Kispiox Timber Supply Area
Timber Supply Review

Data Package

February 2021

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1. Introduction

This data package summarizes the information and assumptions that will be used to conduct the timber supply analysis of the Kispiox Timber Supply Area (TSA). Under Section 8 of the *Forest Act*, the chief forester must review the timber supply for each TSA, at least once every 10 years, and determine an Allowable Annual Cut (AAC). The chief forester may postpone a determination for a further five years, making the total possible time between AAC determinations, 15 years - this option has not been exercised for the Kispiox TSA.

The primary purpose of a Timber Supply Review (TSR) is to identify, collate, and present information for consideration by the chief forester in their AAC determination. This information is about the 'what are the current conditions of the TSA and its forest management'; not the 'what ifs of possible conditions and forest management changes'. It is a multi-step process that involves:

1) The release of a *Data Package* that describes known information and current management;
2) A timber supply analysis that is based on the information in the *Data Package*;
3) The release of a *Discussion Paper* that outlines the results of the timber supply analysis;
4) The presentation of a summary of all technical, First Nations engagement and consultation, and public review information to the chief forester; and,
5) The public release of a *Rationale* that describes the chief forester's AAC determination.

Consultation with First Nations is initiated at the start of the TSR process and continues until an AAC decision is made. As part of the consultation process, First Nations and the public are asked formally for input twice in the process: (1) following the release of the *Data Package*; and, (2) following the release of the *Discussion Paper*. Input received during the data package review phase may be incorporated into the timber supply analysis or identified to the chief forester for consideration in their AAC determination.

This *Data Package* summarizes the information and assumptions that are used to conduct the timber supply analysis for the TSR of the Kispiox TSA. It contains currently available data and management descriptions that are relevant for the timber supply analysis. A final *Data Package* will be prepared following the completion of the timber supply analysis that includes any updated management, data or analysis assumptions.

For more information about the TSR process please visit the following website:
https://www2.gov.bc.ca/gov/content/industry/forestry/managing-our-forest-resources/timber-supply-review-and-allowable-annual-cut

2. Background

2.1 General

The 1.3 million hectare Kispiox Timber Supply Area (TSA) is located in northwestern British Columbia in the Skeena Region, and is administered by the Ministry of Forests, Lands, Natural Resource Operations and Rural Development's (FLNRORD) Skeena Stikine Natural Resource District ("the district") office located in Smithers. In 2009 the Cranberry TSA was amalgamated into the Kispiox TSA adding approximately 76 750 hectares to the TSA. The Cranberry TSA is the former TFL 51 which was surrendered to the Crown in 1993. Figure 1 delineates the Kispiox Timber Supply Area.

A population of approximately 6,000 people resides in communities - including Hazelton, New Hazelton, South Hazelton, Hagwilget, Two Mile, Gitanyow, Glen Vowell (Sik-e-dakh), Kispiox (Anspayaxw), Kitwanga, Cedarvale, and Kitseguecla, - located along the Highway 16 and 37 corridors.

The Kispiox TSA overlaps the traditional territories of the following First Nations: Gitxsan, Wet'suwet'en, Gitanyow, Nisga'a, Lake Babine Nation, Kitselas, and Tsetsaut Skii Km Lax Ha First Nation. The Gitxsan Nation has five villages within the TSA (Gitanmaax, Sik-e-dakh, Kispiox, Gitsegukla and Gitwangak). Wet'suwet'en and Gitanyow each have one village (Hagwilget and Gitanyow). The Nisga'a Treaty finalized in April 2000 provides for a Nass Wildlife Area that is partly overlapped by the TSA. Cultural heritage features are abundant and include traditional use sites, major trading trails, and archaeological features.

The Kispiox TSA transitions coastal and interior climates. Engelmann Spruce-Subalpine Fir (ESSFwv), Interior Cedar-Hemlock (ICHmc1, mc2), Coastal Western Hemlock (CWHws2), and Sub-Boreal Spruce (SBSmc2) biogeoclimatic zones dominate. Forests are dominated by hemlock and subalpine fir. Spruce (Engelmann, white and hybrid), lodgepole pine, western redcedar, amabilis fir and cottonwood are present at lesser levels.

Topography is mountainous, with a mix of wide and narrow forested drainages between ranges. Stream density is very high. Major rivers include the Skeena, Bulkley, Babine, and Kispiox. The confluence of the Skeena and Bulkley rivers occurs near the Hazeltons.

Non-timber resources and values are rich and diverse. They include stand and landscape-level biodiversity, community and fish sensitive watersheds, hydrologically stable watersheds, cultural heritage resources, fish and wildlife habitats, botanical forest products (e.g., pine mushrooms, berries), old and unique forests, scenic resources, and wilderness.

Wildlife and fish species of regional significance, or at risk, are present and include grizzly, moose, mule deer, mountain goat, raptors, bull trout and sockeye salmon. Black bears are widespread, and a population of Kermode black bears extends into the western half of the TSA. Many species are dependent upon the mature and old forest ecosystems within the TSA. The Skeena River and tributaries provide important spawning habitat and migration routes for returning salmon.

The Kispiox TSA was generally unaffected by the recent mountain pine beetle epidemic, as mature pine leading stands comprise less than 8% of the timber harvesting land base (THLB). The most significant forest health issue is a severe outbreak of *Dothistroma* needle blight, which causes recurrent needle defoliation and has frequently led to full mortality of the pine component of young ICH and CWH plantations.

Effective January 1, 2008, the AAC for the Kispiox TSA was set at 977 000 cubic metres based on a 328 000 hectare THLB. Of this total, 177 000 cubic metres was partitioned to geographically remote areas of the TSA. Then, effective March 31, 2009, the Cranberry TSA was consolidated with the Kispiox TSA. As a result, the current AAC for the Kispiox TSA is 1 087 000 cubic metres.

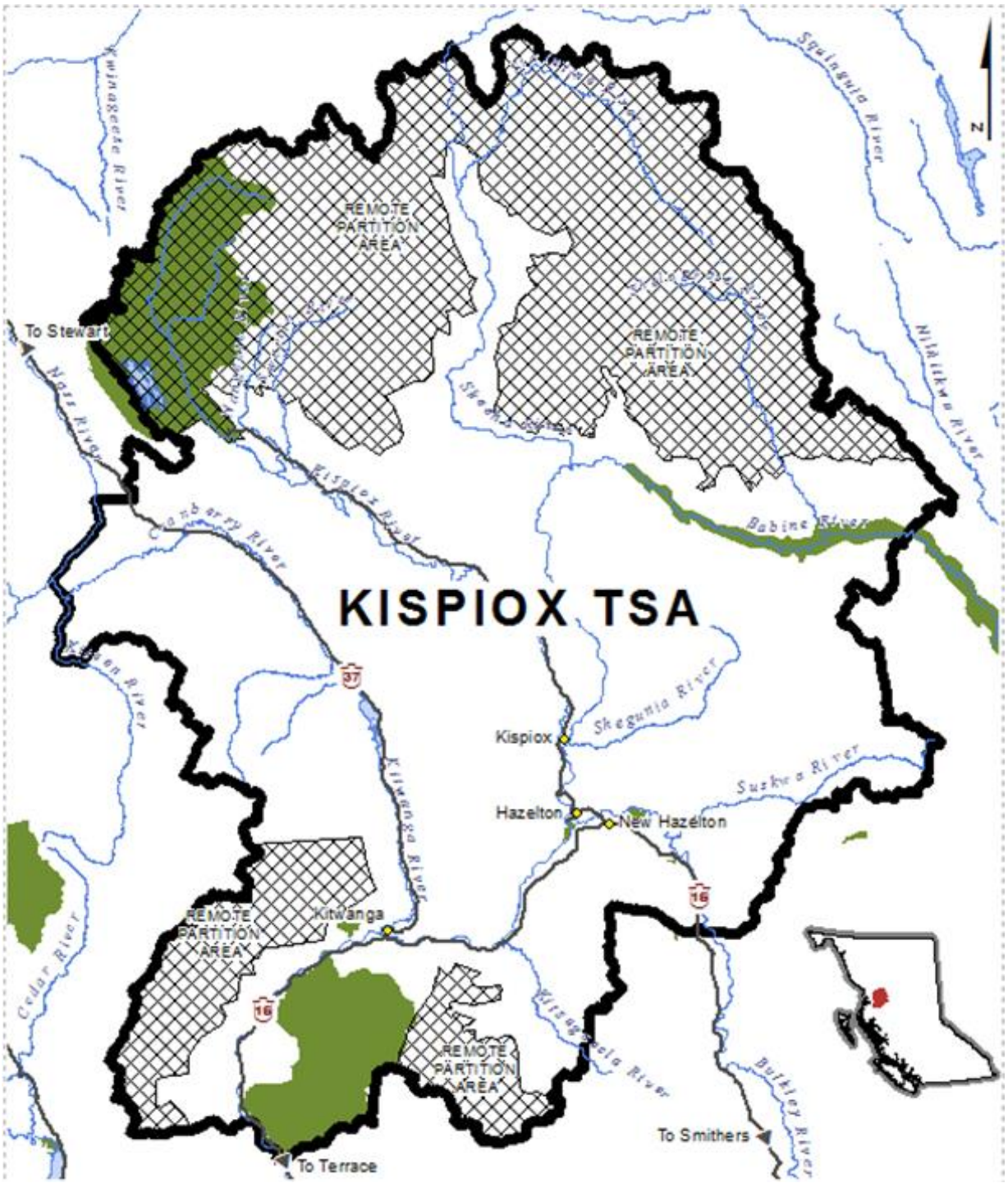

Figure 1. Kispiox Timber Supply Area.

2.2 Land use planning

Land use objectives for a full spectrum of values, including but not limited to: biodiversity, water, fish and wildlife, hydrologic integrity, timber and non-timber, visual resources, access management, recreation, and cultural heritage resources, are established for the Kispiox TSA from the following sources. Figure 2 depicts the strategic land use areas within Kispiox TSA.

Kispiox LRMP

- April 1996 Kispiox Land and Resource Management Plan (amended March 2001);
- April 25, 1996 Order declaring the Kispiox Land and Resource Management Plan to be a Higher Level Plan pursuant to Section 1(1) of the *Forest Practices Code of BC Act* (FPC);
- February 20, 2006 a letter from the District Manager clarified which Kispiox LRMP objectives were applicable to forest industry and thus required Forest Stewardship Plan results and/or strategies – Regarding: Clarification regarding Kispiox Land and Resource Management Plan, Higher Level Plan Order.

Kispiox SRMP

- January 2006 Kispiox LRMP Higher Level Plan Objectives for Biodiversity, Visual Quality, and Wildlife;
- June 1, 2006 Order to Establish Landscape Units and Objectives;
- February1, 2006 Order to Establish Scenic Areas.

West Babine SRMP

- March 2004 Xsu gwin lik'l'inswx: West Babine Sustainable Resource Management Plan (amended February 2012);
- August 1, 2004 Order to Establish the West Babine Landscape Unit and Objectives, and to vary the Atna/Shelagyote and Babine River Special Management Zone Boundaries.

Cranberry SRMP

- June 1, 2012 Cranberry Sustainable Resource Management Plan (non-legal);
- March 3, 2016, Ministerial Order, Land Use Objectives for the Cranberry Sustainable Resource Management Plan, which legalized a broad selection of objectives from the Cranberry SRMP pursuant to Section 93.4 of the *Land Act*;
- March 3, 2016 Order to establish Old Growth Management Areas pursuant to Section 32 of the Environmental Protection and Management Regulation.

Wildlife

- June 20, 2007 Order - Ungulate Winter Range – #U-6-006 (Kispiox and Cranberry TSAs) for mountain goat (amended September 17, 2014);
- February 2019 Order - Wildlife Habitat Area (WHA) #6-055 Grizzly Bear in Shenismike, Babine River Watershed (also known as "Grizzly Drop");
- December 30, 2004 FRPA Section 7 Notice - Indicators of the Amount, Distribution and Attributes of Wildlife Habitat Required for the Survival of Ungulate Species in the Cranberry TSA;
- December 30, 2004 FRPA Section 7 Notice - Indicators of the Amount, Distribution and Attributes of Wildlife Habitat Required for the Survival of Species at Risk in Skeena Stikine District.

Visual management

- Scenic areas were established during the *Forest Practices Code of British Columbia Act* (FPC) legal era (pre-004), and grandparented to the present era through provisions of *Forest and Range Practices Act* (FRPA) Section 180;
- A first category of Visual Quality Objectives (VQOs) were established during the FPC legal era via the West Babine SRMP and Kispiox LRMP, and grandparented to the present era through provisions of FRPA Section 181;
- A second category of VQOs were established via Government Actions Regulation Section 17 (GAR 17);
- A third category of VQOs were established for scenic areas that were made known by name during the FPC legal era, but where spatial mapping of the VQO extent did not occur until the FRPA legal era. Although a GAR process remains necessary for legal VQO establishment, an FPC era District Manager letter to licensees requires interim actions comparable to "Modification" (M) VQO management.

Other

- June 15, 1999 Mill Creek Sensitive Area Plan, Order to Establish a Sensitive Area and Objectives;
- 2002 Botrychium Basin Sensitive Area Plan, Order to Establish a Sensitive Area and Objectives, pursuant to Section 5 of the *Forest Practices Code of BC Act*;
- May 2000 Dominion Telegraph Trail Management Plan;
- March 12, 2008 Plan for a Long-Term Sustainable Supply of Cedar, from Gitanyow Traditional Territory, for Gitanyow Cultural and Domestic Purposes.

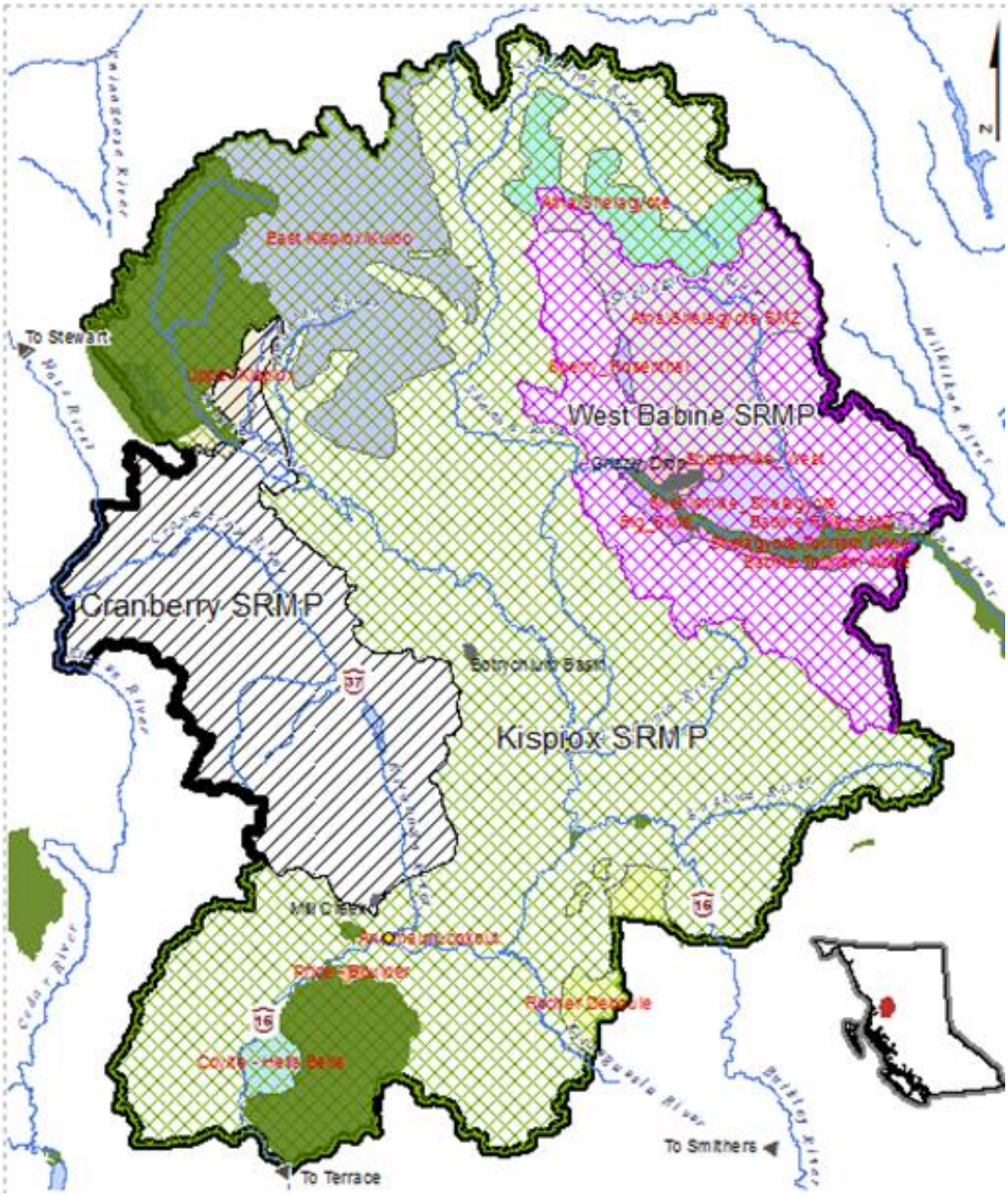

Figure 2. Strategic land use areas within Kispiox TSA.

2.3 Forest industry

Current Forest Tenure Allocation

The current AAC is apportioned to:

Replaceable Forest Licences	50%
Non-replaceable Forest Licences	24%
BC Timber Sales Licences	23%
Community Forest Agreement	1%
Woodlot Licences	1%
Forest Service Reserve	1%

Currently awarded licences include:

Replaceable Forest Licences	Gitxsan Forest Licence Inc. Kispiox River Timber Ltd. Northwest BC Timber Resources Ltd. 0736228 B.C. Ltd.
Non-replaceable Forest Licence	Gitanyow Huwilp Society
Future Potential Licences	Gitanyow First Nations Woodland Licence[1] Forest Tenure Opportunity Agreement planning[2]

Harvesting Patterns

Harvesting and road building has been concentrated in multiple drainages in the southern half of the TSA. This has created extensive harvest and road infrastructure, currently deteriorated, in accessed drainages south of the Babine River, with very little forestry development north of the Babine River. The harvest focus has been primarily on accessing valuable sawlog stands, with the exception of the mid-1990's and again in 2006 when pulp commodity prices were high, and low quality pulpwood stands were also in demand.

Harvest accessibility has been reduced since a key mainline road in the Kispiox TSA, the Suskwa Forest Service Road, has been inaccessible for several years due to an ongoing First Nations territorial concern. As of January 28, 2019, the appraisal rate is no longer being run through this route.

Since 2006 the forest industry has typically targeted residual high-value patches along highways and mainlines for harvest, and there has been minimal new road building. There has been a recent harvest focus in the Hanawald drainage north of the Babine River, accessed through Bulkley TSA. Also, in order to enable salvage logging of a major 2018 wildfire, an area that was previously accessed through the Suskwa FSR, a temporary extension of the 456 Road from Bulkley TSA has been created.

[1] Gitanyow First Nations Woodland Licence is nearing issuance, and is comprised of Supply Block G, the previous Cranberry TSA, and cedar stand reserves, in Schedule K of the Cranberry LUOR.

[2] Forest Tenure Opportunity Agreement planning with a number of Gitxsan administrative watersheds is currently underway.

Wood Volume Harvested

The total harvest volume billed from 2008 to 2018[3] was 2 315 666 cubic metres, which equates to an annual average of 210 515 cubic metres[4]. Of that 11-year total, 50% (1 136 426 cubic metres) was billed over a three-year period (2016 thru 2018), which coincided with a significant increase in lumber market values. The total area harvested from 2008 to 2018 was approximately 5200 hectares.

Wood volumes are processed at a variety of local sawmills, including, Kitwanga Forest Products in Kitwanga, Skeena Sawmills in Terrace, Pacific Inland Resources in Smithers (West Fraser), and Hampton Sawmill in Burns Lake. A limited amount of volume is also sent to export. The limited export of unmanufactured timber from Kispiox TSA, all species with the exception of western redcedar and cypress, is currently enabled through the Order-in-Council (OIC) 513/2008[5].

History of Forestry Employment

Prior to 2001 the public sector (education, health, safety, and government administration) was the dominant employer (45% of all jobs), with the forestry sector second at 30%[6]. The rate of harvest was at or near AAC levels.

Employment in the forestry sector declined sharply in 2001 when Skeena Cellulose Inc. (SCI) went into receivership and its Carnaby sawmill closed. In 2004, the Kispiox Forest Products sawmill in South Hazelton also closed. In 2006 direct forestry sector employment in the TSA accounted for less than 10% of all jobs[7].

[3] Including volumes attributable to the previous Cranberry TSA.

[4] Source: Harvest Billing System.

[5] The OIC allows for 20% of invoiced timber volume on a Cutting Authority to be exported annually, without advertisement. This timber still requires a permit if authorization is being sought to transport out of province, within Canada. Permitted timber where authorization is sought to transport out of Canada requires a Federal Export Permit. The OIC 513/2008 covers the Kispiox TSA, and expires on July 31, 2019. Any other volumes sought to be exported must first be advertised and deemed surplus to the needs of BC's manufacturing community. Any such permitted exemptions expire 180 days, or 6 months after issuance. Source: January 27, 2017 Personal Communication, with Chris Shallow, FLNRORD North Area Regional Export /Waste and Residue Officer.

[6] Data source: Robinson Consulting and Associates Ltd., and Timberline Forest Inventory Consultants Ltd. December 2006. *Kispiox TSA Timber Supply Review III Socio-Economic Analysis, Version 3.2*.

[7] Data source: Stats Canada 2006 Regional District Profile; Bulkley Nechako, Cariboo Stikine, Stikine, Northern Rockies, Peace River - https://www12.statcan.gc.ca/census-recensement/2006/dp-pd/prof/92-591/details/page.cfm?Lang=E&Geo1=CD&Code1=5951&Geo2=PR&Code2=59&Data=Count&SearchText=Bulkley-Nechako&SearchType=Begins&SearchPR=01&B1=All&GeoLevel=PR&GeoCode=5951.

3. First Nations Considerations

3.1 First Nations

The traditional territories of seven First Nations are wholly or partly overlapped by Kispiox TSA. These nations are the Gitxsan Nation, Gitanyow Nation, Lake Babine Nation, Nisga'a Nation, Tsetsaut Skii Km Lax Ha First Nation, Kitselas First Nation and Wet'suwet'en. One nation, Nisga'a Nation, holds a treaty, while some of the other nations are actively involved in the BC treaty process. FLNRORD ministry staff work with the First Nations through engagement and economic agreements, working groups, and other non-treaty processes.

Gitxsan Nation

Gitxsan traditional territories occupy an area of over 2.8 million hectares in northwestern British Columbia. Approximately 40% of the Gitxsan traditional territories are overlapped by Kispiox TSA (1 081 149 hectares). The Gitxsan traditional territories represent the largest First Nations interest in the Kispiox TSA - comprising 83% of the TSA. These territories include the Babine, Bulkley, Kispiox and Skeena Rivers.

Aproximately 8,000 Gitxsan live within their traditional territories with the majority living in five Gitxsan villages - Gitwangak, Gitsegukla, Gitanmaax, Sik-e-dakh (Glen Vowell), and Anspayaxw (Kispiox) - and two provincial municipalities - Hazelton and New Hazelton. The Gitxsan Nation is made up of four clans under which, there are 52 Wilp (house groups). Each Wilp has authority over its respective territories.

Existing and previous agreements between FLNRORD and the Gitxsan Nation include the:

- 2006 Gitxsan Short Term Forestry Agreement which expired October 26, 2011:
    - It provided for access to tenure, not yet realized by the Gitxsan, as well as other economic accommodations, restoration works and a pilot landscape unit planning process for the Gitseguecla Watershed;
- 2017 Pilot Engagement Agreements were initiated with three Gitxsan Administrative Watersheds (Laxyip): Gitwangak, Babine, and Kispiox;
- 2018 Strategic Engagement Agreements (SEAs) were signed with five Gitxsan Laxyip: Babine, Gitwangak, Kispiox, Sustut, and Upper Nass;

The terms of these agreements include:

    - establishing governance structures for government-to-government relationships;
    - enabling consultation processes regarding land and resource decisions; and,
    - working collaboratively on Joint Initiatives, such as, resource revenue sharing, forestry tenure opportunities, forestry business opportunities, collaborative land management and environmental stewardship and human resource capacity development.
- 2018 Strategic Forest Envelope funding for three of the Laxyip (Gitwangak, Kispiox, Babine) provided for human resource capacity development; and,
- Initiatives are currently underway to develop Forest Consultation and Revenue Sharing Agreements (FCRSAs) with all five Laxyip.

Gitanyow Nation

Gitanyow traditional territories occupy an area of over 600 000 hectares in northwestern British Columbia. Approximately 35% of the Gitanyow traditional territories are overlapped by the Kispiox TSA (208 587 hectares). This area is along the western boundary of the TSA in the Middle Nass and Upper Skeena Watersheds (Kitwanga and Kispiox Rivers) and represents 16% of the Kispiox TSA.

The Gitanyow peoples are known collectively as the Gitanyow Nation. The Gitanyow Nation is comprised of two clans under which are eight Wilp. Each Wilp has authority over its respective territory (Lax'yip). The Gitanyow Nation Lax'yip are collectively known as the Gitanyow Territory. The Gitanyow Territory has one community, Gitanyow, with a population of 900.

The *Gitanyow Huwilp Recognition and Reconciliation Agreement* was signed by the Province and the Chiefs of all eight Gitanyow Wilp on March 28, 2012 and was renewed for a five-year term July 2016. The purpose of the Gitanyow Agreement is to establish a more collaborative government-to-government relationship and to allow the Gitanyow to explore economic opportunities. The Agreement also establishes a 'one window' approach to consultation within the Gitanyow Territory.

Lake Babine Nation

Lake Babine Nation (LBN) territory covers over 1.3 million hectares of northwestern British Columbia. Approximately 10% of LBN territory is overlapped by the Kispiox TSA. LBN territory represents 11% (142 878 hectares) of the eastern portion of Kispiox TSA.

LBN live in the three main communities of Fort Babine, Tachet, and Burns Lake and, currently have an Interim Forestry Agreement, and an Incremental Treaty Agreement with the Province of BC.

Nisga'a Nation

The Nisga'a Treaty area covers over 2.6 million hectares of northwestern BC. The Nisga'a Treaty includes provisions for a Nass Wildlife Area, which is partly overlapped by the Kispiox TSA. Under the *Nisga'a Final Agreement Act*, Nisga'a citizens have the right to harvest wildlife within the Nass Wildlife Area in a manner that is consistent with the communal nature of the Nisga'a harvest for domestic purposes, and the traditional seasons of the Nisga'a harvest; and does not interfere with other authorized uses of Crown land.

Approximately 4% of the areas subject to the Nisga'a Treaty are overlapped by the Kispiox TSA - representing 8.5% (110 574 hectares) of the Kispiox TSA.

The *Nisga'a Final Agreement* came into effect May 11, 2000, and was negotiated between Canada, BC and the Nisga'a Nation. It became the first modern day comprehensive treaty in BC. The majority of Nisga'a live in communities along the Nass River, with a population of approximately 6,000.

Tsetsaut Skii km Lax Ha (TSKLH) Nation

Tsetsaut Skii km Lax Ha traditional territories cover over 1.9 million hectares of northwestern British Columbia. Approximately 1.4% of their traditional territories are overlapped by the Kispiox TSA. Tsetsaut Skii km Lax Ha traditional territories represent just under 2% (25 144 hectares) of the Kispiox TSA.

Tsetsaut Skii km Lax Ha Nation is engaged in discussions associated with land and resource use within its asserted traditional territories outside of the B.C. treaty process. They have an approximate population of 30.

Kitselas Nation

Kitselas traditional territory covers over 800 000 hectares of northwestern British Columbia. Approximately 2% of the Kitselas traditional territory is overlapped by the Kispiox TSA. Kitselas traditional territory represents roughly 1.5% (19 534 hectares) of the Kispiox TSA and are in the southwestern corner of the Kispiox TSA.

Kitselas traditional territory stretches from the Pacific Ocean 200 kilometres inland to the Skeena River Valley. The traditional territory surrounds the City of Terrace and the Skeena River. Their total population is approximately 700 with most of the people living in three communities: Gitaus, Kulspai and Endadoon.

BC and Kitselas Nation signed a three-year Consultation Agreement with all NRS agencies in February 2017. Implementation began in July 1, 2018 and applies to all NRS agencies. BC and Kitselas Nation are in the final stages of Treaty negotiations.

Wet'suwet'en

Wet'suwet'en traditional territory covers over 2.0 million hectares of northwestern British Columbia. Approximately 0.2% of the Wet'suwet'en traditional territory is overlapped by the Kispiox TSA. Wet'suwet'en traditional territory represents less than 1% (3984 hectares) of the Kispiox TSA.

Wet'suwet'en traditional territory lies within the southeastern edge of the Kispiox TSA. Of note, the village of Hagwilget, within the Kispiox TSA, is a Wet'suwet'en village, which it lies within Gitxsan territory.

3.2 Engagement and consultation with First Nations

The Province is working to engage First Nations throughout this TSR process, from initiation of data gathering to the time the allowable annual cut decision is made by the chief forester. Commencement of formal consultation will start when the *Data Package* is released. The public documents, to the extent possible, will reflect First Nations' interests as expressed to FLNRORD; and analysis will be mindful of those interests.

Issues communicated by First Nations in both this and previous TSRs have been and will continue to be documented. They will either be addressed by FLNRORD or redirected to appropriate staff in other agencies / ministries. During the TSR process FLNRORD will track status towards issues resolution and share updates with First Nations. At the end of the TSR process, issues and how they were resolved will be included in the consultation record prepared for the decision maker. A summary of First Nations' concerns will be shared, upon request, with their offices when the *AAC Rationale* is complete.

Pre-consultation engagement began in November 2016 with letters sent from the chief forester to all First Nations whose traditional territories are overlapped by Kispiox TSA. As of December 2018, engagement has been modest as other workload, including wildfire response and rehabilitation, took priority for local government staff time. Engagement will increase as draft products near completion throughout 2020.

Commencement of formal consultation will start when this *Data Package* is released. The *Data Package* identifies the best available information on the forest inventory and management practices. The formal review period for the *Data Package* will be 60-days.

An analysis that includes a base case timber supply forecast and sensitivities around uncertainties of the data, forest management, and modelling assumptions will be completed based upon the draft *Data Package* and information obtained during the review period. Following completion of the analysis, a *Discussion Paper*, that summarizes the analysis and related issues, will be released. A second 60-day formal review period will commence at that time.

Following the second formal review period, ministry staff will finalize the collation of the comments received and their clarification, and, if necessary, update analyses to reflect concerns. This information is presented to the chief forester to assist with the AAC determination. The AAC determination is released as a formal rationale document that will be provided to all First Nations with traditional territory that is overlapped by the Kispiox TSA administrative boundary.

3.3 First Nations strategic planning initiatives

Gitanyow Planning Processes

In 2005, a co-operative consultation and planning process involving Gitanyow Hereditary Chiefs, the Ministry of Forests (Skeena Stikine District), and Kispiox Forest Licensees culminated in the draft *Landscape Unit Plan for all Gitanyow Traditional Territories within the Kispiox and Cranberry Timber Supply Areas*.

Subsequently the 2006 *Gitanyow Forestry Agreement* and October 2008 *Reconciliation through Land Use Planning in Gitanyow Traditional Territory* formalized commitment for government-to-government engagement to complete strategic land-use planning within Gitanyow Lax'yip areas. The strategic planning process was led by FLNRORD with independent Gitanyow and Nisga'a planning tables that culminated in two Strategic Resource Management Plans (SRMP), the Nass South SRMP and Cranberry SRMP, both endorsed as Ministerial Policy in 2012.

In March 2012 the *Gitanyow HuWilp Recognition and Reconciliation Agreement* (Gitanyow RRA) was endorsed. Embedded within the Gitanyow RRA (Schedules A and B) is the *Gitanyow Lax'yip Land Use Plan* (GLLUP) which essentially recaptures objectives, measures/indicators, and targets from the Nass South and Cranberry SRMPs.

In March 2016 Land Use Objectives Regulation Order: Cranberry SRMP, legalized most Cranberry SRMP and GLLUP objectives, measures/indicators, and targets, with the exception of those for Moose, Mountain Goat and Grizzly Bear.

- Strategic direction for Mountain Goat is accommodated in the September 2014 Order - Ungulate Winter Range – #U-6-006 (Kispiox and Cranberry TSAs) for mountain goat.
- Strategic direction for Cranberry Moose and Grizzly Bear is currently in development within Wildlife Habitat Area Orders. In order to plan management direction for these species, Forest Stewardship Plan holders typically elect to specify results and/or strategies made consistent with non-legal Cranberry SRMP / GLLUP direction.

All Cranberry SRMP / GLLUP direction that represents 'current management' will be modelled in the TSR base case.

Gitxsan Planning Processes

Gitsegukla Landscape Unit Plan (GgLUP)

The October 2006 Gitxsan Short-Term Forestry Agreement committed the Province to a pilot planning process in the Gitsegukla Administrative Watershed, intended to define the processes and principles for future strategic planning initiatives in Gitxsan Traditional Territory.

From Fall 2009 to August 10, 2010, Gitxsan hereditary chiefs in the Gitsegukla Watershed worked with a consultant to develop the Gitsegukla Landscape Unit Plan (GgLUP). Concurrently, BC used the GgLUP to develop a draft Sustainable Resource Management Plan (SRMP), which in November 2010 was shared with Gitsegukla Chiefs and Kispiox licensees. Projected next steps were for a broadened planning table engagement with Kispiox licensees prior to the SRMP finalization.

Although the process stalled due to BC and Gitxsan Treaty Society resourcing issues, the Province accepts that the GgLUP identifies interests the community wants protected and/or considered in land and resource decisions.

As guided by collaborative engagement activities, sensitivity analysis (ID#1) will seek to conduct analysis that informs the Chief Forester's AAC decision on the implications of implementing the values represented in the GgLUP, ensuring the representation of First Nations values and Interests.

Gitwangak Land Use Plan (GkLUP)

The Province and Gitxsan Hereditary Chiefs are presently co-involved in Engagement Pilots in three of nine Gitxsan Administrative Watersheds: Gitwangak, Kispiox, and Babine. The Simgiget'm Gitwangak Society, comprised of hereditary chiefs in Gitwangak Administrative Watershed, worked with a consultant to develop the Gitwangak Land Use Plan (GkLUP), which they provided to government on April 26, 2017 in the context of potential future government-to-government negotiations.

The GkLUP provides detailed management objectives, targets and strategies for a full spectrum of forest-based values. Because the GkLUP was developed independently with no engagement from the Province or stakeholders, the Province considers it to be neither legally binding nor policy direction. However, the Province does accept that the GkLUP acts to identify interests the community wants protected, and/or considered in land and resource decisions.

To date three Kispiox-based licensees (Gitxsan Forest Licence Inc., Kispiox River Timber Ltd., and Northwest BC Timber Resources Ltd.) have elected to adopt a subset of GkLUP based objectives in their Forest Stewardship Plan, and to provide results and/or strategies made consistent with GkLUP direction.

As guided by collaborative engagement activities, sensitivity analysis (ID#1) will seek to conduct analysis that informs the chief forester's AAC decision on the implications of implementing the values represented in the GkLUP, ensuring the representation of First Nations values and Interests.

3.4 Resource value assessments

In the 2007 William decision (*Tsilhqot'in Nation v. British Columbia)*, the BC Supreme Court ruled that decision makers must consider information on wildlife values associated with Aboriginal rights and Interests (e.g., hunting, trapping, fishing, and trading); and the potential implications of their decisions on wildlife and First Nations' interests. FLNRORD seeks to identify key First Nations' resource values through collaboration, and through reviewing past consultation records for resource values that can be assessed and used to support the TSR decision process.

Key resource value assessments cannot address all concerns communicated by First Nations, however, all concerns will be documented, and those that cannot be addressed within the AAC determination will be communicated to other parts of government for consideration. The published *AAC Rationale* will identify how First Nations' concerns were applied in regard to the AAC determination.

A comprehensive list of potential First Nations resource values was compiled from the following processes:

- May 1999 Nisga'a Final Agreement (the 'Nisga'a Treaty'), which identified moose, grizzly bear, and mountain goat as initial 'designated species' in the Nass Wildlife Area;
- January 2018 Guidance for Assessment of Impacts on Nisga'a Interests which provided other 'valued components' including Fish (salmonid and non-salmonid), American Marten, Fisher, Wolverine, Black Bear, Sooty Grouse, and Migratory Birds;
- Kispiox TSA, TFL 1 and Nass TSA 'TSR pre-engagement' venues, one outcome of which was a June 2017 Level 4 Engagement Process for Kispiox and Nass TSAs, and TFL 1 drafted collaboratively by Gitanyow Hereditary Chiefs and the Province;
- Forest Stewardship Plan consultation;
- Approved Strategic Land Use Plans, including the Kispiox LRMP, Kispiox SRMP, Cranberry SRMP, West Babine SRMP, and Gitanyow Cedar Management Plan;
- Other government-to-government or First Nations-originated Land Use Plans that are non-legal, have advised objectives set by government, or are pending approval, including the Gitwangak LUP (GkLUP), Gitsegukla Watershed SRMP (GgLUP), and the Gitanyow Lax'yip LUP (GLLUP);

- Environmental Stewardship Initiative (ESI) Science Technical Committee venues - locally involving Gitxsan, Gitanyow, Office of the Wet'suwet'en, and Hagwilget Village representatives - outcomes from which are advising the development of Indigenous Stewardship Protocols.

From these sources the following resource values were selected as being of common assessment interest:

- Moose;
- Grizzly bear;
- Northern goshawk;
- Mountain goat;
- "Aquatics", i.e., fish and fish habitat;
- Marten.

A sensitivity analysis (ID#1) will investigate the timber supply implications of incorporating First Nation management direction for these resource values. These include new procedures: some uniquely developed for Kispiox TSA and this analysis, and others which utilize procedures developed by, or in support of the provincial Cumulative Effects Framework (CEF), ESI Indigenous Stewardship Protocols and TSR processes elsewhere in the province.

In addition, it is acknowledged that the June 2017 Level 4 Engagement Process for Kispiox and Nass TSAs, and TFL 1 process document identified Gitanyow interests including ensuring a sustainable level of cut on the Gitanyow Lax'yip (i.e. territory), in order to advance and enhance Gitanyow Wilp (i.e. house) sustainability. Respectful of that interest, the Kispiox TSR will report to the Gitanyow Hereditary Chiefs, the forecasted annual volumes harvested within the Kispiox TSA for each of the eight Wilps.

4. Current Forest Management Considerations and Issues

4.1 Base case management assumptions

The assumptions described in this *Data Package* reflect current legal performance and knowledge with respect to the status of forest land, forest management practices, and timber growth and yield. These assumptions are used to model a timber supply projection that is called the base case scenario. The forecast of the base case scenario is one component of the information presented to the chief forester for a Section 8 AAC determination. Additionally, the base case scenario is used as a reference to which other forecasts are compared in order to test the sensitivity of assumptions or critical issues.

4.2 Climate change

There is substantial scientific agreement that climate is changing and that the changes will affect forest ecosystems. Forest management practices will need to be adapted to the changes and can contribute to climate change mitigation. The technical report, *Adapting forest and range management to climate change in the Skeena Region: Considerations for practitioners and Government staff 2017*, summarizes baseline climate, trends and projections for the area that includes the Kispiox TSA.

Averaged across the Skeena Region, almost 2˚C of warming occurred during the 20th century. Expectations are for shorter and warmer winters, and hotter summers, combining to increase drought potential and fire hazard. Drought stress can increase susceptibility of trees to insects and disease. More frequent and severe natural disturbances and hydrologic events are also expected. The recent mountain pine beetle epidemic, the spread of Dothistroma needle blight, the loss of aspen to defoliators and leaf-miners, and the loss of willow to willow borers have all been linked to climate change.

Based on the 2015 climate compared to the predicted 2050 climate in the Kispiox TSA, the median annual temperature is expected to increase by +1.7˚C. Precipitation is expected to shift significantly with a: +1% increase in summer precipitation; a -10% to +8% change in winter snowfall; and a significant expected decrease in spring snowfall of -59%. In summary it is projected that the Kispiox TSA will see significantly increased Interior Cedar Hemlock mc1 and mc2 BEC subzones, and a reduction in area of Engelmann Spruce Subalpine Fir and Alpine BEC subzones. This means that improved growing conditions will move higher in elevation as the climate becomes wetter and warmer, with a reduction in area occupied by high elevation ecosystems.

Climate change adds complexity to the AAC determination framework by introducing risks/uncertainties to conditions of forest health (biological agents and their behavior changes), site productivity (biophysical changes of the sites drive the growth and yield), stand development (successional changes, stand mortality and growth under changing climate) and forest genetic (i.e., incorporation of climatically suitable and resistant seed sources). These conditions are collectively expressed through the potential future growth and yield of forest stands. Future growth and yield is captured in managed stand yields from TIPSY yield projections. To address uncertainties around future growth and yield sensitivity analyses (ID#4) will increase all managed stand yields by 10% and decrease all managed stand yields by 10%.

Historical climate and future climate projection data, as well as recommendations from district and regional experts to mitigate impacts of climate change will be presented to the chief forester at the time of the determination.

4.3 Cumulative effects

BC is committed to sustainable resource management and must be able to measure the effects of all natural resource activities on values important to public. Cumulative effects are changes to environmental, social and economic values caused by the combined effect of past, present and potential future human activities and natural processes. BC's answer to this potential problem is the Cumulative Effects Framework (CEF). The CEF is a set of policies, procedures and decision-support tools that helps identify and manage cumulative effects consistently and transparently across all natural resource sectors.

Currently, CEF has assessment protocols for aquatic ecosystems, grizzly bear, and old growth forests that are approved for implementation. Indicators under these protocols relevant to the Kispiox TSA will be completed prior to the AAC determination and will be presented to the chief forester.

Guided by the procedures outlined in Appendix 4, sensitivity analyses (ID#11) will be used quantify the degree to which uncertainty associated with cumulative effects. This analysis will be refined as the analysis is conducted.

4.4 Major forest management considerations and issues

Table 1 lists major forest management considerations and issues for the current Kispiox TSA TSR. Issues that fall within the definition of current management are modelled as best possible within the base case harvest forecast. Other issues that may infer significant uncertainties in current management may be assessed in sensitivity analyses, as outlined in Section 9.3. Sensitivity analysis provides information about the timber supply implications around the uncertainties in data and management.

Table 1. Major forest management considerations

Consideration/issue	Description
Land use planning	Legal land use objectives are now fully established across the TSA for values including landscape- and stand-level biodiversity, water, fish & wildlife, hydrologic integrity, timber and non-timber, visual resources, access management, recreation, and cultural heritage resources. Their timber supply implications will be considered in the base case. Timber supply implications of implementing proposed new Wildlife Orders will be explored by sensitivity analyses.
Operability and existing partition	Operability in the Kispiox TSA will be defined in consideration of both physical and economic factors. District staff will recommend the continuance of the geographic partition established by the chief forester during the previous determination, representing 18% of the AAC attributable to harvesting in the remote geographic areas as shown on Figure 1.
Area-based tenures and Cranberry TSA addition	The previous Cranberry TSA was consolidated into the Kispiox TSA in March 2009 as Supply Block G. Area-based tenures are typically removed from the TSA. Current and near-future area-based tenures in Kispiox TSA include woodlots, and the pending Gitanyow First Nations Woodland Licence (FNWL). The latter's boundary was intentionally set to the extent of Supply Block G. For this analysis Supply Block G THLB volumes will contribute to the base case. The base case timber supply forecast diagram will show the projected AAC component relating to Supply Block "G" to advise the chief forester on the timber supply impact of removing this area from the TSA.
First Nations Interests	First Nations values of interest include moose, grizzly bear, goshawk, mountain goat, fish and fish habitat, and marten. Other land-based interests have been identified via First Nations-initiated strategic land-use planning. Sensitivity analyses will be employed to: • assess long-term stability of habitats for identified species relative to base case and alternative timber harvest forecasts; and to, • assess timber supply implications of broadly adopting non-legal objectives from First Nations strategic plans.
Current forest management	Results and strategies (R/S) from approved Forest Stewardship Plans represent "current forest management" for the purposes of generating the base case harvest forecast. Where R/S are essentially consistent amongst FSP holders, constraints are blended. Where they are significantly different, a split by traditional operating area (charts) is introduced.
Natural disturbance: insects, disease, wildfire, and climate change	Forest health agents of note include Dothistroma needle blight, Tomentosus root disease, spruce and western balsam bark beetle, and drought. Wildfires are historically infrequent, but several of moderate size occurred in 2018. Mid-range climate change projections for this unit are for shorter and warmer winters and hotter summers, combining to increase the drought potential and fire hazard. Non-recoverable loss (NRL) estimates and operational adjustment factor assumptions have been revisited and refined for this analysis.

4.4.1 Chief forester's implementation recommendations from TSR3 (2008)

The chief forester's January 2008 *Kispiox TSA Rationale for AAC Determination* provided the following implementation recommendations intended to reduce risk and uncertainty around key timber supply factors. These recommendations are identified by the numbers assigned on page 56 of the 2008 *AAC Determination*. Please note that this section is created here to provide a clear reference to the 2008 TSR implementation recommendations.

Table 2 summarizes the chief forester's 2008 TSR3 implementation recommendation.

The full details that pertain to each topic will be found in the relevant section of this *Data Package*.

Table 2. Chief forester's 2008 TSR3 implementation recommendations

Implementation recommendations	Outcomes
1. Quality-based partition Monitor the relative proportion of sawlog and non-sawlog harvest to advise future AAC decisions regarding the possible need for a quality-based partition.	Harvest performance monitoring undertaken during the past decade has revealed minimal harvest in pulp quality stand types. The base case timber supply forecast will report the contributions of sawlog and pulp quality stands. This will provide the necessary information required to advise whether there is a need to have a quality-based partition in the AAC. If additional information is necessary, an additional sensitivity analysis (ID#6) will assess the impact of implementing a sustainable even-flow projection to sawlog stands.
2. Site productivity Undertake action to complete Predictive Ecosystem Mapping (PEM) or Terrestrial Ecosystem Mapping (TEM) throughout the TSA and correlate the data with SIBEC values. Use the adjusted site indices in the TSR4 analysis to verify the magnitude of additional volumes, projected in TSR3, to become available in the mid- and long-terms.	No new Kispiox TSA-wide PEM or TEM projects have been undertaken since 2008. Site productivity values from the Provincial Site Productivity Layer (PSPL) will be used to develop managed stand yield tables. PSPL uses ecosystem data from existing PEM/TEM datasets coupled with site index estimates from biogeoclimatic ecosystem classification site series (SIBEC) data. In areas where no PEM/TEM data that meets the provincial standard are available - as is the case for Kispiox TSA - site index estimates are provided by a biophysical model employing variables of BEC zone, slope, aspect, elevation, and climate.
3. Operational adjustment factors Analyze any changes identified for OAF values based on approved, locally obtained information.	The recommendation regarding OAFs was in reference to a local Tomentosus root rot study. Localized OAFs have not been developed so the provincial standard values are used as inputs to TIPSY managed stand yield curves. To account for Tomentosus in the base case will reduce yield projections for the spruce component of managed stands within the ICH biogeoclimatic zone by 30%. A sensitivity analysis (ID#7) will explore the timber supply impact of applying no reduction to, and an additional analysis will apply the 30% reduction to the spruce component of all managed stands throughout the Kispiox TSA (to match the reduction applied in the base case for the ICH).
4. Deciduous volume partition Monitor for significantly increased levels of interest for utilization of deciduous volumes that were excluded from the TSR3 projected timber supply. Advise on whether there is a need to specify harvestable volumes attributable to deciduous species.	The level of interest for utilization of deciduous volumes did not increase during the past 10 years. Deciduous-leading stand types and deciduous volumes associated with mixed-species stands will continue to be excluded from base case timber supply projections.
5. Hydrological integrity of watersheds Continue work to identify Fish Sensitive Watersheds and Critical Fish Streams; and continue to correlate the findings of the Interior Watershed Assessment Procedures (IWAP) with the timber supply modelling assumptions and incorporate these findings into the TSR4 analysis.	No work has been undertaken to identify or establish new Fish Sensitive Watersheds or Temperature Sensitive Watersheds. Kispiox IWAP outcomes include: • the establishment of legal objectives that require the protection of the hydrological stability of watersheds in all Planning Areas; • the requirement that Forest Stewardship Plans must commit licensees to equivalent clearcut area targets for specific watersheds; and, • that Forest Stewardship Plan licensees must undertake Required Licensee Assessments identified for all 4th order watersheds in a Kispiox Watershed Integrity Matrix, and abide by the results of the assessments, prior to cutblock and road development. FSP commitments are considered in the base case.

Implementation recommendations	Outcomes
6. Wildlife Collaborate with other agencies and licensees to identify and spatially locate Wildlife Habitat Areas (WHAs) and other habitat requirements necessary to meet Identified Wildlife Management Species (IWMS) objectives; model appropriately in TSR4 analysis.	Land use objectives are established for: • grizzly, moose, and mule deer in the Kispiox LRMP area; • for General Wildlife, goshawk, fisher, and wolverine in the Cranberry SRMP area; and, • for grizzly in the West Babine SRMP area. With regards to Wildlife Orders: • an Ungulate Winter Range Order #U-6-006 Kispiox and Cranberry TSAs for mountain goat, was established in June 2007 and amended September 2014; • an Ungulate Winter Range Order #U-6-040 Moose – Cranberry, Kitwanga, Nangeese within Kispiox TSA is pending; • a Grizzly Bear Wildlife Habitat Area Order #6-055 in Shenismike, Babine River Watershed (also known as "Grizzly Drop') came into effect in February 2019; • A Wildlife Habitat Area Order for Cranberry/Nass Grizzly Bear is pending. Forest Stewardship Plans (FSP's) also specify commitments for moose, grizzly, and goshawk in planning areas where legal objectives are not established, or Orders are pending. Because FSP commitments reflect current management, they are considered in the base case.
7. Patch size distribution for landscape-level biodiversity objectives For the TSR4 analysis, use or develop a timber supply model that permits the incorporation of legal patch-size distribution targets for landscape unit / NDT combinations. Assess the targets in relation to spatial constraint overlaps with objectives for other values (e.g., visual quality, wildlife habitats) to increase the province's understanding of the causal relationships between current conditions and harvest practices, and the creation of desired future forest conditions.	The chief forester's direction from the previous AAC decision was to use or develop a timber supply model that permits the incorporation of legal patch-size distribution targets for landscape unit / NDT combinations. The Spatial Timber Supply Model (STSM) will be used to complete this analysis. Within the model parameters for patch-size distribution will be applied and reported.
8. Cedar Strategy Work with First Nations and licensees to develop a Kispiox cedar management strategy for incorporation into the TSR4 analysis.	Gitxsan and Gitanyow First Nations are concerned with the potential unsustainable harvesting of cedar affecting their ability to acquire cedar of a suitable size and quality to meet current and future cultural and domestic needs. The *Plan for a Long-Term Sustainable Supply of Cedar for Gitanyow Cultural and Domestic Purposes* was completed in March 2008, for Gitanyow Traditional Territory within the Kispiox TSA. The plan identified cedar stand reserves and cedar management strategies and was incorporated into the Cranberry SRMP LUOR legal objectives. The intention of the strategy is to supply Gitanyow cultural and domestic needs, which are estimated at 1000 m^3/year. A comparable strategy has not been completed within Gitxsan Traditional Territory. Considering the ratio of Gitxsan to Gitanyow population, the approximate need is for 10 000 m^3/year. Sensitivity analysis ID#2 will be used to explore the sustainable level of cedar harvest relative to current and projected future growing stock, and estimated needs for cultural and domestic purposes.

Implementation recommendations	Outcomes
9. Unallocated volume Use unallocated TSA volumes to balance licence apportionment.	There was significant underutilized volume relative to AAC during the previous (2000-2005) TSR period. Also, at the time the 2008 AAC Determination was released, a portion of the previous period's AAC remained unallocated. The approach of issuing new tenures for unutilized AAC volume was considered but rejected because it was considered preferable to rebalance existing licence apportionments. For this round of TSR, unutilized AAC volumes are by and large recaptured to the VRI and will contribute to the new AAC.
10. Cultural heritage resources (CHR) inventory Work with licensees and First Nations to reach agreement on methods for collecting and sharing CHR information to allow these features to be appropriately reflected and incorporate into operational planning and the TSR4 analysis.	CHR information is collected and shared through the Skeena Region Cultural Heritage Resource Inventory Program (SCHRIMP) database. For this analysis, reductions to THLB and/or modelled harvest constraints for other values/objectives were determined to adequately address CHR management needs without additional specific land base reductions.

5. Inventories

5.1 Vegetation resource inventory (VRI)[8]

Current Kispiox TSA VRI

The Kispiox and Cranberry forest inventories were converted to the Vegetation Resource Inventory (VRI) format in 2002, and last updated with new harvesting, silviculture, and natural disturbance data, from the FLNRORD RESULTS database, in 2017. The consolidated Kispiox VRI has been projected for growth and age to May 25, 2017.

Forest Analysis and Inventory Branch note that a new inventory for the Kispiox TSA is not planned prior to the expected completion of the present allowable annual cut determination process.

History of the Kispiox TSA Inventory

The forest inventory, prior to VRI, in the original Kispiox TSA was completed in 1992. An inventory audit was completed in 1996 for the Kispiox TSA and the results suggest that the mature component of the inventory is overestimated by 13%. The overestimation was considered to be attributable both to the classification of the forest cover attributes, and to the VDYP[9] volume projections, but the number of audit plots did not permit exact identification of the sources of the overestimation.

Sensitivity analysis (ID#3) will explore the impact of increasing and decreasing natural stand volumes by 10%. This analysis will guide the chief forester in assessing the impact of a potentially overestimated VRI.

The forest inventory for the previous Cranberry TSA was completed in 1990, when it was still TFL 51. The Cranberry TSA has since been incorporated into the Kispiox TSA. An inventory audit was completed in 1995 for the Cranberry TSA and the results suggest that the mature component, greater than 60 years old, of the inventory was statistically acceptable.

Data source and comments:

BCGW[10] Layer: WHSE_FOREST_VEGETATION.VEG_COMP_LYR_R1_POLY

[8] The Vegetation Resources Inventory (VRI) is the standard for forest cover inventory in the province of British Columbia. FLNRORD, Forest Analysis and Inventory Branch (FAIB) is the data custodian of this data that has been collected using a set of approved procedures with associated standards. The VRI is designed to answer two questions: "Where is the resource located?" and, "How much of given vegetation resource is within an inventory unit?" The VRI is a photo-based, two-phase program. Phase 1 involves photo interpretation, delineating polygons of homogenous land cover types and providing estimates of the vegetation attributes for each polygon. Phase 2 includes several ground sampling activities.

[9] The Government of British Columbia develops and maintains a suite of stand-level models and tools to predict the growth and yield of the province's future forests. These predictions play a key role in supporting sustainable forest management decision making by government and its forest licensees in many areas. Variable Density Yield Projection (VDYP) is an inventory-based model producing natural-stand yield tables. VDYP and TIPSY are both used extensively in sustainable forest management planning and timber supply analyses.

[10] The BC Geographic Warehouse (BCGW) is a central government repository of spatial and non-spatial data. The data includes Base Mapping information, such as heights of land, rivers, lakes, roads, place name and administrative boundaries, as well as government program information, like forest cover, ecosystems, economic and health indicators. The BCGW is a foundation for the BC. Spatial data infrastructure and all of the data in it is made ready for a wide variety of uses through a rigorous and standardized publication process that embraces the principles of data custodianship.

5.2 Cutblock update

A cutblock update layer - cutblocks - was developed by district staff to increase the accuracy of the harvest depletion information beyond that found in VRI.

An additional retention layer representing all unharvested areas inside the cutblocks layer was then derived, using the BCGW RESULTS forest cover inventory and RESULTS forest cover reserve layers as primary source layers. Ortho-rectification was again used to identify and add into retention any unharvested areas inside cutblocks that were not present in the primary source layers.

The combination of cutblocks and retention provides an accurate and realistic picture of harvest depletions within the TSA.

Data source and comments:

District Derived Data Layer: Cutblock spatial layer – cutblocks;

District Derived Data Layer: Unharvested areas within cutblocks – retention.

5.3 Biogeoclimatic ecosystem classification – BEC version info

Biogeoclimatic Ecosystem Classification (BEC) is a multi-scaled, ecosystem-based classification system that groups ecologically similar sites based on climate, soils and vegetation. This classification is widely used throughout British Columbia as a framework for resource management and scientific research.

Provincial BEC mapping is available for the Kispiox TSA - Version 11.

Data source and comments:

BCGW Layer: BEC_BIOGEOCLIMATIC_POLY

5.4 Ecosystem mapping

Ecosystem mapping is the stratification of a landscape into map units, according to a combination of ecological features, primarily climate, physiography, surficial material, bedrock geology, soil, and vegetation. Ecosystem maps, along with associated interpretations, supply valuable information for many uses, particularly planning resource allocation.

Terrestrial Ecosystem Mapping (TEM)

The following TEM projects have been completed within Kispiox TSA:

- Babine River Study Area (1992; 1:50,000 scale);
- Big Slide Study Area (1994; 1:20,000 scale);
- Helen Lake, Date Creek, McCully Creek (1998; 1:20,000 scale);
- Floodplain ecosystems of Kitseguecla, Kitwanga, Kiteen, Shelagyote, Sicintine, Upper Kispiox, Upper Cranberry and Suskwa Rivers (1995-2000; 1:20,000 scale);
- Tommy Jack Pass (2000; 1:20,000 scale);
- Bulkley Valley Woodlots (2008; 1:20,000 scale).

TEM's completed between 1995 and 2000 were typically done to 1995 Resource Inventory Committee (RIC) Standards for Terrestrial Ecosystem Mapping in BC.

The 2008 Bulkley Valley Woodlots TEM was completed to 1998 RIC Standard, and to District knowledge is the sole TEM with a formal accuracy assessment.

Predictive Habitat Mapping (PHM)

A predictive model was developed between 2000 and 2004 to support wildlife habitat suitability mapping. This model was termed "Predictive Habitat Mapping" (Mahon *et al.* 2004)[11] to distinguish it from standard PEM. Many of its input layers match those of standard PEM models.

A subsequent TEM study assessed PHM accuracy (Mahon *et al.* 2004). Ecological information was summarized in ground inspection forms for each polygon sampled, also achieving standards recommended for Sensitive Ecosystem Inventory (SEI) mapping (RISC 2006).

PHM was determined to have achieved an accuracy level of 80-85% based on the approach used. The high level of accuracy may reflect more lumping of site series in this model as compared to standard PEM. In addition to site series, the PHM model also combined two subzones in the ESSF (mc and wv), and two ICHmc variants (ICHmc1 and 2).

Pertinent to its use in TSR, subject matter experts have concluded that the model provides a realistic spatial distribution of site series by BEC variant across Kispiox TSA (per Bartemucci *et al*, 2009)[12].

5.5 Site index

Site index (defined as "the mean stand height that dominant and codominant trees will attain at age 50 years") is the common measure used by BC's forest managers for estimating forest site growth capability.

Site index is a key input to growth and yield models for deriving yield tables. For these models, the "potential site index" of a site is the theoretical desired input.

In the Kispiox TSA, the following site index (SI) sources exist:

- Vegetation Resource Inventory estimated site index (VRI-SI);
- Biophysical Model from the Provincial Site Productivity Layer (PSPL);
- SIBEC information tied to Predictive Habitat Mapping (PHM).

Vegetation resource inventory estimated site index (VRI-SI)

For forest stands 30 years of age or greater, the VRI-SI value is derived from site index curves, using VRI heights and ages as inputs. The VRI-SI value for stands less than 30 years of age is captured from multiple sources including growth intercept surveys; ecological correlations (SIBEC), Site Class conversions, historic (previous inventory SI), and adjacent stands.

Importantly for timber supply projections estimates of site index within the vegetation resource inventory (VRI) can underestimate the potential site index for younger stands. As such, different project designs have been developed to determine the potential site index across forest management units.

[11] Predictive Habitat Mapping with Grizzly Bear Habitat Suitability Ratings for the Kispiox and Cranberry Timber Supply Areas, A. Edie and Associates, Ardea Consulting Ltd., BC Ministries of Forests, Sustainable Resource Management and Water, Land and Air Protection and Wildfor Consultants; July 2004.

[12] Bartemucci, P. and P. Williston. 2009. Rare Ecosystems of Babine River Watershed: Project 2009-1; Prepared for Babine Watershed Monitoring Trust. 73 p.

Provincial site productivity layer (PSPL)

This provincial site productivity layer was developed and is updated using ecosystem data from existing predictive ecosystem mapping (PEM) and terrestrial ecosystem mapping (TEM) datasets, coupled with site index estimates from biogeoclimatic ecosystem classification site series (SIBEC) data. In areas where no PEM or TEM data are available, site index estimates are provided by a biophysical model. The estimates developed for the biophysical model are a simple regression model of existing site index data related to BEC zone, slope, aspect, elevation, and various climate variables.

District staff reviewed the PSPL and determined that with the sole exception of the Bulkley Valley woodlots TEM area (which is excluded from Kispiox TSA), no Kispiox TEM or PHM project data was incorporated. The provincial data custodian is currently undertaking a review to determine which additional Kispiox TEM's sufficiently achieve criteria to permit incorporation into a future iteration of PSPL.

In summary, PSPL site productivity values for Kispiox TSA are solely provided by the biophysical model.

As part of an analysis to assess the validity of future managed stand yield projections based on the PSPL, predicted site index values were compared to the measured Young Stand Monitoring (YSM) plot site index data for the five major species in the Kispiox TSA. The analysis concluded that there is no significant difference between the PSPL predicted site index and the YSM measured site index. Table 3 summarizes the results of the PSPL and YSM site index comparison, additional details are provided in Appendix 5.

Table 3. Comparison of site index estimates from the provincial site productivity layer and young stand monitoring plots

Species	Samples (n)	YSM site index			PSPL	ROM	Significance (95% confidence interval)
		Min	Max	YSM			
Balsam	5	19	40	18.9	18.9	1.00	N
Birch	6	27	44	20.8	20.1	1.04	N
Hemlock	11	14	49	20.4	19.9	1.02	N
Lodgepole pine	7	13	35	22.4	22.4	1.00	N
White spruce	9	12	47	23.5	22.4	1.05	N

Data source and comments:

Provincial Derived Data Layer: Provincial Site Productivity Layer DataBC;

District Derived Data Layer: Predictive Habitat Mapping – *phm*.

6. Land Base Definition

6.1 Introduction

This part of the data package outlines the steps used to identify the Crown Management Forest Land Base (CMFLB) and the Timber Harvesting Land Base (THLB). These land base simplifications are used for analysis purposes only and do not confer or imply additional management restrictions.

The CMFLB consists of provincial Crown land with forest cover that is managed by FLNRORD for timber supply and/or other forest management objectives that impact timber supply within the TSA. The CMFLB excludes the following.

Non-provincial lands that are not within the decision land base such as:

- private lands,
- lands under federal jurisdiction (e.g., National Parks and Indian Reserves).

Provincial lands not included in TSA AAC determination:

- community forests;
- tree farm licences;
- controlled recreation areas;
- woodlot licences;
- First Nations woodland licences; and,
- non-forested and unproductive lands with no impact on forest management objectives.

The THLB is that portion of the CMFLB that is available for timber harvesting. Any area in which some timber harvesting will occur remains in the THLB, even if the area is subject to other management objectives such as wildlife habitat and biodiversity that limits timber harvesting. These non-timber objectives may be modelled in the timber supply analysis and may restrict timber supply. The THLB excludes:

- parks and protected areas;
- areas that are not suitable for timber production; and,
- areas where timber harvesting is fully incompatible with management objectives for other resource values.

The above definition for THLB and its complement, non-THLB, are model simplifications. Operationally, areas classified as non-THLB are sometimes harvested and areas classified as THLB may never be harvested.

Table 4, which is commonly called the netdown table, summarizes the classification of the CMFLB, and THLB. Each factor in this table is further described in following sections.

Table 4. Netdown table to identify crown forest management land base (CMFLB) and timber harvesting land base (THLB) for the Kispiox TSA

Netdown factor	Total area (ha)	Net area excluded (ha)	Unique area excluded (ha)
Kispiox TSA gross	1,300,990		
Non-provincial lands	41,593	41,593	12,005
Non-forest and non-productive	503,189	491,040	33,088
Roads, trails, landings and transmission lines[1]	8,095	5,692	3,776
Crown Managed Forest Land Base		762,665	
Provincial Parks & Miscellaneous Reserves	107,636	61,519	9,018
Recreation Sites and Trails	5,028	2,695	698
Inoperable Areas (inaccessible, uneconomic, remote)	861,308	367,905	73,600
Terrain Stability and Environmentally Sensitive Areas (ESA)	290,119	10,125	5,787
Sites with low timber growing potential	268,173	1	1
Problem Forest types	97,518	-	-
Old growth management areas (OGMA) and Core Ecosystems	101,276	17,406	15,060
Ecosystem Networks	31,455	13,789	11,426
Red- and blue-listed Ecological Communities	2,857	1,440	1,228
Riparian	33,103	5,026	4,662
Floodplains	1,586	4	3
Wildlife Habitat Areas, Ungulate Winter Ranges, Cranberry SRMP Goshawk Areas	33,564	1,623	1,552
Existing Wildlife Tree Patches	10,979	7,970	7,811
Other Geographically Defined Exclusions	167,705	4,951	4,946
Cultural Heritage Resources	4,146	1,636	1,636
Permanent Sample Plots	29	10	10
Timber Harvesting Land Base		266,565	
Future Roads Trails Landings		8,333	
Future Wildlife Tree Patches		7,808	
Future Timber Harvesting Land Base		250,424	

Data source and comments:

The netdown table presents values that reflect available data as well as data refinements made during the creation of the resultant data set. Gross land base incorporates the total land base within the TSA boundary.

"Within Section 8 Decision" considers only land base that is within the consideration of the Section 8 AAC determination for the Kispiox TSA.

"Within CMFLB" land base is the crown managed forest land base.

The "unique area excluded" field reports the area with no other netdown factors.

The netdowns for some categories of terrain stability, recreational resource features, endangered and threatened species habitat, cultural heritage sites, and wildife tree biodiversity were based on percentages of the land base units within each of these categories.

6.2 Timber supply area boundary

The gross size of the Kispiox Timber Supply Area is 1 300 990 hectares.

At the time of the previous AAC determination, the size of the Kispiox TSA was 1 224 857 hectares. Consolidation of the Cranberry TSA into the Kispiox TSA by an order in council on March 29, 2009 increased TSA size by 76 133 hectares, or 6.2%.

Data source and comments:

District Derived Data Layer: Kispiox TSA full extent - *bnd*

District Derived Data Layer: Previous Cranberry TSA extent within Kispiox TSA - *cranberry_tsa*

The BCGW file, WHSE_ADMIN_BOUNDARIES.FADM_TSA was used as the original source layer for *bnd*. A 327 hectare overlap with the Bulkley TSA was discovered and removed from the southern extent, and an 87.5 hectare area was filled in on the northern portion of the boundary to meet the extent of Prince George TSA. The final boundary matches what was used for the previous AAC determination.

6.3 Non-provincial Crown Lands

Land not administered by FLNRORD for timber supply in the TSA includes "Non-provincial Crown lands" (e.g., private land, municipal land, federal land, Indian Reserves). Table 5. shows the contribution of each ownership category to the CFMLB and the THLB based on a 2018 FLNRORD compilation of land ownership.

Table 5. Non-provincial Crown lands in Kispiox TSA based on ownership compilation

Ownership categories	Total area (ha)	CMFLB	THLB
40N - Private Land	23,446	No	No
52N – Federal Indian Reserve	9,530	No	No
54N – Federal Land	530	No	No
60N – Crown Conservancy Area, Ecological Reserve, Protected Areas and Provincial Parks	107,636	Yes	No
62C – Crown Forest Management Unit	1,119,048	Yes	Yes
69C – Plantation, Forest Reserve, Biodiversity, Mining, Tourism Areas, Misc Reserves – with or without OICs	30,562	Yes	Yes
69N – Plantation, Forest Reserve, Biodiversity, Mining, Tourism Areas, Misc Reserves – with or without OICs	2,139	Yes	No
77A - Woodlot Licence, Schedule A	229	No	No
77B - Woodlot Licence Schedule B	7,223	No	No
80N – Municipal Parcels	341	No	No
81N – Local/Regional Parks	9	No	No
99C - Crown Miscellaneous Leases	164	No	Yes
99N – Crown Miscellaneous Leases	121	No	No

Data source and comments:

District Derived Data Layer: Ownership Categories - *f_own*

District staff developed a refined version of the BCGW provincial ownership layer in 2018, working in consultation with local to branch-level FLNRORD Lands, and Recreation Sites and Trails staff, and in collaboration with the data custodian for the BCGW provincial ownership layer. The methodology and final product were reviewed with and sanctioned by the provincial data custodian.

Appendix 1 to the *Data Package* details the methodology used and the specific Ownership Code assignment decisions that were made in developing this layer.

6.4 Not managed within TSA AAC

The TSA boundary incorporates all provincial forest including area-based tenures that may not be considered within the Section 8 AAC determination for the TSA: for these tenures (e.g., tree farm licences, community forest agreements, woodlot licences, and First Nations Woodland Licences) there may be separate AAC determination processes.

In the Kispiox TSA, the only area-based tenures are 15 woodlots (Table 6). However, a pending First Nations Woodlands Licence is likely to be issued during this analysis period.

Table 6. Tenures not managed within the TSA allowable annual cut in the Kispiox TSA

Ownership code - description	Total area (ha)	CMFLB	THLB
Woodlot Licences (Schedule A)	229	No	No
Woodlot Licences (Schedule B)	7,223	No	No

Data source and comments:

District Derived Data Layer: Ownership codes - *f_own*

Woodlot Licences Schedule A lands are identified and excluded from THLB as private lands.

6.5 Non-forest and non-productive forest

A large area of the Kispiox TSA is non-forested or is unable to produce a forest. These types are not expected to contribute to either timber supply or forested management objectives.

Under the older forest cover inventory (FC1/FIP), attributes specifically for non-forested, non-productive and non-commercial cover were classified. However, within the new Vegetation Resource Inventory (VRI) these descriptors are not classified but attributes are collected that identify non-anthropogenic attributes. These include non-vegetated and various classes of vegetated areas based on the BC land classification system (BCLCS).

The forest inventory of the Kispiox TSA is an older FIP based inventory that has been moved to the current VRI based format for projection. Within the current inventory projection, not all of the older FIP based inventory attributes are maintained; however, the non-productive descriptor is still maintained.

In the base case, non-forest and non-productive are identified based on both the FIP based non-productive descriptor and appropriate BCLCS attributes. Table 7 presents the attributes used to identify non-forest and non-productive forest that is to be excluded from the timber harvesting land base.

Table 7. Description of non-forest, very low productivity and non-commercial areas

Attributes	Total area (ha)	Description
Non-forest (out of THLB and CMFLB)		
BCLCS level 1 = N AND no logging history	334,185	Non-vegetated
BCLCS level 2 = N and BCLCS level 4 not = AT or SL AND no logging history	21,453	Vegetated but non-treed excluding shrub areas
BCLCS level 2 = N and BCLCS level 3 = W AND no logging history	8	Non-treed wetlands
BCLCS level 3 = A OR BGC = (ESSFunp, MHmm2, HMmmp, BAFAun) AND no logging history	5,590	Alpine
Very low productivity forest (out of THLB and CMFLB)		
Site Index < 5.0 m or crown closure layer 1-2 < 20% AND no logging history	117,952	Land base that is not productive for timber supply or non-forest objectives
Non-commercial forest (out of THLB)		
BCLCS level 2 = 'T' AND BCLCS level 3 = 'W' AND no logging history	260	Treed wetlands
BCLCS level 4 = 'ST or 'SL' AND no logging history	6,534	Shrub
FC1 non-productive forest descriptor is present AND no logging history	17,207	

Data sources and comments:

BCGW file: Vegetation Resources Inventory - *VEG_COMP_LYR_R1_POLY*

District Derived Data Layer: Cutblock spatial layer - *cutblocks*

District Derived Data Layer: Unharvested areas within cutblocks - *retention*

BC land classification system (BCLCS) attributes found within the forest inventory identify non-vegetated and various classes of vegetated areas. Non-vegetated, non-treed and alpine areas are removed from the CMFLB unless they have been logged. They do not contribute to objectives for wildlife habitat or biodiversity within the Kispiox TSA.

Some area is comprised of forest with no harvest history, and very low height or crown closure attributes. These areas are excluded from both the CMFLB and THLB, because their poor height and crown closure attributes were determined to be unsuitable for achievement of landscape-level biodiversity and wildlife habitat objectives.

As Table 5 indicates, "logging history" is a key factor in CMFLB definition. To address Kispiox VRI data gaps and anomalies around silviculture openings, a combination of VRI attributes and specially created cutblock and retention layers (see Section 5.2 '*Cutblock update*') was used to identify these areas:

VRI attributes:

- OPENING_IN (Opening Indicator) = "Y"
- LINE_7B_DI (Disturbance portion of History Symbol) is like "L"
- OPENING_ID (Opening Identifier) > 0

cutblock attributes:

- STATUS = not <null>

retention attributes:

- SOURCE = not <null>

6.6 Roads, trails, landings and linear corridors

Productive forest land is lost due to permanent roads, trails and landings (RTL) and maintained transmission lines. Existing estimates of the area occupied by RTL and transmission lines is shown in Table.

Table 8. Roads within the Kispiox TSA

Description	Modelled buffer width (m)	Total area (ha)*	CMFLB	THLB reduction %
Overgrown Road	5	94	No	100
Unimproved Road	10	1,964	No	100
Resource Road	15	2,708	No	100
Main Resource Road	20	887	No	100
Highways	50	1,035	No	100
MOT/Local Road	25	998	No	100
Railway	15	180	No	100
Transmission Line	30	255	No	100
Total Existing Road		8,121		
Future Roads, Trails, and Landings		8,333	No	

*Based on buffer width.

Data sources and comments:

District Derived Data Layer: Roads - *roads_buffer*

District Derived Data Layer: Railway - *rail_buffer*

District Derived Data Layer: Transmission lines - *transmission_line*

Roads

In 2018, the District produced an amalgamated Kispiox road layer from the following sources:

WHSE_BASEMAPPING.TRIM_TRANSPORTATION_LINES, WHSE_BASEMAPPING.DRA_DGTL_ROAD_ATLAS_MPAR_SP, WHSE_FOREST_TENURE.FTEN_ROAD_SECTION_LINES_SVW, and Major Licensee road digital files.

Major Licensee road digital files

Using best available orthophoto and satellite imagery, roads were them orthorectified, or removed if non-existent and assigned a Class of 2WD, 4WD, ATV, or PROPOSED. Then, in reference to FRMA road status and FCODE attributes in the dataset, and with subject matter expert advice, the roads were assigned a Condition of GOOD, AVE, DIFFICULT, IMPASSIBLE, or PROPOSED.

Using combinations of Class and Condition codes, roads were grouped into the six categories shown in Table 7. A polygonal file of realistic road and trail rights-of-way (ROW) was then generated, using the (GIS-derived average) ROW buffer width by road class values that show in Table 7.

Railway

The railway line was extracted from WHSE_BASEMAPPING.TRIM_TRANSPORTATION_LINES, then orthorectified using best available orthophotos and satellite imagery. The railway line was buffered to a GIS-averaged width of 15 metres.

Transmission Lines

Main transmission line corridors were extracted from the Crown Tenures and Trim Cultural Lines datasets. Transmission line ROW widths (visible cleared areas) as measured off best available orthophoto and satellite imagery varied from 20 to 80 metres. An average 30 metres was selected for analysis purposes.

For this analysis, road, railway and transmission line ROW buffers will be converted to a buffer-area attribute of the adjacent polygons.

Landings

Best available orthophoto and satellite imagery was spot-reviewed in several geographic locations to assess the need to develop a spatial layer of landings for this analysis. District staff are ultimately comfortable that area associated with landings is sufficiently accounted for within the averaged road ROW width allowances.

Future Roads, Trails and Landings

Estimates for future roads, trails, and landings (RTL) borrow from a RESULTS *% Permanent Access Structures - Opening Report* for all Kispiox TSA cutblocks where harvest was initiated between January 1, 2007 and January 1, 2019. The Table 6 figure – 4.4% - represents the weighted average percent of Permanent Access Structure (PAS) across those cutblocks.

The result (4.4%) is much lower than the 7% permitted under the *Forest Planning and Practices Regulation* but is consistent with the increasing use of roadside harvest techniques (i.e., no or fewer landings). The practice of roadside harvest can result in even less non-productive (NP) area than is reported because roadside pile areas are frequently burnt and replanted within a season of harvest.

Future RTL reductions are applied to the stand area when harvested for the first time by the timber supply model.

Data sources and comments:

WHSE_TANTALIS.TA_CROWN_TENURES_SVW and
WHSE_BASEMAPPING.TRIM_CULTURAL_LINES.

6.7 Recreation sites and trails

Recreation sites and trails may be legally established and/or designated under the *Land Act* or the *Forest and Range Practices Act* (FRPA).

Although the legal designation of a recreation site or trail does not preclude industrial activity or harvesting, a *Land Act* authorization must be sought from the District Recreation Officer. Such authorizations typically specify restrictions or conditions to harvest that act to reduce THLB availability.

Table 9. Recreation sites and trails in the Kispiox TSA

Category	Total area (ha)	CMFLB (ha)	THLB reduction %
Recreation sites, Reserves, and UREP's	1,884	Yes	Per THLB_INCL
Recreation trails	3,144	Yes	40%

Data sources and comments:

District Derived Data Layer: Recreation Sites, Reserves, UREP's – *rec*

District Derived Data Layer: Recreation trails – *trails_buffer*

Recreation Sites, Reserves, UREPs

In 2018, District and Recreation Sites and Trails staff collaboratively developed a Kispiox Recreation layer – *rec* - of established Recreation Sites, and Recreation Reserves including UREPs (*Land Act* Reserves established for the Use, Recreation and Enjoyment of the Public).

A Recreation Site is legally established under Section 56 of FRPA and requires authorization under Section 16 of Forest Recreation Regulation for industrial use purposes.

A Recreation Reserve is a non-legal spatial entity indicating the presence of recreational opportunities or potential. Industrial developments proposed within their boundaries trigger a referral to the District Recreation Officer.

These areas are managed in an integrated fashion that permits a certain level of harvest. For purposes of this analysis, it was agreed that inclusion of operable forest in these areas to the THLB would occur on a sliding scale relative to the size of the site or reserve.

- Recreation Sites less than 10 hectares were assigned 0% inclusion. Sites between 10 and 100 hectares were assigned 25% inclusion. Sites greater than 100 hectares were permitted to contribute 50% to the THLB.
- Recreation Reserves and UREPs were generally considered to 100% contribute to the THLB. Exceptions were made for Recreation Reserves or UREPs with known developed infrastructure, or a level of use that would obviously reduce the availability of the area for harvest. Reductions were then applied relative to the level and area of use.

Appendix 2 to the *Data Package* details the specific THLB_INCLUSION assignment decisions that were made in developing this layer.

Trails

Recreation Trails can be legally designated, or "known" but non-legal. Legal status is confirmed in FTA. In 2018, District and Recreation Sites and Trails staff collaboratively developed a Recreation Trails data layer – *trails_buffer*. A linear layer was first developed, sourced in a local trails layer and the provincial recreation lines datasets. This layer was then buffered 100 meters to either side to create the district derived *trails_buffer dataset*.

Planned forest developments within 100 meters of legally designated and/or "known" recreational trails are referred to the District Recreation Officer. Typical advice is for a minimum 30-metre forested buffer to either side of the trail, and/or 60% forested retention anywhere within the first 100 meters to either side of the trail. For that reason, a 40% THLB inclusion factor is shown in Table 8.

Data source and comments:

WHSE_FOREST_TENURE.FTEN_RECREATION_LINES_SVW

District Derived Data Layer: *trails_buffer*

6.8 Inoperable areas

Areas are considered inoperable where there are physical barriers or limitations to harvesting, where appropriate logging methods (e.g., cable) are not available or are deemed to be too costly, or where stands are not merchantable (low value or high cost). The first factor listed is an example of physical operability or accessibility. The last two factors listed are examples of economic operability. Changing technology and economic conditions can affect both physical and economic operability.

Physically Inoperable Areas

Areas identified as physical inoperable (e.g. forested area on rugged terrain) and/or inaccessible (e.g., severely isolated and hanging valleys) have been broadly mapped across Kispiox TSA. These areas are removed from the THLB but included in the CMFLB.

Table 10. Physically inoperable areas

Operability classification	Total area (ha)	Reduction from THLB (%)
Inaccessible	163,025	100

Data source and comments:

District Derived Data Layer: Inoperable/inaccessible – *accessible*

Economically Inoperable Areas

In 2004 forest licensees in the Kispiox TSA worked in conjunction with the province on a harvest method mapping (HMM) operability project for the Kispiox TSA[13]. Operability was described in terms of two key variables:

- harvest method, which considered operational limitations of slope;
- stand quality, which considered the implications of [forest cover inventory-based] tree species composition, stand age, stand height, stand volume, stand occupancy, and site productivity to the predicted grade profile of volumes harvested from that site.

Assignment of parameters was subjective in nature but represented the considerable cumulative experience and knowledge of licensee and government agency participants to the project. Table 11 through to Table 14 describe HMM codes and their parameters.

For this analysis a GIS-based HMM methodology classified the Kispiox TSA forested land base into combinations of *Harvest Method x Stand Quality* types based on quantitative parameters.

These types are a proxy for licensee Total Chance Plan harvest "chances" and are used in defining the extent of the economically feasible land base for this analysis. They also form the foundation for identifying area to be removed from the THLB as sites with low timber growing potential, problem forest types, and deciduous leading stands, in sections to come.

[13] Corstanje, J. April 2004. Harvest Method Mapping Operability for the Kispiox TSA. Forest Investment Account Project #2237001. 27 pp.

Table 11. Harvest method mapping stand quality codes

Stand quality	
S – Sawlog	(>= 60% sawlog-grade content expected)
M – Marginal sawlog	(40-60% sawlog-grade content expected)
P – Pulp log	(<= 40% sawlog-grade content expected)
D – Deciduous	
L – Sites of low productivity	
T – Sites with density problems	
N – Non-forested	

Table 12. Harvest method mapping harvest method code parameters

Code	Parameters
G – Ground	≤ 40% slope
C – Cable	> 40% ≤ 90% slope
I – Inaccessible	> 90% slope

Table 13. Harvest method mapping stand quality code parameters

Code	Lead species	GTG1	Age class	Ht class	Stocking class	Site class	VOLPH (m^3)	Attribute CD2	LINE_7B_DI	RATNLE
S	All conifers	E–N	8	All	0, 1, R	G	≥ 200	All	All	S1
	All conifers	E–N	8	≥ 4	0, 1, R	M / P	≥ 200	All	All	S2
	Ced, S, Pli	E,I–N	8	3	0, 1, R	M / P	≥ 200	All	All	S3
	All conifers	E–N	5-7	≥ 3	0, 1, R	G / M	≥ 200	All	All	S4
	All conifers	E–N	0-4	All	All	G,M,P	All	DI, PL, SI, ST, null	L	S5
	All conifers	E–N	0-4	All	All	G,M,P	All	Null	All	S6
	Hem,B,S,Ced	E–K	1-4	All	All	G,M,P	All	DI or null	Not L	S7
M	Ced,S,Pli	E,I–N	9	≥ 3	0, 1	G / M	≥ 200	All	All	M1
	Hem or B	F–H	8	≥ 3	0, 1, R	M	≥ 200	All	All	M2
	Hem or B	F–H	8	3	0, 1, R	P	≥ 200 (Cw+S+Pli ≥ 20%)	All	All	M3
	All conifers	E–N	5-7	≥ 3	0, 1, R	P	≥ 200	All	All	M4
	All deciduous	O–Q	All	All	0,1, R or null	G,M,P	(Cw+S+Pli ≥ 30%)	All	All	M5
P	Hem or B	F–H	9	All	0, 1	G,M,P	≥ 200	All	All	P1
	Hem or B	F–H	8	3	0, 1	P	≥ 200 (Cw+S+Pli ≥ 20%)	All	All	P2
	Ced, S, Pli	E,I–N	9	≥ 3	0, 1	P	≥ 200	All	All	P3
D	All deciduous	O–Q	All	All	0,1, 2A, R or null	G,M,P	(Cw+S+Pli < 30%)	All	All	D1
L	All	All	All	All	All	L	All	All	All	L1
	All conifers	E–N	5-9	All	2,3,4 or null	G,M,P	All	All	All	L2
	All conifers	E–N	5-9	≤ 2	All	G,M,P	< 200	All	All	L3
	All conifers	E–N	5-9	≤ 2	All	P	≥ 200	All	All	
T	All conifers	E–N	5-9	All	2 – 4, R	G,M,P	<200	All	All	T1
	Pli	L–N	1-4	All	All	G,M,P	All	DI or null	Not L	T2

[1] GTG = Growth Type Group.

[2] Attribute_CD and Activity Code (now LINE_7B_DI) describe disturbances and activities that have occurred in the polygon (e.g. Attribute_CD – DI = Disturbance, PL = planting, ST = stand tending, L = logged).

Note: "Growth Type Group", "Stocking Class", and "Site Class" are attributes from the old FC1/ FIP that are not carried in the VRI. These attributes were recreated by the District to enable the re-run of HMM used for this analysis.

A review of the resulting spatial layer found that some stands were not being classified due to gaps in the HMM methodology. These gaps were classified according to a procedure developed by District staff, which is outlined in Table.

Table 14. Stand quality harvest method mapping gap code assignments

Code	GTG	Age class or age	Ht class	Stocking class	Site class	Volume (m^3/ha)	Cw+S+Pli >= 20%	Cw+S+Pli >= 30%	Attribute code	Activity code	RATNLE
	G, L, M	3-4	2-3	0, 1	M, G	>=200	YES	YES	All	All	S8
S	E to N	0-4	All	All	G, M, P	<200	All	All	PL, SI, ST	All	S9
	F, G	8-9	3	R*	P	<200	All	All	Not null	All	S10
P	F to H	8	3	1	P	>=200	NO	NO	All	All	P4
T^	E to N	>=5	All	All	G, M, P	<200	All	All	Null	Null	T3
X**	All	<= 36 yrs	All	All	All	0	All	All	All	All	X1

* R – a stocking class of R is indicative of a stand that has been partially (25 – 75%) logged. Mature volume per hectare was consistently <100 m^3 for the stands captured in this category, indicating the stand was likely >50% logged. Logged stands are assumed to get planted thus should automatically be assigned to the Sawlog category.

** X – a secondary code of X was assigned to all stands < 26 years of age, or had volume per hectare = 0. These stands are immature or NSR, and did not need to be coded to S, M, P, D, L or T because they will be assigned directly to a managed stand yield curve.

^T – these stands were coded T because with these parameters they should easily have achieved volumes >200 m^3/ha. Some unknown factor is affecting the merchantability of these stands.

The HMM-based "economic operability netdowns" are summarized in Table 15. These are consistent with Corstanje (2004). Recommended "netdowns" from the 2004 study were based on historic harvest activities to 2004, which may or may not be representative of current economic conditions.

Table 15. Harvest method mapping for economic operability

Harvest method code	Stand quality code	Total area (ha)	CMFLB	THLB reduction %
G	D, L, T	134,194	Yes	100
C	M, P, D, L, T	79,170	Yes	100
I	All	5,607	Yes	100

Data source and comments:

District Derived Data Layer: HMM Harvest Method and Stand Quality – *hmm*.

To explore if the HMM classification scheme is representative of current economic operability, the classifications were also compared with recent harvest activities. Figure 3 plots the area for each HMM operability classification within the Kispiox TSA for areas harvested within the past decade, based on data from the Electronic Commerce Appraisal System (ECAS) and RESULTS data sets.

Figure 3 reports the total area in the Kispiox TSA within each HMM classification, and the area harvested within that classification. The figure indicates that the HMM codes do reflect current economic operability as few stands excluded from the THLB based on the economic operability classification were actually harvested (3%).

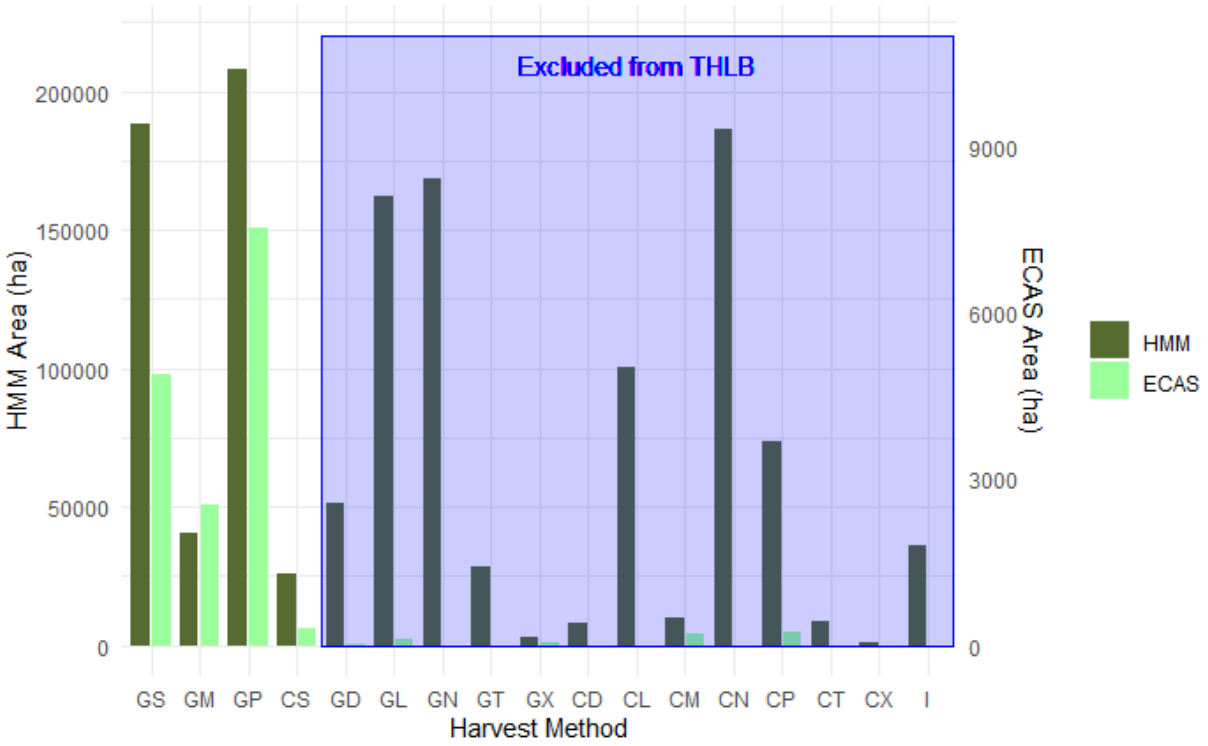

Figure 3. CFMLB and ECAS area summary for harvest method mapping classification.

Table 16 reports in tabular form, the ECAS data shown in Figure 3, as well as the area and cumulative percentile of harvest area. As earlier noted, 3% of recent harvest activity occurred in stands classified as economically inoperable indicating that the classification system does represent current economic operability.

Table 16. Harvest area summary for harvest method mapping

HMM	THLB inclusion	Area (ha)	Percentile
GP	Y	5,023	47
GS	Y	3,254	78
GM	Y	1,698	94
CS	Y	207	96
CP	N	171	97
CM	N	148	99
GL	N	83	99
GX	N	40	100
GD	N	22	100
CD	N	1	100
CL	N	1	100
CN	N	1	100
I	N	1	100
Total		10,650	

Figure 4 below plots the location of harvest activity (cutblock boundaries) and stand quality types within the Kispiox TSA. The map shows that recent harvest activity has been distributed throughout the Kispiox TSA in a range of stand quality types. The map also shows that there has been no harvest activity within the remote partition areas within the Kispiox TSA.

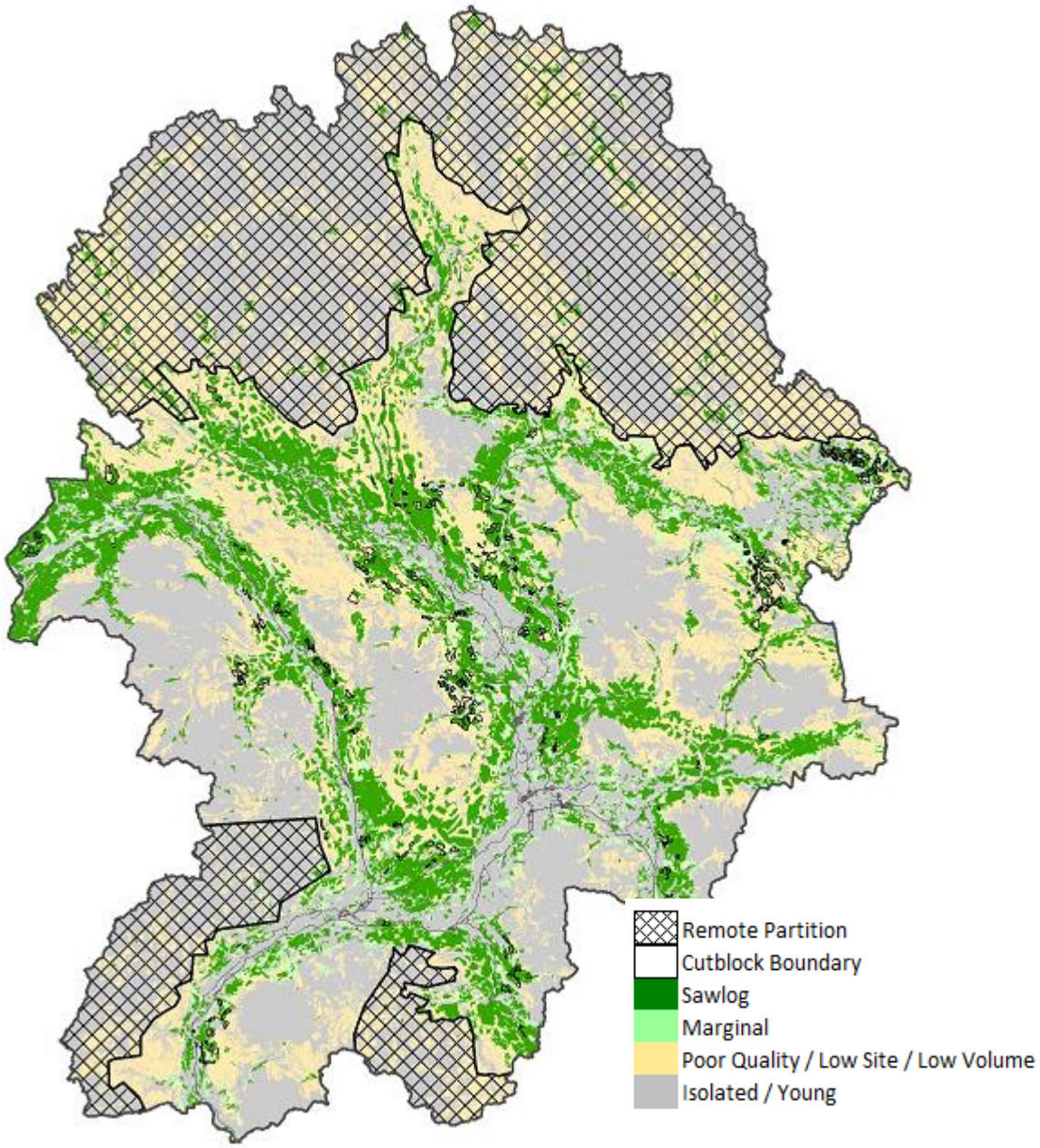

Figure 4. Harvest method mapping and ECAS cutblocks for 2007 - 2019.

The ECAS data set also provides information specifically about harvest method. Comparing the classified and actual harvest method provides further insight into how well the classification scheme reflects current economic operability. Table 17 reports the area over the past decade by classified and actual harvest method, this further supports the HMM as a reasonable estimation of current economic operability.

Table 17. Areas of mapped and appraised harvest method

Harvest method	HMM area (ha)/(%)	ECAS area (ha)
Ground	10,120 / 95%	9,189 / 94%
Cable	526 / 5%	624 / 6%

Table 18 reports ECAS data summarized for the last decade and shows that over the past decade there has not been any harvesting on slopes greater than 63%. Although harvesting on steeper slopes, up to and including 80% slope, did occur in the preceding seven years.

The HMM classifies slopes greater than 90% as inaccessible, which are then removed from the THLB. However, as Table 18 reports there has been no history activity on slopes steeper than 80% within the past decade greater. Although the HMM classification may be optimistic about the economic operability of steep slopes, for the purpose of this analysis the classification is effective as slopes greater than 80% are removed from the THLB based on the physical operability coverage.

Table 18. Distribution of slope across harvested cutblocks in the Kispiox TSA

Percentage	50	75	90	95	96	97	98	99	100
Slope (2008-2019)	21	30	38	45	45	46	47	51	63
Slope (2001-2019)	21	31	43	47	47	51	53	80	80

Remote areas

In the 2008 *AAC Rationale*, the chief forester included a partition of 177 000 cubic metres to encourage the future development in remote portions of the TSA. There has been no forest development in this region subsequent to the determination, consequently these areas have been excluded from the THLB in the current base case analysis. A sensitivity analysis (ID#5) will evaluate the potential timber supply of this area which will be used by the chief forester in consideration of a geographic partition in the AAC decision.

Table 19. Area summary for remote stands

Inoperable classification	Total area (ha)	Reduction from THLB (%)
Remote	479,312	100

6.9 Terrain stability and environmentally sensitive areas (ESA)

Terrain stability mapping is a method to delineate areas of slope stability with respect to stable, potentially unstable, and unstable terrain within a particular landscape. A careful evaluation of the landslide hazards and risks help to reduce the frequency and magnitude of landslides associated with forest development. High risk areas are excluded from harvesting. Table 20 shows the terrain stability and ESA categories that are to be excluded from the THLB.

Reductions for other environmentally sensitive categories - wildlife, water, and fisheries - are addressed elsewhere in this *Data Package*.

Table 20. Terrain stability and environmentally sensitive area reductions

Category	Description and criteria	Total area (ha)	CMFLB inclusion	THLB reduction (%)
Avalanche tracks	SS_NAME = not <null>	79,617	No	100
Highly unstable soils	STABILITY_CLASS = 'V' and no logging history	27,473	Yes	86
Moderately unstable soils	STABILITY_CLASS = 'IV' and no logging history	52,936	Yes	70
Unstable soils where TSM does not exist	FEATURE = 'Erosion proxy' or 'Slope >60% on ES Terrain' and no logging history	125,188	Yes	74
Alluvial fans	SURF_EXP = 'fan' and no logging history	4,905	Yes	37

Data source and comments:

District Derived Data Layer: Avalanche tracks – *avalanche_phm*

District Derived Data Layer: Highly and Moderately unstable soils – *stability*

District Derived Data Layer: Unstable soils where TSM does not exist - *stability*

District Derived Data Layer: Alluvial fans - *alluvial_fans*

Avalanche tracks have significant stability and regeneration concerns. They are 100% excluded from the THLB.

Highly unstable soils are generally unsuitable for harvesting or road construction, due to high likelihood of landslide initiation. Class V polygons from completed Terrain Stability Mapping (TSM) are used to represent areas of highly unstable soils. A portion of Class V polygons was previously harvested and successfully reforested, indicating that the extent of unstable terrain in Class V is likely overestimated. District staff determined an appropriate reduction % for Table 15 using the following technique:

- the proportion of Class V area in operable land base that was harvested within last 30 years relative to the gross area harvested was determined;
- the proportion of Class V area in operable land base that may be harvested over next 100 years if current Class V depletion rates hold steady was then calculated using a ratio (i.e., percent harvested over next 100 years) = (percent harvested last 30 years x 100 years) / 30 years);
- the reduction percent is set to {100% - (proportion estimated to be harvested next 100 years)};
- the reduction percent is treated as a non-spatial percent reduction to the area of each Class V polygon.

Moderately unstable soils may be at least partially unsuitable for harvesting, due to a moderate likelihood of landslide initiation. Class IV (potentially unstable terrain) polygons from TSM are used to represent moderately unstable soils. The Table 15 reduction % for Class IV terrain was determined using the same process as that employed for Class V.

For areas without TSM, the extent of areas of unstable soils was approximated. District staff completed a GIS-based soil erosion potential mapping project, using a process documented by Madrone Consultants Ltd. which interprets terrain and soil mapping, landform mapping, and slope class attributes into soil erosion potential classes.

- **HIGH:** all fluvial, colluvial and morainal surface material on slope codes 4, 5 or 6. If gullying present, a HIGH rating was given for slopes codes 4, 5 or 6 regardless of surface material. The same was generated for avalanche areas.

- **VERY HIGH:** all fluvial surface material on slope codes greater than seven; all morainal and colluvial surface materials on slope codes greater than eight. If gullying present, a VERY HIGH rating was given for slope codes greater than seven regardless of surface material. The same was generated for avalanche areas.

Areas with environmentally sensitive soils and slopes greater than 60%, and areas of VERY HIGH and HIGH soil erosion potential, are used to represent unstable soils in areas where TSM has not been completed. The Table 14 reduction percent for areas without TSM was determined using the same process as that employed for Class V terrain.

Alluvial fans *"fans"* have issues including inherent instability and potential for debris torrents that can affect road integrity and reforestation success. Fans are treated sensitively, but not avoided during primary forest development activities. The reduction percent for fans shown in Table 20 was determined using the same process as that employed for Class V terrain.

6.10 Sites with low timber growing potential

Sites may have low productivity either because of inherent site factors (nutrient availability, exposure, excessive moisture, etc.), or because they are not fully occupied by commercial tree species. Sites with low timber growing potential include existing forested stands that are unlikely to achieve minimum stand volume criteria as described in Section 7.1.4, '*Minimum harvestable criteria, prior to decadence*'. As these stands are not considered to be harvestable, unless there is previous harvest history, they are removed from the THLB using the criteria listed in Table.

Table 21. Low timber growing potential

Logging history	HMM harvest method	HMM stand quality	Total area (ha)	THLB reduction (%)
No	All	L	268,173	100

Data source and comments:

District Derived Data Layer: HMM Harvest Method and Stand Quality – *hmm*;

HMM Harvest Method and HMM Stand Quality tables can be found in Section 6.8, '*Inoperable areas*'.

6.11 Problem forest types (non-deciduous)

Problem forest types are stands that are physically operable but are not currently utilized or have marginal merchantability.

Table 22. Problem forest types for non-deciduous stands

Logging history	HMM harvest method	HMM stand quality	Total area (ha)	THLB reduction (%)
No	C,G	T	38,175	100

Data source and comments:

District Derived Data Layer: HMM Harvest Method and Stand Quality – *hmm*;

HMM Harvest Method and HMM Stand Quality tables can be found in Section 6.8, '*Inoperable areas*'.

6.12 Deciduous

Deciduous-leading stands which contain less than 30% commercial conifers are removed from the THLB as they are typically not targeted for harvest.

Table 23. Problem forest types for deciduous stands

Logging history	HMM harvest method	HMM stand quality	Total area (ha)	THLB reduction (%)
No	C,G	D	59,343	100

Data source and comments:

- District Derived Data Layer: HMM Harvest Method and Stand Quality – *hmm*.

HMM Harvest Method and HMM stand quality tables can be found in Section 6.8, '*Inoperable areas*'.

- One of the implementation recommendations from the January 2008 *Kispiox TSA Rationale for AAC Determination* was for district staff to monitor for significantly increased levels of interest or intent for utilization of deciduous volumes, to advise the chief forester in a decision on whether to specify harvestable volumes attributable to deciduous species (i.e., a deciduous partition).
- Monitoring results show that deciduous volume harvest comprised less than 1% of total volume harvested during the last decade. Similar results were observed in review of the Electronic Commerce Appraisal System (ECAS) data and harvest billing system (HBS) data.

6.13 Landscape biodiversity related exclusions

6.13.1 Old growth management areas (OGMA) and core ecosystems

OGMAs are legally established and spatially defined areas of old growth forest that are identified during landscape unit planning or an operational planning process. Core ecosystems provide a representative cross-section of ecosystems, retain representative samples of old growth forest and provide interior forest conditions.

Within the Kispiox SRMP area, up to 10% of the overall area of the grouping of OGMA's within a BEC subzone, within a large-sized landscape unit (i.e., a planning unit), can be harvested for limited prescribed purposes, providing that an area of equal size and equal or greater value is identified as a replacement per provisions of the August 2010 *Old Growth Management Area (OGMA) Amendment Policy – Skeena Region*. Within the Cranberry SRMP area similar provisions apply, except to individual OGMA's versus OGMA groupings. Current OGMA amendments are captured in the OGMA coverage.

There are no OGMAs in the West Babine SRMP area. Old forest is protected within Core Ecosystems which serve a similar function, and additional aspatial management of old-seral biodiversity targets is required (see Section 7.3.9). Core Ecosystem objectives legally permit small scale harvest to address forest health issues, but licensee Forest Stewardship Plans consistently commit to harvest avoidance, thus these areas are excluded from THLB but included in the CMFLB.

Table 24. Old growth management areas and West Babine SRMP core ecosystems

Description	Total area (ha)	CMFLB	THLB
Old Growth Management Areas	81,612	Yes	No
Core Ecosystems - West Babine SRMP	19,664	Yes	No

Data source and comments:

BCGW Layer: Old Growth Management Areas - *RMP_OGMA_LEGAL_CURRENT_SVW*;

BCGW Layer: Core Ecosystems – *RMP_PLAN_LEGAL_POLY_SVW*;

STRGC_LAND_RSRCE_PLAN_NAME = 'West Babine Sustainable Resource Management Plan';

LEGAL_FEAT_OBJECTIVE = 'Core Ecosystems' Draft Old Growth Management Areas (OGMA) were delineated within Kispiox SRMP and Cranberry SRMP areas as a deliverable of a December 2004 Kispiox Biodiversity Analysis[14] consistent with methods outlined in the *Landscape Unit Planning Guide* (1999). The base unit used for the analysis was the set of Kispiox landscape units with assigned Biodiversity Emphasis Option (BEO) that were included in the 2004 *Order Establishing Provincial Non-Spatial Old Growth Objectives*.

Old seral targets were selected from the *Biodiversity Guidebook* (1995) consistent with the assigned BEO. Delineation to achieve old seral targets looked first to capture old seral from non-contributing CMFLB, then from THLB with significant non-timber values (e.g., retention VQO areas, community watersheds, pine mushroom habitat, cultural heritage resource features, high-value wildlife habitat, goshawk nesting and fledgling areas), and finally from less constrained THLB.

For many circumstances where insufficient old seral existed in a strata (biogeoclimatic subzone and landscape unit) to achieve targets, OGMAs included a capture of mature seral recruitment forest that would age into old seral within 60 to 70 years. Draft OGMAs have since been legally established.

6.13.2 Ecosystem networks

Cranberry SRMP area: Ecosystem Networks (EN) are landscape corridors focused around streams, lakes, and wetlands. The EN encompasses the full hydroriparian zone[15], and is "the best approximation of the hydroriparian zone utilizing aerial photos, mapped topography and digital elevation models". These EN have been identified under the Cranberry SRMP and are legal objectives. Under the Cranberry SRMP the EN is further protected by a 200-metre buffer where seral forest cover requirements are applied.

The EN will be 100% excluded from the THLB but remains within the CMFLB. Forest management constraints associated with the buffer are described in Section 7.3.10.

West Babine SRMP area: The ecosystem network extends throughout the plan area and includes both core ecosystems and landscape corridors. Legal objectives have been established.

Core ecosystems provide a representative cross-section of ecosystems, retain representative samples of old growth forest and provide interior forest conditions. As per the previous section, these areas are excluded from the THLB.

Landscape corridors maintain connectivity within the landscape, reduce habitat fragmentation, permit movement and dispersal of plant and animal species, and maintain forests dominated by mature tree cover. Their forest cover requirements are described in Section 7.3.10.

Kispiox SRMP area: No legal objectives exist. However, ENs and buffers have been delineated in both the Gitwangak LUP and Gitsegukla SRMP areas. Three major forest licensees have committed via their Forest Stewardship Plans to extend Cranberry SRMP area hydroriparian zone management practices into their chart areas within the Gitwangak LUP area[16]. That commitment is shown in Table.

In the base case analysis forest cover requirements will be applied consistent with the Cranberry and West Babine SRMP. A sensitivity analysis (ID#1), for the Gitwangak LUP and Gitsegukla SRMP areas, a no harvest rule will be applied to ecosystem networks (Table), and forest cover requirements applied to the EN buffers as shown in Table 39.

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[14] Ardea Biological Consulting. 2004. *Kispiox Biodiversity Analysis*. Report submitted to Ministry of Sustainable Resource Management. 11pp.

[15] The hydroriparian zone is defined as the area that extends to the edge of the influence of water on land, or land on water, as defined by plant communities (including high bench or dry floodplain communities) or landforms, plus one and one-half site specific tree heights horizontal distance (Hydroriparian Planning Guide, Coast Information Team, Jan. 30, 2004).

[16] *chart_areas* note: the replaceable forest licence formerly held by Pacific Bioenergy Timber (Kispiox) Corp was recently acquired by Northwest BC Timber Resources Ltd. The necessary update to LICENSEE has yet to be made. For purposes of this analysis, any file references to 'Pacific Bioenergy Timber (Kispiox) Corp.' are now applicable to Northwest BC Timber Resources Ltd.

Table 25. Ecosystem network in the Cranberry SRMP

Description	Total area (ha)	CMFLB	THLB
Cranberry Ecosystem Network	26,018	Yes	No
Gitwangak LUP Ecosystem Network in GFLI chart areas	5,437	Yes	No

Data source and comments:

District Derived Data Layer: Cranberry SRMP Ecosystem Network - *cranberry_econet*

District Derived Data Layer: Gitwangak LUP Hydroriparian Zone - *gitwangak_hrz*

District Derived Data Layer: Major forest licensee chart areas - *chart_areas*

LICENSEE = 'Gitxsan Forest Enterprises Inc.' or ‘Kispiox River Timber Ltd.’ or

‘Pacific Bioenergy Timber (Kispiox) Corp.’

District Derived Data Layer: Gitwangak LUP area - *plan_unit*, PLAN_UNIT = 'Lower Skeena'

6.14 Stand-level biodiversity - wildlife tree retention

Stand-level wildlife tree retention (WTR) targets are legally established within each of the Kispiox SRMP, West Babine SRMP, and Cranberry SRMP plan areas, with the objective of maintaining a range of structural attributes of old forest ecosystems within forest stands throughout the rotation.

Table 25 provides a summary of expected levels of wildlife tree retention (WTR) by Planning Area, Applicable Unit, BEC subzone and relative cutblock size. West Babine SRMP uniquely expects greater WTR for patches that exceed 80 hectares. The WTR applied in the model will be the weighted average retention requirement based on the mid-point of the expected range of patch sizes reported in Table 46Table.

Legal targets are frequently lower than the default 3.5% per-cutblock levels specified for this objective by the Forest Planning and Practices Regulation (FPPR). Major licensees advise that their operations typically average 10% stand-level retention per cutblock, well above both FPPR and legal targets. However, retention above Table 26 levels links to achievement of FSP commitments for other values that also get managed at a stand level, e.g., cultural heritage resources, riparian habitats, critical grizzly bear habitats, pine mushroom habitats, rare and endangered ecosystems, etc. Land base reductions and forest cover constraints for those values are specified elsewhere in this *Data Package*, so are not double-accounted for here.

In the timber supply model wildlife tree patches are retained portions of the harvest unit that retain their original stand attributes and are deferred from harvest until the treated portion of the unit achieves minimum harvest criteria. The retained portion becomes eligible for harvest at the same time as the adjacent treated portion of the stand, and depending on the harvest priorities defined in the model, may be retained or an alternative area within the unit may be retained.

Table26. Percent of cutblock area required as wildlife tree retention

Planning area	Applicable unit	Unit name	BEC subzone	Percent retention weighted by legal patch size distribution targets
West Babine SRMP	Mid-sized landscape unit	Shelagyote	ESSFwv	1.2
		Babine River	ESSFmc	8.6
			ICHmc	1.2
			SBSmc	3.7
		Gail-Thomlinson	ESSFwv	1.2
		Nichyeskwa	ESSFmc	6.1
			SBSmc	3.7
		Shedin	ESSFwv	1.2
		Hanawald	ESSFmc	8.6
			ICHmc	3.7
			SBSmc	6.1

Planning area	Applicable unit	Unit name	BEC subzone	Percent retention for all cutblock sizes
Kispiox SRMP	Planning unit	Babine[17]	ESSFmc	3
			ESSFwv	0.5
			ICHmc	3
			SBSmc	1
		Kispiox North	ESSFwv	0
			ICHmc	1
		Kispiox South	ESSFwv	2
			ICHmc	6
		Upper Skeena	ESSFwv	0.5
			ICHmc	1
			SBSmc	2
		Middle Skeena North	ESSFwv	0.5
			ICHmc	3
		Middle Skeena South	CWHws	8
			ESSFwv	2
			ICHmc	3
		Lower Skeena	CWHws	0.5
			ESSFwv	0.5
			ICHmc	4
			MHmm	0
		Suskwa	ESSFwv	0.5
			ICHmc	4
		Gitsegukla	CWHws	4
			ICHmc	3
Cranberry SRMP	Planning unit	Cranberry	All	3.5

[17] The Babine and Gitsegukla planning unit % of cutblock area required for a WTP is taken from the BCTS Skeena FSP. Due to historical planning issues the WTP % for these planning units was not specified in the Kispiox SRMP.

Data source and comments:

BCGW Layer: SRMP areas - RMP_STRGC_LAND_RSRCE_PLAN_SVW

District Derived Layer: Mid-sized Landscape Units - *lu_dki*

District Derived Layer: Planning Units - *plan_unit*

BCGW Layer: Biogeoclimatic Ecosystem Classification - *BEC_BIOGEOCLIMATIC_POLY*

6.15 Pine mushrooms

The pine mushroom (*Tricholoma magnivelare*) is a commercially important wild mushroom species that grows in coniferous forests throughout British Columbia, Oregon, Washington and northern California. British Columbia's wild mushroom industry was valued in 1999 at about $25 to $45 million dollars with an estimated annual harvest of 250 to 400 tonnes. The industry remains an important source of employment to residents of communities in the Kispiox TSA.

Highly productive sites include areas where soils are well to very rapidly drained and are generally coarse in texture, often with a high coarse fragment content and a thin forest floor. Western hemlock is consistently the dominant tree species, with lodgepole pine also frequently present in the tree layer. Plant communities typically feature sparse herb and shrub layers with a high coverage of mosses. These attributes suggest pine mushrooms consistently occur on low-productivity forests typical of rocky ridges and hill tops, as well as on coarse textured soils near rivers.

Legal objectives specifying forest management expectations for productive pine mushroom habitat (PPMH) are established in each SRMP area.

In the **Cranberry SRMP** area, at least 50% of mapped PPMH sites (spatially identified in Schedule H of the Cranberry SRMP Order) must be maintained in forest ages ranging from 80-200 years.

In the **West Babine SRMP** area, at least 60% of [site series ICHmc1/01b and ICHmc2/01b areas within mapped polygons] must be maintained at a stand age greater than 80 years. These constraints are captured to Table 38.

In the **Kispiox SRMP** area, the Kispiox LRMP requires the maintenance of mushroom resources, and provision of opportunities for the sustainable harvest of mushrooms. The legal objective was not supported by spatially mapped polygons.

Detailed, field verified PPMH mapping has since been completed in several geographic locations in the Kispiox SRMP area, including McCully Creek, Date Creek and Helen Lake areas, and lower reaches of the Skeena River. For this analysis District staff also developed a "productive pine mushroom habitat" proxy layer, *ppmh_proxy*, to fill gaps in PPMH mapping.

Specific to the Kispiox SRMP area, licensee FSPs commit to ensure that PPMH sites are identified and mapped at the stand level during operational planning and included in wildlife tree retention areas (WTRA) with a minimum 15-metre forested buffer designed for wind-firmness.

As noted in Section 6.14, '*Stand-level biodiversity*', WTRA retention above the levels specified in Table 21 link to achievement of FSP commitments for management of other values including PPMH. Specifically, areas within the Kispiox SRMP areas identified as PPMH have a WTP retention level of no less than 10%.

Data source and comments:

District Derived Layer: Field-verified Productive Pine Mushroom Habitat (PPMH) – *botanical_forest_products*

District Derived Layer: PPMH proxy - *ppmh_proxy*

The following method was used to derive *ppmh_proxy*, consistent with ecological parameters described by Kranabetter et al (2002)[18].

- Selected VRI forested polygons with pine or hemlock as one of the first five species; Hw, Pli, Ep or Sx-leading; <= height class 4;
- Reselected to those <= 800 meters elevation; in ICHmc1/mc2 or CWHws2;
- Reselected to ones that were "dry" to "submesic" relative soil moisture (using a SINMAP-derived moisture grid, calibrated to field-mapped PPMH locations);
- Reselected to those within the TSR4 operable land base for this analysis;
- Reselected to those within the 80-200 year range (ran spatial checks against *botanical_forest_products* at this stage)[19];
- Finally, removed overlaps with mapping extents for *botanical_forest_products*.

6.16 Red- and blue-listed ecological communities

Red-listed ecosystems are ecosystems that the province considers to be at risk of being lost (extirpated, endangered or threatened). Blue-listed ecosystems are areas of special concern.

Legal objectives are established for certain red- and blue-listed ecological communities[20] within all three Kispiox planning areas, that pertain to communities that exceed 0.25 hectares in size (or 1.0 hectare where the community exists as the dominant component of a complex).

Cranberry and Kispiox SRMP

Red-listed communities: 100% of the area must be retained from harvest. A variable-width windfirm forested buffer must legally be retained to ensure maintenance of soil chemistry, soil moisture, temperature, and light conditions for the community.

Blue-listed communities, a minimum of 70% of the gross area, and/or 70% of the basal area of forest within the community, must be retained from harvest. Operationally, a 15-metre forested buffer is also established as a measure to further protect the community.

[18] Kranabetter, John & Trowbridge, R & Macadam, A & Mclennan, Donald & Friesen, J. (2002). Ecological descriptions of pine mushroom (*Tricholoma magnivelare*) habitat and estimates of its extent in northwestern British Columbia. Forest Ecology and Management. 158. 249-261. 10.1016/S0378-1127(00)00718-0.

[19] Review findings were that the proxy had comparable area (25% less area than that of *botanical_forest_products* within the same locations), comparable spatial distribution, and approximately 50% spatial overlap.

[20] Links to red- and blue-listed ecological communities information.

Conservation Data Centre http://a100.gov.bc.ca/pub/eswp/

West Babine SRMP Table 1: Conservation Data Centre (CDC) Blue-Listed Plant Communities

https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/natural-resource-use/land-water-use/crown-land/land-use-plans-and-objectives/skeena-region/westbabine-srmp/west_babine_srmp_amended_2012.pdf

West Babine SRMP

Red-listed communities, 95% of the area must be retained. An additional wind firm forested buffer must be retained to maintain the conditions of the community. For TSR purposes a 30-metre buffer proxy is used.

In blue-listed communities, a minimum of 95% of the area, or 95% of the basal area, of the community must be retained. Operationally, a 15-metre forested buffer is also established as a measure to further protect the community (for modelling purposes 100%).

Table 27. Red- and blue-listed ecosystems

Planning area	List	Total area (ha)	CMFLB	THLB reduction %
Kispiox	Red	1,633	Yes	100
Kispiox	Blue	637	Yes	70
Cranberry	Red	585	Yes	100
Cranberry	Blue	2	Yes	70
West Babine	Red	0	Yes	95
West Babine	Blue	0	Yes	95

Date source and comments:

District Derived Layer: red- and blue-listed ecosystems - *red_blue_listed_species*

The following method was used to derive *red_blue_listed_species:*

A lookup table of red- and blue-listed ecosystems that occur within Kispiox TSA was developed, using Conservation Data Center (CDC) listings as a primary source.

The lookup table was employed to select polygons exceeding 0.25 ha in size, with matching site classifications, from the Predictive Habitat Mapping spatial layer, phm.

6.17 Riparian reserve and riparian management zones

Riparian areas frequently contain the highest number of plant and animal species found in forests, and provide critical habitats, home ranges, and travel corridors for wildlife. Biologically diverse, these areas maintain ecological linkages throughout the forest landscape, connecting hillsides to streams and upper headwaters to lower valley bottoms.

Objectives for riparian management areas (RMA) are identified under the Forest Planning and Practices Regulation (FPPR) and incorporated into FSPs. Implementation of objectives include establishment of riparian reserve zones and/or riparian management zones. Riparian reserve zones (RRZ) require full cover retention along the stream, lake, or wetland. Riparian management zones (RMZ) have retention requirements intended to protect the integrity of riparian reserve zones.

Typical FSP commitments that govern modelling:

Kispiox and West Babine SRMP:

- For S1, S2, S3's, maintain FPPR standard RRZ, and typical RMZ with >=20% Basal Area (BA) retention;
- For Wetlands and Lakes, maintain FPPR standard RRZ, and typical RMZ with >=10% BA retention;
- For all S4, S5, S6 maintain FPPR standard RMA;
- For all S4 in 4th Order Watersheds with "Riparian Reserve" identified as an assessment need – maintain 10m RRZ;
- For alluvial S4, S5 and (S6 >= 1.5 m) and alluvial (S6 < 1.5 m) reaches that flow into fish-bearing, maintain 10m RRZ, >=10% BA retention in remainder of RMA;
- For all remaining S4, S5 and S6, >=10% BA retention throughout RMA.

Cranberry SRMP:

- As above, except LI RMZ width increased from 0 to 20m (>=10% BA retention).

Table 28. Riparian management area modelling reductions

Waterbody description	Riparian class	Reserve zone (RZ) width (metres)	Management zone (MZ) width (metres)	MZ reduction (%)[21]	Modelled width (metres)
River >=100m	S1-A	0	100	20	20
River >=20 and <100m width	S1-B	50	20	20	54
River >=5 and <20m width	S2	30	20	20	34
Fish-bearing stream >=1.5 and <5m width	S3	20	20	20	24
Fish-bearing stream <1.5m width	S4-Gen	0	30	10	3
S4-Gen in sensitive areas	S4	10	20	10	12
Non fish-bearing stream >= 3m width	S5-Gen	0	30	10	3
S5-Gen in sensitive areas	S5	10	20	10	12
Non fish-bearing stream <3m width	S6-Gen	0	20	10	2
S6-Gen in sensitive areas	S6	10	10	10	11
Wetland >5 ha	W1	10	40	10	14
Wetland >=1 and <5 ha	W3	0	30	10	3
Wetland complex >=5 ha	W5	10	40	10	14
Lake >=1000 ha	L1-A	0	0	10	0
L1-A in Cranberry SRMP area	L1-A1	0	20	10	2
Lake >=5 and <1000 ha	L1-B	10	0	10	10
L1-B in Cranberry SRMP area	L1-B1	10	10	10	11
Lake >=1 and <5ha	L3	0	30	10	3

Data source and comments:

District Derived Layer: Riparian buffers – *riparian*

A GIS project was conducted to approximate the areas of forest retained in the riparian reserve zones and riparian management zones for streams, lakes, and wetlands, consistent with Forest Stewardship Plan (FSP) commitments representing "current management" for Kispiox TSA. Each stream, lake, and wetland class was spatially identified, then buffered in accordance with Table 23 *Modelled Buffer Width* criteria to create a spatial riparian buffer file. The amount of area within the buffers was calculated and applied as an area reduction to the affected stand in the analysis.

Appendix 3 provides full details on the methodology used. General steps are provided below.

Freshwater Atlas (FWA) rivers, wetlands, lakes and stream network files from the BC *Geographic Warehouse* (BCGW) were used as source files for the project. FWA water feature files were used in preference to other available source files because FWA was determined to correlate most closely with the extent of Kispiox VRI waterbody-related polygons.

[21] Reflects result/strategy targets from current Forest Stewardship Plan for BCTS Skeena.

- S1-A, S1-B class and certain S2 class rivers were spatially identified from the FWA Rivers file using measured stream width criteria and GNIS_NM.
- Streams classed as S3, S4, S5, S6, and other S2 class streams were identified using an interpretation of Stream Feature Code (FCODE), Order, Magnitude and GNIS_NM attributes from the FWA Streams file. Fisheries Information Summary System (FISS) data was incorporated to support differentiation of fish-bearing from non-fish bearing reaches.
- Current Forest Stewardship Plans specify increased levels of retention for smaller streams (S4, S5, S6 class) that have an alluvial substrate, or flow into fish-bearing waters, or are within watersheds identified as having significantly high historical levels of natural or human-caused riparian disturbance.
- W1, W3, and W5 class wetlands, and L1-A, L1-B, and L3 class lakes were identified from the FWA Wetlands and FWA Lakes files, respectively, using their area attributes.

For the analysis, riparian buffers will be converted to a buffer-area attribute of the affected polygons (versus being treated as spatial entities).

6.18 Floodplains

Floodplains are an area in which the stream channel frequently realigns. Old cut-off and side channels become active during flooding and are important fish habitat. Floodplains also have special significance for wildlife habitat and biological diversity. The diversity of plant and animal species is generally higher than in upland ecosystems and distinct plant and animal communities are present. They also have high value as travel corridors, nesting sites, and feeding areas.

Stream dynamics and generally erodible soils of active floodplains require that little or no access road construction occur on these sites, and that low intensity harvesting occurs over a lengthened rotation to retain characteristics of the unlogged stand.

Within Kispiox TSA a Terrestrial Ecosystem Mapping (TEM) project identified high-, mid-, and low-bench floodplain areas for the Kitwanga, Kitseguecla, Kispiox, Suskwa, Sicintine, Shelagyote, and Cranberry rivers. Consistent with legal objectives set by government applicable to all three SRMP areas, mid- and low-bench floodplains are excluded from the THLB, and high-bench floodplains are permitted to contribute in their entirety to THLB.

Table 29. Floodplains

Class	Total area (ha)	CMFLB	THLB reduction %
Low bench	397	Yes	100
Mid bench	1,189	Yes	100

Data source and comments:

District Derived Layer*:* Mapped floodplain areas – *floodplain*

6.19 Wildlife habitat areas and ungulate winter ranges

Wildlife habitat areas (WHAs) are areas mapped to meet the habitat requirements of an Identified Wildlife Management Species (IWMS). The purpose of WHAs is to conserve those habitats considered most limiting to the IWMS.

(WHA) #6-055 Grizzly Bear in Shenismike, Babine River Watershed (also known as “Grizzly Drop’) was established in January 2019. This WHA is comprised of a conditional harvest zone, and a no harvest zone (NHZ) that is fully excluded from the THLB but contributes to CMFLB. Work is also underway on a WHA Order for Cranberry/Kispiox Grizzly. This order will be included in the AAC decision if completed prior to a decision.

An ungulate winter ranges (UWR) is defined as an area that contains habitat that is necessary to meet the winter habitat requirements of an ungulate species. In the Kispiox TSA, #U-6-006 (Kispiox and Cranberry TSAs) for mountain goat, established in 2007 and amended in 2014, requires retaining 100% of the forested area within the mapped polygons. There is a pending UWR for moose (# 6-040 Moose –Cranberry, Kitwanga, Nangeese within Kispiox Timber Supply Area).

Should the pending UWR for moose be enacted prior to the analysis it will be incorporated into the base case or modelled as a sensitivity analysis.

Table 30. Wildlife habitat area and ungulate winter range exclusions

Wildlife species	Identifier	Attribute	Total area (ha)	CMFLB	THLB exclusion
Grizzly Bear WHA	tag = "6-055"	TIMBER_HARVEST_CODE = "NO HARVEST ZONE"	625	Yes	100%
Mountain Goat UWR	UWR_NUMBER = "u-6-006"		32,838	Yes	100%
Mountain Goat UWR	UWR_NUMBER = "u-7-019"		38	Yes	100%
Goshawk			63	Yes	100%

Data source and comments:

BCGW Layer: Wildlife Habitat Areas - *WCP_WILDLIFE_HABITAT_AREA_POLY*

BCGW Layer: Ungulate Winter Ranges - *WCP_UNGULATE_WINTER_RANGE_SP*

Individual wildlife habitat area information (spatial data set, approved order and general wildlife measures) is available from http://www.env.gov.bc.ca/wld/frpa/iwms/wha.html.

6.20 Other geographically defined exclusions

This section provides information on additional areas to be excluded from the timber harvesting land base (THLB), as summarized in Table 26, to account for area exclusions not discussed in previous sections.

6.20.1 Mill Creek Sensitive Area

A June 1999 Order established the Mill Creek Sensitive Area (117 hectares) comprised of a cedar stand zone, a reserve zone, and a management zone. Within the cedar stand zone and the reserve zone commercial timber harvesting and road construction is prohibited except to manage forest health and wildfires. Partial harvest is permitted within the management zone.

The entire Mill Creek Sensitive Area is excluded from the THLB, consistent with pertinent current Forest Stewardship Plans for that area which specify that FSP holders will not plan or authorize harvesting or road construction there.

6.20.2 Botrychium Basin Sensitive Area

The *Botrychium Basin Sensitive Area Plan* was legally established in March 2002 to preserve a representative example of an antique forest, and to protect a globally significant population of a red-listed fern *Botrychium montanum.*

The establishing Order provides for a reserve zone (134 hectares) and a management zone (123 hectares). Within the reserve zone timber harvesting and road construction is prohibited except to manage forest health and wildfires. Partial harvest is permitted within the management zone, subject to the condition that it ensures the retention of interior forest condition for the core reserve area, and maintains additional representation of antique forests.

The reserve zone is intentionally co-located with an OGMA (SKE_KIS_611). See Section 6.1.4 for OGMA modelling considerations. The management zone is otherwise unconstrained, and licensee FSP's are silent regarding management intent.

For this analysis a >60% mature and old-seral modelling constraint shall be modelled for the management zone, consistent with the objective. This forest cover requirement is identified in Table 34.

6.20.3 West Babine SRMP special management zones

Shelagyote / Babine Tourism Node: Within this zone tourism, visual quality and high value grizzly bear habitat values are being managed. This zone is fully excluded from the THLB.

Atna / Shelagyote SMZ within the West Babine SRMP Area: Within this zone ecological and back country tourism values are being managed. This zone is fully excluded from the THLB.

Gunanoot Lake is a Wilderness Lake that has been protected within a West Babine SRMP Core Ecosystem polygon whose extent includes a 200-meter buffer to the lake feature. West Babine SRMP Core Ecosystems are excluded from the THLB (Section 6.1.3).

6.20.4 Kispiox LRMP special management zones

Andimaul Lookout was established to maintain a rocky mountain juniper community, deciduous forest and a recreation trail. This zone is fully excluded from the THLB.

Atna / Shelagyote SMZ within the Kispiox LRMP Area: Within this zone ecological and back country tourism values are being managed. Management for other values addresses the objectives for this zone and will be discussed in Section 7, '*Current Forest Management Assumptions*'.

6.20.5 Cranberry SRMP special management zones

Gitanyow Cedar Stand Reserve polygons were established to maintain a sustainable source of cedar for Gitanyow traditional, cultural and subsistence use. Cedar Stand Reserves (697 ha) are reserved for Gitanyow management and harvest. They remain within the THLB subject to management under the Gitanyow Forest Stewardship Plan, as discussed in Section 7.4.

The **10 Link Watershed** is intended to provide a domestic water supply to a planned expansion of Gitanyow village. Consistent with major licensee Forest Stewardship Plan commitments this area is fully excluded from the THLB. Its forested land base is permitted to contribute to CMFLB.

6.20.6 Water management units

Water Management Units (WMU's) are mapped in three areas of Kispiox TSA: the Cranberry SRMP area, the Gitwangak LUP area, and the Gitsegukla SRMP area (see Section 3.3, '*First Nations Strategic Planning Initiatives*', for a description of the latter two planning processes).

WMU's are contiguous areas of high ecological sensitivity considered inappropriate for road development. They include high elevation sites of difficult growing conditions, slopes showing evidence of instability, terrain broken by rock outcrops, closely spaced watercourses, gullies or avalanche tracks, areas of saturated soils or high-water tables, fans and talus slopes, and low timber volume sites.

The Cranberry SRMP area has legal WMU objectives requiring full exclusion from THLB of forested area within hydroriparian zones (HRZ's) for all streams, lakes and wetlands that are within each WMU. Comparable objectives have yet to be established within the other two plan areas.

For purposes of this analysis, the very minimal area of THLB that exists within Cranberry WMU's will be excluded from the THLB. A sensitivity analysis (ID#1) will assess the timber supply impact of excluding THLB within mapped Gitwangak LUP and Gitsegukla SRMP WMU's.

6.20.7 Cranberry SRMP special habitats – general wildlife

The Cranberry SRMP Order includes legal objectives for each polygon identified as Special Habitats for General Wildlife. Within these areas, 100% of the forested area of the "hydroriparian zone"[22] plus a buffer of one and a half site specific tree lengths is retained. These Special Habitats for General Wildlife, as identified in Schedule J of the Cranberry SRMP Order, are removed from the THLB.

Table 31. Exclusion of specific geographically defined areas

Area description	Identifier	Total area (ha)	CMFLB	THLB
Mill Creek Sensitive Area	PRIMARY = “Mill Creek”	117	Yes	No
West Babine SRMP – Shelagyote / Babine Tourism Node	STRGC_LAND_RSRCE_PLAN_NAME = “West Babine Sustainable Resource Management Plan” AND LEGAL_FEAT_OBJECTIVE = “Tourism Node”	2,226	Yes	No
West Babine SRMP - Atna / Shelagyote SMZ	STRGC_LAND_RSRCE_PLAN_NAME = “West Babine Sustainable Resource Management Plan” AND LEGAL_FEAT_ATTRB_1_VALUE = “Atna\Shelagyote SMZ”	69,953	Yes	No
Andimaul Lookout	STRGC_LAND_RSRCE_PLAN_NAME = “Kispiox Land and Resource Management Plan” AND LEGAL_FEAT_ATTRB_1_VALUE = “Andimaul Lookout”	219	Yes	No
10 Link Watershed	STRGC_LAND_RSRCE_PLAN_NAME = “Cranberry Sustainable Resource Management Plan” AND NON_LEGAL_FEAT_ATTRB_1_NAME = “Ten Link Community Watershed”	919	Yes	No
Cranberry Water Management Units	WMU_ID = “Water Management Units”	89,005	Yes	No
Special Habitats for General Wildlife	WILD_PATCH = “High Value Patch Habitat “	5,132	Yes	No
Botrychium Basin Reserve	SENS_AREA_PRIM = ”Botrychium Basin” AND SENS_AREA_SEC =”Reserve Zone”	134	Yes	No

Data source and comments:

District Derived Layer*:* Mill Creek Sensitive Area - *sensitive_areas*

District Derived Layer*:* Cranberry Water Management Units - *cranberry_wmu*

District Derived Layer*:* Special Habitats for General Wildlife - *cranberry_special_hab_wildlife*

BCGW Layer: 10 Link Watershed - *RMP_PLAN_NON_LEGAL_POLY_SVW*

BCGW Layer: Remaining Specific Geographically Defined Areas - *RMP_PLAN_LEGAL_POLY_SVW*

[22] "hydroriparian zone" is defined as the stream channel, lake or wetland; full width of floodplains including high-bench); up to the top of inner gorge for steep-walled stream gullies, and hydrologically connected unstable slopes (class IV and V terrain).

6.21 Cultural heritage resources

A cultural heritage resource is an object, site or location of a traditional societal practice that is of historical, cultural, societal or archaeological significance to the province, community or an Aboriginal people. This can include archaeological sites, structural features, heritage landscape features and traditional use sites.

Prime examples of First Nations cultural heritage resource features include, for example: culturally modified trees (CMTs); cultural trails; traditional ceremonial and spiritual use sites and areas; resource use and historical habitation sites; cultural plants; ecological features with cultural significance; and monumental cedar. Other examples of cultural heritage resources include the Telegraph Trail which is of societal significance to the province.

Traditional use sites have been used by one or more groups of people for ceremonial or sustenance activities. These sites often lack physical evidence of artifacts or structures and have cultural significance to a living community. Berry picking sites, herb and medicinal plant sites, culturally modified trees, spiritual sites, traditional trails, traplines, fishing stations and hunting areas are examples of traditional use sites. Traditional use studies have been initiated for the Suskwa and Shedin watersheds in the planning area. Structural features are buildings or structures made by humans that are significant to a living community. Most of these features date from the historic past (i.e., last 150 years). Mortuary poles, fish drying racks and long houses are examples of structural features.

6.21.1 Pre-1846 features

Archaeological sites consist of the physical remains of past human activity that predate 1846, and, for example, could include cultural depressions and lithics. Such sites automatically receive protection under the *Heritage Conservation Act.* Licensee practice is to have these areas assessed by a professional archaeologist, and where possible and appropriate to proceed with harvest under provisions of site alteration permits obtained through authority of *Heritage Conservation Act*. This may or may not permit some level of harvest on the site.

Examples of archaeological sites in the Kispiox planning area are the Battle Hill National Historic Site near Kitwanga, totem poles at ‘Ksan, Kitwanga, Kitseguecla, Kitwancool and Kispiox, and Temlaham, a Gitxsan spiritual site downstream of Hazelton on the Skeena River. Trails with historical significance include The Grease Trail.

In the Kispiox TSA, 329 archaeological sites covering approximately 1937 hectares have been identified and recorded within the government’s archaeological data base. These include a wide range of types such as culturally modified trees, cultural trails, middens, cache pits, resource gathering areas, burial sites, and historic settlements. As it is unclear what level of harvest will be permitted on these sites, for the current timber supply analysis, we have elected to exclude these sites from the THLB.

To address the possibility of unknown archaeological sites, a predictive model developed for the TSA identifies the potential for finding an archaeological site (low, medium, and high). These potential areas are not modelled in the current analysis. Licensees are responsible for using this tool to determine where more detailed field assessments are required prior to harvesting or road building. If a new archaeological site is identified, it is automatically protected under the *Heritage Conservation Act*, and is recorded as an archaeological site within the government’s archaeological data base. New sites will be excluded in the next round of TSR.

Data sources and comments:

District Derived Layer - *raad_site*

6.21.2 Post 1846 features

Under current legislation and legal plans, objectives have been established for cultural heritage resources, for example:

FPPR s. 10

The objective set by government for cultural heritage resources is to conserve, or, if necessary, protect cultural heritage resources that are:

(a) the focus of a traditional use by an Aboriginal people that is of continuing importance to that people, and,

(b) not regulated under the *Heritage Conservation Act*.

Kispiox LRMP Section 6.6 and 6.16

- To maintain cultural heritage resources including archaeological sites, traditional use sites and trails, and structural features. A specific objective is to protect features at Kispiox, Hazelton/Hagwilget, Kitwancool, Cedarvale, Kitseguecla, Kisgegas and Kuldo;
- To recognize the significance of house territories and associated resources to First Nations;
- To protect historic features associated with river boat traffic on the Skeena River, the Dominion Telegraph Trail and early mineral exploration;
- To maintain sites that are important for production of traditional medicinal plants (e.g., lily roots, devil's club).

Cranberry SRMP LUOR Order Objective 35 and 36

- Preserve cultural heritage resources and cultural sites, including culturally modified trees, trails, cache pits, house pits, grave sites, fishing sites, pictograph sites, smoke houses, cabins, and camping sites;
- Maintain the areas identified on Schedule K [of the Cranberry SRMP LUOR Order], as a source of cedar for the applicable First Nation to practice their traditional, cultural and subsistence uses.

Experience has shown that most cultural heritage concerns can either be avoided or mitigated through current management practices. As an example, because cultural heritage resources are often situated near water bodies, they can be protected within a riparian management area or within wildlife tree retention areas; both of these management tools are accounted for within the TSR analysis under Section 6.14 Stand Level Biodiversity – wildlife tree retention, and Section 6.17 Riparian Reserve and Riparian Management Zones. Based on this logic, post-1846 cultural heritage features are being protected within these forest management areas, and do not require additional THLB reductions.

The **Dominion Telegraph Trail** is a designated cultural heritage feature protected under the *Heritage Conservation Act*. Forest management in and around the trail is advised by the *Dominion Telegraph Trail Management Plan (DTTMP) Guidelines for Resource Development.* To accommodate guidance, 25% of a 200 m corridor centered on the trail is permitted to contribute to THLB for small-scale harvest of bark beetle infestations.

Table 32. Cultural heritage resources

Description	Total area (ha)	CMFLB	THLB reduction (%)
Archaeological Sites (from *raad site*)	1,911	Yes	100
Other CHR Features	N/A	Yes	0
Dominion Telegraph Trail (Yukon Telegraph)	1,651	Yes	75
Gitanyow Grease Trail	583	Yes	75

Data source and comments:

District Derived Layer: Dominion Telegraph Trail - *trails_buffer*

District Derived Layer*: raad_site*

District Derived Layer: *fnlus_point*

District Derived Layer: *fnlus_line*

fnlus_point and *fnlus_line* are Kispiox TSA clips from BCGW data layers WHSE_HUMAN_CULTURAL_ECONOMIC.FN_LAND_USE_SITES_POINT and WHSE_HUMAN_CULTURAL_ECONOMIC.FN_LAND_USE_SITES_LINE, respectively.

POINTs and LINEs are locations of traditional societal practise that are of historical or cultural significance, as gathered from formal information sharing or project specific consultation, published and unpublished materials including Traditional Use Studies (TUS) and Traditional Ecological Knowledge (TEK) studies. These layers represent our best understanding of the location of point and linear features used post-1846 by First Nations.

6.22 Growth and yield and permanent sample plots

FLNRORD maintains a network of growth and yield permanent sample plots (PSPs) across the province for the purposes of understanding forest growth and the calibration of growth and yield models. FLNRORD intent is to maintain a PSP up to 120-150 years of age before releasing the plot from study. Although legal objectives for PSP's have not been established under *FRPA*, Kispiox licensee FSP's commit to avoidance or protection actions around active PSP plots and their buffers.

In the Kispiox, FAIB maintains 128 Growth and Yield PSPs and 3 National Forest Inventory ground samples.

In 2018, 22 additional CMI samples were established in stands > 50 years of age, and 17 young stand monitoring (YSM) plots were established in stands 15-50 years of age. Both the CMI and YSM samples are used to validate growth and yield models. FLNRORD FAIB staff advise that for TSR analysis purposes a circular area of 68 metre radius is reasonable to spatially associate with each plot. The CMI and YSM samples are permanent monitoring plots of the growth of harvested stands, but unlike PSPs they are not expected to be protected from future harvest. The CMI and YSM plots are established to monitor standard forest activity and therefore are not protected. The intent is for licensees not to alter their plans due to the presence of these plots.

Although there are 128 PSPs in the Kispiox, FAIB is currently only protects 38 as permanent. The area (29 ha) of these protected PSPs will be excluded from the THLB but remain within the CMFLB.

Table 33. Growth and yield permanent sample plot reductions

Installations	Installations	Total area (ha)	CMFLB	THLB
Growth & Yield Permanent Sample Plots (PSP)	38	29	Yes	Yes

Data sources and comments:

BCGW Layer: Research installations – WHSE_FOREST_VEGETATON.GRY_PSP_STATUS_ACTIVE

PROJ_KEY = not <null>

7. Current Forest Management Assumptions

7.1 Harvesting

7.1.1 Recent harvest performance

Harvest in the Kispiox TSA has been significantly below the allowable annual cut. In the past 10 years, only 18% of the allowable annual cut was harvested. The lack of harvesting is due to many issues including: significant strategic land base constraints, lack of markets for the low quality wood (marginal hemlock sawlogs, pulp), poor wood quality within over mature stands, a historical harvest focus on a small portion of the TSA, licensee bankruptcies and long-haul distances to milling facilities.

Table 34. Harvest volume billed in Kispiox TSA from 2008 to 2018

	Volume (m^3)			
Year	**Total**	**Sawlog**	**Pulp**	**Deciduous**
2008	106,668	63,184	37,535	5,949
2009	30,848	22,275	8,573	0
2010	125,826	87,211	38,612	3
2011	231,674	163,529	68,140	5
2012	117,073	80,953	36,120	0
2013	201,347	168,210	32,841	288
2014	152,704	122,776	29,821	107
2015	213,100	169,727	41,264	2,109
2016	359,081	303,465	50,390	5,226
2017	399,023	317,115	79,979	1,929
2018	378,322	286,338	84,697	7,287
Average	210,515	146,823	46,179	2,082

Figures 5 and 6 illustrate that over the past five years, harvesting in the Kispiox TSA has generally matched the species and age-class profiles of the TSA. Although harvesting tends to harvest balsam-leading stands and stands older than 250 years disproportionately less.

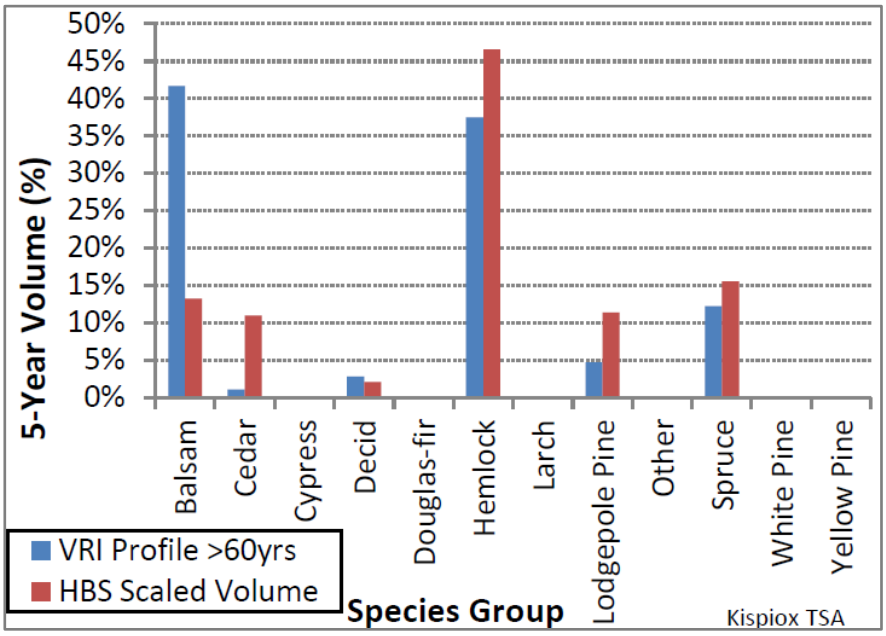

Figure 5. Five-year scale volume by species for the Kispiox TSA.

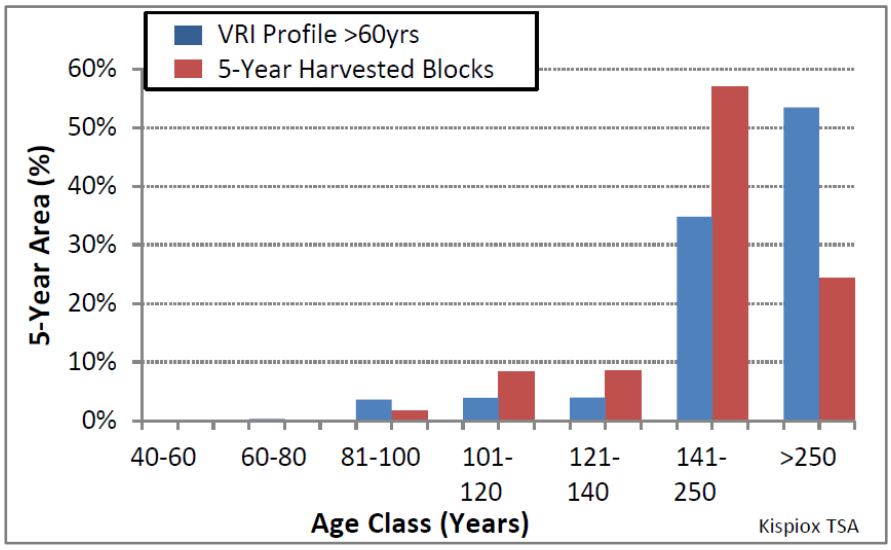

Figure 6. Five-year harvest age for the Kispiox TSA.

Data source and comments:

FLNRORD Provincial timber management objectives.

7.1.2 Merchantability specifications

The Interior Timber Merchantability Specifications of the *Provincial Logging Residue and Waste Measurement Procedures Manual* specifies the utilization levels for the billing of harvested timber used in the monitoring of AAC.

The utilization levels define the maximum stump height, minimum top diameter (inside bark) and the corresponding minimum diameter (at breast height) by species (Table 35.). For yield table projections in the timber supply analysis, the specifications for minimum stump diameter are converted to a corresponding breast height diameter.

Table 35. Harvest merchantability specifications for the Kispiox TSA

Species	Utilization		
	Corresponding minimum Diameter at Breast Height (DBH) (cm)	Maximum stump height (cm)	Minimum top Diameter inside Bark (DIB) (cm)
Pine	12.5	30	10
All other	17.5	30	10

7.1.3 Mixed deciduous

The purpose of this section is to identify the proportion of mixed-species stands that are unmerchantable. The unharvested portion of a stand does not contribute to the estimated stand volume and thereby does not contribute to timber supply.

Table 36 shows the percent exclusion for the deciduous portion of mixed-species stands. Small volumes of birch and cottonwood are harvested but the total volume amounts to less than 1% of the total volume.

Table 36. Volume exclusions for mixed species types

Species	Volume exclusion (%)
All deciduous	100

7.1.4 Minimum harvestable criteria

The minimum harvestable age (MHA) is the minimum age at which a stand is considered to be harvestable. While harvesting may occur in stands at the minimum ages to meet forest level objectives (e.g. maintaining overall harvest levels for a short period of time or avoiding large changes in harvest levels), most stands will not be harvested until past the minimum ages due to management objectives for other resource values (e.g. requirements for the retention of older forest).

A review of ministry harvest appraisal records from 2008 to 2019 for the Kispiox TSA shows that harvest volumes range from 142 to 791 cubic metres per hectare. The lowest tenth percentile value is 324 cubic metres per hectare and 200 cubic metres per hectare is between the first and second percentile.

For existing natural stands the MHA will be set as the youngest age at which an individual stand has achieved a merchantable volume of 200 cubic metres per hectare, this is consistent with the volume threshold used to define inoperable stands under the harvest method mapping (HMM) described in Section 6.8.

Table 37. Distribution of harvest unit-volume in the Kispiox TSA

Percentage	0	1	2	3	4	5	10	25	50
Unit volume 2008-2019 (m^3/ha)	142	142	239	250	292	305	324	348	422

For the base case, the minimum harvestable criteria for managed stands will be the age at which the stand reaches 95% of culmination mean annual increment. Application of this criteria will ensure that managed stands provide the optimal volume production over time.

Sensitivity analyses will investigate the effect on timber supply of lowering and raising the minimum harvestable ages and the minimum harvestable volume criteria.

7.1.5 Harvest scheduling priorities

Harvest priorities or minimum harvest levels can be set for geographically-defined areas to reflect current licensee practices in response to forest health issues, operational pressures and/or licence requirements.

Table 38 describes harvest scheduling priorities and states the time period over which this priority applies. The harvest priorities in Kispiox TSA are as follows:

- Defer harvest in Madii Lii wilp of Gitxsan Suskwa Administrative Watershed for at minimum one decade to allow time for resolution of current road inaccessibility issues.
- Prioritize harvest over the first decade in accessible low- to medium-burn severity areas of two 2018 wildfires: R41913 (Pope) and R41913 (Gail) to mimic current salvage logging efforts.

Table 38. Priorities for harvest scheduling

Description	Location	THLB area (ha)	Decade	Priority or harvest target
Madii Lii territory within Suskwa Administrative Watershed	LAXWIIYIP= "Madii Lii"	12,745	1	Priority 0 (defer harvest)
Low- to Moderate-Burn Severity areas in two 2018 wildfires: Pope, and Gail South in Djogaslee wilp	FireNum = "R41945" OR "R41913" AND SIMGIIGYET = "Djogaslee" AND BurnSev = "Low" or "Medium"	738	1	Priority 1

Data source and comments:

District Derived Data Layer: Wildfires, Burn Severity ratings – *fires_2018*

District Derived Data Layer: Gitxsan Simgiigyet – *gitxsan_wilp*

7.1.6 Log grade definition

On April 1, 2006 new log grades were implemented for the BC Interior. Under this system, grades are based on the log's size and quality at the time the log is scaled or assessed without regard to whether it was alive or dead at harvest. Former grades 3 and 5 (potential dead volumes), that were previously excluded, may now be included in grades that are billed against a licensee's AAC. Some exemptions to this inclusion may exist (see Section on Log Grade 4).

Growth and yield models used for the timber supply analysis do not incorporate dead tree volumes. In 2006, the report *Summary of dead potential volume estimates for management units within the Northern and Southern Interior Forest Regions* provided estimates of dead tree volume based on various sources of sample data available. For the Kispiox TSA, possible sources of data for potential dead volumes include inventory audit plots, VRI phase II ground samples, permanent sample plots, and temporary sample plots, and at this time, for the Kispiox TSA, the inventory audit is considered the best such source. The audit data indicate that the dead-potential volume is about 16.3% of the green volume for the forested land base over 60 years of age in this TSA.

This information will be presented to the chief forester for consideration but the base case will not include any modelling assumptions or adjustments on this account.

7.1.7 Log grade 4

The Section 8 AAC is tracked by monitoring harvest billed against awarded AAC of forest licences. Harvest billed includes both timber used and that which is identified as waste. "Waste" means timber, except timber reserved from cutting, whether standing or felled, which meets or exceeds the timber merchantability specifications described in the *Provincial Logging Residue and Waste Measurement Procedures Manual* that was not removed from the cutting authority area.

At the time of the introduction of new log grades, provincially, licensees argued that not all grade 4 was economic to harvest. To address this issue, the ministry agreed to create a dry-grade 4 category (effectively the old grade 5 category) that if left on site would not be counted as waste (though it is captured under cruised based authorities). Further, to encourage all grade 4 use, exclusions (i.e., not billed against a licensee's AAC) have been permitted for grade 4 where this volume is shipped to a facility other than a sawmill or veneer plant. The District notes that no "grade 4 credit" has been used in the Kispiox TSA since the previous determination.

No specific modelling considerations for log grade 4 waste exemptions or for Grade 4 credit are made. Available information on dry grade 4 waste and grade 4 credit will be presented to the chief forester for consideration in the AAC determination.

7.1.8 Unharvested volumes

During the last TSR period a large portion of the allowable annual cut (AAC) was not harvested. This occurred for a number of reasons including a significant portion of the timber profile is not sawlog quality wood and there is a lack of markets for this type of timber.

Prior to the AAC determination, a separate consultation process and Skeena Regional Executive Director decision regarding the administration of accumulated unissued BCTS, unharvested and uncommitted volumes will occur[23]. A portion of the unharvested and uncommitted volumes will be retained to be used as part of the current tenure issuance process.

7.2 Silviculture

Since 1987 major licensees have had a legal responsibility for basic silviculture. To enable assessment of this responsibility, licensees conduct surveys of the regeneration on a cutblock and report this information in the FLNRORD database RESULTS. Summary information from RESULTS will be the basis for regeneration assumptions in the base case analysis.

7.2.1 Silvicultural systems

Clearcuts and clearcuts with reserves are the most frequent silviculture systems used in the Kispiox TSA. Under these systems, a range of opening sizes containing even-aged forests is produced. A characteristic of the clearcut with reserve system is the maintenance of older forest patches within harvest blocks. These remnants are intended as wildlife tree patches, riparian reserve and management zones, and island remnants to conserve old growth characteristics.

7.2.2 Incremental silviculture

Incremental silviculture practices are activities that provide benefit to stands beyond the practices required to meet basic silviculture obligations such as juvenile spacing, fertilization, pruning, or other enhanced treatments.

In the Kispiox TSA during 2008-2010, approximately 560 hectares of "incremental" spacing occurred under the Job Opportunities Program and the Northwest Revitalization Program. The programs targeted dense juvenile forest, between the ages of 15 and 35 years on moderate or higher site class sites, in previously harvested areas, Silviculture and inventory labels were updated in RESULTS.

Section 8.2.2.2, '*Stands with a harvest history*' provides modelling assumptions for treated openings.

[23] https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/timber-tenures/timber-tenure-bulletins-policies-procedure/policy_regarding_the_administration_of_unharvested_volumes_uncommitted_volumes_and_unused_bcts_volumes.pdf

7.3 Integrated resource management

The base case analysis is generated in consideration of legal government objectives. However, in some situations "current management" implemented by standard licensee operational practices require additional consideration. The legal government objectives that are established for Kispiox TSA are listed in Section 2.2, '*Land use planning*'.

Under *FRPA*, major forest licence holders must prepare Forest Stewardship Plans (FSP) specifying their intended standard operational practices, in terms of results and/or strategies (R/S) made consistent to the prescribed extent with legal objectives. The FSP preparer is also empowered to specify R/S for non-legal objectives thus elevating them into the realm of "current management".

Standard operational practices within spatially-defined objective areas separate into two general categories: areas where harvest is avoided, and areas subject to some operational limitation that for purposes of modelling can be described in terms of a forest cover requirement or "constraint".

Areas comprising the first category are by and large already described in Section 6 and excluded from the timber harvesting land base (THLB) consistent with specifications of tables in that section. The current section addresses the latter category.

Table 39 provides a summary of values and objectives with forest cover requirements that are to be incorporated into the timber supply model. Each of these requirements is discussed in greater detail in the subsequent sections.

Major forest licensees within the Kispiox TSA have broadly overlapping FSP Forest Development Units (FDU) but typically restrict operations under their FSP to their standard operating areas, or "charts", defined during the timber allocation process (TAP) engagement. For this reason, where R/S are significantly different between FSPs a split by operating area is introduced in the upcoming sections. If the R/S are similar or identical, or if there is a spatial overlap of operating areas, then the specified forest cover requirements represent a blend of R/S from multiple FSPs.

Table 39. Summary of forest cover requirements

Resource objective	Retention target	Retention criteria age (years)	Applicable land base
Botrychium Basin Sensitive Area – Management Zone	Minimum 60%	>100	CMFLB within Management Zone
Botanical – Cranberry SRMP - Pine Mushroom Habitat	Minimum 50%	>80 and <200	CMFLB within Schedule H polygons
Botanical – West Babine SRMP - Pine Mushroom Habitat	Minimum 60%	>80	CMFLB within mapped polygons
Grizzly – West Babine SRMP - Big Slide Access Management Zone (AMZ)	Minimum 70%	>70	
Grizzly – West Babine SRMP - Sperry/Rosenthal AMZ	Minimum 50%	>50	CMFLB within individual AMZ's
Grizzly – West Babine SRMP - Shenismike West AMZ	Minimum 50%	>50	
Grizzly – Kispiox SRMP – Upper Kispiox AMZ	Minimum 50%	>50	
Grizzly – West Babine SRMP – Critical Habitats (CH) and Buffered Non-Forested CH			
Grizzly – Kispiox SRMP – Critical Habitats (CH) and Buffered Non-Forested CH	No Harvest		THLB within Grizzly Bear Complex polygons
Grizzly – Cranberry SRMP –Critical Habitats			
Grizzly – Cranberry SRMP – Buffers to Critical Habitats	Minimum 90%	>100	CMFLB, within buffers, within individual Grizzly Bear Complex polygons
Moose – Cranberry SRMP areas – Seral Constraint	Minimum 30%	>100	CMFLB within individual Moose Winter Range polygons
Mule Deer Winter Range – Kispiox and Cranberry SRMP areas	Minimum 6%	> 150	Combined CMFLB of all three habitat polygons
Goshawk - Cranberry SRMP – Foraging Territories	Minimum 60%	> 100	CMFLB within individual mapped territories
Water –Hydrological Integrity	See Section 7.3.7		
Biodiversity – Patch Size	See Section 7.3.8		
Biodiversity – Seral Stage	See Section 7.3.9		
Biodiversity – Cranberry SRMP - Ecosystem Network Buffers	Minimum 70%	CWH >80 ICH, SBS >100 years ESSF, MH >120	CMFLB within individual buffer elements in Cranberry SRMP area and in GFLI chart in Lower Skeena LU
Biodiversity – West Babine SRMP – Landscape Riparian Corridors	Minimum 70%	CWH >80 ICH, SBS >100 years ESSF, MH >120	CMFLB within individual landscape corridor elements
Visual Quality	See Section 7.3.11		
Special Management Zone – West Babine SRMP – Babine River	Minimum 30%	>140	CMFLB within SMZ
Cedar – Cranberry SRMP - Cedar Reserve Polygons	Maximum 15%	<40	Combined CMFLB for all polygons

7.3.1 Wildlife – grizzly bear

The Kispiox TSA is home to several key grizzly bears populations. Populations of grizzly bear are found in northern watersheds of the Kispiox TSA, from the upper Kispiox River in the west to the Babine River and Gunanoot Lake in the east. Connectivity between populations in northern watersheds is likely. Populations in the Suskwa River, Harold Price Creek and south Babine River drainages to the east and south-east are also probably linked. Populations are threatened by increased road access and timber harvesting in critical bear habitat (e.g., riparian areas, avalanche chutes and seepage areas).

The grizzly bear is one of six key resource values identified of being of significant value to First Nations.

Legal objectives for mapped high-value grizzly bear polygons (grizzly habitat complex polygons) are established in the West Babine and Kispiox SRMP areas.

Forest management expectations in the West Babine SRMP area include: no alteration of critical habitats (CH)[24]; no alteration of the 100 meter forested buffer around non-forested critical habitats; seral constraints within three mapped access management zones (AMZ); and road density limits – i.e., maintain road density in 80% of Shedin and Hanawald mid-sized watersheds at < 0.6 km/km^2.

Forest management expectations in the Kispiox SRMP area include: no alteration of critical habitats (CH); no alteration of the 100 meter forested buffer around non-forested critical habitats; and seral constraints within the mapped Upper Kispiox Access Management Zones (AMZ).

[24] West Babine SRMP Table 7 Management Direction for Grizzly Bears

https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/natural-resource-use/land-water-use/crown-land/land-use-plans-and-objectives/skeena-region/westbabine-srmp/west_babine_srmp_amended_2012.pdf

Table 40. Summary of grizzly bear forest cover requirements for the West Babine and Kispiox SRMPs

Resource objective	Retention target	Retention criteria age (years)	Applicable land base	CMFLB area (ha)	Current retention or (THLB [ha])	Current retention percent (%)
Grizzly – West Babine SRMP – Critical Habitats (CH) and Buffered Non-Forested CH	No Harvest			6,708	(1,690)	N/A
Grizzly – West Babine SRMP - Big Slide Access Management Zone (AMZ)	Minimum 70%	>70		2,885	2,563	89%
Grizzly – West Babine SRMP - **Sperry/Rosenthal AMZ**	Minimum 50%	>50	CMFLB	1,485	1,485	100%
Grizzly – West Babine SRMP - **Shenismike West AMZ**	Minimum 50%	>50		3,746	3,745	100%
Grizzly – Kispiox SRMP – Critical Habitats (CH) and Buffered Non-Forested CH	No Harvest			39,166	(7,806)	N/A
Grizzly – Kispiox SRMP – Upper **Kispiox AMZ**	Minimum 50%	>50	CMFLB	1,686	1,684	100%

The Cranberry SRMP area remains with no legal grizzly objectives pending finalization and enactment of a WHA for *Cranberry/Nass Grizzly Bear*. However, licensee FSP's consistently commit to manage in accordance with Cranberry SRMP draft objectives. Their practices - applicable to Grizzly Habitat Complex polygons – include: no alteration of critical habitats exceeding one hectare; maintaining >90% of the 100 meter forested buffer around non-forested critical habitats exceeding two hectares in size in a mature or old-seral condition; and reduced stocking standards.

For this analysis, District staff used Predictive Habitat Mapping (PHM) to develop a spatial layer (*grizzly_cv_habitat)* of all Critical Habitats that PHM was capable of predicting, plus buffers to those Critical Habitats as specified above, clipped to the extent of Grizzly Habitat Complex polygons. Forest cover expectations by plan area are captured to Table 38.

Grizzly Bear Wildlife Habitat Area Order #6-055 in the Shenismike, Babine River Watershed (also known as "Grizzly Drop') came into effect in February 2019 and has a Conditional Harvest Zone. Retention areas within this zone must focus on protecting microsites (<1 ha) of ICHmc1 04 & 06 site series within and adjacent to proposed cutblocks to assist in ensuring the availability of subalpine fir for purposes of grizzly bear spring-time bark stripping. This is accommodated in modelling approaches for wildlife tree retention areas (WTRA), see Section 6.14.

In the circumstance that the WHA Order for *Cranberry/Nass Grizzly Bear* is finalized prior to the AAC decision, its timber supply implications will be explored through a sensitivity analysis.

District-wide habitat suitability mapping for grizzly bear, moose, and mountain goat was completed in 2004 by a working group of BC Ministry of Forests and BC Environment staff and consultants. Predictive Habitat Mapping (PHM), previously described in Section 5, was used as the base inventory for this work.

The Working Group assigned seasonal-use habitat suitability ratings, by PHM type, for each species of focus. Concentrations of highest-value (i.e. "critical") habitat suitability types were then delineated into high-value habitat polygons to support the establishment of spatially-defined legal objectives.

Table 41. Grizzly bear forest cover requirements within the Cranberry SRMP

Resource objective	Retention target	Retention criteria age (years)	Applicable land base	CMFLB area (ha)	Current retention or (THLB [ha])	Current retention percent (%)
Grizzly – Cranberry SRMP –Critical Habitats		No harvest		4,989	(344)	N/A
Grizzly – Cranberry SRMP – Buffers to Critical Habitats	Minimum 90%	>100	CMFLB, within buffers, within individual Grizzly Bear Complex polygons	8,894	7,766	88%

Data source and comments:

District Derived Data Layer: Grizzly Habitat Complex polygons - *grizzly_hv_habitat*

District Derived Data Layer: PHM Critical Habitats – *grizzly_cv_habitat*

WHA for *Cranberry/Nass Grizzly Bear* – (awaiting spatial from Skeena Region Ecosystems staff)

7.3.2 Moose

Moose are one of six key resource values identified of being of significance to First Nations. First Nations and BC resident hunters place a high value on moose habitat and population management. Moose numbers appear to have been declining, most likely as a result of hunting, predation and habitat alteration. Recovery of moose populations is dependent on the management of: habitat, access and timber harvesting.

The best habitats provide: abundant accessible forage; coniferous canopies that intercept snow and act as thermal and security cover; large trees to help ward off predators; and opportunities for escape from predators. The abundance and quality of winter habitats are key factors that influence the over-winter survival of moose. Moose habitat suitability mapping serves as a proxy for moose winter range. It consists primarily of low elevation wetland-timber complexes, floodplains of main rivers and large tributary streams adjacent to coniferous stands. Forest harvesting and wildfire have resulted in some interim moose winter range by providing early seral forage in areas where mature/old forest canopy intercepts snowfall and thus reduces snow depths.

Legal objectives established for the Kispiox SRMP area require: retention of moose forage and maintenance of security; visual screening; and thermal /snow interception cover within mapped winter range. All Licensee FSP's commit to the following practices in the Kispiox SRMP area: no disturbance of >1 ha pure willow and/or red-osier dogwood sites; retention of security cover within 50 m of >1 ha subhygric to subhydric sites containing willow and red-osier dogwood as dominant shrub species; and retention of security cover within or adjacent to cutblocks.

Moose habitat suitability mapping was derived from Predictive Habitat Mapping (PHM). Concentrations of highest-value suitability types were delineated into moose winter habitat polygons across the full TSA – the "*moose_winter_range"* spatial layer - to support establishment of spatially-defined legal objectives.

For this analysis, forest cover requirements for moose habitat in the Kispiox SRMP area are considered accounted for through the cumulative effects of forest cover requirements for other values, particularly grizzly habitat, riparian area, and Wildlife Tree Retention requirements. No legal objectives were established in either the West Babine or Cranberry SRMP areas. For the West Babine SRMP area, licensee FSP's typically commit to Kispiox SRMP management practices.

For the Cranberry SRMP area, licensees consistently commit to the draft Cranberry SRMP objectives, which are reasonably consistent with those of Kispiox SRMP, but additionally specify a threshold retention level of >30% of mature and old forest in each Moose Winter Range polygon, for snow interception. This requirement is captured to Table 42.

UWR # 6-040 *Moose –Cranberry, Kitwanga, Nangeese within Kispiox Timber Supply Area* is nearing finalization. If available prior to the analysis, the timber supply implications of UWR#6-040 will be assessed through a sensitivity analysis.

Table 42. Moose forest cover requirements within the Cranberry SRMP

Resource objective	Retention target	Retention criteria age (years)	Applicable land base	CMFLB area (ha)	Current retention (ha)	Current retention percent (%)
Moose – Cranberry SRMP areas – Seral Constraint	Minimum 30%	>100	CMFLB within individual Moose Winter Range polygons	24,399	12,422	51

Data source and comments:

District Derived Data Layer: Moose Winter Range polygons – "*moose_winter_range*"

UWR 6-040 polygons – "*cranberry_moose_uwr"*

7.3.3 Mountain goat

A significant number of the North American population of mountain goats reside in the Skeena Region of BC, representing somewhere between 16,000 to 35,000 animals. In BC, the mountain goat is yellow-listed, indicating that their welfare is not of immediate conservation concern, however, provincial populations are considered to be of long-term conservation concern. Mountain goats have low reproductive rates and are vulnerable to hunting mortality which can increase as a result of new access.

Mountain goats are one of 6 key resource values identified of being of significance to First Nations.

Within the Kispiox TSA, the abundance and quality of winter habitats are key factors that influence over-winter survival of goats. The best habitats provide: abundant accessible forage; coniferous canopies that intercept snow and act as thermal and security cover; and opportunities for escape or defense against predators. Summer habitat for goats mostly consists of alpine ridges and alpine meadows with nearby cliffs that provide escape terrain. The general management direction for mountain goats aims to: manage mountain goat winter range to help ensure a healthy mountain goat population; avoid disturbance and displacement of mountain goats during vulnerable periods; and minimize pressure on the mountain goat population from legal and illegal harvest through human access management.

An Ungulate Winter Range (UWR) Order U-6-006 was established under the *Forest and Range Practices Act* in June 2007 and amended in September 2014. Licensee FSP's consistently commit to manage mountain goat winter habitat polygons in accordance with the Order's General Wildlife Measures (GWM's). GWM's specify no harvest within goat polygons (Section 6.19), plus seasonal and access management operational constraints within 500 or 1000 metres of polygons.

In accommodation to First Nations referral concerns, some licensees FSP's additionally commit to no harvest within 500m of the canyon-dwelling goat polygons specified by the Order, where these polygons exist within the area of overlap of the Cranberry SRMP and/or the draft Gitwangak LUP (i.e. the Lower Skeena Landscape Unit) and their operating areas (i.e. "charts").

To represent this current management practice, District staff developed a spatial layer "*buff_cany-goat_FSP"* using the following process:

- selected all U-6-066 canyon-dwelling goat habitat polygons (UWR_UNIT_N = 5, 8, 13, 17, 18, 19, 32-34, 37, 44, 56, 66 and 71);
- and from that set, selected those that met the criteria in the preceding paragraph (which reduced the selection to UWR_UNIT_N = 32-34, 44 and 56);
- then buffered the final set by 500 metres.

To represent this current management practice, District staff developed a spatial layer "*buff_cany-goat_FSP*". In the base case analysis the no-harvest buffers for canyon-dwelling goat will be removed from the THLB and available for harvests. Forest cover expectations for *buff_cany-goat_FSP* are captured to Table 44.

Table 43. Mountain goat forest cover requirements within the Cranberry SRMP

Resource objective	Retention target	Retention criteria age (years)	Applicable land base	CMFLB area (ha)	THLB (ha)	Current retention percent (%)
Mountain Goat – 500 meter Buffers to U-6-006 Canyon-Dwelling Goat Habitat Polygons - in Cranberry SRMP and Gitwangak LUP areas	No harvest		THLB within buffers, within Gitanyow Huwilp Society, Gitxsan Forest Enterprises Inc., and Kispiox River Timber Ltd operating areas	956	(624)	N/A

Data source and comments:

BCGW Layer: WCP_UNGULATE_WINTER_RANGE_SP

District Derived Data Layer*: buff_cany-goat_FSP*

District staff developed the spatial layer "*buff_cany-goat_FSP*" using the following process:

- selected all U-6-066 canyon-dwelling goat habitat polygons (UWR_UNIT_N = 5, 8, 13, 17, 18, 19, 32-34, 37, 44, 56, 66 and 71);
- and from that set, selected those that met the criteria in the preceding paragraph (which reduced the selection to UWR_UNIT_N = 32-34, 44 and 56);
- and buffered the final set by 500 metres.

7.3.4 Mule deer

Mule deer populations in the Kispiox are stable or increasing. As with other key wildlife species, winter range maintenance is key to the overwinter survival of mule deer. Deer winter range attributes include: southerly aspects; low-moderate elevations (< 1000m); stands providing thermal and snow interception values associated primarily with riparian communities and sites of drier moisture regimes.

Three geographically distinct mule deer winter range polygons were mapped by BC Environment staff in support of the Kispiox SRMP planning process. Legal objectives for mule deer winter range were subsequently established for the Kispiox SRMP area, requiring: that >15% of mapped mule deer winter range be managed at a rotation age of 150 years; and that >40% be older than 150 years at any one time.

Although legal objectives have not yet been established for the Cranberry SRMP area, licensee FSP's consistently commit to managing the mule deer winter range polygon in that area in the same fashion. In addressing this objective, licensee FSP's typically commit to ensuring that 40% of the 15% (or 6% of the total hectares of mule deer winter range CMFLB across all three mapped polygons) is older than 150 years at any time. If this condition is violated, the oldest stands within mule deer winter range are deferred from logging until such time as they recruit into the 'less than 150 year' category.

Table 44 shows the forest cover requirement for mapped mule deer winter range polygons that will be modelled.

Table 44. Mule deer winter range forest cover requirements within the Kispiox and Cranberry SRMP

Resource objective	Retention target	Retention criteria age (years)	Applicable land base	CMFLB area (ha)	Current retention (ha)	Current retention percent (%)
Mule Deer Winter Range – Kispiox and Cranberry SRMP areas	Minimum 6%	> 150	Combined CMFLB of all three habitat polygons	29,700	6,200	21

Data source and comments:

District Derived Data Layer: Mule Deer Winter Range polygons – *mule_deer_winter_range*

7.3.5 Northern goshawk (Accipiter gentilis atricapillus)

Goshawks are considered a strong indicator of forest ecosystem health. They are primarily adapted to mature- and old-conifer stands that are even-aged and have a closed canopy with an open understory. What is unclear is the adaptability of goshawks to habitat alteration.

In 2017, the northern goshawk moved from yellow-listed to blue-listed in BC. A blue-listed species is considered not immediately threatened, but at risk due to their sensitivity to human activities or natural events. In the Skeena Region, northern goshawk has been documented to have gone through a 95% population decline in recent years (A. Hetherington, pers com). This decline has been attributed to the loss and fragmentation of mature-old forest habitat. In addition, there has been an increase in mortality by blackflies, both directly and indirectly (disease).

Goshawks are one of six key resource values identified of being of significance to First Nations.

Legal objectives established for the Cranberry SRMP area require maintenance of:

- all known goshawk nests;
- post-fledgling areas, with allowance for operations outside of the critical use period defined as February 15 to August 15;
- and ≥ 60% mature- and old-forest structure and function within determined foraging areas around known goshawk nest and post-fledgling areas.

Licensee FSPs typically commit to a professional assessment of breeding and foraging areas for known nest sites, in accordance with best management practices (e.g. Stuart-Smith *et al*, 2012[25]), and to address any recommended mitigative actions consistent with achieving objectives. One licensee, Gitxsan Forest Licence Inc – GFLI, has elected to extend their Cranberry SRMP practices into their charts within the draft Gitwangak LUP area (i.e. the Lower Skeena Landscape Unit).

Goshawk specific legal objectives are not established in either the West Babine or Kispiox SRMP areas. However, FPPR Section 7(1) requires maintenance of sufficient wildlife habitat (in terms of amount and distribution of area, and attributes) for survival of species at risk (now including goshawk), subject to the requirement that it not unduly impact timber supply. Historically under the Forest Practices Code a 1% timber supply allowance was specified for management of habitats for species at risk identified via the Identified Wildlife Management Strategy (IWMS).

For management of species-at-risk outside the Cranberry SRMP area, licensees typically point to FSP commitments for managing landscape and stand-level biodiversity, riparian habitats, and habitats for key indicator species such as grizzly bear, mule deer, and moose.

To support analysis, District staff developed the following two goshawk spatial layers. Development logic is consistent with best management practices suggested by Stuart-Smith et al (2012).

In the base case analysis known goshawk nest within the Cranberry SRMP will be removed from the THLB. The retention of nest sites outside of the Cranberry SRMP will be incorporated into a sensitivity analysis in order to quantify the timber supply impact of these current management practices.

- *nogo_nestbuff* – comprised of aggregated 100 m radius circular buffers around active and historic nests or nest clusters from WHSE_WILDLIFE_INVENTORY.SPI_SURVEY_OBS_NONSENS_SP
- *nogo_terr* - comprised of 2 km radius circle (~2400 hectare) "foraging territories" centred on nests or nest clusters

For the base case analysis, *nogo_nestbuff* polygons are excluded from THLB in the Cranberry SRMP area and in GFLI charts of the Lower Skeena Landscape Unit. *Nogo_terr* polygons in those same areas will be modelled with a >= 60% (mature + old forest structure) forest cover constraint. Elsewhere, habitat needs for northern goshawk are assumed to be consistent with constraints modelled for other values (e.g., WTRA reductions, OGMA management).

- A sensitivity analysis (ID#9) will explore the impact of applying the above *nogo_nestbuff* and *nogo_terr* constraints across the TSA.

Recently, a project initiated by the Skeena Goshawk Management Committee has led to the identification of *potential* northern goshawk territories, i.e., well-spaced areas comprising 2400 hectares of >60% mature and old forest, refined though spatial analysis to ensure extents reasonably co-locate with harvest-constrained areas such as OGMAs. These potential territories are captured to a *NorthernGoshawk_KxTSR4* spatial layer.

A second sensitivity analysis (ID#10) will explore the timber supply implications of modelling these areas with a (>60% mature & old forest) constraint.

[25] A. Kari Stuart-Smith, William L Harrower, Todd Mahon, Erica L. McClaren, and Frank I Doyle, 2012. A Scientific Basis for Managing Northern Goshawk Breeding Areas in the Interior of British Columbia: Best Management Practices.

Table 45. Goshawk forest cover requirements within the Cranberry SRMP

Resource objective	Retention target	Retention criteria age (years)	Applicable land base	CMFLB area (ha)	Current Retention or (THLB [ha])	Current retention percent (%)
Goshawk – Cranberry SRMP - nest sites and buffers	No harvest		THLB within nest buffer areas, in Cranberry SRMP area and in GFLI chart in Lower Skeena LU	61	(0)	NA
Goshawk - Cranberry SRMP – foraging territories	Minimum 60%	> 100	CMFLB within individual mapped territories	8,589	6,100	71%

Data source and comments:

District Derived Layer: Buffers for active and historic NOGO nests - *nogo_nestbuff*

District Derived Layer: NOGO foraging territories - *nogo_terr*

District Derived Layer: Potential NOGO territories – *NorthernGoshawk_KxTSR4*

7.3.6 Other species of importance

Legal objectives have been established specifying habitat management expectations for bull trout (all SRMP areas) and for certain furbearers (fisher and wolverine – Cranberry SRMP area only). On review it was determined that habitat supply needs are adequately accounted for within existing exclusions and forest cover requirements for other values, e.g., riparian management.

7.3.7 Water - hydrological integrity

All three planning areas have objectives set by government requiring protection of the hydrological integrity of watersheds, and the maintenance of water quality and quantity within the range of natural variability.

During a multi-year process that concluded in 2007, a Kispiox Expert Water Panel (KEWP) of representatives from the Ministry of Forests, Ministry of Water, Lands, Agriculture and Parks, Federal Department of Fisheries and Oceans, Gitanyow Fisheries Authority, and Gitxsan Watershed Authority developed a strategic plan with the following elements:

- Kispiox watershed sub-basins (4th Order Watersheds) agreed-on as the base unit for assessment;
- A Level 1 Watershed Assessment, generated for each sub-basin in accordance with methodologies of the *1995 CODE Interior Watershed Assessment Procedure Guide*book;
- Direction to licensees on required future detailed assessments for each sub-basin, e.g., stream crossing quality assessment, terrain stability, riparian reserve, gentle-over-steep terrain;
- Thresholds to high integrity risk, by sub-basin, for indicators including equivalent clearcut area (ECA), peak flow index, road density, and stream crossing density. Proposed development beyond thresholds "triggers" future detailed assessments.

Licensee FSP's consistently commit:

- To undertake KEWP required assessments, and undertake actions to address assessment recommendations, for all sub-basins in Kispiox TSA;
- To maintain a minimum 10-metre riparian reserve zone on either side of all S4 streams within sub-basins requiring a 'riparian reserve" assessment. This practice advised Section 6.16, '*Riparian reserve and management zone modelling criteria*';
- To additionally complete and abide by the results of a hydrological assessment for all 4th Order Watersheds in the Cranberry SRMP area, and all mid-sized watersheds in the West Babine SRMP area, prior to undertaking development that exceeds ECA thresholds;
- For community watersheds, to ensure operations remain below the high-risk threshold for ECA, and for road density by important elevation or soil sensitivity class.

To approximate current management practice for this value, the model will enforce the Equivalent Clearcut Area % caps specified in Table 46.

Table 46. Equivalent clearcut area caps within Kispiox TSA

Plan area	Applicable unit	Unit name	CMFLB area (ha)	Equivalent clearcut area (ECA) % cap
West Babine SRMP	Mid-sized watershed	Gail	14,789	20
		Hanawald	17,955	30
		Nichyeskwa	7,129	15
		Shedin	27,294	25
		Shelagyote	25,751	20
Kispiox, Cranberry, and West Babine SRMP	4th Order watershed (FOW)	Andi	6,964	22
		Blackstock	3,037	26
		Borden	2,140	22
		Cataline	3,299	21
		Clifford	3,029	23
		Corral	2,304	25
		Cranberry East	3,908	25
		Cranberry West	4,471	25
		Cullon	9,640	23
		Hazelton	6,003	24
		Hevenor	4,291	24
		Ironside	4,751	24
		Kits	246	24
		Kitseguecla East	1,670	24
		Lower Kispiox	33,012	22
		Lower Kitwanga	14,535	22
		Madii Lii	2,453	23
		Tea	5,110	21
		Xsan	7,272	23
	Community watershed	Chicago	81	27
		Sikedakh	1,050	25
		Kits	293	Addressed via Kits FOW
		Juniper	3,013	30
		Station	261	23
		Two Mile	1,899	Addressed via Hazelton East FOW
		Dale	887	Addressed via Lower Kispiox FOW
		Quinmass	6	Addressed via Lower Kispiox FOW
		Ten Link	674	No harvest; see section 6.21

Data source and comments:

District Derived Layer: Mid-Sized Watersheds – *land_units*

District Derived Layer: 4th Order Watersheds – *watershed_4th*

BCGW layer: Community Watersheds – WHSE_WATER_MANAGEMENT.WLS_COMMUNITY_WS_PUB_SVW

The ECA% caps specified for mid-sized watersheds in Table 34 have been copied in from the West Babine SRMP. The ECA% caps specified in Table for 4th Order Watersheds and Community Watersheds are consistent with documented Kispiox Expert Water Panel recommendations.

7.3.8 Biodiversity – patch size distribution

Targets for spatial distribution of cutblocks, also called "patch size distribution," are based on the pattern that would be expected due to natural disturbances such as fire and windthrow. The distribution of patch sizes varies depending on the ecosystem. The assumption is that the wildlife and flora within these ecosystems will be adapted to the landscape pattern and will fare better if these patterns are emulated.

Legal objectives for the distribution and range of patch sizes are established for each planning area within Kispiox TSA, as per Table 47.

All FSP's commit to ensure operations result in a pattern that consistently trends towards the specified distribution targets. Focus is restricted to the subset of openings that are in the 0-20 year range. Openings that "age out" beyond 20 years are dropped from the patch population, and new openings are added in.

Table 47. Patch size distribution ranges by plan area

			Percentage of forested area (CMFLB) within Cranberry SRMP area			
Plan area	**Natural disturbance type (NDT)**	**Biogeoclimatic (BEC) zone variant**	**Small patches (<40 ha)**	**Medium patches (40 - 80 ha)**	**Large patches (81-250 ha)**	**Very large patches (251-1000 ha)**
Cranberry SRMP	NDT 1	MHmm2	30 to 40	30 to 40	20 to 40	-
		ESSFwv	30 to 40	30 to 40	20 to 40	-
	NDT 2	CWHws2	30 to 40	30 to 40	20 to 40	-
		ICHmc2	30 to 40	30 to 40	20 to 40	-
		ICHmc1	30 to 40	30 to 40	20 to 40	-
Kispiox SRMP			Percentage of forested area within each planning unit			
	NDT 1		30 to 40	30 to 40	20 to 40	-
	NDT 2		30 to 40	30 to 40	20 to 40	-
	NDT 3		20 to 30	10 to 20		60 to 80
West Babine SRMP	Mid-sized watershed		Percentage of forested area within mid-sized watersheds			
	Shedin		15	45	20	40
	Babine		10	60	30	-
	Shelagyote		10	60	30	-
	Hanawald		5	10	30	55
	Gail/ Thomlinson		5	10	30	55
	Nichyeskwa		5	10	30	55

Chief forester direction to this analysis, from the last AAC determination, was to use or develop a timber supply model that would permit incorporation of legal patch-size distribution targets.

The spatial model selected for this analysis, Spatial Timber Supply Model (STSM), has a block size distribution function that controls the distribution of patch size. The harvesting component of the STSM model selects eligible and available stands to create an initial harvest cutblock, this block is expanded to adjacent eligible and available stands to reach the target block sizes based on an input distribution.

7.3.9 Biodiversity – seral stage distribution and old growth retention

Legal objectives for seral stage distribution and old growth retention are established for each planning area within Kispiox TSA (Table 48), as one of a number of coarse filter approaches employed for maintaining ecological diversity at the landscape level over time.

Table 48. Seral stage distribution and old growth retention

Plan area	Applicable unit	Biogeoclimatic (BEC) variant	CFMLB area (ha)	% CMFLB retention by BEC subzone		
				Early (maximum %) [current %]	Mature + Old (minimum %) [current %]	Old (minimum %) [current %]
Cranberry SRMP	Upper Kispiox SMZ	ESSFwv	2,697	17 [0]	54 [30]	28** [68]
		ICHmc1	5,883	27 [14]	46 [19]	13** [66]
	Cranberry River	ESSFwv	11,338	22 [2]	36 [70]	19** [23]
		MHmm2	279	22 [0]	36 [100]	19** [0]
		CWHws2	7,028	36 [15]	34 [64]	9** [6]
		ICHmc1	9,263	36 [14]	31 [25]	9** [56]
		ICHmc2	23,643	36 [25]	31 [45]	9** [13]
	Kispiox	ESSFwv	218	22 [0]	36 [78]	19** [22]
		ICHmc1	21	36 [24]	31 [24]	9** [57]
		ICHmc2	94	36 [1]	31 [1]	9** [99]
	Kiteen	MHmm2	571	22 [0]	36 [91]	19** [6]
		CWHws2	886	36 [6]	34 [77]	9** [17]
		ICHmc2	2052	36 [41]	31 [35]	9** [1]
	Kitwancool	ESSFwv	9525	22 [0]	36 [19]	19** [81]
		CWHws2	4,228	36 [10]	34 [16]	9** [72]
		ICHmc2	1,251	36 [13]	31 [36]	9** [26]
	Kitwanga	ESSFwv	2,282	22 [7]	36 [33]	19** [53]
		CWHws2	5,215	36 [19]	34 [19]	9** [39]
		ICHmc2	6,255	36 [10]	31 [39]	9** [13]
	Moonlit	ESSFwv	10,290	22 [3]	36 [19]	19** [77]
		CWHws2	6,523	36 [21]	34 [29]	9** [47]
		ICHmc2	4,919	36 [30]	31 [38]	9** [19]
	Nass River Kalum	ICHmc1	4,869	36 [27]	31 [56]	9** [1]
		ICHmc2	515	36 [13]	31 [66]	9** [1]
	Sweetin	ESSFwv	12	22 [0]	36 [8]	19** [92]
		ICHmc1	3,570	36 [20]	31 [37]	9** [33]
		ICHmc2	35	36 [0]	31 [0]	9** [100]
	Upper Cranberry	ESSFwv	9,449	22 [1]	36 [22]	19** [77]
		MHmm2	58	22 [0]	36 [19]	19** [81]
		CWHws2	5,112	36 [3]	34 [11]	9** [85]
		ICHmc2	273	36 [10]	31 [17]	9** [73]
Kispiox SRM	Atna	ESSFwv	17,384	22 [0]	36 [34]	Assumed captured through Old Growth Management Areas (OGMA) and do not contribute to THLB
		SBSmc2	452	54 [0]	23 [33]	
	Deep Canoe	ESSFwv	3,333	22 [0]	36 [17]	
		ICHmc1	3,754	36 [14]	31 [23]	
	Hazelton Mid-Sized Watershed	ESSFwv	5,794	22 [0]	36 [51]	
		ICHmc1	4,927	36 [11]	31 [47]	
		ICHmc2	15,298	36 [8]	31 [59]	9 [3]

Plan area	Applicable unit	Biogeoclimatic (BEC) variant	CFMLB area (ha)	% CMFLB retention by BEC subzone		
				Early (maximum %) [current %]	Mature + Old (minimum %) [current %]	Old (minimum %) [current %]
	Juniper	ESSFwv	4,119	22 [1]	36 [34]	Assumed captured through Old Growth Management Areas (OGMA) and do not contribute to THLB
		ICHmc2	3,549	36 [6]	31 [52]	
	Kispiox	ESSFwv	6,297	22 [5]	36 [18]	
		ICHmc1	15,059	36 [30]	31 [13]	
		ICHmc2	30,789	36 [30]	31 [35]	
	Kitseguecla	ESSFwv	13,627	22 [2]	36 [17]	
		MHmm2	13	22 [0]	36 [46]	
		CWHws2	8,246	36 [12]	34 [19]	
		ICHmc2	9,545	36 [29]	31 [48]	
	Kitwanga	ESSFwv	375	22 [4]	36 [61]	
		CWHws2	739	36 [15]	34 [52]	
		ICHmc2	9,207	36 [15]	31 [34]	
	Kuldo	ESSFwv	10,321	22 [0]	36 [11]	
		ICHmc1	7,348	36 [4]	31 [19]	
	Larkworthy	ESSFwv	7,131	22 [1]	36 [30]	
		ICHmc1	17,197	36 [7]	31 [40]	
		ICHmc2	371	36 [27]	31 [33]	
	McCully	ESSFwv	11,841	22 [1]	36 [16]	
		ICHmc1	6,896	36 [7]	31 [25]	
		ICHmc2	12,028	36 [11]	31 [62]	
	Natlan	ESSFwv	8,014	22 [7]	36 [41]	
		ESSFww	18	22 [0]	36 [67]	
		ICHmc1	5,409	36 [22]	31 [33]	
		ICHmc2	1,954	36 [33]	31 [23]	
	Seven Sisters	ESSFwv	12	22 [0]	36 [0]	
		MHmm2	8,245	22 [0]	36 [20]	
		CWHws2	10,029	36 [2]	34 [65]	
		ICHmc1	7,191	36 [7]	31 [69]	
	Shedin	ESSFwv	107	22 [0]	36 [15]	
		ICHmc1	24	36 [0]	31 [38]	
		ICHmc2	4	36 [0]	31 [50]	
	Shegunia	ESSFwv	10,060	22 [2]	36 [33]	
		ICHmc1	5,524	36 [8]	31 [45]	
		ICHmc2	2,721	36 [18]	31 [63]	
	Sheladamus	ESSFwv	8,363	22 [1]	36 [20]	
		ICHmc1	16,654	36 [3]	31 [21]	
	Shelagyote	ESSFwv	8	22 [0]	36 [0]	
	Sicintine	ESSFwv	8,259	22 [0]	36 [31]	
		ICHmc1	5,569	36 [0]	31 [10]	
		SBSmc2	3,200	54 [0]	23 [28]	
	Skeena West	ESSFwv	38	22 [0]	36 [71]	
		MHmm2	7,562	22 [0]	36 [20]	
		CWHws2	13,437	36 [5]	34 [31]	
		ICHmc2	5,508	36 [7]	31 [74]	
		ESSFwv	7,742	22 [9]	36 [15]	

Plan area	Applicable unit	Biogeoclimatic (BEC) variant	CFMLB area (ha)	% CMFLB retention by BEC subzone		
				Early (maximum %) [current %]	Mature + Old (minimum %) [current %]	Old (minimum %) [current %]
West Babine SRMP	Skeena Crossing	MHmm2	129	22 [0]	36 [42]	9 [5]
		CWHws2	4,142	36 [21]	34 [33]	
		ICHmc1	1,152	36 [20]	31 [50]	
		ICHmc2	23,169	36 [26]	31 [53]	
	Suskwa Mid-Sized Watershed	ESSFwv	7,651	22 [1]	36 [50]	
		ICHmc1	6,632	36 [20]	31 [50]	
		ICHmc2	6,126	36 [21]	31 [53]	
	Sweetin	ESSFwv	3,446	22 [1]	36 [19]	Assumed captured through Old Growth Management Areas (OGMA) and do not contribute to THLB
		ICHmc1	6,364	36 [17]	31 [9]	
		ICHmc2	611	36 [36]	31 [50]	
	Tenas	ESSFwv	9,140	22 [3]	36 [28]	
		ICHmc1	12,439	36 [15]	31 [28]	
		ICHmc2	14,026	36 [29]	31 [47]	
	Upper Kispiox	MHmm2	9,251	22 [0]	36 [12]	
		ICHmc1	25,138	36 [0]	31 [15]	
		ICHmc2	31	36 [52]	31 [0]	
	Across West Babine SRMP area	ESSFwv	41,631	11 [0]	61 [34]	39 [66]
		ESSFmc	32,758	26 [7]	44 [27]	15 [59]
		ICHmc	28,783	27 [2]	46 [46]	13 [49]
		SBSmc	30,695	39 [1]	35 [44]	17 [53]

[**]Old Growth Management Areas (OGMA) established in the Cranberry SRMP area are removed from the THLB. However, the old seral forest captured within these OGMAs did not consistently achieve the target values specified here, thus these retention targets will be modelled to make up the difference.

Early forest is defined as < 40 years across all BEC subzones.

Mature forest is defined as > 80 years for CWH, > 100 years for ICHmc and SBSmc. > 120 years for ESSF and MH.

Old forest is defined as > 250 years except in the SBSmc where it is defined as > 140 years.

Data source and comments:

BCGW Layer: SRMP areas - *RMP_STRGC_LAND_RSRCE_PLAN_SVW*

BCGW Layer: Upper Kispiox Special Management Zone – *RMP_PLAN_LEGAL_POLY_SVW*

BCGW Layer: Biogeoclimatic variant - *BEC_BIOGEOCLIMATIC_POLY*

District Derived Data Layer: Planning Unit – *plan_unit*

District Derived Data Layer: Mid-Sized Watersheds – *land_unit*

7.3.10 Biodiversity – ecosystem networks and buffers

Ecosystem networks (EN) are legally established in the Cranberry and West Babine SRMP areas. Timber harvest land base reductions associated with EN were specified previously (see Section 6.13.2, '*Ecosystem Networks*').

The EN in the Cranberry SRMP area is further protected by a 200 metre buffer (100 meters on each side), which has a legal objective requiring retention of 70% or greater "mature and old" forest structure (live trees, range of diameter classes, snags, coarse woody debris, tree species, etc.).

Landscape riparian corridor elements of the EN in the West Babine have the same forest cover requirement.

- "Mature and old" seral thresholds of 80 years or greater for CWH, 100 years or greater for ICHmc and SBSmc, and 120 years or greater for ESSF and MH pertain (Section 7.3.9). These modelling requirements are presented in Table 38.

Ecosystem networks – and protective buffers – are also spatially delineated in the Gitwangak LUP and Gitsegukla SRMP areas. In accommodation to First Nations referral concerns, three licensees elected to extend their commitments for Cranberry SRMP EN management into their chart areas within the Gitwangak LUP area. Retention requirements for the Gitwangak LUP and Gitsegukla SRMP areas as shown in Table 49.

Table 49. Ecosystem networks forest cover requirements within the Cranberry and West Babine SRMP

Resource objective	Retention target	Retention criteria age (years)	Applicable land base	CMFLB area (ha)	Current retention (ha)	Current retention percent (%)
Biodiversity – Cranberry SRMP - Ecosystem Network Buffers	Minimum 70%	CWH >80	CMFLB within individual buffer elements in Cranberry SRMP area and in GFLI chart in Lower Skeena LU	28,992	22,364	77%
		ICH >100		62,621	39,646	63%
		SBS >100		0		
		ESSF >120		45,805	44,054	96%
		MH >120 years		908	889	98%
Biodiversity – West Babine SRMP – Landscape Riparian Corridors	Minimum 70%	CWH >80	CMFLB within individual landscape corridor elements	0		
		ICH >100		28,783	27,545	96%
		SBS >100		30,696	21,099	69%
		ESSF >120		74,342	69,381	93%
		MH >120 years		0		

Data source and comments:

BCGW: Cranberry SRMP Ecosystem Network buffer – *RMP_PLAN_NON_LEGAL_POLY_SVW*, NON_LEGAL_FEAT_OBJECTIVE = 'Ecosystem Network Buffer'

BCGW: West Babine SRMP Landscape Riparian Corridors – *RMP_PLAN_LEGAL_POLY_SVW*, LEGAL_FEAT_OBJECTIVE = 'Landscape Corridors'

7.3.11 Visual quality

Scenic areas - and visual quality objectives (VQOs) for their viewscapes - are legally established in Kispiox TSA.

- Scenic areas were legally "made known" to *Forest Act* agreement holders via a March 1998 Kispiox District Operating Procedure, and include recreation sites, recreation trails, travel corridors, viewsheds, provincial parks, and important recreational fishing areas. Scenic areas are grandparented to the present day through provisions of Section 180 of the *Forest and Range Practices Act* (FRPA).

Three categories of VQO exist for the Kispiox TSA land base, these include: VQOs established during the Forest Practices Code (CODE) era via the 2004 West Babine SRMP and Kispiox LRMP, grandparented to the present day through provisions of FRPA section 181.

- VQOs established via Government Actions Regulation Section 17 (GAR 17), which enables a visual quality class (VQC) for a scenic area to be continued as a VQO where prior to October 24, 2002 the

District Manager advised *Forest Act* agreement holders of assigned visual sensitivity class (VSC) by letter. The Kispiox District Manager released just such a letter on October 29, 1999.

Forest Planning and Practices Regulation Section 9.2 subsequently enabled inference of VQO from the visual sensitivity class (VSC):

For VSC = 1, VQO can range from preservation to retention;

For VSC = 2, VQO can range from retention to partial retention;

For VSC = 3, VQO can range from partial retention to modification;

For VSC = 4, VQO can range from partial retention to modification;

For VSC = 5, VQO can range from modification to maximum modification;

By default the lowest permissible VQO for the VSC was identified as the established VQO.

- VQOs for scenic areas "made known" by name during the Forest Practices Code era, but where spatial mapping of VQO extent did not occur until the FRPA era. A GAR process remains necessary for legal VQO establishment.

These areas remain subject to a legal Kispiox LRMP objective to "maintain visual quality in [named] scenic areas". A *CODE*-era District Manager letter to licensees required interim actions comparable to "Modification" (M) VQO management, and on that basis these areas shall be modelled with a "Modification" VQO over-writing the established VQO provided on the BCGW file.

For this analysis visual resource management is modelled in accordance with the *Procedures for Factoring Visual Resources into Timber Supply Analyses* (MOF 1998) using planimetric % alteration ranges for each VQO modified by visual absorption capability (VAC) rating of each visual polygon (Table 50). This approach is preferred over a single percent alteration for each VQO to better reflect the wide variation in landscape conditions.

Table 50. Assignment of visual quality objectives by planimetric view and visual absorption capability (VAC)

Established VQO**	Gross land base (hectares)	% alteration by VAC (planimetric view)		
		Low	Medium	High
Preservation	1,979	0.17	0.50	0.83
Retention	6,476	2.0	3.0	4.0
Partial retention	1,303	6.7	10.0	13.3
Modification	3,569	16.7	20.0	23.3

** Source: *VEGETATION.REC_VISUAL_LANDSCAPE_INVENTORY*

A modified VQO methodology will be applied in this analysis. The modification includes alterations to the VAC ratings used to divide the percent alteration ranges into thirds, and the mid-point of each third is used as a generalized target to model each combination of VQO and VAC[26]. The modified procedures also determined a weighted visually effective green-up (VEG) height for each visual unit based on slope classes (Table 51). This procedure is used in the base case.

[26] Peter Rennie, Landscape Forester, FLNRORD.

Table 51. Slope classes for calculating VEG height

Visual quality vegetation height requirements											
Slope classes (%)	0-5.0	5.1-10	10.1-15	15.1-20	20.1-25	25.1-30	30.1-35	35.1-40	40.1-45	45.1-50	50.1-55
Height (metres)	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	6.5	7.0	7.5

Data source and comments:

Procedures for Factoring Visual Resources into Timber Supply Analyses (MOF 1998).

7.3.12 Other special management zones

Table 52 lists and specifies modelling considerations for all remaining special management zones with legal objectives.

Table 52. Considerations for other special management zones

SRMP area	Special management zone	Objectives	Modelling considerations
Kispiox	East Kispiox/Kuldo	Maintain scenic resources, backcountry recreation opportunities and habitat for grizzly bears and mountain goats.	Addressed – see Visual Quality, Recreation Sites and Trails, Mountain Goat, and Grizzly sections
	Atna/Shelagyote	Maintain scenic resources, backcountry recreation opportunities, grizzly bear denning habitat, mountain goat habitat and extensive wetlands.	Addressed – see Visual Quality, Recreation Sites and Trails, Mountain Goat, Grizzly, and Riparian sections
	Rocher Deboule	Maintain scenic resources, backcountry recreation opportunities and wildlife habitat.	Addressed – see Visual Quality, Recreation Sites and Trails, and 7.3 Wildlife subsections
	Upper Kispiox	Emphasis on maintaining visual and water resources, recreation resources, habitats for grizzly and important fish, and traditionally used plants.	Addressed – see Visual Quality, Riparian, Water – Hydrological Integrity, Recreation Sites and Trails, Grizzly,Stand-Level Biodiversity, Cedar Management, and Cultural Heritage Resources sections
West Babine	Babine River	Protect grizzly, recreation/tourism, fish habitat and water quality values in areas adjacent to Babine River Corridor Park	More than 30% of forest stands to be greater than 140 years in age. Captured to Table 38.
Cranberry	Upper Kispiox	Emphasis on maintaining wildlife habitat, water quality, and fish habitat values	Addressed – see 7.3 Wildlife subsections, and Riparian, Water Management Unit, and Water – Hydrological Integrity sections
	Alice Good Catchment Area	Water quality	Addressed – see Ecosystem Networks section

Table 53. Babine River SRMZ forest cover requirements

Resource objective	Retention target	Retention Criteria age (years)	Applicable land base	CMFLB area (ha)	Current retention (ha)	Current retention percent (%)
Special Management Zone – West Babine SRMP – Babine River	Minimum 30%	>140	CMFLB within SMZ	10,767	10,758	93

7.4 Cedar management

Gitxsan and Gitanyow First Nations are concerned with potential unsustainable harvesting of cedar, affecting their ability to acquire cedar of suitable size and quality to meet current and future cultural and domestic needs.

A *Plan for a Long-Term Sustainable Supply of Cedar for Gitanyow Cultural and Domestic Purposes* was completed March 2008, for Gitanyow Traditional Territory within Kispiox TSA. The Plan identified cedar stand reserves and cedar management strategies intended to supply long-term Gitanyow cultural and domestic needs estimated at 1000 m^3/year.

The Cranberry SRMP LUOR Order established a legal objective to maintain mapped areas in Schedule K as a source of cedar for traditional, cultural and subsistence uses for cultural heritage resources.

- These areas are associated with First Nations Woodlands Licence (FNWL) #N3A, which immediately pends issuance to Gitanyow Huwilp Society.
- As Gitanyow's current FSP specifies intent for both traditional use and small-scale harvest, these areas are retained in the THLB. For analysis purposes this management is captured with the maximum disturbance criteria reported in Table. A multi-pass system is modelled through seral retention requirements to mimic licensee intent, as captured to Table 39 (above).

Because a comparable spatially-based cedar management strategy has yet to be completed within Gitxsan Traditional Territory, no specific cedar modelling constraints are proposed in this analysis. Considering the relative size of Gitxsan *versus* Gitanyow population, 10 000 m^3/year may reasonably address the need. FLNRORD will look to explore sustainability of maintaining cedar volume harvest levels over time.

Table 54. Cedar reserve polygon forest cover requirements within the Cranberry SRMP

Resource objective	Retention target	Retention criteria age (years)	Applicable land base	CMFLB area (ha)	Current retention (ha)	Current retention percent (%)
Cedar – Cranberry SRMP - Cedar Reserve Polygons	**Maximum 15%**	**<40**	**Combined CMFLB for all polygons**	**681**	**26**	**4**

Data source and comments:

BCGW Layer: RMP_PLAN_LEGAL_POLY_SVW;

LEGAL_FEAT_OBJECTIVE = "Cedar Stand Reserves"

7.5 Forest health

7.5.1 Dothistroma (Dothistroma septosporum)

Dothistroma needle blight is a significant agent affecting the health of young pine in the CWH, ICH and transitional ICH/ SBS zones of the Kispiox TSA[27]. Dothistroma causes premature loss of needles which over successive years can significantly reduce pine growth. In worst cases, regenerated stands have experienced 100% pine mortality. Individual trees seldom recover from Dothistroma as it stays dormant in dry years then becomes active again in moist years.

[27] Woods, A., Coates, K.D. and Hamann, A., 2005. Is an unprecedented Dothistroma needle blight epidemic related to climate change?. BioScience, 55(9), pp.761-769.

In 2002 the District and Region conducted detailed aerial overview surveys to assess the extent, severity and impact of Dothistroma across all openings with a pine component exceeding 50%. Management classes were then assigned to over 700 strata in Kispiox TSA. These strata formed the nucleus of the District's Dothistroma Management Program, which carries on to the present day.

- "Action Imperative" opening treatment strata (currently 25 total) are targeted for immediate silviculture action (e.g., ground survey/ treatment prescription, rehabilitation, planting/fill-planting, or brushing) to assist non-pine species survival and to achieve stocking standards. District objective is for 5% or less, loss of productive area to NP Brush. Any area that converts to NP Brush will be captured in the forest cover layer in RESULTS.
- "Wait and See" strata (currently 204 total) typically have marginal stocking of conifers other than pine, and low-moderate current Dothistroma severity. Every two years these stands are aerially monitored to reassess DFS severity, and immediately reassign to Action Imperative if severity class elevates to High.
- No action is undertaken for "Stocking Likely Without Pine" strata.

Table 55. Management classification for stands with greater than 50% pine in the Kispiox TSA

Dothistroma management category	Total area (ha)
Action Imperative	1,653
Wait and See	5,681
Stocking Likely Without Pine	17,278

It is expected that the majority of Dothistroma affected stands will become re-stocked through either natural or artificial regeneration and the primary effect on timber supply will be a delay in achieving full stocking.

In the 2008 Kispiox Timber Supply Review base case analysis Dothistroma affected stands were addressed by converting the pine stands to alternate species and applying age reduction adjustment. In this analysis Dothistroma will be modelled in the base case as follows:

- "Stocking likely without pine" will have their specific managed stand yield table adjusted so that the volume at each age is reduced by the incremental volume of the past 10 years. This will capture the existence of younger conifers below the main pine canopy that will form new stands after the pine dies. Species composition will be adjusted such that the pine component of the stand will be assigned to the next leading species.
- "Wait and See" will remain on their existing specific managed stand yield table from their current age. This represents normal growth.
- "Action Imperative" will have their specific managed stand yield table adjusted so that the volume at each age is reduced by the incremental volume of the past 20 years to a minimum volume of 0. This represents immediate fill planting to increase stocking of existing understocked conifers in these stands. Species composition will be adjusted such that the pine component of the stand will be assigned to the next leading species.

7.5.2 Tomentosus root disease (*Inonotus tomentosus)*

Tomentosus (*Inonotus tomentosus*) root disease is found frequently in spruce and pine stands in central and northern British Columbia, and at higher elevations in southern BC. Tomentosus can result in reduced annual growth, and lead to volume loss over the rotation. Additionally, the disease can persist in stumps and infect regenerating stands.[28]

[28] 2018, Managing Root Disease in British Columbia, Ministry of Forests, Lands, Natural Resource Operations and Rural Development.

Two ongoing studies are investigating Tomentosus in spruce-leading stands in the ICH zone of the Kispiox TSA (Alex Woods – Regional Pathologist). The first investigates the impact of Tomentosus in mature stands, the second investigates the disease in managed stands, each study is described briefly below.

Tomentosus in Mature Stands

The first study examined 50 spruce-leading stands older than 80 years. A summary of this study, as well as modelling parameters for Tomentosus in mature stands is described in Section 7.5.4 below.

Tomentosus in Managed Stands

The second study examined 10 spruce-leading plantations. This study began in 2000 when research plots were established, by the regional forest pathologist, in the oldest managed spruce stands in the Kispiox TSA. The 10 stands were randomly selected from the population of spruce-leading plantations, aged 20 to 30 years old at the time of plot establishment, from the ICH zone of the Kispiox THLB. The population contained just over 50 stands, as clearcut harvesting was not common practice in the area prior to the late 1960s. Stands were selected without prior knowledge of Tomentosus root disease presence or incidence.

The study found that near age 50, measured spruce volumes were 30% less than modelled volumes, after standard OAFs were applied. The study results indicate total merchantable volumes are 17% less than the modelled volumes for 40 to 48-year-old stands due to Tomentosus root disease in spruce leading stands (greater than 50% spruce) within the ICH. The research concluded, that the difference between TASS II projections and measured stand volumes, are due to a combination of root disease impacts and the uneven natural distribution of trees in typical operational plantations.

Based on this research, the base case will reduce yield projections for the spruce component of managed stands within the ICH biogeoclimatic zone by 30%. A sensitivity analysis (ID#7) will explore the timber supply impact of applying no reduction to, and an additional analysis will apply the 30% reduction to the spruce component of all managed stands throughout the Kispiox TSA (to match the reduction applied in the base case for the ICH).

7.5.3 Other forest health issues

Forest health damaging agents present within Kispiox TSA include insects, pathogens, animals, and abiotic events (e.g., fire), many of which have the potential to cause significant timber loss[29]. The empirical basis of the model VDYP, and the use of operational adjustment factors or specific options (e.g., for root rots) in the model TIPSY, are presumed to capture volume loss due to endemic levels of pests.

Catastrophic losses (e.g. fires), and epidemic pest infestations are unpredictable, and highly variable from year to year. The capture of such losses is described below under non-recoverable losses. The principle of regularly revisiting the AAC decision and the ability to revisit a decision earlier are important components of the AAC decision to address unpredictable events.

7.5.4 Non-recoverable losses

Non-recoverable losses (NRL) are accounted for by estimating an average annual unsalvaged loss and deducting this amount from the harvest projection throughout the forecast horizon (Table 56).

Additional and detailed considerations by forest health agent are provided in sections to follow.

[29] FLNRORD's Forest Health Program evaluates the impact of forest health damaging agents on forest resource values and when necessary prescribes and implements management practices aimed at protecting or recovering forests. https://www2.gov.bc.ca/gov/content/industry/forestry/managing-our-forest-resources/forest-health

Table 56. Kispiox THLB volumes killed and not harvested, 1999-2018 annual and average

Year	Balsam Bark Beetle	Mountain Pine Beetle	Spruce Beetle	Drought	Fire	Flooding
1999	279,685	894	0	0	-	-
2000	219,843	0	60,519	0	-	-
2001	1,264,082	557	69,302	0	-	1,820
2002	106,546	209	0	0	-	2,419
2003	154,277	375	572	0	-	-
2004	35,181	1,085	152	0	12,821	567
2005	41,976	183	4	0	1,741	564
2006	97,880	28	0	0	702	1,564
2007	59,805	9,618	0	0	144	342
2008	12,505	63,617	0	0	-	-
2009	62,374	23,971	141	0	39,139	1
2010	51,141	34,552	90	0	240	672
2011	9,543	62,463	0	0	-	998
2012	27,506	51,643	0	0	-	198
2013	42,445	16,393	0	0	92	546
2014	65,261	8,720	2	0	-	-
2015	73,879	274	21	0	-	-
2016	119,882	0	125	0	-	-
2017	62,075	1,193	383	414	-	324
2018	62,106	0	1,144	53,049	168,111	-
Totals (m^3)	2,847,992	275,775	132,455	53,463	378,919	10,015
20-year Average	142,400	13,789	6,623	2,673	18,946	501

Data source and comments:

- https://www.for.gov.bc.ca/ftp/HFP/external/!publish/Forest_Health/
- Circa 2001 forest inventory derived from the circa 2001 Vegetation Inventory (VRI) and the circa 2001 State of the Forest;
- 1999 through 2017 Aerial Overview Surveys (AOS) of Forest Health;
- Logging history derived from the VRI and RESULTS databases;
- Provincial Mountain Pine Beetle Spread Model (https://www2.gov.bc.ca/gov/content/industry/forestry/managing-our-forest-resources/forest-health/forest-pests/bark-beetles/mountain-pine-beetle/mpb-projections)
- Best available provincial Timber Harvesting Land Base as of 2017.

Table 56 content for the year 2018 was derived by the District, applying essentially the same methodology against 2018 AOS spatial data. Wildfire losses were refined in reference to provincial Burn Severity mapping (*fires_2018*, which distinguishes high-, medium-, low-severity and unburned areas), and factoring in known operational or accessibility constraints.

Table 56 shows THLB volumes that were killed and to date have not been harvested. As an annual average, less than 3% of killed THLB volumes were harvested during the specified 20-year period.

For the base case, the District is comfortable with having the Table 40 “20-year average” figures represent Kispiox NRL’s for all but Western Balsam Bark Beetle. These volumes will be deducted from the harvest projection annually, throughout the forecast horizon.

NRL considerations for Western Balsam Bark Beetle follow below.

Western Balsam Bark Beetle (IBB)

Western Balsam Bark Beetle is the most destructive pest of mature subalpine and amabilis fir in British Columbia. Provincial AOS mapping indicates that IBB is now widespread throughout higher elevation balsam-leading (ESSF and MH) stands in Kispiox TSA. This development is concerning, as balsam comprises close to 40% of residual mature THLB volumes.

IBB is often characterized as a "chronic endemic" pest. A recent southern BC study[30] found on average up to 1% annual balsam mortality and in excess of 30% cumulative mortality occurring in mature and old balsam-leading ESSF stands. District experience is that largest and highest volume trees are killed and canopy gaps fill with younger cohorts, resulting in a forest matrix where merchantable stand volumes stabilize at levels below or equal to 70% of potential. However, mortality in the largest and highest volume balsam stems continues, and currently balsam mortality is typically not recovered.

Currently, district staff and the regional entomologist are working with provincial specialists to better understand how stand-level balsam mortality is captured by VDYP loss factors for balsam in the ESSF and MH zones. As this work is ongoing the NRLs reported in Table 40 will be applied in the base case analysis.

To explore the potential impact of IBB a sensitivity analysis will be completed. The sensitivity analysis (ID#8) will apply a 30% yield reduction to balsam-leading stands older than 250 years and within the ESSF.

Mountain Pine Beetle (IBM)

IBM is one of the most destructive insect pests of mature pine in BC. The Kispiox TSA was at the extremity of the IBM epidemic that recently affected BC's central interior which saw increased infestation levels that peaked in 2011 and have since declined to low levels. For Kispiox TSA, the pest is of relatively minor concern because mature pine-leading stands comprises less than 10% of the THLB[31], frequently occurring in geographically isolated bands along river terraces and ridges.

Spruce Beetle (IBS)

IBS is currently causing widespread damage in mature spruce forests in several geographic areas of BC, locally including Bulkley, Morice and Lakes TSA's. IBS is of definite concern for Kispiox TSA because spruce has high economic value, and residual mature spruce-leading stands comprise about 15% of the THLB.

Table 40 identifies relatively minor NRL's attributed to IBS. Additional to provincial AOS, detailed aerial overview surveys (DAOS) were conducted by District in both 2017 and 2018. To confirm Table 40 figures, District ran a visual comparison of AOS to DAOS, and is comfortable with the degree of correspondence.

Wildfire

An analysis conducted in support of Kispiox TSR2 explored wildfire losses from 1978 to 1998. A comparable approach to that used in creating *VolumeLossesByTSA.1999-2017.THLB2017.xlsx* was employed. The resulting NRL figure of 12 105 m^3/year is ultimately quite similar to the Table 40 NRL figure (18 946 m^3/year) derived from wildfire losses that occurred during the 1999-2018 period.

Despite the similarity, significantly higher volumes burned in 2018 than in any other year during the period. Climatologists predict increased intensity and frequency of wildfires during the 2020 to 2050 period as climate envelopes shift within coastal-interior transition units such as Kispiox TSA.

[30] Maclauchlan, Lorraine. (2016). Quantification of *Dryocoetes confusus*-caused mortality in subalpine fir forests of southern British Columbia. Forest Ecology and Management. 359. 210-220. 10.1016/j.foreco.2015.10.013.

[31] Source: Section 3.1 of Timberline Forest Inventory Consultants Ltd. March 2007. *Kispiox Timber Supply Area – Timber Supply Review III – Timber Supply Analysis Report, Version 5.0*. Prepared for: Kispiox TSA DFAM Group. 157 pp.

For this analysis, District presently supports the relatively low NRL figure as it is consistent with historic wildfire loss levels. The chief forester may elect to revisit the Kispiox AAC sooner than 10 years, in the situation that wildfire losses occur post-decision at levels that affect short- to mid-term timber supply.

Drought

Table 40 shows that drought-induced mature volume kill has been identified by the AOS dating back to 2014, with 2018 seeing a significantly increased intensity and area of occurrence. Although this is an alarming development, it cannot as yet be confirmed as a trend.

Other forest health agents

Windthrow events in the Kispiox are small area and sporadic in nature. No events were recorded in the 2018 provincial aerial overview survey (AOS). For this analysis windthrow levels will be considered "endemic" thus addressed within VDYP growth and yield curves. Aspen Leaf Miner (474 996 m^3 affected in 2018) and Satin Moth (37 161 m^3 affected in 2018) are serious defoliators of all species of poplar and willow.

An Aspen Leaf Miner outbreak has been occurring in northwestern BC since the early 2000's. Heavily damaged leaves can lose up to 75% of their photosynthetic capability. Although limited mortality has been confirmed, severe defoliation in successive years is suspected to result in reduced growth, branch die back and top-kill.

Satin Moth are capable of completely defoliating trees. Severe defoliation in consecutive years results in reduced radial growth of stems, branch mortality, and some tree mortality. The impact of defoliation can be severe on trees already stressed by other factors such as drought.

Neither pest is considered immediately limiting to the Kispiox timber supply, because deciduous volumes are excluded from the THLB. However, such cumulative loss erodes stand- to landscape-level biodiversity retention strategies designed to address non-timber objectives, e.g. wildlife habitat needs.

Tomentosus in mature stands

A study of spruce-leading stands older than 80 years found endemic losses to Tomentosus in 46 of 50 stands. The volume loss of spruce and lodgepole pine stems in these stands was estimated to be 4.29 m^3/hectare/year (Alex Woods pers com).

Measured stand volumes were then compared to VDYP estimates for those same polygons, measured mean net volumes across study polygons were found to be 22% greater than modelled volume estimates, the study found that volume loss in spruce was offset by gains in hemlock (Alex Woods pers com). Based on this research it was concluded that losses associated with Tomentosus root disease in spruce-leading stands older than 80 years are adequately reflected in VDYP yield predictions and that a non-recoverable loss adjustment is not required for this analysis.

7.6 Disturbance outside of the timber harvesting land base

Many forest cover requirements described in Table 57 apply to the Crown managed forest land base (CMFLB), which includes forested areas outside of the THLB. Over time portions of the forested areas outside of the THLB undergo natural disturbance events which affect age class distribution and forest cover conditions. Disturbance events change the seral condition of forest from old to young, not modelling disturbance would result in an overestimation of future old-seral forest conditions.

Approximately 77% of CMFLB outside the THLB is comprised of mature- and old-seral age classes (age classes 7, 8 and 9). Stands less than 20 years of age comprise less than 7% of this land base. This skew to mature- and old-stands is likely attributable to successful fire suppression efforts.

The base case scenario will incorporate natural disturbances based on return intervals defined in the 1995 *Forest Practices Code of British Columbia Biodiversity Guidebook*. For each year of the forecast, a representative area will be modelled as disturbed and the stand age reset to 0 years old.

Table 57. Natural disturbance return intervals

BEC zone	NDT	Return interval (years)	Old growth age (years)	Rotation length (years)	Forested non-THLB (hectares)	Periodic area disturbance (hectares/year)
CWH	2	250	250	395	41,678	105
ESSF	1	350	250	490	178,575	365
ESSF	2	150	140	231	20,206	88
ICH	2	200	250	350	169,445	484
MH	1	350	250	490	15,431	32
SBS	3	350	250	490	21,019	43

Data source and comments:

Timberline Forest Inventory Consultants Ltd. March 2007. *Kispiox Timber Supply Area – Timber Supply Review III – Timber Supply Analysis Report, Version 5.0.* Prepared for: Kispiox TSA DFAM Group. 157 pp.

8. Growth and Yield

8.1 Growth and yield models

Knowledge of the volume available from stands over time is a critical input for timber supply modelling. Growth and yield models are used to generate the volume estimates based on the characteristics of the individual stands.

To quantify the volume of timber available from a stand over time, volume tables are created based on stand attributes, growth characteristics, and the most suitable growth and yield model. Wherever possible yield projections will be developed for individual forest polygons or silvicultural openings. Yield projections for stands without the necessary input information will (e.g., for future stands) be built through the aggregation of attributes from similar stands.

For the current analysis, two of the Ministry's growth and yield models will be used. The model VDYP was specifically developed to project the mature forest inventory. The model TIPSY is suitable for projection based on regeneration characteristics of a managed stand.

8.1.1 Variable density yield prediction model (VDYP7)[32]

The Variable Density Yield Prediction (VDYP7) model, developed by the FLNRORD, is an empirical growth model that has been parameterized based on a large temporary (52,000 plots) and permanent (9,300 plots) sample plot database collected from mature natural forests in British Columbia.

Input information for the VDYP7 model is based on VRI attributes, typically at the individual forest polygon level. Decay, waste and breakage estimates are incorporated within VDYP7 and are based on biogeoclimatic ecosystem classification (BEC) loss factors using a decay sample tree database which consists of over 82,000 trees.

8.1.2 Table interpolation program for stand yields (TIPSY)[33]

The Table Interpolation Program for Stand Yields (TIPSY) provides yield tables for single-species and even-aged stands based upon the interpolation of yield tables generated by the individual tree growth model Tree and Stand Simulator (TASS). Mixed species yield tables generated by TIPSY are weighted averages of single-species yields and do not directly considered inter-species interactions.

Input information for TIPSY is based on stand initiation characteristics including species, initial density, regeneration method (planted or natural), genetic gains, and potential site index. TIPSY also enables considerations for various silviculture treatments, forest health, and general operational adjustment factors.

BatchTipsy Composer version 5.0 will be used for this analysis. This version uses a database of TASS III generated yield tables for lodgepole pine and white spruce and TASS II generated yield tables for all other species.

[32] Information on VDYP is available at www2.gov.bc.ca/gov/content/industry/forestry/managing-our-forest-resources/forest-inventory/growth-and-yield-modelling/variable-density-yield-projection-vdyp.

[33] Information on TIPSY is available at https://www2.gov.bc.ca/gov/content/industry/forestry/managing-our-forest-resources/forest-inventory/growth-and-yield-modelling/table-interpolation-program-for-stand-yields-tipsy.

8.1.3 Tree and stand simulator (TASS)[34]

The Tree and Stand Simulator, TASS, developed by FLNRORD, is an individual tree level model for commercial species of British Columbia. TASS predicts the potential growth and yield of even-aged and single species stands by modelling individual tree crown dynamics and the crown relationship to bole growth and wood quality. The individual tree and crown focus make TASS well suited for predicting the response to many silviculture treatments and the exploration stand dynamics. Two versions of the TASS model will be utilized in the Kispiox TSR. TASS III will be used for pine- and spruce-leading stands while TASS II will be used for stands with all other leading species types. TASS III is a recently released version, with limited species (pine and spruce), that extends TASS into more complex stand structures and multiple-species and multi-age cohorts.

8.2 Analysis units

In previous TSRs, yield tables were generated for similar stand aggregations called analysis units (AU). An analysis unit was typically composed of stands with similar species composition, site productivity, treatment regimes, and other management considerations. Timber volume projection (yield tables) were produced for each AU. Analysis units were used to simplify the model for computational requirements, additionally databases mining techniques were not available to create yield curves for individual polygons. Unlike past analyses for the Kispiox TSA, this analysis builds a unique set of yield curves for each forest cover polygon (stand) using the VDYP and TIPSY models.

Creating a unique set of yield curves for each stand, rather analysis units, increases the consistency of forest estate modelling across the province and improves transparency in the process; the same methodology is used against the same database across provincial TSRs. Generating yield curves unique to each stand allows for the field data stored and managed within the VRI and RESULTS databases to be fully utilized.

8.3 Stand types

To ensure that yield curves are developed using the most appropriate growth and yield model individual stands are classified by their stand type. The ‘Natural’ stand type includes stands without a silvicultural record (i.e., it does not have an opening identification) in the RESULTS database. This may include mature stands that have never been harvested or stands harvested prior to silviculture record keeping. The ‘Managed’ stand type includes stands with a silvicultural record and may include planted or naturally regenerated stems. Natural stand yield curves are developed using the VDYP model while managed stands are created using the TIPSY model.

Over the timber supply modelling horizon stands may transition from one stand type to another, this is to ensure that an appropriate yield is projected for each stand under different conditions throughout the planning horizon. Natural stands require a VDYP yield curve for their current condition, and a TIPSY yield curve for their future managed condition. Existing managed stands (stands with a silviculture record) regenerated prior to 1987 require a TIPSY yield curves to reflect their current and future conditions. These stands are built in TIPSY assuming stems are regenerated naturally because stands regenerated prior to 1987 have limited planting records and were frequently regenerated without stocking standards.

Existing managed stands regenerated after 1987 require a single yield curve, assuming stems are planted, to reflect their current and future conditions; this is based on the assumption that their future condition will be very similar to their current condition.

[34] Information on TASS is available at https://www2.gov.bc.ca/gov/content/industry/forestry/managing-our-forest-resources/forest-inventory/growth-and-yield-modelling/tree-and-stand-simulator-tass.

In the timber supply model natural stands and managed stands established prior to 1987, that are harvested are then regenerated as a 'Future' stand. The attributes of future stands are based on current management practices in the TSA aggregated by BEC zone, subzone combination and site index from the Provincial Site Productivity Layer (PSPL). In this procedure future stands are assigned a generic species composition but retain their specific site index.

Existing managed stands regenerated after 1987 are expected to be regenerated similar to their current conditions. Based on this assumption these stands assigned their current yield curve in future.

There is an exception to this procedure, the 2016 Cranberry SRMP specifies that a harvested stand exceeding one contiguous hectare and comprised of more than 50% deciduous trees by basal area, must be replaced by a stand with similar deciduous composition. For modelling simplification, these stands following harvest will be modelled as natural stands.

8.3.1 TIPSY input data

Input data for TIPSY is from site specific, field derived silviculture information stored in the Reporting Silviculture Updates and Land Status Tracking System (RESULTS). The RESULTS application tracks silviculture information by managing the submission of openings, disturbances, silviculture activities and obligation declarations as required by the *Forest and Range Practices Act*. Whereas the purpose of the RESULTS data is to track licensee obligation, for TSR purposes, the data is validated for the purpose of creating an individual yield table for each opening.

Data from RESULTS is used to derive species composition and density including both the planted and natural stand components.

Planted species composition is derived from RESULTS planting and survey data. Survey data is used to adjust species composition to account for ingress, mortality and to capture changes in species composition from the time of planting to the time of survey.

Genetic gain is incorporated into the timber supply analysis through TIPSY where site specific RESULTS seedlot information is linked to the Seed Planning and Registry Application (SPAR) of the Forest Improvement and Research Management Branch[35].

To assess if managed stands will achieve their projected future volumes a supporting analysis was completed. The analysis completed by Forest Analysis and Inventory Branch (FAIB) compared managed stand yield projections with stand monitoring plot (YSM) yield projections. YSM projections are believed to provide the best estimate of future yields. Results of the analysis indicate that throughout the ranges of ages the average MSYT projection is within the 95% confidence interval of the average YSM TASS 2.

8.3.2 Planted and natural density in managed stands

The distribution of trees within a stand influences the growth of the stand. While there are many distributional patterns, TIPSY provides two general distribution options: natural and planted. A natural distribution has increased patchiness whereas a planted tends to a more uniform distribution, as would be required under current silviculture obligations.

[35] Information on SPAR is available at https://www2.gov.bc.ca/gov/content/industry/forestry/managing-our-forest-resources/tree-seed/seed-planning-use/spar.

Within individual silvicultural openings there are planted and naturally regenerated stems. Within a silvicultural opening, there can be one to many forest cover polygons. Each of these polygons represents a unique stratum identified at the time of the inventory survey. The final species composition and density for the opening is derived by weighting the original planting activity numbers to give a planted composition and density for the opening. This is then adjusted for ingress and mortality by using the weighted combination of the inventory survey information. All information is subject to validation rules such as minimum and maximum planting densities as well as exclusion of fill and replanting treatments before adjustment. If an opening has no record of planting activities, then the species composition and density is based on the weighted inventory survey information.

The species present within the silviculture record are identified. The percent composition of each species is based upon the density identified. For modelling purposes up to five species are considered.

The proportion of area planted is based on the area planted divided by the net area reforested (NAR), to a maximum of 100%. The proportion of area naturally regenerated is the difference between the planted area and the NAR. If the planted area accounts for more than 90% of the NAR area, the opening is assumed to be 100% planted, conversely if the planted area accounts for less than 10% of the NAR area, the opening is assumed to be 0% planted, that is 100% natural. Planting date is based on the date of disturbance.

Where more than one planting treatment is recorded, weighted totals are used. Not all planting treatment records are valid. The following rules are in place to flag invalid records:

- The density planted needs to be > 500 stems per hectare and < 3,000 stems per hectare;
- Fill plants and replants are not included;
- The planting species and density may be adjusted based on forest cover checks;
- The disturbance start date of the largest treatment unit must be after April 1, 1987.

8.3.3 Wildlife tree patches and multi-layered stands

Existing wildlife tree patch reserves identified in the RESULTS dataset are treated as natural stands and are assigned a VDYP yield curve. In the timber supply model existing WTPs are reserved from harvest until the treated portion of the stand is eligible for harvest.

The RESULTS dataset provides silvicultural layer (height or age) stand attributes. Stands with distinct multiple layers in the RESULTS dataset are treated as multi-layered stands. The TIPSY model does not project multi-layered growth and yields, growth and yield projections for these stands are developed using the VDYP model. In the timber supply model these stands are typically modelled under a multiple entry regime requiring a custom VDYP yield curve.

8.3.4 Operational adjustment factors

Yield projections in TIPSY are based upon potential yields where a site is fully occupied. As a stand may not fully occupy a site or be able to reach its potential growth (e.g., due to forest health issues) it is necessary to adjust the potential yields of TIPSY to reflect an operational yield.

In TIPSY, there are two operational adjustment factors (OAF) that are used to modify the potential yields. These OAFs differ in their application. OAF 1 is a static reduction across all time periods and for example may reflect non-productive openings within a forest. OAF 2 is dynamic reduction that increases overtime and for example may reflect a forest health issues that increases as the stand ages.

For the base case analysis, values of 15% for OAF 1 and 5% for OAF 2 will be applied.

8.4 Summary silviculture data

As previously described the TIPSY model is populated with site specific, field derived silviculture information captured in the RESULTS dataset, this includes data related to delay in regeneration and the use of genetically improved seed stock. The following section provides some additional background information silviculture relevant to the TIPSY input factors.

8.4.1 Planting delay

A delay exists between the time that a stand is harvested and the regeneration of that stand. For existing managed stands this delay is determined for individual stands directly from the RESULTS silviculture records. It is calculated as the difference between the disturbance start date and the activity completion date. Where more than one valid planting treatment is reported, the completion date from the latest treatment is used. Planting delay is incorporated into the timber supply as a TIPSY model input.

To provide a more general context, planting delays in the Kispiox TSA between 2000 and 2005 the vary between 2.0 and 2.2 years.

8.4.2 Tree improvement

Licensees are obliged to use the best available seed source when regenerating sites with planted stock. Planted stock may have faster growth than naturally regenerated trees. The faster growth may be due to either use of high-quality genetically improved seed from seed orchards or use of seed harvested from superior wild trees. Options include genetically improved seed from seed orchards (Genetic Class A), seed harvested from superior wild trees (Genetic Class B+), and seed harvested from natural stands (Class B).

- Seedlings grown from Class A and B+ seed are expected to have volume gain or "genetic worth" (GW) relative to Class B seed. As an example, a seedling grown from Class A seed that has been assigned a GW value of 10 is expected to gain 10% more volume by rotation than a tree generated from Class B seed.
- Forest planners within Kispiox TSA have access to superior seed for lodgepole pine (Pli), interior spruce (Sx), interior Douglas-fir (Fdi), and western larch (Lw).
- As noted in the proceeding section, seed stock information recorded in the RESULTS database is used in conjunction with the Seed Planning and Registry Application (SPAR) of the Forest Improvement and Research Management Branch to determine the genetic gains associated with individual managed stands.

Mature forest in the ICHmc BEC variant, largest ecological subzone in the district, is an important source of timber supply for the Kispiox. There is concern that genetic gains expected for spruce and pine in the ICHmc may not be realized if climate shifts occur. The Province's Drought Risk Assessment Tool[36] also predicts high drought-induced mortality risk within the ICHmc may occur for several species including spruce and pine.

Sensitivity analysis (ID#4) explores the uncertainties around future growth and yield in managed stands, and will guide district and regional experts in developing recommendations to the chief forester for mitigating the impacts of climate change.

[36] The Drought Risk Assessment Tool https://www2.gov.bc.ca/gov/content/environment/natural-resource-stewardship/natural-resources-climate-change/natural-resources-climate-change-adaptation/tools permits users to calculate the relative risk of drought-induced mortality for a species based on BEC unit and Relative Soil Moisture Regime. The tool provides an estimate of the drought risk for the current climate, as well as predicted climates for 2020, 2050, and 2080.

9. Forest Estate Modelling

9.1 Forest estate model

The Spatial Timber Supply Model version 2020 (STSM) will be used for this analysis. STSM is run using the Spatially Explicit Landscape Event Simulator (SELES). STSM is approved for use in timber supply analysis by FAIB and the results of the analysis will be peer reviewed. The model will be set to examine spatial forest inventory data on a one-hectare grid level.

9.2 Base case scenario

The objective of the base case scenario is to provide a baseline harvest flow from which the chief forester can understand the dynamics of timber supply in the management unit given current forest management assumptions. The base case scenario has typically reflected a harvest flow that initiates from the current AAC and transitions to a lower mid-term level before moving to upward to a stable long-term level.

Many land use plan changes have occurred in the Kispiox TSA since the last timber supply review. The complexities of new planning initiatives must be modelled to understand the full effect on the AAC. Several alternative harvest flows based on different initial harvest levels are possible given current forest management assumptions. From these alternatives, a base case scenario is selected, that in conjunction with sensitivity analyses, to represent timber supply dynamics.

9.3 Sensitivity analysis

Sensitivity analysis can help to understand the implications of uncertainty around data and management assumptions and can be used to determine which variables have the greatest influence on harvest forecasts. Specific issues can also be investigated to enhance understanding of possible impacts on timber supply.

The sensitivities listed in Table 59 are being considered in the timber supply analysis. This list will be refined in consultation with Ministry staff, First Nations, and other stakeholders throughout the process.

Table 58. Sensitivity analyses to assess influence and issue analyses

ID#	Key Issue	Sensitivity Levels
1	First Nations Strategic Plans	Investigate First Nations values represented in the Gitwangak LUP and Gitsegukla SRMP.
2	Cedar sustainability	Maintain historic (2008-2018) cedar volume harvest levels + 10,000 m^3/year (domestic needs) within Gitxsan territory.
3	Natural stand volumes	Increase/decrease all VDYP yields by +/-10%.
4	Managed stand volumes	Increase/decrease not within the ICH TIPSY yields +/– 10%.
5	Remote areas	Include economically inoperable remote areas in the THLB.
6	Sawlog sustainability	Model an even flow model forecast for sawlog quality stands.
7	Forest health (Tomentosus)	Increase TIPSY yields for spruce component of stands within the ICH biogeoclimatic zone 30% (i.e., remove reduction applied in the base analysis) and decrease TIPSY yields for the spruce component of all stands not within the ICH 30% (to match yield reduction in ICH).
8	Forest health (Balsam bark beetle)	Apply a 30% reduction to balsam leading stands older than 250 years of age and within the ESSF.
9	Active/ historic goshawk nest buffers and viable foraging territories	Apply a no-harvest constraint within northern goshawk nest site buffers and a minimum 60% mature + old seral retention requirement within foraging territories outside the Cranberry SRMP area.
10	Seral forest retention in potential goshawk territories	Apply a minimum 60% mature and old seral retention requirement within potential foraging territories throughout the Kispiox TSA.
11	Cumulative effects	Investigate analysis guided by Appendix 4.

10. Associated Analysis and Reporting

The primary focus of the TSR will be to develop a timber supply analysis of the current TSA land base and forest management practices. The *Data Package* is an initial document that describes available information and the direction for future analysis and information collection.

10.1 Timber supply analysis - discussion paper

A *Discussion Paper* reporting the preliminary timber supply analysis results will be released for public review. Information used in the timber supply analysis is described in the *Data Package* and updated based on information identified during First Nations consultation, the public review process, and the analysis process.

The timber supply analysis should be viewed as a "work in progress". Following the release of the *Discussion Paper,* further analysis may be needed to complete, refine existing analysis, or address issues identified during the consultation and review process.

10.2 First Nations consultation and public review

Two formal review periods are provided within the TSR process: the first review period is for the *Data Package*, and the second review period is for the *Discussion Paper*. Information collected through First Nations consultation and public review processes provide important information for the AAC determination. Information received through written and oral presentations are collated and presented to the chief forester prior to the AAC determination. Information received is also, where possible, incorporated into the *Data Package* and analysis.

Please note that until the timber harvesting land base (THLB) is determined, it is not possible to finalize the values shown in some of the tables in this document. The *Updated Data Package* will incorporate the finalized values. Submissions and new information made available prior to the analysis may lead to changes in the data listed in this package.

The chief forester's AAC determination will be documented through the public release of an *AAC Determination Rationale*. This *Rationale* identifies reasons for the decision and discusses specific considerations; further the *Rationale* provides recommendations where the chief forester has identified deficiencies in information or a need for improved stewardship.

10.3 Carbon sequestration

Forest carbon is of emerging importance in forest management in BC and new climate change mitigation initiatives across the country, for example, forest carbon initiatives (FCI).

For the Kispiox TSA, the TSR4 results from the base case harvest flow and natural disturbance forecasts will be used as one of the major disturbance inputs data for the Carbon Budget Model developed by the Canadian Forest Sector (CBM-CFS3). The CBM-CFS3 is an aspatial, stand- and landscape-level modelling framework that simulates five major forest carbon stocks dynamics required under the Kyoto Protocol (aboveground biomass, belowground biomass, litter, dead wood and soil organic carbon). It also complies with the carbon accounting rules and best practice methodologies developed by the Intergovernmental Panel on Climate Change (IPCC) and United Nations Framework Conventions on Climate Change for signatory countries and territories greenhouse gas (GHG) emission's annual reporting.

The model uses much the same information as is required for forest management planning (e.g., forest inventory, tree species, growth and yield curves, natural and human-induced disturbance information, forest harvest schedule and land-use change information), supplemented with information from national ecological parameter databases.

From the climate change perspective, regardless of what management strategies are implemented on the ground, the ultimate goal is to reduce greenhouse gas (GHG) emissions to the atmosphere. The net ecosystem carbon balance (NECB) is used to describe the net change between the given ecosystem and atmosphere. A positive NECB means the atmosphere carbon pool is increasing, thus, the given ecosystem is losing carbon, otherwise referred to as a carbon source ecosystem. A negative NECB means the ecosystem is a carbon sink.

In order to make different GHGs (e.g., methane, nitrous oxide) comparable in carbon accounting, carbon dioxide equivalent (CO2e) is adopted, and the global warming potential (GWP) is used to convert each of greenhouse gases into CO2e. The conversions used in this analysis are: 1 CH4 = 28 CO2e; 1 N2O = 298 CO2e.

The harvest wood product (HWP) was treated as one-time emission during the past, however, as more evidence supported that the HWP carbon pool is increasing, it should be treated as individual carbon pool for sinks and sources calculation. Thus, the storage of carbon and emissions in different products (i.e., construction lumber, other lumbers, chips and paper) are also computed over 100 years of lifecycle to account for lifetime GHG emissions.

Results from the carbon analysis for the Kispiox TSA will be presented as one factor for consideration when the chief forester makes the AAC determination.

11. Information Sources

Approved Legal Orders. Ministry of Forests, Lands and Natural Resource Operations. See https://www2.gov.bc.ca/gov/content/industry/crown-land-water/land-use-planning/regions;

Archaeology in British Columbia. Ministry of Forests, Lands and Natural Resource Operations. See https://www2.gov.bc.ca/gov/content/industry/natural-resource-use/archaeology;

Biodiversity guidebook. Ministry of Forests. https://www.for.gov.bc.ca/ftp/hfp/external/!publish/FPC%20archive/old%20web%20site%20contents/fpc/fpcguide/BIODIV/biotoc.htm

Forest Act. See Section 8 Allowable annual cut https://www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/96157_02;

Forest and Range Practices Act. See www.bclaws.ca/civix/document/id/complete/statreg/02069_01;

Gitanyow Huwilp Recognition and Reconciliation Agreement between Gitanyow Nation and Her Majesty the Queen in right of the Province of British Columbia, 2012, amended 2016;

Guiding principles and considerations when planning the harvest of second growth. See https://www.for.gov.bc.ca/dkm/Kalum%202nd%20growth%20guidelines%202011.pdf, Kalum Resource District, 2011;

Ministerial Order Land Use Objectives Regulation Order Cranberry Sustainable Resource Management Plan, Ministry of Forests, Lands and Natural Resource Operations, March 2016;

Kispiox Timber Supply Area Data Package, prepared by Timberline Forest Inventory Consultants Ltd. for the Kispiox TSA DFAM Group, January 2007;

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Kispiox Timber Supply Area Rationale for AAC determination, effective January 1, 2008, Ministry of Forests ,Victoria, BC.

British Columbia. 2014. Forest Planning and Practices Regulation. See www.bclaws.ca/civix/document/id/complete/statreg/14_2004;

British Columbia. 2014. Government Actions Regulation. See www.bclaws.ca/civix/document/id/complete/statreg/582_2004;

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12. Appendices

Appendix 1 Skeena Stikine District methodology in developing the Kispiox TSR ownership layer

General principles:

- When building the "f_own" layer, private land was considered the constant. Where other layers overlapped, boundaries were clipped to the private land.
- Where tenures or land designations overlapped, the smaller tenures were cut out of the larger tenure layer and identified with the code for the smaller tenure (e.g., gravel reserves and a communication site that are located within the community forest and a woodlot). These would be noted in the comments field in the file.

40 – Private Land

- Used Cadastre to define private land. Checked for anomalies with parcel map BC and private land identified in provincial ownership layer.

52 – Indian Reserve

- Used CLAB IR layer.

54 – Federal Dominion Government Block

- Used Cadastre to define federal land. Clipped layer to CLAB IR.

60 – Crown Conservancy area, ecological reserve, protected area, provincial park.

- Used Tantalis Park / Ecological Reserve to define.

61 – UREPs

- a lot of UREPs in the Tantalis layer did not appear in the provincial ownership layer. Some are covered by established Rec Sites. Some are covered by Rec Reserves.

District made the decision to remove all UREPs from *f_own*, and add them into a newly-created "Kispiox TSA Recreation Layer". The new Recreation Layer is comprised of:

- Established Recreation sites;
- Recreation Reserves;
- UREPs.
- Areas previously covered by UREP now show in f_own as 62-Crown.

62 – Crown Forest Management Unit

- Essentially adopted the provincial ownership version.

On review it was discovered that boundary "slivers" of TFL 1 summing to less than one hectare were present. For analysis purposes these will be assumed to contribute to 62C – Crown Forest Management Unit.

68 – Crown - Forest Service Recreation Reserves

- District made the decision to remove these areas (identified on the provincial ownership layer) from f_own to the new Recreation Layer.

69 – Plantation Forest Reserve, Biodiversity, Mining, and Tourism areas, and Misc. Reserve (with or without OICs)

Section 16s:

- Section 16s (from a Lands perspective are "no-go" areas and generally have improvements).
- Added all Section 16s except those that would be covered elsewhere (UREPs, Rec Sites and Trails, Roadways).
- Watershed Reserves: all five watershed reserves (0264161, 6404826, 6405001, 0275829, 0269458) are also represented by Community Watershed parcels although the polygons do not match entirely. Presented these to Crown Lands. These watershed reserves do not remove the areas from the THLB. Designate as 'C'.
- First Nations – Treaty Areas: 6407332 is '69C'. This was established to highlight that "Deep Consultation" needs to happen here.
- 6407379, 6407380, 6407381 also coded 69C.
- Miscellaneous Land Uses – Other:
- 6404723, 6408387 - because these are small, and Section 16 designate as '69N'.
- 0275227 - coded '69C' (reserve to protect access to the river).
- 6405992 – this is the same area as 6404826. Lands information states: "This is a reserve set up in Sikedakh Creek watershed with FN bands in exchange for permission for the Kispiox Valley road widening, essentially an agreement to widen the road through Kispiox, Gitanmaax, and Glen Vowell FN bands, was supposed to be good for 20 years exp. 2015. It is a "Consultation" reserve" = '69C'.
- Miscellaneous Land Uses – Planning Marketing/Develop/Projects: Located in Hazelton. This looks surveyed in the Cadastre so '69N".
- Transportation – Roadway: '62C'.

The following were coded to 69N:

- Sand and Gravel Reserves (count = 34);
- Rip Rap (3);
- Quarrying Miscellaneous (1);
- Waste Disposal Site (1);
- Snow Survey (1);
- Science Measurement/Research (3);
- Public Access/Public Trails (1);
- Heritage/Archaeological Site (1);
- Greenbelt (1);
- Forest Management Research (7);
- Fishery Facility (2);
- Environment Protection/Conservation (2);
- Communication Sites (4);
- Rationale is that all Reserves not contributing to the long term timber supply and not represented elsewhere would fall under this category;
- Didn't add Section 16s that wouldn't remove timber from the land base or that were covered elsewhere;
- Transportation Roadway (14) – Added to 69C;

Section 17s:

- Environment, Conservation, & Recr – Science Measurement/Research: '69N';
- First Nations – Treaty Area: 6408279 '69N' because it also overlaps a Sand and Gravel Reserve;

Section 15s:

- Added Institutional Cemetery to 69N.

77 – Woodlots

- Used managed licence layer where status code is active and issued.

80 – Municipal Parcel - from cadastre.

81 – Local Regional Park – two parcels were located in town and coded N.

91U – in Cadastre is an ownership = unknown. No PID information so can't be checked in LTSA. These appear to be mysterious narrow parcels – perhaps pieces of road – near Carnaby/Kitseguecla. Considered 62 C and will be dropped as Road R/W.

99 – Crown Misc. Lease.

- 99N All leases except Ag extensive and Ag Grazing leases - i.e., community, commercial, rec residential, Alpine ski, communication etc. Did not add 'Accepted' applications. Did include applications where tenure had been 'Offered'.
- 99C Ag leases as per the *Data Package* for TSR3 are excluded from the forested management land base but included in the THLB because volume is harvested over the term of the lease, at which point, the lease may go to land auction and converted to private land.

Appendix 2 Skeena Stikine District and Skeena Region recreation and trails

Decisions made in assigning THLB_INCLUSION Values to Kispiox Recreation Layer.

The following rules were applied to assign **THLB_INCLUSION** values:

- Section 15 UREPs: 0% THLB_INCLUSION;
- Rec Reserves and Section 16 UREPs: 100% THLB_ INCLUSION;
- Section 17 UREPs: 100% THLB_ INCLUSION;

Section 16 UREP Exceptions:

- 0269336 & 0203021 – Overlap with the Suskwa/Bulkley and Suskwa North Recreation Reserves that are assigned 0% THLB_INCLUSION. See notes below.

Rec Reserve Exceptions:

- Rossvale Ski trail – 75% due to development of trails;
- Glen Mtn Recreation Area – this is an area with an established mountain bike trail system. It is also well used by other forms of recreation. It is close to the community 50%;
- Kitwancool Lake – 50% due to unmanaged campsites and day use areas;
- Suskwa North and Suskwa-Bulkley Reserves: both are well used and highly valuable therefore 0%;
- Cedarvale – overlaps with a Section 15 UREP therefore 0%;
- New Hazelton Reserve: Municipal land therefore 0%;
- Skeena-Lot 699 – Local Park and Section 16 therefore 0%.

Recreation Sites Exceptions: Sites <10 ha = 0% Inclusion:

- Sites <100 ha = 25% Inclusion Sites >100 ha = 50% Inclusion;
- Pentz Lake. This site we applied 0% inclusion. This is because this is a popular lake and the reserve is small relative to the lake (the lake portion is 25 ha).

Appendix 3 Detailed methods for riparian buffer width assignment

Riparian class code (RIPCLS_CD)	FPPR size (m)(ha)	BCGW data source	Identifying Features (advise Criteria 1-3)	Criteria1 (extra BCTS FSP commitments)	Criteria2	Criteria3	RRZ (m)	RMZ (m)	RMZ Reduction (%)	Modelled buffer width for THLB netdown (= RRZ width + (BA% x RMZ width))
S1-A	>=100	FWA_RIVERS_POLY	Specific named Rivers; GIS average measured polygon width including floodplains.	>=100m avg GIS-measured width	GNIS_NAME1 =		0	100	>=20%	20
S1-B	>=20 and <100	FWA_RIVERS_POLY	As above	>=20 and <100 avg GIS-measured width	GNIS_NAME1 =		50	20	>=20%	54
S2	>=5 and <20	FWA_RIVERS_POLY	GIS average measured polygon width including floodplains.	<20m width			30	20	>=20%	34
		FWA_STREAM_NETWORKS_SP	FCODE; association with RIVER polygons	"FCODE" = GA24850000 (Definite River/Stream); WA11410000 (Flow connector); WA24111110 (Construct line - main flow); WA24111190 (Construct line-flow connector)	Connects or flows into/out of a RIVERS_POLY (id'd by GNIS_NAME1)		30	20	>=20%	34
			FCODE, Order, Magnitude	"FCODE" = GA24850000 (Definite River/Stream); GA24850140 (Indefinite stream); GA24850150 (Intermittent stream); WA11410000 (Flow connector); WA24111110 (Construct line - main flow); WA24111170 (Construct line-flow connector); WA24111190 (Construct line-flow connector)	>= 4	>150	30	20	>=20%	34
S3	>=1.5 and <5	FWA_STREAM_NETWORKS_SP	FCODE, Order, Magnitude	"FCODE" = GA24850000 (Definite River/Stream); GA24850140 (Indefinite stream); GA24850150 (Intermittent stream); WA11410000 (Flow connector); WA24111110 (Construct line - main flow); WA24111170 (Construct line-flow connector); WA24111190 (Construct line-flow connector)	>= 4	>20 and <= 150	20	20	>=20%	24

S4_gen	<1.5	FWA_STREAM_NETWORKS_SP	FCODE, Order, Magnitude	"FCODE" = GA24850000 (Definite River/Stream); GA24850140 (Indefinite stream); GA24850150 (Intermittent stream); WA11410000 (Flow connector); WA24111110 (Construct line - main flow); WA24111170 (Construct line-flow connector); WA24111190 (Construct line-flow connector)	>= 4	<= 20	0	30	>=10%	3
S4		FWA_STREAM_NETWORKS_SP; watershed_4th	S4_gen stream; 4th Order Watersheds where "Riparian Reserve" id'd as assessment type	RIPCLS_CD = "S4_gen"	"SHED" = Aluk Babine E Babine N Borden Boulder Bretson Brown Paint Burdick Carrigan Cataline Clifford Corral Cranberry Cullon Date Douse Hazelton Ironside Luno Mill Nangeese Steep Canyon Tea"		10	20	>=10%	12
S4		FWA_STREAM_NETWORKS_SP; erosion_proxy_50k	S4_gen stream; "Alluval and/or flows into fish-bearing"	RIPCLS_CD = "S4_gen"	"SURF_MAT" = active-fluvia active-fluvial fluvial glacial_fluv glacial_fluvi glacio-fluvial lacustrine organic		10	20	>=10%	12

S5_gen	>3	FWA_STREAM_NETWORKS_SP	FCODE, Order, Magnitude (and Named Stream)	"FCODE" = GA24850000 (Definite River/Stream); GA24850140 (Indefinite stream); GA24850150 (Intermittent stream); WA11410000 (Flow connector); WA24111110 (Construct line - main flow); WA24111170 (Construct line-flow connector); WA24111190 (Construct line-flow connector)	<= 3 AND GNIS_NM not [blank]	<= 20 AND GNIS_NM not [blank]	0	30	>=10%	3
			FCODE, Order, Magnitude		<=3	>20				
S5	>3	FWA_STREAM_NETWORKS_SP; erosion_proxy_50k	S5_gen stream; "Alluval** and/or flows into fish-bearing"	RIPCLS_CD = "S5_gen"	"SURF_MAT" = active-fluvia active-fluvial fluvial glacial_fluv glacial_fluvi glacio-fluvial lacustrine organic		10	20	>=10%	12
S6_gen	<= 3	FWA_STREAM_NETWORKS_SP	FCODE, Order, Magnitude	"FCODE" = GA24850000 (Definite River/Stream); GA24850140 (Indefinite stream); GA24850150 (Intermittent stream); WA11410000 (Flow connector); WA24111110 (Construct line - main flow); WA24111170 (Construct line-flow connector); WA24111190 (Construct line-flow connector)	<= 3	<= 20	0	20	>=10%	2
S6	<= 3	FWA_STREAM_NETWORKS_SP; erosion_proxy_50k	S6_gen stream; "Alluval and/or flows into fish-bearing"	RIPCLS_CD = "S6_gen"	"SURF_MAT" = active-fluvia active-fluvial fluvial glacial_fluv glacial_fluvi glacio-fluvial lacustrine organic		10	10	>=10%	11
L1-A	>= 1000 ha	FWA_LAKES_POLY	FWA Polygon area	"AREA" >= 1000 ha			0	0	>=10%	0
L1-A1	>= 1000 ha	FWA_LAKES_POLY; PLAN_UNIT	FWA Polygon area, Strategic Plan area	"AREA" >= 1000 ha	PLAN_UNIT = "Cranberry"		0	20	>=10%	2

L1-B	>5 and <1000	FWA_LAKES_POLY	FWA Polygon area	"AREA" >5 and <1000			10	0	>=10%	10
L1-B1	>5 and <1000	FWA_LAKES_POLY; PLAN_UNIT	FWA Polygon area, Strategic Plan area	"AREA" >5 and <1000	PLAN_UNIT = "Cranberry"		10	10	>=10%	11
L3	>=1 and <= 5 ha	FWA_LAKES_POLY	FWA Polygon area	"AREA" >=1 and <= 5 ha			0	30	>=10%	3
W1	> 5 ha	FWA_WETLANDS_POLY	FWA Polygon area	"AREA" > 5 ha			10	40	>=10%	14
W5		FWA_WETLANDS_POLY					10	40	>=10%	14
W3	>=1 and <= 5 ha	FWA_WETLANDS_POLY	FWA Polygon area	"AREA" >=1 and <= 5 ha			0	30	>=10%	3

** Used known fish locations sites to reclassify and queried S5, S5_gen, S6, S6_gen streams as S4 or S4_gen

****Alluvial stream** - (low gradient); bed and banks are composed of material transported by the stream under present flow conditions.

Non--alluvial stream - bedrock controlled. Mountain streams flowing in coarse glacially deposited materials, or significantly controlled by fallen timber, suggest a non-alluvial system

Data Source for Surficial Materials, to advise selection of alluvial streams

Database: \\spatialfiles2.bcgov\work\FOR\RNI\DSS\Local_Data\kispiox_tsa_data.gdb

Feature Dataset: terrain

Feature Class: erosion_proxy_50k

Attribute: SURF_MAT Pertinent Codes: active-fluvia

active-fluvial

fluvial

glacial_fluv

glacial_fluvi

glacio-fluvial

lacustrine

organic

Appendix 4 Analyzing wildlife values in the Gitanyow and Gitxsan First Nation traditional territory

Introduction

Wildlife and aquatic values under consideration by the Kispiox Timber Supply Review (TSR) were identified based on a series of engagement processes between First Nations and the Province (*Data Package*).

- Moose
- Grizzly bear
- Norther Goshawk
- Mountain Goat
- Fish and fish habitat
- Marten

The sensitivity analysis identified here are intended to capture the intent of an additional, more detailed sensitivity.

Cranberry SRMP applied across Kispiox TSA sensitivity.

Apply Cranberry SRMP (Gitwangak LUP, and Gitsegukla SRMP) constraints to entire Kispiox TSA. This includes:

Fish and Fish habitat –Use Kispiox Ecosystem Network as the hydroriparian zone proxy.

Marten - assume that Goshawk predicted territories) co-locate sufficiently with high-value marten habitats.

Aquatic and wildlife specific measures sensitivity.

Additive to the analysis noted above, an analysis to further address habitat requirements for aquatic ecosystems, marten, goshawks, moose, grizzly bear and goats.

Sensitivity 2a) Road Density

Conserving high-value salmon watersheds is important not only to the salmon they support but as well to grizzly bears that target them. Managing road densities in these watersheds will likely benefit goshawk, marten, moose and mountain goats as well.

Minimizing road density for 4th order watersheds with highest salmon value.

Salmon, grizzly bear habitat:

- Skeena East ESI fish and fish habitat and Grizzly bear protocol;
- mapped salmon spawning and rearing habitat;
- high-value spawning and rearing watershed assessment units;
- maintain target percentage of high value watersheds with road densities below 0.6km/km^2 or 1.2 km/km^2.

Sensitivity 2b) Access Management

Access management directly benefits Moose, Grizzly, Goshawk, Marten and Goats. By association it could reduce salmon habitat pressures as well. Using 4th order watersheds identify priority locations of core secure habitat. Introduce a rule that stipulates that no more than 33% of the watersheds with core secure polygons can be accessed for harvest in any one decade, plus a quick-in quick-out harvest pass for the accessed polygons (i.e., harvest pass must be completed in less than 11 years).

Note for Mountain Goats these are defined spatial areas associated with UWR Order #U-6-006. Will need to measure how well these co-located with sensitivities 1, 2 and 3. If lack of conservation then may need to treat as a unique set.

It is anticipated that through habitat co-location with Goshawk territories that some core secure habitat polygons for all five species will be met.

Food and cover availability objective - forest cover constraints:

Grizzly bear habitat:

- Skeena East ESI grizzly bear protocol;
- Kispiox mid-seral definition – BEC subzone biodiversity guidebook mid-seral definition;
- High quality grizzly bear landscape units – high salmon or food value as identified in Skeena East ESI grizzly bear protocol;
- no more than 30% of high-quality landscape units in mid-seral condition.

Moose habitat:

- Skeena East ESI moose habitat protocol;
- winter habitat within mapped UWR;
- maintain target percentage of mapped UWR in preferred condition.

Number and composition of territories objective – modified cover constraint:

Northern Goshawk, Marten habitat:

- Skeena Goshawk protocol;
- Forest composition of territory within high-value goshawk zones;
- maintain target percentage of territories within a zone in preferred condition.

Appendix 5 Kispiox TSA young stand monitoring program

Kispiox TSA Young Stand Monitoring Program

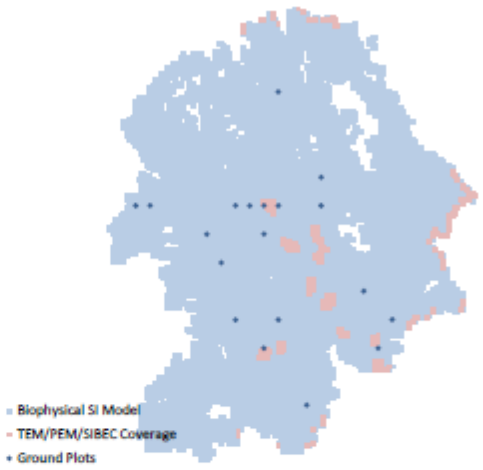
Overview

Young Stand Monitoring (YSM) programs have been established across a number of management units in BC. This handout provides a high-level technical summary of results compiled by FAIB for the Kispiox TSA YSM.

The target population for TSA-based monitoring programs includes Crown 15-50 year old forested stands defined by the Vegetation Resources Inventory (VRI) rank 1 layer. Licensee's TFL-based monitoring programs generally use other population criteria.

Ground samples (dots on map, right) are established on a 5 X 10 grid, with trees tagged in 0.04ha permanent plots and planned for periodic re-measurements.

Some key YSM objectives are to: describe the characteristics and structure of young stands, report on forest health, assess the accuracy of predicted attributes, and compare against growth models to help evaluate if young stands will meet future timber supply expectations.



Meas	# Ground Samples by Year (end of growing season)	
#	2017	Total
0	19	19

Summary of Key Findings for Existing Young Stands in the Kispiox TSA related to Timber Supply

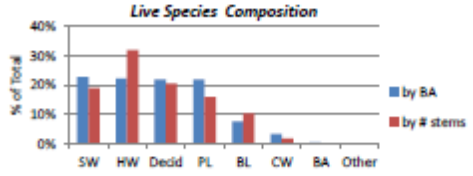
1)	The leading species from YSM ground samples is compared to the interpreted leading species in the VRI forest cover inventory. The leading species percent agreement is :	42%	*(% agreement)*
2)	Species composition from YSM ground samples is compared to RESULTS opening records (used for modeling existing managed stands in TSR). The overall species composition overlap is:	73%	*(% of stems/ha)*
3)	The Provincial Site Productivity Layer (PSPL, used for modeling existing managed stands in TSR) is assessed for bias using YSM ground based site index data. Site index bias (in percent) is listed by species if significant, where a positive percent is an under-estimate in the PSPL, and a negative percent is an over-estimate:	None	
4)	YSM samples plus TASS projections of YSM samples both include conifer and deciduous tree species. The deciduous proportion in the YSM samples (% of total volume) is :	22%	*(% of m3/ha)*
5)	YSM samples plus TASS projections of YSM samples include the separate tracking of both managed vs. residual coharts. The residual proportion in the YSM samples (% of total volume) is :	0%	*(% of m3/ha)*
6)	The periodic annual increment (PAI) of TSR MSYTs are compared against re-measured YSM samples over the same remeasurement period, to test if TSR projections are significantly different :	NA	
7)	The PAI of the YSM TASS projections are compared against re-measured YSM samples over the same remeasurement period, to test if TSR projections are significantly different :	NA	
8)	For YSM samples measured since 2017, the forest health impact from stem rusts is directly modeled in YSM TASS projections using GRIM / CRIME. The projected volume impact of stem rusts by age 100 is :	0.7%	*(% of m3/ha)*
9)	For selected forest health agents expected to cause short term mortality, a simplistic method is used to approximate a future impact in YSM TASS projections of :	3.1%	*(% of m3/ha)*
10)	For selected forest health agents expected to cause incremental mortality, a simplistic method is used to approximate a future impact in YSM TASS projections (reported at age 100) of :	1.0%	*(% of m3/ha)*
11)	TSR MSYTs are compared against YSM TASS projections, to test if TSR assumptions will meet future expectations of YSM stands grown to rotation. Reported are the maximum percent difference of TSR volume relative to YSM (a negative % is where TSR is lower than YSM, positive % is where TSR is greater than YSM); the projected age this occurs at; and a test if the differences between the two is significant.	*Max % vol diff* *Age @max vol diff* *Significant?* *TSR bias?*	-13% 60 No No

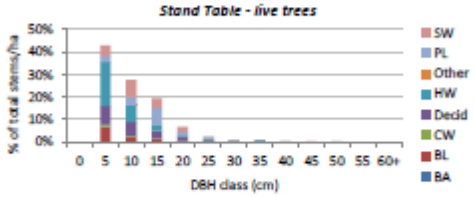
Forest Analysis and Inventory Branch (ver. February 2021) 1

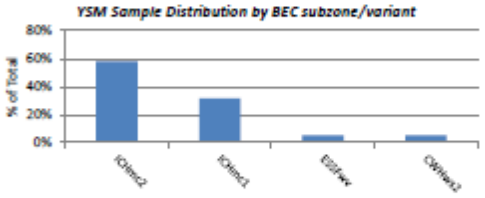
Young Stand Description

Stand summaries (all species combined) are compiled and summarized for all samples in the target population at latest measurement. Compilations are for all standing trees >=4cm DBH, except net merchantable volume (ie., PL >= 12.5cm DBH, & all other species >=17.5cm DBH, excluding 30cm stump height, 10cm top diameter, & decay). Species code names are listed on page 5.

	n	Live				Dead
		Avg	Min	Max	SD	Avg
Basal Area (m2/ha)	19	25.6	3.2	47.8	12.4	0.6
Total Stems (#/ha)	19	2,375	150	5,579	1,371	58
Quadratic Mean DBH (cm)	19	11.7				11.0
Whole Stem Vol. (m3/ha)	19	153	13	462	117	3
Net Merch Vol. (m3/ha)	19	81	3	385	92	1
Total age all site trees (yrs)	38	35	18	55		







Species Composition Compared against Forest Cover Inventory & RESULTS

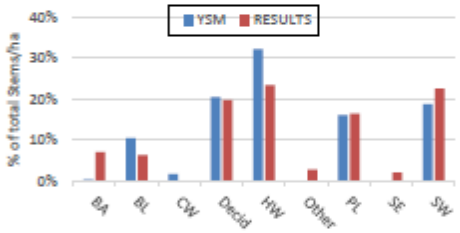
Leading species (by basal area) is compared between YSM & the VRI Inventory where the *'correct leading species classification rate'* is a percent of all YSM samples with matching inventory leading species (table left). Overall species composition (by stem count) is also compared between YSM and RESULTS Opening ID data (table right). The planted & natural stem counts from RESULTS data are combined to compare overall species composition overlap between YSM and RESULTS.

Leading species cross-table comparison (sum of the # of YSM plots)

VRI \ YSM	BL	Decid	HW	PL	SW	Total
BA					1	1
BL	1					1
Decid			1	2	1	4
HW		1	2	1		4
PL			2	2	1	5
SW		1			3	4
Total	1	2	5	5	6	19

Correct Leading Species Classification Rate = **42%**

Species Composition Comparison (based on stem count)



Overall Species Composition Overlap = **73%**

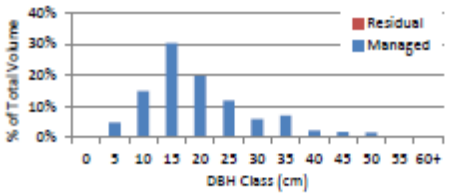
Site Index vs. Provincial Site Productivity Layer

Site index (SI) is an estimate of a stand's potential productivity by species. Predicted SI is from the Provincial site productivity layer (PSPL v7.0), using ecological mapping plus SIBEC tables (or SI biophysical model when no ecological mapping is available), from a spatial overlay of the PSPL with YSM locations. YSM ground SI is from an average of four suitable site trees per species from each YSM sample. The average and ratio of means (ROM) are computed from the paired SI estimates (table right). PSPL underestimates SI when ROM>1, and overestimates SI when ROM<1. Ratios are highlighted in red when significant (@ alpha=0.05). Note the overview TSA map illustrated on page 1 also highlights the area coverage by TEM/PEM & SIBEC (pink) vs. Biophysical model (blue).

Spc	#Pairs	YSM BH Age (yr)			SI (m)		ROM	Sig
	n	Avg	Min	Max	YSM	PSPL		(95%)
BL	5	30	19	40	18.9	18.9	1.00	N
EP	6	32	27	44	20.8	20.1	1.04	N
HW	11	32	14	49	20.4	19.9	1.02	N
PL	7	22	13	35	22.4	22.4	1.00	N
SW	9	25	12	47	23.5	22.4	1.05	N

Post-Harvest-Regenerated vs. Residual Trees

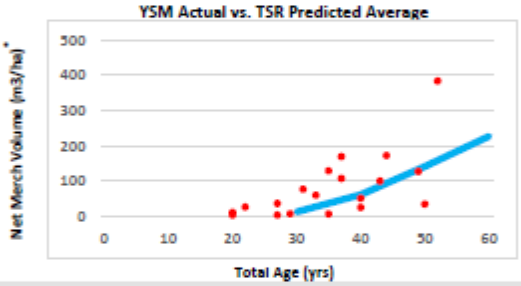
Young stands may include older residual trees which have important ecological, management, and growth implications. Residual trees are identified in the field using standard measurement protocols. Depending on analysis, it may be necessary to separate the residual from post-harvest-regenerated trees in young stands. The contribution of the residual cohart in the measured YSM samples is reported (chart, right).

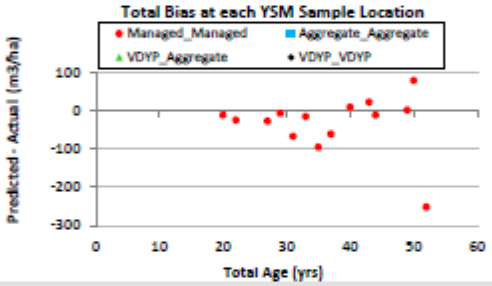


Percent of total volume comprising residuals = *0%*

Comparing Current Volumes: TSR Predicted Yield Tables vs. YSM Actual Measurements

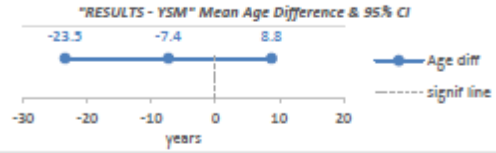
YSM volumes are compared to both existing managed (MSYT) and existing natural (NSYT) stand yield tables developed for FAIB's timber supply review (TSR) analysis. For YSM locations modeled in TSR as managed, MSYTs are from TIPSY ver 4.4 using "RESULTS" Silviculture Opening records spatially matched to each YSM sample location, or using aggregate inputs where RESULTS data are not available. For YSM locations modeled in TSR as unmanaged, NSYTs are from VDYP ver 7 using VRI inventory rank1 attributes. TSR predicted volumes are compared to YSM volumes using RESULTs age adjusted to the year of ground sampling (or VRI VEGCOMP adjusted age when no RESULTS data exist). The left graph plots YSM actual volume (points are joined where re-measurements are available), plus the average of all spatially intersected TSR existing yield tables (solid blue line). The right graph illustrates the total bias (predicted minus actual volume) at each individual YSM sample location. TSR predicted volumes underestimate current YSM volume when the bias is negative, and overestimate current YSM volume when positive.





Test to Compare RESULTS Total Age vs. YSM Ground Sample Age

TSR uses the RESULTS age (or VRI age when no RESULTS data are available) as the starting age in timber supply forecasts. This reference age (adjusted to the year of ground sampling) is also used to match the predicted yield table volume with a YSM volume at each sample point location. T-tests of the paired age differences (RESULTS - YSM) provides a check for significant differences between RESULTS and YSM ages (highlighted when significant @ alpha=0.05, table right). Note that YSM sample tree ages may include a combination of both managed and (sometimes) older residual coharts based on the sample tree data collection criteria.



Age Source	# obs	Mean Age
RESULTS	19	35.3
YSM	19	42.7

P-Value of Age Diff
0.350

RESULTS summary by Regeneration & Genetic Worth

YSM sample locations are intersected with RESULTS opening IDs to summarize average regeneration type and genetic worth used as TSR MSYT inputs (tables right). YSM samples spatially joined with an existing RESULTS opening ID are summarized separately from those without opening ID's and hence joined to an aggregated MSYT input estimate.

Regeneration Type	Opening id	Aggregate
Planted	35%	0%
Natural	65%	100%

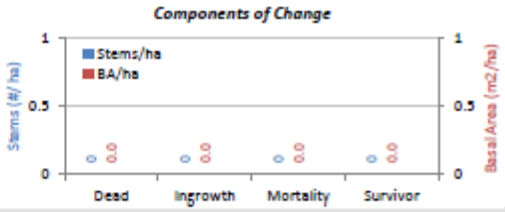
Species Genetic Worth %	Opening id	Aggregate
PL	0.6	

Components of Change : Re-measured YSM Samples

Growth and mortality of the (n=0) re-measured YSM ground samples are summarized into components of change, for all tagged trees over an average period of - years (figure right):

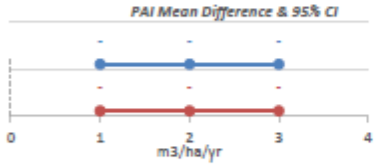
Survivor	*Alive at both measurements*
Ingrowth	*Exceeds minimum tagging limits at last measure*
Mortality	*Died inbetween measurements*
Dead	*Dead standing at both measurements*

Not reported as fewer than 5 YSM re-measurements completed to date.



Test to Compare Modeled vs. YSM Re-measured Periodic Annual Increment

Periodic annual increment (PAI) in units of m3/ha/yr, is computed from all re-measured YSM ground samples, and compared against predicted PAI from TSR yield tables, as well as from YSM TASS projections over the same YSM re-measurement period. T-tests of the paired difference checks for significant differences in PAI (highlighted when significant @ alpha=0.05, table right).



YSM vs. TSR MSYTs			
attr.	**# obs**	**Yrs**	**PAI**
YSM		-	-
TSR		-	-

TSR-YSM diff (m3/ha/yr)			
p-val	**Diff**	**L95**	**U95**
	-	-	-

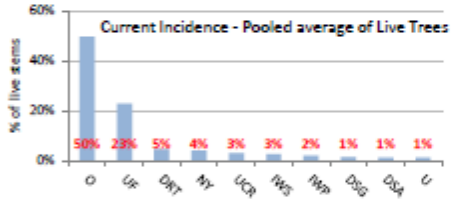
YSM vs. TASS projections			
attr.	**# obs**	**Yrs**	**PAI**
YSM		-	-
TASS		-	-

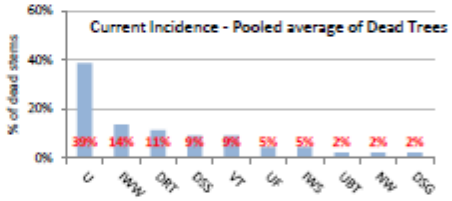
TASS-YSM diff (m3/ha/yr)			
p-val	**Diff**	**L95**	**U95**
	-	-	-

Not reported as fewer than 5 YSM re-measurements completed to date.

Current Forest Health Incidence

All tagged trees are assessed for up to five forest health damage agents per tree. The incidence of the 10 most frequent damage agents are summarized as a percent of the total stems by live / dead status (below). Unknown damage associated with a loss indicator is further divided into forks, crooks, or broken tops. A full list of recorded damage agent code names is on page 5.

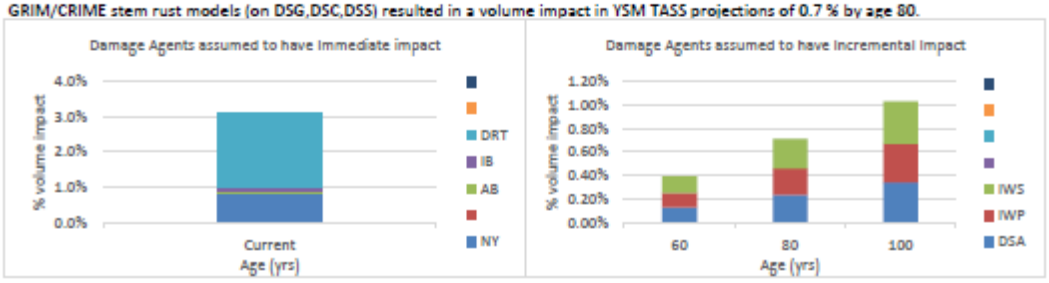




Approximating Future Forest Health Risks

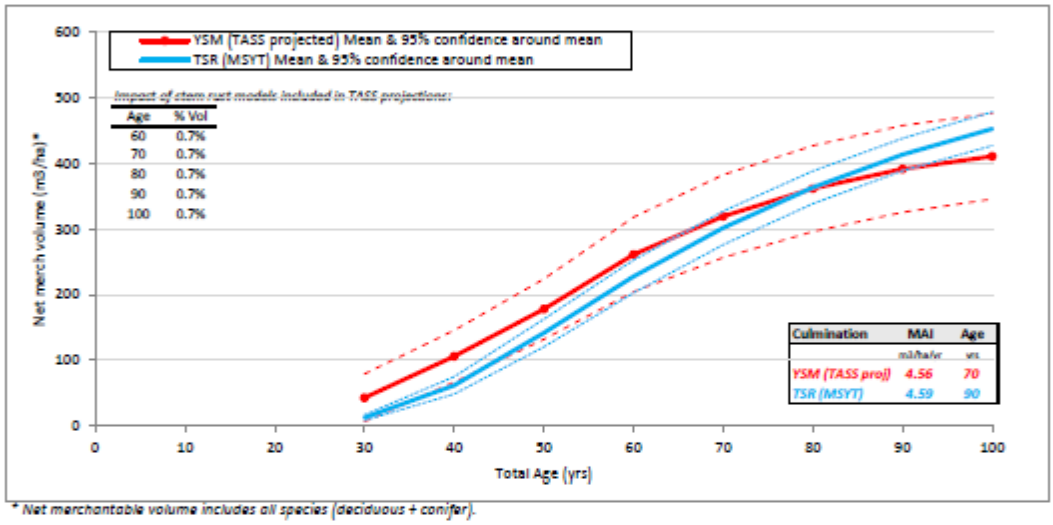
There are a number of forest health agents recorded in YSM samples that do not yet have specific forest health models built. A simplistic approach is used as an interim step to estimate future impacts, and involves creating two groups of damage agents: 1) those expected to result in immediate mortality vs. 2) those causing incremental mortality or growth loss through to rotation. For the first group, 90% of the current measured incidence is assumed to cause immediate mortality (left graph). For the second group, the impact is modeled as a product of the current measured incidence times a mortality rate of 2.5% volume loss per decade (right graph). Their combined impacts is included as an additional adjustment factor to the plotted YSM TASS projections (next section).

GRIM/CRIME stem rust models (on DSG,DSC,DSS) resulted in a volume impact in YSM TASS projections of 0.7 % by age 80.



Will Existing Young Stands Meet Expectations at Rotation?

To assess if young stands will meet future volume expectations, each YSM tree list is projected from its latest measurement date to rotation using TASS, and compared against each spatially matched TSR existing yield tables. TASS3 is run for all YSM ground samples comprising at least 80% (by basal area) of PL & SW combined, while TASS2 is run for all other YSM ground samples. No genetic gain estimates are applied, since ground based SI estimates are used for all YSM TASS projections. The average of all YSM TASS projections and their upper & lower 95% confidence interval around the mean (red lines) are compared against the average of all spatially matched TSR yield tables (blue line). If the TSR projection overlaps within the 95% confidence interval of the average YSM TASS projection, it may be reasonable to assume young stands will meet timber supply expectations. If not, there may be a need to revisit TSR assumptions. TASS YSM projections include default operational adjustment factors OAF1 (15%) and OAF2 (5%) that linearly increase to the maximum OAF1/2 at 100 years. TASS projections also incorporate the stem rust models (GRIM on DSG, & CRIME on DSC/DSS) for YSM samples measured in 2017 or later, as well as those estimated forest health impacts associated with immediate or incremental mortality (previous section). All TASS runs use the stem-mapped YSM tree data to define the spatial distribution of trees, or an assumed random pattern for those YSM samples not yet stem mapped.



** Net merchantable volume includes all species (deciduous + conifer).*

Test to compare YSM TASS projections against TSR MSYTs

TSR MSYTs are evaluated against YSM TASS projections, using paired t-tests of the volume differences (TSR-YSM) when projected from 60 & 100 years. Highlighted fields (table right) indicate significant differences at alpha = 0.05. Overall percent differences are computed as (TSR-YSM/YSM), and the age at maximum absolute percent difference, is identified (table right).

Projection age (yrs)	60	70	80	90	100
% vol diff	-13%	-6%	1%	6%	10%
P-value of vol diff	0.125	0.334	0.693	0.856	0.427
# YSM samples	19	19	19	19	19

Max % vol diff	-13%
Age @max vol diff	60
Significant? (when n>=10)	No
TSR bias?	No

Total number of YSM samples by:

Sample Type			TSR Yield Table Assignment "Current to Future" Regime		YSM Plot Occupancy of trees >=4cm DBH		Availability of stem mapped YSM Samples used in TASS Projections		TASS Version used for YSM Projections	
Grid (km)		Total								
CMI	20 X 20	2	Managed_Managed	19	Treed	19	Stem mapped plots	19	TASS ver. 2	16
YSM	5 X 10	17	Total	19	Empty	0	Not stem mapped	0	TASS ver. 3	3
Total		19			Total	19	Total	19	Total	19

Tree Species and Damage Agents Recorded from YSM Samples in the Kispiox TSA

Tree Species Codes / Names	
AC	Black cottonwood
AT	Trembling aspen
BA	Amabilis fir
BL	Subalpine fir
CW	Western redcedar
DR	Red alder
EP	Paper birch
FD	Douglas-fir
HW	Western hemlock
PL	Lodgepole pine
SW	White spruce

Damage Agent Codes / Names	
AB	Bear
AM	Moose
AS	Squirrel
AX	Birds
DDE	Rust Red Stringy Rot
DF	Foliage Diseases
DFE	Elytroderma Needle Cast
DFL	Pine Needle Cast
DFS	Dothistroma Needle Blight
DRT	Tomentosus Root Rot
DS	Stem Diseases (Cankers and Rusts)
DSA	Atropellis Canker (Lodgepole pine)
DSC	Comandra Blister Rust
DSG	Western Gall Rust
DSS	Stalactiform Blister Rust
IB	Bark Beetles
ID	Defoliators
IWP	Lodgepole pine Terminal Weevil
IWS	White pine Weevil (on Spruce)
IWW	Warren's Root Collar Weevil
NGC	Frost Crack
NW	Windthrow
NX	Wind scarring or rubbing
NY	Snow or Ice (includes snow press)
NZ	Sunscald

Damage Agent Codes / Names (cont.)	
O	None
TL	Logging Wounds
TM	Other Mechanical Damage (non-logging)
TR	Pruning Wound
U	Unknown Damage
UBT	Unknown Broken Top Damage
UCR	Unknown Crook Damage
UF	Unknown Fork Damage
USW	Unknown Sweep Damage
VP	Vegetation Press
VT	Tree Competition

General Notes / Assumptions

* TSR existing MSYTs are based on FAIB ver. 2020-jun-02 using TIPSY 4.4, with RESULTS opening age, species density, regen type and genetic worth, and based on spatially matched RESULTS opening ID where present, or based on aggregated RESULTS input data where Opening ID is unavailable.
* TSR existing NSYTs were separately run using VDYP7 & the published 2019 VRI, for those YSM sample locations modeled as "existing unmanaged".
* Each YSM GPS location is intersected with the published 2019 VRI VEGCOMP and linked to each TSR yield table by the FEATURE_ID attribute.
* YSM samples that collectively comprise at least 80% PL & SW combined use TASS 3 (ver 3.01.21) for future yield projections. YSM samples that include all other species combinations use TASS 2 (ver. 2.07.76) for future yield projections. The rationale for using TASS3 on predominatly PL/SW mixed stands is to ensure consistency when comparing YSM TASS projections against TSR MSYTs generated using TIPSY 4.4.
* The YSM tree list and ground based attributes are projected in TASS from the ground measurement year using a reference stand age defined by the RESULTS opening ID if present, otherwise from the VRI VEGCOMP poly rank1 projected age (adjusted to year of ground sampling).
* All YSM TASS projections include standard OAF1 (15%) and OAF2 (3%) adjustments, with OAF1 applied in a non-standard way by assigning zero OAF1 at the YSM sample's current age and volume, and linearly increasing so that 100% of the OAF1 value is achieved by age 100.
* For those YSM samples that are stem-mapped, TASS input tree lists are generated from each sample by first clipping hexagon shaped plots from both circular 0.04ha main plot (tagged trees >9cm DBH) and 0.01ha subplot (tagged trees 4-9cm DBH), replicating each hexagon and randomly orienting and superimposting both main and subplots onto an expanded 1ha stem-mapped tree list comprising tagged trees >=4cm DBH.
* For those YSM samples not yet stem-mapped, TASS assumes a random spatial pattern of currently measured trees.
* TASS required input of height vigour is estimated as a ratio of current tree height divided by the plot site height of the same tree species.
* TASS projections of YSM samples measured since 2017 include GRIM/CRIME model impacts (ie., height & %encirclement data are measured for each stem rust after this date). The impact of other recorded damage agents are approximated as having either immediate impact (@90%) or incremental impact (@2.5%/decade), and are assigned an impact group from discussions with provincial forest health specialists.
* Potential site index estimates are from the Provincial Site Productivity Layer (PSPL) ver 7.0 intersected with each YSM GPS location.
* YSM leading species is compared to the published VRI VEGCOMP (ver. 2019) leading species for leading species agreement, while overall species composition is compared to the RESULTS species composition used inTSR MSYTs (which includes the combined planted plus natural coharts).
* All histograms presented (ie., stand table, species comp, forest health incidence), are computed as pooled means of all YSM samples combined.
*All reported net merchantable volumes are at 12.5cm close utilization for PL, 17.5cm for other species, and include all species (deciduous + conifer)
* YSM summaries include both managed (post-harvest-regenerated) and residual coharts. Also, the comparison between YSM and TASS PAI for remeasured YSM samples include both of these coharts. However, comparisons of YSM TASS projections against TSR MSYTs exclude the residual cohart, to ensure consistency with assumptions made in the TSR MSYTs.

References

YSM Technical Handouts for all available TSAs, plus resource information on Provincial Monitoring Programs

https://www2.gov.bc.ca/gov/content/industry/forestry/managing-our-forest-resources/forest-inventory/ground-sample-inventories/provincial-monitoring

Public access to Ground Sample Data approved as OpenData under BC Open Government License

https://catalogue.data.gov.bc.ca/dataset/824e684b-4114-4a05-a490-aa56332b57f4

13. Your input is needed

Public input is a vital part of establishing the allowable annual cut. Feedback is welcomed on any aspect of this *Data Package* or any other issue related to the timber supply review for the Kispiox TSA.

Ministry staff would be pleased to answer questions to help you prepare your response. Please send your comments to the resource district manager at the address below.

Your comments will be accepted until April 26, 2021 for consideration with respect to the *Data Package*. A further comment period will be made available following the release of a *Discussion Paper* that outlines the results of a timber supply analysis.

You may identify yourself on the response if you wish. If you do, you are reminded that responses will be subject to the *Freedom of Information and Protection of Privacy Act* and may be made public. If the responses are made public, personal identifiers will be removed before the responses are released.

For more information or to send your comments, contact:

Skeena Stikine Natural Resource District
Ministry of Forests, Lands and Natural Resource Operations and Rural Development
Bag 6000
Smithers, B.C. V0J 2N0

Telephone: 250-847-6300

Or contact:

Glen Buhr, Stewardship Officer and/or Jennifer Plummer, Stewardship Forester
Skeena Stikine Natural Resource District
Ministry of Forests, Lands, Natural Resource Operations and Rural Development

Phone: (250) 847-6308

Electronic mail: Glen.Buhr@gov.bc.ca and/or Jennifer.Plummer@gov.bc.ca

For information on the Timber Supply Review visit the Timber Supply Review & Allowable Annual Cut web site at https://www2.gov.bc.ca/gov/content/industry/forestry/managing-our-forest-resources/timber-supply-review-and-allowable-annual-cut

Further information regarding the technical details of the timber supply review process and timber supply analysis is available on request by contacting Forests.ForestAnalysisBranchOffice@gov.bc.ca