of the peatlands and an inadequate understanding of wetland processes in this area. This information is required to conduct an informed impact assessment of the peatlands.

Climate Change

North-western Canada has experienced the greatest temperature increases in North America, over the past 30-50 years. Under a high emissions scenario, northwestern B.C. may experience as much as a 3-5 ^{o}C increase in mean annual warming.. These are among the largest projected increases for western North America. Historically, these temperature changes have been, and are projected to be, largest in the winter months. It is expected that changes in precipitation regimes and an increased frequency of extreme temperature and precipitation events will accompany this warming (Pojar 2009).

Potential Impacts of a Changing Climate

Under a changing climate, northwestern BC, including the Klappan TRA, can expect transformations in both biodiversity and ecosystems. These changes could include: biome shifts; species losses, gains and reassembly in communities; changes to snowpack and to stream temperatures, flows and fish habitat; melting of permafrost; increased frequency of extreme events in general, and thus increased damage from storms, floods, erosion including mass movements, droughts, wildfires, and outbreaks of pests, like bark beetles, needle and leaf diseases, defoliating insects (Pojar 2009). Aboriginal land use and food security are considered to be particularly vulnerable to climate change impacts, due to the effects of climate-forced environmental change, its effect on the availability of traditional foods and the health implications of a changing climate (Furgal, 2006, and Ford et al. 2006).

Due to the challenges that the environment will face from climate change, any future land use planning in British Columbia should consider climate change and its implications. This planning should not only consider protecting current ecosystems and contemporary plant and animal communities, but also enduring features such as the different types of bedrock geology, physiography, landforms, lakes and streams that will underpin future ecosystems. (Pojar 2009).

Potential Greenhouse Gas Emission Sources

Climate Change implications are increasingly considered an important component of the Environmental Impact Assessment process in Canada, both provincially and federally. Coal mining has a range of potential greenhouse gas emission sources. As coal mining is currently the main industrial activity proposed within the boundaries of the TRA, new greenhouse gas emissions (GGEs) from proposed coal mining activities should be considered through the Environmental Impact Assessment process and be appropriately mitigated.

In addition, to the emissions from coal mining related activities, there are other emission sources which should be considered including:

- Changes in fugitive methane emissions from coal seamsChanges in ow temperature oxidation and spontaneous combustion;
- Increased carbon emissions related to energy production, explosives and land clearing;

- Permafrost thaw and the release of methane and carbon dioxide (Day et al. 2010, and Frolking et al. 2011).

An additional potential source of GGEs to consider in the Klappan is emissions related to disturbances of the extensive peatlands of the TRA. Peatlands are a major near-surface global carbon pool, whick in an undisturbed state act as a weak carbon sink, and are a globally significant storehouse of carbon. When they are drained, peatlands can be converted to carbon sources due to the enhanced decomposition of peat that results from ensuing drier conditions. Hydrologically, peatlands require near surface water tables to maintain their state of saturation and to sustain their growth. The permanently saturated state of undisturbed peats locks in the stored carbon by maintaining the peat soils in an anoxic state, which substantially reduces peat oxidation and the release of greenhouse gases. When a peatland water table is significantly reduced, the peatlands become disturbed, growth declines and the peat deposits can decompose, thus liberating greenhouse gases (Frolking et al. 2011).

Managements Considerations

Protection of enduring features that will underpin future ecosystems.

Consideration should be given to the management of alpine areas that are expected to persist in the face of climate change.

Hydrologic disturbance of the TRA peatlands has the potential to produce greenhouse gas emissions. Potential sources of hydrologic disturbance include the drain down of shallow aquifers along the proposed rail grade and the groundwater "cone of depression" from the dewatering of coal seams during mining.

Coal mining has a potential carbon footprint related to fugitive methane gas emission that needs to be considered.

Permafrost thaw, in relation to land clearing and hydrologic impacts is a potential carbon source in the TRA that needs to be considered in proposed land use developments.

Information Gaps

Significant information gaps exist in the TRA with respect to the assessment of greenhouse gas emissions and current storage. They include:

1. *Peatland depth, density, and the hydrologic system that supports them, should be mapped;*
2. *Permafrost affected soils should also be mapped;*
3. *A carbon accounting procedure should be included in any environmental impact assessment.*

Fisheries Values

Regional Context

The TRA encompasses the headwaters of three major drainages, the Stikine, Skeena and Nass Rivers. All of these systems are vital and productive salmon-bearing river drainages which also contain a diversity of other freshwater fish species. Important commercial, sport and Aboriginal fisheries occur in all three drainages which contribute significantly to the economy of northern coastal B.C.. Further information on fish economic values at a regional scale is discussed in the economic section.

Fish, and salmon in particular, have sustained Tahltan from time immemorial and will continue to provide for future Tahltans. The archaeological evidence at Tahltan, Nannock's village, the heartland of Tahltan Territory, indicates hundreds of cache pits; these are an indication of past abundance and would have been used to store salmon for the future (Asp unpublished). Today Tahltan families come home from far and wide annually to continue the culture of being provided for by salmon.

Approximately 34 fish species utilize the combined Skeena, Stikine and Nass system-wide drainages, and these are listed in Table 22 of Appendix 5. The table was largely derived from the 2013 Fisheries Information Summary System (FISS) data and then updated based upon literature and peer review.

Within the species complex there are three main species groups:

1. Estuarine species – Those that reside in brackish water habitats within the transition zone between river and ocean environments.
2. Anadromous species – Those which migrate upstream from the sea into freshwater to spawn. Incubation and often some period of rearing also occur in freshwater.
3. Resident species – Those that spend their entire lifecycle within the freshwater environment.

Although the majority of species listed largely reside outside of the TRA, it does provide some context on species diversity in consideration of potential downstream effects.

TRA Specific Information

The multiple headwaters and associated watersheds within the TRA are depicted in Map 13. The Klappan and Spatsizi watersheds drain into the Stikine River, while the Bell-Irving watershed drains into the Nass River. The upper Skeena is generally defined as the watershed area upstream of Kluatantan River. The Kluatantan River is approximately 550 km from the Skeena mouth and the upper Skeena reach is about 60 km in length.

The 2008 Tahltan-ILMB Joint Planning Information Package for the Tlebāne / Klappan, as described in the Management Context section, did not provide adequate consideration of fisheries values. It did not specifically assess fish and fish habitat information; nor did it acknowledge that salmon were present within the study area, only within downstream

environments. Without the compilation and review of existing baseline information, it can be easy to underestimate fisheries values within a specific area.

During this KSI process, fisheries values within the TRA have been thoroughly considered. Background documents specifically relating to fish or fish habitat within the TRA that were utilized are listed in Appendix 4. Although there are some fisheries data gaps, review of this existing information indicates that high fisheries values are present, particularly in the upper Skeena River area. The fish communities within the study area contribute to the ecology, nutrient regime, and diversity of the drainage and support aboriginal, recreational and commercial fisheries.

Cultural Fish Values

Salmon have always been critically important to the Tahltan for food, social and ceremonial purposes. Within the TRA, the upper Skeena in particular supports sockeye, Chinook, steelhead and coho salmon, and as such, provided bountiful fishing and processing opportunities. For the Tahltan, freshwater fish resources are also an important cultural food source. This includes rainbow trout, bull trout, Dolly Varden, mountain whitefish, burbot, and arctic grayling. Allbright (1984) noted that the traditional freshwater fishery formed a key element of the subsistence economy. The harvest of surplus to conservation needs on a species by species basis allowed for optimal utilization of the fish resource.

Tahltan fisheries within the study area were concentrated at strategic seasonal locations near village and camp sites, or located at easily exploited and efficient capture sites. The abundant and predictable fish resources, particularly during spawning times, provided the opportunity for the Tahltan people to harvest and preserve a high quality staple food. The catching, processing, and storage of large quantities of seasonally available fish, alongside hunting and gathering plant and tree resources, enabled a resilient economy.

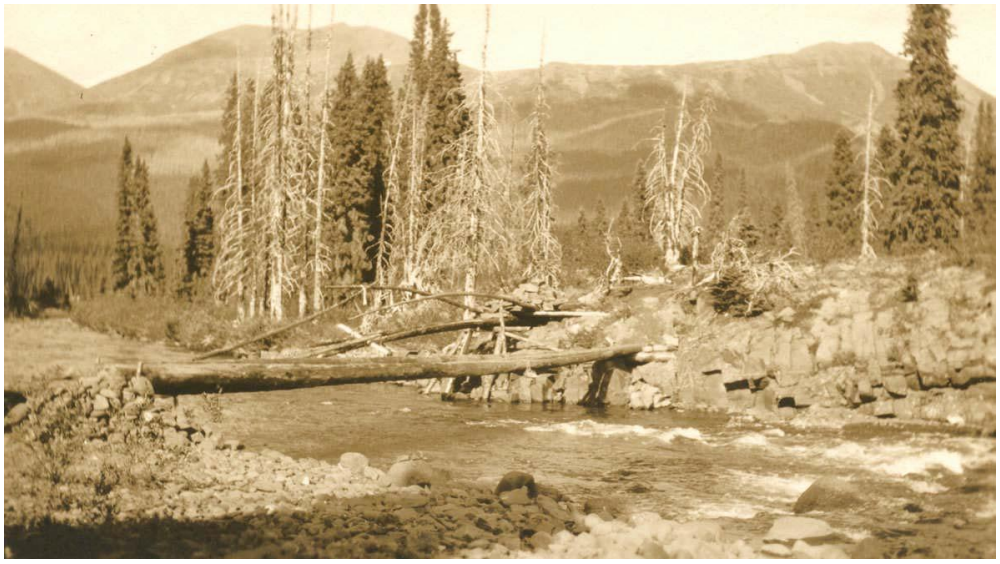
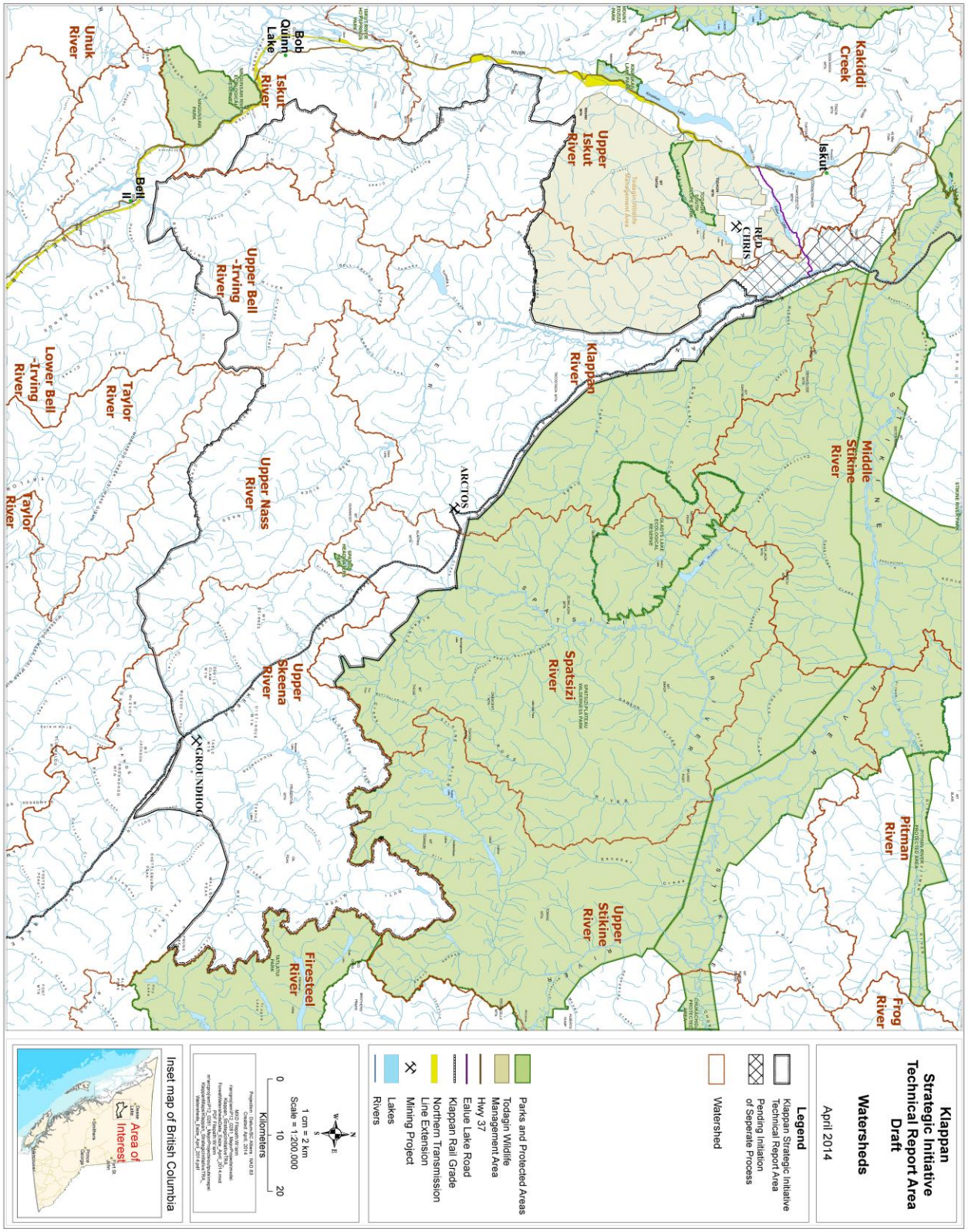


Photo 9. Log bridge and older aboriginal cantilevered bridge across Kluatantan River (Campbell-Johnston, 1912).



Map 13. Watersheds.

Species Assemblage and Life History Summaries

As displayed in Table 8, there are 12 different fish species that have been captured within the TRA. This includes some anadromous species within the upper Skeena and Nass drainages. The Klappan River is not known to contain anadromous fish populations due to barriers located in the Stikine Grand Canyon.

Bull trout and coastal cutthroat trout are currently blue-listed by the B.C. Conservation Data Centre, meaning they are indigenous species of special concern in British Columbia. Dolly Varden are currently yellow-listed. However, they are ranked with an S4 designation and are considered to be of conservation concern for many reasons: they have a small range or low abundance in the province; they have shown provincial declines; or there are perceived long-term threats.

Table 8. Fish species documented within the TRA (Based on FISS and literature review). It is important to note that check marks indicate species of fish documented in the system using recognized sampling standards and/or noted in FISS. However, due to sampling effort and other limitations this, there may be data gaps in terms of species occurrence in the three watersheds of the project area.

	Drainage (within the TRA)		
Fish Species	**Skeena**	**Stikine**	**Nass**
Anadromous group			
Chinook Salmon (*Oncorhynchus tshawyscha*)	√		√
Coho Salmon (*Oncorhynchus kisutch*)	√		√
Sockeye Salmon (*Oncorhynchus nerka*)	√		
Steelhead (*Oncorhynchus mykiss*)	√		√
Resident group			
Arctic Grayling (*Thymallus arcticus*)		√	
Bull Trout (*Salvelinus confluentus*)	√	√	√
Burbot *(Lota lota)*		√	
Cutthroat Trout (*Onchohynchus clarkii clarkii*)	√		
Dolly Varden (*Salvelinus malma*)	√	*	√
Longnose Sucker *(Catostomus catostomus)*		√	
Mountain Whitefish (*Prosopium williamsoni*)	√	√	√
Rainbow Trout *(Oncorhynchus mykiss)*	√	√	√

*Although there are some previous references to Dolly Varden in the upper Stikine / Klappan River their presence is unknown. All char captured during a 2001 survey were determined to be bull trout based upon branchiostegal counts. Therefore, all previous records of Dolly Varden were likely referring to bull trout. (Schell, 2001.)

Brief life history summaries for fish species documented within the study are provided in Table 9. Referenced information in this table is general in nature and may not accurately describe the unique life histories of the fish species found within the TRA. Site specific information for these

species is discussed in subsequent sections. It is also important to consider that there are diverse life history strategies occurring across the ranges of these species, especially at the extremes of their spatial range such as in the Stikine/Nass/Skeena headwaters. Fish species found in these habitats often employ unique strategies to cope with temperature and growing season constraints.

Table 9. Brief life history summaries for fish species documented within the TRA.

Fish Species	Environment and Migration	Spawning period	Diet
Chinook salmon (*Oncorhynchus tshawyscha*)	Adults return to natal streams from the sea to spawn. Fry may migrate to the sea after only 3 months in fresh water, some may stay for as long as 3 years, but generally most stay a year in the stream before migrating.[1]	July to October[5] August - for upper Skeena[9]	Food in streams is mainly terrestrial insects and small crustaceans.[1]
Coho salmon (*Oncorhynchus kisutch*)	The fish occur in the ocean and adults return to the rivers where they were born. The young fish emerge in springtime and they usually live in fresh water for 1-2 years (sometimes up to 4 years).[1]	August to October[5]	Young fish in rivers eat mainly insects. [1&2]
Sockeye salmon (*Oncorhynchus nerka*)	In some populations (normally riverine stocks), sockeye fry go to the sea during their first summer but most spend one or two (rarely three or four) years in a lake before migrating.[3]	September to October[5]	In lakes, fry first feed inshore, then move offshore, where they feed on plankton.[1]
Steelhead (*Oncorhynchus mykiss*)	In general, upper Skeena steelhead have only summer-run populations. Here steelhead enter the drainage between June and October and mature in the river (often overwintering in lakes, deep canyon, main-stem locations[11] or stream confluences/areas of upwelling.	Mid-May to late June[11]	Feed on a variety of aquatic and terrestrial invertebrates and small fishes.
Arctic grayling (*Thymallus arcticus*)	Inhabits open water of clear, cold, medium to large rivers and lakes. Enters rocky creeks to spawn.[4]	May to June[7]	Young feed on zooplankton shifting to immature insects; adults feed mainly on surface insects but also on fishes, fish eggs, lemmings, and planktonic crustaceans.[5]
Bull trout (*Salvelinus confluentus*)	Occupy a wide variety of habitats and may have multiple life histories: resident (spends entire life in streams); fluvial (adults in large rivers with spawning and rearing in smaller tributaries); adfluvial (adults in lakes with spawning and rearing in streams.[1] This species typically spawn in colder high gradient stream.[3]	September to November[5]	Known to be opportunistic predators and diet varies depending on life history.[10]
Burbot *(Lota lota)*	Inhabit lakes and large rivers with slow-moving current[4] and are also found in small streams, especially as juveniles.	January to March[5]	Smaller individuals feed on insect larvae, crayfish, mollusks and other invertebrates with a changing preference for fishes in larger

Fish Species	Environment and Migration	Spawning period	Diet
			individuals.[5]
Cutthroat trout (*Oncorhynchus clarki clarki*)	Highly diverse life histories that prefer relatively small streams, with gravel bottoms and gentle gradients for spawning. However adult, sub-adult and juvenile life stages are found in lakes and also display purely fluvial life histories; moving from mainstem large rivers into tributaries to forage spawn and/or overwinter.[1]	February to May[5]	Feeds on fish, crustaceans, and insects.[6]
Dolly Varden (*Salvelinus malma*)	Occurs in deep runs and pools of creeks and rivers; also in lakes and the sea. Spawning typically occurs in cold higher gradient streams.	September to November[5]	Young remain in streams for 3-4 years and feed on insects, leeches, snails, and salmon eggs. [5]
Longnose sucker *(Catostomus catostomus)*	Found in clear, cold water of lakes and tributary streams. Moves from lakes into inlet streams or from slow, deep pools into shallow, gravel-bottomed portions of streams to spawn.[1]	May to June[8]	Feed on benthic invertebrates.[5]
Mountain whitefish (*Prosopium williamsoni*)	Occurs in lakes and fast, clear or turbid streams.[5]	October to February[5]	Feeds mainly on benthic organisms such as aquatic insect larvae, mollusks, fishes, and fish eggs.[5]
Rainbow trout (*Oncorhynchus mykiss*)	Inhabit headwaters, creeks, small to large rivers, and lakes.[4]	April to June[7]	Generally feed on invertebrates, insects, snails, leeches, salmon eggs and once mature, may prey on other fish.[5]

References: [1](Morrow, 1980); [2](Coad & Reist, 2004); [3](Margolis et al, 1966); [4](Page & Burr, 1991); [5](Scott & Crossman, 1973); [6](Clemens & Wilby, 1961); [7](Ford et al, 1995); [8](Geen et al, 1966); [9](Erhardt, 2009-11); [10](McPhail & Baxter, 1996); [11](Beacham et al, 2012).

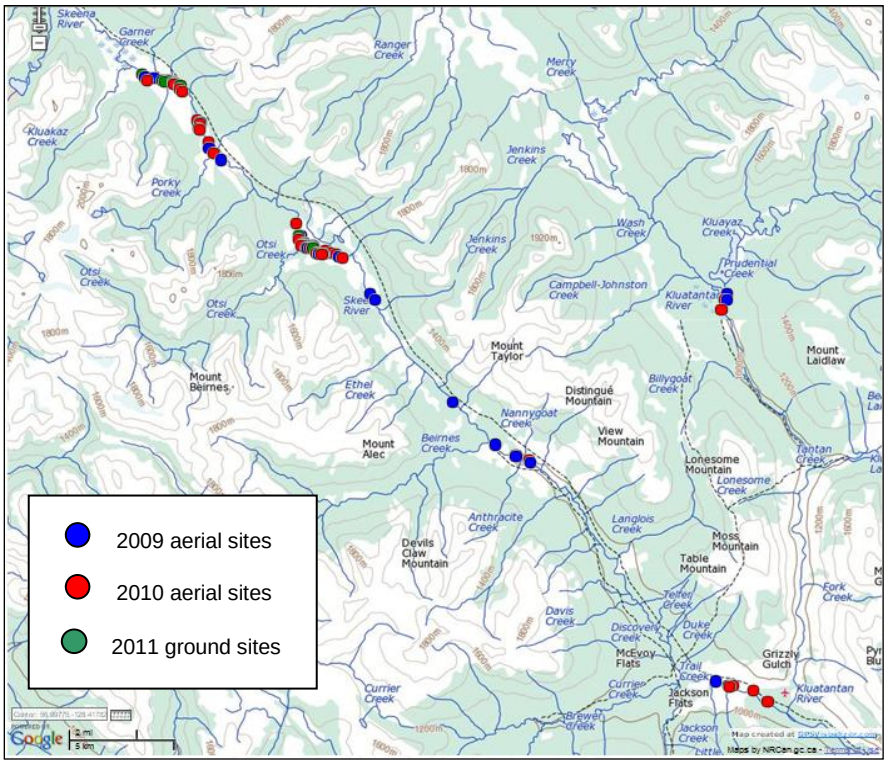
Salmon and Steelhead Distribution

The known distribution of salmon within the TRA is depicted in Map 15. Steelhead have either been confirmed, or are likely to be present where there are Chinook or coho salmon. This map was created from the Tahltan Fisheries Salmon Atlas, using salmon distribution data from FISS. Salmon distribution on the upper Skeena River was extended upstream based upon more recent fisheries assessment surveys (Erhardt 2009-11).

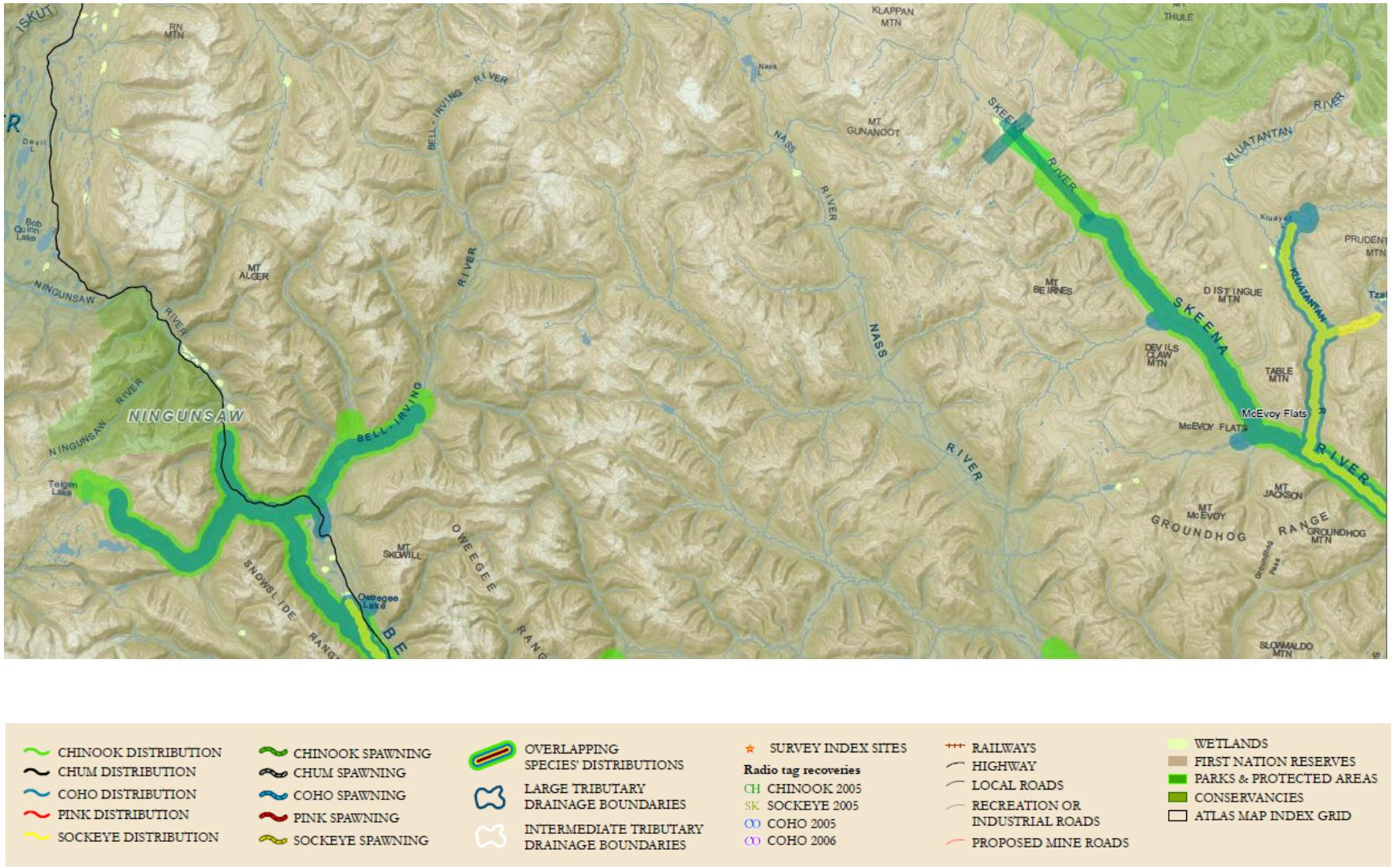
The distribution of Nass River salmon is limited to southern most portions on the east side of the study area. Here Chinook and coho salmon are documented in the Bell-Irving River, upstream to approximately the confluence of Rochester Creek. The distribution of Skeena River salmon however, extends well into the study area. Chinook salmon are present up the Kluatantan River and upstream on the Skeena River to the Kluakaz Creek confluence. Coho salmon distribution also extends to the initial Skeena headwaters and up into tributaries such as

Kluakaz Creek and Garner Creek. Sockeye salmon distribution runs up the Kluatantan River to the Kluatantan Lakes and Kluayaz Lake.

Recorded Chinook salmon spawning sites from aerial and ground surveys in the upper Skeena River (Erhardt 2009-11) are displayed in Map 14. There is distinct overlap across the years for specific spawning sites, particularly within the Upper Skeena, below Kluakaz Creek and below Otsi Creek. In these areas, ground surveys confirmed that in recent years, Chinook spawners have largely tended to utilize the same sites.



Map 14. Recorded Chinook salmon spawning sites on the Upper Skeena (2009-11).



Map 15. Known salmon distribution within the KSI study area.

Salmon Conservation Units

The Wild Salmon Policy (WSP) was released by DFO in 2005 and is designed as a sustainable ecosystem-based management policy directed at salmon resources. (Fisheries and Oceans Canada 2005) An overview of the WSP framework components is shown in Table 23 of Appendix 5. Some key attributes of the WSP include:

- Creating a paradigm shift in management to protect weak stocks and biodiversity;
- Adopting a risk management approach;
- Integrate planning in a strategic manner by linking salmon science, habitat/ecosystem conditions and status, and fisheries management;
- Providing a transition to collaborative monitoring across all levels of management.

Under the WSP, there are established Conservation Units (CUs). A CU is defined as a group of wild salmon sufficiently isolated from other groups that, if extirpated, are very unlikely to re-colonize naturally within a timeframe, such as a human lifetime or a specified number of salmon generations.

Steelhead CUs were defined (by Tautz et. al. 2011) for the Skeena River with methodology consistent with the WSP, the process utilized combined information from habitat, life history and molecular genetics parameters. This analysis provided support for the characterization of Skeena steelhead as a species rich in genetic variation as expressed by the complexity of life history types present and utilization of diverse habitat types. As yet, a similar CU analysis for steelhead in the Nass or Stikine drainages has not been conducted.

Formalized CUs which are applicable to the TRA are summarized in Table 10.

Table 10. Salmon and Steelhead conservation units within the TRA

Species	Conservation Unit	# of sites (in database)	Classification based upon	Comments
Chinook	Upper Skeena	3	genetics / timing	Sites include Kluakaz, Otsi, Kluatantan / Kluayaz and Beirnes
	Upper Nass	16	genetics / timing	Tseax and upstream
Sockeye River-type	Skeena River-high interior	1	ecology	Only one site with very little information and unknown status
Sockeye Lake-type	Upper Skeena - Kluayaz	1	lake / genetics	One lake with very little information and unknown status
	Upper Skeena - Kluatantan	1	lake / genetics	One lake with very little information and unknown status

Species	Conservation Unit	# of sites (in database)	Classification based upon	Comments
Coho	Upper Skeena	3	genetics / timing	The most interior of coho sites
	Upper Nass	16	genetics / timing	Tseax and upstream
Steelhead	Upper Skeena headwaters	-	genetics / habitat / life history	Genetic analysis of population structure included: Kluatantan, Upper Skeena and Lower Sustut

Watershed Specific Information

Klappan

The Klappan River flows into the Stikine River from the south. The eastern bank of the lower Klappan River and most of the Little Klappan are located in the Spatsizi Plateau Wilderness Provincial Park. The Klappan and the Little Klappan Rivers are composed of approximately 140 and 83 km of main-stem respectively, as well as over 320 km of tributary streams, which provide migration corridors and support various fish habitats. Major tributaries include McEwan Creek, Eaglenest Creek, Little Klappan River, Tsetia Creek, Maitland Creek, Tumeka Creek and Sweeny Creek.

Photo 10. Lower Klappan River.

The Klappan River is located upstream of the Grand Canyon of the Stikine which is a barrier to fish and no anadromous populations are found above it (Schell 2001). The study area is known to support rainbow trout, mountain whitefish, bull trout, burbot, Arctic grayling and longnose sucker.

Tumeka Lake is located upstream of an impassable barrier on Tumeka Creek. Rainbow trout were transplanted into the lake by an unknown guide/outfitter in about 1977, and a survey by MELP biologists in 1984 found the fish to be large and in exceptionally good condition at that time (Balkwill *et al.* 1984), however catch per effort was relatively low. Reports since then indicate that this stock is reproducing naturally and that fish size and condition factor has decreased substantially. This decrease in fish size is reflective of natural reproduction increasing the population abundance and competition for food (Schell 2001).

Some key aspects and considerations of fish habitat in the Klappan River include the following:

- The Klappan River has a seasonally turbid period, but clear water tributaries are common downstream of the Little Klappan River, and lightly turbid tributaries are not uncommon upstream of this (Schell 2001). This seasonal turbidity should not suggest that the system is unproductive, it is clear during low flow periods and fish species often adapt site specific life histories to maintain productivity. Clearwater habitats are a key area for Tahltan use.
- Field surveys (Schell 2001) found that while many of the Klappan sites were found to contain fair to good spawning substrates in sufficient water depth, many of these channels were aggregated, or contained a significant amount of fine sediments. Although spawning habitat may be relatively less abundant, this increases the importance of suitable spawning habitats and reflects an increased sensitivity to potential habitat impacts.
- With a few exceptions, species diversity in the Klappan seems relatively low, limited to bull trout and mountain whitefish in much of the watershed. However, low species diversity speaks to increased specialization and not decreased fish values.
- While the Klappan River appears to maintain low densities of fish, such is considered an increased vulnerability to impacts such as access to fishing and habitat alterations.

Upper Skeena

The upper Skeena area within the TRA possesses very high fish values. Chinook, sockeye, and coho salmon, steelhead, rainbow trout, Dolly Varden, bull trout, cutthroat trout and mountain whitefish are all known to be present. Major habitat characteristics include very good juvenile rearing in off channel habitat, thermal and flow regimes moderated by groundwater, and spawning habitat with preferred substrate located on tributary fans.

The upper most portion of the Skeena River flows through a wide valley vegetated with willows, grasses and the occasional coniferous stand, with a high frequency of pools and runs with a low gradient. Fish habitat within the upper Skeena River watershed has been characterized as being good to excellent in quality due to slower flows, frequent pools and

cover in the form of undercut banks, deep pools and occasional large woody debris (Sekerak and Stallard 1984).

Photo 11. Upper Skeena River headwaters below Kluakaz Creek.

The Upper Skeena main-stem in the vicinity of Kluakaz Creek consists of a large area of sub-alpine grasslands. The river course is meandering, with substrate of cobble, gravel and periodic boulders. The water depth is predominately shallow with periodic pools and undercut banks. The Skeena River main-stem in the area of Otsi Creek contains a meandering channel with frequent gravel bars and connections to wetland habitats. Salmon spawning areas are comprised primarily of riffle/glide complexes with cobble/gravel substrate. Salmon provide a vital role in the area by sustaining both aquatic and terrestrial food webs and by supplying marine derived nutrients to the ecosystem. Dolly Varden are known to be distributed throughout the watershed and occupy stream habitat from main-stem riverine areas to headwater tributaries. Bull trout in the watershed display specific use of main-stem riverine habitats and lower reaches of larger tributary streams (Triton 2009).

The Sustut River enters the upper Skeena River approximately 75 km south-east from the Kluatantan River confluence. Although it is outside the TRA, there is an extensive amount of Provincial stock assessment and life history data for Sustut River steelhead, which is likely to be representative of upper Skeena steelhead life history. It is also a good indicator of the extremely short growing season in the headwaters of systems within the study area. Reports on Sustut River steelhead are available at http://www.env.gov.bc.ca/skeena/fish/sk_series_reports/sk_report_index.htm.

There is very little stock assessment information (i.e. relating to the abundance of fish) in the upper Skeena. Tahltan Fisheries surveys from 2009-11 indicate that the predominate age class for adult Chinook salmon is 5 years. Expanded aerial survey counts for Chinook in the study area, conducted from 2008-2010 were 410, 303 and 289 respectively. Other observations indicate that since 2011, Chinook escapement has decreased and remains relatively low. The overall Skeena River aggregate escapement estimate from genetics analysis was approximately 48,000 in 2011, as opposed to 93,000 in 2010 and 80,000 in 2009 (Ivan Winther, pers. comm. 2012).

The expanded aerial survey count for coho in the upper Skeena, conducted in 2008 was 331 (Rabnett and Wilson 2009). It is important to note that aerial counts for coho salmon often underestimate abundance due to this species' affinity for under-cut banks and associated riparian vegetation cover. Previous studies indicate that coho fry along with Dolly Varden are well distributed throughout the upper Skeena. Sockeye salmon distribution appears to be limited to the Kluatantan system.

Upper Nass

The portion of Nass River watershed within the TRA, is composed of approximately 60 km of main-stem and over 110 km of tributary streams. The stream network provides resident freshwater fish communities with migration, spawning, and rearing habitat. Freshwater resident fish include: mountain whitefish, rainbow trout, bull trout and Dolly Varden. To date, no anadromous salmon have been specifically recorded upstream of Muskaboo Creek. Chinook and coho salmon, along with steelhead are documented in the Bell-Irving River, upstream to approximately the confluence of Rochester Creek.

The Nass River originates from Nass Lake, a relatively small headwater lake, lying 10 km southwest of Klappan Mountain. The uppermost reach that flows out of Nass Lake is characterized by meanderings across the low gradient valley bottom, and is slightly entrenched for most of the next 60 km. The channel is frequently confined by bedrock, although moderate amounts of floodplain are located upstream of Konigus Creek. There are swift flows in areas of rapids and chutes upstream of Muskaboo and Konigus creeks, with the main-stem being turbid more frequently than not, which hinders fish passage (Sekerak et al. 1984). It is suspected that Chinook, coho, and steelhead spawn upstream of Muskaboo Creek, but this hypothesis would need to be confirmed with further field studies.

Although detailed information for the upper Nass is somewhat limited, a previous reconnaissance fisheries inventory project (Van Schubert 1999) provides some indications of habitat condition. The streams appear to be in a natural state, with pervasive glacial influence and variable water temperature and turbidity. Suitable spawning habitats are usually scattered in small patches, and deep pools provide good quality overwintering habitat in the main streams. Migration routes may be obstructed in most of the major systems by bedrock falls and cascades. Muskaboo Creek and the Taylor River appear to contain relatively good habitats for bull trout and Dolly Varden, while the lower reaches of the upper Nass appear most productive

for rainbow trout/steelhead juveniles. Fish densities, growth and condition were found to be low compared to other Nass watersheds. Aquatic species in the upper Nass are likely challenged with long migratory routes, lower water temperatures, a shorter growing season and lower nutrient levels.

As with the Klappan River, it is important to note for the upper Nass, that although spawning habitat may be relatively limited, this reflects an increased sensitivity to potential habitat impacts. Also, while the Upper Nass may have relatively low densities of fish, this should be interpreted as an increased vulnerability to impacts such as access to fishing and habitat alterations.

Photo 12. Nass Lake.

Groundwater and Fish Habitat

The importance of groundwater to the freshwater lifecycle of fishes is fairly well documented, particularly for some salmon species and in northern climates. Seasonal roles that groundwater may facilitate are displayed in Table 11.

Table 11. The importance of groundwater to fluvial fishes (Power et al. 1999)

Groundwater role	Fall/winter season	Summer/autumn season
Provision of baseflows	Maintains free flowing water, habitat and migratory channels through winter minimal flows.	Maintains minimal flows and wetted perimeter and living space through dry periods when evapotranspiration exceeds precipitation
Modulation of temperatures	Prevents or delays ice formation. Provides areas with temperatures above 0°C. Influences ice thickness and break up.	Dampens diel fluctuations in temperature, slows and limits seasonal warming, delays cooling in autumn.
Influences water quality	Supplies dissolved inorganic and organic nutrients and oxygen to stream. Water quality tempered by hyporheic exchanges.	Helps maintain stream productivity by steady input of nutrients. Stimulates macrophyte growth. Water quality tempered by hyporheic exchanges.
Provision of refugia	Sets size and quality of winter refugia. Influences mortality and may set overwintering carrying capacities.	Provides protection from upper lethal temperatures. May set carrying capacities in hot dry summer weather.

In the upper Skeena, a comparison of habitat characteristics between spawning and non-spawning sites indicates the preference for spawning site selection includes a substantial water temperature difference between surface and substrate, indicating groundwater or subsurface flow (Erhardt 2011). As well, temperature data loggers towed through several Chinook spawning reaches demonstrate that certain sections of the river may have a thermal regime which is affected by groundwater influence and/or ambient air temperatures. In this regard, it is suspected that Chinook Salmon in the Upper Skeena have a high fidelity to utilizing specific spawning sites with groundwater influences. Tahltan Fisheries surveys on the upper Skeena also indicate that groundwater is likely to be a key factor in the survival and productivity of other fish species, particularly rearing coho fry and Dolly Varden.

Groundwater function as related to fish habitat in the TRA are deemed to be vitally important. These groundwater influences likely provide tolerable temperatures ranges for over-wintering habitats and growth. Without these areas of temperature refugia, salmonid recruitment may not persist. It is also important to recognize that species such as steelhead have a protracted freshwater residency period. Juveniles may reside in small headwater tributary streams for up to six years before smelting and immigrating to the ocean. This fact makes any perturbations that compromise groundwater or surface water quality an additional challenge for salmonid survival and productivity.

Previous or Current Impacts Within The Study Area

Impacts to fish habitat within the study area are largely related to the construction and subsequent abandonment of the B.C. rail grade. Fish habitat, water quality and fish access have

all been compromised as a result of construction activities and the impacts have escalated, due to the ongoing lack of monitoring, maintenance or habitat restoration. As well, previous coalbed methane or mining exploration, such as those related to providing access and drilling programs, may have had some impacts on fish habitat.

Fish harvesting is another impacts that may occur at a regional level, particularly affecting Skeena River salmon species. Discrete anadromous stocks are particularly vulnerable to risks from US and Canadian coastal mixed-stock over fishing. Salmon in the headwaters must escape through all fisheries in the lower and outlying waters. Also, the fact that these are relatively small stocks makes them even more vulnerable to harvest effects and cumulative effects from habitat degradation. Another consideration relates to climate change, in particular for anadromous fish species which may experience reduction in marine survival due to ocean conditions.

In terms of the B.C. Rail – Dease Lake Extension grade along the Klappan River, Schell (2001) recommended that regulations concerning stream crossings and the recognition of bull trout as a species vulnerable to habitat degradation necessitate a more current examination of the impacts. Erosion, stream crossings, road encroachment and fish passage on selected sites in the lower Klappan River were assessed by Rabnett in 2007. The results and background information showed that the abandoned rail grade is located on the northern floodplain for much of its length, and construction practices have resulted in the following impacts:

- Effectively reduced the lateral movement of the river in some floodplain areas;
- Blocked off some of the floodplain and many side and back channels;
- Chronic erosion due to both failing hillslopes and fill slopes, destabilized stream banks, and a failure to implement adequate erosion control measures;
- Reduction of fish passage from the frequently turbid Klappan main-stem into many small clear water tributaries.

Fisheries impacts from the rail grade are also highly evident on the upper Skeena watershed. Rabnett and Wilson conducted a fish passage culvert inspection assessment for this area in 2008. It concluded that due to the relatively large amounts of surface and near-surface groundwater, the rail grade has ditched upslope and concentrated this drainage into adjacent creeks, with the result that most culverts have since blown out, along with massive amount of sedimentation. The recommendations from this survey included the removal or deactivation of the 73 stream crossings located from Garner Creek downstream to the Kluatantan River.

Photo 13. Typical culvert along the rail grade in the upper Skeena area

A more recent hydrologic and fisheries environmental impact assessment of a small portion of the rail grade in the uppermost headwaters of the Skeena River was conducted by Tahltan Fisheries in 2013 (Erhardt and Hudson 2014). This survey included consideration of hydrologic, thermal, peak flow, groundwater and fish passage effects. Results from this assessment are provided in the railgrade section of this report. However, to summarize from a fisheries perspective, habitat impacts and destruction is extensive resulting in reduced available habitat. Most of the potential fish habitat above the grade is isolated and much of the habitat between the grade and the main-stem Skeena has been r destroyed, dewatered or otherwise adversely affected.

Along the railgrade, alterations of groundwater or flows could have several deleterious effects upon fish survival and productivity inclusive of:

- Decreased winter survival of eggs (i.e. freezing effects);
- Lower dissolved oxygen levels and/or nutrient levels;
- Delayed incubation development or pre-mature alevin upward movement;
- Reduced capacity for the modulation of water temperatures;
- Changes to the amount or quality of refugia habitats;
- Reduction in the spatial and temporal extent of flows to critical habitats.

Summary

Fish communities within the TRA contribute to the ecology, nutrient regime, and diversity of area and support both aboriginal and recreational fisheries. Fish and salmon in particular have always been vitally important to the Tahltan for food, social and ceremonial purposes.

There are 12 different fish species known to utilize the study area, including 3 salmon species as well as steelhead. Distribution of Nass River salmon is limited to the outskirts of the study area, while distribution of Skeena River salmon extends well into the area. There are 8 established salmon conservation units within the study area, including Chinook, sockeye, coho and steelhead for the upper Skeena watershed, and Chinook and coho for the upper Nass watershed.

Fisheries values in the Klappan watershed are generally considered to be moderate with good habitats utilized by freshwater resident species. Fisheries values in the upper Skeena and Nass watersheds are considered to be high with excellent and diverse habitats, along with the presence of salmon species.

Impacts to fish habitat within the study area are largely related to the construction and subsequent abandonment of the B.C. rail grade. Fish habitat, water quality and fish access has been compromised as a result of construction activities and impacts have escalated due to the ongoing lack of monitoring, maintenance or habitat restoration.

The majority of previous fisheries surveys in the study area have been conducted at a reconnaissance level and usually in response to impending or proposed industrial development. There are a variety of data gaps for both freshwater and anadromous fish species.

There is much diversity in life history strategies across the ranges of these species and this point is certainly valid at the extremes of their spatial range – as is the Stikine/Nass/Skeena headwaters. Fish species found in these habitats often employ unique strategies to cope with temperature and growing season constraints. This simply emphasizes the fact that these habitats that are particularly vulnerable to perturbations.

The well-being of salmon and freshwater fish is inextricably tied to the availability of intact and productive habitats, and the preservation of such is vital to their conservation and sustainability. The maintenance of sound and productive habitats in the study area depends upon adequate scientific information and timely measures to prevent further habitat disruption. Although current fisheries information has some limitations, enough is currently known to generally evaluate management options and consider the implementation of precautionary habitat protection measures as related to land use.

Management Considerations

- *Groundwater function as it relates to fish habitat suitability and fish productivity should be conserved, protected and in some cases restored.*
- *Fish access to all habitats needs to be maintained and in certain places re-established. Historic impacts need to be assessed and then restored (see the railgrade section).*
- *Most of the fish species in the TRA employ unique life history strategies to deal with water temperature or climate variability, which makes them more susceptible to habitat impacts (e.g., riparian loss, groundwater influences and sedimentation).*
- *Fish species such as Bull Trout, Dolly Varden and Cutthroat Trout have be well documented to be particularly sensitive to habitat impacts associated to land use development (Haas 1998). The species are also particularly sensitive to overexploitation when remote areas are made accessible via regulated and unregulated road or trail development.*
- *Spawning habitats are rare and not well documented within the Klappan River and upper Nass River portions of the TRA, and must be identified and properly managed.*
- *Opening up of remote areas to access can threaten particular fish species that are vulnerable to over-harvest.*
- *Decisions made within the study area have the potential to impact downstream populations.*

Information Gaps

- *Further confirmation of fish species within the TRA through additional literature review or field investigations. This would include detailed fish distribution and presence surveys.*
- *Additional information on specific life history parameters for fish species within the TRA (i.e. incubating period emergence timing).*
- *Assessment of the type and scale of impacts to fish or fish habitats within the TRA (past, present and cumulative).*
- *Identification of critical fish habitats within the TRA.*
- *Surveys of fish passage and specific access issues.*
- *Assessment of groundwater function and current conditions as it relates to fish habitat suitability.*

Terrestrial Values

Ecological Classification Systems

The two most commonly used ecological classification systems in British Columbia are the Ecoregion Classification system, and the Biogeoclimatic Ecosystem Classification (BEC) system. The former system has stratified the province into discrete geographic areas, at five different levels. The two highest levels, Ecodomains and Ecodivisions are very broadly based and can be used to classify the province at a global level. The next three levels are Ecoprovinces, Ecoregions and Ecosections, which are increasingly detailed and narrower in scope. Ecoregions are distinct geographic areas with major physiographic and minor macroclimatic variations. Specific climate, vegetation and soil interactions within these ecoregions can best be described by biogeoclimatic zones, and the same BEC zone may occur within several ecoregions (Demarchi 2011). All these sites in the Klappan support a broad variety of species, many of which Tahltans have always used for food and medicinal reasons.

Biogeoclimatic Zones in the Klappan

The BEC system classifies areas according to their climatic, vegetal and landform similarities. The Klappan area contains six different biogeoclimatic zones. It is dominated by a non-forested alpine landscape covering 34% of the area, and is classified as Boreal Altai Fescue Alpine. Very little grows in these regions other than dwarf willow, grasses, sedges and lichen. The remaining zones are: Boreal White and Black Spruce, Interior Cedar Hemlock, Engelmann Spruce – Subalpine Fir, Sub-Boreal Spruce and Spruce-Willow-Birch.

There are three main categories within the biogeoclimatic ecosystem classification:

zone: an area that shares the same dominant climax tree species and regional climate;

sub-zone: an area within a zone that shares climax vegetation cover and sub-regional climate ;

variant: a further division that delineates areas within sub-zones that vary slightly by climate (e.g. drier, wetter, warmer, or cooler areas).

Specific definitions and characteristics of each BEC zone may be found in: www.for.gov.bc.ca/hre/becweb/resources/classificationreports/regional/index.html.

Ecoregion Classification in the Klappan

The Klappan is dominated by the Northern Skeen Mountains ecosection. It also contains the northernmost portion of the Eastern Skeena Mountains ecosection, a portion of the Southern Boreal Plateau, sandwiched between the Todagin Wildlife Management Area and the Spatsizi Plateau, and a very small percentage of the Northern Omineca Mountains.

Table 12 shows the relative percentages and areas of each BEC zone and ecosection within the TRA.

Table 12. Ecosections and BEC zones within the TRA

BEC ZONE	ECOSECTIONS								
	Northern Skeena Mountains		Eastern Skeena Mountains		Southern Boreal Plateau		Northern Omineca Mountains		
	Hectares of BEC Zone within KSI Area Ecosection	% of BEC in KSI Area Ecosection	Hectares of BEC Zone within KSI Area Ecosection	% of BEC in KSI Area Ecosection	Hectares of BEC Zone within KSI Area Ecosection	% of BEC in KSI Area Ecosection	Hectares of BEC Zone within KSI Area Ecosection	% of BEC in KSI Area Ecosection	Total Hectares of BEC Zone in KSI Area
BAFAun	164 936	22%	42 921	6%	44 790	6%	495	0%	**253 142**
BWBSdk	5088	1%			34 636	5%			**39 724**
ESSFmc	27 813	4%	110 849	15%	8996	1%			**147 658**
ESSFmcp	14 743	2%	39 312	5%	6299	1%	3	0%	**60 356**
ESSFun	29 190	4%							**29 190**
ESSFunp	31 588	4%							**31 588**
ESSFwv	53 627	7%							**53 627**
ESSFwvp	28 027	4%	1	0%					**28 028**
ICH vc	4435	1%							**4 435**
SBS mc 2	2827	0%	4969	1%					**7 796**
SBS un	6 767	1%							**6 767**
SWB mk	18 850	3%	9	0%	35 418	5%			**54 277**
SWB mks	12 003	2%	159	0%	20 167	3%	12	0%	**32 341**
TOTALS	**399 894**	**53.4%**	**198 220**	**26.5%**	**150 306**	**20%**	**510**	**0%**	**748 930**

Northern Skeena Mountains

This ecosection is characterized by high, rugged mountains, a moist coastal/interior transition climate, and a landscape that has been heavily modified by glaciations. Within the Klappan, a minor amount of Sub-Boreal Spruce (SBS) forests can be found in some of the valleys, Engelmann Spruce – Subalpine Fir (ESSF) forests dominate the mid-slopes and Alpine Tundra (AT) ecosystems carpet the upper slopes. There is also a very minor occurrence of Interior Cedar-Hemlock in the southwestern corner.

Eastern Skeena Mountains

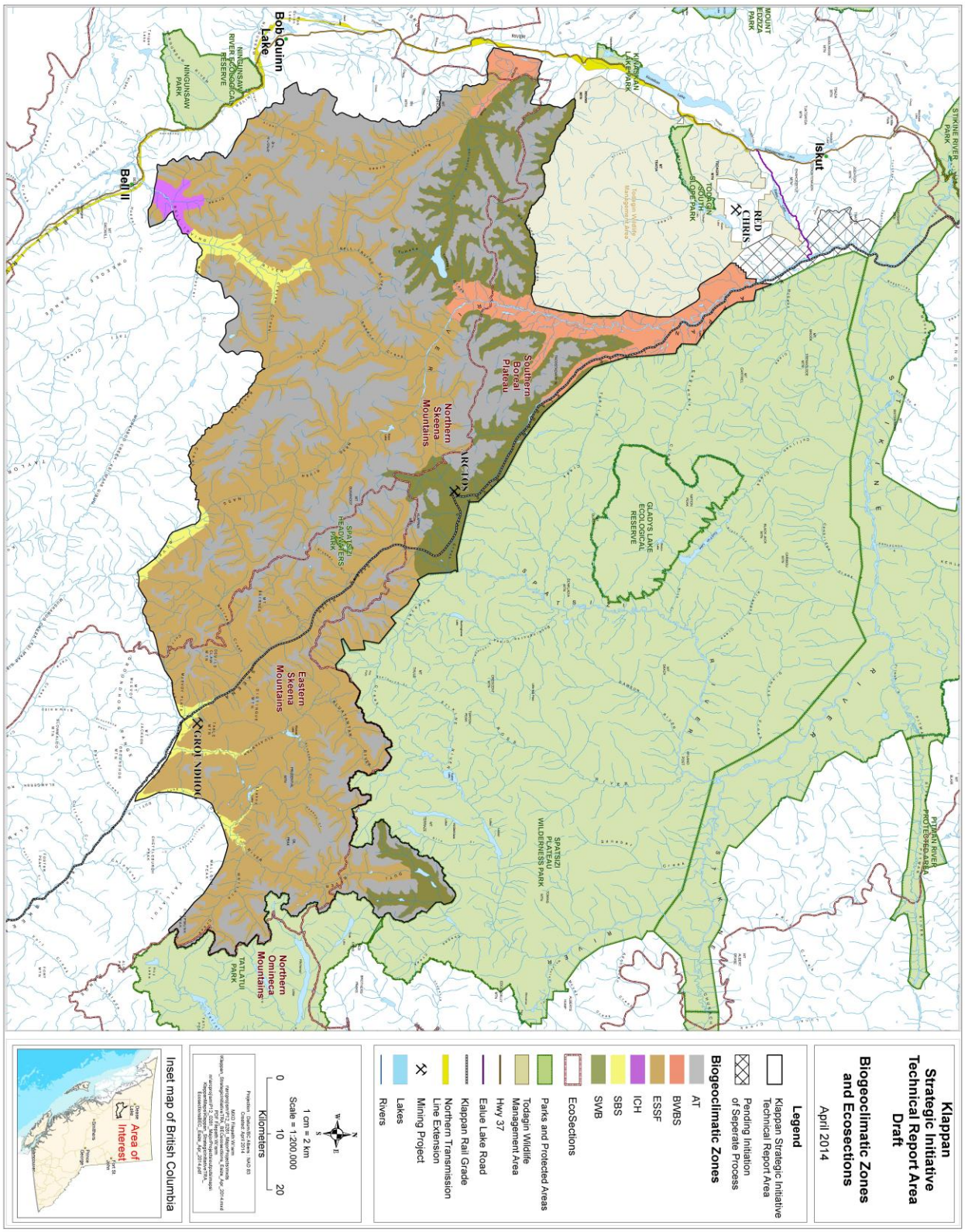
Only the northernmost tip of this ecosection pokes into the Klappan, and it is comprised mainly of AT at the highest elevations, ESSF forests along the midslopes, and a small percentage of SBS located in the valley bottoms. It lies within the rainshadow of the higher Northern Skeena Mountains to the west, and thus generally receives less precipitation with the occasional high snowfall due to Arctic outflow events.

Southern Boreal Plateau

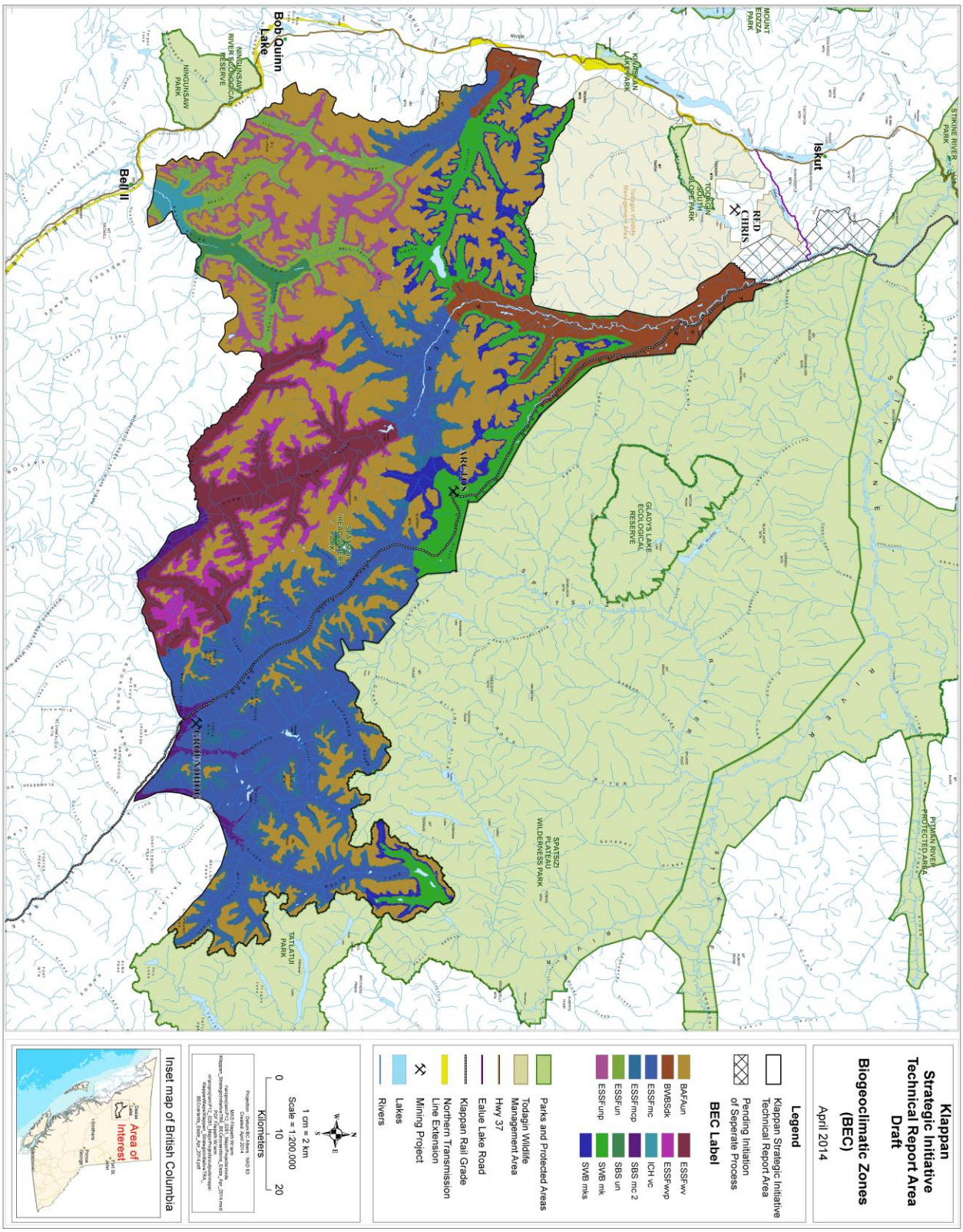
The Southern Boreal Plateau in the Klappan is dominated by shale and sandstone, and has been heavily modified by glaciations. It lies within the rainshadow of the Coastal Mountains, and in the winter or early spring arctic-outflow events can cause extremely cold temperatures. Boreal White and Black Spruce (BWBS) forests grow in the valley bottoms of this ecoregion, Spruce-Willow-Birch (SWB) forests dominate the lower to mid-slope regions, and the remainder is largely either AT or bare rock.

Northern Omineca Mountains

The Northern Omineca Mountains have been modified by glaciations that varied in intensity depending on location and elevation. These glaciers left deep drift in valley bottoms and formed many low-level lakes and wetlands. It is a region of rounded mountains and wide valleys. Prevailing climatic winds from the west bring heavy rains throughout the summer, and in the winter arctic air can flow down from the north causing extremely cold temperatures and heavy snow levels. The valleys and lower mid-slopes are dominated by scrubby, cold SWB forests, and the mid-slopes a mostly colder ESSF sub-zones.



Map 16. Ecosections and BEC Zones.



Map 17. BEC Zones.

Regional Protected Area Strategy Gap Analysis

In 1996 and again in 1998, the Regional Protected Areas Team (RPAT) provided a summary of gap analysis results for the high ranking Protected Area System (PAS) under the Protected Area Strategy for B.C. (B.C. Government 1995). Two ambitious goals define PAS:

> ***Goal 1: Representativeness***
>
> *To protect viable, representative examples of the natural diversity of the province, representative of the major terrestrial, marine and freshwater ecosystems, the characteristic habitats, hydrology and land, forms, and the characteristic backcountry recreational and cultural heritage values of each ecosection.*
>
> ***Goal 2: Special Features***
>
> *To protect the special natural, cultural heritage and recreational features of the province, including rare and endangered species and critical habitats, outstanding or unique botanical, zoological, geological and paleontological features, outstanding or fragile cultural heritage features, and outstanding outdoor recreational features such as trails*

As part of their commitment to Goal 1, RPAT established the Spatsizi Plateau Extension Area of Interest. It is found mostly (104 000 ha) within the Southern Boreal Plateau, with 18 300 ha in the Eastern Skeena Mountains, and 5 200 ha in the Northern Skeena Mountains. Further protection of the Southern Boreal Plateau is not thought to be necessary due to the fact that almost 50% of this ecosection is currently protected.

The Spatsizi Plateau Extension was not proposed as a study area in 1996, mostly due to mineral access concerns, and was referred to future land use planning process to resolve access issue and recommend land use objectives. This extension was considered during the drafting of the Cassiar Iskut-Stikine LRMP, and was not forwarded for Protected Area designation, although the upper sections of it were added to the Spatsizi Park.

The Technical Report Area extends over portions of the Southern Boreal Plateau, Eastern Skeena Mountains, Northern Skeena Mountains and the Northern Omineca ecosections, and lies primarily within the Skeena Stikine Forest District. Approximately 49.9% of the Southern Boreal Plateau, 7.4% of the Eastern Skeena Mountains, 3.2% of the Northern Skeena Mountains and 14.8% of the Northern Omineca ecosections are already protected in the Provincial Protected Area System (Table 13).

Management Considerations:

- *Protection strategies should evaluate representation of ecosystems, ecosections, special features and enduring features.*

Table 13. Protected Area Summary by Ecosection

	Hectares Total Area	Hectares in Technical Report Area	% of Ecosection in Technical Report Area	% of Ecosection currently protected	Comments
Technical Report Area	**748 930**	**748 930**	**100**		
Northern Skeena Mnts	1 715 666	399 894	53.4	3.20	Primarily Ningunsaw, Swan Lake, & Damdochax Parks & Protected Areas.
Eastern Skeena Mnts	768 055	198 220	26.5	7.40	Primarily Sustat Park & Protected Area
Northern Omineca Mnts	1 388 499	510	0.1	14.8	Primary Tatlatue & Finlay Russel Parks
Southern Boreal Plateau	2 309 335	150 306	20.1	49.90	Primarily Spatsizi Plateau Wilderness & Mount Edizza Parks

Rare and Endangered Species and Ecosystems

There are a number of rare and endangered species of wildlife, plants and ecosystems, which are located in the Klappan and surrounding area. Generally, an attempt is made within B.C. to manage endangered species using a multi-scaled, coarse-filtered/fine-filter approach. This method presumes that the conservation of most species can be ensured by preserving a diversity of habitat and ecosystems across the landscape, this is the coarse-filter. In a forest management context, this entails the maintenance of landscape-level components such as old-growth, forest connectivity and the distribution of patch sizes. At the stand level, it usually involves wildlife tree retention, variable retention strategies or coarse woody debris. It also acknowledges that some species have specific habitat requirements that must also be protected in order for that species to survive, this is the fine-filter approach, and these species are managed on an individual basis where they exist.

Consequently biodiversity planning, including cumulative effects, involves identifying and maintaining suitable habitat at a variety of scales, in order to preserve these species over time. To adequately manage this, there are several things industrial developers should consider when planning their projects. Two issues having the greatest impacts upon wildlife are: the location and extent of roads being built, and the developmental footprint of the site itself, as it can damage or eradicate critical habitats. The extent of the impact will be related to the rate, location and amount of habitat lost. Development can also affect wildlife's ability to move between seasonal habitats and increase the amount of human-wildlife interactions. Unfortunately, while a number of species in the Klappan are of conservation value, there is a distinct lack of data regarding their numbers and locations, making conservation efforts difficult (TCC and BC Min. Inte. Land Mgmt. Bureau 2008).

Table 14 and Table 15 are lists of species and ecosystems considered endangered or threatened that, using the best information currently available, may be present in the Klappan. While the distribution and populations of the species at risk are currently unknown for the Klappan TRA: where ecological communities or habitat types are known, they can be considered indicators of these species and the risk potential should be assessed. There are several species at risk that have a confirmed distribution within the TRA: woodland caribou, grizzly bear, wolverine, short-eared owl, bull trout and western toad. Specific knowledge of the species at risk is limited, and what data exists is dated. For example, the last survey of the Spatsizi Woodland Caribou Herd occurred in 2002. The B.C. Conservation Data Centre otherwise does not show information that is specific to the TRA.

Management Considerations when Planning

- *Follow existing recovery plans for identified species or ecosystems at risk.*
- *If no recovery plans exists, conduct surveys to determine presence and abundance and develop an appropriate management plan.*

Table 14. Endangered and Threatened Species within the Klappan

Scientific Name	English Name	COSEWIC	BC List
***** Birds**			
Asio flammeus	Short-eared Owl	SC (Mar 2008)	Blue
Chordeiles minor	Common Nighthawk	T (Apr 2007)	Yellow
Contopus cooperi	Olive-sided Flycatcher	T (Nov 2007)	Blue
Euphagus carolinus	Rusty Blackbird	SC (Apr 2006)	Blue
Falco peregrinus	Peregrine Falcon	SC (Apr 2007)	No Status
Falco peregrinus anatum	Peregrine Falcon Anatum Subspecies	SC (Apr 2007)	Red
Hirundo rustica	Barn Swallow	T (May 2011)	Blue
***** Freshwater Fish**			
Acipenser medirostris	Green Sturgeon	SC (Nov 2013)	Red
Oncorhynchus kisutch	Coho Salmon	E (May 2002)	Yellow
Salvelinus confluentus	Bull Trout	SC (Nov 2012)	Blue
***** Mammals**			
Gulo gulo	Wolverine	SC (May 2003)	No Status
Gulo gulo luscus	Wolverine, Luscus Subspecies	SC (May 2003)	Blue
Myotis lucifugus	Little Brown Myotis and Northern Long-eared Myotis	E (Nov 2013)	Yellow
Ochotona collaris	Collared Pika	SC (Nov 2011)	Blue
Ursus arctos	Grizzly Bear	SC (May 2002)	Blue
Rangifer tarandus	Northern Mountain Woodland Caribou Populations	SC (Nov 2012)	
***** Amphibians**			
Anaxyrus boreas	Western Toad	SC (Nov 2012)	Blue

Table 15. Rare Ecosystems Table (As identified by the CDC)

Description	Scientific Name	English Name	Global Rank	Provincial Rank	BC Status (CDC)	BEC Zones
Forest upland	*Pinus contorta/ Carex pauciflora/ Sphagnum spp.*	lodgepole pine/few-flowered sedge/peat-mosses	GNR	S2S3	Blue	ESSFmc/11; ESSFmc/Wb10; SBSmc2/15; SBSmc2/Wb10
Forest swamp	*Populus balsamifera -Picea spp./ Cornus stolonifera*	cottonwood (balsam poplar, black cottonwood) – spruces/red-osier dogwood	GNR	S2	Red	BWBSdk1/12; BWBSdk1/Fm02
Forest riparian	*Alnus incana / Cornus stolonifera / Athyrium felix-femina*	mountain alder/red-osier dogwood/lady fern	GNR	S3	Blue	ICHvc/52; ICHvc/Fl02
Fen wetland	*Carex lasiocarpa / Drepanocladus aduncus*	slender sedge – buckbean/hook-mosses	GNR	S3	Blue	BWBSdk1/Wf05; SBSmc2/Wf05
Fen wetland	*Carex limosa – Menyanthestrifoliata / Drepanocladus spp.*	shore sedge – buckbean/hook-mosses	GNR	S3	Blue	SBSmc2/Wf08
Fen wetland	*Eleocharis quinqueflora / Drepanocladus spp.*	few-flowered spike-rush/hook-mosses	GNR	S2	Red	ESSFmc/Wf09; SBSmc2/Wf09
Marsh wetland	*Equisetum fluviatile – Carex utriculata*	swamp horsetail – beaked sedge	GNR	S3	Blue	BWBSdk1/Wm02; SBSmk2/Wm02
Fen wetland	*Eriophorum angustifolium – Carex limosa*	narrow-leaved cotton-grass – shore sedge	GNR	S3	Blue	ESSFmc/Wf13
Bog wetland	*Scheuchzeria palustris / Sphagnum spp.*	scheuchzeria/peat-mosses	GNR	S3	Blue	SMSmc2/Wb12
Fen wetland	*Trichophorum alpinum / Scorpidium revolvens*	Hudson Bay clubrush/rusty hook-moss	GNR	S2	Red	SBSmc2/Wf10

Wildlife Values

The Klappan is an area richly populated with a variety of wildlife. This wildlife has provided the Tahltan with abundance and life from time immemorial. The many contiguous watersheds provide habitat for a number of ungulate species, as well as large-ranging carnivorous species, which together comprise a large portion of the Spatsizi predator-prey system. Some species of particular importance to the Tahltan include: woodland caribou, moose, mountain goats, Stone's sheep, grizzly bears, marmot, wolverine and other furbearers. The Tahltan value these species for a variety of reasons. They are hunted for both sustenance and commercial opportunity, and this land-use forms an integral platform upon which many other cultural, spiritual and land-based activities occur. As such, the maintenance of these as healthy and resilient wildlife populations is a high priority to the Tahltan. These populations also play roles of global significance in terms of conservation and destination tourism. For example, Stone's sheep and mountain goat are globally significant as approximately 99% of the world's population of Stone's sheep and approximately 50% of the world's population of mountain goats occur in British Columbia, and as such, occupy habitats within portions of the TRA.

The Klappan also provides habitat for regionally, provincially, and nationally significant species, including ones that have been listed by the B.C. Conservation Data Centre (CDC) and the Committee On the Status of Endangered Wildlife In Canada (COSEWIC) as being endangered, threatened or of special concern. These have been listed in Table 14.

The Cumulative Effects Assessment (CEA) prepared for the Klappan in 2006, and the one completed in 2013 suggested that the greatest potential impact towards wildlife in the area stemmed from potential access development. These impacts occurred as a result of changes in road density and pattern, as well as the direct and indirect disturbances generated from increased area traffic. These access impacts could include: the loss of habitat, temporal disruption of wildlife during vulnerable periods, displacement from preferred habitats and regular migration routes, increased mortality risks and the disruption of predator-prey balances. The CEA also found that these impacts were not evenly distributed throughout the area. Industrial access roads in the north had a greater impact on caribou, moose and marten, while the same kind of development in the south was more likely to impact grizzly bear.

The assessment also noted that a loss of habitat can occur as a result of other land-based disturbances related to development. However, the CEA study reported critical habitats for some species were not limiting in the area, and so habitat loss will have a species specific level of impact. It may, however, be a concern where habitat loss is higher in specific watershed or sub-watershed. It is also important to consider effects to populations from access and land base disturbances that can have considerable impacts, while not overly degrading habitats.

Habitat values have been mapped for the following species of interest in the Klappan: woodland caribou (*Rangifer tarandus caribou*), moose (*Alces alces*), mountain goat (*Oreamnos americanus*), Stone's sheep (*Ovis dalli stonei*), grizzly bears (*Ursus arctos horribilus*), and marten. Other furbearers which have been included as being important to the Tahltan are: marmot

(*Marmota manox and Marmota caligata*), lynx (*Lynx Canadensis*), beaver (*Castor Canadensis*), wolverine (*Gulo gulo), fisher* (*Martus pennant*) and grey wolves (*Canus lupus*).

Habitat values and maps being used in this report are based upon both expert and local knowledge of the wildlife in the Klappan. These sources were used in the Klappan Cumulative Impact Assessment (CEA) to provide the relative importance of habitats in the TRA, and they were a modification of the habitat suitability rankings completed for the Cassiar Iskut-Stikine LRMP. Today, when habitats are being mapped and ranked, several maps for each species are generated. These maps would include: natal areas, winter use, reproductive areas (e.g. rutting areas), critical habitats, (e.g. escape terrain), or areas of seasonal importance. The approach was to rate habitats based on their relative importance year-round and was specific to the planning area. So, for moose, both high value calving habitat and winter habitats were given the same ranking and shown on the same map. The information was then provided to the planning table and community members so they could indicate where changes should occur based on their knowledge of the area.

Management Considerations

- *Resource developments should provide an assessment of the implications on habitat supply, distribution and linkages/fragmentation of important wildlife habitats, and temporal disturbances that can conflict with critical seasonal habitats and migrations by alienating those habitats.*

Cultural Significance

The history of wildlife management in British Columbia begins with First Nations. Early conservation of important species was only possible because First Nations recognized clan and family hunting and fishing monopoly rights (Ball 1981). Before the European arrival, First Nations peoples practiced a system of land tenure that provided the base for effective management of major animal, fish and plant resources. Because this system lasted well into the European fur-trade era, many First Nations management practices in the lands that became the province of British Columbia can be described with considerable accuracy (Ball 1981).

Tahltans concerned themselves with the conservation of all species important to them. For example, in 1912, decades before the conservation of grizzly bears became ingrained in the consciousness of conservationists and other British Columbia residents, Tahltans asked that an annual bag limit of three be placed on the grizzly bear (B.C. Gov Game warden report 1913, pp. 16).

The well-known Tahltan bear dog was a critical element of Tahltan hunting and wildlife management. Trained dogs were used for hunting bear, deer, caribou and elk (Ball 1981). They were an important commodity and well cared for by hunters (Ball 1981). Dogs were used to pursue an animal after the hunter spotted its tracks, and a dog that could hold the animal at bay until the hunter arrived was highly valued. Ball (1981) noted that "Without the use of trained dogs, Indians would have been much more indiscriminate in their killing of game".

Photo 14. Tahltan bear Dog (Canada Post)

Tahltans hunted in the mountains: both because the animals they desired were there, and because the terrain allowed hunters easier access to animals than in lower elevations where wildlife had ample opportunity to escape. As well, all species used the mountain passes and Tahltans used this knowledge to hunt more effectively.

Mountain Goat (Oreamnos americanus)

Mountain goats generally confine themselves to the steep, mountainous regions of B.C.: as security habitats, or escape terrain, such as talus slopes, rocky cliffs or rock outcrops are critical for their survival. Escape terrain is so important to mountain goats that they have been documented as having annual habitat use generally confined within 300-500 m of escape terrain. In the winter it can be reduced to less than 150m. While mountain goats are frequently observed at further distances from escape terrain in other seasons in order to access mineral licks and browse upon emerging vegetation, escape terrain is still considered the key habitat feature. The availability of escape terrain habitat is scattered across the Klappan in the steep, rocky terrain, this is summarized in Table 16. However within this gross area, effective habitats that include critical winter range and natal areas, are expected to be much less available.

Life History

Mountain goats live as individuals and in small herds that frequently change size and composition depending upon the season. Nanny-kid, or nursery groups, can be as small as 3, or they can grow to include as many as 20 individuals after kidding. Billys live alone or in small groups, often dictated by the season and/or maturity of the individuals, and typically occupy the more rugged and less productive habitats. All groups maintain well-defined hierarchies based upon social dominance, size, strength and experience. Mountain goats learn their home ranges from their mother; these are known as matriarchal-based home ranges. While they are not overly territorial, they do protect their personal space and at times may be involved in several physical altercations per hour. Mating season generally peaks between late November and early December, with kids born approximately 6 months later between mid-May and mid-June. In their first year, kid mortality is high and can exceed 50% post-winter. Yearling mortality comprises the next largest impact to abundance, with post-winter mortality rates often between 15-20%. The availability of effective and high value winter range habitat is the key limiting factor for mountain goat populations.

Mountain goats will generally winter as low in elevation as available habitat provides, and will follow new growth up the mountainside as it occurs, taking advantage of its most nutritious stages. Mineral licks are very important to the mountain goats in the spring and summer, particularly for lactating nannies, and they will travel long distances to access them. The travel to licks is done in such a way as to maximize use of available escape terrain. In the summer and early fall, they feed at or above the treeline, preferring alpine swales and boulder meadows, as long as it is within some distance from escape terrain. Their winter ranges are steep sites that shed snow and generally have a southerly exposure. Because of the territory they inhabit, they will eat a widely varied diet, depending on what is seasonally available.

Table 16. Summary of Mountain Goat Habitat within the TRA

GOAT	Hectares	% of Habitat in KSI Area
Habitat	68 836	9%
Total KSI Area	748 930	

Cultural Significance

Tahltan oral data speaks profoundly regarding the mountain goat and the multiple ways mountain goats provided a means of thriving in their homeland. This placed mountain goats equal to salmon in survival for Tahltan people. The hair was used to make rope, which was then used to make many items including fishnets, bags, and snares for moose, caribou and bear. The hide of the back of the goat was used to make the strongest rope. The goat hide, when dried, also made "impenetrable war uniforms", shields for the front and back of the warrior. The hide also made extremely warm blankets, and goat horn was used to make tools and weapons.

> *"... And next is goat horn. It's a hard one; it's as hard as a knife. They killed anything with it, even grizzly bear…" (Consultant 1980s Tahltan Knowledge Study).*

Present Situation

Information regarding the mountain goat population in the Klappan TRA is limited, as most of the available information is focused on the Todagin Wildlife Management Area. Within the Klappan, local Tahltan knowledge is one of the best sources available for identifying key habitats, mineral licks, and movement corridors that could be used as monitoring indicators.

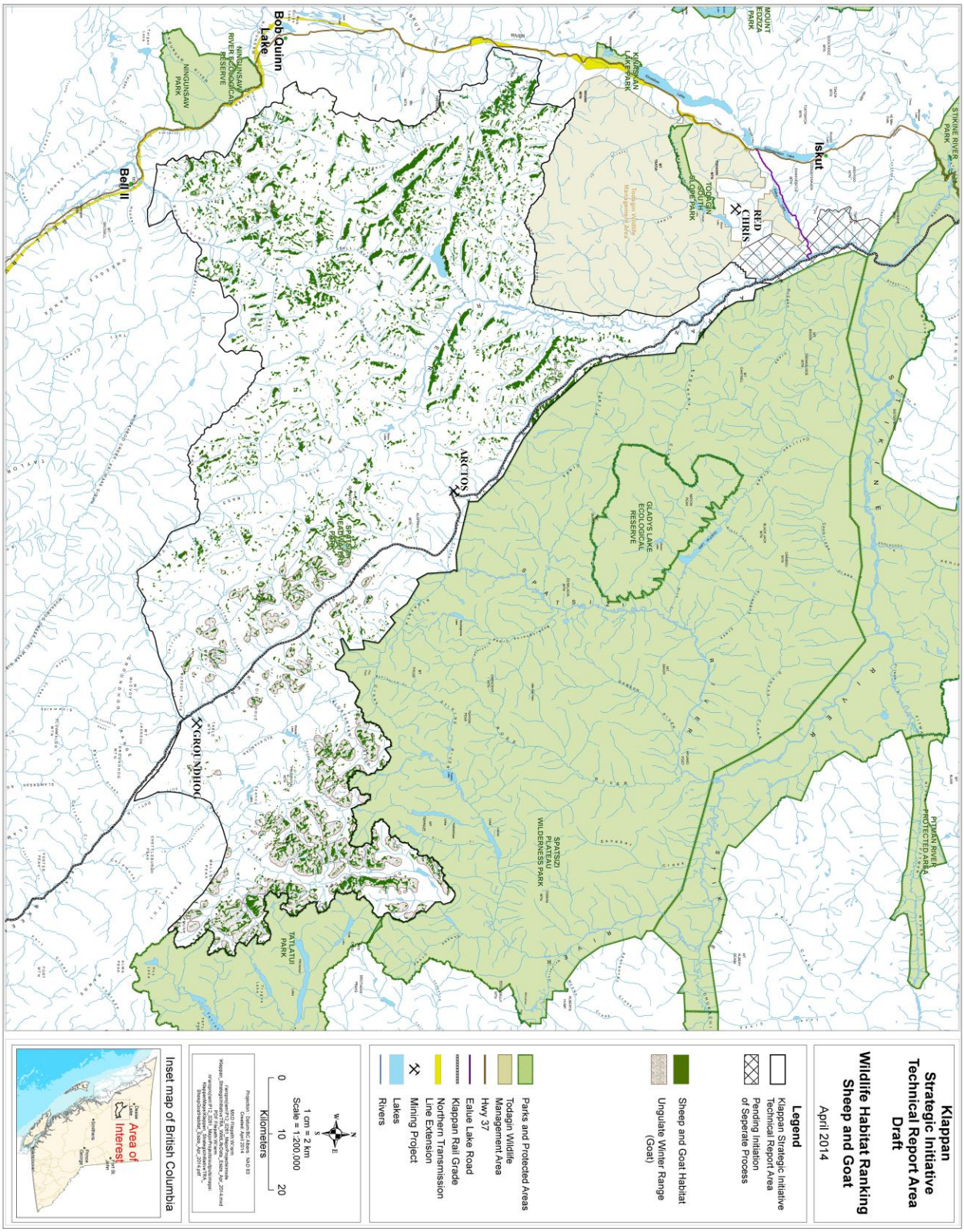
Mountain goats can potentially suffer from both direct and indirect disturbances linked to resource development. These disturbances can arise from exploration, such as aircrafts flying overhead or from operations such as blasting. This could result in increased energetic costs from increased movements, and an indirect loss of habitat from mountain goats moving to lower quality habitats. If this happens, resultant population effects could include reduced pregnancy rates and/or increased kid mortality rates, as well as increased mortality of adults and juveniles, thus reducing recruitment rates. It is the proximity, intensity and cumulative effects of proposed activities that will determine the extent of the disturbance to the goats. Additionally, it will also depend on the availability of suitable habitats within the mountain block or mountain blocks within the individual's home range, as mountain goats do not typically foray long distances away from core areas of escape terrain.

Management Considerations

- *Establishing provincial aircraft distance requirements adjacent known critical habitats and during winter and kidding periods for the Klappan TRA.*
- *Where mechanized land use disturbance is being proposed in close proximity to high value habitats, to include a mitigation and monitoring plan by a qualified biologist to ensure the disturbance is not impacting mountain goats.*
- *Recommending alpine or elevational restrictions for all motorized (ATV & snowmobile) use for recreational purposes including hunting.*

Information Gaps

- *The last population survey for mountain goat outside of the Todagin Wildlife Management Area is not known, but it has not occurred for at least twenty years. It is a data gap that should be tabled with the Tahltan- B.C. Fish and Wildlife Working Group to identify solutions to address this gap.*



Map 18. Goat Habitat.

Caribou (Rangifer tarandus caribou)

The Woodland caribou in this region belong to the Northern Mountain Population, and they occur across the boreal and sub-alpine ecosystems of northwestern B.C.. Higher value habitat types can be found throughout the Klappan, and is concentrated along the borders of the Spatsizi Plateau Wilderness Park, as well as the southern and eastern edges of the Todagin South Slope Park. These habitat areas have been summarized in Table 17. In addition to identifiable seasonal habitats, migratory linkages at a landscape scale can be more difficult to delineate and so caribou require management attention at both a broad and localized scale. Northern Mountain Caribou are considered a species of special concern (COSEWIC 2012) under the federal *Species at Risk Act*, and as such require special consideration.

Life History

In the winter, woodland caribou use a variety of habitats, but they prefer areas with mature, open lodgepole pine forests interspersed with openings, shrub-wetlands, bogs, and mixed deciduous-coniferous stands. These areas typically produce high concentrations of the ground lichens comprising up to 80 percent of their winter diet. In the winter woodland caribou tend to favour windswept uplands, alpine, bogs and south facing slopes where the snow depth is not prohibitive to cratering for food. In the spring caribou cows migrate and then disperse across alpine ranges for calving, reorganizing into small natal groups in the summer. In the fall caribou herds show a high fidelity to traditional ranges, forming larger rutting aggregations/groups on alpine and sub-alpine habitats. After the rutting season and into December as winter progresses and snow depths increase, caribou generally disperse into smaller groups again and spend their time in the lower elevation pine forests and higher elevation windswept alpine. This dispersal into small groups during much of the year spreads the population across their range and makes it more difficult for predators such as wolves to hunt them. These winter movements can be significant and can vary each winter depending upon a number of factors such as snow condition, food availability, predators and anthropogenic disturbances (e.g., industrial traffic and recreational snowmobile use). A recent study of caribou movements using radio-collars has shown that caribou from the Williston Lake area (outside the TRA) have wintered in the Tuaton and Laslui Lakes areas which are located within the TRA, underscoring the importance of maintaining the effectiveness of traditional landscape migratory corridors and habitats.

The gestation period of woodland caribou is seven to eight months. Usually a single calf is born in May to early June, but twins do occur and newborn calves have been observed at the end of June. After an initially high infant mortality rate of approximately 50%, their average lifespan ranges from 4 to 15 years, with cows typically living longer than bulls. The main predators of caribou throughout their life include grizzly and black bears, golden eagles, wolves, wolverine and humans. Most females begin breeding at 28 months. Males can begin breeding as early as 20 months, although social dominance generally excludes them from rutting success prior to their third or fourth year. The breeding season usually occurs in late September to late October, and during the rut, males use their antlers in clashes to determine dominance.

Table 17. Summary of Caribou Habitat Rankings Within the TRA

Caribou Habitat Ranking	Hectares	% of Rank in KSI Area
1	24 50	3%
2	67 924	9%
3	91 068	12%
4	232 508	31%
5	53 259	7%
6	279 321	37%

Cultural Significance

Tahltan have hunted caribou for generations, and those hunters spent a considerable amount of time in the alpine for this purpose. Hunting in high elevation areas like the Klappan, provides easier access to the caribou and better visibility. The following are oral data collected from the Tahltan Knowledge Study in the 1980s:

> *"... I the old days it was mainly caribou.... in 1887, there was very few moose, just caribou, and of course there were sheep in the mountains..."*
>
> *"you can hunt grizzly, black bear, goat and caribou and moose from one camp*
>
> *."... Even caribou, they skinned the head and made a container, even out of the bladder and intestines. Bear fat was saved. They used part of the caribou hoof to make a fish float which rattled, to know when fish were in our nets. Sinew from moose or caribou was use to make thread... "*

Present Situation

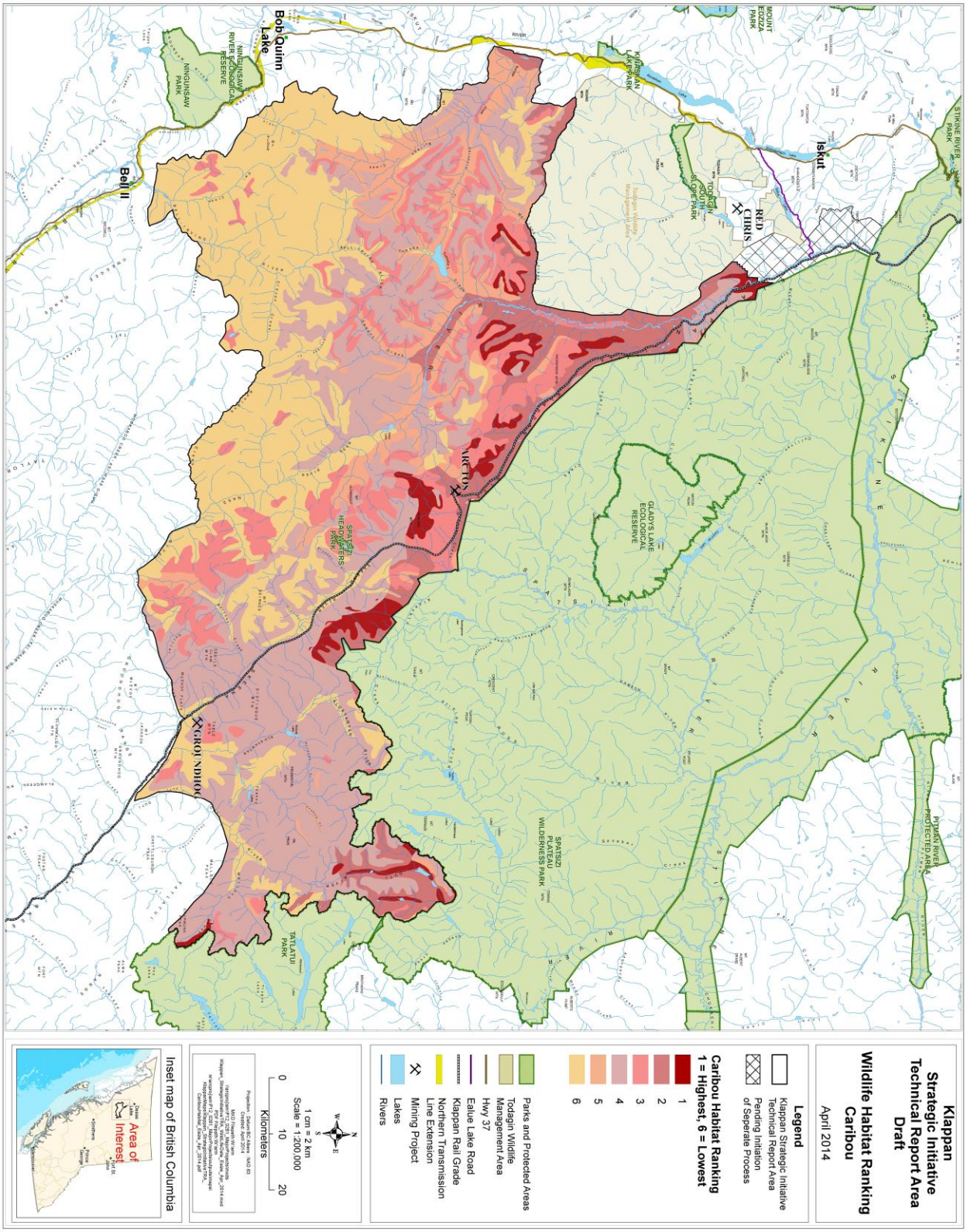
Currently, both resident and non-resident hunters can harvest caribou in the Klappan, but only caribou bulls with at least one antler which has a minimum of 5 tines (points), including the tip of the main beam above the rear point, are available for harvest during the general open season. A very limited number of draw opportunities also exist for licensed hunters to harvest 'Any Bull' through the Limited Entry Hunting draw framework. Although both sexes grow antlers each year, the growth is not entirely based on the size of the animal, with licensed harvest being restricted to bulls only. A large bull may only grow antlers with four tines in a given year and a smaller bull could have five tines for multiple years. The 5 point management approach restricts the overharvest of large bulls and conservatively limits the overall harvest on bulls to ensure breeding and herd productivity is not compromised.

Management Considerations

- *Maintain adequate amounts of well-distributed, critical habitats available across seasonal ranges and through time. Exclusion of activities in critical seasonal ranges such as traditional rutting ranges and migration corridors should occur.*
- *Preserve access to these areas for woodland caribou by preventing fragmentation of the areas or displacing the caribou from other resource development activities.*
- *Minimize risk to woodland caribou from human-caused mortality.*
- *Use techniques that enhance retention and recovery of terrestrial lichens.*
- *Develop recreational, commercial tourism, and access management strategies that limit or prohibit recreational and tourism activities and access in specific areas during critical seasons.*

Information Gaps

- *The last population survey for woodland caribou occurred in 2002 for the Spatsizi Woodland Caribou Herd. It is a data gap that should be addressed by aerial surveys for the entire TRA, and should include portions of the Spatsizi Park.*
- *Migratory corridors have also not been mapped for the TRA caribou herd and because caribou use traditional corridors in response to specific winter/seasonal characteristics/events, specific studies that will confirm these sites (e.g., radio-telemetry projects.)*
- *These are data gaps that should be tabled with the Tahltan- B.C. Fish and Wildlife Working Group to identify solutions to address these gaps.*



Map 19. Caribou Habitat in the TRA.

Moose (Alces alces)

Northern B.C. moose in typically inhabit boreal and sub-boreal ecosystems and lower elevation riparian habitats found throughout the Klappan. In the winter, due to higher snow depths occurring in the Northern and Eastern Skeena Mountains, moose will typically move to lower elevation forests in the Southern Boreal Plateau. Preferred habitats are summarized in Table 18 and shown in Map 20.

Life history

Moose are generally solitary animals that move through familiar summer and winter home ranges within a larger annual home range. Because of their solitary nature, moose do not defend their home range, nor do they compete for dominance except for males during the rut. The only significant social bonding that occurs is between the mother and calf which lasts for 1-2 years, with female calves remaining near the cow for the longest period. Moose experience a prolonged breeding period which begins in late September and can run until mid-to late November. During this period males engage in shoving matches using their antlers, after which the females actively choose their mates. The gestation period lasts for eight months and typically single calves are born between May and early June, with twins occurring more commonly where habitat productivity is high. The average lifespan for a moose is 15-25 years and females typically begin breeding at two years of age.

The seasonal movements of moose, or the usage of their home ranges, can vary widely among individuals. It has been documented, that while a portion of the population can have extremely large home ranges, with movement between seasonal ranges: another portion may have a small home range, where all needs can be met within a small area. This variance does not relate to a particular age or sex, but more to the quality of habitats found in the area. Moose occupying mountainous or plateau terrains usually migrate between winter/spring ranges in valley bottoms and higher elevation summer ranges. Moose are browsers, meaning they predominantly forage on annual woody growth from shrubs such as willow and dogwood. In the winter they tend to concentrate along river valleys and in burns, wetland complexes and logged areas, in order to take advantage of dense shrub complexes that offer such browse, and because snow conditions are typically shallower and more dense. In addition, it is common to find moose at treeline when winter temperature inversions occur, as it can be considerably warmer at higher elevations during inversions. In the summer they prefer aquatic plants and the succulent new growth of herbs and shrubs and occupy areas adjacent to riparian features such as lakes and rivers where preferred forage is available, and to assist with thermal regulation, as high summer temperatures can result in heat stress on moose. Preferred calving habitats are an association of habitats that provide security, forage and are located near wetlands, lakes or rivers.

Table 18. Summary of Moose Habitat Rankings within the TRA

Moose Habitat Ranking	Hectares	% of Rank in KSI Area
1	8 513	1%
2	24 978	3%
3	97 861	13%
4	284 896	38%
5	52 136	7%
6	280 545	37%

Cultural Significance

Moose are both a culturally important species and a significant traditional food source for the Tahltan Nation. Historically moose were not hunted as often as they are today, and it is likely that as moose have become more abundant in the Tahltan Nation Territory, and there was greater access to firearms, the importance of moose has increased. In the Tahltan Knowledge Study, it was noted that:

> *"...That's how old Tahltan generations used to survive in the winter, all on groundhog, and salmon, and gopher... They could hardly get moose, it was so hard to come close to them with bow and arrow..."*

Present Situation

The only moose population survey that has been conducted in the Klappan occurred in 2001, and at the time the population was estimated at approximately 500 animals. Transects were flown in 2000, 2010, and again in 2013 as part of the Red Chris Mine Project wildlife monitoring. These transects provide counts only, and cannot provide population estimates, although they can be used to provide information on bull and calf ratios.

Given that only one population survey occurred 13 years ago, it is hard to provide an assessment of the current status of the moose population in the Klappan TRA. The Klappan has become a valuable moose-harvesting area for the Tahltan, and recently the communities have raised strong concerns about the status of the moose population here: especially when licensed hunting and predation pressures are also considered. In 2011, to address concerns being expressed from the Tahltan, the licensed hunting season in the Klappan was reduced from 90 to 30 days, and Compulsory Inspections (CI) were required for moose harvested in all Wildlife Management Units in the Tahltan Nation Territory. CIs require the licensed hunter to provide a kill location, an incisor tooth for aging, and the antlers with the upper skull attached for examination. This information provides more spatially specific harvest information and can better assist in determining where the majority of harvesting is occurring within a large Wildlife Management Unit. As a paired approach to obtain a level of comfort with reported moose

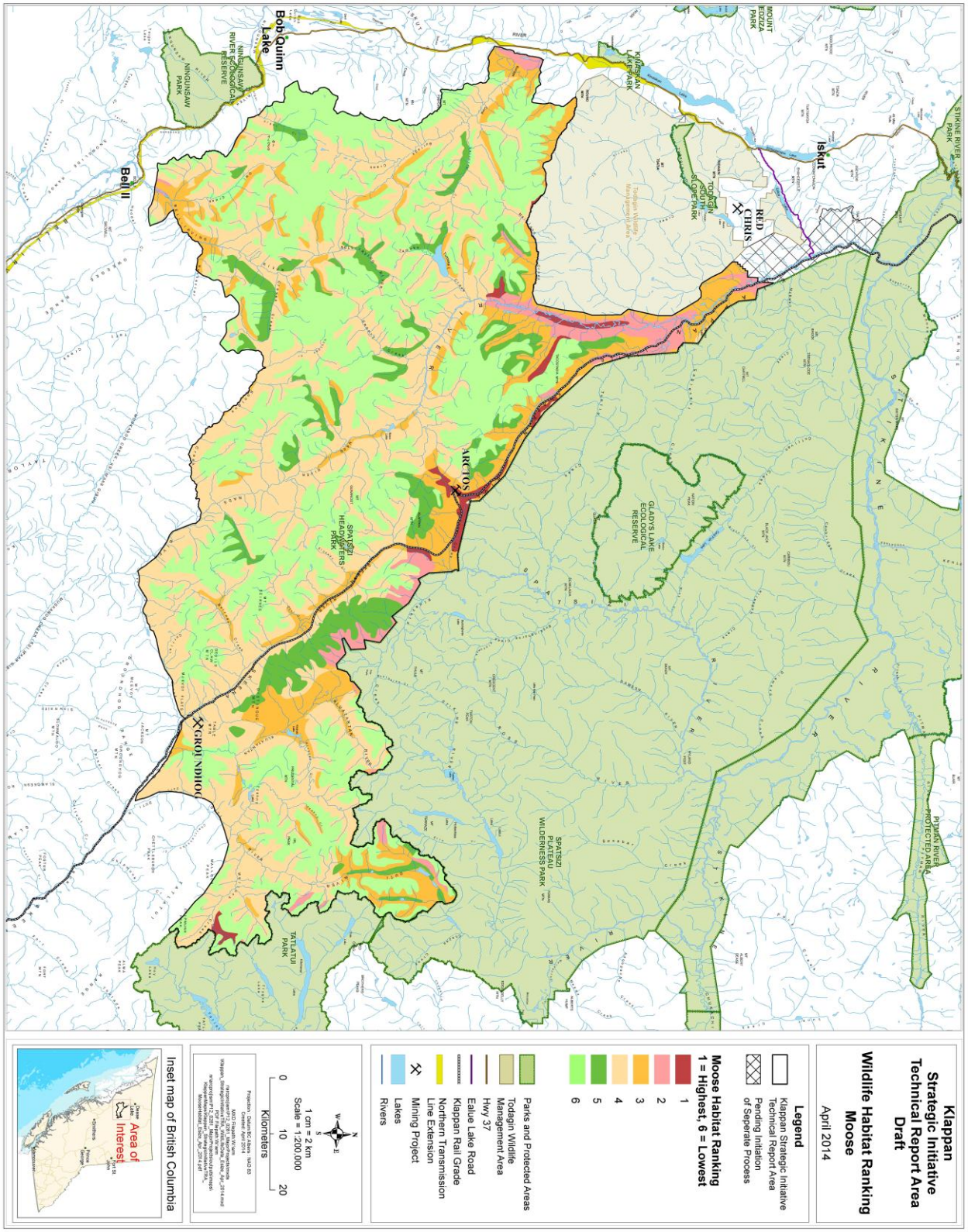
harvest numbers in the Klappan and along the Stikine River, jointly operated B.C.-Tahltan game-check stations were operated for the peak of the licensed hunting period.

Management Considerations

- *Maintain adequate amounts of well-distributed, critical habitats that are available across seasonal ranges and through time.*
- *Minimize risk to moose from human-caused mortality.*
- *Monitoring bull:cow ratios (>= 50:100) for low density moose populations as documented in the 2013 Draft Provincial Framework For Moose Management report.*
- *Undertake a stratified random block survey in the Klappan moose population unit to provide current population information upon which to base licensed harvest opportunities.*
- *The Tahltan/B.C. Working group is working to assess all forms of harvest and management approaches to better manage moose in this area. This body will make recommendation to support moose management in the area including landuse, resource development and regulatory mechanisms*

Information Gaps

- *Tahltan/B.C. Fish and Wildlife Working group has begun an assessment of compulsory inspection data. This may then be able to provide more information on harvest distribution and amounts, which could form the basis for proposed changes to management approaches and regulation changes. As well, a stratified, random block survey is required in the very near future to facilitate an analysis of the changes in the population since 2001.*
- *These are data gaps that should be tabled with the Tahltan- B.C. Fish and Wildlife Working Group to identify solutions to address these gaps.*



Map 20. Moose Habitat.

Grizzly Bear (Ursus arctos horribilus)

Grizzly bears across northern B.C. have similar foraging habitat and seasonal use, except for areas that have salmon in their ecosystems. In these areas, bears will use the rivers and lakes during spawning runs to both catch salmon and to feed on dead salmon carrion. In northern ecosystems without salmon, bears focus on foraging vegetation; however they will also actively prey upon and scavenge alpine rodents, moose, caribou, and mountain ungulates. In some areas it has been suggested that grizzly bears have become attuned to firearm discharges and may seek out hunter kill locations in order to feed on the carcass. In the Klappan TRA, these northern interior bears will generally fall into one of 2 behavioural ecotypes: one that predominantly feeds on terrestrial proteins, berries, ants and vegetation; and a second who migrate to limited salmon spawning habitats located in the Skeena and Nass River headwaters and use these food sources each year. The abundance of grizzlies in any given area depends highly upon the productivity of the food sources. Grizzly habitats are summarized in Table 19.

Life History

By and large, Grizzly bears are an unsocial animal, the only connections being between a mother and her cubs, and between adult mating pairs. The mating period last from late May to early July, but most pairings only last for a few days. Both male and female Grizzlies are polygamous, which may result in littermates having different fathers. Eggs fertilized during the mating period do not implant until the sow hibernates, and tiny hairless cubs are born in January or February. The sow then nurses them in the den until they emerge in April or May. Cubs remain with their mother for approximately two and a half years and reach maturity at five or six. The average lifespan is 20-30 years.

Vegetation can make up 60-90% of their diet, however, they will seek out protein sources when available, such as salmon, carrion and young ungulates. In the spring, after emerging from their dens, they will look for carrion and frozen berries and seek out the earliest snow-free areas to forage on early growing plans. In the Klappan, that can include south-facing slopes or lower elevation riparian areas. As spring progresses, the grizzlies will follow vegetation emergence uphill. In the summer and fall, other food sources like marmots and ground squirrels can be important protein sources, and they will travel to access berries and salmon runs. In late fall they will seek out their dens and hibernate, generally from October to May.

Table 19. Summary of Grizzly Habitat Rankings within the TRA

Grizzly Habitat Ranking	Hectares	% of Rank in KSI Area
1	173 925	23%
2	135 883	18%
3	193 214	26%
4	54 653	7%
5	133 291	18%
6	57 966	8%

Cultural Significance

All wildlife species are important to, and used by Tahltans. Salt licks were key habitats as they attracted a variety of ungulates and predators such as grizzlies. At salt licks hunters set snares for mountain goats, sheep, caribou, moose and grizzly bears. Tahltans hunted mountain goats and grizzly bears together.

> *".. And there's also the grizzly country over there. Right on this whole ridge spread all through here and right up, that's all good, it's got grizzly and goats on them…*
>
> *"You can hunt grizzly, black bear, goat and caribou and moose from one camp." (Consultant 1980s Tahltan Knowledge Study).*

Present Situation

Under the federal *Species at Risk Act,* grizzly bears are a species of special concern (COSEWIC 2012). However, there is limited information available on interior grizzlies within the Klappan TRA. The most recent study of grizzlies was associated with the Galore Creek Mine Project, and the Red Chris Mine Project is observing bears near their mine site, however both of these studies are outside of the TRA. Tahltan knowledge can assist in identifying key habitats, spawning concentrations, marmot colonies and ungulate natal areas that could be used as monitoring indicators of grizzly population health in the Klappan.

Grizzly bears are susceptible to population declines due to their low reproductive rates, especially when mortalities are higher for adult females then males. Adult females usually have three years between newborn cubs, and if the number of female mortalities is high, this can result in significant population declines in a short time period. Hunting and mortalities from resource development including road kills, waste attraction and human-bear interactions are all sources of concern (COSEWIC Status Assessment 2012).

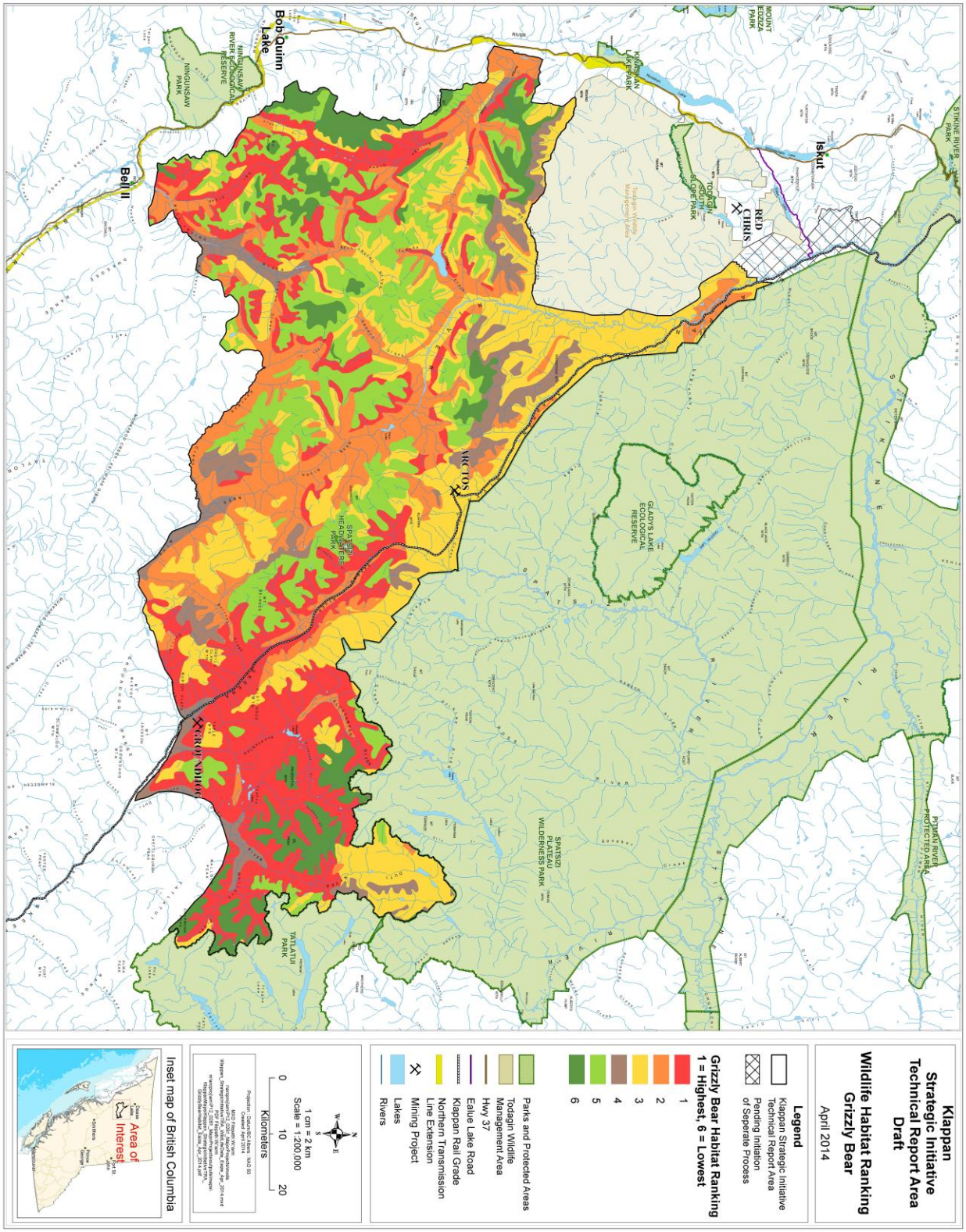
The estimated density of bears within the Spatsizi Grizzly Bear Population Unit is 20-30/1000km^2; however, the unit includes Spatsizi Park where resource development is not allowed (B.C. Grizzly Bear Population Estimate 2012). Some are concerned that grizzly bears may move out of the Klappan TRA if significant resource development were to occur as this has been documented elsewhere (Johnson et al. 2005).

Management Considerations

- *Having access management in place and road densities minimized to reduce habitat fragmentation, displacement, and human- bear encounters from resource development.*
- *Using mitigation strategies to reduce human-wildlife encounters and attractants to bears.*
- *Strategies to reduce displacement of bears from resource development and associated cumulative effects.*

Information Gaps

- *Increased population information collection if resource development projects are being proposed in the TRA.*
- *This is a data gap that should be tabled with the Tahltan- B.C. Fish and Wildlife Working Group to identify solutions to address this gap.*



Map 21. Grizzly Habitat.

Stone's Sheep (Ovis dalli stonei)

Stone's sheep are only found in British Columbia, and a very small area in the Yukon, adjacent to the B.C. border, and they inhabit alpine and sub-alpine regions within the northern third of B.C.. They are well-adapted to mountainous terrain, and herds are generally separated by plateaus and forested lowlands. They are not ranked as a species at risk within B.C., as their habitats are considered secure. The Todagin Plateau, adjacent to the Klappan, provides critical winter range and lambing habitat for a sizeable Stone's sheep population, and is protected under a Wildlife Management Area designation. Otherwise, Stone's sheep may be found across the Klappan in steep, mountainous areas, with sheep and goat habitat generally overlapping (Table 20). Talus slopes, rocky cliffs and rock outcrops all provide security habitats for Stone's sheep. However, the reliance on this habitat is generally less than with mountain goats. Sheep have greater mobility than mountain goats, and can utilize habitats at a greater distance from escape terrain; sheep have been documented 300-700 metres from escape terrain. Other important factors affecting Stone's sheep populations include the availability of suitable winter-spring habitats that can provide adequate forage during winter, winter severity, predation protection during lambing, and human disturbance through industrial and recreational activities.

Life History

Stone's sheep are social animals, living in large groups or herds. Males and females live separately for most of the year, with young males leaving the female groups by the age of two. Females generally conceive their first lamb at one year, and breeding season runs from mid-November to mid-December. Single young are born between mid-May and June with twins being very rare. Infant mortality is very high and is mostly due to predation from species such as bears, eagles, wolverine and wolves. Rams have been documented to live as long as 14 and ewes can attain an age of 16 years old.

In the spring they migrate upward, foraging on tender grass, forbs and shrubs as they become available, and in the summer they graze high elevation plateaus near to escape terrain. In the winter they forage either in windswept high-elevation areas, or move downhill to areas with shallower snow depths. Despite their habitat being primarily in cold northern regions, they are poorly adapted to snowy environments. They lack the long legs of moose, or the broad hooves of caribou, making it difficult for them to travel through deep snow. Stone's sheep are reliant on precipitous escape terrain to avoid predation, especially during the lambing period, however in the spring and summer they will travel great distances from escape terrain in order to access vital mineral licks.

Table 20. Summary of Stone's Sheep Habitat within the TRA

SHEEP	Hectares	% of Habitat in KSI Area
Habitat	68 836	9%
Total KSI Area	**748 930**	

Cultural Significance

As indicated in other sections, Tahltan used high elevational habitats to harvest a number of species during the snow free periods, including Stone's sheep. Some areas were used, and are still used year round where access to sheep is available. Camps and high elevation ridges were selected where the greatest diversity and abundance of wildlife were available, especially sheep and goats.

Present Situation

Information regarding the Stone's sheep population in the Klappan TRA is limited, as most of the available information has been focused on the Todagin Wildlife Management Area. Local Tahltan knowledge remains the best source for identifying key habitats, mineral licks, and movement corridors that could be used as monitoring indicators of Stone's sheep population health.

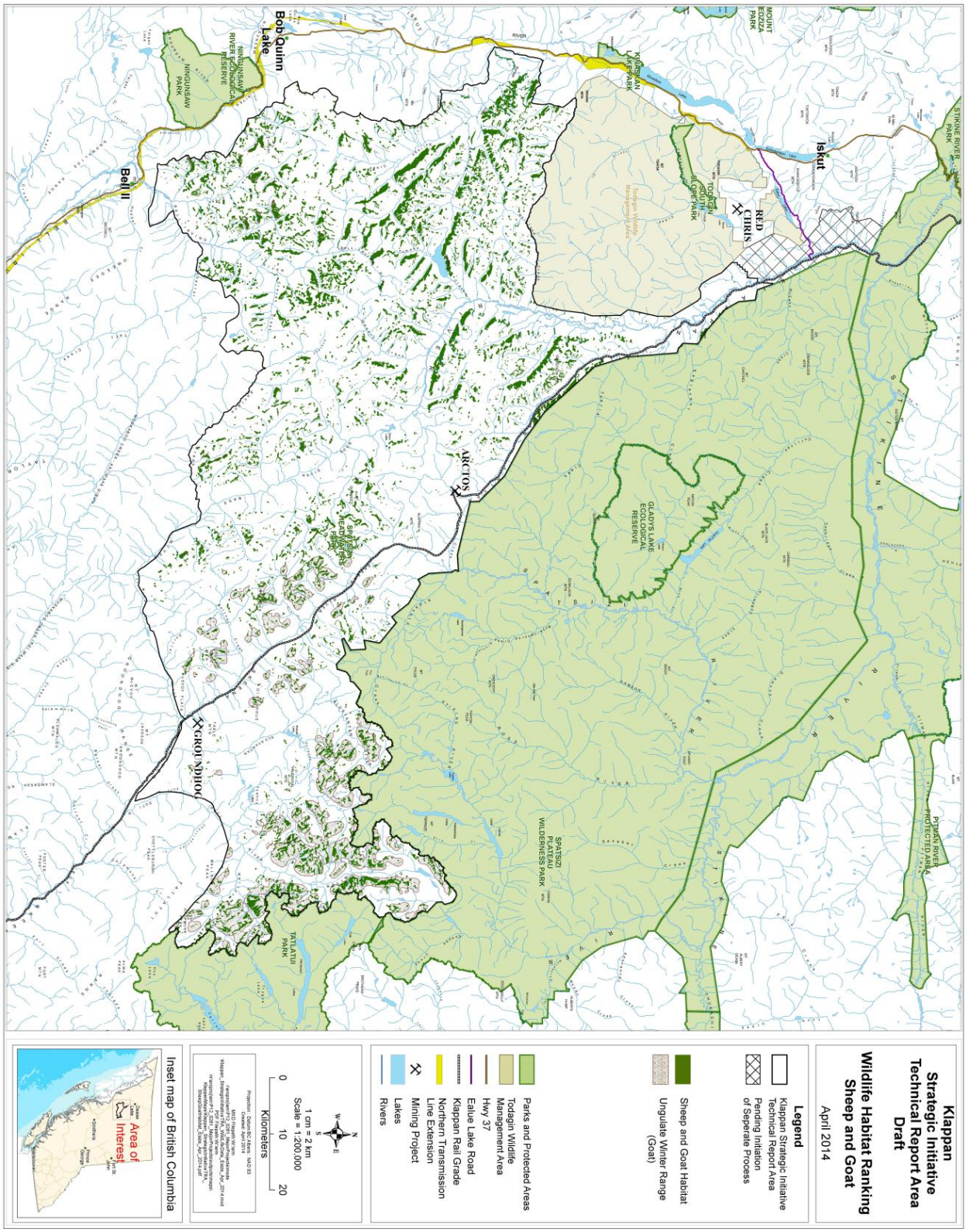
Stone's sheep appear to have a potential for direct and indirect disturbance from resource development that is similar to that of mountain goats. This could result in increased energetic costs resulting from increased movements, and alienation of habitats. If this happens, resultant population effects could include reduced pregnancy rates and/or increased kid mortality rates, as well as increased mortality of adults and juveniles, thus reducing recruitment rates. It is both the proximity and the cumulative effects of the proposed activities that will determine the extent of the disturbance. Additionally it will also depend on the availability of suitable habitats within the mountain block or mountain blocks within a reasonable distance.

Management Considerations

- *Applying provincial aircraft distance recommendations during winter and kidding periods for the Klappan TRA.*
- *Where mechanized land use disturbance is being permitted within 500m of high value habitats, to include a mitigation and monitoring plan by a qualified biologist to ensure the disturbance is not impacting mountain goats.*
- *Recommend alpine or elevational restrictions for ATV, snowmobiles and winter backcountry recreation use.*

Information Gaps

- *The last population survey for Stone's Sheep outside of the Todagin Wildlife Management Area is not known, but it has not occurred for at least twenty years. It is a data gap that should be tabled with the Tahltan-B.C. Fish and Wildlife Working Group to identify solutions to address this gap.*



Map 22. Stone's Sheep Habitat.

Marmot (Marmota caligata)

Hoary marmots can be found in higher elevation alpine and sub-alpine areas across the Klappan. They prefer meadows or open sub-alpine fir forests near rock slides and talus slopes where they feed on grasses and other flowering plants.

Life History

Hoary marmots are burrowers, and they live in familial colonies with home ranges of up to 10 hectares. They construct three types of burrows within this range: those for sleeping, refuge and hibernation. They are a sedentary species and are most active in early morning or late afternoon, spending their time foraging or playing. They hibernate from September to April, and mate soon after. Females give birth to 2-5 young in the late spring early summer after about one month gestation. Their average lifespan is 5 years, and they begin breeding after 2-3 years. After that they will breed every other year with the previous litter dispersing to form their own colonies.

Cultural Significance

Marmots, or groundhogs as they are sometimes called, are important mountain species, and were critical as a food source when larger animals were lacking. They could easily be caught using snares, whereas hunting larger game before the age of rifles was challenging. Marmots are used for food, but traditionally have also been used for other purposes:

> *"... And then in summer they snare groundhog too. They save the groundhog hide. They sew it up together. Make good blanket."*
>
> *"...that's how old Tahltan generation used to survive in the winter, all on groundhog, and salmon, and gopher... They could hardly get moose, it was so hard to come close to them with bow and arrow..." (*Consultant 1980s Tahltan Knowledge Study)

Management Considerations

- *Identifying and maintaining colonies within a resource development footprint.*
- *Maintain access for Tahltan to harvest marmots.*
- *Reclamation strategies to recolonize areas for marmots from resource development.*

Furbearers

A large variety of furbearers can be found within the Klappan TRA. For this report, beaver, lynx, marten, fisher, wolverine, and wolves have been included, as they are species that have been identified by the Tahltan as being of particular interest.

Life History

Beaver

Beavers prefer to live in rivers and streams, or on ponds where there are slower-moving sections, and near lake shores that are not exposed to heavy wave action. In addition, they prefer shores and bottoms that are muddy for burrowing purposes. Muddy areas also make channeling and damming much easier than on rocky or gravel shores and bottoms. Stable water flows and areas of sufficient depth are also needed, to maintain access to food caches and to escape from predators during winter.

Generally beaver colonies are established in deciduous forests that provide sufficient forage within 50 metres of the water's edge. The duration of an active colony on any particular site can range up to 10 years or more, but it is highly dependent upon the availability of forage. Once the forage supply is reduced or limited, colonies may be abandoned or the colonies may die from starvation. Colony life is also dependent on predation and harvesting pressures. As beavers are removed from a colony, it may make the available forage sufficient to continue its maintenance. Their predators can include river otters, wolves, bears, or foxes.

Lynx

Habitat use for lynx is strongly associated with the forested habitats preferred by snowshoe hare, its main prey species. This includes lower elevation coniferous habitats combined with thick willow shrub patches. Snowshoe hares can also be found on the edges of forests or in burns with thick shrub cover. The hare population generally cycles over a 10-year period, and as the population increases, habitat uses expand to less optimal habitats. Lynx populations cycle along with the hares, and will peak and decline shortly after the hare population begins to decline: from a combination of predation, and limited forage availability. Lynx will use mature and old coniferous forests for resting and denning, using blowdown and deadfall both to avoid predation and for cover.

Fisher

Fisher primarily inhabits dense coniferous forests with a continuous canopy, as they prey on porcupine, snowshoe hares, mice, squirrels, and voles. These dense forests usually have productive understories that can support good prey populations. Fishers will use hollow trees, stumps, deadfall, or abandoned beaver dens for shelter. For furbearers, they have large home ranges, and are solitary in nature outside of reproduction periods or when defending their territories.

Marten

Marten rely on berries, as well as small mammals such as grouse and snowshoe hare for food. Marten inhabit the mature forested habitats and openings where their food sources can be found. Their preferred habitats include: coniferous leading forests, root wads and snags for reproduction and denning, and habitats types linked to its prey, primarily voles and hares. Generally, voles are found in spruce-leading coniferous stands, with high coarse woody debris and blow down, limited shrub layers, and dense crown closures. Hares are found in similarly dense forests, but with a higher shrub layer and with increased openings covered by willow thickets.

Wolverine

Wolverines are distributed throughout mountainous regions in British Columbia and utilize a diversity of habitats, from low elevation forests to alpine tundra. They are a species with large home ranges: adult males 300-500 km^2 and adult females 100-300 km^2.

Wolverine prey on a diversity of small mammals such as: rodents, birds, Stone's sheep lambs, mountain goat kids, and woodland caribou calves. In the summer they also consume berries, fish, insects, roots, and bird eggs. In addition, wolverines will eat carrion, and will seek out and scavenge large mammal carcasses.

Wolves

Wolves are social animals with pack size ranging from a few, to over fifteen individuals. For wolves that maintain territories and have stable packs, each pack often has a pair of alpha wolves. Unless the pack structure becomes disrupted, it is normally only the alpha male and female that breeds. Litters usually consist of five to ten pups that are born from May to June. During summer, the den site may be the center of attention, and in some cases, the non-dominant pack members will return food to the den and assist in both rearing the young and guarding the pups from predators. After the pups have grown and can travel with the adults, the pack may move farther from the den. Wolf pack territories are variable in size and are dependent upon the density and annual movements of prey species, geography, and the distribution of adjacent pack territories. Typical prey species include moose, woodland caribou, Stone's sheep, and mountain goats.

Cultural Significance

Trapping has always been always important to the Tahltan, even prior to the European fur trade. In 1911, Emmons noted the importance of hunting and trapping, when whole villages would disappear on seasonal trips. Tahltan hunting tools included bows and obsidian arrows, guns when they became available, knives to skin animals, and deadfall traps and snares to catch furbearers (Emmons 1911).

Tahltan trapped all of the furbearing species, including beavers, marten, fisher, mink, lynx, river otter, coyotes, fox, bears and wolves. They used snares and built deadfall traps before the introduction of steel traps. They even killed grizzly bears using massive deadfall traps. Beaver was a key species and an especially important trade item with other First Nations.

> *"… You see in these traditional hunting areas … there are really important beaver hunting areas that they would hunt each spring through April, May and on into June and the holidays…"*
>
> *"… The Kaskas … traded in return beaver and marten and some lynx. But with the inland Tlingits they traded mostly in beaver, beaver and ground squirrels because they had some fine robes from the Teslin country… The trade items of the Tahltans always were fish and bear grease, soap berries, and things like that… " – (Consultant, 1980s Tahltan Knowledge Study).*

Present Situation

Lynx, marten, and fisher are all sensitive to the population cycles of small mammals such as grouse, porcupine, and snowshoe hare. They can experience significant population declines if one or more prey species is at a low point in the population cycle. At this time there is limited information on the status of these cycles outside of Tahltan observations of these furbearers and their prey species.

Wolverines have large home ranges, low reproductive rates, and are found at low densities (1 wolverine for 160-170 km^2). This means that populations can be easily impacted from trapping, human alterations of home ranges, and the cumulative effects of human-wolverine interactions. Wolverines are a blue listed species (vulnerable) and an Identified Wildlife Species. The western population of wolverine is listed as a species of special concern under the Federal *Species of Risk Act*.

While wolves are an important predator of large mammals in the area, no surveys or studies on wolves have occurred recently in the Klappan area. In response to First Nation and licensed hunter organization requests, the Skeena Region (MFLNRO) is proposing removing bag limits on wolves for licensed hunters.

Management Considerations

- *Maintain a diversity of seral habitats with effective landscape level linkages in older coniferous stands for cover to support prey species and provide for critical habitats that will also maintain forest structure for furbearer denning and reproduction habitats.*
- *Use mitigation strategies to reduce human-wildlife encounters and attractants to furbearers.*
- *Where applicable, use predator management, including trapping, to reduce predation pressures on ungulates.*

Information Gaps

- *For wide ranging species such as wolves and wolverine, undertaken specific survey protocols that will provide information on genetic diversity, population density and population estimates.*
- *This is a data gap that should be tabled with the Tahltan- B.C. Fish and Wildlife Working Group to identify solutions to address this gap.*

Railgrade

The Dease Lake Extension (DLE) was an idea conceived by the British Columbia Rail Corporation (BCR), a B.C. Crown Corporation. Their proposal was to construct a rail extension from Fort St James, to Dease Lake. This was to serve as a development railway, whereby the provision of inexpensive industrial transportation would spur development of northwest resources. There were no secured clients for the line, and no specific freight that needed transport. It was believed that publicly owned railways could be used as instruments of public policy to develop the northwest; as the pioneering railways of the 1800s had done for southern Canada. The Provincial government was driven to establish a northwestern rail link before the federal carrier (CN) in order to be in a positive position to maximize their share of freight revenues from Yukon and Alaska once the transcontinental link was complete (McKenzie et al. 1977).

BCR's documented strategy for construction of the two northern extensions, both the Dease Lake Connector and the Ft. Nelson Extension, was initially to design and build them to a minimum standard to save capital costs. The plan was to accept the possibility of high rates of derailments and maintenance costs initially, and then upgrade the lines once revenues had repaid the initial capital costs (McKenzie et al. 1977).

By this time many other freight options such as trucking and air freight, had come of age, making the development railway a thing of the past. By 1977 BC Rail was in dire financial straits, because of poor returns on its southern routes and cost overruns on its two northern extension routes. The public subsidization of BCR triggered a public reaction that drove the Province to establish a Royal Commission on the British Columbia Railway. Contractors had found difficult ground conditions and thus huge increases in the volumes of material needing to be moved. Once the difficulty of the terrain and the inadequacy of the original engineering became apparent, local and experienced contractors raised their unit prices. They were then outbid by inexperienced contractors not familiar with the area and its challenges. (McKenzie et al. 1977) From the upper Skeena and moving north, water management became a major issue. Costs on the project increased from the initial BCR estimate of $68.9 million in 1969 to an actual expenditure level of $360 million by the time the project was abandoned in 1977.

Tasked with determining the reasons for the massive cost overruns on the DLE, the Royal Commission found that contributing factors related to the following:

- Inadequacy of the original engineering of the project;
- The lack of baseline data to inform the design;
- Universal awarding of contracts to the lowest bidder without any contractor eligibility criteria;
- The lack of qualified railway engineers; and
- The need for numerous field fit realignments during construction.

Despite its findings, the Royal Commission did not result in any significant follow up actions.

Construction

Construction of the rail grade through the Klappan TRA was a pioneering effort into previously un-accessed territory. Federal and Provincial environmental regulatory agencies were unable institute effective regulatory oversight (B.C. Fish and Wildlife 1975). These agencies reported: extensive areas of river channelization and redirection; impassable stream crossings; major slumps; and waste disposal into the Skeena, Spatsizi, Klappan and Tanzilla Rivers. In many places the grade was located directly in river channels, and the flow redirected into diversions. The impacts to streams and fish habitats were widespread and there was no assessment of fisheries distribution prior to construction. Groundwater aquifers were drained and waste soils were pushed into gullies and fish bearing streams. Many smaller streams were simply diverted into ditchlines to avoid the cost of culvert installation, resulting in the de-watering of significant areas of fish habitat (Erhardt and Hudson 2014, Chislett 1974). A Fish and Wildlife report documented that most of the diversions and instream works were constructed without any form of government authorization (Enders and Guillion 1974).

Lacking a properly engineered design or baseline environmental data, construction contractors rushed into the Klappan headwaters, unaware of the complex hydrology of the area, and resulting in significant environmental disturbances that are still causing impacts today. Due to the lack of planning, contractors began cutting corners to control massive cost over-runs and minimize their risk, and in hindsight, the identified impacts were predictable.

Photo 15. September 1974 photograph of the rail grade under construction. The photo shows the rail grade being constructed in the active channel of the Klappan River.

Impact Assessment

While there has never been any comprehensive impact assessment, maintenance or reclamation of the railgrade by the BCR, there was a reconnaissance study and overview flight in 1984 that identified impacts associated with the rail grade (MOE 1985). A subsequent reconnaissance study and overview flight in 2013 confirmed that these impacts have persisted (Erhardt and Hudson 2014). The study are included in Appendix 9.

A summary of the issues found includes:

- **Stream Crossings**: Both studies identified numerous stream crossings that did not allow for fish passage. The Tahltan study in 2013 found that five of seven culverts assessed did not have fish passage at any stage and the crossing of Etokade Creek, a major left bank tributary of the upper Skeena had very limited adult passage and no upstream juvenile passage. These culvert installation problems were related to jump height barriers at culvert outlets and velocity barriers in culvert barrels. The result of these issues is the alienation of most of the fish habitat upstream of the rail grade (MOE 1985 and Erhardt and Hudson 2014);
- **Fish Habitat Destruction**: Fish habitat destruction is extensive along the rail grade. Habitats were destroyed by direct mechanical channelization during culvert installation, dewatered by stream diversion and redirection. Additionally, channels were destabilized by localized flow concentrations and extensive areas of high value fish habitat in the Klappan and Upper Skeena were isolated or buried by the rail grade (MOE 1985 and Erhardt and Hudson 2014);
- **Stream Temperature Impacts**: Temperature monitoring at Chief Louie Creek indicated that channelized stream reaches are highly thermally impacted (Erhardt and Hudson 2014);
- **Groundwater Impacts**: Erhardt and Hudson (2014) noted a high degree of impact to shallow groundwater aquifers along the rail grade. Rail grade construction has intercepted shallow groundwater along the grade and has likely resulted in drawdown of the water table;
- **Water Quality Impacts:** Rail grade impacts related to significant sediment inputs (MOE 1985) photo 16, and water temperature effects (Erhardt and Hudson 2014) were highlighted and the adverse effects on fisheries resources discussed.

Photo 16. A photo of rail grade construction effects along the Spatsizi headwaters near the Skeena divide. The photo shows material wasted directly into the river. Photo date is June 1976.

Photo 17 is a copy of the stream impact map excerpted from the Erhardt and Hudson (2014) impact assessment report. The map shows the high degree of impacts resulting from the Dease Lake Extension.

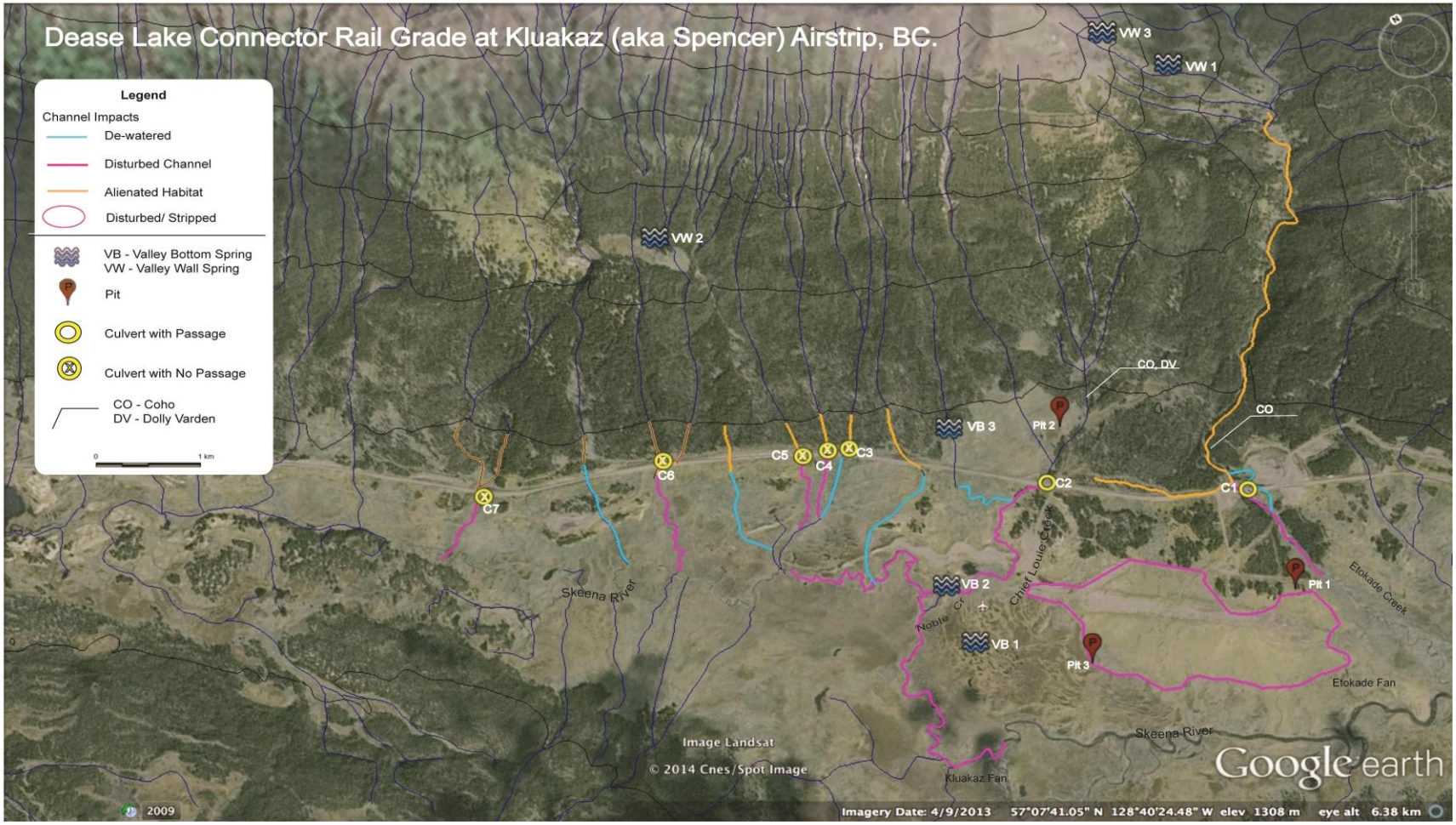


Photo 17. Impact assessment map of the DLE assessed by Tahltan Fisheries in 2013. Yellow stream reaches are areas of alienated fish habitat above impassable barriers on the grade, light blue reaches are areas of dewatered habitats and pink sections are disturbed habitats with severe erosion and habitat degradation.

Management Context

Given the work to date, there is a strong indication that the DLE has had a lasting and significant impact on the hydrology and fisheries of the Klappan TRA. Extensive areas of fish habitat are destroyed and impacts to surface and ground water resources are evident along the grade, both of which have had a significant impact on the aquatic ecology of the region. Fish passage through the rail grade is severely limited, resulting in the loss of fish habitat, but perhaps the most important impacts are those related to groundwater hydrology.

The Klappan is a multi headwater area with a rare and complex hydro-system of groundwater aquifers confined beneath deep blanket peat deposits. An ecosystem complex of peatlands and other non-forested wetlands and shrub-carr communities has developed across the Klappan since the last glacial recession, approximately 14 000 years ago (Photo 7). The peatlands that blanket much of the landscape are groundwater dependent, requiring a stable near surface water table to maintain the growth of the active top layer of sedges and mosses. Each growing season, a new layer of sedge/moss biomass is added to the peat. The peat densifies under its own saturated weight and the rate of decomposition of the lowermost layers decreases due to the low porosity of semi-decomposed peat and reduced oxygen content that results. Over long periods of time, the peats seal the underlying groundwater return zones, causing a local rise in groundwater levels in upslope discharge/recharge zones. Rising groundwater levels create new saturated areas that the sedges and mosses then colonize, enhancing peatland development to cover the new areas of elevated water table (Bauer et al 2003). In the Klappan, this peat expansion has blanketed large areas in the valley bottom and extended up the valley sides, confining groundwater in both the bedrock and unconsolidated materials. What results is a complex multi-layered aquifer system confined beneath deep, low porosity peat deposits. The previous Hydrology section and the Erhardt and Hudson report (Erhardt and Hudson 2014) contains a more detailed description of the conceptual groundwater model of the Klappan TRA.

The peatlands in the Klappan force the storage of huge amounts of groundwater that is slowly released, augmenting winter and late summer base flows. This stored groundwater has a major influence on the aquatic ecology of Klappan headwater streams, by preventing freezing in the winter and overheating in the summer. There is a great deal of ecosystem service value attributable to the Klappan hydro system. Given that the Klappan is a central headwater area, hydrologic impacts have the potential to transmit far downstream in the Skeena and Stikine watersheds. A reconnaissance level, groundwater impact assessment at Kluakaz Airstrip, suggests that impacts to shallow groundwater in the Klappan are potentially occurring with respect to the abandoned rail grade.

Management Considerations

The hydrology of the Klappan is sensitive to disturbance of the peatlands because they largely control the hydrology. Looking ahead to potential future land use decision making with respect to the DLE the following issues become apparent:

1. ***Lack of Information**: there is a critical lack of information around the historic and ongoing impacts of the DLE. No meaningful monitoring, reclamation or impact assessment has been conducted by the tenure holder or the Crown. There was also no baseline environmental data collected in advance of DLE construction so the exact nature and extent of the impacts will be difficult to ascertain;*
2. ***Regulatory Oversight**: The reconnaissance work to date has demonstrated the need for regulatory oversight and monitoring. There are many apparent contraventions of the Federal Fisheries Act and Provincial Water Act, among others, that are yet to receive proper regulatory attention. This is a fundamental issue that must be addressed before any proposed industrial land use can be considered;*
3. ***Abandoned Dump Sites**: An abandoned dump site was surveyed by Tahltan Fisheries in 2013 (Tahltan Fisheries, 2014) and others are presumed to exist at abandoned DLE work camps along the grade. There is no information with respect to the location, permit status, contents or contamination risk of these sites;*
4. ***Cumulative Effects**: While it is clear that the DLE has resulted in a significant amount of current and historic environmental impact in the Klappan, the lack of comprehensive impact assessment makes the determination of the potential cumulative effects from proposed land uses not possible at this time;*
5. ***Groundwater Protection**: The DLE has resulted in a variety of impacts to groundwater along its length. Including, but not limited to ditchline interception and potential drawdown of shallow aquifers. Upgrading the DLE has the potential to worsen these impacts since completion of the rail grade would require upgrades to bring it up to a modern standard. This has the potential to affect local groundwater conditions, including loss of hydrologic integrity;*
6. ***Identification** of potential archeological sites along railgrade.*

Information Gaps

Future studies that could be conducted to reduce land use uncertainty around the rail grade include:

1. *Undertake an as-built survey of the rail grade, access roads, borrow areas and camp sites is needed to determine the following;*
    a. *Identify destruction or loss of fish habitat, including an assessment of fish passage;*
    b. *Scope areas of groundwater interception including concentration in ditchline flows and effects on local groundwater tables;*
    c. *Identify possible contravention of Federal and Provincial acts;*
2. *A sediment source survey of the Rail Grade infrastructure is needed to estimate the degree of sediment delivery from the grade;*
3. *Water temperature study to determine the thermal effect of the rail grade infrastructure;*
4. *Soil and peatland mapping (depth and parent material) to estimate existing impacts, predict future impacts and support eco-hydrologic studies and effects assessments (see water section for more details);*
5. *Contamination studies of known dump sites. Reconnaissance survey for other sites;*
6. *Soil-dating of peats to support inclusion of Tahltan archeological baseline data.*

Current Land Use and Zoning

Current Management Zones

In the Klappan TRA there are a variety of legal and non-legal zonations which should be considered when planning.

At the highest level, there are portions of the Cassiar-Iskut LRMP, the Fort St James LRMP and the Mackenzie LRMP that all overlap the TRA. These LRMPs have been signed by government, and present general Policy Direction by MFLNRO. They provide broad directions for sustainable use of resources, and are intended to guide ongoing resource management activities with a set of Best Management Practices.

All forestry activities should consider relevant *Forests and Range Practices Act* (FRPA) legislation and the *Objectives set by government* (OSBG).

There are two, legal *Ungulate winter range zones* that have been established in the TRA for Mountain goat. They are: U-6-002 and U-7-019, and each of these provide best management practices for working in these areas.

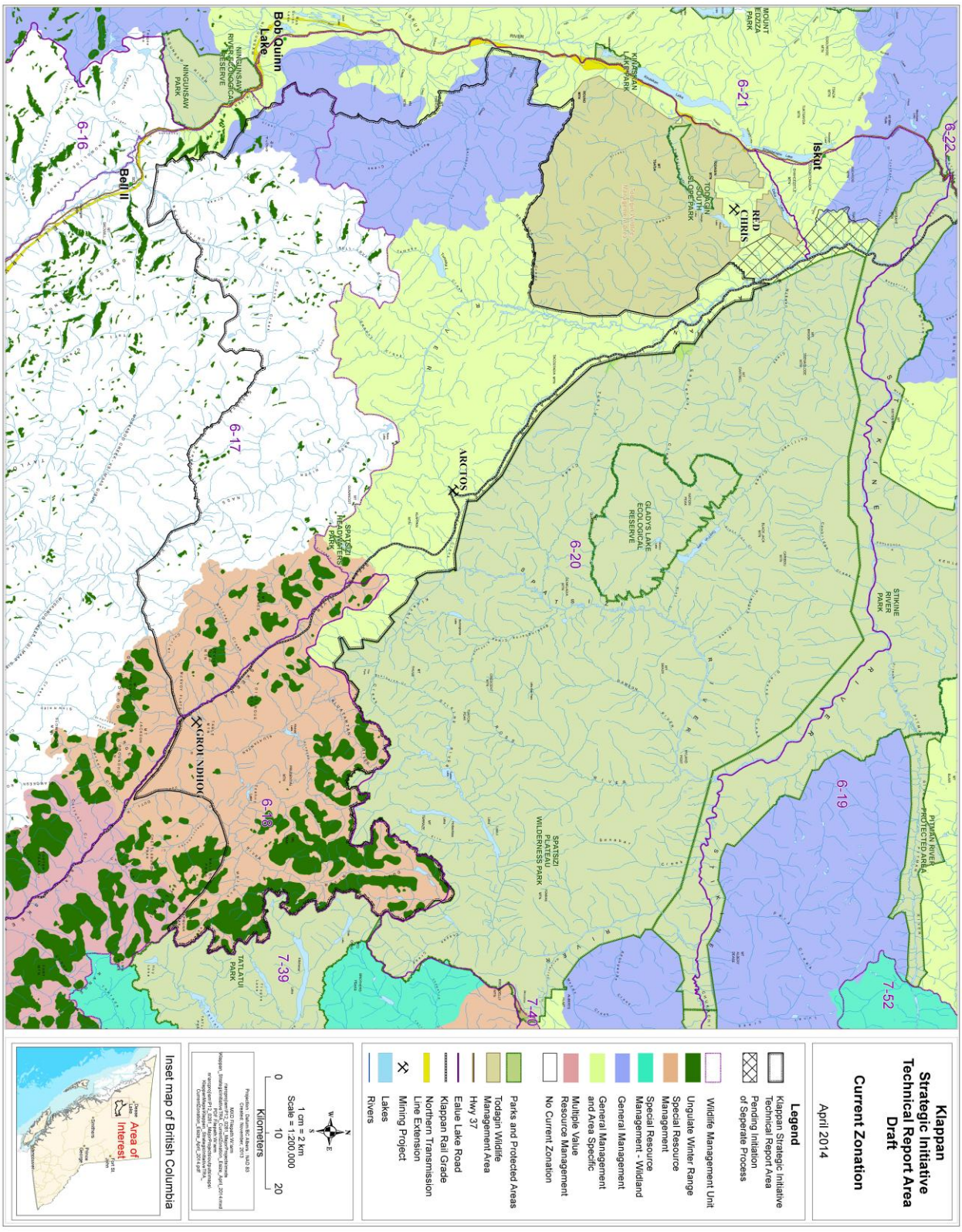
Landscape Units have been developed across B.C., including the Cassiar. Current priorities for these areas are the conservation of old-growth areas and the retention of wildlife trees.

The Fort St James and Mackenzie Forest Districts have also established Agricultural Development Areas and Settlement Reserve Areas under section 93.4 of the *Land Act*. These are areas that have been designated as appropriate for settlement or agricultural development, and the associated legal objectives generally relate to the harvesting of timber.

It should be understood that this is by no means an exhaustive list of management considerations that should be investigating when planning. It is up to the developer to ensure that they are abiding by all legal designations as well as considering the best management practices for relevant values.

Management Considerations

- *When planning consider all relevant management designations and their associated legal objectives or best management practices.*



Map 23. Current landuse zonation in the TRA.

Existing Tenures

The region surrounding the Klappan is often characterized by its remoteness. Due to its distance from major population centres, there has not been a lot of commercial activity in the region, with development occurring in distinct spurts.

There are over twenty sectors of the economy that depend upon continued and reasonable access to crown land. Therefore, the allocation and administration of these tenures play an essential role in expanding and diversifying the economy. Tenures are issued under broad purposes such as commercial recreation, energy production and transportation. These are broken down in governmental records into more detailed sub-purposes. Most of the issued tenures in the region cluster around population centres, however, Map 24 shows tenures issued for: scientific research, hunting camps, communication sites, sand and gravel, among others.

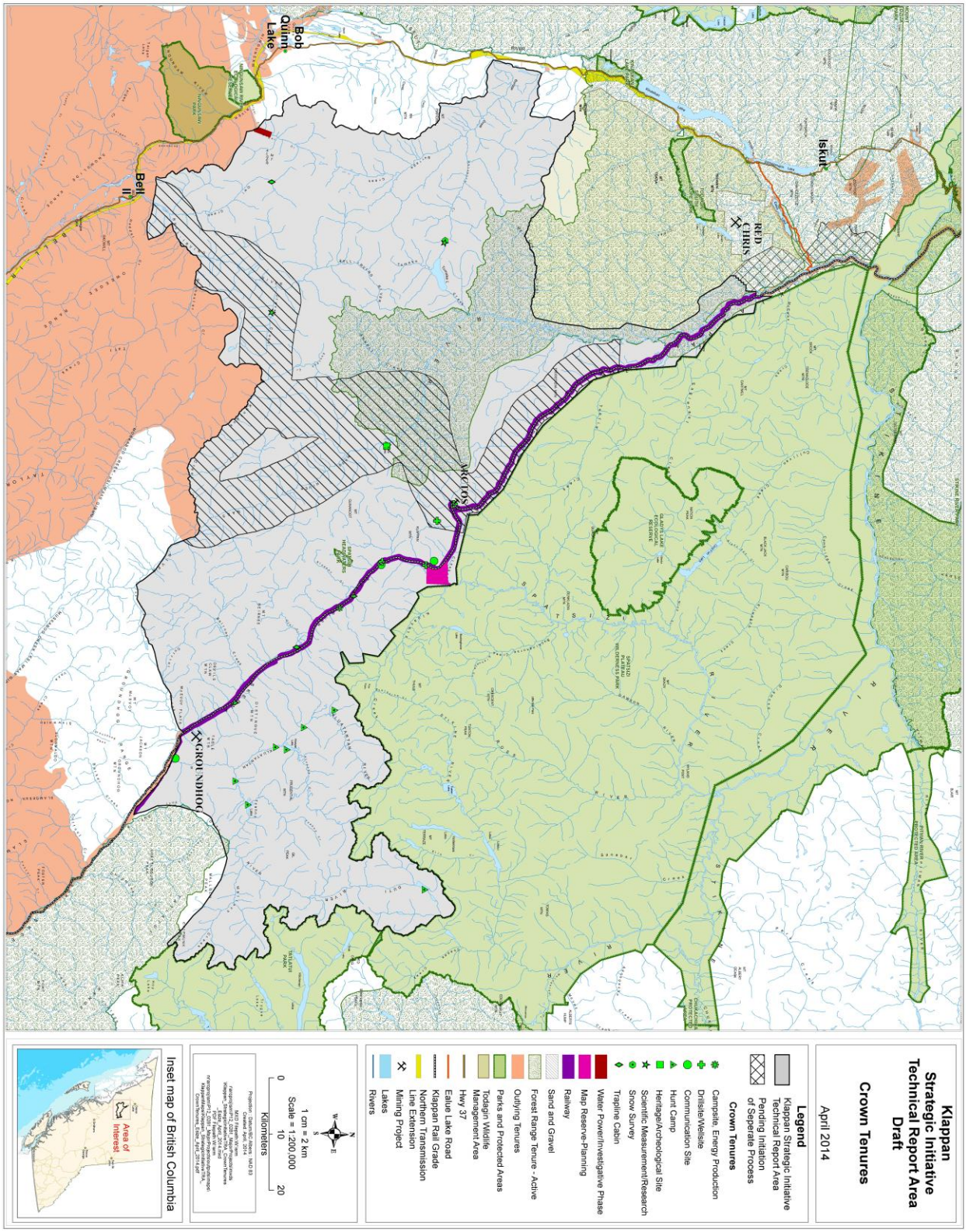
The Crown Tenure map depicts current tenures that are active in the area. It does not include, guide outfitting territories, trapping territories or coal and mineral tenures as these are all depicted on separate maps.

Map Reserves are areas established for the Ministry of Environment under Section 17 of the *Land Act*. They designate a portion of Crown land for a particular use, from scientific research to industrial development. Map reserves are then unavailable for disposition under any other tenure that is not compatible with the designated purpose.

Range tenures are designed to ensure continued access to crown lands for grazing and hay-cutting purposes. In this region are often associated with either ranching or guide-outfitting operations.

Management Considerations

- *Provides the current status of land and its encumbrances for consideration in planning.*



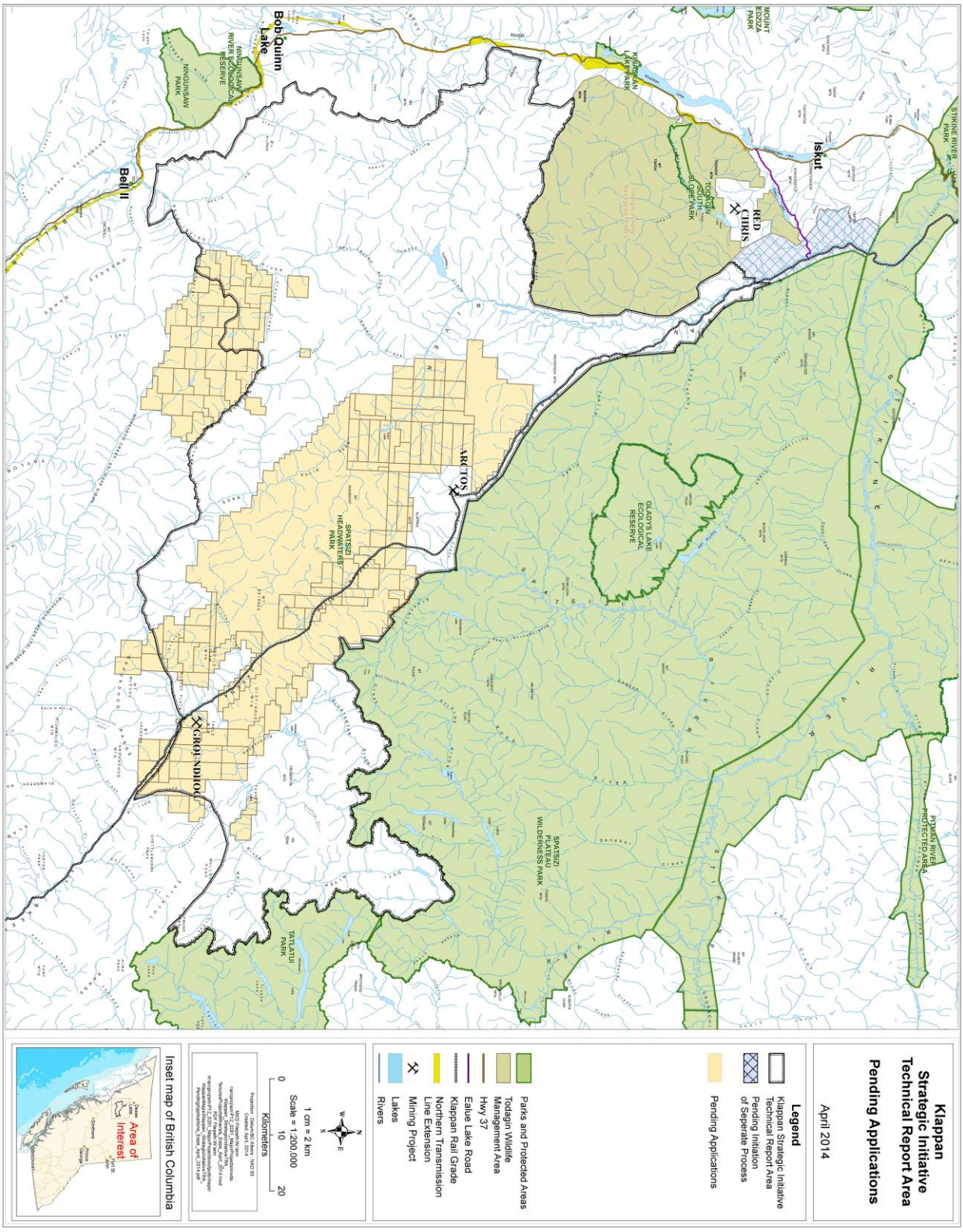
Map 24. Issued Crown Tenures.

Pending Applications

All coal and mineral tenures are shown on the map, and have an expiry date associated with the licence or lease. Current applications are also shown; however, this data can change regularly as these applications can be received on-line, the most current data shown on the map. At the moment, there is a deferral order on all pending coal licence applications within the Klappan TRA, extending until the end of 2014. Mineral tenures are shown for reference only as there are no mineral tenures or applications within the TRA. At this time, there are no other tenure types pending, although there are a variety of tenures that are up for renewal, such as commercial recreational tenures.

Management Considerations

- *Provides a snapshot of current tenure activity that can be useful in the identification of resource use conflicts and assessment of the implications of land use decisions on mining activities.*



Map 25. Current Crown Tenure Applications

Summary of Management Considerations and Information Gaps

Management Considerations

These management considerations should be taken into account if any of the following values are within your planning area.

Tourism

- *Managing access to 4-wheel use into peatlands and alpine areas*
- *Identify possible areas for resource overlap when planning, including access, camp sites, and visual quality.*
- *Maintain current recreational access points, such as for Dideene Portage, Eaglenest Trail and Mcewan Creek Trailhead.*

Fishing

- *Possible downstream effects of development on commercial, sport and aboriginal fisheries*

Guide Outfitting

- *Identify locations of guide outfitting territories and potential conflicts (temporal and spatial) when resource planning or permitting resource development.*
- *Major projects should provide an assessment of the implications of resource development on guide outfitting and wildlife abundance and distribution.*
- *In terms of global significance, 99% of the world's population of Stone's sheep and approximately 50% of the world's population of mountain goats occur in British Columbia. The existence of these unique species of wildlife in British Columbia and within the TRA, supports a global responsibility for the sustainable management of those species and the economic opportunities that sound management approaches provide.*

Trapping

- *Identify locations of trapping territories and potential conflicts (temporal and spatial) when resource planning or permitting resource development.*
- *Resource development should provide an assessment of the implications of the development that considers habitat supply, forest succession/seral stage distribution and linkages/fragmentation, and temporal disturbance.*

Timber Values

- *Consider avoiding areas of high cultural or environmental values*
- *Consider aligning with other resource deferrals in the Klappan*
- *Consider seasonal timing to avoid vulnerable periods for wildlife, sensitive periods for fish and to minimize soil and water impacts.*
- *Visual quality of an area and the impact it will have on the outdoor recreational experience.*

Coal and Mineral Exploration and Mining

- *The Klappan TRA contains a rare and significant quantity of high quality anthracite coal, if developed it would generate significant economic benefits*
- *Access management needs to be considered for acceptable endeavours/projects within and beyond the Klappan TRA*
- *Coalbed methane reserves are to be managed consistent with other resource reserves.*

Water

- *Existing and ongoing hydrologic impacts in the TRA resulting from the construction and subsequent abandonment of the Dease Lake connector rail grade. There has been no comprehensive assessment of those impacts and therefore it cannot properly inform land use. Learning from the past is a hallmark of good land use planning.*
- *Lack of baseline information means there is no way to assess the value of, or potential impacts to ecosystem services provided by the TRA to downstream reaches of the Skeena, Nass and Stikine Rivers.*
- *Maintenance of the integrity of the peatland/aquifers*
- *Rail grade construction and coal mining have the potential to lower groundwater levels in the Klappan with potential impacts to peatland and wetland function. This has many potentially adverse outcomes to fish habitats but may also affect the carbon storage function of the peatlands by reducing the amount of atmospheric carbon that is annually sequestered and increasing the carbon footprint of land use.*
- *Wetlands, including peatlands, often support clear water tributaries that act as refugia for fishes during periods of high flow and turbid water. This is particularly important for clear water tributaries in the Klappan and Spatsizi where there is a prolonged turbid water period. The Skeena also has extensive areas of clear water tributary that serve as clear water refugia.*
- *Potential land use hydrologic impacts to the Klappan TRA include the following;*
  - *Dewatering coal seams during mining pose the potential to alter the groundwater regime in the area and reduce peripheral groundwater flow;*
  - *Inter basin transfers from surface water diversions pose a risk to hydrology and the potential for inter basin transfer of organisms;*
  - *Shallow ground water interception by the rail grade can potentially alter the storage function of the shallow aquifers and reduce low flow augmentation and flood mitigation.*

Climate Change

- *Protection of enduring features that will underpin future ecosystems.*
- *Consideration should be given to the management of alpine areas that are expected to persist in the face of climate change.*
- *Hydrologic disturbance of the TRA peatlands has the potential to produce greenhouse gas emissions. Potential sources of hydrologic disturbance include the drain down of shallow aquifers along the proposed rail grade and the groundwater "cone of depression" from the dewatering of coal seams during mining.*
- *Coal mining has a potential carbon footprint related to fugitive methane gas emission that needs to be considered.*
- *Permafrost thaw, in relation to land clearing and hydrologic impacts is a potential carbon source in the TRA that needs to be considered in proposed land use developments.*

Fish

- *Groundwater function as it relates to fish habitat suitability and fish productivity should be conserved, protected and in some cases restored.*
- *Fish access to all habitats needs to be maintained and in certain places re-established. Historic impacts need to be assessed and then restored (see the railgrade section).*
- *Most of the fish species in the TRA employ unique life history strategies to deal with water temperature or climate variability, which makes them more susceptible to habitat impacts (e.g., riparian loss, groundwater influences and sedimentation).*
- *Fish species such as Bull Trout, Dolly Varden and Cutthroat Trout have be well documented to be particularly sensitive to habitat impacts associated to land use development (Haas 1998). The species are also particularly sensitive to overexploitation when remote areas are made accessible via regulated and unregulated road or trail development.*
- *Spawning habitats are rare and not well documented within the Klappan River and upper Nass River portions of the TRA, and must be identified and properly managed.*
- *Opening up of remote areas to access can threaten particular fish species that are vulnerable to over-harvest.*
- *Decisions made within the study area have the potential to impact downstream populations.*

Terrestrial

- *Protection strategies should evaluate representation of ecosystems, ecosections, special features and enduring features.*

Rare and Endangered Species and Ecosystems

- *Follow existing recovery plans for identified species or ecosystems at risk.*
- *If no recovery plans exists, conduct surveys to determine presence and abundance and develop an appropriate management plan.*

Wildlife

- *Resource developments should provide an assessment of the implications on habitat supply, distribution and linkages/fragmentation of important wildlife habitats, and temporal disturbances that can conflict with critical seasonal habitats and migrations by alienating those habitats.*

Mountain Goats

- *Establishing provincial aircraft distance requirements adjacent known critical habitats and during winter and kidding periods for the Klappan TRA.*
- *Where mechanized land use disturbance is being proposed in close proximity to high value habitats, to include a mitigation and monitoring plan by a qualified biologist to ensure the disturbance is not impacting mountain goats.*
- *Recommending alpine or elevational restrictions for all motorized (ATV & snowmobile) use for recreational purposes including hunting.*

Caribou

- *Maintain adequate amounts of well-distributed, critical habitats available across seasonal ranges and through time. Exclusion of activities in critical seasonal ranges such as traditional rutting ranges and migration corridors should occur.*
- *Preserve access to these areas for woodland caribou by preventing fragmentation of the areas or displacing the caribou from other resource development activities.*
- *Minimize risk to woodland caribou from human-caused mortality.*
- *Use techniques that enhance retention and recovery of terrestrial lichens.*
- *Develop recreational, commercial tourism, and access management strategies that limit or prohibit recreational and tourism activities and access in specific areas during critical seasons.*

Moose

- *Maintain adequate amounts of well-distributed, critical habitats that are available across seasonal ranges and through time.*
- *Minimize risk to moose from human-caused mortality.*
- *Monitoring bull:cow ratios (>= 50:100) for low density moose populations as documented in the 2013 Draft Provincial Framework For Moose Management report.*
- *Undertake a stratified random block survey in the Klappan moose population unit to provide current population information upon which to base licensed harvest opportunities.*
- *The Tahltan/B.C. Working group is working to assess all forms of harvest and management approaches to better manage moose in this area. This body will make recommendation to support moose management in the area including landuse, resource development and regulatory mechanisms.*

Grizzly Bear

- *Having access management in place and road densities minimized to reduce habitat fragmentation, displacement, and human- bear encounters from resource development.*

- *Using mitigation strategies to reduce human-wildlife encounters and attractants to bears.*
- *Strategies to reduce displacement of bears from resource development and associated cumulative effects.*

Stone's Sheep

- *Applying provincial aircraft distance recommendations during winter and kidding periods for the Klappan TRA.*
- *Where mechanized land use disturbance is being permitted within 500m of high value habitats, to include a mitigation and monitoring plan by a qualified biologist to ensure the disturbance is not impacting mountain goats.*
- *Recommend alpine or elevational restrictions for ATV, snowmobiles and winter backcountry recreation use.*

Marmot

- *Identifying and maintaining colonies within a resource development footprint.*
- *Maintain access for Tahltan to harvest marmots.*
- *Reclamation strategies to recolonize areas for marmots from resource development.*

Furbearers

- *Maintain a diversity of seral habitats with effective landscape level linkages in older coniferous stands for cover to support prey species and provide for critical habitats that will also maintain forest structure for furbearer denning and reproduction habitats.*
- *Use mitigation strategies to reduce human-wildlife encounters and attractants to furbearers.*
- *Where applicable, use predator management, including trapping, to reduce predation pressures on ungulates.*

Railgrade

The hydrology of the Klappan is sensitive to disturbance of the peatlands because they largely control the hydrology. Looking ahead to potential future land use decision making with respect to the DLE the following issues become apparent:

1. ***Lack of Information**: there is a critical lack of information around the historic and ongoing impacts of the DLE. No meaningful monitoring, reclamation or impact assessment has been conducted by the tenure holder or the Crown. There was also no baseline environmental data collected in advance of DLE construction so the exact nature and extent of the impacts will be difficult to ascertain;*
2. ***Regulatory Oversight**: The reconnaissance work to date has demonstrated the need for regulatory oversight and monitoring. There are many apparent contraventions of the Federal Fisheries Act and Provincial Water Act, among others, that are yet to receive proper regulatory attention. This is a fundamental issue that must be addressed before any proposed industrial land use can be considered;*
3. ***Abandoned Dump Sites**: An abandoned dump site was surveyed by Tahltan Fisheries in 2013 (Erhardt and Hudson , 2014) and others are presumed to exist at abandoned DLE work camps along*

the grade. There is no information with respect to the location, permit status, contents or contamination risk of these sites;

4. ***Cumulative Effects**: While it is clear that the DLE has resulted in a significant amount of current and historic environmental impact in the Klappan, the lack of comprehensive impact assessment makes the determination of the potential cumulative effects from proposed land uses not possible at this time.;*
5. ***Groundwater Protection**: The DLE has resulted in a variety of impacts to groundwater along its length. Including, but not limited to ditchline interception and potential drawdown of shallow aquifers. Upgrading the DLE has the potential to worsen these impacts since completion of the rail grade would require upgrades to bring it up to a modern standard. This has the potential to affect local groundwater conditions, including loss of hydrologic integrity;*
6. ***Identification** of potential archeological sites along railgrade.*

Current Management Zones

- *When planning consider all relevant management designations and their associated legal objectives or best management practices.*

Existing Tenures

- *Provides the current status of land and its encumbrances for consideration in planning.*

Pending Applications

- *Provides a snapshot of current tenure activity that can be useful in the identification of resource use conflicts and assessment of the implications of land use decisions on mining activities.*

Information Gaps

The following are information gaps which hinder our ability to adequately manage for the identified values within the Klappan TRA.

Coal and Mineral Exploration and Mining

- *The coal in the Klappan TRA has limited exploration and resulting quantification.*

Water

- ***Hydrometric Data:*** *Lack of hydrometric station data for the Upper Skeena, Nass and Stikine watersheds reduces the ability to accurately estimate the baseline hydrologic regime and to estimate impacts to those regimes from any proposed land uses;*
    - *Installation of hydrometric stations would be targeted following identification of sensitive areas of groundwater/surfacewater interactions (e.g., as-built railgrade survey and eco-hydrological characterization)*
- ***Peatlands and Eco-hydrology:*** *Uncertainty around peatland extent and hydrologic function exist at all scales. There is a need for peatland/wetland mapping and research into their hydrologic function. Studies need to include:*
    - *Mapping of vegetative communities in association with the railgrade;*
    - *Introduced species survey;*
    - *Use the eco-hydrology studies as a hydrological indicator as it is a cost effective and practical method to understand hydrologic processes;*
    - *Eco-hydrology approaches provide valuable tools for looking at impacts and predicting future effects;*
    - *Shallow groundwater mapping is crucial for access planning;*
    - *Field studies to understand movement of water within the peatlands, (groundwater/surface water interactions);*
    - *Field studies to understand the degree of communication between deep and shallow aquifers and issues around aquifer vulnerability.*
- ***Rail Grade Impacts:*** *There is uncertainty around historic and ongoing hydrologic impacts resulting from the Dease Lake Connector rail grade. There needs to be an as-built survey of the existing infrastructure and research into the associated impacts.*
- ***Regional Groundwater Flow System:*** *The regional ground water flow field in the TRA is not well understood. A study of the regional flow field is necessary to assess the vulnerability of existing groundwater resources. This work needs to be coupled with studies of surface water / groundwater interactions in the area to understand the degree of linkage between aquifers components and the surface flow system and to understand the degree of influence that groundwater has on the aquatic and terrestrial ecosystems of the area. Characterization of the headwater aquifers should include studies to determine the nature, extent and variability of groundwater divides.*

- ***Water Quality:*** *Studies should include a sediment source survey along the rail grade to determine the degree of sediment delivery from the grade and baseline water quality to estimate any effects due to disturbance of the peatlands and to establish baseline water quality and thermal regime.*

  Peatland hydrology of the Klappan TRA is therefore a topic of considerable relevance in the assessment of impacts and potential impacts. There is a lack of baseline information on the extent and ecological properties of the peatlands and an inadequate understanding of wetland processes in this area. This information is required to conduct an informed impact assessment of the peatlands.

Water

Significant information gaps exist in the TRA with respect to the assessment of greenhouse gas emissions and current storage. They include:

- *Peatland depth, density, and the hydrologic system that supports them, should be mapped;*
- *Permafrost affected soils should also be mapped;*
- *A carbon accounting procedure should be included in any environmental impact assessment.*

Fish

- *Further confirmation of fish species within the TRA through additional literature review or field investigations. This would include detailed fish distribution and presence surveys.*
- *Additional information on specific life history parameters for fish species within the TRA (i.e. incubating period emergence timing).*
- *Assessment of the type and scale of impacts to fish or fish habitats within the TRA (past, present and cumulative).*
- *Identification of critical fish habitats within the TRA.*
- *Surveys of fish passage and specific access issues.*
- *Assessment of groundwater function and current conditions as it relates to fish habitat suitability.*
- *Collection of current water quality data, especially temperatures and turbidity measurements.*

Mountain Goats

- *The last population survey for mountain goat outside of the Todagin Wildlife Management Area is not known, but it has not occurred for at least twenty years. It is a data gap that should be tabled with the Tahltan- B.C. Fish and Wildlife Working Group to identify solutions to address this gap.*

Caribou

- *The last population survey for woodland caribou occurred in 2002 for the Spatsizi Woodland Caribou Herd. It is a data gap that should be addressed by aerial surveys for the entire TRA, and should include portions of the Spatsizi Park.*
- *Migratory corridors have also not been mapped for the TRA caribou herd and because caribou use traditional corridors in response to specific winter/seasonal characteristics/events, specific studies that will confirm these sites (e.g., radio-telemetry projects.)*

- *These are data gaps that should be tabled with the Tahltan- B.C. Fish and Wildlife Working Group to identify solutions to address these gaps.*

Moose

- *Tahltan/B.C. Fish and Wildlife Working group has begun an assessment of compulsory inspection data. This may then be able to provide more information on harvest distribution and amounts, which could form the basis for proposed changes to management approaches and regulation changes. As well, a stratified, random block survey is required in the very near future to facilitate an analysis of the changes in the population since 2001.*
- *These are data gaps that should be tabled with the Tahltan- B.C. Fish and Wildlife Working Group to identify solutions to address these gaps.*

Grizzly Bear

- *Increased population information collection if resource development projects are being proposed in the TRA.*
- *This is a data gap that should be tabled with the Tahltan- B.C. Fish and Wildlife Working Group to identify solutions to address this gap.*

Stone's Sheep

- *The last population survey for Stone's Sheep outside of the Todagin Wildlife Management Area is not known, but it has not occurred for at least twenty years. It is a data gap that should be tabled with the Tahltan- B.C. Fish and Wildlife Working Group.*

Furbearers

- *For wide ranging species such as wolves and wolverine, undertaken specific survey protocols that will provide information on genetic diversity, population density and population estimates.*
- *This is a data gap that should be tabled with the Tahltan- B.C. Fish and Wildlife Working Group to identify solutions to address this gap.*

Railgrade

- *Future studies that could be conducted to reduce land use uncertainty around the rail grade include:*
    1. *Undertake an as-built survey of the rail grade, access roads, borrow areas and camp sites is needed to determine the following;*
        a. *Identify destruction or loss of fish habitat, including an assessment of fish passage;*
        b. *Scope areas of groundwater interception including concentration in ditchline flows and effects on local groundwater tables;*
        c. *Identify possible contravention of Federal and Provincial acts;*
    2. *A sediment source survey of the Rail Grade infrastructure is needed to estimate the degree of sediment delivery from the grade;*
    3. *Water temperature study to determine the thermal effect of the rail grade infrastructure;*

4. *Soil and peatland mapping (depth and parent material) to estimate existing impacts, predict future impacts and support eco-hydrologic studies and effects assessments (see water section for more details);*
5. *Contamination studies of known dump sites. Reconnaissance survey for other sites;*
6. *Soil-dating of peats to support inclusion of Tahltan archeological baseline data.*

Appendices

Appendix 1: Klappan Strategic Initiative Terms of Reference

September 4, 2013

Klappan Strategic Initiative
Terms of Reference

September 4, 2013

1) BACKGROUND:

The Klappan is an area of significant cultural, traditional, spiritual and environmental values to the Tahltan Nation. As set out in the *Klappan Declaration* of September 2005, the Tahltan view the stewardship and protection of the Klappan as a solemn duty and sacred trust under Tahltan laws and customs.

The Klappan area is included in the Cassiar Iskut Stikine Land and Resource Management Plan as an area-specific management zone and contains a wide range of environmental, social and economic values important to the Province.

The Province has committed to working with the Tahltan to examine the feasibility of developing a protected area in the Klappan. The Province may also consult, as appropriate, with other First Nations, industry and stakeholders.

Under a Memorandum of Understanding dated March 30, 2007, Tahltan and the Province (the "Parties"), along with Shell Canada, engaged in a facilitated dialogue regarding Shell's operations in the Klappan, which ultimately lead to the relinquishment by Shell of its rights in the Klappan. The Parties acknowledge the success of that collaborative effort and share an interest in building on those results by developing a long term land use direction for the Klappan that includes consideration for a protected area.

On March 14, 2013, the Parties entered into a Shared Decision Making Agreement (SDM Agreement), which commits the Parties to fostering "an effective, respectful and enduring government-to-government relationship" through, among other things, collaborating on land and resource issues. Pursuant to section L of Appendix B to the SDM Agreement, the Parties may identify Strategic Topics for Engagement through the Government-to-Government Forum (G2G Forum), established under Appendix D of the SDM Agreement.

The Parties have agreed that land use and management of the unique values of the Klappan is a Strategic Topic, to be called the "Klappan Strategic Initiative."

The Parties have developed these Terms of Reference (TOR) to guide their Engagement on the Klappan Strategic Initiative.

Engagement related to proposed activities for the Arctos, Atrum and other specific projects will be dealt with separately, as provided for under the SDM Agreement; for example, the Parties have agreed to establish a Level 4 Working Group to develop Engagement processes for the Arctos project.

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2) GOALS AND OBJECTIVES

The intended outcome of the Klappan Strategic Initiative is the development of joint recommendations, to be provided to the respective decision-makers of each Party, for land use direction and management of the Klappan, for the benefit of the Tahltan people and all British Columbians.

Goals and objectives of the process include:

1. Strengthening and deepening the Parties' relationship and understanding of their respective interests.
2. Building Tahltan capacity to contribute to and participate in land and resource planning and management.
3. Addressing short and long term stewardship interests (including conservation and protection) related to the Klappan.
4. Addressing the Parties' respective cultural, traditional, spiritual, social, environmental and economic interests and developing an understanding of values important to each Party.
5. Establishing a shared set of management goals, objectives and criteria to guide decisions affecting the Klappan.
6. Identifying tools, measures, options and implementation considerations, including legislative tools, for implementing the shared set of management goals, objectives and criteria.

3) PRINCIPLES

The Parties agree to develop and implement the Klappan Strategic Initiative in accordance with the following principles. The principles identified here are not exhaustive, and may be further developed as the process advances:

1. The Parties will strive to work in a collaborative manner intended to build shared understanding and respect.
2. The Parties will have joint responsibility for the process, consistent with this TOR.
3. Tahltan and scientific knowledge and other available information will be identified and integrated into the process.
4. The Parties will ensure that their respective representatives are properly resourced and mandated to participate in the process and provide regular updates to their respective decision-makers.
5. The Parties will implement this initiative consistent with the provisions of the SDM Agreement.

September 4, 2013

4) GENERAL APPROACH

The Parties agree to the general approach outlined below and will endeavour to have recommendations before the Tahltan and Provincial governments in six months.

STAGE	DESCRIPTION	TIME FRAME
Stage 1	Tahltan and government to jointly establish the members of a Technical Working Group as described in Appendix 1.	September 15-October 15, 2013 (to be completed within 30 days)
Stage 2	The Technical Working Group to develop a technical report in preparation for government-to-government discussions of senior representatives.	October 15, 2013-January 15, 2014 (to be completed within 90 days)
Stage 3	Review of technical report and development of joint recommendations by senior representatives to decision-makers for long term management and land use direction for the Klappan. This may include beginning consultation with other First Nations, industry and/or stakeholders.	January 15, 2014-March 15, 2014 (within 60 days)
Stage 4	Recommendations are brought forward to the governments for review, consideration and decision.	Dependent on the available dates by senior decision-makers, and the review process.
Stage 5	Implementation if accepted.	Dependent on the completion of Stage 4.

The G2G Forum Co-Chairs will collaboratively facilitate the above process.

The Province may consult with other First Nations, industry and other stakeholders as appropriate during the Klappan Strategic Initiative.

The Tahltan intend to engage community members as appropriate during the Klappan Strategic Initiative.

The Parties may jointly engage stakeholders during the Klappan Strategic Initiative.

The Parties recognize that negotiation mandates will need to be secured from each government at certain times in the engagement process including prior to engagement of senior representatives to develop recommendations in Step 3.

Senior representatives for the Province will include Ministry of Forests, Lands and Natural Resource Operations (lead agency and chair) and the Ministries of Energy and Mines, Aboriginal Relations and Reconciliation, Environment and Jobs, Tourism and Skills Training.

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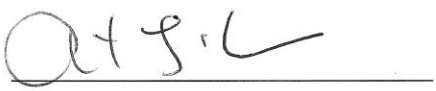
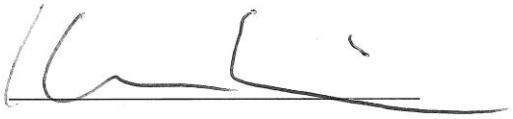
Senior representatives for the Tahltan will include the Tahltan Central Council and other Tahltan government representatives at the call of the Tahltan Central Council.



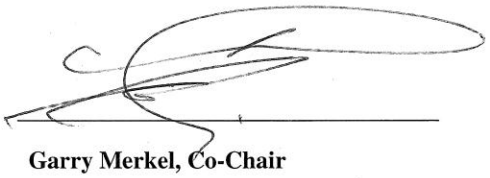
Annita McPhee, President

Approved on behalf of the Tahltan



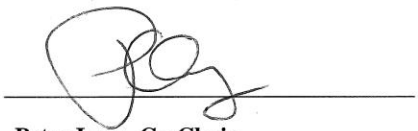
Kevin Kriese, Assistant Deputy Minister

Approved on behalf of the Province



Garry Merkel, Co-Chair

Approved on behalf of the G2G Forum



Peter Levy, Co-Chair

Approved on behalf of the G2G Forum

September 4, 2013

Appendix 1

TECHNICAL WORKING GROUP

The Parties agree to establish a Technical Working Group for the Klappan Strategic Initiative.

The purpose of the Technical Working Group is to implement the work set out in Step 2 and to assist the work of the senior representatives as required.

The Technical Working Group will develop a work plan within 30 days of its establishment to be approved by G2G Forum Co-Chairs. The working group may commence work on the technical report prior to the work plan being approved.

The Technical Working Group will prepare and submit a technical report within 90 days or as otherwise agreed, which will identify:

a) Environmental, cultural, social and economic values important to both governments;

b) A geographic boundary and place names for the area to which the Klappan Strategic Initiative will apply;

c) Current and adjacent land uses including existing tenures and pending applications;

d) Options for potential land use goals, objectives and criteria for the Klappan and/or defined geographic sub-areas to guide future decisions;

e) Potential provincial designation tools for the Klappan and/or defined geographic sub-areas to achieve the options identified in (d);

f) Potential provincial interim designations/protection measures pending implementation of the government decisions following the Klappan Strategic Initiative;

g) A range of collaborative management approaches that have the potential to manage and protect values important to both governments, including an assessment of implications of those approaches; and

h) Other items as determined throughout the course of its work.

APPOINTMENTS AND COMPOSITION:

The Technical Working Group will be composed of up to three representatives from each of the Tahltan and the Province.

The Technical Working Group will be co-chaired by a representative of each the Tahltan and the Province.

The Technical Working Group will have a first meeting as soon as practicable. The timing, frequency and format of working group meetings will otherwise be managed by the group.

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The Technical Working Group representatives will be supported by technical staff from each Party, as appropriate.

A meeting of the working group requires a quorum of at least one representative from each party.

RESOURCES

Each Party will be responsible for its own expenses to support its participation in the Technical Working Group. The Technical Working Group will utilize available information.

TERM

The Technical Working Group will remain in place until the senior representatives no longer require its service.

COMMUNICATIONS

The G2G Forum co-chairs will be responsible for any external communication on behalf of the Technical Working Group.

Appendix 2: Tahltan Declaration

1910 Declaration of the Tahltan Tribe

We, the undersigned members of the Tahltan tribe, speaking for ourselves, and our entire tribe, hereby make known to all whom it may concern, that we have heard of the Indian Rights movement among the Indian tribes of the Coast, and of the southern interior of B.C. Also we have read the Declaration made by the chiefs of the southern interior tribes at Spences Bridge on the 16th July last, and we hereby declare our complete agreement with the demands of same, and with the position taken by the said chiefs, and their people on all the questions stated in the said Declaration, and we furthermore make known that it is our desire and intention to join with them in the fight for our mutual rights, and that we will assist in the furtherance of this object in every way we can, until such time as all these matters of moment to us are finally settled. We further declare as follows:—

Firstly— *We* claim the sovereign right to all the country of our tribe—this country of ours which we have held intact from the encroachments of other tribes, from time immemorial, at the cost of our own blood. We have done this because our lives depended on our country. We have never treated with them, nor given them any such title. (We have only very lately learned the B.C. government makes this claim, and that it has for long considered as its property all the territories of the Indian tribes in B.C.)

Secondly – *We* desire that a part of our country, consisting of one or more large areas (to be erected by us),be retained by us for our own use, said lands and all thereon to be acknowledged by the government as our absolute property. The rest of our tribal land we are willing to relinquish to the B.C. government for adequate compensation.

Thirdly— *We* wish it known that a small portion of our lands at the mouth of the Tahltan river, was set apart a few years ago by Mr. Vowell as an Indian reservation. These few acres are the only reservation made for our tribe. We may state we never applied for the reservation of this piece of land, and we had no knowledge why the government set it apart for us, nor do we know exactly yet.

Fourthly – We desire that all questions regarding our lands, hunting, fishing, etc., and every matter concerning our welfare, be settled by treaty between us and the Dominion and B.C. governments.

Fifthly—*We* are of the opinion it will be better for ourselves, also better for the governments and all concerned, if these treaties are made with us at a very early date, so all friction, and misunderstanding between us and the whites may be avoided, for we hear lately much talk of white settlement in the region, and the building of railways, etc., in the near future.

Signed at Telegraph Creek, B.C., *this eighteenth day of October, nineteen hundred and ten, by*

Nanok, Chief of the Tahltans
Nastulta, alias Little Jackson
George Assadza, Kenetl, alias Big Jackson
and eighty other members of the tribe

Appendix 3: Coal Bearing Assemblages in the Bowser Basin

Groundhog –Gunnanoot deltaic Assemblage

Sandstone, siltstone, carbonaceous and calcareous mudstone, with minor conglomerate and coal; locally arranged in fining-up cycles; sandstone is fine- to medium-grained with planar bedding and planar tabular cross bedding; most sandstone is thin- and thick-bedded, medium-grained, recessive weathering wacke; resistant weathering arenite is less common and forms discontinuous sheets and lenses; finer grained strata are thinly bedded and locally include densely packed plant fossils; conglomerate sheets and lenses, <10% of the unit, include large scale cross bedding; plant fossils are common and include in-situ trees; marine fossils are rare.

Skelhorne detaic assemblage

Thinly interlayered and vari-coloured siltstone, sandstone, and conglomerate (with or without coal), commonly arranged in coarsening- and thickening-upward cycles; common features of sandstone are parallel bedding, cross bedding, ripples, burrows, bivalve coquina; conglomerate comprises a lower proportion of the unit (15 to 30%) than in the Eaglenest assemblage; conglomerate units up to 50 m thick cap cycles up to 70 m thick, and tops locally have megaripples; plant and marine fossils are ubiquitous, trace fossils including Skolithus and Diplocraterion are common, as are log fragments several metres long.

Jenkins Creek non-marine assemblage

Mudstone, siltstone, fine-grained sandstone, medium-grained sandstone, rare conglomerate and coal; commonly arranged in fining-up cycles; sandstone is grey, green, and brown weathering and occurs as laterally continuous sheets, discontinuous sheets, and lenses; lenses are planar and trough cross bedded; fossil plants abundant, including in-situ roots and plants with delicate structure; marine fossils absent.

Eaglenest deltaic assemblage

Conglomerate, sandstone, siltstone, mudstone, and rare coal; arranged in coarsening- and fining-up cycles of mudstone to pebble or cobble conglomerate; prominently rusty weathering, and 30 to 80% conglomerate; sheets of conglomerate to 50 m thick include planar beds, tabular planar cross stratification and trough cross stratification, sets locally up to 10's of metres thick; sandstone has planar cross stratification and hummocky cross stratification; sparse marine fossils but abundant plant fossils, including silicified log fragments.

Deveils Claw alluvial – fluvial assemblage

Conglomerate, sandstone, siltstone; a high proportion of pebble conglomerate (30-80%) in laterally continuous sheets with large-scale cross bedding; conglomerate forms bases of fining-up cycles with medium-grained sandstone, fine-grained sandstone, carbonaceous siltstone, and minor coal; sandstone has platy and trough cross bedding; fossil plants common; marine fossils absent.

Appendix 4: Background Fisheries Information

Table 21. Background fisheries information

Year	Report author, title and proponent	Scope of work
1997	Baxter, J.S. 1997. *Kluatantan River Steelhead: Summary of Current Data and Status Review, 1997.* Prepared by B.C. MoE, Fisheries Branch, Smithers, B.C.	Summarized current data and stock status information on the Kluatantan River steelhead population.
2012	Beacham, T.D., Wallace, C.G., Le, K.D., & Beere, M. 2012. *Population Structure and Run Timing of Steelhead in the Skeena River, British Columbia.* North American Journal of Fisheries Management, 32:2, 262-275.	A study focused upon population-specific run timing and genetic varation of Skeena River steelhead.
2005	Bocking, R.C., Parken, C.K., Atagi, D.Y., LGL Limited, DFO-PBS, and MWLAP-Skeena Region. February 2005. *Nass River Steelhead Habitat Capability Production Model and Preliminary Escapement Goals.*	A habitat-based steelhead production model for the Nass watershed which developed a method for estimating smolt production capacity and spawning potential based on watershed features, physical habitat data, and biological production parameters.
1975	Bustard, D. and Chudyk, B. 1975. *A Reconnnaissance of some streams in the Upper Skeena and Upper Spatsizi Watersheds as related to proposed B.C. Rail construction.* B.C. Fish and Wildlife Branch, Smithers, B.C..	A short study on the remaining unconstructed portion of the rail grade to assess fishery values in order to inform stream crossings and grade construction.
2008	Counterpoint Consulting. October, 2008. Economic Dimensions of the Skeena Watershed Salmonid Fisheries. Prepared for: The Pacific Salmon Foundation.	Provides and economic snapshot of Skeena salmon and steelhead fisheries, with particular analysis of the commercial sector.
2009 - 2011	Erhardt, R. 2009-2011. *Upper Skeena Chinook Surveys - Yearly reports.* Prepared for Tahltan Fisheries, Dease Lake, B.C.	Chinook DNA collection and aerial survey counts. Linear and stationary water temperature monitoring. Assessment of Chinook spawning site habitat characteristics.
2013	Erhardt, R. and Hudson, P. 2013. *Upper Skeena Aquatic Surveys - 2012.* Prepared for Tahltan Fisheries, Dease Lake, B.C.	On-site field work for the expansion of data collection regarding hydrology and groundwater conditions. Hydrometric and groundwater stations installed. Opportunistic collection of salmon habitat information.
2005	Fisheries and Oceans Canada. *Canada's Policy for Conservation of Wild Pacific Salmon.*June, 2005.	A policy document with a goal to restore and maintain healthy and diverse salmon populations and their habitats for the benefit and enjoyment of the people of Canada in perpetuity.

Year	Report author, title and proponent	Scope of work
2007	Gottesfeld, A.S., and Rabnett, K.A. January, 2007. *Skeena Fish Populations and Their Habitat.* Prepared for the Skeena Fisheries Commission.	Presents an overview of: biophysical features of the Skeena drainage; important fish populations; the nature and history of resource development and a brief overview of the socioeconomic status.
1998	Hass, G.R., 1998. *Indigenous fish species potentially at risk in B.C. with recommendations and prioritizations for conservation forestry/resource use, inventory and research.*Ministry of Fisheries Research and Development Section University of British Columbia. Fisheries Management Report No. 105.	Provides a categorization and assessment of the indigenous fish species potentially at risk in British Columbia.
1979	Jones, M.L. and Tsui, P.T.P. 1979. *Fisheries investigations in the vicinity of proposed hydroelectric reservoirs on the Stikine and Iskut rivers in northwestern British Columbia.* Prepared by Aquatic Environments Ltd. for B.C. Hydro.	Baseline fishery, water quality and benthic invertebrate studies inclusive of some sampling on the Klappan River and tributaries.
2007	Rabnett, K. 2007. *Assessment of Lower Klappan River and Tributary Crossings*. Prepared for the Klabona Keepers Society.	Present background information and survey results for river erosion assessments conducted at selected lower Klappan stream crossings and road encroachments.
2008	Rabnett, K. and Wilson, T. 2008. *Upper Skeena Fish Passage Culvert Inspection*. Prepared for Gitksan Watershed Authorities (GWA).	One component of a regional effort to investigate fish passage limited by roads and railway grades in the Skeena Basin. GWA was retained by the PSC to conduct a FPCI on all non-bridged B.C. Rail crossings of fish bearing streams in the upper Skeena Watershed.
2009	Rabnett, K. and Wilson, T. 2009. *Upper Skeena Salmon Studies 2008*. Prepared for the Skeena Fisheries Commission	Background information for the upper Skeena. Chinook DNA collection. Aerial surveys for adult Chinook and coho. Water quality sampling.
2006	Rescan Environmental Services Ltd. 2006. *Letter re: Addendum to Ealue Lake Road Assessment - July 23 and 29, 2006.* Prepared for Shell Canada, Alberta.	Several sites were revisited after no fish were captured and no definitive barriers found. A description of roadwork at each site was provided.
2006	Rescan Environmental Services Ltd. 2006. *Letter re: Ealue Lake Road Assessment - July 23 and 29, 2006.* Prepared for Shell Canada, Alberta.	Habitat assessment conducted four sites along the Ealue Lake Road inclusive of looking for potential downstream barriers at sites without fish capture.
2006	Rescan Environmental Services Ltd. 2006. *Letter re: Skeena River Rail Grade Road Fisheries Assessments.* Prepared for Shell Canada, Alberta.	An initial habitat assessment and barrier survey was conducted a three sites along the Skeena River Rail Grade.

Year	Report author, title and proponent	Scope of work
2008	Rescan Environmental Services Ltd. 2006. *Letter re: Summary Report for Fish Collection Permit # SM07-38302.* Prepared for MoE, Skeena Region.	Fish community surveys conducted in the upper Skeena inclusive of Otsi and Currier Creeks as part of baseline information for Shell Canada.
2001	Schell, C.S. 2001. *Overview (1:50,000) inventory of the Klappan River Watershed.* Prepared for B.C. MoE, Skeena Region.	Standardized overview inventory intended to survey large watershed areas with little previous information. Focus is upon fish species presence and probable distributions along with broad habitat classification.
1984	Sekerak, A.D., Taylor, J.A. and Stallard, N. 1984. *Fisheries investigations in relation to the Mount Klappan Coal project.* Prepared by LGL Ltd. for Gulf Canada Resources Inc. Calgary, AB.	To obtain information on fish distribution and composition, crucial fish habitats and potential adverse impacts from the Mt. Klappan Coal Project.
1977	Shepard, C. and J. Algard. 1977. *Fisheries Survey - B.C. Railway, Dease Lake Extension.* An unpublished report produced by Fish and Wildlife, Smithers, B.C..	Investigated mainstems of the Klappan and Little Klappan Rivers in relation to construction of the rail grade.
2014	Tahltan Fisheries. 2014 .*Reconnaissance Hydrologic and Fisheries Environmental Impact Assessment of the Dease Lake Connector Rail Grade at Kluakaz (aka Spencer Flats) Airstrip B.C. August, 2013.* Prepared for Tahltan Fisheries, Dease Lake, B.C.	Assessments of fish passage at culverts sites. Field reconnaissance of surface and groundwater conditions, fish habitat utilization and water temperature / water quality.
2011	*Tautz, A.F., Pollard, S., Hooton, R.S., Ptolemy, R.A. and Taylor, E.B. Skeena Steelhead Conservation Units.*	Steelhead Conservation Units were defined for the Skeena River using methodology consistent with the Wild Salmon Policy. The process combined habitat , life history and molecular genetics knowledge.
2007	Triton Environmental Consultants Ltd. 2007. *Klappan / Skeena Coalbed Methane Exploration Project Fisheries Background Review Report.* Prepared for Shell Canada Ltd. Calgary, AB.	To complete a fisheries background review, identify in-stream work windows and produce associated 1:20,000 scale project maps for the Klappan/Skeena Coalbed Methane Exploration Project access road.
2009	Triton Environmental Consultants Ltd. 2009. *Upper Skeena River Watershed Fisheries Program Report.* Prepared for Shell Canada Ltd. Calgary, AB.	Reconnaissance 1:20,000 fish and fish habitat inventory to: dertermine fish presence / distribution; collect age samples; and identify key habitats.
2013	Transboundary Technical Committee. January, 2014. *Preliminary Estimates of Transboundary River Salmon Production, Harvest and Escapement and Review of Joint Enhancement Activities in 2013.* Prepared for the Pacific Salmon Commission.	Estimates of harvests and escapements of Pacific salmon returning to the Stikine, Taku and Alsek Rivers are presented and compared with historical patterns and averages.

Year	Report author, title and proponent	Scope of work
1999	Van Schubert, R.M. 1999. *1:20,000 Reconnaissance Fish and Fish Habitat Inventory of the Taylor and Upper Nass River Watersheds.* Prepared by Environmental Dynamics Inc. for B.C. M0E, Fisheries Branch, Smithers, B.C.	Standardized overview inventory intended to survey large watershed areas with little previous information. Focus is fish and fish habitat resource inventory information with a particular focus upon rainbow trout / steelhead.

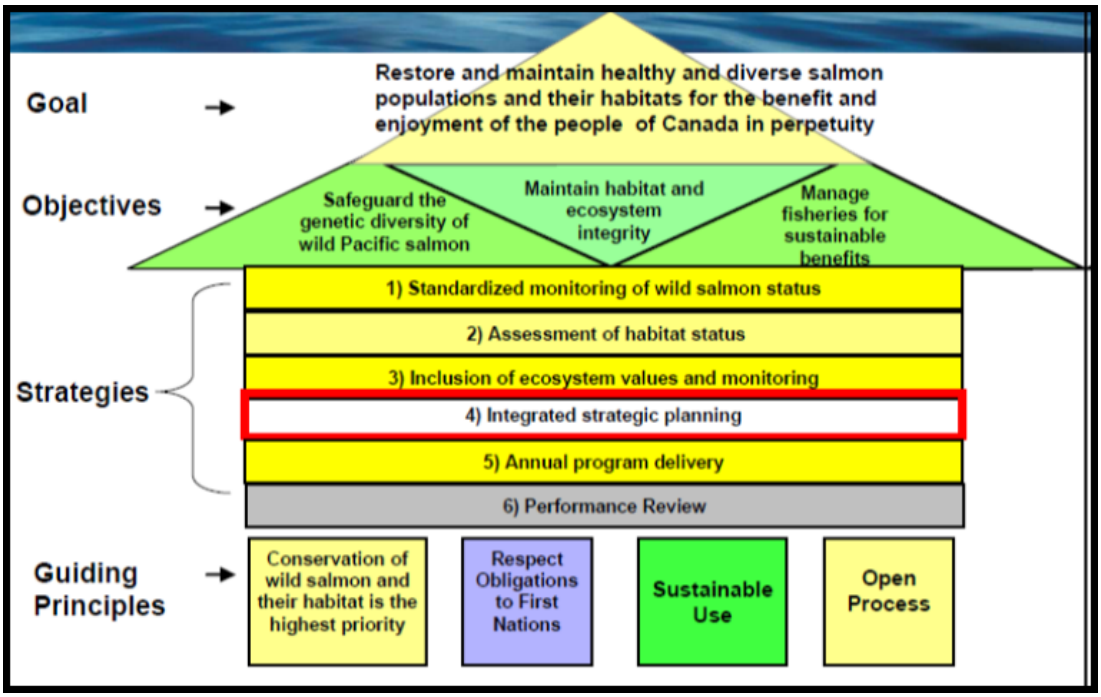
Appendix 5: Other Fisheries Information

Table 22. Fish species within the three major river drainages

Highlighted are those species known to be within the study area.	Drainage		
Fish Species	**Skeena**	**Stikine**	**Nass**
Estuarine group			
Eulachon (*Thaleichthys pacificus*)	√		√
Green Sturgeon (*Acipenser medirostris*)	√	√	√
Longfin Smelt (*Spirinchus thaleichthys*)	√		
White Sturgeon (*Acipenser transmontanus*)	√		
Anadromous group			
Arctic Smelt *(Osmerus mordax)*		√	
Chinook Salmon (*Oncorhynchus tshawyscha*)	√	√	√
Chum Salmon *(*Oncorhynchus keta*)*	√	√	√
Coastrange Sculpin *(Cottus aleuticus)*	√	√	√
Coho Salmon (*Oncorhynchus kisutch*)	√	√	√
Pacific Lamprey *(Lampetra tridentata)*	√	√	√
Pink Salmon (*Oncorhynchus gorbuscha*)	√	√	√
Prickly Sculpin (*Cottus asper*)	√	√	√
River Lamprey (*Lampetra ayresi*)	√	√	√
Sockeye Salmon (*Oncorhynchus nerka*)	√	√	√
Steelhead (*Oncorhynchus mykiss*)	√	√	√
Threespine Stickleback (*Gasterosteus aculeatus*)	√	√	√
Resident group			
Arctic Grayling (*Thymallus arcticus*)		√	
Bull Trout (*Salvelinus confluentus*)	√	√	√
Burbot *(Lota lota)*	√	√	
Cutthroat Trout (*Onchorhynchus clarki clarki*)	√	√	√
Dolly Varden (*Salvelinus malma*)	√	√	√
Kokanee (*Oncorhynchus nerka*)	√		√
Lake Chub *(Couesius plumbeus)*	√	√	
Largescale Sucker *(Catostomus macrocheilus)*	√		√
Longnose Dace (*Rhinichthys cataractae)*	√		√
Longnose Sucker *(Catostomus catostomus)*	√	√	√

Highlighted are those species known to be within the study area.	Drainage		
Fish Species	**Skeena**	**Stikine**	**Nass**
Mountain Whitefish (*Prosopium williamsoni*)	√	√	√
Northern Pikeminnow (*Ptychocheilus oregonensis*)	√		
Peamouth Chub *(Mylocheilus caurinus*)	√		√
Pygmy Whitefish (*Prosopium coulterii)*	√		
Rainbow Trout *(Oncorhynchus mykiss)*	√	√	√
Redside Shiner (*Richardsonius balteatus*)	√		√
Western Brook Lamprey (*Lampetra richardsoni*)	√	√	√
White Sucker (*Catostomus commersonii)*	√		

Table 23: Overview of the Wild Salmon Policy Framework Components



Appendix 6: Information Sources

To be populated once completed.

Appendix 7: Stakeholder Consultation

To be populated once completed.

Appendix 8: Community Consultation:

To be populated once completed.

Appendix 9: Reconnaissance Hydrologic and Fisheries Environmental Impact Assessment of the Dease Lake Connector Rail Grade at Kluakaz (aka Spencer) Airstrip B.C.

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