

Kamloops Timber Supply Area
Timber Supply Review

Data Package

UPDATE

September 2015

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Executive Summary

The Kamloops Timber Supply Area (TSA) is located in south central British Columbia and covers approximately 2.77 million hectares of the Thompson Okanagan Region. It ranges from Logan Lake in the south to Wells Gray Provincial Park in the north-west, including the Blue River area, and is bounded by the Columbia Mountains to the east and the Cariboo Regional District to the west.

Effective June 1, 2008, the Allowable Annual Cut (AAC) for the Kamloops TSA was set at 4.0 million cubic metres. The AAC was partitioned by various species groups (pine, non-pine, cedar and hemlock, deciduous) and by tenure description (Pulpwood Agreement 16). Harvest in the period 2009-2013 that has been billed against the AAC level has averaged about 2.7 million cubic metres per year.

Under Section 8 of the *Forest Act* the chief forester must review the timber supply for each TSA at least once every 10 years and determine an AAC. Ministry of Forests, Lands and Natural Resource Operations (FLNR) staff identified that an earlier timber supply review (TSR) was warranted for Kamloops TSA given the availability of a new vegetation resources inventory. The new inventory reduces the uncertainty about the forest composition following an extensive mountain pine beetle infestation that peaked in 2006.

The TSR and AAC determination is a multistep 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 Public 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, as part of consultation, and the public are asked formally for input following the release of the data package and the Public Discussion Paper.

The data package contains information of currently available data and management descriptions that is relevant for the timber supply analysis. A draft data package was presented for First Nations and public review in September 2014. This September 2015 updated data package summarizes the information and assumptions that are used to conduct timber supply analysis for the TSR of the Kamloops TSA as presented in the public discussion paper.

The First Nations consultation process is initiated at the start of the TSR and continues until an AAC decision is made. The original data package was made available in September 2014 to First Nations as one part of the consultation process. A second 60 day First Nations and public comment period will be initiated following the release of the updated data package and the Public Discussion Paper.

1. Introduction

This data package summarizes the information and assumptions that are used to conduct timber supply analysis for the Timber Supply Review (TSR) of the Kamloops Timber Supply Area (TSA). Under Section 8 of the *Forest Act* the chief forester must review the timber supply for each TSA at least once every 10 years and determine an appropriate Allowable Annual Cut (AAC). For more information about the TSR please visit the following website: <http://www.for.gov.bc.ca/hts/pubs.htm>.

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 (i.e., Kamloops Land and Resource Management Plan);
- 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 the TSR program is to identify and if reasonable model the “what is”, not the “what if”. Changes in forest management objectives and data, when and if they occur, will be captured in future TSRs.

This data package is an update of the September 2014 data package and was prepared following the completion of the timber supply analysis for the September 2015 public discussion paper.

A First Nation consultation and public review period has been established to allow submission of comments and concerns to the Ministry of Forests, Lands and Natural Resource Operations (FLNR) for the consideration of the chief forester in determining the AAC. Input from the consultation or public review that has timber supply implications may be incorporated into the timber supply analysis or identified to the chief forester for consideration in his 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 consultations comments around the September 2014 data package were requested. A further comment period will be available following the release of the public discussion paper. See Section 11 for further information.

2. Background

2.1 General

The Kamloops TSA is located in south central BC and covers approximately 2.77 million hectares of the Thompson Okanagan Region. It ranges from Logan Lake in the south to Wells Gray Provincial Park in the north-west, including the Blue River area, and is bounded by the Columbia Mountains to the east and the Cariboo Regional District to the west.

The forest, water, land and range resources of the TSA are administered by the Thompson Rivers Natural Resource District of the Ministry of Forests, Lands and Natural Resource Operations. The topography of the Kamloops TSA is diverse, ranging from hot, dry grasslands in the valley bottoms in the south to wet rugged mountains in the north, and is bisected by the North Thompson River which joins the South Thompson River at Kamloops.

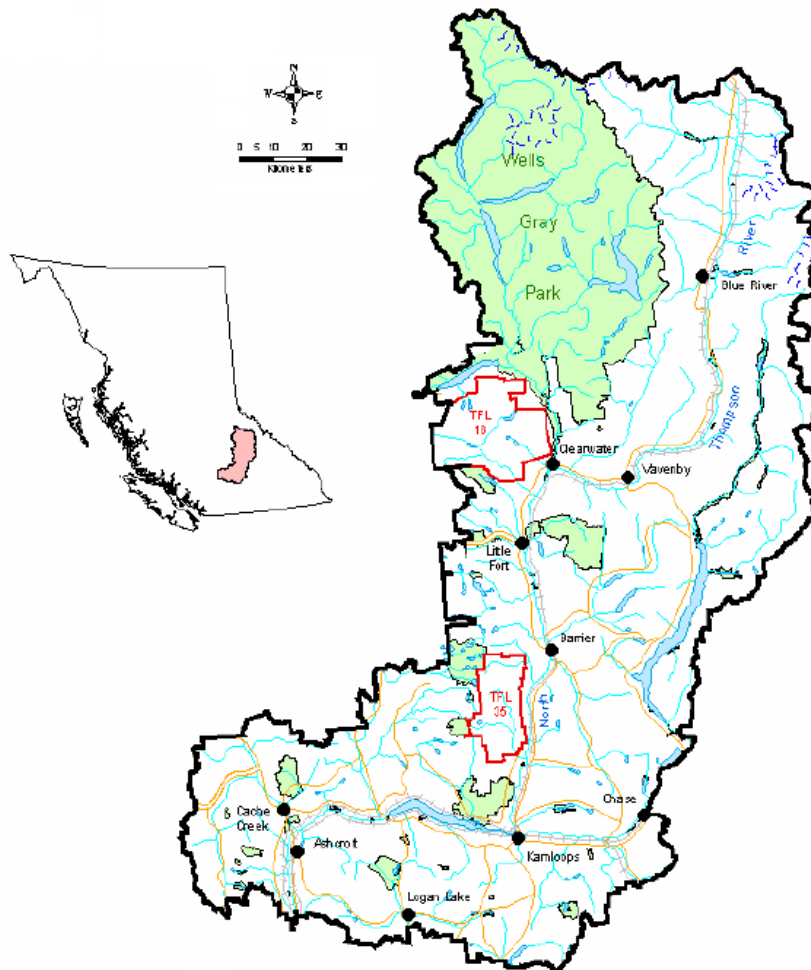


Figure 1. Kamloops Timber Supply Area

The Kamloops TSA includes extensive grasslands and forests that together provide timber and other forest products, forage for livestock and various wildlife species, fish, water, minerals, and opportunities for recreation and tourism. Ranching is very important to the local economy; the TSA contains about 1/3 of grazing leases in the province.

The area currently considered suitable and available for timber harvesting—the timber harvesting land base, or ‘THLB’—covers roughly 45 percent of the TSA (excluding Wells Gray Provincial Park). Of the THLB area, forest stands predominated by Douglas-fir cover roughly 33 percent; lodgepole pine, 30 percent; spruce, 18 percent; and subalpine fir, 9 percent. Ponderosa pine, western red cedar, western hemlock and trembling aspen are also present.

Diverse landscapes in the TSA provide a variety of wildlife habitats, including the grasslands, lakes and wetlands, forested slopes, and alpine areas. Grizzly bear, black bear, mule deer, moose, bighorn sheep and smaller furbearers, as well as many species of birds and amphibians, are common. The TSA includes portions of the range of three herds of mountain caribou. Twenty-nine species are considered identified wildlife species for which special management is required by provincial forest practices legislation. In the TSA, numerous rivers, lakes and streams support many species of fish including rainbow trout, kokanee, steelhead, brook trout and white fish. Significant demands are also placed on water resources for ecological needs and to meet both domestic and agricultural needs.

Parks, recreation sites and trails, in addition to roaded and non-roaded areas, provide opportunities for numerous outdoor activities. Residents and tourists enjoy recreation activities including hiking, camping, hunting, fishing, wildlife viewing, boating, mountain-biking, snowmobiling, off-road vehicles (ORV's), downhill and cross country skiing, and ski touring. The TSA includes a number of parks and popular recreation areas.

Recent census data indicate a total population of 113,730 people residing in the TSA in 2013. The major population centres in the TSA are Kamloops, Clearwater, Logan Lake, Chase, Barriere, Cache Creek and Ashcroft. Smaller communities include Vavenby, Little Fort and Blue River and the First Nations communities that are listed below.

The economy of the Kamloops TSA is well diversified, and is dominated by an extensive local economy in the City of Kamloops which is based on trade, administration, services and manufacturing. Services, retail, trade, construction and government are the main employment sectors. The three largest government sector employers are Interior Health, School District 73, and Thompson Rivers University. Agriculture and forestry account for about 1.6% of the total labour force in the City of Kamloops and about 4.0% for the smaller incorporated communities within the TSA.

Effective June 1, 2008, the AAC for the Kamloops TSA was set at 4.0 million cubic metres.

The AAC was partitioned by various species groups (pine, non-pine, cedar and hemlock, deciduous) and by tenure description (Pulpwood Agreement 16). Harvest in the period 2009-2013 that has been billed against the AAC level has averaged about 2.7 million cubic metres per year.

2.2 Land Use Planning

The Kamloops Land and Resource Management Plan (KLRMP) was designated a higher level plan on January 23, 1996. This plan and subsequent amendments provides legal land use direction to the Kamloops TSA. All major forest tenure holders are required to prepare legally binding Forest Stewardship Plans (FSP) that reference the 23 objectives of the KLRMP.

Management of the forest and range within the Kamloops TSA is also guided by the Thompson Nicola Fraser Sustainable Forest Management (SFM) Plan. Forest tenure holders who retain or seek environmental certification of their management practices by the Canadian Standards Association participate in the plan. The SFM plan sets performance values, objectives, indicators and targets addressing environmental, social and economic aspects of forest management in the TSA. The SFM plan is monitored by a SFM advisory group which is made up of a cross-section of local interest groups. Participants in the plan report annually to the public.

2.3 First Nations

There are 31 First Nations communities with asserted territories within the Kamloops Timber Supply Area reflecting a rich cultural history and active community and economic influence within the area. Those communities belong to six Nation groups, including the Secwepemc (Shuswap) Nation, Nlaxa'pamux (Thompson) Nation, Stat'imc Nation, Syilx (Okanagan) Nation, Tsilhqot'in and Carrier. In addition, most First Nations communities affiliate with a tribal association. Tribal associations of note within the TSA include Shuswap Nation Tribal Council, Northern Shuswap Tribal Council, Nlaxa'pamux Nation Tribal Council, Nicola Tribal Association, Okanagan Nation Alliance, Stat'imc Chiefs Council, and Lillooet Tribal Council.

Ten First Nations reside in communities located within the TSA, with a total population of about 5000 people. These include the Adams Lake Indian Band, Bonaparte Indian Band, Tk'emlups te Secwepemc, Simpcw First Nation, Neskonlith Indian Band, Skeetchestn Indian Band, Whispering Pines/Clinton Indian band, Little Shuswap Indian Band, Ashcroft Indian Band and Oregon Jack Indian Band. Other First Nations communities have traditional interests within the Kamloops TSA, but their main communities reside outside the TSA.

The majority of the bands in the Kamloops TSA are not involved in the Treaty process; rather, ministry staff work with non-treaty First Nations through engagement and economic agreements, working groups, and other non-Treaty processes. As of April 2014 there are 17 First Nations with current Forest Consultation and Revenue Sharing Agreements, plus 9 under active negotiation in the TSA area. There are also five First Nation signatories to the Secwepemc Reconciliation Framework Agreement which overlaps a significant portion of the TSA: Tk'emlups te Secwepemc, Skeetchestn Indian Band, Splots'in First Nation, Adams Lake Indian Band and Shuswap Indian Band .

2.4 Forest Industry

Within the Kamloops TSA, pulp and paper, sawmill, veneer and plywood, and specialty (e.g. log homes, timber framing, post and rail) processing facilities operate. Together these facilities produce a diverse mix of forest products that are consumed worldwide.

The majority of timber in the TSA is processed at facilities owned by major tenure holders. Supplemental volume to address needs consumed by these milling facilities is accessed via many sources including but not limited to BC Timber Sales, Tree Farm Licences (TFL), Community Forest Licences, Woodlots, Small Scale Salvage Forestry License to Cuts, Non-replaceable Forest License agreements, mountain pine beetle agreements, and outside TSA purchases or trades.

The current AAC is apportioned to Replaceable Forest Licences (39%), Non-replaceable Forest Licences (36%), BC Timber Sales Licences (19%), Pulpwood Agreement TSL (2%), future Woodlots Licences (<1%) and Forest Service Reserve (2%).

First Nations are involved in the forest sector. Eight bands or First Nation entities hold either replaceable or non-replaceable forest licences in the Kamloops TSA. The combined AAC for the replaceable licences is approximately 105,080 cubic metres, and 552,520 cubic metres for the non-replaceable licences.

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. The forecast of the base case scenario is one component of the information presented to the chief forester for a Section 8 AAC determination.

3.2 Major forest management considerations and issues

Table 1 lists major forest management considerations and issues for the current Kamloops TSA TSR. Issues that fall within the definition of current management are modeled as best possible within the base case harvest forecast. Other issues that may infer significant uncertainties in current management may be assessed in sensitivity analyses as outlined in Section 8. In such cases, sensitivity analysis assesses the timber supply implications and can assist in assigning degrees of risk during the AAC determination.

Table 1. Major forest management considerations

Consideration/issue	Description
Vegetation Resources Inventory	A Phase 1 Vegetation Resources Inventory was completed in March 2014. This inventory includes a live and dead tree inventory based on 2010-2011 aerial photography that will address post mountain pine beetle infestation inventory concerns. In 2014 VRI Phase 2 sampling was completed which will provide a field based sample comparison to the Phase 1 aerial photo based inventory.
Land use zones	The Higher Level Plan Order (HLPO) for the Kamloops Land and Resource Management Plan (KLRMP) was approved January 1996 (amended March 1996, January 2006, February 2009). The HLPO establishes resource management zones and objectives for these zones. Objectives were established for water management, riparian management areas, recreation and tourism, ecosystem management, biodiversity, fisheries, range, wildlife, visuals, cultural and heritage sites, and settlement resource management.
Old growth management areas	Old growth management areas were legally established in April 2013 to address landscape level biodiversity objectives.
Fish and Wildlife	Specific management objectives have been established for the protection of habitat for many ungulate (e.g., mule deer, moose, and caribou) and identified species in the Kamloops TSA. An updated ungulate winter range order for mule deer and an order for fisheries sensitive watersheds are being developed.
Visual resources	The KLRMP visual guidelines and subsequent higher level plan orders form part of the basis of visual resource management in the TSA. Additionally, District manager letters have established visual quality objectives in the south and FRPA regulation has established visual quality objectives in the north.
Site productivity	Site productivity based on forest inventory attributes has been shown to be underestimated. Efforts to improve estimates of potential site productivity have been completed by licensees through a site index adjustment project. The ministry has modelled estimates of site productivity but efforts to complete a SIBEC based site productivity coverage are incomplete.

(continued)

Table 1. Major management considerations (concluded)

Consideration/issue	Description
Range	Within the Kamloops TSA the forested areas provide much of the summer range for livestock and include 1/3 of provincial grazing leases. Potential conflicts between grazing and forestry are seen likely to increase.
Current Harvest Levels	Harvest in the Kamloops TSA in the period 2009-2013 has averaged about 2.7 million cubic meters . Within the Cedar-Hemlock partition an average of 26,000 cubic meters (13.7% of partition) was harvested.
Insects and diseases	Mountain pine beetle infestations have significantly impacted the forests of the Kamloops TSA directly through mortality and anticipatory harvest. The infestation reached a peak in 2006 and has subsequently subsided. Forest health concerns continue to exist for pest problems within non-pine forest types in particular for spruce budworm, western spruce and balsam bark beetle, and Douglas-fir bark beetle.
Tenure	Pulpwood Agreement 16 expired in 2015. This agreement provided tenure for volume that did not meet traditional merchantability specifications considered with the Section 8 AAC determination.

4. Inventories

4.1 Vegetation Resource Inventory

A new Vegetation Resources Inventory photo interpretation project (Phase 1) was completed in March 2014. This inventory used air photos flown in 2010 and 2011. Reporting Silviculture Updates and Land status Tracking System (RESULTS) updates available during the classification were incorporated. Further RESULTS depletion information for years 2012 and 2013 were incorporated separately. The data set used for the timber supply analysis was published in December 2014 on the British Columbia Geographic Warehouse¹ (BCGW).

The Kamloops TSA is the first provincial project to include a forest cover layer describing dead attributes for stands with more than 30% mortality based on density loss. Attributes collected for dead layers include species composition, leading age and height, basal area and density.

A VRI Phase 2 project will be completed in 2014 in which ground sample information is collected that complements the Phase 1 inventory. Information from this phase will be presented to the chief forester for consideration.

4.2 Ecosystem Mapping

British Columbia has an extensive biogeoclimatic ecosystem classification program. In the Kamloops TSA, mapping of climatic zonal and subzonal classification is available with corresponding descriptive guide. An update of this mapping is currently in preparation but was not published prior to the initiation of analysis for the TSR.

Portions of the Kamloops TSA have been mapped to the site series level via Predictive Ecosystem Mapping (PEM) and Terrestrial Ecosystem Mapping (TEM) projects. However, a large portion of the TSA does not have mapping to the site series level and many early PEM/TEM projects have not had or passed provincial standard quality checks.

4.3 Site productivity

In the Kamloops TSA several sources of information on site productivity exist that may be used as input to growth and yield models (e.g., TIPS Y) for deriving managed stand volume tables. Forest inventory site index, based estimates of height and age from aerial photography, are recognized as likely underestimating site productivity for younger and older stands. To address this issue, two projects have been conducted to estimate polygon specific potential site indices across the TSA.

The FLNR as part of a provincial project have compiled into a single data base the potential site indices based on a SIBEC approach where appropriate information exists or otherwise based on a biophysical model. The SIBEC approach assigns a potential site index to the site series identified from ecosystem mapping. The potential site index is based on the average of ground samples collected by approved methodology. In the Kamloops TSA as site series information is not available for the entire TSA (i.e., there is no approved predictive ecosystem mapping for the TSA) a biophysical model approach was applied by the FLNR to determine potential site indices for the entire TSA. The biophysical model is a simple regression model of existing 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>

The Kamloops TSA licensee group completed a site index adjustment project that looked at 42% of the TSA. In this project the land base was focused on lodgepole pine and spruce-leading stands where potential site indices may be applied for management purposes. The final report for this project was released March 31, 2008. Interfor completed a similar project in the Adams Lake portion of the TSA under their Innovative Forestry Practice Agreement.

For the base case scenario, potential site indices derived from the FLNR provincial layer will be used. A critical issue analysis will also be conducted using results of the Kamloops TSA licensee group site index adjustment project.

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 FLNR for timber supply and/or other forest management objectives that impact timber supply within the TSA. The CMFLB excludes:

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

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

Provincial lands not included in TSA AAC determination:

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

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

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

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

Table 2, 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 2. Netdown table to identify crown forest management land base (CMFLB) and timber harvesting land base (THLB) for the Kamloops TSA

Netdown Factor	Within gross land base (ha)	Within TSA Section 8 Decision (ha)	CMFLB (ha)	Unique area excluded from THLB
Kamloops TSA gross	2 769 469			
Non-provincial lands	219 846	0	0	63 360
Not managed within TSA AAC	186 193	0	0	149 027
Non-forest	798 668	653 506	0	122 241
Roads, trails, landings and transmission lines ¹	34 708 6369	25 661 3746	0 0	20 126 515
Crown forest management land base		1 686 363		
Provincial Parks & Miscellaneous Reserves	624 731	623 864	282 024	220 629
Heritage Trails	261	261	251	144
Inoperable	325 784	321 888	152 400	19 803
Sites with low growing potential	174 869	160 677	114 240	11 571
Problem forest types	86 356	82 908	63 153	10 250
Deciduous	84 207	59 905	52 266	26 944
Landscape level biodiversity – OGMA	201 451	188 668	181 367	85 122
Wildlife Habitat Areas	2 793	2 708	711	213
Wildlife Management Areas	5 961	5 947	3 520	315
Mountain Caribou	236 299	236 331	146 300	46 924
Research Installations	2 429	2428	2 298	2 089
GY PSPs	356	297	294	240
Terrain Stability u/p / ESA1	111 202	105 172	95 297	27 719
Archaeological sites	3 399	2 025	1 224	696
Riparian Reserve and Management Areas	68 244	52 480	36 274	15 207
Stand level biodiversity – WTP	n/a	n/a	n/a	19 274
Timber harvesting land base		931 373		

Data source and comments:

The netdown table presents values that reflect available data as well as data refinements made during the creation of the resultant data set. Gross land base incorporates the total land base within the TSA boundary. “Within Section 8 Decision” considers only land base that is within the consideration of the Section 8 AAC determination for the Kamloops TSA (i.e., excludes TFLs). “Within CMFLB” land base that the crown managed forest land base. “Unique area excluded from THLB” shows the area for each factor that was uniquely excluded from the THLB with respect to factors above dotted line. To reduce model complexity, the netdown of linear features such as roads and riparian zones was determined after the netdown for all other features. The netdown for terrain stability and for wildlife tree biodiversity were based on percentages of the landbase.

5.2 Timber Supply Area Boundary

The gross size of the Kamloops Timber Supply Area is 2 769 469 hectares. Within the bounds of the Kamloops TSA are areas (e.g., TFLs, provincial parks) that do not contribute to the AAC as determined under *Forests Act* Section 8 for timber supply areas.

In earlier TSRs Wells Gray Provincial Park was identified separate from other provincial parks and not included in the gross size of the TSA. In the current data set Wells Gray Provincial Park represents 536,109 hectares of gross land base of the TSA.

Data source and comments: BCGW² file WHSE_ADMIN_BOUNDARIES.FADM_TSA

5.3 Non-provincial Crown Lands

Land not administered by the FLNR for timber supply in the TSA includes “Non-provincial Crown lands” (e.g., private land, municipal land, federal land, Indian Reserves)

Table 3 shows the contribution of each ownership category to the CMFLB and the THLB based on the 2012 FLNR FAIB compilation of land ownership from the Crown land registry and the Integrated Cadastral Information Society. Private land is updated based on the 2014 integrated cadastral fabric.

Table 3. Non-provincial Crown Lands in Kamloops TSA based on FAIB ownership compilation.

Ownership code - Description	Gross land base (ha)	CMFLB	THLB
Private – Crown Grant	182292	No	No
Federal Reserve	706	No	No
National Park	0	No	No
Indian Reserve	32814	No	No
Military Reserve	1	No	No
Dominion Government Block	44	No	No
Crown Misc. Lease (Fairground, R&G Club site, recreation cottage site)	65	No	No

Data source and comments: BCGW file WHSE_FOREST_VEGETATION.F_OWN and WHSE_CADASTRE.CBM_INTGD_CADASTRAL_FABRIC_SVW

5.4 Not managed within TSA AAC

A variety of area based tenures exist within the boundary of the Kamloops TSA but are not considered in the Section 8 AAC determination for the TSA: Tree farm licences, community forest agreements, woodlot licences, and First Nations Woodland Licences. For these tenures, there are separate AAC determination processes. For the current analysis these tenures are excluded from the CMFLB and THLB.

Controlled recreation areas (Sun Peaks, Harper Mountain, Saddle Mountain) that are found within the Kamloops TSA are also excluded from the CMFLB and THLB as harvest that occurs within the CRA is not recorded as part of the cut control of the TSA.

² British Columbia Geographic Warehouse. For further information see <http://www.data.gov.bc.ca/dbc/geographic/index.page>

First Nations Woodland Licences are in the application phase and have yet to be awarded. Consideration with respect to the TSA AAC will be made upon award of the licences.

Table 4 shows the contribution to the CMFLB and THLB of the tenure categories that are not managed within the TSA AAC.

Table 4. Tenures not managed within the TSA allowable annual cut.

Ownership code - Description	Gross land base (ha)	CMFLB	THLB
Tree Farm Licences	110854	No	No
Woodlot Licences (Schedule B)	30909	No	No
Community Forests	38065	No	No
First Nations Woodland Licences	0	No	No
Controlled Recreation Areas	6354	No	No

Data source and comments:

BCGW files WHSE_FOREST_VEGETATION.F_OWN,
REG_LEGAL_AND_ADMIN_BOUNDARIES.CONTROLLED_REC_AREAS_BC,
WHSE_FOREST_TENURE.FTEN_MANAGED_LICENCE_POLY_SVW

5.5 Timber Licence Reversions

Timber licences are a form of timber tenure that gives the holder exclusive right to harvest merchantable timber from defined areas of Crown land. The timber cut from timber licenses is not part of the TSA AAC. After the area is harvested, the expectation is that the licensee would at some point request the area be deleted from the license. As such, the future stand is expected to be part of the Section 8 AAC determination.

Two timber licences exist in the Kamloops TSA but are expected to expire in 2015 and 2021. Conversations with both licensees identify that a further 400 ha and 600 ha are to be harvested from the remaining area of the two licences.

For the TSR analysis, the forest estate model used does not enable time step addition of land base into the THLB. As a modeling surrogate, the entire area of the timber licences is considered part of the TSA but a proportionate one time volume deduction equal to the estimated future harvest is removed from the area otherwise identified as THLB within the timber licence boundaries.

Table 5. Timber Licences within the TSA

Timber Licence Number and Holder	Gross land base (ha)	Expiry Date	2014-2024 Harvest Assumption (ha)
T0888 - Interfor	9 281	2015	400
T0713 - Gilbert Smith Forest Products	12 255	2021	600

Data sources and comments:

BCGW files WHSE_FOREST_TENURE.FTEN_TIMBER_LICENCE_POLY_SVW and WHSE_FOREST_TENURE.FTEN_TL_ELIMINATION_POLY_SVW

Harvest assumptions from Marino Bordin (Interfor) and Dave Tremblay (Gilbert Smith Forest Products)

5.6 Non-forest and non-productive forest

A large area of the Kamloops 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 previous 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 that identify non-vegetated and various classes of vegetated areas based on the BC land classification system (BCLCS) are collected. These Non-forested areas include water and non-vegetated land such as rock, ice and bare land. These areas are assumed not to contribute to timber supply or non-timber objectives modelled within the timber supply analysis.

The previous forest cover inventory identified a non-productive attribute that captured forested land considered not capable of producing a productive forest. To supplement the existing VRI that does not capture this anthropogenic attribute, FLNR FAIB created a Forest Management Land Base (FMLB) indicator that is included with inventory layer provided on the BCGW. FMLB is a generalized surrogate that relies on BC Land Classification System and site index.

In the current timber supply analysis we did not directly use the FMLB attribute but instead used similar criteria, as shown in Table 6, to remove non-forested areas, non-productive forest, and non-commercial cover from the THLB. This netdown for the Kamloops TSA uses components drawn from the FMLB definition but does not utilize FMLB directly to identify excluded land base.

The Table 6 criteria did not address all forest stands that had previously been harvested and were currently or were to be regenerated. For example there were over 10,000 ha of BCLCS level 2 = 'N' with a level 4 = 'GH' that had been harvested. A data check of the RESULTS data base suggested most of these stands would be regenerated.

For the final netdown Table 6 criteria for the non-forest, very low productivity or non-commercial forest classification were applied but stands with a harvest record after 1987 identified in the VRI were included in the CMFLB.

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

Attributes	Gross land base (ha)	Description
Non-forest		
VRI: BCLCS level 1 equal 'N'	307,733	Non-vegetated
VRI: BCLCS level 2 = 'N' AND BCLCS level 4 not equal to 'ST' or 'SL'	197,420	Vegetated but non-treed, excluding shrub areas
VRI: BCLCS level 2 = 'N' AND BCLCS level 3 = 'W'	11,549	Non-treed wetlands
VRI: BCLCS level 3 = 'A'	234,688	Alpine
BEC: zone = 'IMA'	106,400	Alpine
Very low productivity forest		
VRI: site index < 3.0 m or null AND no logging history	598,959	Land base that is not productive for timber supply or non-forest objectives.
Non-commercial forest		
VRI: BCLCS level 2 = 'T' AND BCLCS level 3 = 'W'	757	Treed wetlands
VRI: BCLCS level 4 = 'ST or 'SL' AND no logging history	282,693	Shrub and not already logged

Data sources and comments:

A pre-production data set of the 2014 VRI Phase 1 was provided by Forest Analysis and Inventory Branch. This data set was not attributed for FMLB. Overlap exists among the netdown factors identified in Table 6.

5.7 Roads, Trails, Landings and Transmission Lines

Productive forest land is lost due to permanent roads, trails and landings (RTL). Existing estimates of the area occupied by RTL is determined by applying average road width buffers to identified roads. The road layer is based on recently collated data set. Road buffers were determined based on an aerial photo based exercise that measures road width. Table 7 shows the length of road types within the Kamloops TSA and reductions to be made for existing RTL.

As development occurs in the TSA, further RTL reductions will occur. Typically, the timber volume from the area occupied by the new roads and trails would be assumed available for an initial harvest and not available for later harvests. As the forest estate model used in this analysis cannot accommodate this temporal change of THLB, future roads, trails, and landings will not be accounted for directly. The chief forester will be presented information on the likely impact of future RTL for consideration in making his AAC determination.

Vegetation management occurs on transmission lines. For TSRs in other TSAs, BC Hydro had identified that a 60-metre buffer for right-of-ways along transmission lines would be an appropriate provincial standard. Such a buffer will be applied to the identified transmission lines.

In the timber supply analysis, an overlay of buffered roads and transmission lines was created. However, rather than splintering the resultant polygons, the deductions from the THLB are applied aspatially; the area found within THLB is deducted from the THLB of a polygon.

Table 7. Roads within the Kamloops TSA.

Description	Length (km)	Modelled Buffer Width (m)	Gross land base Based on buffer(ha)	CMFLB	THLB
Roads	35 772	10	34 709	No	No
Transmission Line	1180	60	7082	No	No

Data sources and comments:

An integrated data set of linear road features created by FLNR TOR geospatial services staff in June 2013 TKA_buf_IntegratedRoads_2013_20131206_101.gdb (2013-12-06). Transmission line features are from the BCGW file WHSE_IMAGERY_AND_BASE_MAPS.DRP_BCTC_TRANSMISSION_LINES_SP. Railway lines are identifiable within the VRI and are excluded under the non-forest, non-productive forest and non-commercial cover.

5.8 Provincial Parks & Miscellaneous Reserves

Over 22% of the land base in the Kamloops TSA is provincially designated for the protection of its natural environment. Such protection is afforded under various designations including Provincial Class A Parks, Protected Areas, Ecological Reserves.

Provincial Class A Parks preserve the natural environment and provide public use and enjoyment; they range from the internationally recognized Wells Gray Provincial Park to the tiny Monte Creek Provincial Park that protects a treed riparian area. Protected areas include areas such as Lac du Bois Grasslands Protected Area. Ecological reserves include the Tranquille Ecological Reserve.

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 FLNR for timber supply and thus are excluded from the THLB.

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

Reserve Type	Number	Gross land base (ha)	CMFLB	THLB
Ecological Reserve	2	259	Yes	No
Protected Area	4	35 554	Yes	No
Park Class A	59	588 875	Yes	No

Data source and comments: BCGW file WHSE_TANTALIS.TA_PARK_ECORES_PA_SVW

5.9 Recreation sites and trails

Under the *Forest and Range Practices Act*, 181 recreation sites, trails and interpretive sites have been established in the Kamloops TSA. The management strategy for these sites typically identifies the maintenance of a recreational feature such as a campsite or trail and the conservation of natural vegetation. This does not preclude industrial activity or harvesting, authorization is required prior to any industrial activity or harvesting, but some loss of forest productivity could be expected. FLNR recreation staff suggested that the recreation sites and trails are anticipated to only have minor associated timber supply impacts.

The Hudson Bay Brigade Trail is designated as a Heritage Trail. “Heritage Trails” are declared under the *Heritage Conservation Act* and by designation through an Order in Council, to have a 200 m right-of-way that requires a “permit” for any alterations.

For the TSR base case, recreation sites, trails and interpretive sites will not be specifically excluded from the timber harvesting land base except for the Hudson Bay Brigade Trail.

Areas designated as Crown Use, Recreation and Enjoyment of the Public (UREPs) fall under *Land Act* reserves, but without having designation under other legislation they are not reserved from harvest. For the TSR analysis UREPs are not directly removed from the THLB but may be excluded due to other designations.

Table 9. Recreation sites and trails.

Category	Gross land base	CMFLB	THLB
Active recreation sites and reserves	36,254	Yes	Yes
Active recreation trails	2,919	Yes	Yes
Designated heritage trail	260	Yes	No

Data sources and comments:

BCGW files WHSE_FOREST_TENURE.FTEN_RECREATION_POLY_SVW and WHSE_FOREST_TENURE.FTEN_RECREATION_LINES_SVW

5.10 Inoperable areas

The ministry in consultation with major licensees developed operability mapping in 1991 which was updated in 2002. Harvesting is deemed not feasible in these areas. Characteristics used in defining operability lines include steep slopes, broken topography, difficult road access, soil instability, high elevation, timber quality and combinations of these. There is an inherent estimation of the economics included into these factors based on the experience of ministry and industry staff.

A comparison of this line work with a FLNR FAIB 2013 consolidated cut block layer identifies little overlap with the inoperable layer.

Inoperable areas, except for polygons that have harvest history, will be removed from the THLB but included in the CMFLB.

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

Category	Gross land base (ha)	CMFLB	THLB
Inoperable	325,623	Yes	No

Data sources and comments:

A Thompson Rivers Natural Resource District maintained file (oper_tka_w.shp) operable boundaries that corrects or updates BCGW file REG_LAND_AND_NATURAL_RESOURCE.OPERABILITY_AREAS_SIR_POLY.

5.11 Terrain Stability and Environmentally Sensitive Areas

Terrain stability mapping (TSM) provides a more accurate assessment of slope stability than environmentally sensitive areas (ESA) mapping for sensitive soils. ESA mapping was completed for the older forest cover inventory and is no longer updated. In the Kamloops TSA much of the land base has been mapped to various standards of TSM, however, areas without TSM exist.

TSM may be conducted to various standards. Areas classified in TSM as U (*unstable*) or Class V (*very unstable*) terrain, are generally unsuitable for harvest. However TSM is inherently conservative to ensure that all unstable areas are identified and subjected to field assessment. TSM tends to overestimate the amount of class U or V terrain because of limited field sampling for some levels of survey intensity. To account for this conservativeness in the assessment relative to operations, the netdown in a timber supply analyses may be based on a subjective percentage. Commonly terrain classes U and V are modelled as 80% unharvestable and the potentially unstable classes P and IV are modelled as 20% unharvestable. For the base case analysis these netdown percentages are applied.

Under the previous forest inventory environmentally sensitive areas (ESA) were identified for a variety of issues (e.g., soils, regeneration problems, wildlife). For areas where TSM mapping does not exist, all highly sensitive (ESA1) areas for soils were used as a surrogate to identify areas that are excluded from the THLB.

Table 11 shows the terrain stability categories that area excluded from the THLB and environmentally sensitive areas that are excluded from the THLB where no terrain stability mapping exists for the TSR base case. Ministry staff will review past harvesting behavior within TSM terrain and ESA classes and present this information to the chief forester for consideration.

Table 11. Description of terrain stability mapping and environmentally sensitive area deductions.

Source	Category	Gross land base (ha)	CMFLB inclusion	THLB exclusion
TSM	V	21,536	Yes	80%
	U	18,138	Yes	80%
	IV	70,894	Yes	20%
	P	54,117	Yes	20%
ESA1 (where no TSA mapping)	S	60,611	Yes	100%

Data sources and comments:

BCGW file WHSE_TERRESTRIAL_ECOLOGY.STE_TER_STABILITY_POLYS_SVW. Ron Van der Zwan of Thompson Rivers Natural Resource District provided a data set of ESA used in previous TSR.

5.12 Sites with low timber growing potential

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

For the base case timber supply analysis stands with a forest inventory site index less than 8 m will be considered not to produce a merchantable crop of trees and are excluded from the THLB (Table 12). Stands with a site index less than 3.0 m were excluded based on the non-productive criteria.

These low site stands are not considered desirable to harvest but may contribute to other non-timber objectives; they are removed from the THLB but included within the CMFLB.

Table 12. Description of sites with low timber growing potential.

Leading Species	Inventory Site index (m @ 50 years)	Gross land base (ha)	CMFLB	THLB
All	< 8.0 m and ≥ 3.0 m	174,725	Yes	No

Data source and comments

The gross land base estimate of site index less than 8.0 and greater or equal to 3.0 includes all lands within the TSA boundary on which a site index value is present.

5.13 Problem Forest types

Problem forest types are stands that are physically operable but are not currently utilized or have marginal merchantability. In the Kamloops TSA for non-deciduous species, several problem forest types have been historically identified and described within past TSR. For the current TSR, these past problem forest type definitions were reviewed by ministry staff. For the most part, it was found that the historical problem forest types were not applicable (e.g., little identified area in new VRI) or the intent could be captured by other mechanisms (e.g., minimum harvestable volume and age criteria).

For the purposes of this netdown only the problem forest type for low crown closure balsam (subalpine fir) and spruce stands was maintained. Based on the 2006 inventory only 84 ha of this type have been harvested since 2006. In a study of mortality in subalpine fir, the FLNR regional pathologist found that stands over 100 years were subject to continuous western balsam bark beetle infestations eventually resulting in death of the majority of the dominant subalpine fir.

Problem forest types are excluded from the THLB but included in the CMFLB. If an area identified as a problem forest type has been harvested in the past it will be included in the THLB and assigned to the most appropriate analysis unit. Deciduous species are discussed separately in a below section.

Table 13. Problem forest types criteria.

Description	Age	Height	Crown closure	Gross land base (ha)	CMFLB	THLB
Balsam and spruce leading stands	>140	<28.5	<36%	77,074	Yes	No

Data source and comments:

Polygon attributes will be based on the updated VRI Phase 1. Gross land base includes all lands within the TSA boundary including ownership and tenure not included within the Section 8 AAC determination for the TSA.

5.14 Deciduous

The demand for deciduous broadleaf sawlogs in the TSA is limited, being mostly for birch stands. Current practice for licensees is to leave deciduous stems in conifer-leading stands as wildlife trees or coarse woody debris in order to meet biodiversity objectives.

Since the 2008 AAC determination the district has issued 2 forest licences to cut (FLTC's) for birch. The total volume harvested was less than 1000 cubic metres.

A non-replaceable license for the harvest of 20,000 cubic metres of deciduous leading stands was issued in 2007 (expires November 2017) and corresponds with the partition identified in the 2008 Section 8 AAC determination. Harvest under this licence after 6 years has totaled 18 045 cubic metres (9% of expectation).

For the current TSR, deciduous leading stands will be excluded from the THLB. Further, as noted within the volume table descriptions, deciduous within conifer leading stands will be removed from volume tables.

Table 14. Problem forest types criteria – deciduous.

Description	Gross land base (ha)	CMFLB	THLB
Deciduous-leading stands	83,681	Yes	No

Data source and comments:

A deciduous leading stand is where the sum of all deciduous species is greater or equal 50%

5.15 Old Cedar Hemlock Stands

Old cedar and hemlock stands provide unique challenges within the Kamloops TSA. To address these challenges the chief forester in 1996 established a partition for these forest types; this partition has been maintained in subsequent decisions. Associated with the partition, specific non-replaceable licences have been issued and restrictions placed on replaceable forest licences that do not allow the harvest of these stands.

The harvest in the old cedar-hemlock partition over the period 2009 to 2013 has averaged only 27,300 cubic metres per year, about 13.6% of the AAC partition available. Concerns exist around the harvest profile as hemlock is harvested significantly less than its inventory profile (about 18% as compared to 42% of THLB)

The base case analysis does not identify a partition of the old cedar and hemlock stands. Sensitivity analysis will investigate the timber supply implications of removing the contribution of hemlock-leading stands that are greater than 140 years old.

Table 15. Cedar Hemlock partition criteria within the Kamloops TSA.

Description	Gross land base (ha)	CMFLB	THLB
32-Cedar G/M (SI>17 and age>140)	490	Yes	Yes
33-Cedar P/L (SI≤17 and age>140)	50,120	Yes	Yes
34-Hemlock G/M (SI>16 and age>140)	3,937	Yes	Yes
35-Hemlock P/L (SI≤16 and age>140)	71,061	Yes	Yes

5.16 Pulpwood Agreement No. 16

In 1990 the government issued to Ainsworth Engineering LP a 25 year term pulpwood agreement (PA16) that includes the southwest portions of the TSA. The intent of this agreement was to provide pulp quality timber to be used within their oriented strand board plant. The agreement outlined a number of conditions prior to accessing timber (e.g., accessing residual volume from other licences).

During the period of 2009-2013, 489,243 cubic metres had been harvested under the PA with an average of 97,451 cubic metres per year.

Given the expiry of the agreement in April 2015 and the timing of the next AAC determination, the current TSR does not specifically consider PA16 and associated utilization standards in the base case scenario.

5.17 Landscape Biodiversity

5.17.1 Seral stage requirements

In the Kamloops TSA landscape biodiversity objectives are addressed through an old growth management area strategy rather than specified seral stage requirements.

5.17.2 Old growth management areas (OGMA)

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.

Landscape biodiversity objectives for old seral forest types originate from the KLRMP. The 2006 amendment to the HLPO provided provisions for old growth management areas. In 2013 pursuant to Section 93.4 of the *Land Act* objectives for old growth management were established within the KLRMP area, including the Bonaparte extension area. OGMA identification in the Kamloops TSA is the result of many years of negotiation, analysis, government and stakeholder input and managerial direction.

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

Table 16. Old growth management areas in the Kamloops TSA.

Description	Gross land base (ha)	CMFLB	THLB
Old Growth Management Areas	234 400	Yes	No
Legal	201 365	Yes	No
Non-legal (in parks)	33 035	Yes	No

Data source and comments:

BCGW files WHSE_LAND_USE_PLANNING.RMP_OGMA_LEGAL_CURRENT_SVW and WHSE_LAND_USE_PLANNING.RMP_OGMA_NON_LEGAL_CURRENT_SVW

5.17.3 Disturbance outside of the THLB

The forested land base may be disturbed by many factors including natural events such as fire, pests, and 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 timber supply model FSSAM enables the modelling of “natural” disturbance. FSSAM compares the inverse of the return interval based on the BEC subzone against a random number between 0 and 1 generated from a uniform distribution.

For the TSR, the base case scenario will not model natural disturbance but a sensitivity analysis will be completed that incorporates natural disturbance based on return intervals defined in the 1995 Forest Practices Code of British Columbia Biodiversity Guidebook.

5.18 Stand Level Biodiversity - Wildlife tree retention

The *Forest and Range Practices Act* (FRPA) establishes an objective to maintain structural diversity in managed stands by wildlife tree retention (WTR) in each cutblock. The default value under FRPA is a minimum of 7% retention in each block. Licensees may vary from this requirement by specifying an acceptable alternative in their FSP.

WTR's are often located within areas that are otherwise constrained, such as riparian areas, sensitive or inoperable terrain and therefore the impact to the THLB is likely less than 7% minimum retention requirement.

Based on information provided by licensees in the TSR for the 2008 AAC determination, current practice at that time suggested that 1.9% of the THLB within a cutblock is uniquely retained for wildlife tree patches. A net down for WTR's was modelled by applying this percentage reduction as an aspatial THLB reduction.

5.19 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 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 *Forest Planning and Practices Regulation* (FPPR) and incorporated into FSPs.

Implementation of objectives include establishment of riparian reserve zones and/or riparian management zones. Riparian reserves require full cover retention along the stream, lake, or wetland. Riparian management zone requirements establish requirements that must be met over the stream length or water body perimeter.

Riparian reserves zone buffers were identified as per Forest Practice Code guidelines with which current defaults of the FPPR are generally consistent. The riparian management zones are converted to an effective reserve width and added to the reserve zone for the netdown used in the timber supply analysis.

In the timber supply analysis, riparian areas are removed by an aspatial THLB reduction. The aspatial reduction is calculated at the polygon level based on the overlap of the riparian buffer zone with the THLB in the polygon.

Table 17 shows the derivation of the buffer size used to account for riparian reserve zones and riparian management zones along streams and around lakes and wetlands and identifies the area assumptions for riparian netdowns within the Kamloops TSA.

Table 17. Riparian management area buffer determination and land base considerations

Stream, wetland or lake class	Gross Area or Length (ha or km)	Reserve zone width (metres)	Management zone width (metres)	RMZ avg basal area retention (%)	Combined buffer width (metres)	Buffer Gross area(ha)	CMFLB	THLB
S1 stream	2168	50	20	25	55	19919	Yes	No
S2 stream	1793	30	20	25	35	12370	Yes	No
S3 stream	5065	20	20	25	25	26082	Yes	No
S4 stream	1258	0	30	12	4	1010	Yes	No
S5 stream	4415	0	30	12	4	3540	Yes	No
S6 stream	17367	0	20	3	0	0	Yes	Yes
Unknown stream class	8396	N/A	N/A	N/A	N/A	0	Yes	Yes
W1/W5 wetlands (>5 ha) all BEC zones	12770	10	40	12	15	4436	Yes	No
W2 wetlands (1 to 5 ha) PP, BG, IDFxh, xw,xm	295	10	20	12	12	136	Yes	No
W3/W4 wetlands (0 to 1 ha) PP, BG, IDFxh, xw, xm	45	0	30	12	3	8	Yes	No
W3/W4 wetlands (1 to 5 ha) all BEC zones	4402	0	30	12	3	541	Yes	No
Lake L1-A	176 404	0	0	0	0	0	Yes	No
Lake L1- B	31 837	10	0	0	10	2 484	Yes	No
Lake L2	732	10	20	0	10	228	Yes	No
Lake L3	3623	0	30	0	0	0	Yes	No
Lake L4	269	0	30	0	0	0	Yes	No

Data sources and comments: Ron Van der Zwan, Thompson Rivers Natural Resource District provided district archived data sets of stream classes and lake shore management zones in the Kamloops TSA. CMFLB- Crown Managed Forested Land Base. THLB – Timber Harvesting Land Base

5.20 Lakeshore management zones

To support the objective of the Kamloops TSA Higher Level Plan, a Lakes LRUP was developed in both in the former Clearwater Forest District and the former Kamloops Forest District. The guidance of these plans have been identified in some but not all of the Forest Stewardship Plans within the Kamloops TSA.

The Lakes LRUP classified lakes and identified lakeshore management zones with recommended management.

The timber supply analysis incorporated lakeshore management by a maximum disturbance constraint based on the assigned visual quality objective identified in the LRUP (Table 18). The lakeshore management buffer data set used in the previous TSR was the base for the zones.

Table 18. Lakeshore management zone modelled maximum alteration percentages.

Visual Quality Objective	Percent Alteration
No harvest	0
Preservation	0.5
Retention	3.0
Partial Retention	10.0
Modification	20.0

5.21 Fisheries Sensitive Watersheds

Fish are one of the 11 objectives identified under *FRPA*. *FRPA* (e.g., Section 150.1) and in particular the Fisheries Sensitive Watersheds (FSW) portions of the *Government Actions Regulation* (Sec 14) and the *Forest Practices and Planning Regulation* (Sec 8.1) require the management of a watershed that has significant downstream fisheries values.

FSW's are proposed for the following watersheds or basins/sub-basins within these watersheds in the Kamloops TSA: Sinmax, Barriere, Louis, Lemieux, Deadman, and Adams upstream of Adams Lake.

As the proposed FSW's are not currently legally established, FSW's will not be modelled in the base case but will be modelled as a sensitivity analysis.

5.22 Wildlife Habitat Areas

Wildlife habitat may be identified and managed through several processes including the *Identified Wildlife Management Strategy*, identification and approval of ungulate winter range (UWR), and management practices specified in plans that establish legal objectives, such as the Kamloops LRMP.

Wildlife habitat areas have been established in the Kamloops TSA for Western Screech Owl, Lewis's Woodpecker, Williamson's Sapsucker, Spotted Bat, Badger, Great Basin Spadefoot and data sensitive species under the *Government Actions Regulation* (GAR) or grandparented under the *Forest Practices Code Act* for the protection of identified wildlife.

Table 18 lists the established WHAs. In a previous FLNR assessment these WHA were found to cover 412 ha of THLB of which the short term timber supply impact is expected to be equivalent to 194 hectares of mature THLB. For modelling simplification given the small timber supply impact, all WHAs will be excluded from the THLB and recognition of this simplification will be presented to the chief forester for the Section 8 AAC determination.

Table 18. *Wildlife habitat area exclusions.*

Wildlife species and communities	WHA Identification	Gross land base (ha)	CMFLB	THLB
Badger	3-117 to120, 3-122, 3-147	42	Yes	No
Great Basin Spadefoot	3-124, 3-125	39	Yes	No
Lewis's Woodpecker	3-071 to 073, 3-075 to 079, 3-084, 3-087 to 088, 3-102, 3-105 to 109, 3-153 to 155, 3-157	616	Yes	No
Spotted Bat	3-115	9	Yes	No
Western Screech Owl	3-030, 3-031, 3-069	110	Yes	No
Williamson's Sapsucker	3-096, 3-127	46	Yes	No
Data sensitive	3-050,3-055 to 057, 3-059, 3-063, 3-110 to 3-112, 3-114	1934	Yes	No

Data source and comments:

BCGW file: 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>.

5.23 Wildlife Management Areas

Wildlife management areas (WMA) may be designated under the Section 4 of the *Wildlife Act*.

Two WMA have been designated within the Kamloops TSA: Tranquille WMA and Dewdrop-Rosseau Creek WMA. Harvesting in these areas has been restricted either through legal requirements or by practice through the application of management plans.

For the timber supply analysis, WMAs are excluded from the THLB.

Table 19. *Wildlife management areas in the Kamloops TSA*

Wildlife Management Area	Gross land base (ha)	CMFLB	THLB
Tranquille	275	Yes	No
Dewdrop-Rosseau Creek	5685	Yes	No

Data source and comments:

BCGW file: WHSE_TANTALIS.TA_WILDLIFE_MFMT_AREAS_SVW.

5.24 Mountain Caribou

Mountain Caribou are a globally unique population. They are the world's southernmost Caribou population and the only remaining Caribou that live in rugged, mountainous terrain and feed on arboreal lichens in winter. As part of a provincial Mountain Caribou Recovery Implementation Plan, the BC government established three *Government Action Regulation (GAR) Orders* within the Kamloops TSA to assist in the recovery of mountain caribou populations.

GAR Order U-3-004 consists of three zones. The no harvest zone will be excluded completely from the THLB. Within the modified harvest zones, at least 9757 ha of suitable habitat must be maintained of which a minimum of 1800 hectares of suitable habitat must otherwise be on the THLB. For modelling purposes, district stewardship staff identified 1800 hectares of THLB that would qualify as suitable habitat and this was netted out of the analysis.

For the corridor zone order U-3-004 identifies a minimum of 33% of suitable habitat for Mountain Caribou movement between seasonal habitats is to be maintained. Suitable habitat, which reflects movement abilities, is not specifically defined but old growth is considered preferred habitat. This was mistakenly not modelled in the base case and will be modelled as a sensitivity analysis where 33% of the corridor zone must be greater than 140 years.

GAR order U-3-005 identifies a no harvest zone and for the analysis this zone will be excluded from the THLB.

GAR order U-8-004 covers a small area of the Kamloops TSA and within that area the objectives, which relate to silviculture activities, are unlikely to impact timber supply.

Table 20. Government Action Regulation Orders for Mountain Caribou in the Kamloops TSA.

Order	Zone	Gross land base (ha)	CMFLB	THLB
3-004	No Harvest	207 255	Yes	No
	Modified harvest	68 112	Yes	Exclude at least 1800 ha
	Corridor	5 692	Yes	Yes
3-005	No Harvest	14 276	Yes	No
8-004		231	Yes	Yes

Data source and comments:

BCGW file: WHSE_WILDLIFE_MANAGEMENT.WCP_UNGULATE_WINTER_RANGE_SP

Mountain caribou WHAs 5-096 and 5-117 are identified as having some area within the Kamloops TSA along the border with 100 Mile House TSA. As this area overlaps with Wells Gray Provincial Park, it is ignored.

5.25 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*. To conduct activities within the boundaries of an archaeological site, a permit is required

In the Kamloops TSA, there are 2714 sites covering approximately 3442 hectares that have been recorded within the government's archaeological data base. These include a wide range of sites located both within urban and forest land base. For the current timber supply analysis, these sites will be excluded from the THLB.

Most archaeological sites have not been recorded. However, protection is automatically provided to sites such as those containing physical evidence of human use or activity predating 1846, burial places, and aboriginal rock carvings or paintings.

To address the possibility of unknown archaeological sites, a predictive model developed in 2010 identifies the potential for finding an archaeological site (low, medium, and high). Licensees are responsible for using this tool to determine where more detailed field assessments are required prior to harvesting

If a new archaeological site is identified the licensee operationally assesses the identified areas and where appropriate, may acquire site alteration permits under the *Heritage Conservation Act*. These potential areas are not modelled in the current analysis but would be expected to be captured in future TSRs.

Data sources and comments:

FLNR Archaeological Branch provided a data layer of archaeological sites extracted from the Remote Access to Archaeological Data (RAAD) database

5.26 Cultural Heritage Sites

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

Experience has shown that most cultural heritage concerns and in particular smaller archaeological sites can be addressed through current management practices or through changes to the management practices. For example, cultural heritage resources are often situated near water bodies and can therefore be protected by using a riparian management area or creating a wildlife tree patch; 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.

No land base exclusions were made specifically to account for cultural heritage resources except for archaeological sites as described above.

The Skeetchestn Indian Band has provided the ministry with and identify on their website with a management plan that address cultural and environmental concerns. Such information is presented to the chief forester with respect to First Nations consultation. A sensitivity analysis will be completed that incorporates a desire for increased riparian reserve zones.

5.27 GY PSP and Research installations

The FLNR maintains a network of growth and yield permanent sample plots (PSPs) across the province for the purposes of understanding forest growth and the calibration of growth and yield models. 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 FLNR desire is to maintain a PSP up to 120-150 years of age at breast height before releasing the plot from study.

FLNR FAIB staff identified that an area with a 68 metre radius would be reasonable to associate on average with each plot. For the Kamloops TSA TSR this area of the 246 PSPs will be aspatially excluded from the THLB but allowed to contribute to the CMFLB.

Several forest research installations are present within the Kamloops TSA. Two research installations have been identified as resource features (crown land used for research or experimental purposes) by a *Government Actions Regulation* order: Mayson Lake Research Area and Opax Mountain – Isabel Lake Research Area. This GAR order does not specify objectives but provides guidance such that any forest activity would not compromise the research goals of the resource feature.

For the Kamloops TSA TSR, while some harvesting could be feasible within the research installations, less likely than not, these 2 research installations will not be harvested and therefore for the purposes of this TSR are excluded from the THLB.

Table 21. Growth and yield permanent sample plot and research installations in Kamloops TSA.)

Installations	Gross land base (ha)	CMFLB	THLB
GY PSP	353	Yes	No
Research	2420	Yes	No

Data sources and comments:

BCGW file WHSE_FOREST_VEGETATON.GRY_PSP_STATUS_ACTIVE and research installation boundaries as per the GAR order provided by FLRNO Thompson-Okanagan Natural Resource Region

6. Current Forest Management Assumptions

6.1 Harvesting

6.1.1 Recent Harvest Performance

Effective June 1, 2008, the AAC for the Kamloops TSA was set at 4.0 million cubic metres. The AAC was partitioned by various species groups (pine, non-pine, cedar and hemlock, deciduous) and by tenure description (Pulpwood Agreement 16). Harvest in the period 2009-2013 that has been billed against the AAC level has averaged about 2.68 million cubic metres per year but has seen levels above 3.0 million cubic metres in the most recent years.

Table 22. Allowable annual cut billed in the Kamloops TSA from 2009 to 2013.

Year (June to May)	Old Cedar and Hemlock Leading		Other Stand Types	
	Volume (m3)	% of partition	Volume (m3)	% of remainder
2009	23,802	11.9%	2,023,745	53.3%
2010	41,493	20.7%	2,393,090	63.0%
2011	31,425	15.7%	2,535,324	66.7%
2012	15,640	7.8%	3,252,151	85.6%
2013	24,201	12.1%	3,217,377	84.7%
TOTAL	136,561	13.7%	13,421,686	70.6%

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 (Table 23). 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 within the Kamloops TSA.

Analysis unit	Utilization		
	Corresponding minimum DBH (cm)	Maximum stump height (cm)	Minimum top DIB (cm) ¹
Pine	12.5	30	10
Cedar	17.5	30	15
All other	17.5	30	10

¹The specification for minimum top diameter inside bark will be modelled as 10 cm for cedar due to limitations of the growth and yield models

6.1.3 Mixed deciduous

Deciduous species are not typically utilized within the Kamloops TSA. For the analysis, the deciduous component of mixed stands is excluded from the yield tables. Deciduous leading stands, as noted previously, are excluded from the THLB.

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 until well beyond the minimum harvestable criteria because of management objectives for other resource values (e.g. requirements for the retention of older forest for mountain caribou objectives).

For the base case scenario, the age at which the stand reaches a 95% culmination mean annual increment (i.e. optimal point for volume production) will be used as the minimum harvestable criteria unless the stand has not yet reached 100 cubic metres per hectare by that age; if the 100 cubic metres per hectare threshold is not reached, the minimum harvestable criteria will be the age that 100 cubic metres per hectare is reached. This choice of minimum harvestable criteria favours long term harvest levels over filling in pinch points in timber supply that would use stands below the minimum harvestable criteria. Sensitivity analyses investigate lowering and raising the minimum harvestable criteria.

A random sampling of 30% of Kamloops TSA cutting permits submitted into the ministry database Electronic Commerce Appraisals System (ECAS) in 2013 shows BCTS and licensees targeting a minimum net volume of 90 cubic metres per hectare; a maximum net volume of 778 cubic metres per hectare, and an average net volume of 274 cubic metres per hectare for cutting authorities within the THLB.

6.1.5 Harvest scheduling priorities

The order in which stands are harvested can impact 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.

In the current timber supply analysis, the only harvest priority modelled in the base case is an oldest available stand first option. As a sensitivity option, prioritizing stands with a higher dead component is investigated.

6.1.6 Cut block Update

The base case scenario used a Phase 1 VRI that was completed in 2013/2014 based mainly on 2011 aerial photography. Harvest depletions available up to August 2014 were incorporated into the inventory file upon its release in December 2014. The 2014 FLNR provincial harvest depletion layer that incorporates several ministry data sources was not used for the update.

6.1.7 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 that are billed against a licensee's AAC. Some exemptions to this inclusion may exist (see Section on Log Grade 4)

Growth and yield models used for the TSR do not incorporate dead tree volumes (i.e., former grades 3 and 5). In the 2008 AAC determination for the Kamloops TSA an accounting for the exclusion of these log grades was made based on available information sources (inventory audit, harvest billing records, permanent sample plot data).

Information, including the 2014 VRI Phase II which identifies dead tree information, will be presented to the chief forester for consideration but no modelling assumptions will be incorporated within the timber supply analysis.

6.1.8 Log Grade 4

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

At the time of the introduction of new log grades, 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 is a grade 4 credit.

The Minister may determine a limitation of the amount of grade 4 volume that is credited in a management unit such as a TSA.

Available information on dry grade 4 waste and accounting within respect to the AAC will be presented to the chief forester. No specific modelling considerations for log grade 4 is made in the base case timber supply analysis.

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 FLNR database RESULTS. Summary information from RESULTS will be the basis for regeneration assumptions in the base case analysis.

6.2.1 Silvicultural Systems

Most harvesting within the Kamloops TSA involves a clear cut or clear cut with reserve silviculture system. During the past 5 years 99 percent of the harvest has used clearcut or clearcut with reserves. The annual area harvested under a selection system has averaged 60 ha over the past 6 years and only 297 ha have been commercially harvested in the past decade under a non-replaceable forest licence that expires in December 2014.

Ministry staff expect that interest for partial harvest systems within the drier Douglas-fir stands is still present. For the base case, all stands were modelled using a clear cut silviculture system assumption. For the dry fir selection harvesting zone, as identified by BEC subzones in the previous timber supply reviews, a sensitivity analysis sensitivity analysis will explore the timber supply implications of managing these stands using a partial cut silviculture system.

6.2.2 Regeneration Impediments

Forest licensees are required to reforest harvested stands. In the Kamloops TSA most sites have no impediments to prompt and successful regeneration, however, some plantations may face challenges associated with cold sites at high elevation, drought on severely dry sites or browsing and trampling from wildlife or cattle.

A delay may exist between the harvest of a stand and when the site is in a fully regenerated state. Based on RESULTS data available for declared regeneration, the average difference between harvesting and new stand establishment was calculated to be 2.28 years. This delay may be due to operational (e.g., access to appropriate planting stock) or site considerations (e.g., natural regeneration or addressing impediments).

In the base case scenario, 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 at 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 the projected age is zero, the projected age will be assigned the difference between 2014 and the year of harvest less regeneration delay.

6.2.3 Immature plantation history

Concerns have been expressed by ministry staff and others that plantations past the free-to-grow stage may not be growing as expected due to forest health issues.

To assess the health and productivity of young stands between the ages of 20 and 40 years the ministry has recently initiated Stand Development Monitoring (SDM) protocol. SDM collects and provides introductory analysis of data in five specific areas: stand density (total, well-spaced (WS) and free-growing (FG) stems per hectare), stand species composition, stand health, tree volume and site index. SDM data can be used to track how stand attributes change in managed forests. During 2009-2011 50 polygons have been sampled in the Kamloops TSA.

Some concerns about the SDM sampling methodology have been expressed. A subsequent young stand monitoring (YSM) program has been developed. Initial YSM data has been collected in 2015 in the Kamloops TSA.

For the AAC determination, information on the status of immature plantation health will be presented to the chief forester. For modelling simplicity, this information is not incorporated into the base case of the timber supply analysis.

6.2.4 Not satisfactorily restocked (NSR) areas – pre 1987

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

Backlog NSR in the Kamloops TSA has been reduced to the point where it cannot be reliably identified.

In the current TSR, no consideration will be made for backlog NSR given the low amount present and subsequently the 2014 VRI to provide updated information.

6.2.5 Incremental Silviculture

Incremental silviculture practices are practices incremental to those required to meet basic silviculture obligations. These practices include practices such as juvenile spacing and fertilization.

In the Kamloops TSA during 2004-2013 only 656 hectares were juvenile spaced, 205 hectares were late rotation fertilized, and 7 ha were pruned. Future levels of incremental silviculture are expected to be similarly low.

Given the small area on which incremental silviculture has been conducted no modelling considerations will be made for the base case scenario of the timber supply analysis.

6.3 Integrated resource management

The crown forests of the Kamloops 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.

An extensive land use planning process was conducted for the Kamloops TSA. This process resulted in the first provincially approved Land and Resource Management Plan (LRMP) in 1995. The Kamloops LRMP became a Higher Level Plan under the Forest Practices Code Act on January 31, 1996. Twenty three of the original objectives of the plan have remained in effect through various amendments and creation of other specific orders under *FRPA* and the *Land Act*.

Within the Kamloops TSA all approved FSPs prepared by major forest licence holders are required to state results and strategies that meet the 23 objectives.

Objectives that impact timber supply are modelled within the base case scenario of the timber supply analysis (e.g., ungulate winter range, visual management). These objectives are described below in specific sections. Objectives that do not impact timber supply are not modelled.

6.3.1 Adjacency, Green Up, and Patch Size Distribution

Harvesting adjacent to another cutblock regulations are identified within *FPPR* Section 65 and related Section 64 describing maximum cut block size.

In general, a new cutblock is to be at least 2 tree lengths from existing cutblock that has not met stocking and height requirements. Height requirements in the Kamloops TSA are an average height of 3m for the 10% tallest trees. Further qualifications relate to distance from groups of reserved trees, basal area retention, and forest health exclusions.

The Kamloops TSA has a default maximum cutblock size of 40 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.

As a surrogate to the spatial adjacency requirements, adjacency requirements will be modelled based on a maximum disturbance of 33% on the THLB for a landscape unit BEC subzone combination permitted to be below 3 m height. This requirement applies only to THLB not otherwise constrained by another management objective (e.g., visuals, ungulate winter range).

During the recent mountain pine beetle infestation, adjacency requirements were relaxed for forest health needs. No modelling considerations for this relaxation will be included in the base case.

6.3.2 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 *Forest Planning and Practices Regulation* of the FRPA.

There are 16 designated community watersheds within the Kamloops TSA covering 97,037 hectares.

In general, licensees in the Kamloops TSA have committed in their FSPs to complete hydrologic assessments that would then indicate management actions.

In previous Kamloops TSA TSRs, Ministry hydrology and timber supply analysis staff identified the following methods that address the expected practice in community watersheds. The approach was to ensure that no more than an equivalent clear-cut area (ECA) of 20% of the gross land base that applies to the upper 60% of all community watersheds and that standard management practices applies to the lower 40% of the watershed. The upper 60% (snow pack area) is considered hydrologically recovered upon reaching 9 metres in height and the lower 40% being a 3 metre green up height. Therefore, averaging the above, in each community watershed the modelled practice was that no more than 25.2% of the gross area in a community watershed could be less than 6.6 metres in height.

For the TSR, the base case scenario incorporates the previously modelled maximum disturbance method.

Table 24. Community watersheds within the Kamloops TSA

Community Watersheds	Gross land base (ha)	CMFLB	THLB
Russell	1768	Yes	Yes
Nelson	1200	Yes	Yes
Currie	17	Yes	Yes
Peterson	8200	Yes	Yes
Avola	306	Yes	Yes
Skowootum	1110	Yes	Yes
Toops	3	Yes	Yes
Paul	12459	Yes	Yes
Paul Lake	15164	Yes	Yes
Jimmies	1358	Yes	Yes
Hascheak	654	Yes	Yes
Mcdougall	1601	Yes	Yes
Rosen	279	Yes	Yes
Leonie	3010	Yes	Yes
Tranquille	43758	Yes	Yes
Cornwall	6150	Yes	Yes

Data sources and comments:

BCGW file: WHSE_WATER_MANAGEMENT.WLS_COMMUNITY_WS_PUB_SVW

6.3.3 Other watersheds

Hydrological assessments may be completed by licensees in watersheds other than formal community watersheds. Licensees have indicated that for some watersheds, assessments show that the current ability to harvest in the watershed may be limited in the near future. For the current base case scenario, no requirements in addition to other legal objectives and for green up adjacency will be modelled. Where available specific examples of harvest limitations due to hydrological concerns will be collated and presented to the chief forester.

Water intakes for human consumption occupy minimal area and as they will have insignificant timber supply impact these intakes are not modelled. The management of domestic watersheds for water objectives is not expected to cause additional timber supply impact.

6.3.4 Ungulate winter range – mule deer, moose, mountain goat

The Kamloops TSA includes critical winter range for several ungulate species. Under the 1996 higher level plan order and subsequent amendments, objectives of the Kamloops LRMP for mule deer, moose, and caribou were established. Caribou objectives subsequently have been updated through GAR orders as part of a provincial Mountain Caribou Recovery Implementation Plan (See above section on Mountain Caribou).

The Kamloops LRMP identified a critical deer winter range zone with the requirement of maintaining or enhancing mature forage and habitat requirements; specifically the objectives are to maintain 25% of the forest in thermal cover and that harvesting is evenly dispersed spatially and temporally.

In 2015/16 a new *Government Actions Regulation* order is expected for mule deer winter range. This GAR order would replace existing critical deer winter range requirements. The draft GAR order will be modelled in a sensitivity analysis and made available to the chief forester if such a change occurs prior to the AAC determination.

The Kamloops LRMP identified critical moose winter range with the requirement of maintaining suitable thermal and forage requirements. Ministry staff identify that forest management practices should be able to meet these requirements without timber supply implications, although ministry staff do have concerns whether the requirements are being operationally met.

Ministry staff identify that a GAR order is being proposed for mountain goat. No or low timber supply impacts are expected due to the measures within the proposed order.

In the base case scenario the objectives for mule deer winter range are modelled similarly to the previous TSR as a minimum retention constraint that reflects the strategy of maintaining at least 25% of forested area in thermal cover and a maximum disturbance constraint that reflects other strategies related to distribution and size of clearcuts (Table 25).

Table 25. Modelled constraints for ungulate winter range objectives

Ungulate winter range	Gross land base (ha)	Constraint		
		Estimated requirements	Unit applied to	Qualification
Mule deer (KLRMP)	173,446	>25%	DWR zone	>20 m
		<20%	DWR zone	< 3 m

Data sources and comments:

BCGW file: WHSE_LANDUSE_PLANNING.RMP_PLAN_LEGAL_POLY_SVW on 10 July 2014.

6.3.5 Visual quality objectives

Visual quality is one of the 11 values to be managed under the *Forest and Range Practices Act*.

Prior to the mid-1990s in the Kamloops TSA, visual quality was managed through the application of design guidelines in a cooperative manner between District staff and forest licensees. The KLRMP and subsequent higher level plan orders (1996, 2006) formalized visual resource management in the TSA. These management objectives have been continued through regulation under the *Forest and Range Practices Act*.

For the TSR, 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 26). This approach is preferred over a single percent alteration for each VQO to better reflect the wide variation in landscape conditions.

Table 26. Assignment of visual quality objectives by planimetric view and visual absorption capability(VAC)¹

Established VQO	Gross land base (ha)	% alteration by VAC (planimetric view)		
		Low	Medium	High
Preservation	5171	0.17	0.50	0.83
Retention	97 773	2.0	3.0	4.0
Partial retention	505 587	6.7	10.0	13.3
Modification	247 925	16.7	20.0	23.3

¹ Peter Rennie, Landscape Forester, FLNR recommended a modification of the percent alterations reported in the 1998 procedures where the VAC ratings are used to divide the percent alteration ranges into thirds, and the midpoint of each third is used as a generalized target to model each combination of VQO and VAC.

The procedures also identified determining a weighted visually effective green-up (VEG) height for each visual unit based on slope classes (Table 27). This procedure is used in the base case. Some concerns have been expressed that this methodology overestimates VEG height requirements as it may not adequately take into account the “visual point” aspect of monitoring a visual unit. A sensitivity analysis will be conducted that simply uses a VEG height of 3 m to demonstrate a lower bound of VEG height.

Table 27. 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:

BCGW file: WHSE_FOREST_VEGETATION.REC_VISUAL_LANDSCAPE_INVENTORY

6.4 Forest Health

6.4.1 Mountain pine beetle

The mountain pine beetle infestation increased rapidly in the Kamloops TSA, starting in 2000 and peaking in 2006. The infestation then declined throughout the TSA. Since 2010 minimal areas of infestation have been recorded; only 67 hectares of trace red attacked were mapped in 2013. In the Kamloops TSA this outbreak has now subsided.

As the infestation is assumed to be completed, no projections of future MPB related mortality will be made in the timber supply analysis.

The 2014 VRI Phase 1 inventory will provide information on dead tree volumes through a specific dead tree layer. The Kamloops TSA is one of the first VRI projects to collect this dead tree layer. In the base case the identified dead tree volume is assumed to be fully available for harvest for 10 years. Sensitivity analyses that explore other shelf life assumptions will be conducted.

Data sources and comments:

Documents and data sets for the provincial level projection of the current mountain pine beetle outbreak developed by the Ministry of Forests, Lands and Natural Resource Operations are found at www.for.gov.bc.ca/hre/bcmapb/

6.4.2 Other Forest Health Issues

Many forest health damaging agents in addition to mountain pine beetle are present within the Kamloops TSA. These agents include insects, pathogens, animals, and abiotic events; many agents have the potential to cause significant timber losses. The Forest Health Program of the FLNR evaluates the impact of forest health damaging agents on forest resource values and when necessary prescribes and implements management practices to prevent damages.

In 2013 aerial overview surveys of the Kamloops TSA identified for conifer stands:

- Widespread western balsam bark beetle infestations particularly in the northern half of the TSA (71 782 hectares)
- Declining spruce beetle infestations in terms of both extent and severity (1 502 hectares)
- Scattered but widespread Douglas-fir beetle (236 hectares) for which an aggressive trap tree program has helped reduced the populations in several areas
- Mountain pine beetle activity is down to only 67 hectares of trace to light attack
- Damage from western spruce budworm declined in both extent and severity of defoliation (31 411 hectares), much of which was related to treatment of nearly 29 800 hectares
- Two-year cycle budworm damage was low as it was an “off” year in the feeding cycle (1 135 hectares)
- Presence of dothistroma needle blight (110 hectares) and larch need blight (3.5 hectares)
- Other damage agents included bear feeding (109 hectares), fertilizer burn (62 hectares), flooding (15 hectares), slide damage (9 hectares), windthrow (8 hectares), and fire (2 944 hectares).

Ministry forest health staff anticipate spruce beetle infestations will increase slightly over the next 5 years; Douglas-fir beetle will increase significantly in the next year and continued concerns with western balsam bark beetle and spruce budworm.

Abnormal or catastrophic infestations and devastations are unpredictable and highly variable from year to year. The principle of regularly revisiting the AAC decision and the ability to revisit a decision earlier are important components of the AAC decision to address unpredictable events.

In the timber supply analysis, the timber supply impact of an endemic level of pests is modelled through both the volume tables and the identification of non-recoverable losses. The empirical basis of the model VDYP and the use of operational adjustment factors or specific options (e.g., for root rots) in the model TIPS capture volume loss due to endemic levels of pests. The capture of catastrophic losses (e.g., fire, epidemic infestations) is described below under non-recoverable losses.

6.4.3 Non-recoverable Losses

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

For the Kamloops TSA timber supply analysis these future losses are accounted for by estimating an average annual unsalvaged loss and deducting this amount from the harvest projection throughout the planning horizon of the TSR (Table 28). Values were calculated based on procedures outline by the FLNR Resource Practices Branch. Continued loss resulting from the 2000-2011 MPB epidemic will be accounted for separately by modelling the decay of dead tree volume identified in the VRI Phase 1.

In the Public Discussion Paper a general assumption of a NRL of 100,000 cubic metres was applied. This is expected to be an upper limit of such losses. The estimated NRL are still being compiled and will be presented to the chief forester at the time of the AAC determination.

Table 28. *Estimated average unsalvaged losses in the Kamloops TSA*

Cause of loss	Annual unsalvaged loss (m ³ /year)
Spruce Bark Beetle	21 500
Douglas-fir Bark Beetle	6 900
Balsam Bark Beetle	25 500
Spruce Budworm	TBD
Tussock moth	13 000
Wildfire	24 500

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.

7.2 Natural stand yield tables

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

Natural stands have a wide range of stand structure and natural disturbance history. Stands naturally or artificially regenerated prior to 1987 legislated basic silviculture obligations are considered in the base case to best reflected by natural stands growth.

7.2.1 Analysis Units

Individual forest inventory polygons will be considered the analysis unit for natural stands. Natural stands will be those established prior to 1987 when legislative changes placed legal responsibility for basic silviculture obligations on major licensees.

7.2.2 Model

Volume tables for natural stands will be derived using the Variable Density Yield Prediction (VDYP7) model developed by the FLNR. 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 the VDYP7 model will be based on the VRI attributes of individual polygons. Information on VDYP is available at www.for.gov.bc.ca/hts/vdyp/

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.

7.3 Managed stand yield tables

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

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 timber volume projections for managed stands are created based on analysis units classified on the biogeoclimatic zone, the leading species of the original stand and site index. Regeneration information (species percent, regeneration delay, density, and genetic worth) are based on summarizing information from RESULTS by the biogeoclimatic zone and the leading species of the original stand (see Table 29). Information on site index is based on the assigned potential site index of the resultant polygon (see Site Productivity for further information).

7.3.2 Model

Yield tables for managed stands are created using the Table Interpolation Program for Stand Yields (TIPSY) version 4.2 developed by FLNR. This stand level model is derived from volume tables generated from FLNR individual tree model TASS.

Volume tables used in the forest estate model are the species composition weighted average of TIPSY yield tables derived for individual species using the stand attributes.

Information on TIPSY is available at www.for.gov.bc.ca/hre/gymodels/TIPSY/index.htm

7.3.3 Initial regeneration conditions

The regeneration assumptions for the initial species composition and density will be based upon summaries from RESULTS (Table 29). These summaries will be based upon planting records, regeneration surveys or free growing surveys for openings identified as non-uneven-aged. Where regeneration information is not available for a polygon based on Table 29, average information for the BEC zone will be used.

7.3.3 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.

As noted in Section 4.2, for the base case scenario, potential site indices derived from a FLNR provincial layer of site productivity will be used as input for managed stand yield projections. Although the desire for the provincial layer is to use site indices derived based SIBEC data (ground sampled data related to ecosystem site series), potential site index estimates for the Kamloops TSA are based upon a biophysical model.

A critical issue analysis was also conducted using site indices derived from a site index adjustment project of the Kamloops TSA licensee group.

Data sources and comments:

FLNR FAIB Site_Prod_with_Approved_PEM_TEM_v3.1_20131028. See <http://www.for.gov.bc.ca/hts/siteprod/provlayer.html>

7.3.4 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 may 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 Tree Improvement Branch (see www.for.gov.bc.ca/hti/spar/index.htm). RESULTS information provides a seed source for individual plantations and thus enables linkage to the genetic gain database.

An area weighted summary of seed use and its genetic worth was determined for managed stand analysis units and used as input into the growth and yield model. The summary was based on polygons within the analysis units identified in the RESULTS database. No modelling consideration was made for expected future improvements in genetic worth.

7.3.5 Operational adjustment factors

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

In TIPSYS, there are two operational adjustment factors (OAF) that are used to modify the potential yields. These OAFs differ in their application OAF1 is a static reduction across all time periods and for example may reflect non-productive openings within a forest. OAF2 is dynamic reduction that increases overtime and for example may reflect a forest health issues that increases as a stand ages.

Ideally, OAFs that have been localized to the managed area are desirable, however, these OAFs are difficult to determine. For the Kamloops TSA TSR, the values that have commonly been used provincially of 15% for OAF1 and 5% for OAF2 will 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.

For the current analysis the standard OAFs will be applied except in Douglas-fir leading stands in the ICH subzone. In these stands the presence of *Armillaria* root rot is known to reduce potential yields. TIPSYS provides an option to supplement the OAFs in consideration of *Armillaria* in the ICH. For the base case *Armillaria* will be considered at a moderate level.

Table 29. Regeneration assumptions for managed stand analysis units based on summary of regeneration survey information within RESULTS for the Kamloops TSA.

BEC Zone	Previous Leading Species	Species composition (%)								Prorated Genetic Worth (%)				Well spaced stems per ha	Regen Delay (yrs)	No. openings
		B	C	CD	F	H	L	P	S	F	L	P	S			
ESSF	B	5.7	0.0	0.1	0.0	0.1	0.0	0.9	93.2	0.0	0.0	0.1	11.0	1408	2.0	47
ESSF	P	6.3	0.2	0.5	1.2	0.7	0.0	59.9	31.1	0.8	1.3	1.4	9.9	1282	2.0	91
ESSF	S	8.7	0.0	0.4	0.0	0.0	0.0	9.5	81.4	0.1	0.0	0.2	9.9	1354	2.3	73
ICH	C	1.7	24.4	0.8	14.1	3.7	0.1	4.2	51.0	0.4	1.1	1.5	8.8	1337	2.4	58
ICH	F	0.5	9.8	2.4	48.0	0.9	1.6	22.5	14.4	4.6	0.5	4.9	6.2	1344	1.9	317
ICH	P	1.3	4.2	3.3	33.5	0.3	1.8	44.4	11.3	7.3	0.6	6.1	5.6	1338	1.8	215
ICH	S	0.6	9.3	0.0	28.2	2.4	1.6	21.5	36.5	6.3	1.4	2.7	9.9	1314	1.8	29
IDF	F	0.1	0.3	10.9	39.5	0.0	0.9	46.6	1.7	1.7	0.0	4.2	1.5	1188	2.7	165
IDF	P	0.8	0.1	5.6	14.1	0.0	0.0	75.1	4.2	0.3	0.0	4.3	2.9	1237	2.4	282
MS	F	1.9	1.0	2.2	32.0	0.0	0.5	49.5	13.0	5.9	0.6	8.4	9.8	1240	1.8	40
MS	P	1.7	0.0	0.8	6.6	0.2	0.1	77.9	12.8	0.1	0.1	2.7	7.3	1375	1.9	710
MS	S	6.9	0.0	0.9	8.5	0.0	0.2	50.8	32.7	0.2	1.2	2.4	4.9	1283	1.8	47
SBPS	P	0.0	0.0	0.4	6.6	0.0	0.0	83.0	10.1	0.0	0.0	1.7	7.6	1335	1.8	64
SBS	P	7.0	0.0	2.2	9.9	1.5	0.0	56.5	22.9	0.3	0.0	2.8	8.2	1308	2.0	131
SBS	S	10.1	2.2	0.5	8.8	0.0	0.0	52.1	26.3	0.0	0.0	1.2	5.1	1214	1.6	19

Data source and comments:

The summary was based upon records for immature and not uneven-aged management records based upon a regeneration survey with an end date back to and including 2003. The information was extracted from the ministry RESULTS data base in February 2014. Previous leading species based on species label for circa 1995 forest cover inventory. Genetic worth values are prorated values based on the number of seedlings and genetic worth. Seed lot information for an opening is available through the RESULTS data base. Genetic worth values are identified from the ministry SPAR data base.

8. Forest Estate Modelling

8.1 Forest Estate Model

The Forest Service Spatial Analysis Model (FSSAM) (Version 4.006 build 2014.06.05) will be used for developing the base case scenario and the sensitivity issue analyses. FSSAM is a forest estate simulation model developed by the Forest Analysis and Inventory Branch of the FLNR.

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. In most TSRs the base case scenario has reflected a harvest flow that initiates from the current AAC and transitions to a lower mid-term level before moving to upward to a stable long-term level.

For the current TSR in the Kamloops TSA there is no expectation that the current AAC level, that was implemented to address the mountain pine beetle infestation, will be maintained. Several alternative harvest flows based on different initial harvest levels are possible given current forest management assumptions. From these alternatives, a base case scenario was selected, that in conjunction with sensitivity analyses, to represent timber supply dynamics.

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 harvest able ages by +/- 10 years. Apply an existing and managed stand minimum harvestable volume of 100 m ³ /ha in place of MHA.
Size of the THLB	The THLB within all polygons will be changed by +/-10%.
Management for visual quality	Low and high VAC levels will be used.
Regeneration assumptions	Previous timber supply review species composition, initial density, and OAFs will be used.
Harvest priorities	Alternative harvest priorities available within the timber supply model.
Shelf life of MPB killed timber	Higher and lower decay rate assumptions for identified dead volumes will be explored
Site productivity for older stands	The results of a licensee conducted site index adjustment and +/- 2m will be investigated
Old hemlock problem forest type	Old hemlock stands will be removed from the THLB

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 - Public Discussion Paper

To summarize the results of the timber supply analysis a public discussion paper will be released for public review. Information used in the analysis is described in the data package and updated based on information identified during the consultation, public review and the analysis process.

The timber supply analysis should be viewed as a “work in progress”. As such, following the release of the public discussion paper, further analysis may be needed to complete, refine existing analysis, or address issues identified during the consultation and review process.

9.2 Cumulative Effects Analysis

Cumulative effects analysis identifies changes to environmental, social, and economic values caused by the combined effect of present, past, and reasonably foreseeable future actions or events on the land base. To identify cumulative effects the FLNR are developing a consistent approach that will address a range of values. For the Kamloops TSA, whether to complete a cumulative effects is being investigated. If completed the analysis will only look at the current status and not provide projections based on the base case scenario.

9.3 First Nations Consultation and Public Review

Information collected through First Nations Consultation and public review processes provide important information for the AAC determination. Information received through written and oral presentations are collated and presented to the chief forester.

10. Information Sources

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Ministry of Forests and Range. 2005. Provincial Logging Residue and Waste Measurement Procedures. Manual. Revenue Branch, Ministry of Forests and Range, Victoria, BC. and amendments to October 2013.

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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 Kamloops 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 September 2014 data package were accepted until November 15, 2014 for consideration with respect to the data package. A further comment period will be made available following the release of a Public 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:

Thompson Rivers Natural Resource District
Ministry of Forests, Lands and Natural Resource Operations
1265 Dalhousie Drive,
Kamloops, B.C. V2C-5Z5

Telephone: 250-371-6500 Fax: 250-371-6565

Or contact:

Alan Card, Stewardship Forester
Thompson Rivers Natural Resource District
Ministry of Forests, Lands and Natural Resource Operations
Phone: (250) 371-6531
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Further information regarding the technical details of the timber supply analysis is available on request by contacting Forests.ForestAnalysisBranchOffice@gov.bc.ca

Visit the Forest Analysis and Inventory Branch web site at <http://www.for.gov.bc.ca/hts>