

Nass Timber Supply Area Timber Supply Review

Data Package

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Executive Summary

The Nass Timber Supply Area (TSA) is located in northwestern British Columbia in the Skeena Region and covers approximately 1.7 million hectares. The western part of the Nass TSA is mountainous, with coastal plains and rugged ice-capped mountains whereas the eastern portion of the TSA is characterized by wide and flat plateaus bordered by the Skeena and Coast Mountain ranges.

Under Section 8 of the *Forest Act* the chief forester must review the timber supply and determine an allowable annual cut (AAC) for each TSA at least once every 10 years. The chief forester may postpone a determination for a further five years if the AAC is not likely to be changed significantly.

Effective June 12, 2002, the AAC for the Nass TSA was set at 865 000 cubic metres including a partition of 200 000 cubic metres attributable to the Upper Nass portion of the TSA. Subsequently, the chief forester postponed the next AAC determination until July 30, 2017. The average harvest level for 2013 to 2017 was 230 000 cubic metres annually; no harvest has occurred in the Upper Nass.

The Timber Supply Review (TSR) and AAC determination is a multi-step process that involves:

1) release of a data package that describes known information and management, 2) timber supply analysis based upon the data package, 3) release of a discussion paper that outlines the results of the timber supply analysis, 4) presentation of a summary of all technical, consultation, and public review information to the chief forester and, 5) release of a rationale that describes the chief forester's AAC determination. First Nations/Nations, as part of consultation, and the public are asked formally for input following the release of the data package and the discussion paper.

The First Nations/Nations consultation process is initiated at the start of the TSR and continues until an AAC decision is made. This data package is made available to First Nations/Nations as one part of the consultation process and the discussion paper will also be shared when it is completed.

This data package summarizes the information and assumptions that are used to conduct timber supply analysis for the TSR of the Nass TSA. The data package contains information of currently available data and management descriptions that is 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.

1. Introduction

This data package summarizes the information and assumptions that are used to conduct timber supply analysis for the TSR of the Nass Timber Supply Area (TSA). Under Section 8 of the *Forest Act* the chief forester is to review the timber supply for each TSA at least once every 10 years and determine an appropriate allowable annual cut (AAC). Under the *Act*, as was done for the Nass TSA, the chief forester upon review may postpone the determination once for a further five years. For more information about the TSR 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>.

The data package contains those inputs that represent current legal requirements and performance for the TSA and for the purposes of TSR are defined by:

- the current forest management regime — the productive forest land available for timber harvesting, the silviculture treatments, the harvesting systems and the integrated resource management practices used in the area;
- land-use plans approved by Cabinet;
- legal objectives established under the *Forest and Range Practices Act* and the *Land Act* (e.g., visual quality objectives, wildlife habitat areas, and ungulate winter ranges).

The primary purpose of TSR is to identify and if reasonable model the “what is”, not the “what if” of current forest management in a TSA. Changes in forest management objectives and data, when and if they occur, will be captured in future TSRs. In the data package, information is presented on current forest management, relevant data and how such information will be used for developing a forest estate model of the timber supply.

A First Nations/Nations consultation and public review period has been established to allow submission of comments and concerns to the Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNRORD) for the consideration of the chief forester in determining the AAC. Input during the data package review phase from consultation with First Nations/Nations or the public review may be incorporated into the timber supply analysis or identified to the chief forester for consideration in the AAC determination. The chief forester’s AAC determination will be documented through the public release of an AAC determination rationale.

As part of the public review and First Nations/Nations consultations, comments around the data package are being requested from First Nations/Nations within a minimum of a 60-day timeline depending upon agreements between the province and First Nations/Nations and the public during a 60-day review process. A further comment period will be available following the release of the discussion paper. See Section 11 for further information.

2. Background

2.1 General

The Nass TSA is located in northwestern British Columbia in the Skeena Region and covers approximately 1.7 million hectares. This TSA is administered from the Coast Mountains Natural Resource District office in Terrace.

The Nass TSA is remote and sparsely populated. The communities within and adjacent to the TSA include; Stewart (401 census 2016), Meziadin Junction, Elsworth camp, Nisga'a Nation citizens living on Nisga'a Lands (1880 census 2016), and Nass Camp.

A number of First Nations/Nations have traditional territories or treaty areas and interests within the Nass TSA. These First Nations/Nations are: Gitanyow, Gitksan, Nisga'a (a treaty Nation), Tahltan, and Tsetsaut Skii km Lax Ha.

The forests of the Nass TSA provide a wide range of forest land resources, including forest products, recreational opportunities, and wild pine mushroom harvesting. At the same time, the forests provide essential ecosystem services and support a variety of wildlife habitats. Mineral extraction and tourism industries can also be found operating within the Nass TSA.

The western part of the Nass TSA is mountainous, with coastal plains and rugged ice-capped mountains. The eastern portion of the TSA is characterized by wide and flat plateaus bordered by the Skeena and Coast Mountain ranges. Overall in the Nass TSA, summers are warm, while cold Arctic fronts frequently descend into the area in the winter.

The forests of the Nass TSA are dominated by western hemlock and subalpine fir, while lodgepole pine, sitka spruce and western redcedar also occur, as do lesser amounts of deciduous forests and scattered wetlands. The forests of the Nass TSA are home to a wide variety of wildlife species, including moose, mountain goat and black bear. Rivers support a rich variety of fish, such as salmon, steelhead, rainbow trout and Dolly Varden char. Wetlands and lakes provide habitat for a variety of birds and other species. Currently, nine species identified as at risk may be found in the Coast Mountains Natural Resource District, including coastal tailed frog, marbled murrelet, bull trout, fisher, moose, grizzly bear, wolverine, great blue heron, and in the north east part of the TSA, northern mountain caribou.

Parks, glaciers, water bodies, recreation sites and trails, and roaded and non-roaded areas provide opportunities for numerous outdoor activities in the Nass TSA. Although there are opportunities for recreation, the demand is limited due to the low population density of the region and because the majority of the area is inaccessible. Recreational activities in the TSA include backcountry touring, heli-skiing, sport fishing, hiking, hunting and wilderness viewing along the Stewart/Cassiar Highway. Within the TSA, Meziadin Lake Provincial Park, Swan Lake-Brown Bear Park and the Hanna-Tintina Conservancy have been established as protected areas.

Effective June 12, 2002, the AAC for the Nass TSA was set at 865 000 cubic metres including a partition of 200 000 cubic metres attributable to the Upper Nass portion of the TSA. Subsequently, the chief forester issued an order postponing the next AAC determination until July 30, 2017.

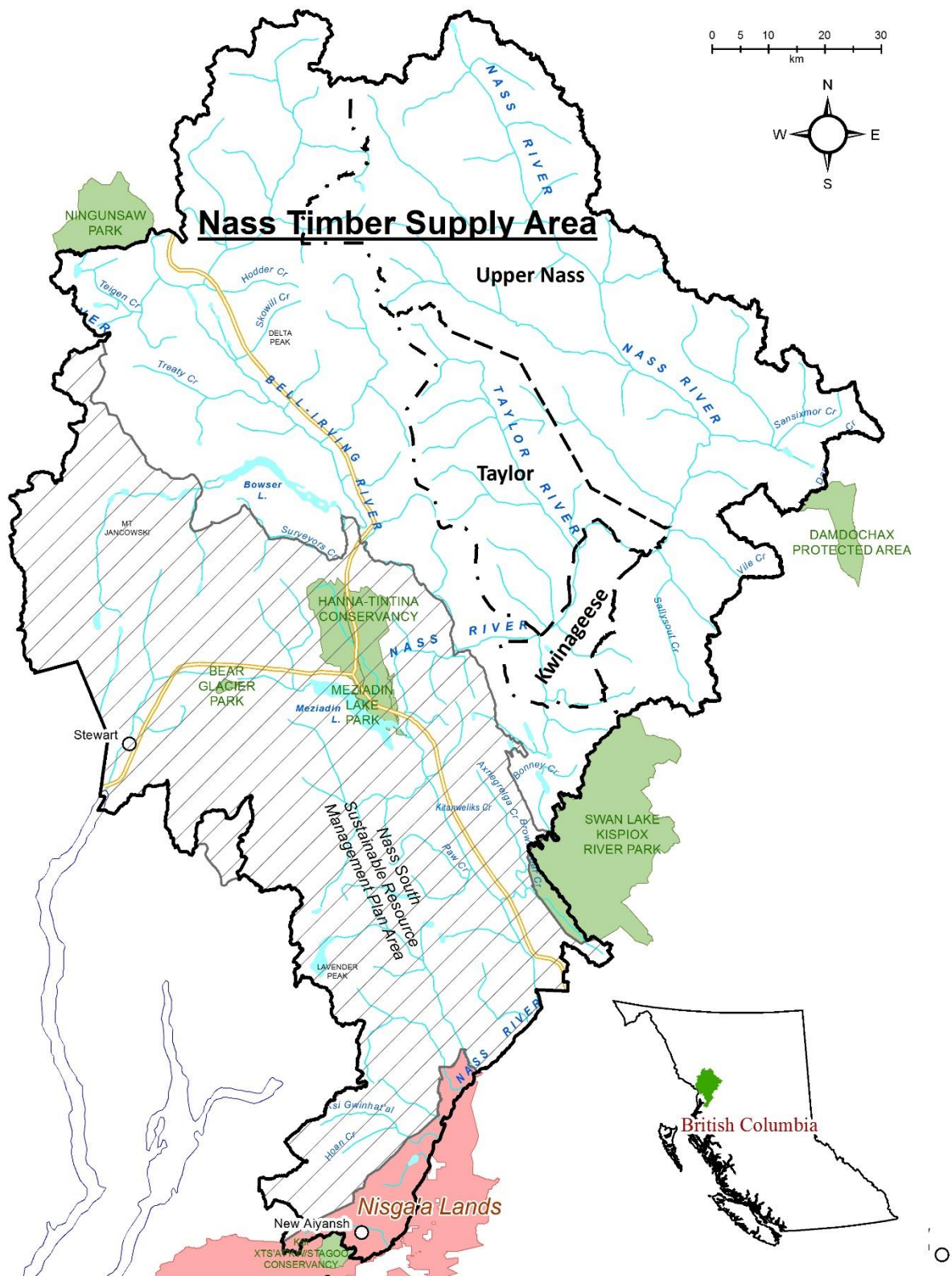


Figure 1. Nass Timber Supply Area.

2.2 Land use planning

Management in the south and west of the Nass TSA is guided by the Nass South Sustainable Resource Management Plan (SRMP) which was completed in 2008. The Nass South SRMP was developed to help address sustainability issues identified by the Gitanyow Nation in their traditional territory in the Nass TSA. The SRMP goals/objectives/measures/indicators and targets, which comprise the *Gitanyow Lax'yip Land Use Plan* (GGLUP), were included in Schedules A and B of the *Gitanyow Huwilp Reconciliation and Recognition Agreement* accepted by government in 2012.

The plan was developed to address forest management issues of Gitanyow in their traditional territory in the Nass TSA and to establish legal objectives under the *Forest and Range Practices Act* (FRPA). Nisga'a Lisims Government also participated in the SRMP planning process with respect to treaty interest areas that are located within the Nass TSA. At that time the two major licensees and British Columbia Timber Sales (BCTS) had committed to follow the plan, and subsequently the two major licensees revised forest stewardship plans to reflect the SRMP and GGLUP. Many objectives from the Nass South SRMP were formalized in 2016 under Section 93.4 of the *Land Act* for the purposes of FRPA. These include objectives for: water, biodiversity, pine mushrooms, fur-bearers, northern goshawk, special habitats for general wildlife, fisheries, cultural heritage resources, and water management units. These objectives and how they are considered in the TSR forest estate modelling are further discussed below.

The SRMP and GGLUP do not include the Upper Nass partition area, the Taylor and Kwinageese watersheds in the east and most of the area north and east of Bowser Lake.

Specific forest stewardship plans (FSP) were developed for the Nass South SRMP and GGLUP objectives by Skeena Sawmills Ltd. and Canada Resurgence Developments Ltd. BCTS has a replacement FSP, approved in 2016, that is consistent with the SRMP and GGLUP objectives.

For the Kwinageese watershed, the Kalum Forest District manager in 1993 approved the Kwinageese Integrated Resource Management Plan (IRMP). The plan prescribed special management zones to address non-timber values, including biodiversity, fish and wildlife and recreation opportunities. The Kwinageese IRMP is considered a policy plan of which components have been incorporated into current management as identified through forest stewardship plans.

The province, Skeena Region, is embarking on a new land use planning initiative with the Tahltan Nation for the northern portion of the Nass TSA within Tahltan's asserted traditional territory.

2.3 First Nations/Nations

In the Nass TSA, five First Nations/Nations have asserted traditional territory or treaty interests. They are: the Gitanyow Nation; the Gitxsan Hereditary Chiefs within the Nass Watershed; the Nisga'a Lisims Government (NLG) including the Nisga'a Villages of Gingolx, Gitwinksihlkw, Laxgalt'sap and New Aiyansh (Gitlaxt'aamiks); the Tahltan Nation including the Tahltan Band and the Iskut Band; and the Tsetsaut Skii Km Lax Ha First Nation.

Consultation and engagement with the Gitanyow Hereditary Chiefs (GHC) are to follow the *Gitanyow Huwilp Recognition & Reconciliation Agreement* (2016). The GHC have identified Gitanyow Wilp sustainability as an Aboriginal Interest and a sensitivity analysis will look at harvest flow proportionate across the eight Wilps of the Gitanyow Nation which are the Lax Gibuu (Wolf) clan of Wilps of; Gwass Hlaam, Wii'litsxw, Malii, and Haizimsque, and the Lax Ganeda (Frog/Raven) clans of Wilps; Gamlakyeltxw, Gwinuu, Luuxhon and Watakhayetsxw. The GHC have presented boundaries for House (Wilp) territories within the Nass TSA.

The Province is aware of ongoing strategic negotiations between FLNRORD and the Ministry of Indigenous Relations and Reconciliation (MIRR) with the Gitxsan Hereditary Chiefs and recently signed Upper Nass Watershed Agreement. Consultation and engagement with the Gitxsan Hereditary Chiefs within the Upper Nass Watershed will be consistent with the *Upper Nass Laxyip Strategic Engagement Agreement* (2018). The Gitxsan Hereditary Chiefs have presented boundaries for House (Wilp) territories within the Nass TSA. Not all of the Gitxsan Hereditary Chiefs are signatory to the *Upper Nass Laxyip Strategic Engagement Agreement*. Consultation will occur individually with the Gitxsan Houses (Wilps) of Gyologyet and Wiigoobl.

The Province is aware of ongoing negotiations between FLNRORD, MIRR and the NLG regarding commitments resulting from the Kitsault Dispute Settlement which include; a strategic framework agreement, a landscape level monitoring tool and potential accommodation funding opportunities. Consultation and engagement with the NLG will be consistent with the Nass Stewardship Protocol (NSP) negotiations.

Consultation and engagement with the Tahltan Nation are to follow the *Tahltan Central Government Shared Decision Agreement* (2013).

Agreements with the First Nations/Nations in the Nass TSA are listed in Table 3.

Table 1. Current agreements and accommodation measures with First Nations/Nations in the Nass TSA

First Nations / Nations	Agreement	Accommodation measures with province
Gitanyow	<ul style="list-style-type: none"> Gitanyow Huwilp Recognition and Reconciliation Agreement (2016) Agreement which includes the Gitanyow Lax'yip Land Use Plan and Nass South SRMP. 	<ul style="list-style-type: none"> Gitanyow FCRSA (2016) First Nations Tenure (FTOA) Gitanyow Supplemental Forest Licence (SFL) Sustainable Forestry Envelope Funding (SFE) (2018/2019) Gitanyow Natural Gas Pipeline Benefits Agreement (Prince Rupert Gas Transmission Project) (2014) Gitanyow Natural Gas Pipeline Benefits Agreement (Westcoast Connector Gas Transmission Project) (2014)
Gitxsan	<ul style="list-style-type: none"> Gitxsan Strategic Engagement Agreement (SEA) with the Nass Watershed of the Gitxsan; the Upper Nass Laxyip (2018). No agreement with the Gitxsan Wilps Gyologyet and Wiigoobl. 	
Nisga'a	<ul style="list-style-type: none"> Nisga'a Final Agreement (1999). Ongoing Nisga'a Nass Stewardship Protocol Negotiations (NSP) resulting from commitments under the Nisga'a Kitsault Settlement Agreement. 	<ul style="list-style-type: none"> Nisga'a Nation Brucejack Economic & Community Development Agreement (ECDA) (2018) Nisga'a Nation Natural Gas Pipeline Benefits Agreement (Prince Rupert Gas Transmission Project) (2014) Nisga'a Nation Kitsault Economic & Community Development Agreement (2014) Nisga'a Kitsault Mine Settlement Agreement (2014)
Tahltan	<ul style="list-style-type: none"> Tahltan Central Government Shared Decision-making Agreement (2013). Klappan Agreement (2017). Klappan Plan Decision-Making & Management Board Terms of Reference (2017). 	<ul style="list-style-type: none"> Tahltan Nation Brucejack Gold Mine Revenue Sharing Agreement (2018)
Tsetsaut Skii Km Lax Ha	None	None

Table 2. *Gitxsan and Gitanyow House (Wilp) Territories with current Hereditary Chief names within the Nass TSA and agreement contacts*

Nation	Siimgiigyet (current Hereditary Chief)	Wilp territory	Area (hectares)
Gitanyow	Will Marsden	Gamlakyeltxw and Sindihl	80 944
	George Daniels/Harry Daniels	Gwaas Hlaam and Biiyoosxw	39 657
	Ken Russell	Haitsimasxw and Galee	7 640
	Don Russell	Luuxhon	63 639
	Glen Williams and Tony Morgan	Malii and Axwindesxw	30 413
	Gregory Rush	Wii Litsxw and Txawokw	161 270
	Agatha Bright and Debbie Good	Watakhayetsxw and Sidok	11
Gitanyow Wilp Sustainability Director	Tara Marsden		
Gitxsan	Wii Minosik (Larry Sklush)	Dam Tuutsxwhl Ax	74 811
	Delgamuukw (Earl Muldon)	Gwin Hagiisdixw	33 341
	Xhlieyemlakha (John Olson)	Miin Lax Mihil	49 947
	Niist (Bill Blackwater Sr.)	Taax Tsinihl Denden	22 746
	Wii Gyet (Lloyd Morrison)	Wii Gyet	6 438
	Gyolgyet (Fedelia O'Brien)	Xsana Loop	51 246
	Luus (Roy Wilson)	Xsi Lax Uu Andoo o	7 015
	Djogaslee (Ted Mowatt)	Xsi Luu Biiyoosxwit	23 124
	Niist (Bill Blackwater Sr.)	Xsi Luu Wit Wiidit	184 551
	Wiigoobl (Don Wahlstrom)	Xsigalliixawit	24 690
	Gyologyet (Fedelia O'Brien)	Xsihl Guugan	90 909
Gitxsan Upper Nass Laxip Facilitator	Linda Matthews		

2.4 Forest industry

The economic viability of the timber development in the Nass TSA has been highly dependent on log export and pulp log markets. Currently there are no wood processing facilities located within the Nass TSA. Skeena Sawmills Ltd., a major forest licence holder and sawmill operator, sources timber from the Nass TSA and other management units to supply sawlogs to their Terrace sawmill. Since the 2002 AAC determination the pulp mills in Prince Rupert and Kitimat have closed, further reducing demand for forest products from the Nass TSA. All other wood products from the Nass TSA not utilized in the Terrace sawmill are shipped through the Stewart Port for export to overseas markets.

Of the current AAC of 865 000 cubic metres, 58 percent is apportioned to Replaceable Forest Licences, 13 percent to non-replaceable Forest Licences (for economic development opportunities for First Nations/Nations), 28 percent to BC Timber Sales Licences and 2 percent to Forest Service Reserve. Also in the Nass TSA there is a portion of the AAC that is subject to a partition of 200 000 cubic metres that applies to the Upper Nass portion of the TSA. There is no road access to the partition area at this time, with the cost for developing access being historically prohibitive to forest licensees. Current commitments include replaceable forest licences for Skeena Sawmills Ltd. and Canada Resurgence Developments. Historic poor market conditions have led to a significant decrease in the harvesting within the TSA, although, periodic increases in market conditions are reflected in increases in harvest activities.

First Nations/Nations with asserted traditional territory in the Nass TSA are expressing desire to be involved in the forest sector. At this time there are 157 293 cubic metres apportioned for First Nations/Nations in the form of either forest licences or non-replaceable forest licences. This volume includes the cancelled Sim Gan forest tenures. The Gitanyow Nation First Nations Tenure Opportunity (FTOA), and Gitanyow Nation Supplemental Forest Licence (SFL) are aligned with Northcrest Forest Products and with its legacy companies of Kitwanga Mills, Kitwanga Exports and KLC Group. They have operations including; chipping, export and value added ventures within the Nass TSA that support the GHC short-term and long-term interests. The Nisga'a Nation is interested in reinstating the cancelled Sim Gan Forest Licence.

Export of timber from the Nass TSA was enabled through a 2008 Order in Council (OIC) that exempted tenures holders for all timber species from log manufacturing requirements. The OIC in effect for the Nass TSA was extended and then rescinded on July 31, 2019. A new log export policy was developed with input from First Nations/Nations and the forest industry, and a subsequent OIC was approved for the Nass TSA on July 10, 2019, and will be rescinded on July 31, 2024. The new OIC allows for a 70% exemption from log manufacturing requirements.

Stewart is the major coastal shipping point for export of the timber harvested in the Nass TSA. Export facilities are located at the end of the Portland Canal, south of the town of Stewart. The port facilities enable year round access to overseas markets for timber export. The proximity to the Nass TSA enables movement of fibre from the TSA that would not be economical to move to traditional sawlog markets in Terrace.

3. Current Forest Management Considerations and Issues

3.1 Base case management assumptions

The assumptions described in this data package reflect current 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 forecast that is called the base case scenario and is one component of the information presented to the chief forester for a Section 8 AAC determination under the *Forest Act*. Further, the base case scenario is used as a reference to which other harvest forecasts are compared in order to test the sensitivity of assumptions or critical issues.

3.2 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 by promoting carbon uptake and storage. Deciding on the preferred management approach will involve consideration of established climate change strategies, and available adaptation and mitigation options together with social, economic, cultural, and environmental objectives.

The technical report *Climate patterns, trends, and projections for the Omineca, Skeena, and Northeast Natural Resource Regions, British Columbia* (Foord, V. 2016) summarizes baseline climate, trends, and projections for the area that includes the Nass TSA. The Skeena Natural Resource Region has become warmer and wetter over approximately the last century. Most significantly, summer precipitation has increased by more than 10 percent and winter temperatures have increased by about 2°C. Projections to 2055 for the Skeena Natural Resource Region suggest that mean annual temperature may increase by 3.1°C and mean annual precipitation may increase by seven percent. Increases in precipitation in the region will likely be as rainfall as snow is projected to decrease by about 35 percent. For the Coast Mountains Natural Resource District, which is closest to the coast, snow is projected to decrease by 72 percent.

It is not possible to confidently predict the specific quantitative impacts on timber supply of climate change given both the uncertainty of the rate and specific characteristics of climate change and the uncertainty around the impact to the forest and how management will respond. Therefore, the base case will not include specific accounting for climate change projections. However, current changes (e.g., recent natural disturbances, silvicultural practices, forest growth monitoring) that may relate to climate change are captured as part of existing data collection processes and incorporated into the timber supply review. Furthermore, information on climate trends, potential impacts to forest ecosystems and communities that depend on forests and related values, and potential management responses will be presented for consideration when the chief forester makes the AAC determination.

3.3 Cumulative effects

The need to measure the effects of all natural resource activities on the values important to British Columbians led to the provincial government establishing a Cumulative Effects Framework (CEF) to guide the assessment of cumulative effects across natural resource sectors. The CEF and TSR both provide landscape-level assessments that report on the state of values to support decision making. Currently, CEF has assessment protocols for aquatic ecosystems, grizzly bear, and old growth forests that are approved by the Natural Resource Sector for implementation. Indicators under these protocols relevant to the Nass TSA that have been completed prior to the AAC determination will be presented to the chief forester.

3.4 Major forest management considerations and issues

Table 3 lists major forest management considerations and issues for the current Nass TSA TSR. Issues that fall within the definition of current management are modelled as best as possible within the base case harvest forecast. Other issues that may infer significant uncertainties in current management may be assessed in further sensitivity analyses.

Table 3. Major forest management considerations

Consideration/issue	Description
Vegetation Resources Inventory	The current forest inventory is primarily based on aerial photography and classification completed prior to 1990 under Forest Cover Inventory standards. Updates to the inventory have captured harvesting and natural disturbances up to 2017.
Land use planning	The Nass South SRMP was completed in 2008. The SRMP goals/objectives/measures/indicators and targets, which comprise the Gitanyow Lax'yp Land Use Plan, were included in the Gitanyow Huwilp Reconciliation and Recognition Agreement with the provincial government in 2012. Objectives for water, water management units, biodiversity, pine mushrooms, fur-bearers, northern goshawk, general wildlife, fisheries and cultural heritage resources were formalized in 2016 under a Land Use Objectives Regulation Order. The Nass South SRMP and GLLUP apply to about half of the TSA (Gitanyow's asserted traditional territory).
Nisga'a lands	The Nisga'a Treaty was fully ratified in April 2000. Categories of Lands identified in the Nisga'a Final Agreement are excluded from the Nass TSA in the base case of the timber supply analysis.
Upper Nass	The economic viability of Upper Nass harvesting operations remains in question. No harvesting has occurred in the Upper Nass. Funding of large infrastructure investments (roads and bridges) is uncertain at this time.
Operability	Operability in the Nass TSA is dependent on both physical and economic factors. Several operability mapping studies have been completed within the Nass TSA, but there are concerns about the validity of this mapping given current economic conditions.
Problem forest types	Some sites within the operable land base are difficult to regenerate once harvested. Other sites are occupied by timber of sub-marginal merchantability. These sites are avoided during harvesting; however, identification of such sites based on inventory attributes may be difficult.
Markets	No primary processing facilities exist in the Nass TSA and limited facilities exist with the region. An Order in Council (OIC), approved July 10, 2019, allows for 70% export of logs (i.e., exemption from Section 127 of the <i>Forest Act</i>) from the Nass TSA.
Forest health	Elevated levels of spruce beetle were detected in the Nass TSA in 2015, especially the Bell-Irving river corridor. Beetle probing has occurred in this corridor and the Coast Mountains Natural Resource District is working with Skeena Region, forest licensees in the Nass TSA and First Nations/Nations to address the potential impacts from spruce beetle.

3.5 Management changes since 2001

The current AAC is based upon analysis completed in 2001. Since 2001 a number of changes to forest management have occurred in the Nass TSA that may impact the timber supply. These changes include:

- New legislation in BC governing forest management – the *Forest and Range Practices Act* and associated Regulations replaced the *Forest Practices Code of BC Act* (FPC).
- A June 2008 OIC, valid for 10 years, enabled 100 percent export of logs from the Nass TSA. This OIC was extended until January 26, 2019, while consultation with First Nations/Nations and engagement with stakeholders occurred. A new OIC, approved July 10, 2019, allows for 70% export of logs from the Nass TSA. This OIC will be rescinded on July 31, 2024.
- Old Growth Management Areas (OGMA) have been spatially delineated and made legal via objectives designated in 2016 in the Nass South SRMP and GLLUP area. Outside of the SRMP and GLLUP area, the OGMA's are established via the *Objectives enabled by Regulation: Order Establishing Provincial Non-Spatial Old Growth Objectives*, 2004 and implemented via the Biodiversity Emphasis Options fully described in the *Forest Practices Code of BC Biodiversity Guidebook*, 1995.
- The Nass South SRMP was completed in 2008 and was incorporated into the Gitanyow Huwilp Reconciliation and Recognition Agreement in 2012, with legal objectives from the SRMP established in 2016.
- The following protected areas have been established:
 - Hanna-Tintina Conservancy Area (2013);
 - Ningunsaw Provincial Park (2003);
 - Damdochax Protected Area (2001).
- The following Government Action Regulations (GAR) have been established for wildlife:
 - Mountain goat ungulate winter range (2008);
 - Moose ungulate winter range (2014);
 - Grizzly bear wildlife habitat area (2014).

4. Inventories

4.1 Vegetation resource inventory

The forest inventory in the Nass TSA was originally completed in 1975, a partial re-inventory occurred in 1989, and since 2001 a few small areas have been re-inventoried to Vegetation Resource Inventory (VRI) standards. As such, over 85 percent of aerial photography and forest cover classification within the inventory was collected prior to 1990; and most inventory attributes were classified under the older Forest Inventory Protocol standards.

Inventory audits were completed in 1993 (revised report 1996) for the Upper Nass and in 1996 for the Lower Nass. These audits suggested that the mature component of the inventory was statistically acceptable; but the immature site index assignment may not be accurate in the Lower Nass.

The data set used for the timber supply analysis was extracted in June 2018 from the British Columbia Geographic Warehouse (BCGW)¹. Attributes were projected to January 1, 2018. Polygons were updated for harvest and natural disturbance depletions to the beginning of 2017 using the Forest Analysis and Inventory Branch consolidated cutblocks layer (2018). This spatial data set combines harvest data from VRI, Reporting Silviculture Updates and Land Status Tracking System (RESULTS) reporting system, forest tenures applications and satellite imagery using change detection processes.

FAIB staff responsible for the VRI program note that a new inventory for the Nass TSA is not planned prior to the current timber supply review process.

Data source and comments:

WHSE_FOREST_VEGETATION.VEG_COMP_LYR_R1_POLY

WHSE_FOREST_VEGETATION.VEG_CONSOLIDATED_CUT_BLOCKS_SP

4.2 Ecosystem mapping

British Columbia has an extensive biogeoclimatic ecosystem classification program. In the Nass TSA, mapping of climatic zonal and subzonal classification is available with a corresponding descriptive guide.

Portions of the Nass TSA have been mapped to the site series level via Predictive Ecosystem Mapping (PEM) projects; however, these past projects have not had or failed accuracy assessments.

Data source and comments:

WHSE_FOREST_VEGETATION.BEC_BIOGEOCLIMATIC_POLY

4.3 Site productivity

In the Nass TSA several sources of information on site productivity exist that may be used as input to growth and yield models for deriving managed stand volume tables.

- Forest inventory site index-based estimates of height and age from aerial photography.
- Provincial site productivity layer developed by FAIB based on either SIBEC relationships or default biophysical model.

Site index based on forest inventory attributes is believed, as determined in other management units, to underestimate the potential site productivity for younger and older stands. In the base case, the provincial site productivity layer estimates will be used. For the Nass TSA, the estimates are based on a biophysical model that is a simple regression model of improved site index data related to BEC zone, slope, aspect, elevation, and various climate variables.

¹ The British Columbia Geographic Warehouse is the source for land and resource data managed and made available by the BC government. See <http://www.data.gov.bc.ca/dbc/geographic/index.page>.

In other management units, the provincial site productivity layer site index estimates are based on a SIBEC approach. The SIBEC approach assigns a potential site index to the site series identified from ecosystem mapping. However, as no approved site series mapping has been completed in the Nass TSA, a SIBEC approach could not be applied.

5. Land Base Definition

5.1 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 modelled 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 management forest land base (CMFLB) and timber harvesting land base (THLB) for the Nass TSA

Netdown factor	Within gross land base (hectares)	Percent of gross (%)	Unique area excluded from THLB (hectares)
TSA boundary	1 711 705		
Non-provincial Crown Lands	30 641	1.8	30 641
Non-forest and non-productive forest	1 086 395	63.5	1 076 409
Roads, trails, landings and linear corridors	8 686	0.5	6 478
Crown management forest land base	598 177	34.9	
Provincial parks and miscellaneous reserves	36 247	2.1	22 712
Recreation sites and trails	160	0.0	109
Recreation trails	326	0.0	188
Inoperable areas	244 922	14.3	28 165
Upper Nass	452 980	26.5	138 629
Low timber growing potential	315 801	18.4	107 647
Deciduous	6 076	0.4	1 472
Old growth management areas	34 739	2.0	22 393
Ecosystem network	59 577	3.5	20 342
Wildlife tree retention areas	2 968	0.2	808
Riparian reserves and management areas	32 375	1.9	7 514
Watershed management units	35 640	2.1	9 712
Wildlife habitat areas	60 589	3.5	12 710
Special habitats for general wildlife	1 075	0.1	171
Archaeological sites	147	0.0	10
Permanent sample plots	33	0.0	7
Ungulate winter range	81 056	4.7	1 595
Pine mushrooms	15 413	0.9	6 421
Timber harvesting land base	217 571	12.7	

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. “Unique area excluded from THLB” shows the area for each factor that was uniquely excluded from the THLB exclusive of other netdown factors.

5.2 Timber supply area boundary

The gross size of the Nass Timber Supply Area is 1 711 705 hectares. Within the bounds of the TSA are areas that do not contribute to the AAC as determined under Section 8 of the *Forest Act* (e.g., Nisga’a lands, Nisga’a Interests, Indian Reserves and Indian Reserve Cut Off Lands).

Boundary adjustments were made to the TSA by an order in council on January 28, 2001 that were not modelled in the 2001 analysis but were accounted for in the AAC determination. This 90 196 hectare block, formerly part of the North Coast TSA, is included in the current analysis.

Data source and comments:

WHSE_ADMIN_BOUNDARIES.FADM_TSA

5.3 Non-provincial Crown lands

Land not administered by the FLNRORD for timber supply in the TSA is excluded from the THLB. Non-provincial Crown lands include private land, municipal land, federal land, Indian Reserves, and Indian Reserve Cut Off Lands. A provincial land ownership layer is maintained by FAIB that amalgamates many data sources to efficiently identify the areas to exclude. The ownership layer was updated in May 2018.

Table 5 shows the gross area of each ownership category and the modelled contribution to the CMFLB and the THLB.

Table 5. Non-provincial Crown lands in Nass TSA

Description	Gross land base (hectares)	CMFLB	THLB
Private	1 579	No	No
Land Claim Settlement Area	28 169	No	No
Federal Reserve	86	No	No
Municipal Parcels	210	No	No
Crown Lease	63	No	No
Unknown Ownership/Exceptions	532	No	No

Data source and comments:

WHSE_FOREST_VEGETATION.F_OWN

5.4 Not managed within TSA AAC

The TSA boundary incorporates provincial Crown lands that may not be considered within the Section 8 AAC determination for the TSA. Area-based tenures (e.g., tree farm licences, community forest agreements, woodlot licences, and First Nations Woodland Licences) have separate AAC determination processes so are excluded from the THLB. In the Nass TSA, there are currently no area-based tenures.

Data source and comments:

WHSE_FOREST_VEGETATION.F_OWN,
REG_LEGAL_AND_ADMIN_BOUNDARIES.CONTROLLED_REC_AREAS_BC,
WHSE_FOREST_TENURE.FTEN_MANAGED_LICENCE_POLY_SVW

5.5 Non-forest and non-productive forest

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

Under the old Forest Inventory Planning (FIP) based inventory, attributes specifically for non-forested, non-productive and non-commercial cover were classified. However, within the new VRI these descriptors are not classified but attributes are collected that identify similar non-subjective attributes. These include non-vegetated and various classes of vegetated areas based on the BC land classification system (BCLCS).

The forest inventory of the Nass TSA is an older FIP based inventory that has been converted to the current VRI 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 6 presents the attributes used to identify non-forest and non-productive forest that is to be excluded from the timber harvesting land base.

Table 6. Description of non-forest, very low productivity and non-commercial areas

Attributes	Gross land base (hectares)	Description
BCLCS level 3 = 'A'	853 296	Alpine
BCLCS level 1 equal 'N'	34 381	Non-vegetated
BCLCS level 3 = 'W'	13 597	Wetlands
BCLCS level 2 = 'N' AND BCLCS level 4 not equal to 'ST' or 'SL'	134	Non-treed herb/bryoid cover
BCLCS level 4 = 'ST' or 'SL' AND no logging history	86 913	Non-treed shrub cover (no logging history)
Site index < 3.0 m or null AND no logging history	21 087	Sparsely treed and does not contribute to forest cover objectives (no logging history)
FC1 non-productive forest descriptor is present AND no logging history	76 863	Old classifications carried over in VRI (no logging history)
BCLCS level 1 equal 'U'	124	Unclassified
Total non-forest and non-productive	1 086 396	

Data sources and comments:

BCGW: WHSE_FOREST_VEGETATION.BEG_COMP_LYR_R1_POLY

5.6 Roads, trails, landings and linear corridors

Productive forest land is lost due to permanent roads, trails and landings (RTL) and maintained transmission lines. Separate estimates are made in the base case to reflect the loss in productive forest land due to existing RTL and the losses that will occur as the road network expands over time to access future cutblocks.

Existing RTL

The Provincial Consolidated Roads layer is a composite of multiple spatial data sources (Digital Road Atlas, Forest Tenures, TRIM, Oil and Gas Commission, and RESULTS) that was created for use in provincial cumulative effects projects. It will be used in the base case as the most comprehensive source for road network information. The roads are represented by lines in the spatial data and the area permanently maintained as cleared right of way must be estimated. In the base case, the non-forested area around roads will be approximated by applying a buffer around the road lines to represent the average width of the right of way. The buffer widths are based on provincial averages that vary by road surface type and are listed in Table 7.

Table 7. Provincial average road right of way widths

Road surface	Modelled buffer width (metres)	CMFLB	THLB
Rough	15	No	No
Loose	20	No	No
Paved	30	No	No
Transmission line	40	No	No

During logging, additional area is permanently lost from the forested land base when landings are established. Under current practice, licensees attempt to replant the majority of the cutblock area but a proportion of the access structure area remains highly disturbed and cannot support regeneration. The Consolidated Roads layer accounts for the major access structures within the majority of recorded cutblocks based on RESULTS data. In some instances, additional area permanently lost to trails and landings within cutblocks is also recorded in the RESULTS data and will be excluded from the forested area as part of the Consolidated Roads layer exclusion. Some additional trails and landings may not be excluded due to the inconsistency of the RESULTS data.

There are BC Hydro transmission line right of ways passing through the TSA. These areas are maintained with vegetation control so they will also be excluded from the forested area in the base case. The Consolidated Roads layer and transmission line mapping were combined with the provincial one-hectare grid to calculate the forested area within each hectare lost to roads, trails, landings and linear corridors. The proportion of the hectare lost was applied as a partial reduction to the CMFLB in the land base classification. A total of 8686 hectares were excluded from the CMFLB for the base case.

Future RTL

As development occurs in the TSA, additional area will become permanently non-forested due to future RTLs. The timber supply model includes a module that projects the future road network development from the current road network based on slope and estimated water crossings. The area permanently lost to the projected road development is tracked and adjusted at each time step of the model forecast. Future cutblocks are forecast along this network so that the area lost to roads within cutblocks is accounted for in the base case using this module and the road widths listed in Table 7. Recent harvesting has transitioned away from the use of landings and the majority of harvesting currently uses roadside landing. Therefore, any area that will be left permanently disturbed as a result of landing to the roadside in future harvesting will be accounted for by the non-forest right of way reduction for future roads.

Data sources and comments:

WHSE_BASEMAPPING.DRA_DIGITAL_ROAD_ATLAS_LINE_SP

WHSE_FOREST_TENURE.ABR_ROAD_SECTION_LINE

WHSE_FOREST_VEGETATION.RSLT_FOREST_COVER_INV_SVW

WHSE_FOREST_TENURE.FTEN_ROAD_SECTION_LINES_SVW

WHSE_BASEMAPPING.TRIM_TRANSPORTATION_LINES

WHSE_MINERAL_TENURE.OG_PETRLM_DEV_RDS_PRE06_PUB_SP

WHSE_MINERAL_TENURE.OG_PETRLM_DEV_ROADS_PUB_SP

WHSE_MINERAL_TENURE.OG_PETRLM_ACCESS_ROADS_PUB_SP

WHSE_TANTALIS.TA_TRANSPORTATION_SVW

WHSE_TANTALIS.TA_SURVEYED_ROW_PARCELS_SVW

5.7 Provincial parks and miscellaneous reserves

British Columbia has an extensive protected areas strategy that was developed to protect natural, cultural and recreational values. At the initiation of the 1993 Protected Areas Strategy the Nass Basin Ecosection had been underrepresented in the British Columbia protected areas system.

Protection is afforded under several acts including the *Ecological Reserves Act*, *Park Act*, *Protected Areas Act* and *Environment and Land Use Act*. Provincial Class A Parks preserve the natural environment and provide public use and enjoyment and in the Nass TSA include Bear Glacier, Meziadin Lake and Swan Lake Provincial Parks. The Damdochax Protected Area and the Gingietl Creek Ecological Reserve bound the Nass TSA.

The Hanna-Tintina Conservancy was established in 2013 to protect high value salmon spawning habitat in Hanna and Tintina creeks and along the shoreline of Meziadin Lake. The conservancy, in which commercial timber harvesting is not permitted, effectively tripled protected areas within the Nass TSA. The management planning for this Conservancy has stalled, but will be re-initiated within a year in partnership with the Nisga'a Lisims Government and the Gitanyow Nation.

These types of protected areas within the TSA will be considered part of the CMFLB and contribute to objectives for biodiversity and wildlife (Table 8). However, these areas are not administered by the FLNRORD for timber supply and will be excluded from the THLB in the base case.

Table 8. Protected areas not managed within the TSA allowable annual cut

Reserve type	Gross land base (hectares)	CMFLB	THLB
Conservancy, Ecological Reserve, Protected Area, or Provincial Park	34 388	Yes	No
Biodiversity, Mining, Tourism Area	1 794	Yes	No
Special Forest Management Area	65	Yes	No

Data source and comments:

WHSE_TANTALIS.TA_PARK_ECORES_PA_SVW

WHSE_TANTALIS.TA_CONSERVANCY_AREAS_SVW

5.8 Recreation sites and trails

Within the Nass TSA there are several recreation sites and trails or canoe routes identified. The management strategy for these sites typically identifies the maintenance of recreational features, such as a campsite or trail, and the conservation of natural vegetation. This does not preclude industrial activity or harvesting but authorization is required prior to any industrial activity or harvesting. The recreation sites and trails discussed below are known to have high use or established infrastructure and will be excluded from the THLB in the base case.

The largest recreation site is Bonney Lake which provides opportunities for camping, picnicking, angling, boating and canoeing (including a canoe route trail discussed below). The next biggest sites are Jigsaw Lake and Clements Lake which are both managed for a natural recreation experience. A series of one-hectare sites are maintained for the cabins along the Telegraph Trail.

The ownership layer identifies area designated as Use, Recreation and Enjoyment of the Public Reserves. This area is excluded from harvest authorizations in the TSA and will therefore also be excluded from the THLB in the base case.

Table 9. Recreation sites in the Nass TSA

Category	Gross land base (hectares)	CMFLB	THLB
Recreation Site	70	Yes	No
Use, Recreation and Enjoyment of the Public Reserve (61 C)	90	Yes	No

Similar to recreation sites, established recreation trails known to have high use or established infrastructure and will be excluded from the THLB in the base case. Typically a buffer area of 10 metres on either side of the centreline is protected. For example, the objective for the Bonney Lake Portage Recreation Trail is to maintain a semi-primitive non-motorized recreational experience. The active trails, lake shoreline and natural vegetation are protected within 10 meters on either side of the trail centerline to provide opportunities for canoeing, hiking and angling along the trails. A total of 326 hectares were excluded from the THLB for the base case to account for recreation trails.

Data sources and comments:

WHSE_FOREST_TENURE.FTEN_RECREATION_POLY_SVW

WHSE_FOREST_TENURE.FTEN_RECREATION_LINES_SVW

5.9 Inoperable areas

Operability is based on the presence or absence of physical barriers or limitations to harvesting, applicable logging methods and the merchantability of stands. An operability study was conducted in 1989 for most of the Nass TSA and, in 1997, the remaining Upper Nass area was completed. Further studies that looked at operability within the Nass TSA were completed in 2006 and 2007.

The 1989 study, including the 1997 addition, was compared to the history of harvesting since that year. The study was found to be out of date in describing inoperable areas. There has been significant recent harvesting in areas that were classified as inoperable in the study. The study will therefore not be used in the base case.

The 2006 study, which included both the Nass and Kalum TSAs, looked at the potential changes in the economic operability of stands based on improved site productivity information collected. The study produced mapping that assessed the potential harvest system (ground or cable based), the wood quality (sawlog, marginal or pulp) and identified problem areas where stand density is either too low or too high. The study did not expressly identify areas that are inoperable. This study will only be used for descriptive purposes in the base case to attribute the timber supply to a harvest system.

The 2007 operability study was completed as part of the preparation of the Nass South SRMP. The classification of operability was found to be quite reasonable when compared with historic harvesting since 2007. A very minimal amount of harvesting has occurred in the areas classified as inoperable. However, since the study only covers the SRMP area, the operability mapping will only be used for sensitivity analysis.

In the previous 2001 timber supply analysis the FIP based inventory included classification of environmentally sensitive areas (ESA). The areas mapped for ESA sensitive soils were classified as inoperable and excluded from the THLB. The ESA mapping is very dated and is not included in the current VRI so it is no longer acceptable for use in TSR. It has been replaced by the current standard of terrain stability mapping. However, only a small project area within the TSA has terrain stability mapping completed. Since the terrain stability mapping does not sufficiently cover the TSA it will not be used in the base case.

Unstable terrain is often associated with steep slopes and the areas mapped as inoperable in the studies discussed above tend to correlate with steep slopes. These steep areas tend to be concentrated at the top of valleys in the sub-alpine and in deep river draws where harvesting rarely occurs. An evaluation of historic harvesting since 1987 has shown that the steepest slope harvested, at the 99th percentile, was a 55 percent grade. This compares to 77 percent which is the highest slope in the forested land base at the same 99th percentile. Areas of steeper terrain can be found within the TSA but are non-forested.

Slope mapping is consistent across the TSA and the maximum slope grades identified above are based on the most recent harvest performance data available. Since the last AAC determination (2002), the harvest levels have been well below the AAC. Forest development during this period has focussed on existing road infrastructure that is closest to market. Infrastructure development, including access to slopes greater than 55 percent has been occurring recently. To reflect this increasing trend, inoperable areas will be represented in the base case by excluding all slopes greater than 60 percent. A sensitivity analysis will explore the effect on timber supply of excluding all slopes above the 90th percentile which occurs at 31 percent slope.

Table 10. Area identified as inoperable for harvesting in the Nass TSA

Category	Gross land base (hectares)	CMFLB	THLB
Steep slope >60%	244 922	Yes	No

Data sources and comments:

BC Digital Elevation Model

In the previous timber supply review, district staff observed that, while performance on cable terrain had increased over the last five years, use of backhoes to harvest some cable areas was isolating small patches of terrain that would likely be infeasible or uneconomic to harvest in the future. District staff report that this trend has not continued since that time and is no longer a concern.

5.10 Upper Nass

The Upper Nass zone lies within the northeastern portion of the Nass TSA and includes the Sallysout watershed and the area east of the Taylor, Taft and Bell-Irving watersheds to the Nass TSA boundary, which is adjacent to the Prince George TSA. No major development has occurred or is planned to occur to access the Upper Nass zone.

In 1997, BCFS district staff contracted Sterling Wood Group Incorporated to review the physical operability and to investigate alternative access routes into the Upper Nass. Based on this revised operability the Upper Nass, if accessible, may contain about 60 000 hectares of land base suitable for timber harvesting. However, at the time of the study, due to high construction costs to access the Upper Nass, the estimated least expensive route would cost 19.7 million dollars.

In the previous timber supply review the Upper Nass zone was excluded from the THLB in the base case. In the 2002 AAC *Rationale*, the chief forester included a partition of 200 000 cubic metres attributed to the Upper Nass to encourage the future development of this area. There has been no forest development subsequent to the determination so the Upper Nass will remain excluded from the THLB in the current base case. However, sensitivity analysis will evaluate the potential timber supply of the Upper Nass zone under the current base case assumptions. This information may be used by the chief forester to consider extending the partition in the new AAC decision.

Table 11. Area identified as currently inaccessible

Category	Gross land base (hectares)	CMFLB	THLB
Upper Nass	452 980	Yes	No

Data sources and comments:

FLNRORD district shapefile nass_zon

5.11 Low timber growing potential

Sites may have low productivity because of inherent site factors such as nutrient availability, exposure, or excessive moisture. Some of these stands are unlikely to grow a merchantable crop of trees.

Low sites will be identified as natural stands that have yield projections that do not achieve the minimum harvestable volume criteria (Section 6.1.4) and will never be eligible for harvest in the timber supply forecast. Since these stands are not harvestable they should not be included in the THLB.

Table 12. Description of sites with low timber growing potential

Leading species	Minimum harvest volume (m ³ /hectare)	Gross land base (hectares)	CMFLB	THLB
All	277	315 801	Yes	No

Data source and comments:

WHSE_FOREST_VEGETATION.VEG_COMP_LYR_R1_POLY

VDYP7

5.12 Problem forest types

Problem forest types are stands that are physically operable but are not currently utilized or have marginal merchantability. In the Nass TSA several problem forest types have been historically identified and described within past TSR.

In the 2001 timber supply analysis, the main problem forest type of concern was low density, open-grown mature hemlock and balsam-leading stands. To a lesser degree, small, densely-stocked lodgepole pine stands were also considered a problem forest type being avoided for harvest. The inventory attributes used to identify these stands were retired in the transition to the current VRI. In preparation for this analysis, investigations using the current inventory found that stands of these general characteristics were already excluded from the THLB by the revised low timber growing potential factor. The low stocking or poor stagnated growth resulted in yield projections that never achieve minimum harvest criteria.

In the 2002 AAC *Rationale*, the chief forester considered it unlikely that all the leading-hemlock and balsam stands greater than 141 years of age would be merchantable and therefore some portion should be excluded as problem forest types. He encouraged district staff to examine this issue prior to the next determination. District staff note that the viability of these stands for harvest is closely tied to market demand and pricing, particularly for pulp logs. In preparation for this analysis, the species and age of all stands harvested since the previous analysis were summarized by comparing the cutblock location to the archived 2002 FC1 inventory. Over the past 15 years the harvest profile in terms of species and age class has reasonably matched the profile of the forested TSA. This positive trend is also evident in the summaries provided in the *Provincial Timber Management Goals, Objectives & Targets Management Unit Targets Report* (August, 2018) prepared annually by FAIB.

Considerable areas within the TSA are not merchantable for harvest but these stands are well identified and excluded from the THLB in the base case by the other factors in land base definition process. Therefore, since there is no clear pattern that one particular stand type is being avoided for harvest, there will be no problem forest type reduction applied in the current base case.

5.13 Deciduous

Deciduous broadleaf species are not commercially used in the Nass TSA. As such, for the current TSR, deciduous-leading stands will be excluded from the THLB.

In the Nass South SRMP Order and GLLUP, objectives have been established to maintain a diversity of deciduous and coniferous species. It is required that deciduous-leading stands or an equivalent area is regenerated as deciduous leading in order to maintain the natural species representation. In the base case scenario, the timber supply implications of this objective are assumed to be addressed by the exclusion of deciduous-leading stands contributing to the timber supply.

Table 13. Problem forest types criteria – deciduous

Description	Gross land base (hectares)	CMFLB	THLB
Deciduous-leading stands	6 076	Yes	No

Data source and comments:

WHSE_FOREST_VEGETATION.VEG_COMP_LYR_R1_POLY

5.14 Landscape biodiversity

Biodiversity planning occurs at multiple levels, including the landscape level. In British Columbia the approach to landscape-level biodiversity planning is through a variety of mechanisms including requirements for the distribution of seral stages (e.g., old or old plus mature requirements), old growth management area designations, patch size distribution, and connectivity corridors.

5.14.1 Seral stage requirements

On June 30, 2004 the Non-Spatial Old Growth Order came into effect. This order established all landscape unit boundaries and established non-spatial targets for each landscape unit. Licensees are required to follow the old growth percentages by Natural Disturbance Type (NDT) from the *Biodiversity Guidebook*. The targets, listed as seral stage ‘old’ in Table 14, will be modelled in the base case for the entire TSA.

The 2016 Nass South SRMP Order and GLLUP expands on the *Biodiversity Guidebook* objectives by setting ‘early’ and ‘mature plus old’ in addition to the ‘old’ seral requirements. These requirements are identified in Schedule G of the order as shown in the below in Table 14. These additional seral-stage requirements will be modelled within the SRMP and GLLUP area in the base case.

Table 14. Nass South SRMP seral stage requirements

Landscape unit	Biodiversity emphasis option	Biogeoclimatic ecosystem classification	Seral stage	Age (years)	Forest area (%)
Bear	Intermediate	CWHwm	Early	<40	<30
			Mature + Old	>80	>36
			Old	>250	>13
		ESSFwv	Early	<40	<22
			Mature + Old	>120	>36
			Old	>250	>19
		MHmm2	Early	<40	<22
			Mature + Old	>120	>36
			Old	>250	>19
		MHun	Early	<40	<17
			Mature + Old	>120	<22
			Old	>250	>36
Bowser	Low	ESSFwv	Early	<40	N/A
			Mature + Old	>120	>19
			Old	>250	>19
		ICHvc	Early	<40	N/A
			Mature + Old	>100	>17
			Old	>250	>13
Brown Bear	Low	ESSFwv	Early	<40	N/A
			Mature + Old	>120	>19
			Old	>250	>19
		ICHmc1	Early	<40	N/A
			Mature + Old	>100	>15
			Old	>250	>9
Cambria Icefield	Low	ESSFwv	Early	<40	N/A
			Mature + Old	>120	>19
			Old	>250	>19
		MHmm2	Early	<40	N/A
			Mature + Old	>120	>19
			Old	>250	>19
Kinskuch	Intermediate	ESSFwv	Early	<40	<22
			Mature + Old	>120	>36
			Old	>250	>19
		ICHmc1	Early	<40	<36
			Mature + Old	>100	>31
			Old	>250	>9
		ICHvc	Early	<40	<30
			Mature + Old	>100	>34
			Old	>250	>13

(continued)

Table 14. Nass South SRMP seral stage requirements (continued)

Landscape unit	Biodiversity emphasis option	Biogeoclimatic ecosystem classification	Seral stage	Age (years)	Forest area (%)
Kwinamuck	Low	CWHws2	Early	<40	N/A
			Mature + Old	>80	>17
			Old	>250	>9
		ICHmc1	Early	<40	N/A
			Mature + Old	>100	>15
			Old	>250	>9
		MHmm1	Early	<40	N/A
			Mature + Old	>120	>19
			Old	>250	>19
		MHmm2	Early	<40	N/A
			Mature + Old	>120	>19
			Old	>250	>19
Madely	Intermediate	ESSFwv	Early	<40	<22
			Mature + Old	>120	>36
			Old	>250	>19
		ICHmc1	Early	<40	<36
			Mature + Old	>100	>31
			Old	>250	>9
		ICHvc	Early	<40	<30
			Mature + Old	>100	>34
			Old	>250	>13
Tchitin	High	CWHws2	Early	<40	<27
			Mature + Old	>80	>51
			Old	>250	>13
		EssFwv	Early	<40	<17
			Mature + Old	>120	>54
			Old	>250	>28
		ICHmc1	Early	<40	<27
			Mature + Old	>100	>46
			Old	>250	>13
		MHmm2	Early	<40	<17
			Mature + Old	>120	>54
			Old	>250	>28
Tintina	Low	ESSFwv	Early	<40	N/A
			Mature + Old	>120	>19
			Old	>250	>19
		ICHmc1	Early	<40	N/A
			Mature + Old	>100	>15
			Old	>250	>9
		ICHvc	Early	<40	N/A
			Mature + Old	>100	>17
			Old	>250	>13

(continued)

Table 14. Nass South SRMP seral stage requirements (concluded)

Landscape unit	Biodiversity emphasis option	Biogeoclimatic ecosystem classification	Seral stage	Age (years)	Forest area (%)
White	Intermediate	ESSFwv	Early	<40	<22
			Mature + Old	>120	>36
			Old	>250	>19
		ICHmc1	Early	<40	<36
			Mature + Old	>100	>31
			Old	>250	>9
		ICHvc	Early	<40	<30
			Mature + Old	>100	>34
			Old	>250	>13
		MHmm2	Early	<40	<22
			Mature + Old	>120	>36
			Old	>250	>19
Wildfire	Intermediate	ESSFwv	Early	<40	<22
			Mature + Old	>120	>36
			Old	>250	>19
		ICHvc	Early	<40	<30
			Mature + Old	>100	>34
			Old	>250	>13

5.14.2 Old growth management areas

Old growth forests are considered a key biodiversity component and a coarse filter for maintaining ecological diversity at the landscape level over time. It is recognized that OGMA's are only one tool in maintaining biodiversity. Old growth attributes are also managed across the landscape at a stand level and may be included via other fine filter tools such as wildlife tree patches, wildlife habitat areas, or other tools used to capture specific features important to old growth and biodiversity goals. OGMA's, while usually comprising "old forests", may also capture younger forests or unusual/rare features that have importance, either to the integrity of the OGMA or within themselves.

In the Nass TSA, old growth management areas were established in 2016 for the Nass South SRMP and GLLUP area as an objective under Section 93.4 of the *Land Act*. Schedule H of this order identifies the location of the old growth management areas. Outside of the Nass South SRMP and GLLUP area, the OGMA's are established via the *Objectives enabled by Regulation: Order Establishing Provincial Non-Spatial Old Growth Objectives*, 2004 and implemented via the Biodiversity Emphasis Options fully described in the *Forest Practices Code of BC Biodiversity Guidebook*, 1995.

In the base case, OGMA's will be excluded from the THLB and included within the CMFLB that contributes to other non-timber objectives.

Table 15. Old growth management areas in the Nass TSA

Description	Gross land base (hectares)	CMFLB	THLB
Old growth management areas	34 739	Yes	No

Data source and comments:

WHSE_LAND_USE_PLANNING.RMP_OGMA_LEGAL_CURRENT_SVW and
WHSE_LAND_USE_PLANNING.RMP_OGMA_NON_LEGAL_CURRENT_SVW

5.14.3 Ecosystem network

The Nass South SRMP and GLLUP were developed to manage forest connectivity by establishing ecosystem networks that are zones within and across landscapes. The networks were intended to capture biodiversity “hotspots”, high habitat values, important wildlife movement corridors, and serve to connect habitats across all elevations. The Nass South SRMP Order and GLLUP specify ecosystem networks and their expected management.

The ecosystem network is the best approximation of the major hydroriparian zones developed utilizing aerial photos, mapped topography and digital elevation models. The legal linework delineating the upper edge of the ecosystem network was intended to mirror the edges of the hydroriparian zone. Objective 18 of the order excludes harvesting from the hydroriparian zone so, in the base case, the ecosystem network will be fully excluded from the THLB and included within the CMFLB that contributes to other non-timber objectives.

Objective 20 of the order specifies that a 100-metre buffer must be retained around an ecosystem network but does allow for limited harvest within the buffer. The order specifies that harvesting within the buffer must retain at least 70 percent of the naturally occurring mature and old-forest structure (live trees, range of diameter classes, snags, coarse woody debris, tree species, etc.) of the harvest unit measured either as basal area or forest area. This allowance will be approximated in the base case by reducing the THLB within the buffer by 70 percent.

Table 16. Ecosystem network in the Nass TSA

Description	Gross land base (hectares)	CMFLB	THLB
Ecosystem network	47 405	Yes	No
Ecosystem network buffer	12 172	Yes	30%

Data source and comments:

WHSE_LAND_USE_PLANNING.RMP_PLAN_LEGAL_POLY_SVW

5.14.4 Disturbance outside of the THLB

The forested land base may be disturbed by many factors including natural events such as fire, pests, wind, and anthropological events such as forest harvesting and road building. These disturbances influence both timber supply and requirements for non-timber objectives. Natural disturbance outside the THLB should be accounted for to prevent the forest from aging continuously and contributing inappropriately to forest cover requirements of non-timber objectives.

The base case will model natural disturbance based on return intervals defined in the *1995 Forest Practices Code of British Columbia Biodiversity Guidebook*. Each period of the forecast, a representative area will be modelled as disturbed and reset to 20 years old.

Table 17. 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	1	250	250	395	4 863	12
CWH	2	200	250	350	3 920	11
ESSF	1	350	250	490	93 415	191
ESSF	3	150	140	231	18 370	80
ICH	1	250	250	395	59 729	151
ICH-	2	200	250	350	85 924	245
MH	1	350	250	490	30 062	61
SBS	3	350	250	490	27 318	131

Data source and comments:

Forest Practices Code of British Columbia Biodiversity Guidebook.

5.15 Stand-level biodiversity - wildlife tree retention

FRPA establishes an objective to maintain structural diversity in managed stands by wildlife tree retention (WTR) in each cutblock. The default target under the Forest Planning and Practices Regulation (FPPR) is to maintain a minimum of 3.5 percent retention in each block and a minimum of seven percent of the total annual area of cutblocks. Licensees may vary from this requirement by specifying an acceptable alternative in their FSP.

WTRs are often located within areas that are otherwise constrained, such as riparian areas, sensitive or inoperable terrain and therefore the direct impact to the THLB is likely less than the seven percent minimum retention requirement.

The Nass South SRMP Order and GLLUP, similar to the FPPR, specify that at least 3.5 percent of each proposed cutblock and that at least seven percent of the aggregate of all proposed cutblocks on an annual basis must be maintained or must recruit structural diversity over a rotation as wildlife tree retention.

The WTRs established during historic harvesting were identified using RESULTS silviculture data. These reserves, totalling 2968 hectares, will be excluded from the THLB in the base case under the assumption that the same area, or an equivalent area, will be reserved at the time of future harvest rotations.

All WTR to be established with future harvesting will be represented in the base case by a 3.5 percent reduction in THLB applied at the time of first harvest. The remaining 3.5 percent of the total target of seven percent is assumed to be located within areas already excluded from the THLB for other management objectives such as riparian and inoperable areas.

Table 17. Existing reserves in the Nass TSA

Description	Gross land base (hectares)	CMFLB	THLB
Non-commercial reserve	561	Yes	No
Non-productive reserve	1 436	Yes	No
Wildlife tree reserve	971	Yes	No

Data source and comments:

WHSE_FOREST_VEGETATION.RSLT_FOREST_COVER_RESERVE_SVW

5.16 Riparian reserve and management areas

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.

Riparian management objectives have been established to minimize or prevent impacts of forest and range operations directly on these aquatic resources (e.g., water quality, aquatic ecosystem) and on the values within the surrounding area (e.g., wildlife habitat). Objectives for riparian management are identified under the FPPR and incorporated into FSPs.

Under the South Nass SRMP Order and GLLUP, an objective was established to maintain reserve and management zones around riparian features. The identified requirements for reserve zones and management zones widths are equivalent to the minimums for streams, wetlands and lakes under Sections 47, 48 and 49 of the FPPR except for a minimum management zone width of 20 metres (*versus* zero) for an L1 lake. The order does not specify the level of retention required in riparian management zones so the levels set in the FPPR were assumed to be applicable across the entire TSA.

Historic riparian modelling

The Nass TSA does not have a completed stream inventory and classification. In the 2001 timber supply review, in order to consider riparian areas appropriately, the riparian reserve and management areas were identified for a sample of 12 representative maps, with the results then extrapolated to the whole TSA.

District staff, in conjunction with Ministry of Environment, Lands and Parks staff, stratified the TSA into three geographic zones for the riparian analysis. The three geographic zones were identified due to differing amounts of streams, wetlands and lakes within each geographic zone. The southwest lower Nass zone contains two large lakes (Bowser and Meziadin) as well as numerous fish bearing streams tributary to the Nass River. The southeast lower Nass zone contains numerous small lakes as well as fish bearing streams tributary to the Nass River. The north Bell Irving zone has fewer lakes and fish bearing streams in comparison to the other two zones.

Representative mapsheets were selected for each of the three geographic zones and a fisheries biologist was tasked with classifying streams, wetlands and lakes within each map. The *Forest Practice Code* requirements for riparian reserve zones and riparian management zones were then assigned for each stream, wetland and lake. The total area excluded from timber harvesting was then totalled as a percentage of the forested area by BEC grouping and geographic zone. These reductions were applied to the THLB to account for riparian management objectives in the 2001 analysis.

Table 18. *Riparian reserve and management zone reductions*

Zone	BEC variant	Reduction (%)	Area removed (hectares)
Southeast lower Nass	AT, ESSFwv, ESSFmc, MHmm1	2.8	6 258
	ICHmc1	3.8	9 241
	SBSmc	4.9	2
Southwest lower Nass	AT, ESSFwv, ESSFmc, MHmm1	0.4	1 706
	ICHmc1	1.6	217
	ICHvc	2.4	3 863
Bell Irving	AT, ESSFwv, ESSFmc, MHmm1	1.4	7 678
	ICHvc	2.7	1 553
	SBSmc	4.9	1 857

Data source and comments:

Forest Practices Code of British Columbia Biodiversity Guidebook.

Base case modelling

The FPPR has revised the riparian management objectives since the 2001 timber supply review. The reserve and management zone widths have not changed but the basal area retention levels were reduced by approximately one half. Also, many major riparian features that would have contributed to the estimated total reserve area in 2001 are now completely excluded by ecosystem networks and watershed management units within the SRMP and GLLUP area. It is not possible to calculate how these changes would alter the estimated reduction factors. However, it is certain the factors would be decreased since the basal area retention requirements decreased and the large reserves around the major riparian features, now protected under the SRMP and GLLUP, are no longer contributing to the overall average.

The base case will model the riparian reductions as they were applied in the 2001 analysis with the understanding that timber supply will likely be underestimated. Sensitivity analysis will model the timber supply impacts of reducing the factors by half for consideration by the chief forester at the determination meeting.

Kwinageese IRMP

The approval and implementation of the Forest Practices Code in 1995 superseded most of the recommendations in the Kwinageese IRMP with the exception of those for riparian management, which exceed the *Forest Practices Code* guidelines. Following the recommendations of the Kwinageese IRMP, a riparian reserve zone on the Kwinageese River will be modelled by excluding from the timber harvesting land base a buffer width of 150 metres, applied to both sides of the river, for a total width of 300 metres.

5.17 Water management units

The Nass South SRMP and GLLUP identify Special Resource Management Zones (SRMZ) where management direction for some resource values is incremental to general management direction.

The Nass South SRMP Order establishes SRMZ status on four Water Management Units (WMU) (Schedule K). These WMUs encompass the valley walls and headwater bowls of the large rivers and streams within the plan area. The valley slopes are steep, generally 50 percent to 70 percent in gradient, and continuous from valley bottom to ridge top. Throughout the WMUs there is evidence of past and current slope instability.

The Nass South SRMP and GLLUP identify that the high sensitivity of these headwater wetlands, lakes, and streams requires special management to ensure that industrial operations avoid or minimize impact to water quality and watershed hydrology. The SRMP Order and GLLUP set an objective to retain 100 percent of the forested area of the hydriparian zone of each stream, wetland and lake within each WMU. The majority of the area within the WMUs is considered to be within the hydriparian zone so the entire WMU will be excluded from the THLB in the base case.

Table 20. Nass South SRMP water management units

Watershed management unit	Gross land base (hectares)	CMFLB	THLB
Bell-Irving	5 747	Yes	No
Kinskuch	10 679	Yes	No
Madely/Kwinageese	12 842	Yes	No
Scrub Lake	6 372	Yes	No

Data source and comments:

WHSE_LAND_USE_PLANNING.RMP_PLAN_LEGAL_POLY_SVW

5.18 Red- and blue-listed ecological communities

Specified red- and blue-listed ecological communities under the Nass South SRMP Order and GLLUP require special management considerations. In red-listed communities 100 percent of the area and basal area is generally expected (with a few exceptions) to be maintained within the community as well as a wind firm forested buffer. In blue-listed communities at least 70 percent of the area or basal area of each is expected to be maintained.

Ecosystem mapping is not available for the TSA and Schedule E and F of the Nass South SRMP Order only provides a description of the ecosystems in which the red- and blue-listed ecological communities may be found. These communities can only be identified as they are encountered during operational harvest planning. These areas are then expected to be protected by establishing wildlife tree retention areas or extending riparian reserves to include the communities and the windfirm buffer. Since these types of reserves are already accounted for in the base case no additional exclusions from the THLB will be modelled for this factor. Red- and blue-listed ecological communities that exist outside of the wetter areas such as bogs, or wet forests, are rare across the landscape and/or are not targeted for harvest due to their low site productivity.

Data source and comments:

Schedule E of the February 25, 2016 Ministerial Order Land Use Objectives Regulation Order Nass South Sustainable Resource Management Plan.

5.19 Wildlife habitat areas / specified areas

In the Nass TSA under the Identified Wildlife Management Strategy (IWMS) extensive wildlife habitat areas for grizzly bear were established in 2014 that provides for forested buffers around high value habitats. The general wildlife measures associated with this wildlife habitat area (WHA) require retaining 100 percent of the forested area in a mature or old forest condition with allowance to 90 percent to address operational flexibility where necessary.

In the base case, this WHA will be excluded from the timber harvesting land base.

Table 19. Wildlife habitat area exclusions in the Nass TSA.

Wildlife species and communities	WHA/specified area identification	Gross land base (hectares)	CMFLB	THLB
Grizzly bear	6-282	60 589	Yes	No

Data source and comments:

WHSE_WILDLIFE_MANAGEMENT.WCP_WILDLIFE_HABITAT_AREA_POLY

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>

5.20 Special habitats for general wildlife

The Nass South SRMP and GLLUP identify areas of habitat for general wildlife, centred on wetland and riparian features which are “hot spots” of biodiversity and wildlife activity. Relative to their size, wetland and riparian habitats tend to have a disproportionately higher value for general wildlife than the surrounding forest matrix, and are used by a variety of amphibians, birds and mammals. These areas also serve as biological anchors throughout the landscape.

The Nass South SRMP Order and GLLUP has the objectives of maintaining the effectiveness of riparian habitats adjacent to wetlands and retaining the forested area of the hydriparian zone of areas identified as special habitats for general wildlife.

In the base case, these special habitats for general wildlife, as identified in Schedule J of the Nass South SRMP Order, will be removed from the THLB.

Table 20. Special habitats for general wildlife in the Nass TSA

What	Gross land base (hectares)	CMFLB	THLB
Special habitats for general wildlife	1 075	Yes	No

Data source and comments:

WHSE_LAND_USE_PLANNING.RMP_PLAN_LEGAL_POLY_SVW

5.21 Archaeological sites

Archaeological sites consist of the physical remains of past human activity. Such sites are identified and receive protection under the *Heritage Conservation Act* and other legislation as required. To conduct activities within the boundaries of an archaeological site, a permit is required.

In the Nass TSA, there are approximately 64 sites covering approximately 147 hectares that have been recorded within the Province of BC’s Remote Access to Archaeological Data (RAAD). These include a wide range of sites located both within urban and forest land base. These sites and a 50- metre buffer around them will be excluded from the THLB in the base case.

RAAD is a database of known archaeological interests including sites and some overview assessments. For sites not known, and discovered, protection is automatically provided to sites under the *Heritage Conservation Act* and other legislation as required. Examples of these sites include, but are not limited to those containing physical evidence of human use or activity predating 1846, burial places, and Aboriginal rock carvings or paintings.

If a new potential archaeological site is identified the licensee operationally assesses the identified area(s), follows-up with FLNRORD and Nations who assert traditional territory in the identified area as appropriate, and where required, apply for an alteration permit under the *Heritage Conservation Act*. While these potential areas are not modelled directly in the current analysis they may be captured under other modelling considerations and, if identified in RAAD, would be expected to be captured in future TSRs.

Experience has shown that most cultural heritage resources and in particular smaller archaeological sites can be addressed through current management practices or through changes to the management practices. For example, cultural heritage and archaeological resources are often situated near water bodies and can therefore be protected by using a riparian management area or creating a wildlife tree retention area; both of these management tools are accounted for separately in the timber supply analysis. In other cases these sensitive sites can be protected by using management practices such as winter logging.

Data sources and comments:

WHSE_ARCHAEOLOGY.RAAD_TFM_SITE

5.22 Cultural heritage sites

The *Forest and Range Practices Act* defines a cultural heritage resource as 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. These sites can include but are not limited to; archaeological sites, structural features, linear features such as trails, heritage landscape features, guide outfitter and trapline interests, and traditional use sites, polygons and lines.

In the Nass South SRMP Order and GLLUP objectives were established for preserving 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 and for maintaining a sustainable source of cedar for traditional cultural and subsistence use.

For the base case, the protection of cultural heritage resources (CHR) will be considered to be addressed, through management tools for other values (e.g., wildlife tree retention and riparian) that can be located to also protect CHRs. No land base exclusions will be made to account for cultural heritage resources except for archaeological sites as described above.

5.23 Permanent sample plots

A network of growth and yield permanent sample plots (PSP) is maintained by FLNRORD across the province for the purposes of understanding forest growth and the calibration of growth and yield models. Objectives for these plots have not been established under FRPA. However, harvesting of active PSPs is currently avoided within the plot and its buffer. The objective for the PSP program is to maintain PSPs up to 120-150 years of age before releasing the plot from the study.

FLNRORD FAIB staff identified that an area with a 68-metre radius would be reasonable to associate on average with each plot. For the base case, this radius area around the five PSPs will be excluded from the THLB but considered to contribute to the CMFLB.

Table 21. Growth and yield permanent sample plot in Nass TSA

Installations	Gross land base (hectares)	CMFLB	THLB
GY PSP	33	Yes	No

Data sources and comments:

WHSE_FOREST_VEGETATON.GRY_PSP_STATUS_ACTIVE

6. Current Forest Management Assumptions ---

6.1 Harvesting

6.1.1 Recent harvest performance

Harvest levels in the Nass TSA have been significantly below the AAC. In the five years prior to 2015, only 12 percent of the AAC was harvested. Harvest levels increased in 2016/2017 due to an increase of development of other resources in the Nass TSA, including BC Hydro's Northwest Transmission Line (NTL). No harvest occurred in the Upper Nass partition during that time. The lack of full AAC utilization is due to many issues including: sawlog and pulp log markets, timber quality, tree species, lack of infrastructure (e.g., roads and bridges), lack of primary breakdown processing facilities, and haul distances.

The Nass TSA has a marginal sawlog profile due to poor quality timber. The species profile is comprised mainly of Western and Mountain Hemlock, Sub-Alpine fir and Amabilis fir, a small component of spruce, and a very minor component of pine. The stands in the Nass TSA frequently have hidden rot in the hemlock and blind conk in the firs. Low pulp markets have contributed to low utilization of timber in the TSA, with firm wood rejects being left as waste.

The undercut volume from the 2006 to 2010 cut control period was disposed (written off) by the Regional Executive Director. The cut control period of 2011 to 2015 resulted in an undercut volume of 2 457 200 cubic metres, but this undercut must account for the NTL harvest of 348 660 cubic metres and lack of harvest in the partition area (719 400 cubic metres) so only 1 427 554 cubic metres is available for disposition.

The balance of the 2011 to 2015 undercut has been disposed of to Gitanyow First Nation in support of their economic development strategy. In a signed FTOA the Minister committed to a non-replaceable forest licence with 180 000 cubic metres for 10 years and upon substantial completion of a processing facility a further 120 000 cubic metres under a supplemental forestry licence to cut.

The apportionment for the Nass TSA had identified for the area outside of the Upper Nass, 500 195 cubic metres for replaceable forest licences, 111 294 cubic metres for non-replaceable forest licences, and 238 511 cubic metres for BCTS Timber Sale Licences/Licence to Cut. Currently, the licence disposition includes 454 196 cubic metres under replaceable licences and 180 000 cubic metres under non-replaceable licences (i.e., the Gitanyow First Nation FTOA).

Table 22. Volume billed in the Nass TSA from 2006 to 2017

Year	Total	Deciduous	Pine	Other
2006	164 114	0	0	164 114
2007	191 533	1 513	1 131	188 864
2008	127 737	0	155	127 529
2009	58 721	14	6	58 694
2010	85 685	3 648	0	82 037
2011	121 577	78	188	121 310
2012	118 515	236	539	118 738
2013	136 684	322	171	136 189
2014	19 608	0	13	19 595
2015	107 161	700	98	106 360
2016	526 702	10 733	141	515 828
2017	359 891	2 281	46	357 564
Average	168 161	1 627	207	166 402

6.1.2 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. For yield table projections in the timber supply analysis, the specifications for minimum stump diameter are converted to a corresponding breast height diameter.

Table 23. Harvest merchantability specifications as modelled within the Nass TSA

Analysis unit	Utilization		
	Corresponding minimum DBH (cm)	Maximum stump height (cm)	Minimum top DIB (cm)
Pine	12.5	30	10
All other	17.5	30	10

6.1.3 Mixed deciduous

Deciduous species are not typically utilized within the Nass TSA. Deciduous-leading stands, as noted previously, are excluded from the THLB. In coniferous-leading stands with deciduous, a proportionate reduction in the volume table will be made for deciduous component which is not expected to be utilized.

The Nass South SRMP Order and GLLUP identify an objective to maintain a diversity of coniferous and deciduous species that represent the natural species composition at the landscape and stand levels by ensuring that all cutblocks at the free-growing stage will have a diversity of species ecologically appropriate to the site.

In the SRMP and GLLUP area, the previous deciduous composition percentage will be used as an area reduction factor applied to the regenerating managed stand yield under the assumption that the deciduous component is maintained through future rotations.

6.1.4 Minimum harvestable criteria

The minimum harvestable criteria are the earliest age or volume at which stands are considered to be harvestable within the timber supply model. While harvesting in the model may occur in stands at the minimum criteria in order to meet forest level objectives, most stands are not harvested in the model until well beyond the minimum harvestable criteria because of management objectives for other resource values.

A review of ministry harvest appraisal records from 2002 to 2015 for the Nass TSA shows that cutting permit volume range from 192 to 769 cubic metres per hectare. The lowest one-tenth percentile value is 277 cubic metres per hectare.

This volume limit will be used in the base case as the minimum harvestable threshold for existing natural stands. It was also previously discussed as the limit used to identify areas of low timber growing potential all stands. Stands not capable of achieving this volume will be excluded from the THLB since they will never achieve the minimum harvestable criteria.

For the base case, the minimum harvestable criteria for managed stands will be the age at which the stand reaches 95 percent of culmination mean annual increment. Using 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.

6.1.5 Harvest scheduling priorities

The order in which stands are harvested can influence the overall timber supply. Licensees select stands to harvest through consideration of many factors. For the current timber supply analysis, the forest estate model provides several methods in which to control the harvest scheduling.

The *Provincial Timber Management Goals, Objectives & Targets Management Unit Targets Report* (August 2018) prepared annually by the ministry summarizes the last five years of harvesting in terms of volume class and age class. The profile of the harvest is then compared to the profile of the total mature forested area of the TSA (Figure 2 below is reproduced from the report). The objective of the report is to identify if recent harvesting is representing the profile of the TSA or if one particular stand type is being disproportionately harvested.

In the past five years, harvesting in the Nass TSA has generally matched the profile of the TSA. However, it is evident that recent harvesting tends to favour higher volume and younger stands relative to the profile. Therefore, stands will be ordered for harvest based on highest volume first in the base case.

The location of harvest areas is also restricted by the extent of the existing road networks. As discussed under the ‘*Roads, trails, landings and linear corridors*’ factor, the timber supply model will project the predicted future development of the road network over time. Harvesting will be restricted to areas with existing road access or areas projected to have been accessed by that forecast time step.

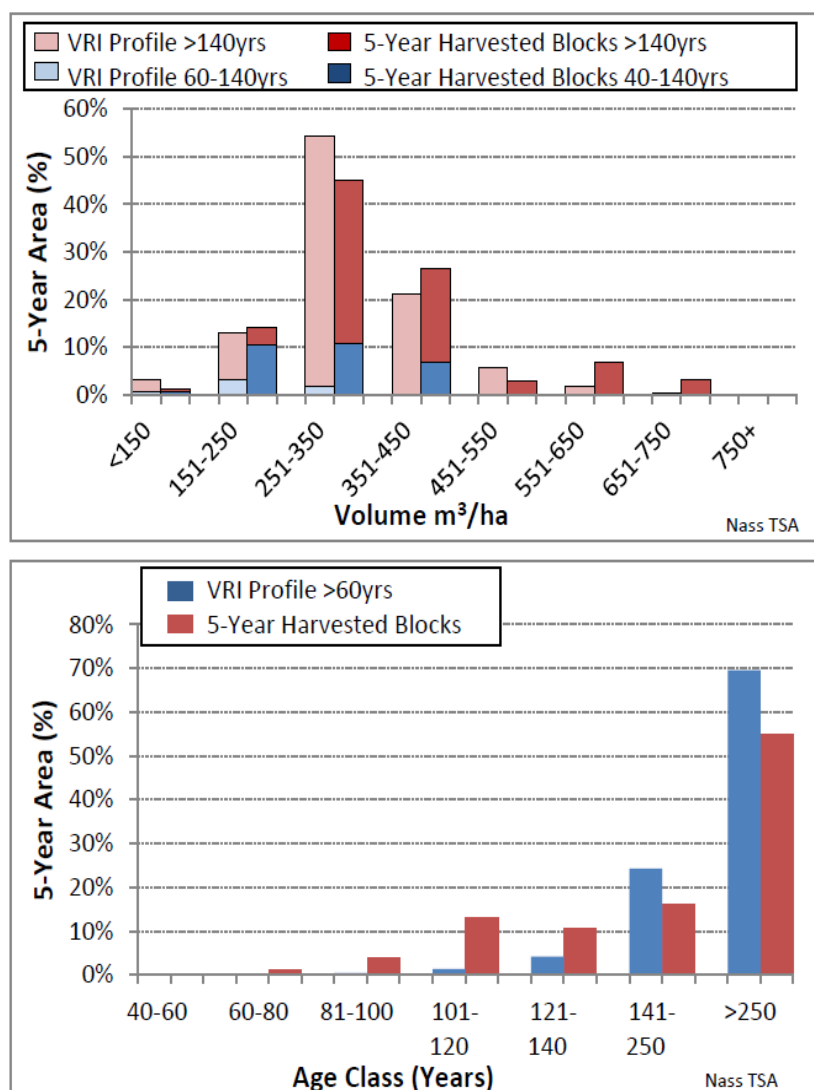


Figure 2. Stand volume and age class profile for 2012-2017 harvest in the Nass TSA.

6.1.6 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, that were previously excluded, may now be included in grades 2 and 4 that are billed against a licensee's AAC. Some exemptions to this inclusion may exist (see section on Grade 4 Credit). These changes were designed to accommodate the mountain pine beetle-killed volume in the Interior TSAs. However, in the Nass TSA, only a small volume of the dead and dry (former grades 3 and 5) component has been charged since 2006.

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 Nass TSA, there were 49 VRI audit sample plots that contained an average of 9.8 percent dead potential volume.

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.

6.1.7 Grade 4 credit

The 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. This results in a grade 4 credit.

Wood from the Nass area is difficult to scale and has a very high grade 4 component (excluding dead and dry). This wood can present as having many types of rot, hidden defects, and other grade characteristics that will take it out of a sawlog grade and re-assign it to a grade 4. For the past few years the export sawlog grade 1 and 2 has been the predominant interior grades used in the north as the pulp market has decreased. Now pulpwood opportunities are increasing as pulp mills on Vancouver Island are re-opening and that volume is shipped south.

The Minister may determine a limitation of the amount of grade 4 volume that is credited in a management unit such as a TSA. In the Nass TSA there have been no grade 4 credit volume requests from licensees.

6.2 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.

6.2.1 Silvicultural systems

Clearcut with reserves is the most frequent silviculture systems used in the Nass TSA. Under this system, a range of opening sizes containing even-aged forests is produced. Cutting of adjacent blocks is restricted until green-up conditions are met. The clearcut with reserve system maintains older forest patches within or adjacent to harvest blocks. These remnants are intended as wildlife tree patches, riparian reserve and management zones, and island remnants to conserve old growth characteristics.

In the base case, all harvesting will be modelled as clearcut with reserves silvicultural system. The modelling of reserves has been discussed in the stand-level biodiversity and mixed-deciduous factors.

6.2.2 Regeneration delay

A delay may exist between the harvest of a stand and when the site is in a fully regenerated state. In the Nass TSA impediments to prompt and successful regeneration associated with cold sites at high elevation have been identified in past timber supply analyses.

In the base case, a regeneration delay was calculated from RESULTS data for each managed stand analysis unit for future managed stands. It was also assumed that stock is typically one year old when planted, as such reducing the regeneration delay by one year.

For existing stands that have an identified harvest date but no regeneration information, the projected age will be assigned the difference between 2018 and the year of harvest less regeneration delay.

6.2.3 Not satisfactorily restocked areas

The ministry backlog policy defines backlog not satisfactorily restocked (NSR) as productive forest land denuded prior to 1987 that has not been regenerated to the desired stocking standards for the opening.

In the previous timber supply review, large old fire disturbances that were not expected to be restocked were identified as backlog NSR and excluded from the timber harvesting land base.

The silviculture responsibility for 3225 hectares of NSR reverted to the crown following the bankruptcy of several forest companies. Through the 2006 to 2009 North West Forest Restoration and Enhancement Program, 1651 hectares of NSR were restocked and the remainder was restocked through district administered silviculture treatments and surveys. However, there has been little follow-up survey to determine free growing for these regenerated and impeded stands.

In 2011, the Forest Practices Branch identified through an aerial survey 5900 hectares of backlog NSR (primarily old burns) in the Nass TSA. The district was able to resolve the issue of NSR 5758 hectares (97 percent) by appropriate surveys and reclassification. In 2012/13 an additional 1049 hectares were surveyed and addressed. This updated information has been incorporated into the 2017 inventory projection.

In the current TSR, no consideration will be made for backlog NSR given the low amount present.

6.2.4 Incremental silviculture

Incremental silviculture practices are practices incremental to those required to meet basic silviculture obligations like achievement of free-growing status for harvested areas. These include practices such as juvenile spacing and fertilization.

In the Nass TSA there has been minimal investment in incremental silviculture activities. This is in part due to the return on investment analyses that are performed prior to prescribing incremental silviculture activities on a stand. As the Nass TSA is quite removed from a processing facility (i.e., greater than 200 kilometres), a positive return on an incremental silviculture investment may not be realized.

Some juvenile spacing treatments post-free growing on stands with high site productivity has occurred but the timber supply gains will be insignificant and therefore will not be modelled in the base case.

6.3 Integrated resource management

The crown forests of the Nass TSA are managed for many values. The objective and management of these values are identified within various instruments including legislation, higher level plans, *FRPA* or the *Land Act* orders and approved FSPs.

In southern sections of the Nass TSA objectives for the Nass South SRMP and GLLUP have been established. These are discussed within other sections of the data package. Further, the entirety of the Nass South SRMP and GLLUP has been agreed upon and included in the Forest Stewardship Plans of the major forest licensees.

In its 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 the decision on wildlife and the interests of First Nations/Nations. In this regard, FLNRORD seeks to collaborate with First Nations/Nations to identify values for assessment and decision support into TSR, as well as to review past consultation records for key values that could be evaluated.

6.3.1 Adjacency, green-up and patch size distribution

Cutblock adjacency and patch size distribution objectives are used to ensure that the structural characteristics left after harvest are consistent with the temporal and spatial distribution of openings that would result from a natural disturbance. This is an important consideration for values related to hydrology and landscape-level biodiversity.

The FPPR default maximum cutblock size in the British Columbia Interior is 60 hectares, however, there is also flexibility to create larger openings based on biodiversity patch management where the licensee ensures that the structural characteristics of the cutblock after harvest resembles an opening from a natural disturbance.

The Nass South SRMP and GLLUP include an objective that identifies the desired range of opening sizes (patch size distribution) to be attained by the end of a rotation. This patch size distribution, by natural disturbance type, is to be achieved within the SRMP and GLLUP area and attempted to be met at the landscape level.

Requirements for harvesting adjacent to an existing cutblock are set through Section 65 of the FPPR specifies that timber must not be harvested on a new cutblock unless the tallest trees on a minimum of 75 percent of the net area to be reforested on all existing adjacent cutblocks are at least three metres in height.

Modelling a specified range of opening sizes is a complex task that is not well addressed by the current timber supply model. The effect on timber supply of the SRMP patch size objectives will be addressed in the base case through a limit on the rate of harvest disturbance. This constraint will also address the effect on timber supply of meeting the FPPR adjacency requirements.

The disturbance limit modelled will approximate a three-pass harvest system. In the base case, a maximum of 35 percent of the THLB will be permitted to be below three metres height within a landscape unit and BEC subzone combination. This requirement applies only to the THLB not otherwise constrained by another management objective (e.g., visuals, ungulate winter range).

6.3.2 Hydrologic stability

The Nass South SRMP Order and GLLUP identify specific objectives for water resources. These include objectives for maintaining or protecting hydrologic stability of watersheds, ecological functioning of streams, rivers, wetlands and lakes, the functional integrity of flood plains protection and structure such as large woody debris, fish habitat and human water consumption.

Some of the SRMP and GLLUP objectives for water resources will be directly modelled within the base case whereas other objectives are expected to be addressed operationally. The base case modelling assumptions for the objectives for riparian features were discussed under riparian reserve and management areas section. The base case will also model the SRMP Order objective to maintain the hydrologic stability of the watersheds identified in Schedule B. This will be achieved by ensuring that the harvested area does not exceed the maximum equivalent clearcut area (ECA) thresholds specified for each watershed in Schedule B1 and listed in Table 24 below.

A significant number of water licences exist in the TSA that are almost exclusively located on private land. As such, water intakes for human consumption occupy minimal THLB and will not be modelled in the base case.

Table 24. Hydrologic stability objectives of Nass South SRMP

Map ID	Unit name	ECA threshold %
1	Meziadin River tributary (contains Yaakin Lk)	25
2	White River tributary 1 (west of Femur Lk)	35
3	White River tributary 2 (west of Scrub Lk)	35
4	Niska Creek	25
5	Kinskuch River	25 (in ICHmc1/in Plan area)
6	Outlet of Arbor Lake	25
7	Bear River tributary (east of Le Sueur Crk)	25 (in CWHwm)
8	Le Sueur Creek	25 (in CWHwm)
9	grouped(1) Bitter Creek	25 (in CWHwm)
10	Glacier Creek	25 (in CWHwm and MHun separately)
11	Bell-Irving River tributary 4 (east flank on Mt. Bell-Irving)	30 (in ICH)
12	Bell-Irving River tributary 3 (east flank on Mt. Bell-Irving)	30 (in ICH)
13	Bell-Irving River tributary 2 (east flank on Mt. Bell-Irving)	30 (in ICH)
14	Bell-Irving River tributary 1 (east flank on Mt. Bell-Irving)	30 (in ICH)
15	Tchitin River	30 (in ICHmc1 and CWHws2 separately/in Plan area)
16	Nass River tributary 1 (east of Kinskuch confluence)	30 (in ICHmc1/in Plan area)
17	Kshadin Creek tributary (west of Taylor Lk)	25 (in ICHmc1 and CWHws2 collectively/in Plan area)
18	Kwinageese River	20 (in Plan area)
19	Nass River tributary 5 (across river from Meziadin Junction)	30
20	Grouped (2) Bonney Creek (unit also contains Alpha Lk)	25 (in Plan area)
21	Wolverine Creek	30
22	Grouped (3) Axnegrelga Creek (unit also contains Hughan and Jigsaw Lks)	20 (in Plan area)
23	Kitanweliks Creek	30
24	Paw Creek	30
25	Van Dyke Creek	30
26	Brown Bear Creek	20 (in Plan area)
27	Little Paw Creek	30
28	Axnegrelga Creek tributary (west of Brown Bear Lk)	20
29	Outlet of Noordam Lake	35
30	Nass River tributary 4 (east of Kinskuch Peak)	35
31	Nass River tributary 2 (contains Abbi Lk)	35
32	Nass River tributary 3 (across river from Sideslip Lk)	35

Data source and comments:

WHSE_LAND_USE_PLANNING.RMP_PLAN_LEGAL_POLY_SVW

6.3.3 Community watersheds

Water in community watersheds is a value identified under the *Forest and Range Practices Act*. Under FRPA, licensees are required to specify results and strategies that meet the objective set by government for water quality. Objectives for water in community watersheds are established under Section 8.2 of the FPPR of the FRPA. Mandatory practice requirements are in place under the FPPR to address water quality in community watersheds, these include no road construction or harvesting of timber within 100 metres of a licensed water intake in a community watershed.

The Kas Mintl Am Hawak community watershed occupies 31 hectares within the Nass TSA and is the only designated community watersheds within the Nass TSA. The entire watershed will be excluded from the THLB in the base case.

Table 25. Community watersheds within the Nass TSA

Community watersheds	Gross land base (hectares)	CMFLB	THLB
Kas Mintl Am Hawak	31	Yes	No

Data sources and comments:

WHSE_WATER_MANAGEMENT.WLS_COMMUNITY_WS_PUB_SVW

6.3.4 Ungulate winter range

The Nass TSA includes critical winter range for several ungulate species. Ungulate winter ranges have been established through GAR orders for Mountain goat (U-6-002) in 2008 and moose (U-6-018) in 2014.

UWR 6-002 has six general wildlife measures that consider timber harvesting and access structures within or bordering mountain goat winter range. Table 26 identifies the primary restriction that no timber harvesting or road construction is to occur within the identified winter range and that restriction will be modelled in the base case. The other general wildlife measures are assumed to be addressed through appropriate operational considerations without unduly impacting timber supply.

UWR 6-018 has nine general wildlife measures that address forage, security cover, thermal cover and road access for moose. The implementation of two measures will impact timber supply while other measures, if appropriate operational considerations are made, will not impact timber supply. Table 26 identifies the modelled constraints to address the general wildlife measures that may affect timber supply.

Table 26. Modelled constraints for ungulate winter range objectives for UWR 6-002 (mountain goat) and UWR 6-018 (moose)

General wildlife measure	Gross land base (hectares)	Estimated requirements	Unit applied to
Mountain Goat (GWM 1)	71 355	No harvest	Entire UWR
Moose (GWM 1)	9 701	No harvest	Forage areas
Moose (GWM 7) Snow Interception	38 144	Retain 30% mature+old forest canopy (conditional harvest)	UWR outside forage areas

Data sources and comments:

WHSE_WILDLIFE_MANAGEMENT.WCP_UNGULATE_WINTER_RANGE_SP

Approved UWR orders are available at http://www.env.gov.bc.ca/wld/frpa/uwr/approved_uwr.html

6.3.5 Nass wildlife area

The *Nisga'a Final Agreement Act* (1999) established the Nass Wildlife Area, covering 16 101 square kilometres, that extends outside of the Nisga'a Lands and overlaps with the CMFLB of the Nass TSA. Joint management of wildlife resources is carried out within the wildlife area by the Province and Nisga'a Lisims Government.

The continuing viability of the wildlife populations within in the Nass Wildlife Management Area, particularly moose, grizzly bear and goat, is a high priority for the Nisga'a Nation. Guidance on the management of these species and rate of hunting harvest is provided by Section 27 of the *Nisga'a Forest Act* and Chapter 9 of the *Nisga'a Final Agreement Act*. Neither *Act* specifies any management direction that would have an impact on timber supply.

6.3.6 Northern Goshawk

The Nass South SRMP Order and GLLUP establish objectives for Northern Goshawk. These objectives include maintaining all known nesting and post-fledging areas and associated forage areas. This requires maintaining at minimum 30 percent of the perimeter around the goshawk nest and post-fledging areas that is connected to a foraging area. Within the foraging area at least 60 percent of the mature and old forest structure and function is to be maintained or if not available a recruitment area is to be provided. The SRMP and GLLUP also set an objective to restore compromised goshawk habitat, most notably in the landscape units of Brown Bear, Madely, and White where goshawk habitat has been negatively impacted by harvesting.

In February 2018 FLNRORD released the report, *Implementation Plan for the Recovery of Northern Goshawk, laingi Subspecies (Accipiter gentilis laingi) in British Columbia*. The long-term recovery goal is to ensure viable populations of the coastal sub-species (*Accipiter gentilis laingi*) persist in each conservation region in coastal British Columbia. The southern tip of the Nass TSA overlaps with the North Coast conservation region but the area is classified as a transition zone where either Coastal Northern Goshawk or the larger Interior Northern Goshawk (*Accipiter gentilis atricapillus*) may be found. The interior northern goshawk has recently been regionally identified as a blue-listed species.

A goshawk recovery strategy is being developed specific to the Skeena Region to identify goshawk territories across the land base. The Kalum TSA is a pilot for this strategy and predictive goshawk territories are being identified that include 2400 hectare polygons containing 60 percent mature and old forested cover. This work has not extended into the Nass TSA at this time.

Population estimates and trends are uncertain for the Northern Goshawk, *laingi* subspecies, because it breeds at low densities, may not breed every year, and can be difficult to detect. As such, knowing the locations of all occupied home ranges at any given time is not realistic. Given the size of the TSA relative to the small area of transition zone, the ecosystem biologists advise that there is no need to model any timber supply constraints for goshawk management in the base case. If any nests are located, the SRMP states that OGMA's will be relocated through the OGMA Amendment Process to protect goshawk nest areas and post-fledging areas.

6.3.7 Visual quality objectives

In the Nass TSA, a number of valued areas have been designated for visual quality management. Within these areas, visual quality objectives (VQO) have been established based on physical attributes such as topography and social attributes such as viewer expectations. VQOs ensure that forestry activities are managed so that the size, shape, and location of cutblocks and roads fit with the landscape's natural character. The District Manager established the made-known scenic areas under the *Forest Practices*

Code and these management objectives have been continued through regulation under the *Forest and Range Practices Act*.

In the base case, visual resource management will be modelled according to the *Procedures for Factoring Visual Resources into Timber Supply Analyses* (MOF 1998) using planimetric percent alteration ranges for each VQO modified by visual absorption capability (VAC) rating of each visual polygon (Table). This approach is preferred over a single percent alteration for each VQO to better reflect the wide variation in landscape conditions.

Table 29. *Visual quality objectives by planimetric view and visual absorption capability*

Established VQO	Gross land base (hectares)	% alteration by VAC (planimetric view)		
		Low	Medium	High
Preservation	11 860	0	0.50	1
Retention	21 352	1.1	3.0	5
Partial retention	32 244	5.1	10.0	15
Modification	32 921	15.1	20.0	25

The procedures also identified the methodology used to identify visually effective green-up (VEG) height based on slope classes (Table). This calculation is applied within the base case scenario of timber supply analysis. A sensitivity analysis to demonstrate a lower bound of VEG height will be conducted that simply uses a VEG height of three metres.

Table 30. *Slope classes for calculating VEG height*

	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	55.1 – 60	60.1+ – 65
VEG height (m)	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	6.5	7.0	7.5	8.0	8.5

Data sources and comments:

WHSE_FOREST_VEGETATION.REC_VISUAL_LANDSCAPE_INVENTORY

6.3.8 Pine mushrooms

The pine mushroom (*Tricholoma magnivelare*) is considered the most economically significant mushroom species in the province. The pine mushroom habitat is associated with well drained, coarse textured and nutrient poor soils under hemlock forests (Northwest Institute 1999) and a recent study also suggests pine mushrooms are generally found in commercial quantities on submesic habitat in stands that range from mature, greater than 75 years, to old growth.

A study conducted in 2001 attempted to generate reliable spatial information on the distribution of pine mushroom habitat within a discrete, ecologically-bounded area of the Nass River drainage, in order to determine the impact of forestry on mushroom habitat. The study found that pine mushroom sites consistently correlated with the “submesic” phase of the (01) Hemlock-Step Moss site series in the moist cold subzone (b (Nass variant)) of the Interior Cedar-Hemlock zone (ICHmc1). Using air photo interpretation (from 1:15 000 air photos) and standard Terrestrial Ecosystem Mapping (TEM) techniques, the study estimated the extent of submesic habitat in the TSA. In addition, field researchers ground-truthed portions of the submesic map while accompanied by an experienced pine mushroom picker to verify that the mapped submesic sites indeed corresponded with the areas where an experienced picker would expect to find pine mushrooms in commercial abundance.

The study area covered 13 756 hectares of forested area in the West Nass/Harper Lake area southwest of Meziadin Junction. The study classified 1738 hectares as submesic sites which is approximately 12.6 percent of the total study area.

The Nass South SRMP Order and GLLUP require maintaining at least 50 percent of the productive pine mushroom sites in forests ranging in age from 80 to 200 years. The SRMP and GLLUP identify prime mushroom producing sites as generally pine or hemlock-leading stands below 800 metre elevation in the following ecological site series: ICHmc1/01b, ICHmc2/01b, and CWHws2/03.

For the base case, consideration will be made for the stands meeting the above criteria in the SRMP and GLLUP area. However, without ecosystem mapping, it will not be possible to identify the specific site series. Based on the results of the 2001 study, it will be assumed that 12.6 percent of the ICHmc1 subzone will be in the 01b site series. To represent the SRMP Order requirement to maintain 50 percent of the pine mushroom sites, half of the assumed area, 6.3 percent, will be excluded from the THLB. There is no forested area within the ICHmc2 subzone in the Nass TSA.

The CWHws2 subzone covers 40 424 hectares but no information is available on the extent of the 03 site series or the abundance of pine mushrooms. FLNRORD staff with expertise in the pine mushroom industry estimated that the value of the habitat would be lower than compared with the ICHmc1 zone around the Nass River. Therefore, it will be assumed that six percent of the zone is suitable habitat and that half of the area, three percent, will be excluded from the THLB. Sensitivity analyses will explore the effect on timber supply of high and lower levels of pine mushroom habitat protection.

Table 27. Pine mushroom habitat in Nass TSA

Biogeoclimatic subzone and variant	Subzone area (hectares)	Estimated variant area (hectares)	Protected pine mushroom habitat (hectares)	CMFLB	THLB
ICHmc1 01b	225 394	28 400	14 200	Yes	No
CWHws2 03	40 424	2 425	1 213	Yes	No

Data source and comments:

Pine Mushroom (Tricholoma magnivelare) Habitat in the West Nass/Harper Lake area of Northwest British Columbia: Spatial Extent and Overlap with Timber Interests (Dar, S. 2001).

Ecological descriptions of pine mushroom (Tricholoma magnivelare) habitat and estimates of its extent in northwestern British Columbia (Kranabetter, J.M. 2000).

6.4 Forest health

Many forest health damaging agents are present within the Nass TSA. These agents include insects, pathogens, animals, and abiotic events such as fire; many agents have the potential to cause significant timber losses. The Forest Health Program of the FLNRORD evaluates the impact of forest health damaging agents on forest resource values and when necessary prescribes and implements management practices to prevent damages.

Dothistroma

A decade ago, Dothistroma Needle Blight was the leading source of plantation failure in managed pine stands in the Nass TSA. Stands dominated by lodgepole pine (stocked with less than 400 stems per hectare of conifer other than lodgepole pine) were at high risk of becoming NSR during the Dothistroma outbreak at that time. Since 2006, the district has conducted a periodic aerial survey of the known areas of Dothistroma incidence. Table 28 below documents the periodic decline in the total incidence area and the reduction in the observations of severely impacted stands.

Table 28. *Dothistroma* aerial survey occurrence in Nass TSA

Year	Survey area of occurrence (hectares)	Observation of severely impacted (hectares)
2006	3 520	823
2008	2 507	936
2009	5 460	0
2010	1 400	0
2012	1 965	102
2016	925	0

The original survey population was over 3000 hectares of *Dothistroma* incidence which was recorded in the provincial forest health aerial overview survey. Stands that recovered were removed from the survey population while any new incidences were added. By 2016, the population had decreased to 925 hectares over 26 plantations. In 2017, a significant decline in *Dothistroma* incidence was noted in the aerial overview survey records so no subsequent monitoring actions have been completed.

Fire

Records from 10 years of fire history show the average area affected by fires annually in the Nass TSA to be less than four hectares.

Aspen Leaf Miner

Aspen Leaf Miner incidence in the Nass TSA was recorded on 883 hectares in 2011 and on 8676 hectares in 2012. In 2015, the incidence increased to over 66 384 hectares observed during provincial forest health aerial overview survey. Most of the affected stands were located on floodplain areas of the lower Nass River on Nisga'a treaty lands. Recorded observations dropped to 1920 hectares in 2016.

Forest Tent Caterpillar

The last documented incidence of Forest Tent Caterpillar was in 2010, when 791 hectares were observed during the forest health aerial overview survey.

Satin Moth

There were 1408 hectares of Satin Moth incidence identified in 2017 forest health aerial overview survey.

Venturia

Venturia blight observed in forest health aerial overview surveys increased from 7200 hectares in 2012 to 11 026 hectares in 2013 and then decreased to 5077 hectares in the 2014. Incidence observed has since continued to be in decline.

Spruce Bark Beetle

The district completed a detailed detection flight in September 2018 to assess the status of known Spruce Bark Beetle affected areas that had been tracked for the three prior years. Total areas observed have not yet been calculated but have significantly increased since detection flights in 2017 documented 6361 hectares of Spruce Bark Beetle and Balsam Bark Beetle infestations. Stand mortality is concentrated in the Bell-Irving and Meziadin Lake areas as most of the attacked spruce in those stands are now visibly turning red on a landscape-level scale. Some beetle-killed stands were salvaged by the licensee operating in the area and increased salvage harvesting is planned in the near future.

Balsam Bark Beetle

Forests within the Upper Nass area are dominated by subalpine fir (balsam) which is susceptible to Balsam Bark Beetle attack. In 2017, Balsam Bark Beetle was the predominant reported forest health

issue in the Nass TSA. Observations from the provincial forest health aerial overview survey documented over 215 432 hectares of trace and light Balsam Bark Beetle infestations which represented a significant increase since 2016 (947 hectares), 2015 (143 194 hectares), 2010 (15 034 hectares) and 2009 (4990 hectares). In general, the stands affected are located in upper watershed areas and above elevations where timber harvesting has historically occurred. Recovery of these stands through salvage harvesting is unlikely to occur due to factors such as steep challenging terrain, high infrastructure costs and marginal stand value. Options for mitigation or suppression activities are also constrained due to lack of accessibility which has limited management activities for this pest to monitoring only.

Mountain Pine Beetle

The incidence of Mountain Pine Beetle has not been significant in the Nass TSA for the last decade.

Overall, forest health factors in the Nass TSA are generally at a low level of incidence except for Spruce Bark Beetle and Balsam Bark Beetle. These infestations will likely have a minimal effect on timber supply because they are limited to areas of the TSA limited timber harvesting is expected to occur. For the base case, the empirical basis of the VDYP model and the use of operational adjustment factors in the TIPS model are assumed to represent the volume loss due to endemic levels of pests. The accounting for catastrophic losses (e.g., fire, epidemic infestations) is described below under non-recoverable losses.

6.4.1 Non-recoverable losses

Non-recoverable losses (NRL) are timber volumes destroyed or damaged on the by natural causes such as fire, wind, and disease that are not recovered through salvage operations and remain underutilized. These timber volumes do not include endemic losses that are incorporated within growth and yield model projections.

An annual summary of the volume lost to forest health factors is prepared by FAIB staff based on the annual forest health overview flight mapping. The summary uses the flight mapping, the VRI and the previous TSR THLB to estimate the volume lost to each factor and also accounts for any record of salvage harvesting that has occurred following the disturbance. The summary has been prepared for data collected since 1999 and is current to 2017 which provides a 19-year average of non-recovered losses for the Nass TSA (Table 29).

Future NRLs will be accounted for by annually disturbing an area supporting the average NRL volume within the THLB. In the base case, a THLB area with 6284 cubic metres will be reset to age zero each year of the timber supply forecast.

Table 29. Estimated average unsalvaged losses in the Nass TSA

Cause of loss	Annual unsalvaged loss (m³/year)
Drought	124
Fire	162
Flooding	302
Mountain Pine Beetle	387
Spruce Beetle	748
Western Balsam Bark Beetle	4 561
Total NRL	6 284

Data sources and comments:

FAIB file: Volume Losses By TSA. 1999-2017. CFLB-with THLB2017comparison.xlsx.

7. Growth and Yield

7.1 Background

Knowledge of the volume available from a forest stand 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 forest stand.

British Columbia has a strong history in growth and yield modelling. The various models have been important to improving strategic decision making and understanding of the management of British Columbia's forest resources.

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, on the other hand, is suitable for projection based on regeneration characteristics of a managed stand.

For this analysis, the yield tables will be divided into two general forest management classes (i.e., naturally established and managed stands) to reflect the different expected volume growth between these stand types.

7.2 Natural stand yield tables

Stands naturally or artificially regenerated prior to the 1987 legislated basic silviculture obligations have a wide range of stand structure and natural disturbance history. They will be considered in the base case using natural stand growth projections.

7.2.1 Analysis units

Analysis units are used to aggregate and simplify the land base for growth and yield modelling purposes. An analysis unit is typically composed of forest stands with similar tree species composition, timber growing potential and treatment regimes. The VRI provides a yield table for every individual forest inventory polygon so these will be considered the analysis units for natural stands in the base case.

7.2.2 Model

Volume tables for natural stands will be derived using the Variable Density Yield Prediction Model version 7 (VDYP7) developed by FLNRORD. VDYP7 is an empirical model that has been parameterized based on a large permanent sample plot database collected from mature natural forests in British Columbia.

Input information for VDYP7 is provided by the attributes of individual VRI polygons.

7.2.3 Decay, waste, and breakage

Decay, waste and breakage estimates are incorporated within the growth and yield model VDYP7 and are based on BEC loss factors using a decay sample tree database which consists of over 82,000 trees.

VDYP7 output was developed to provide live merchantable volume estimates. As noted under Section 6.16, '*Log grade definition*', information about the dead potential component of a stand is not included within the VDYP7 yield tables, separate information about the amount will be provided to the chief forester for consideration in the AAC determination.

7.3 Managed stand yield tables

Managed stands are those stands established after the legislative creation of basic silviculture obligations in 1987. Managed stands are expected to be regenerated and have density managed to specified conditions that better capture site productivity than natural stands. Regeneration of managed stands, though mostly planted, can also include stands that were natural regeneration to appropriate stocking standards.

7.3.1 Analysis units

The RESULTS database provides for each cutblock the majority of the information required by TIPSy to produce a yield table. As such, the individual regenerating stand boundary will be used as analysis units for existing managed stands in the base case.

Nevertheless, for modelling purposes, it is necessary to define analysis units to track the growth and yield of future managed stands projected to be established following harvest in the timber supply forecast. These analysis units will be aggregated based on the biogeoclimatic zone, the leading species of the current existing stand and site productivity.

7.3.2 Model

Yield tables for managed stands are created using the Table Interpolation Program for Stand Yields (TIPSy) version 4.3 developed by FLNRORD. This stand level model is derived from volume tables generated from the FLNRORD individual tree process model Tree and Stand Simulator (TASS).

7.3.3 Future managed stand regeneration conditions

The future managed stand regeneration assumptions for the initial species composition and density will be based upon summaries from RESULTS. These summaries include planting records, regeneration surveys or free growing surveys for openings identified as non-uneven-aged. These records will be area-weighted to produce average regeneration assumptions for each future managed stand analysis unit.

The Nass South SRMP Order and GLLUP identify an objective to maintain a diversity of coniferous and deciduous species that represent the natural species composition at the landscape and stand levels by ensuring that all cutblocks at the free-growing stage will have a diversity of species ecologically appropriate to the site. Deciduous species will be regenerated as part of the managed stands but do not contribute to future harvest volumes in the timber supply forecast. Therefore, deciduous species are not included in the regeneration assumptions used by TIPSy to produce yield tables. Instead, as discussed in the mixed deciduous factor, an area reduction factor representing the previous deciduous component will continue to be applied to all future managed stands.

7.3.4 Site index

Site index is the most common measure of forest site productivity and forest growth used in British Columbia and enables forest managers to predict forest stand growth and yield. Site index is reported as the expected height of the largest diameter tree at age 50. While the Ministry has developed formalized standards for deriving site index for the potential productivity of a site, the term site index is derived and used in a variety of contexts.

The provincial site productivity layer (version 7.0) provides, by standard methods, site index estimates of commercial tree species for individual stands with major provincial forest management units. Primarily, the estimates are based on ecosystem data from existing PEM or TEM coupled with Site Index Estimates by Biogeoclimatic Ecosystem Classification Site Series (SIBEC). Secondly, where PEM or TEM data are not available, data from various growth and yield projects were used to create a biophysical model that provides site productivity estimates.

Approved ecosystem mapping is not available for the Nass TSA so the site index estimates found within the provincial productivity layer that are used in the base case originate from the biophysical model.

To understand the uncertainty around site index values, sensitivity analyses will be completed where the potential site index is changed plus/minus one metre.

Data sources and comments:

FLNRORD FAIB All PEM/TEM Data for Site Productivity Layer, Version 7.0 (2019/2020).

7.3.5 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 natural trees that regenerate on the site. 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.

Information on the use of select seed in the TSA and the associated genetic gains are available from the Seed Planning and Registry Application (SPAR) of the Forest Improvement and Research Management Branch. RESULTS information provides a seed source for individual plantations and thus enables linkage to the genetic gain database.

The seed use and its genetic worth recorded in RESULTS for each existing managed stand was considered in producing the yield table for each stand. An area-weighted average of seed use and the associated genetic worth over the past 10 years was used to estimate current performance for each of the analysis units representing future managed stands. No modelling consideration was made for expected future improvements in genetic worth.

Data sources and comments:

FLNRORD Seed Planning and Registry Application Release 6.23 May 29, 2018.

7.3.6 Operational adjustment factors

Operational adjustment factors (OAF) are used to adjust volume estimates from TIPSy to account for factors that affect achievement of optimal growth that are not specifically modelled. The yield tables generated by TIPSy reflect the growth relationships observed in research plots established by FLNRORD and industry. Research plots were generally located in fully stocked, even-aged stands of uniform site and in forests with little or no pest activity.

As a result, TIPSy yields reflect the potential yield of a specific site, species and management regime given full stocking. The OAFs are required to adjust these potential yields to better reflect operational considerations.

In TIPSy, there are two OAFs that are used to modify the potential yields with differing application. OAF 1 is a static reduction across all time periods which, for example, may reflect non-productive openings within a forest. OAF 2 is a dynamic reduction that increases over time and, for example, may reflect a forest health issue that increases as a stand ages.

The standard OAF 1 value of 15 percent will be applied to account for less than ideal tree distributions, small non-productive areas, endemic pests and disease, and random risks such as windthrow. The standard OAF 2 value of five percent to account for decay, waste and breakage will also be applied. These standard OAFs were based on a general assessment from the literature on differences of actual yields and potential yields on managed sites.

8. Forest Estate Modelling

8.1 Forest Estate model

The Spatial Timber Supply Model version 2 (STSM2) will be used for this analysis. STSM2 is run using the Spatially Explicit Landscape Event Simulator (SELES). STSM2 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.

8.2 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 upward to a stable long-term level.

Several of the land use changes that have occurred in the Nass TSA since the last timber supply review may influence the ability to obtain the current AAC. For the current TSR, several alternative harvest flows based on different initial harvest levels will be explored and, from these alternatives, a base case scenario will be selected to represent future timber supply.

8.3 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. Table 30 lists the base sensitivity analyses to be performed. Further sensitivity analyses may be completed as needs are identified.

Table 30. Sensitivity analyses to assess influence and issue analyses

Issue to be tested	Sensitivity levels
Natural stand volumes	All volume tables will be changed by +/- 10%.
Managed stand volumes	All volume tables will be changed by +/- 10%.
Minimum harvestable age	Change minimum harvestable able ages by +/- 10 years.
Minimum harvestable volume	Change MHV to 225 m ³ /ha, 250 m ³ /ha, 300 m ³ /ha.
Upper Nass	Include in THLB.
Riparian reserves and management areas	Reduce riparian factors by half.
Harvest priorities	Use alternative harvest priorities available within the timber supply model.
Site productivity	The potential site indices of the provincial forest productivity layer will be changed by +/- 1m.
Inoperable areas	Exclude all slopes above the 90 th percentile which occurs at 31% slope.
SRMP operability mapping	Use the 2007 operability study for the SRMP area.
Visual quality objectives	Use a visually effective green-up height of three metres.
Pine mushrooms	Protect higher and lower levels of pine mushroom habitat.
Gitanyow Wilp Sustainability	Evaluate harvest flow proportionate across the eight Wilps of the Gitanyow Nation.

9. Associated Analysis, Information Collecting 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. The following work will be completed to and reports will be prepared.

9.1 Timber supply analysis - Discussion Paper

A *Discussion Paper* reporting the preliminary timber supply analysis results will be released for public review. Information received during the consultation with First Nations/Nations and during the public review process will be documented in an updated data package and will be applied in the timber supply analysis.

The timber supply analysis should be viewed as a “work in progress”. As such, 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.

9.2 First Nations/Nations consultation and public review

Information collected through First Nations/Nation 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.

10. Information Sources

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

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

Biodiversity Guidebook. Ministry of Forests. <https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/frep/frep-docs/biodiversityguidebook.pdf>;

Forest Act. See Section 8 Allowable Annual Cut
http://www.bclaws.ca/civix/document/id/complete/statreg/96157_02;

Forest and Range Practices Act. See
http://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. 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 Nass South Sustainable Resource Management Plan, Ministry of Forests, Lands and Natural Resource Operations, February 2016;

Nass Timber Supply Area Data Package, Ministry of Forests, May 2000;

Nass Timber Supply Area Analysis Report, Ministry of Forests, June 2001;

Nass Timber Supply Area Rationale for AAC determination, Ministry of Forests, January 1996;

Nass Timber Supply Area Rationale for Allowable Annual Cut (AAC) determination. Effective August 1, 2002. Ministry of Forests, Victoria, BC.

11. 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 Nass TSA. Ministry staff would be pleased to answer questions to help you prepare your response. Please send your comments to the forest district manager at the address below.

Comments on the November 2019 data package will be accepted until January 30, 2020 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:

Coast Mountains Natural Resource District
Ministry of Forests, Lands, Natural Resource Operations and Rural Development
#200 – 5220 Keith Avenue
Terrace, B.C. V8G 1L1
Telephone: 250-638-5100
Fax: 250-638-5176

Or contact:

Bruce La Haie, A/Stewardship Officer
Coast Mountains Natural Resource District
Ministry of Forests, Lands, Natural Resource Operations and Rural Development
Telephone: (250) 638-5126
Electronic mail: Bruce.LaHaie@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 analysis is available on request by contacting Forests.ForestAnalysisBranchOffice@gov.bc.ca

Appendix 1 List of Acronyms

AAC	Allowable Annual Cut
BCGW	British Columbia Geographic Warehouse
BCLCS	BC Land Classification System
CEF	Cumulative Effects Framework
CHR	Cultural Heritage Resources
CMFLB	Crown Management Forest Land Base
ECA	Equivalent Clearcut Area
ESA	Environmentally Sensitive Areas
FAIB	Forest Analysis And Inventory Branch
FIP	Forest Inventory Planning
FLNRORD	Ministry of Forests, Lands, Natural Resource Operations and Rural Development
FPC	Forest Practices Code Of BC Act
FPPR	Forest Planning And Practices Regulation
FRPA	Forest And Range Practices Act
FSP	Forest Stewardship Plans
FTOA	First Nations Tenure Opportunity
GAR	Government Action Regulations
GHC	Gitanyow Hereditary Chiefs
GLLUP	Gitanyow Lax'yip Land Use Plan
IRMP	Integrated Resource Management Plan
IWMS	Identified Wildlife Management Strategy
MIRR	Ministry Of Indigenous Relations And Reconciliation
NDT	Natural Disturbance Type
NLG	Nisga'a Lisims Government
NRL	Non-Recoverable Losses
NSP	Nass Stewardship Protocol
NTL	Northwest Transmission Line
OAF	Operational Adjustment Factors
OGMA	Old Growth Management Areas
OIC	Order In Council
PEM	Predictive Ecosystem Mapping
PSP	Permanent Sample Plots
RAAD	Remote Access To Archaeological Data
RESULTS	Reporting Silviculture Updates And Land Status Tracking System
RTL	Roads, Trails And Landings
SELES	Spatially Explicit Landscape Event Simulator
SFL	Supplemental Forest Licence
SIBEC	Site Index Estimates By Biogeoclimatic Ecosystem Classification Site Series
SPAR	Seed Planning And Registry Application
SRMP	Nass South Sustainable Resource Management Plan
SRMZ	Special Resource Management Zones
STSM2	Spatial Timber Supply Model Version 2
TASS	Tree And Stand Simulator

TEM	Terrestrial Ecosystem Mapping
THLB	Timber Harvesting Land Base
TIPSY	Table Interpolation Program For Stand Yields
TSA	Timber Supply Area
TSR	Timber Supply Review
VAC	Visual Absorption Capability
VDYP	Variable Density Yield Prediction
VEG	Visually Effective Green-Up
VQO	Visual Quality Objectives
VRI	Vegetation Resource Inventory
WHA	Wildlife Habitat Area
WMU	Water Management Units
WTR	Wildlife Tree Retention