

Okanagan Timber Supply Area Timber Supply Review

Data Package

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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 Okanagan 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: www2.gov.bc.ca/gov/content/industry/forestry/managing-our-forest-resources/timber-supply-review-and-allowable-annual-cut/timber-supply-areas.

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 (e.g., Okanagan Shuswap 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” for forest management on the TSA. Changes in forest management objectives and data, when and if they occur, will be captured in future TSRs.

A First Nation consultation and public review period has been established to allow submission of comments and concerns to the Ministry of Forests, Lands, Natural Resource Operations and Rural Development (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 her 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 data package are being requested from First Nations and the public during a 60-day review process. Following the release of the public discussion paper that discusses the timber supply analysis results based on the data package after any revisions, a further 60-day comment period will be available. Section 12 below describes details around the review process and comment submissions.

2. Background

2.1 General

The Okanagan Timber Supply Area (TSA) is located in south-central British Columbia. The TSA ranges from the Canada-United States international border in the south to Shuswap Lake in the north and is bounded by the Monashee Mountains to the east and the Okanagan Mountains to the west.

The TSA covers approximately 2.45 million hectares of gross land base, of which about 1.5 million hectares are the Crown Forest Management Land Base (CFMLB). After excluding areas, actual and surrogate, due to environmental, economic and operability issues, about 0.8 million hectares contribute to the timber harvesting land base (THLB).

The varied climate and terrain produces a wide range of vegetation, from wet interior hemlock and cedar forests in the north to semi-arid sagebrush grasslands in the south of the TSA. Douglas-fir and lodgepole pine-leading stands represent 25% and 30% of the THLB. Spruce, Subalpine fir, western redcedar, western hemlock and yellow pine are also common, while white pine, aspen, birch, larch, and cottonwood appear in smaller amounts.

The broad variety of habitat types in the TSA support many wildlife species, including approximately 30 red- and blue-listed vertebrates that are associated with forested ecosystems e.g., mountain caribou, mountain goat, grizzly bear, tiger salamander, great basin gopher snake, flammulated owl, interior western screech owl, Lewis's woodpecker, fringed myotis, and spotted bat. In addition, there are numerous fish species including: kokanee, rainbow trout, lake char, largemouth bass, and whitefish. The Shuswap Lake system is one of the most important salmon-producing areas in British Columbia, supporting sockeye lake spawners and providing vital rearing area for hundreds of millions of coho, chinook, and sockeye fry. The Adams River sockeye run is the second largest in British Columbia.

Water is a primary and fundamental resource of the TSA. There are currently 57 community watersheds that cover about 20% of the THLB and given the growing population and dry climate, water stewardship is an important component of forest management in the TSA.

Range use is prominent in the TSA and access to a long-term supply of quality forage on Crown range is essential to the viability for many of these ranching businesses. Currently 138 grazing tenures have been authorized on Crown range under the *Range Act* for about 84,000 Animal Unit Months (AUMs). Almost all of the grazing tenures depend on cutblocks to some level to meet their forage requirements.

With a population of about 405,964 in 2010, the TSA has one of the fastest growing populations in British Columbia. The larger communities within the TSA include: Penticton, Vernon, Kelowna, West Kelowna, Salmon Arm, and Summerland.

The economy of the area is well-diversified and includes agriculture/viniculture, tourism, retail trade, manufacturing, forestry, range, and construction. Emerging industries include film, aviation, health care, and technology industries. The natural resources of the TSA are administered by the Okanagan Shuswap Natural Resource District (OSNRD) that is located in Vernon with a field office in Penticton.

The current AAC for the Okanagan TSA, effective February 29, 2012, was set at 3.1 million cubic metres.

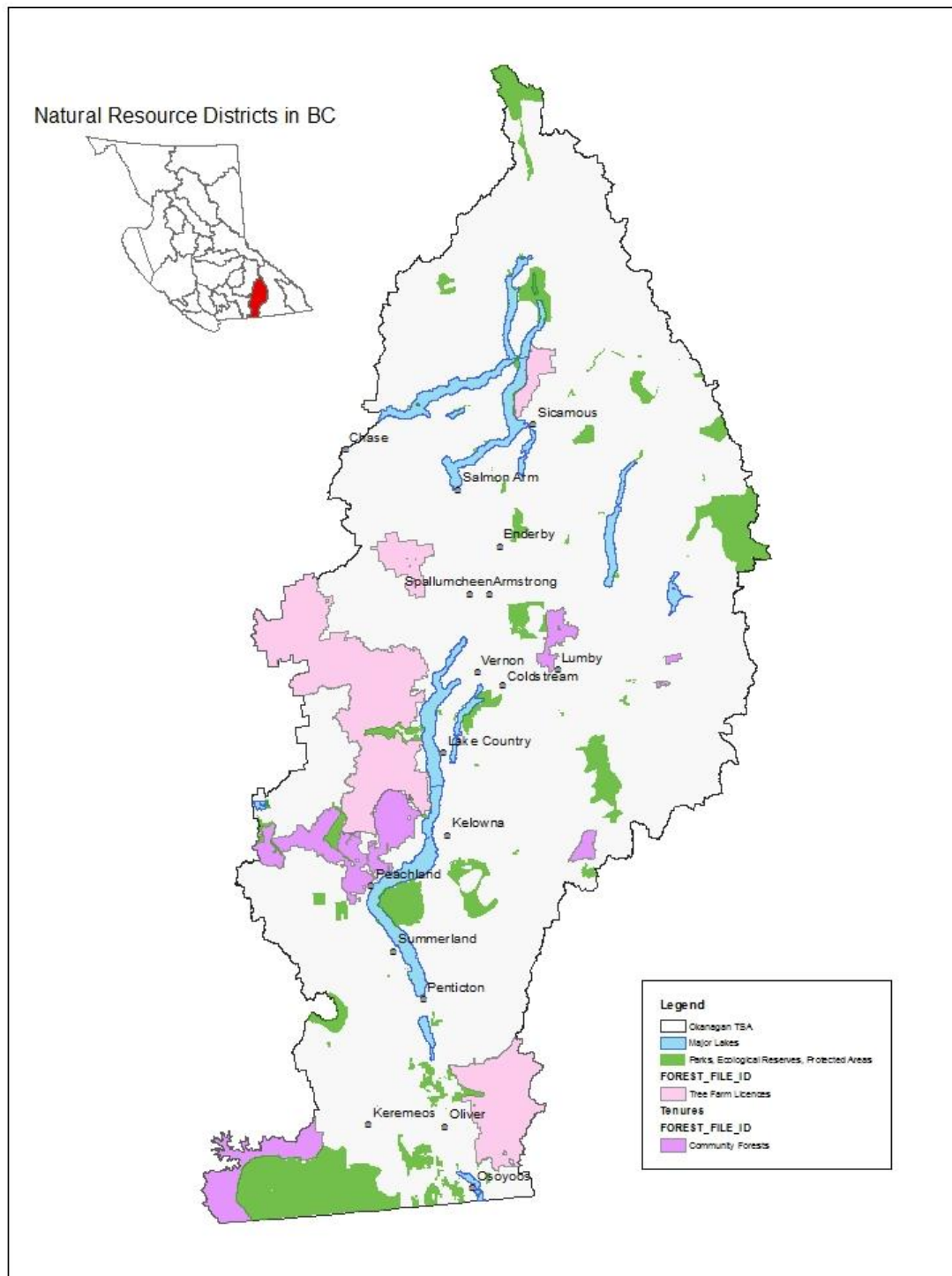


Figure 1. Okanagan Timber Supply Area.

2.2 Land use planning

The Okanagan-Shuswap Land and Resource Management Plan (OSLRMP) is a strategic Crown land use plan for the Okanagan-Shuswap. The plan covers all of the Crown land and resources, including lakes and rivers within the plan area. The plan contains land and resource management objectives and strategies that apply to the entire Crown land base and to identified mapped resource management zones (RMZs).

The provincial government initiated the OSLRMP process in July 1995. Over a 4.5 year period the OSLRMP Table, a group of 30 stakeholders representing a diverse range of interests and local governments, met to develop a recommended Land and Resource Management Plan (LRMP). On September 9, 2000 the OSLRMP Table reached full agreement on a package of LRMP recommendations which was intended to bring land use certainty to resource interests and direction to government managers in the plan area.

On January 18, 2001, the Okanagan-Shuswap LRMP was approved by Cabinet and represented Cabinet directed policy under the *Forest and Range Practices Act* (FRPA) to be considered by statutory decision makers.

On February 6, 2007, an order establishing objectives set by government with respect to the LRMP, made legal specific LRMP objectives that were not already addressed in FRPA. Specific objectives were established for areas of coarse woody debris, recreation areas, trail corridors, tourism, elk, marten, fisher, and bighorn sheep. General objectives were set for community/crown interface, forest roads, streams, and Williamson's sapsucker. No other specific objectives have been approved for the Okanagan-Shuswap LRMP, however, management by government and licensees have followed the intention of the LRMP and the processes to date.

2.3 Forest industry

Within the Okanagan TSA there is a large processing sector with sawmills located in Armstrong, Lavington, Kelowna, and Westbank; and plywood/veneer plants in Armstrong, Lumby, and Canoe. As of 2014 there were also 10 smaller sawmills (less than 40 million board feet annual production), two chipping facilities, two pellet plants, one pole mill, and one shake and shingle mill. The majority of timber in the Okanagan TSA is processed at facilities owned by major tenure holders. Supplemental volume to address needs of 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 Licence to Cuts, Non-replaceable Forest Licence agreements, and outside TSA purchases or trades.

The current AAC is apportioned to Replaceable Forest Licences (59%), Non-replaceable Forest Licences (20%), BC Timber Sales Licences (19%), future Woodlot Licences (<1%), and Forest Service Reserve (2%).

Two Secwepemc Nation and six Okanagan Nation bands have replaceable or non-replaceable forest licenses, community forest agreements, woodlots, or pending First Nation Woodland Licences in the TSA.

3. First Nations Considerations

3.1 First Nations

The traditional territories of 26 First Nations bands are overlapped in whole or in part by the Okanagan TSA. These 26 bands are associated with three broader nation groups: the Okanagan, Secwepemc, and Nlaka'pamux. Many of the bands are also affiliated with political and tribal associations.

None of the bands in the Okanagan TSA are actively involved in the BC treaty process; rather, ministry staff work with non-treaty First Nations through engagement and economic agreements, working groups, and other non-treaty processes. The majority of First Nations in the TSA have current Forest Consultation and Revenue Sharing Agreements (FCRSAs) with FLNR. The Secwepemc Reconciliation Framework Agreement (RFA) is overlapped by a significant portion of the TSA. The RFA has six First Nations signatories: Tk'emlups te Secwepemc, Skeetchestn Indian Band, Splatshin, Adams Lake Indian Band, Shuswap Indian Band, and Little Shuswap Indian Band.

Okanagan Nation (Syilx)

The traditional territory of the Okanagan Nation, or Syilx, encompasses the majority of the Okanagan TSA. The Okanagan Nation Alliance represents seven Okanagan member bands in British Columbia as well as the Colville Confederated Tribes in north-central Washington. The Okanagan bands situated in BC are: Okanagan Indian Band, Westbank First Nation, Upper Nicola Band, Penticton Indian Band, Upper Similkameen Indian Band, Lower Similkameen Indian Band, and Osoyoos Indian Band. These bands have a total registered population of approximately 6,235 people as of November 2017; band members may reside in the Okanagan TSA or within other TSAs. It is important to note that this figure may not adequately represent total ONA populations in the Okanagan TSA, as it does not capture non-registered (non-status) Okanagan people, and may include registered members living outside of the TSA boundaries.

The majority of the ONA reserves and main communities are situated along Okanagan Lake and the Similkameen River. The exception is Upper Nicola Band, whose two main communities are located at Douglas Lake and Nicola Lake. Upper Nicola is also affiliated with Nicola Tribal Association and is the only Okanagan community located in the Nicola watershed.

Secwepemc Nation

The traditional territories of the Secwepemc cover a large tract of land in the interior of British Columbia. The broader Secwepemc nation is made up of many bands, each associated with a division group. Those asserting territorial interests in the Okanagan TSA include: Skeetchestn Indian Band, Tk'emlups te Secwepemc, Splatshin, Adams Lake Indian Band, Little Shuswap Lake Indian Band, Neskonlith Indian Band, Simpcw Indian Band, and Shuswap Indian Band. Of these bands, only Splatshin has a main community located within the Okanagan TSA. The Secwepemc bands with interests in the Okanagan TSA have a population of approximately 6,235 people as of November 2017; band members may reside in the Okanagan TSA or within other TSAs.

Nlaka'pamux Nation

The Nlaka'pamux Nation is made up of 17 bands whose main communities are located outside of the Okanagan TSA in the Fraser Canyon and Southern Interior. These bands are affiliated with various political organizations, including the Nlaka'pamux Nation Tribal Council and the Nicola Tribal Association. Nlaka'pamux traditional territory is located in the southwest portion of the Okanagan TSA, extending as far to the east as Okanagan Lake and to the south as the Washington state border. The Nlaka'pamux bands with interests in the Okanagan TSA have a population of approximately 5,410 people as of November 2017; band members may reside in the Okanagan TSA or within other TSAs.

3.2 Engagement and consultation with First Nations

The Province is working to engage First Nations throughout this TSR process, from the start of data gathering up to the time that allowable annual cut decision is made by the chief forester. Commencement of formal consultation will start when the data package is released. The public documents, to the extent possible, will reflect First Nations' interests as expressed to FLNR; analysis will be mindful of those interests. First Nations have requested that the public documents associated with the TSR incorporate their interests, and to the extent possible this document has done that.

Pre-consultation engagement on the TSR began in June 2016 with a letter from the chief forester to all First Nations whose traditional territories are overlapped by the Okanagan TSA. Subsequently FLNR sent and received numerous letters, emails and phone calls which resulted in numerous meetings between FLNR and First Nations, including meetings between the chief forester and First Nations.

Documentation of communication with First Nations, and a review of some communication from previous TSRs has been and will continue to be tracked so FLNR can ensure concerns are addressed by government. As these issues are being addressed or shared with appropriate staff in other agencies / ministries, FLNR will continue to track their status, share those updates with First Nations and continue to work on issues with First Nations. At the end of the TSR process, the concerns and how they were addressed will become part of the consultation record prepared for the decision maker. A summary of First Nation's concerns will be shared, upon request, with their offices when the rationale is complete.

The formal consultation process will commence with the release of the data package (i.e., this document). The data package identifies the best available information on the forest inventory and management practices. The formal review period for the data package will last 60-days.

An analysis that includes a base case harvest forecast and sensitivities around uncertainties will be completed based upon the draft data package and information obtained during the review. Following completion of the analysis, a discussion paper, that summarizes the analysis and related issues, will be released. A second 60-day formal review period will commence at that time.

Following this second formal review period, ministry staff will collate the comments received, obtain clarification of comments received, and if necessary update analysis to reflect concerns. This information is then presented to the chief forester to assist with her AAC determination. The AAC determination is released as a formal rationale document that will be provided to all First Nations bands and tribal associations with traditional territory within the Okanagan TSA.

3.3 Resource values assessment

In its 2007 *William* decision (*Tsilhqot'in Nation v. British Columbia*), the BC Supreme Court ruled that decision makers must consider information on wildlife values associated with Aboriginal rights and interests (e.g., hunting, trapping, fishing, and trading), and the potential implications of the decision on wildlife and First Nations' interests. In this regard, FLNR seeks to collaborate with First Nations to identify values for assessment and decision support into TSR, as well as to review past consultation records for key values that could be evaluated. In some cases, existing assessment procedures available through the Cumulative Effects Framework (CEF) will be leveraged for this purpose.

Based on a review of past consultation as well as engagement with First Nations, FLNR has proposed the following key values for assessment: water, moose, grizzly bear and roads, and sacred or traditional areas. Water was proposed as a key value given that First Nations communicated concerns around sedimentation, cumulative impacts from industry, future effects of climate change on water, flow including freshet, and critical water temperatures for fish. Moose and grizzly were proposed because of First Nation concerns about the impact of roads and forest harvesting on wildlife and hunting. Sacred or

traditional areas were proposed because First Nations communicated interest in protecting sacred areas and concerns about logging impacting archaeological and cultural integrity. While the chief forester within this Section 8 decision does not have the authority to designate protection of sacred or traditional areas, information about the impact of these areas to timber supply can be assessed. Throughout the TSR, FLNR will continue to collaborate with First Nations on values and the scope of assessment.

Assessments for key values cannot address all the issues communicated by First Nations, however their concerns are being documented and if concerns cannot be addressed during TSR and AAC determination, they will be communicated to other parts of government for consideration. FLNR will continue to engage with First Nations throughout the TSR process and provide documentation on how concerns are being addressed. The published AAC rationale will identify how concerns relevant to the AAC determination have been considered.

4. Current Forest Management Considerations and Issues

4.1 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.

4.2 Major forest management considerations and issues

Table 1 lists major forest management considerations and issues for the current Okanagan TSA TSR. Issues that fall within the definition of current management are modelled as best possible within the base case harvest forecast. Other issues that may infer significant uncertainties in current management may be assessed in sensitivity analyses as outlined in Section 9. Sensitivity analysis provides information about the timber supply implications around the uncertainties in data and management.

Table 1. Major forest management considerations and issues

Consideration/issue	Description
Vegetation Resources Inventory	The current Phase 1 Vegetation Resources Inventory (VRI) is based on aerial photography from 2001 and 2007. The sampling for VRI Phase 2 was completed in 2002 with a follow up in 2006 for mountain pine beetle; the phase 2 provided a field-based sample comparison to the Phase 1 aerial photo-based inventory. The 2016 VRI projection incorporated adjustments for harvesting and mortality due to the mountain pine beetle infestation based on a provincial model that was updated to 2015.
Land use objectives	The Order establishing objectives set by government for the Okanagan-Shuswap Land and Resource Management Plan (OSLRMP) was approved February 6, 2007. Specific objectives established areas of coarse woody debris, recreation areas, trail corridors, tourism, elk, marten, fisher, and bighorn sheep. General objectives were set for community / crown interface, forest roads, streams, and Williamson's sapsucker.
Old growth management areas	Non-legal old growth management (OGMA) areas were established by the southern interior regional manager on September 2004, with further OGMAs established by the regional executive director in March 2006 and December 2007. The OGMAs established by the region were provided to licensees as spatial files. In August 2007 the Integrated Land Management Bureau (ILMB) provided guidance to the OSNRD for managing areas contributing to old growth and biodiversity objectives.
Fish and wildlife	Specific management objectives have been established for the protection of habitat for mule deer, caribou, mountain goat and moose through six approved ungulate winter ranges. Specific management objectives have been established for the protection of habitat through the identified wildlife management strategy through the establishment of 141 wildlife habitat areas. Fourteen fisheries sensitive watersheds have been identified in the Okanagan Shuswap.
Visual resources	The April 2001 OSLRMP provided guidance for managing visuals in three zones. In October 2001 the Vernon, Salmon Arm and Penticton forest district managers established the OSLMRP visual zone 1 as scenic areas with visual quality objectives. A November 2005 order requires the maintenance of foreground visual quality in tourism areas and restoration of natural appearance within scenic areas impacted by past forestry development.

Consideration/issue	Description
Site productivity	The provincial site productivity layer provides site index by tree species for commercial tree species. The estimates are based on available ecosystem data, in areas where no data is available site index estimates are based on biophysical data and species ranges.
Current harvest levels	Harvest in the Okanagan TSA in the period 2012 to 2016 has averaged about 3.23 million cubic metres per year.
Insects and diseases	Mountain pine beetle infestations have impacted the forests of the Okanagan TSA directly through mortality and anticipatory harvest. The infestation reached its' peak in 2008 and has subsequently declined in affected area and intensity. Other forest health concerns such as Douglas-fir bark beetle remain at endemic levels throughout the TSA.

5. Inventories

5.1 Vegetation resource inventory

A Vegetation Resources Inventory photo interpretation project (Phase 1) was completed from 2000 to 2010. This inventory, administered by the Okanagan Innovative Forestry Society, used aerial photography flown in 2001-2002 and updated imagery flown in 2007. VRI Phase 2 samples were collected between 2002 and 2006 with the statistical adjustment report completed in 2012.

The data set to be used for the timber supply analysis was published in January 2016 on the British Columbia Geographic Warehouse¹ (BCGW). This data set incorporated harvest depletion updates from Reporting Silviculture Updates and Land Status Tracking System (RESULTS), fire disturbances, and stand attribute adjustments for the 2002 to 2015 mountain pine beetle infestation.

5.2 Cutblock update

The base case scenario uses a Phase 1 VRI that was completed mainly based on 2001 and 2007 aerial photography. Harvest depletions available up to June 2015 were incorporated into the inventory released in January 2016.

5.3 Ecosystem mapping

British Columbia has an extensive biogeoclimatic ecosystem classification (BEC) program. In the Okanagan TSA, mapping of climatic zonal and subzonal classification (BGC) is available. This 2005 BGC mapping is currently being updated but is not yet available. The 2005 biogeoclimatic mapping is used in the base case scenario; the updated BGC maps are not expected to have a significant change on the modelling of the timber supply.

In the Okanagan TSA, predictive ecosystem mapping (PEM) was completed by the Okanagan Innovative Forestry Society over a period of eight years in three separate projects: the Dry Belt PEM (2002), the Wet Belt PEM (2006) and the Very Dry Belt PEM (2009). PEM is a modelled approach to ecosystem mapping, using existing knowledge of ecosystem attributes and relationships to predict ecosystem representations (e.g., site series). The Dry and Wet Belt PEMs met ministry accuracy assessment tests for TSR use but the Very Dry Belt PEM was not tested for accuracy given that this zone is primarily outside of the timber harvesting land base.

5.4 Site productivity

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.

Forest inventory site index, estimates based on height and age from aerial photography, are recognized as likely underestimating potential site productivity for younger and older stands. To address this issue, projects have been conducted to estimate polygon specific potential site indices across the TSA. These potential site indices are used as input to growth and yield models (e.g., TIPSy or TASS) for deriving managed stand volume tables.

¹ The British Columbia Geographic Warehouse is the source for land and resource data managed and made available by the BC government. See <https://www2.gov.bc.ca/gov/content/data/geographic-data-services>.

In the Okanagan TSA the provincial site productivity spatial layer will be used for potential site indices. This layer for the Okanagan TSA is based on available ecosystem data from existing predictive ecosystem mapping (PEM) and terrestrial ecosystem mapping (TEM) datasets coupled with site index estimates from biogeoclimatic ecosystem classification site series (SIBEC) data. In areas where no PEM or TEM data are available, site index estimates are based on a biophysical model.

6. Land Base Definition

6.1 Introduction

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

The CFMLB 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 CFMLB excludes:

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

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

Provincial lands not included in TSA AAC determination such as:

- 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 CFMLB 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 that limits timber harvesting. 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 some areas classified as THLB may never be harvested.

For the Okanagan TSA timber supply analysis, the land base will be rasterized into one hectare cells rather than maintained as a vector-based polygons. Linear features such as roads and riparian area will be modelled as aspatial reductions of THLB and/or CFMLB.

Table 2, which is commonly called the netdown table, summarizes the classification of the CFMLB, and THLB. Each factor in this table is further described in following sections.

Table 2. Netdown table to identify crown forest management land base (CFMLB) and timber harvesting land base (THLB) for the Okanagan TSA. All reported values are in hectares

Netdown factor	Within gross land base	Within TSA Section 8 decision	CFMLB	Unique area excluded from THLB
Okanagan TSA gross	2 449 135			
Non-provincial lands	355 524	0	0	159 079
Not managed within TSA AAC	322 006	0	0	294 730
Non-forest and unproductive	479 809	259 436	0	259 436
Roads, trails, landings*	42 391*	TBD	0	TBD
Crown forest management land base	TBD			
Provincial parks & reserves	188 896	188 895	144 752	59 137
Inoperable	303 038	285 151	202 245	30 053
Terrain stability**	333 975	273 249	246 491	88 841
Sites with low growing potential	159 030	146 372	118 063	16 991
Problem forest types	333 721	268 738	219 012	64 141
Deciduous	42 493	20 767	19 831	10 919
Landscape-level biodiversity – OGMA	125 710	110 536	108 464	48 429
Wildlife habitat areas	9 734	9 609	8 787	3 368
Very dry sites	426 400	167 480	95 659	30 702
Ungulate winter range	14 293	14 125	13 924	6 673
Riparian reserves & management areas*	TBD	TBD	TBD	TBD
Lakeshore management zone reserves	TBD	TBD	TBD	TBD
Stand level biodiversity – WTP*	TBD	TBD	TBD	TBD
Timber harvesting land base	TBD			

Data source and comments:

“Within gross land base” is total land base of the factor within the TSA boundary; water features are excluded under the non-forest factor. “Within Section 8 Decision” is the gross area of the factor less the area of non-provincial lands and lands not managed within the TSA AAC (i.e., the area that the chief forester will consider in her Section 8 AAC decision). “Within CFMLB” is the gross area of a factor less the non-provincial lands; the not managed within AAC lands; the non-forest and unproductive lands; and roads, trails, and landings. “Unique area excluded from THLB” shows the area for each factor that was uniquely excluded from the THLB (i.e., not overlapping with other netdown factors).

*The factors in italics (Roads, trails, and landings; Riparian reserves and management areas; Lakeshore management zone reserves; and Stand-level biodiversity WTP) are to be modelled by an aspatial netdown given the raster format used for the analysis. Equivalent netdown values are to be determined (TBD) during the development of the data set for the forest estate model.

** Terrain stability includes a 100% netdown for unstable and environmentally sensitive areas and 20% netdown for potentially unstable areas; the netdown areas have been reduced to reflect these values.

6.2 Timber supply area boundary

The gross size of the Okanagan Timber Supply Area is 2.45 million hectares. Within the TSA boundary there are areas such as tree farm licences and provincial parks that do not contribute to the AAC as determined under the *Forest Act* Section 8 for timber supply areas. Table 2 provides further information on areas that do not contribute to the AAC.

Data source and comments:

BCGW file WHSE_ADMIN_BOUNDARIES.FADM_TSA

6.3 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 CFMLB and the THLB based on the 2017 FLNR Forest Analysis and Inventory Branch (FAIB) compilation of land ownership from the Crown land registry and the Integrated Cadastral Information Society. Private land is updated based on the 2017 integrated cadastral fabric.

Table 3. Non-provincial Crown lands in the Okanagan TSA based on FAIB ownership compilation

Ownership code - Description	Gross land base (hectares)	CFMLB	THLB
40N: Private – Crown Grant	289 569	No	No
52N: Indian Reserve	65 928	No	No
99N: Crown Misc. Lease (Fairground, R&G Club site, recreation cottage site)	27	No	No

Data source and comments:

The spatial layer used is `f_own_updated` produced in April 2017 by Iaian Mcdougall, Spatial Data Specialist, FAIB. Non-provincial Crown lands includes eight ownership codes, three which occur in the TSA as described in the table and five that do not occur in the TSA. Those ownership codes not in the TSA are 41N Treaty Land, Status Transfer Land, 50N Federal Reserves, 51N National Parks, 53N Military Reserves, and 54N Dominion Government Block.

6.4 Not managed within TSA AAC

A variety of area-based tenures exist within the boundary of the Okanagan 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 (FNWL). For these tenures, there are separate AAC determination processes. For the current analysis these tenures are excluded from the CFMLB and THLB.

Controlled recreation areas (CRA) such as Big White Ski Resort that are found within the Okanagan TSA are also excluded from the CFMLB and THLB as harvest that occurs within the CRA is not recorded as part of the cut control of the TSA.

Two FNWLs are pending. As the FNWLs are not approved they will not be removed from the THLB for the proposed base case. However, if an FNWL is approved prior to the Section 8 AAC determination, its land base will be excluded. The proposed Splotsin FNWL has a preliminary boundary (17 796 hectares) and the proposed Westbank First Nation FNWL has a draft boundary (17 858 hectares).

Table 4 shows the contribution to the CFMLB 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 (hectares)	CFMLB	THLB
70N: Crown - Active Timber Licence in TSA	17 881	No	No
72A&B: Crown and Private Schedule "A" & "B" lands in TFL	166 729	No	No
75N: Crown – Christmas Tree Permits	79	No	No
77A&B: Crown – Awarded Woodlot Licence	47 562	No	No
79B: Community Forest	81 898	No	No
Controlled Recreation Areas	9 837	No	No

Data source and comments:

The spatial layer used is f_own_updated produced in April 2017 by Iaian Mcdougall, Spatial Data Specialist, FAIB. First Nation Woodland Licences are found in the BCGW file WHSE_FOREST_TENURE.FTEN_MANAGED_LICENCE_POLY_SVW. Controlled recreation areas are found in the BCGW file REG_LEGAL_AND_ADMIN_BOUNDARIES.CONTROLLED_REC_AREAS_BC.

6.5 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; as such the harvest from a timber licence is not considered part of the TSA AAC. The land base associated with a timber licence reverts back to the TSA following the licence expiration; or after the merchantable timber is harvested and the licence has requested that the lands be removed from the timber licence.

Currently three timber licences exist in the Okanagan TSA: T0635 and T0676 are expected to expire in 2026 and T0816 is expected to expire in 2031. Another licence T0888 expired in 2015. For the TSR analysis, the timber licences will be included in the THLB layer but will not contribute to the THLB until 2026 for T0635 and T0676 and 2031 for T0816. Stands younger than 50 years will be assumed to persist past the end of the timber licence expiration; however, stands older than 50 years will be assumed to be harvested before the expiration of the licence.

Table 5. *Timber licences within the TSA*

Timber licence number and holder	Initial licence area (hectares)	Harvested area returning to THLB (hectares)	Net area remaining in licence (hectares)	2015-2025 planned harvest (hectares)	CFMLB	THLB
T0888 Interfor Corp.	4 462		4 462		Yes	Yes
T0676 Dynamic Work Force Ltd.	1 541	7	1 534		Yes	Yes
T0635 Canoe Forest Products Ltd.	5 527	1 653	3 874		Yes	Yes
T0816 Tolko Industries Ltd.	22 462	9 998	12 464		Yes	Yes

Data source and comments:

BCGW file WHSE_FOREST_TENURE.FTEN_TIMBER_LICENCE_POLY_SVW.

6.6 Non-forest and non-productive forest

Non-forested or non-productive lands with no impact on forest management objectives do not contribute or impact timber supply, as such, for modelling of the base case, these lands are excluded from the CFMLB.

Non-forested areas include water and non-vegetated land such as rock, ice and bare land. Non-productive forest includes those that have very low productivity such as stands with a site index less than three metres. Within the VRI there are attributes that identify non-vegetated and various classes of vegetated areas based on the BC land classification system (BCLCS). These VRI attributes are used to identify the non-forest and non-productive forest.

As shown in Table 6 specific criteria were used remove non-forested areas and non-productive forest from the THLB. In some cases, these specific criteria may exclude land that had previously been harvested (e.g., a recently harvested but not yet reforested stand) or may have been otherwise incorrectly classified. As such, stands with a previous harvest record are not excluded from the CFMLB.

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

Attributes	Description	Gross land base (hectares)	CFMLB	THLB
Non-forest				
BCLCS level 1 equal 'N' AND no logging history	Non-vegetated	164 312	No	No
BCLCS level 2 = 'N' AND BCLCS level 4 not equal to 'ST' or 'SL' AND no logging history	Vegetated but non-treed, excluding shrub areas	233 088	No	No
BCLCS level 2 = 'N' AND BCLCS level 3 = 'W' AND no logging history	Non-treed wetlands	5 372	No	No
BCLCS level 3 = 'A' AND no logging history	Alpine	18 617	No	No
zone = 'IMA' AND no logging history	Alpine	18 727	No	No
Very low productivity forest				
site index < 3.0 m or null AND no logging history	Land base that is not productive for timber supply or non-forest objectives.	362 956	No	No
Non-commercial forest				
BCLCS level 2 = 'T' AND BCLCS level 3 = 'W' AND no logging history	Treed wetlands	829	No	No
BCLCS level 4 = 'ST' or 'SL' AND no logging history	Shrub and not already logged	69 932	No	No

Data source and comments:

BCGW file WHSE_FOREST_VEGETATION.VEG_COMP_LYR_R1_POLY (2016 projection). Note that the gross land base is not additive because there are overlaps between factors (i.e., alpine can overlap non-vegetated).

6.7 Roads, trails, and landings

Permanent roads, trails, and landings (RTL) contribute to the loss of productive land.

Several provincial sources of information on roads are available for the Okanagan TSA. An integrated roads file, created by geomatics staff of the FLNR Thompson Okanagan Natural Resource Region in February 2017, that used multiple data sources was identified as the best available. The creation of this data file follows a documented protocol for selecting and integrating the most appropriate road data source based on source accuracy.

To complement the above roads file, geomatics staff determined road use classes (1, 2, 3) based on attribute data of the integrated roads file. Road use class 1 includes freeways, highways and paved local and resource roads. Road use class 2 includes loose surface local roads and forest service roads. Road use class 3 includes forest tenure roads, as built roads, RESULTS forest cover roads, skid trails, and unclassified roads.

Estimates of the area occupied by RTL was determined by applying average road width buffers to identified roads. Road buffers were determined based on past widths used in the TSA as well as a comparison to other TSAs. The table below shows the length of road use classes, the proposed buffer widths, and reductions to be made for existing RTL within the base case analysis.

A review of the road use classes by OSNRD staff identified that road use class 2 is likely underrepresented by about 2200 km. These roads, which were unclassified in the source layers (i.e., digital road atlas) are likely captured in road use class 3. As such, an underestimation of RTL of about 1650 hectares is present given the greater buffer size of class 2 road use as compared to class 3. Until the unclassified roads are addressed by the Province, this potential underestimate will persist.

In the base case, given the use of a one hectare rasterized land base, RTL will be incorporated aspatially by reducing the THLB and CFMLB by an appropriate reduction factor.

As development continues in the TSA, further RTL reductions will occur. 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. The method to determine how to determine future road deductions is to be determined. Possible choices are to utilize available simulated future road routines or apply current levels of observed roading. The chief forester will be presented information on the likely impact of future RTL for consideration in making her AAC determination.

Other linear features such as transmission lines, railways and pipelines unlike roads have not been separately addressed. Given that these linear features would be identified as non-forest based on VRI attributes and classification criteria, it is assumed that these areas are excluded under the non-forest or non-productive criteria.

Table 7. Roads within the Okanagan TSA

Roads use classes	Length (km)	Modelled buffer width (metres)	Gross land base based on buffer(hectares)	CFMLB	THLB
1	6 015	25	15 038	No	No
2	6 109	12.5	7 636		
3	39 435	5	19 718	No	No
Total	51 559		42 391		

Data source and comments:

BC_CE_IntegratedRoads_2017_v1_20170214.gdb was created by FLNR geospatial services staff in February 2017. The integrated roads include BCGW files DRA_DGTL_ROAD_ATLAS_MPAR_SP, TRIM_TRANSPORTATION_LINES, ABR_ROAD_SECTION_LINE, FTEN_ROAD_SECTION_LINES_SVW, RSLT_FOREST_COVER_INV_SVW. Geospatial service's python script Calc_Road_Use_Class.py was updated and utilized to create road use classes. An aerial photo review will be done to check road buffer widths.

6.8 Provincial parks & miscellaneous reserves

Over 9.5% of the land base in the Okanagan TSA is provincially designated for the protection of its natural environment. Such protection is afforded under various designations including Crown Ecological Reserve, Crown Provincial Park Class A, Crown Provincial Park Equivalent or Reserved, Crown Biodiversity, Mining and Tourism Area, and Crown Miscellaneous Reserves.

Provincial Class A Parks preserve the natural environment and provide public use and enjoyment. There are 78 parks in the Okanagan TSA; they range from SXwEXwNITKw (Okanagan Falls) Provincial Park at two hectares to Cathedral Provincial Park at 33 013 hectares.

Protected areas generally have one or more existing or proposed activities that are not usually allowed in a park (e.g., industrial roads). There are 10 protected areas in the Okanagan TSA; they range in size from the Myra Bellevue Protected Area at 50 hectares to the Snowy Protected Area at 25 637 hectares.

Ecological reserves preserve representative and special natural ecosystems, plant and animal species, features and phenomena. There are 15 in the Okanagan TSA; they range in size from Field's Lease Ecological Reserve at 4.5 hectares to Kingfisher Creek Ecological Reserve at 1495 hectares.

These three types of protected areas within the TSA will be considered part of the CFMLB and contribute to objectives for biodiversity and wildlife. 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 Okanagan TSA allowable annual cut

Ownership code	Gross land base (hectares)	CFMLB	THLB
60N - Ecological Reserve	5 155	Yes	No
60N - Protected Area	51 474	Yes	No
60N - Park Class A	132 267	Yes	No

Data source and comments:

The spatial layer used is f_own_updated.

6.9 Recreation sites and trails

Under the *Forest and Range Practices Act*, 175 recreation sites, 60 recreation reserves and 24 trails have been established in the Okanagan TSA. There are an additional 124 recreation sites and 77 trails that have not yet been established but are being managed by FLNR. According to the district recreation officer, recreational sites and trails have increased about 10% annually in the TSA as there is significant pressure from the public and municipalities to maintain and expand recreational opportunities.

The management strategy for recreation 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 by a recreation officer is required prior to any industrial activity or harvesting on an established site. However, while logging is possible, it is likely that harvesting activity will be limited.

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

As recreation sites, trails and UREPs do not have legal protection from harvest they will be included in the THLB, unless otherwise excluded. A review of the contribution of recreation sites and trails to THLB and the harvest history will be completed to understand the impact of harvest on recreation resources. The chief forester will be presented information on the likely impact of current practices related to recreation trails and sites for consideration in making her AAC determination.

Table 9. *Recreation sites and trails*

Category	Gross land base	CFMLB	THLB
Active and pending recreation sites	74 343 ha	Yes	Yes
Active and pending recreation reserves	17 343 ha	Yes	Yes
Active recreation trails	3 157 km	Yes	Yes
UREPs	2 807 ha	Yes	Yes

Data source and comments:

f_own_updated and BCGW files WHSE_FOREST_TENURE.FTEN_RECREATION_POLY_SVW and WHSE_FOREST_TENURE.FTEN_RECREATION_LINES_SVW.

6.10 Inoperable areas

The ministry and major licensees developed operability mapping in 1993 for the Okanagan TSA. The mapping of the former Salmon Arm Forest District was updated in 1997. The operability mapping was based on expert opinion considering initial information on slope, contours, environmentally sensitive area inventory with a sensitive soil classification, and aerial photography. There was an inherent estimation of the economics included into these factors based on the experience of ministry and industry staff.

From 2010 to 2014 there were 67 373 hectares harvested in the Okanagan TSA with 180 hectares (less than one percent) being harvested in inoperable areas. Inoperable areas, except for polygons that have harvest history, will be removed from the THLB but included in the CFMLB.

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

Category	Gross land base (hectares)	CFMLB	THLB
Inoperable	303 038	Yes	No

Data source and comments:

OSNRD confirmed on April 25/17 that their file fopr_tok (forestry operability boundaries) was incorporated into the BCGW file
REG_LAND_AND_NATURAL_RESOURCE.OPERABILITY_AREAS_SIR_POLY.

6.11 Terrain stability and environmentally sensitive areas

Terrain stability mapping (TSM) provides an assessment where existing or potential development may be affected by landslide hazards or slope stability. TSM has replaced Environmentally Sensitive Areas (ESA) mapping that was a component of the older forest cover inventory. In the Okanagan TSA approximately 80% of the land base has been mapped to various standards of TSM.

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. 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. Terrain classes U and V are modelled as 100% unharvestable and the potentially unstable classes P and IV are modelled as 20% unharvestable (Table 11). For the base case analysis these netdown percentages are applied.

On the approximately 20% of the district that is not covered by TSM, ESA mapping is utilized to identify unstable terrain. All ESA polygons with an extremely fragile or unstable soils (S) category in the ESA level 1 (high classification) mapping are excluded from the THLB; this includes polygons with multiple categories (e.g., SA, SPR). The *Mapping and Assessing Terrain Stability Guidebook* indicates that TSM class V is equivalent to an ESA level 1 class therefore these ESA level 1 areas will be modelled as 100% excluded from THLB.

Table 11 shows the TSM categories that are excluded from the THLB, as well as environmentally sensitive areas that are excluded from the THLB. This table also shows the area of unstable, potentially unstable and ESA 1 polygons that have been harvested. Ministry staff expect harvest to increase within the potentially unstable polygons as licensees move out of the less terrain sensitive mountain pine beetle infested stands.

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

Source	Category	Gross land base (hectares)	Harvested within Category (hectares)	Harvested as% of gross land base	CFMLB	THLB
TSM	Unstable (5, V or U)	64 811	3 300	5	Yes	No
	Potential unstable (4, IV, P)	141 934	16 359	9	Yes	20%
ESA	1	127 230	3 393	3	Yes	No

Data source and comments:

BCGW file WHSE_TERRESTRIAL_ECOLOGY.STE_TER_STABILITY_POLYS_SVW, WHSE_FOREST_VEGETATION.VEG_CONSOLIDATED_CUT_BLOCKS_SP and district's local ESA coverage.

The potentially unstable gross land base is reduced only 20% reduction for unharvestable areas and 80% remains harvestable.

6.12 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 a set value (based on species) will be considered not to produce a merchantable crop of trees and are excluded from the THLB. Stands with a site index less than 3.0 metres 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 CFMLB.

Table 12. Description of sites with low timber growing potential

Leading species	Inventory site index (m @ 50 years)	Gross land base (hectares)	CFMLB	THLB
Douglas-fir	< 8.5	7 483	Yes	No
Cedar	<9	16 439	Yes	No
Hemlock	<8	923	Yes	No
Balsam	<8	117 611	Yes	No
Spruce	<7.5	8 394	Yes	No
Lodgepole pine	<7.5	2 694	Yes	No
Larch	<6.5	194	Yes	No
White pine	<8	0	Yes	No
Yellow pine	<7	5 292	Yes	No

Data source and comments:

WHSE_FOREST_VEGETATION.VEG_COMP_LRY_R1_POLY. The gross land base estimate of VRI 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.

6.13 Problem forest types (non-deciduous)

Problem forest types are stands that are physically operable but are not currently utilized or have marginal merchantability. In the Okanagan TSA for non-deciduous species, several problem forest types have been historically identified and described within past TSRs. For the current TSR, these past problem forest type definitions were reviewed and modified by ministry staff.

Problem forest types are excluded from the THLB but included in the CFMLB. 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.

In order to understand the possible contribution of problem forest types to the timber supply, a sensitivity analysis that includes all problem forest types will be completed.

Table 13. Problem forest types criteria

Description	Age (years)	Height (metres)	Volume (m ³ /hectare)	Site index (m@50 years)	Gross land base (hectares)	CFMLB	THLB
Non-Douglas-fir			<100	10-13	68 397	Yes	No
All species except PI	>=101	<= 19.4			167 028	Yes	No
Hemlock leading	>=141				43 056	Yes	No
Pine	>=100		<100		12 079	Yes	No
Pine	>=81	<= 18.5			29 532	Yes	No
Pine	61-80	<= 12.7			11 827	Yes	No
Pine	41-60	<= 9.5			805	Yes	No
Pine	21-40	<= 5.0			9	Yes	No

Data source and comments:

WHSE_FOREST_VEGETATION.VEG_COMP_LRY_R1_POLY. 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.

6.14 Deciduous

The demand for deciduous (broadleaf) sawlogs in the TSA is limited. 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.

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 (hectares)	CFMLB	THLB
Deciduous-leading stands	42 493	Yes	No

Data source and comments:

WHSE_FOREST_VEGETATION.VEG_COMP_LRY_R1_POLY. A deciduous-leading stand is where the sum of the VRI species composition for all deciduous species is greater or equal 50%.

6.15 Landscape biodiversity**6.15.1 Seral stage requirements**

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

6.15.2 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 OGMA's.

Landscape-biodiversity objectives for old-seral forest types originate from the OSLRMP. Following the completion of the OSLRMP, OGMA's within the Okanagan TSA were identified through a collaborative process between the Ministry of Forests and Range, Integrated Land Management Bureau (ILMB), forest industry representatives and Environmental Non-governmental Organizations (ENGOS). OGMA area targets were based on the LRMP accepted objectives for Landscape Units and BEC subzones.

OGMA's within the Okanagan TSA are spatially identified within landscape units as "draft". There are no plans to have them legally established. The ILMB August 2007 *Old Growth Management Area* guidance document allowed for the adjustment of OGMA boundaries over time to deal with insect outbreaks, forest fires, or other changes which may affect their permanency. Any incursions within OGMA's and replacement areas are identified but have not been updated in the BC Geographic Warehouse. Landscape unit objectives are maintained. The draft OGMA's will be excluded from the timber harvesting land base.

As a measure to reduce impacts to timber supply for landscape units in low biodiversity emphasis option areas, the June 2007 Order Establishing Provincial Non-Spatial Old Growth Objectives enables temporary reduction of old forest retention of up to two-thirds. OSNRD confirmed that the OGMA's in the Okanagan TSA were selected using this two-thirds reduction (referred to as "draw down by two-thirds"). As such, an old-seral requirement will be included in the analysis that will require that retention in the low BEO zones is increased by one-third at year 2087 and another one-third at year 2167 to ensure the full objective amount of old forest in low BEO zones by 2167.

Table 15. Old growth management areas in the Okanagan TSA

Description	Gross land base (hectares)	CFMLB	THLB
Old growth management areas	125 710	Yes	No

Data source and comments:

BCGW file WHSE_LAND_USE_PLANNING.RMP_OGMA_NON_LEGAL_CURRENT_SVW.

6.15.3 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 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*.

6.16 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 Forest Planning and Practices regulations identifies that the total amount of wildlife tree retention areas that relates to the cutblocks in a year is a minimum of 7% of the total area of the cutblocks; for an individual cutblock the total amount of wildlife tree retention areas that relates to the cutblock is a minimum of 3.5% of the cutblock.

Licensees may vary the requirement by specifying an acceptable alternative in their FSP. WTRs are often located within areas that are otherwise constrained, such as riparian areas, sensitive or inoperable terrain, therefore the impact to the THLB could be less than 7% minimum retention requirement.

The average wildlife tree retention within the Okanagan TSA for the period April 2012 to February 2017 is 8.8% based on reporting in RESULTS by licensees. During the timber supply analysis, a THLB layer will be constructed and the retention polygons will be examined to determine the area within the THLB. A final percentage of WTRs in the THLB will be calculated and will be modelled aspatially as a yield table reduction. In that last TSR a 6.12% THLB netdown was used.

6.17 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 values (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 zones identify some retention requirements that must be met over the stream length or water body perimeter.

In the timber supply analysis, riparian areas will first be identified in a spatial GIS exercise and then applied as an aspatial THLB reduction. The aspatial reduction is calculated at the one hectare raster level based on the overlap of the riparian buffer zone with the THLB in the raster.

Streams

Although there is some data available which assigns a classification to specific portions of specific streams there is no single dataset which provides a stream class for each stream within the TSA.

A stream reach is a relatively homogeneous section of a stream having a sequence of repeating structural characteristics (or processes) and fish habitat types. The key physical factors used to determine reaches in the field are channel pattern, channel confinement, gradient, and streambed and bank materials. Stream reaches generally show uniformity in these characteristics and in discharge.

At this time there is not a data base that identifies a stream class for each stream reach within the Okanagan TSA. Instead of a specific riparian buffer for each stream class, a weighted average riparian buffer width across all streams, that was calculated for the Okanagan TSA based on an assessment of stream class distribution by Wild Stone Resources, will be used. This average reserve width of 12.4 metres is applied to each side of all streams (S1 to S6) identified in the Okanagan TSA timber supply review file (FWA-based streams).

The OSLRMP identified an additional budget of 9300 hectares within the TSA's THLB as enhanced riparian reserve. Enhanced riparian reserves are to be modelled by determining the ratio of enhanced riparian reserve to the entire THLB and reducing each THLB polygon proportionately to account for the 9300 hectares.

Table 16. Stream buffer widths from the Riparian Management Area Guidebook

Within a community watershed or fish bearing							
Stream width (metres)	Stream class	Riparian reserve zone (metres)	Management zone width (metres)	Total riparian management area width (metres)	Buffer applied to both sides of stream in analysis (metres)	CFMLB	THLB
≥100	S1	0	100	100	12.4	No	No
>20	S1	50	20	70	12.4	No	No
>5-20	S2	30	20	50	12.4	No	No
1.5-5	S3	20	20	40	12.4	No	No
<1.5	S4	0	30	30	12.4	No	No
Not within a community watershed or fish bearing							
Average channel width (metres)	Stream class	Riparian reserve zone (metres)	Management zone width (metres)	Total riparian management area width (metres)	Buffer applied to both sides of stream in analysis (metres)	CFMLB	THLB
>3	S5	0	30	30	12.4	No	No
≤ 3	S6	0	20	20	12.4	No	No

Data source and comments:

BCGW file WHSE_BASEMAPPING.TRIM_EBM_WATERCOURSES.

Lakes

There are two types of lakes in the Okanagan TSA, natural and reservoir (man-made). Properly functioning lakes store large amounts of water, are important in managing floods and droughts, replenish groundwater, positively influencing water quality downstream and provide habitat for fish, invertebrates and birds. Lakes also provide important recreational and tourism opportunities in the Okanagan. Lakes are well mapped in the Province and spatial data is readily available on the BCGW. Lake classification is based on lake size and the biogeoclimatic unit in which they occur. Buffers are applied based on the table below.

Table 17. Lake based riparian management areas buffer width

Feature size and BEC	Class	FPPR Sec49 reserve width (metres)	FPPR Sec 49 management zone width (metres)	Percent (%) retention	Modelled reserve width (metres)	CFMLB	THLB
> 1000 hectares	L1	0	0	0	10	No	No
> 5 hectares	L1	10	0	0	10	No	No
1-5 hectares BG, PP, IDFxh, xw, xm	L2	10	20	25	15	No	No
1-5 hectares not in above BEC	L3	0	30	25	7.5	No	No
0.25-1 hectare BG, PP, IDFxh, xw, xm	L4	0	30	25	7.5	No	No

Data source and comments:

BCGW file WHSE_BASEMAPPING.TRIM_EBM_WATERBODIES.

Wetlands

A wetland is a swamp, marsh, or similar area that supports natural vegetation that is distinct from the adjacent upland areas. More specifically, a wetland is an area where a water table is at, near, or above the surface or where soils are water-saturated for a sufficient length of time that excess water and resulting low oxygen levels are principal determinants of vegetation and soil development. Wetlands can also be transitions between dry land and water such as streams, rivers, lakes and coastline.

Riparian classification is based on whether the wetland is a simple wetland or wetland complex, wetland size and biogeoclimatic unit in which the wetland occurs. The FPPR defines the riparian reserve and riparian management zone widths of wetlands; these correspond to the older FPC *Riparian Management Area Guidebook* widths. Buffers are applied based on the table below.

Individual wetlands were classified using a GIS process to determine their size and the biogeoclimatic zone in which they occur. These wetlands are then buffered based on the modelled reserve widths in the table below and excluded from the THLB.

Table 18. Wetlands-based riparian management areas buffer width

Feature size and BEC	Class	FPPR Sec 48 reserve width (metres)	FPPR Sec 48 management zone width (metres)	Percent (%) retention	Modelled reserve width (metres)	CFMLB	THLB
Wetland complex	W5	10	40	25	20	No	No
> 5 hectares	W1	10	40	25	20	No	No
1-5 hectares in BG, PP, IDFxh, xw, xm	W2	10	20	25	15	No	No
1-5 hectares in other	W3	0	30	25	7.5	No	No
0.25-1 hectares in BG, PP, IDFxh, xw, xm	W4	0	30	25	7.5	No	No

Data source and comments:

BCGW file WHSE_BASEMAPPING.TRIM_EBM_WETLANDS.

6.18 Lakeshore management zones

The February 6, 2007 OSLRMP Order did not establish a legal resource management zone or an objective for lakeshore management; however the management by government and licensees have followed the intention of the OSLRMP and the processes to date respecting lakeshore management zones (LMZ).

To support the objective of the OSLRMP, a lakes local resource use plan (LRUP) was developed. However, the LRUP does not have legal designation and licensees have been inconsistent in using the LRUP as guidance with their FSPs.

In April 2009, the district manager provided a guidance letter to licensees titled, “District Manager Guidance – Harvesting within LMAs in the Okanagan Shuswap Forest District.” This letter identifies an expectation of licensees that they will follow legislation and policy as well as the OSLMRP and the *Lake Classification and Lakeshore Management Guidebook: Kamloops Forest Region*. District staff indicated that in general licensees have followed this guidance.

The *Lake Classification and Lakeshore Management Guidebook* identifies criteria for lake classification and such classification has been completed and available within the data set noted below. In the guidebook a 200 metres LMZ is recommended that includes a reserve zone of 10 metres where no riparian zone exists. The guidance letter in general identifies no harvesting within the reserves zones with exceptions to preserve lakeshore values and with lakeshore management zones a high to very high retention closer to the lakeshore with moderate to low retention further from the lake.

Lakeshore management zones, to address practice as per District Manager guidance, will be modelled as a 10 metre reserve buffer that will be excluded as an aspatial reduction within a raster and a volume table reduction of 30% for stands within the LMZ.

Data source and comments:

BCGW file

REG_LAND_AND_NATURAL_RESOURCE.LAKESHORE_MGMT_ZONES_TOK_POLY.

6.19 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 (FWS) (Section 14) and the Forest Practices and Planning Regulation (Section 8.1) require the management of a watershed that has significant downstream fisheries values.

Fisheries sensitive watersheds may be established to modify management activities to maintain ecosystems. To qualify as a FSW candidate, watersheds must have significant fisheries values as well as watershed sensitivity. The Minister may designate fisheries sensitive watersheds by an Order which sets out management direction to conserve important watershed level attributes protecting fisheries values.

On April 17, 2007 there were two FSW GAR Orders established in the Okanagan TSA that affect 14 watersheds. The Orders provides three objectives:

1. Conserve the natural hydrological conditions, natural stream bed dynamics and integrity of the stream channels in the Fisheries Sensitive Watershed;
2. Conserve the quality, quantity and timing of water flows required by fish in the Fisheries Sensitive Watershed; and,
3. Prevent the cumulative hydrological effects of primary forest activities in the Fisheries Sensitive Watershed from resulting in a material adverse impact on the fish habitat in the watershed.

Information provided by the district indicates that licensees will be managing FSWs through the use of Enhanced Riparian Reserves and wildlife tree retention. While the objectives for FSWs could lead to management that would impact timber supply, no specific management changes have been identified that require specific modelling considerations in the base case.

Table 19. *Fisheries sensitive watersheds*

Fisheries sensitive watershed identifier	FSW Name	Area (hectares)
F-3-001	Anstey River	23 206
F-3-002	Eagle River	34 297
F-3-003	Perry River	43 570
F-3-004	Scotch Creek	58 493
F-3-005	Seymour River	70 463
F-3-006	Yard Creek	12 058
F-8-001	Shorts Creek	15 555
F-8-002	Chute Creek	4 707
F-8-003	Vaseux Creek	27 923
F-8-004	Bessette Creek	55 446
F-8-005	Cherry Creek	50 792
F-8-006	Sitkum Creek	10 143
F-8-007	Upper Shuswap River	59 473
F-8-008	Wap Creek	32 760

Data source and comments:

WHSE_WILDLIFE_MANAGEMENT.WCP_FISH_SENSITIVE_WS_POLY.

6.20 Wildlife habitat areas

Wildlife habitat may be identified and managed through several processes including the Identified Wildlife Management Strategy (IWMS). For the IWMS wildlife habitat areas can be established under the Government Actions Regulation (GAR) or grandparented under the *Forest Practices Code Act*.

Since 2001, 126 wildlife habitat areas have been established in the Okanagan TSA for a variety of mammals, birds, reptiles, amphibians and plant communities. Most WHA range in size from one hectare to 250 hectares, though the largest WHA is over 900 000 hectares in size. The impact to timber supply varies among WHAs due to the associated general wildlife measures (GWM) and the forest composition. Many WHAs are expected to have no timber supply impact given that they contain no THLB or permit some form of harvesting.

Table 20 lists the established WHAs for identified wildlife. The WHAs for most species are seen to be small areas except for WHAs for grizzly bear and mountain caribou.

In an FLNR assessment of the timber harvesting land base impact of the WHAs, excluding those for grizzly bear and mountain caribou, there was minimal assessed impact. Most of these WHAs are small and are not found within the THLB or have general wildlife measures that allow harvesting. Williamson's Sapsucker is discussed further in a separate section below.

Grizzly bear WHAs (8-131 to 8-138, 8-144 to 8-146) and mountain caribou WHAs (8-226 to 8-230) will be excluded from the THLB as the general wildlife measures generally exclude harvesting.

Grizzly bear WHAs that provide general wildlife measures with respect to foraging areas cover a large portion of the Okanagan TSA, however, the general wildlife measures should be able to be met operationally with little timber supply impact. As such, no modelling consideration will be made in the base case.

Mountain caribou WHA 8-233 will be modelled as a minimum disturbance constraint, based on the general wildlife measures, of no more than 30% of the Crown forested land base having a stand height of less than 14 metres. Caribou are discussed further in a separate section below.

Table 20 reflects past assessments of the THLB impacts. This table will be updated for the current analysis when the THLB layer is finalized.

Table 20. Wildlife habitat areas in the Okanagan TSA (excludes WHAs in TFL 59)

Wildlife species and communities	Number of WHAs	Potential for Harvest	Gross land base (hectares)	Equivalent mature THLB	CFMLB	THLB
Antelope-Brush/Needle-And-Thread Grass	9	No	198	0	Yes	Yes
Badger	2	Yes	4	0	Yes	Yes
Bighorn Sheep	5	No	385	0	Yes	Yes
Brewer's Sparrow	1	No	48	0	Yes	Yes
Data Sensitive	9	Unknown	1 722	0	Yes	Yes
Great Basin Spadefoot	1	No	20	0	Yes	Yes
Grizzly Bear - no harvest	11	No	4 722	1 440	Yes	No
Grizzly Bear - general forage	2	Yes	915 412	0	Yes	Yes
Lewis's Woodpecker	45	Yes	1 120	0	Yes	Yes
Mountain Caribou - no harvest	5	No	5 600	1 663	Yes	No
Mountain Caribou - minimum disturbance	1	Yes	16 311	0	Yes	Yes
Sage thrasher	1	No	261	0	Yes	Yes
Tiger Salamander	11	Yes	305	0.6	Yes	Yes
Western Screech Owl	3	Yes	148	0	Yes	Yes
White-headed Woodpecker	4	Yes	199	0	Yes	Yes
Williamson's Sapsucker	16	Yes	471	0	Yes	Yes
Yellow-breasted Chat	17	No	38	0	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>.

6.21 Williamson's Sapsucker

A Williamson's Sapsucker (WISA) population occurs in southern parts of the TSA. WISA are listed as "Endangered" under the Government of Canada's *Species at Risk Act* (SARA) and are protected by SARA measures for listed wildlife species. The Federal Government has implemented a recovery strategy with objectives of ensuring the persistence of WISA populations in Canada by maintaining them at or above the current abundance, and the current distribution and areas of occupancy. The Federal Government has spatially identified critical habitat however current habitat suitability in the Okanagan-Boundary may be insufficient to support the population and distribution objectives.

Improving the suitability of critical habitat values in WISA habitat is critical to the recovery of WISA populations. Forestry is the primary land management activity that affects WISA habitat suitability. To address this, the Province has established Best Management Practices (BMPs) for each area of occupation (AOA) in the Province. The Province's AOAs coincide with the Federal Government's critical habitat (Western, Okanagan/Boundary, and East Kootenays).

The intent of the BMPs is to reduce the effects of forestry related activities on provincial lands within AOAs. There are 14 942 hectares of AOAs with the Okanagan TSA boundary. However, outside of TFL 59, there are only 5622 hectares of AOAs in the Okanagan TSA.

For the current analysis, the intent of the BMP will be investigated and presented to the chief forester as a sensitivity analysis. The regional ecosystem biologist has recommended a sensitivity analysis that retains 225 stems per hectare within the AOAs and in stands with greater than 70% pine that the pine is removed and 125 stems per hectares of non-pine species be retained on average. For timber supply modelling purposes to understand the impact at the TSA level, these requirements will be simplified to a range of possible volume reduction percentages (e.g., 0 to 80%).

There are also two sapsucker breeding locations outside of the area of occupation within the TSA. The BMPs recommend that nest sites outside of AOAs have a 500 metre buffer established. Partial harvesting is permitted inside the buffer therefore the regional ecosystem biologist recommended that the 500 metre buffer be modelled as a 50 metre no-harvest buffer. As the two nest sites with a 50 metre no-harvest buffer will affect less than one hectare, the nest sites outside of AOAs will not be modelled.

As discussed in Section 6.20 the Province has established 471 hectares of WISA WHAs in the Okanagan TSA of which no timber supply impacts were identified; 364 hectares are within TFL 59 which is excluded from this analysis.

Data source and comments:

Environment Canada Data. Critical Habitat for Species at Risk, British Columbia – Williamson's Sapsucker (*Sphyrapicus thyroideus*). CH_869_Sphyrapicus_thyroideus.zip.

6.22 Mountain caribou

Southern mountain caribou populations occur in northern parts of the timber supply area. They are listed as *Threatened* under the Government of Canada's *Species at Risk Act* (SARA) and are provincially red-listed (e.g., species at risk of extinction or extirpation). Consequently, Environment Canada implemented a recovery strategy for southern mountain caribou, which established legal objectives of sustaining the distribution and abundance of all southern mountain caribou populations and spatially identified caribou critical habitat (low elevation winter range, high elevation winter or summer range and matrix types). Environment Canada set an objective of maintaining greater than 65% undisturbed habitat in low elevation winter range and no disturbance in high elevation winter or summer range. Disturbed habitat is defined as areas burned within the last 40 years, or areas that are within 500 metres of less than 40 year old logged forest (i.e., cutblocks) or linear feature created by humans (i.e., roads, trails and pipelines).

For GAR Order U-3-005 of the Revelstoke Shuswap Planning Unit (effective 9 Dec 2009), the general wildlife measures identify that timber harvesting and road construction must not occur within U 3-005 other than for certain exceptions. As such, for the current analysis, the identified no-harvest zone is excluded from the base case THLB.

For GAR Order U-8-004 of the Revelstoke Shuswap and South Monashee Planning Units (effective 9 Dec 2009), there are two general wildlife measures relevant to forestry activities; both are unlikely to have relevant timber supply impacts. The first GWM restricts silviculture activities by not allowing conversion to pure spruce stands; this does not prevent harvesting. The second GWM restricts harvesting in the sub-alpine parkland ecosystem (ESSFdc, ESSFwcp and ESSFxc are about 15 000 hectares) but this area falls outside of the THLB. No consideration will be made for U-8-004 in the base case.

Sensitivity analyses may be completed using the timber supply model to explore the implications for timber supply of implementing Environment Canada's critical habitat protections for caribou, and of current management practices on habitat disturbance levels in caribou range. Specifically, model scenarios may be implemented that allow no habitat disturbance in high elevation winter or summer range areas and maximum 35% habitat disturbance in low elevation winter range and matrix areas. The sensitivity analyses proposed here will explore the implications of current forestry practices and alternative scenarios with limitations on forestry for caribou and timber supply in the future.

Table 21. Government action regulation orders for Mountain Caribou in the Okanagan TSA

Order	Gross land base (hectares)	CFMLB	THLB
3-005	14 293	Yes	No
8-004	178 363	Yes	Yes

Data source and comments:

BCGW file: WHSE_WILDLIFE_MANAGEMENT.WCP_UNGULATE_WINTER_RANGE_SP.

6.23 Wildlife management areas

Wildlife management areas (WMA) may be designated under the Section 4 of the *Wildlife Act*. Activities that involve use of land or resources in a WMA require written permission of the designated regional manager. The regional manager may establish orders restricting certain activities in a WHA.

Two WMAs have been designated within the Okanagan TSA: McTaggart-Cowan /Nsək'lniw't WMA and South Okanagan WMA. The South Okanagan WMA was created for the management of habitat primarily for ecosystems and species at risk. The McTaggart Cowan /Nsək'lniw't WMA was established to protect, maintain and / or enhance habitat for bighorn sheep and other wildlife. These WMAs do not yet have approved management plans. Expectations by ministry staff in the OSLMRP for the McTaggart Cowan /Nsək'lniw't are that management would reflect practices identified within the Okanagan LRMP for bighorn sheep.

For the timber supply review base case the two WMAs will not be excluded from the THLB.

The South Okanagan WMA has minor amounts of THLB - in the last timber supply review the WMA was found to have one hectare of THLB. As such given the small timber supply implications, no modelling considerations will be made for this WMA.

The McTaggart Cowan /Nsək'lniw't has 570 hectares of THLB on which management constraints have been identified and joint approval by FLNR and MOE for harvest is required. Constraints on the McTaggart Cowan /Nsək'lniw't WMA include: 1) a requirement to maintain 33% of the stand to a height of 16 metres or greater, and a crown closure class of three or greater; 2) the 33% could include netdowns but would not include stocking class 4; 3) 15% of the total, but within the 33% would be greater than 140 years of age within the fir and spruce types; 4) small patch cut partial retention systems to be used in fir and spruce types; 5) clearcut with reserve with irregular edges in the lodgepole pine types; and, 6) a total chance plan to manage access is required and must include the restrictions identified in Section 1.4 i) to v) in the OSLRMP. These multiple constraints will be simplified to restrict harvest with minimum retention constraints of 15% of the CFMLB must be greater than 140 years and 33% of the CFMLB must be greater than 16 metres (or equivalent age).

Table 22. Wildlife management areas in the Okanagan TSA

Wildlife management area	Gross land base (hectares)	CFMLB	THLB
McTaggart-Cowan /Nsək'lniw't	6 491	Yes	Yes
South Okanagan	904	Yes	Yes

Data source and comments:

BCGW file: WHSE_TANTALIS.TA_WILDLIFE_MFMT_AREAS_SVW.

6.24 Archaeological sites

Archaeological sites are locations where there is physical evidence of past human activity. Such sites are identified and receive protection under the *Heritage Conservation Act* (HCA). A permit issued by FLNR Archaeology Branch is required to conduct activities within the boundaries of an archaeological site.

In the Okanagan TSA, 1,388 archaeological sites have been recorded within the government's archaeological database. These include a wide range of sites located both within the urban and forest land base.

The vast majority of archaeological sites are located under the surface of the ground, and most have not been recorded. Therefore, it is difficult to estimate the full number of sites in a management unit. However, protection under the HCA 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 when the sites are identified.

Archaeological sites are excluded from timber harvesting and operationally these identified sites serve complementary retention objectives (e.g., wildlife tree patches, riparian areas). For modelling in the base case, given the typical small size of the archaeological site and the modelling use of one hectare raster cells, archaeological sites would be deducted from the THLB aspatially. Given the high likelihood of overlaps with other retention objectives and other THLB exclusions, archaeological sites will not be directly excluded from the THLB to avoid duplication in netdowns.

Table 23. Known archaeological sites in the Okanagan TSA

Gross land base (hectares)	CFMLB	THLB
1,012	Yes	Yes

Data source and comments:

WHSE_ARCHAEOLOGY.RAAD_TFM_SITES_SVW

6.25 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 many 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 areas can be protected by using management practices such as winter logging. Finally, licensees receive information about cultural heritage sites through information sharing and consultation with First Nations, and are encouraged to work together with First Nations to develop plans, as appropriate, to mitigate impact to these sites.

On November 8, 2010 pursuant to Section 5(1)(e) of the Government Actions Regulation (GAR) of the *Forest and Range Practices Act*, a portion of Wap Creek was identified as a cultural heritage resource feature, as it is culturally important to the Secwepemc people. No specific management measures were established under this order, however, forest activities must consider the cultural importance of this area. In the base case analysis, this resource feature is not modeled as a forest management constraint.

During the 2017 field season FREP monitoring will include cultural heritage assessments; the next timber supply should document the results of monitoring.

First Nations have identified that sacred or traditional areas are a key value to consider during an AAC determination. Sacred or traditional areas are expected to be significantly larger than archaeological sites. An assessment of identified sacred or traditional areas will be completed and made available to First Nations as part of the consultation process. This assessment, including information received from First Nations with respect to the assessment and their interests will be presented to the chief forester as part of the AAC determination. It is important to note that the chief forester in her AAC determination cannot make land-use decisions with respect to First Nations sacred or traditional areas.

6.26 Growth and yield permanent sample plots 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 within the Okanagan TSA, 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 before releasing the plot from study.

FLNR FAIB staff identified that a buffer with a 68 metre radius would be reasonable to associate on average with each plot. For the current timber supply analysis, the area of these sites will be presented but the PSPs will be included in the THLB because of the small land base affected.

Resource features have been identified for two research areas: Sicamous Creek Research Area and Upper Penticton Creek Research Area. An order to identify both areas as a resource feature was established on January 16, 2015 pursuant to Section 5(1)(c) of the Government Actions Regulation. As harvest is allowed in these research areas, if the harvest meets the research objectives, these areas will be included in the modelled THLB.

Timber supply impact assessment supporting the above ordered suggested a 600-900 cubic metres per year allowable annual cut impact in the first decade for the Sicamous Creek Research Area and 1200-1700 cubic metres per year in the first decade for the Upper Penticton Creek Research Area.

The Ministry of Environment maintains seven snow pillows in the TSA. Each location requires about 10 square metres for the station. With an estimated buffer of 50 metres radius around each location, the total area for seven stations is five hectares. Given the small impact to timber supply, these snow pillows will not be modelled in the base case.

Table 1. Growth and yield permanent sample plot and research installations in Okanagan TSA

Installations	Gross land base (hectares)	CFMLB	THLB
GY PSP	259	Yes	Yes
Sicamous Creek Research Area	1 549	Yes	Yes
Upper Penticton Creek Research Area	2 949	Yes	Yes
Other research installations	604	Yes	Yes
Snow pillows	5	Yes	Yes

Data source and comments:

BCGW file WHSE_FOREST_VEGETATION.GRY_PSP_STATUS_ACTIVE,
WHSE_FOREST_VEGETATION.RESPROJ_RSRCH_INSTLTNS_GOV_SVW and
WHSE_WATER_MANAGEMENT.SSL_SNOW_PILLOW_LOCATION_SVW.

7. Current Forest Management Assumptions

7.1 Harvesting

7.1.1 Recent harvest performance

Effective February 29, 2012, the AAC for the Okanagan TSA became 3.1 million cubic metres. The AAC has no partitions. The following table provides a five year summary of AAC, the total volume harvested in the Okanagan TSA. The reported total volume harvested includes grade 4 credit volumes (see Section 7.1.6) that are not counted against a licensee AAC.

Table 25. Allowable annual cut billed in the Okanagan TSA from 2012 to 2016

Year (June to May)	AAC (m ³)	Total volume harvested (m ³)
2012	3 100 000	3 495 547
2013	3 100 000	2 940 669
2014	3 100 000	3 256 292
2015	3 100 000	3 357 841
2016	3 100 000	3 101 196
Total	15 500 000	16 151 545

7.1.2 Merchantability specifications

The Interior Timber Merchantability Specifications of the *Interior Appraisal 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 minimum diameter (outside bark) at stump height.

For yield table projections in the timber supply analysis, the specifications for minimum stump diameter are converted to a corresponding breast height diameter (Table 2).

Table 2. Harvest merchantability specifications within the Okanagan TSA

Analysis unit	TSR Modelled	Merchantability Specification		
	Corresponding minimum DBH (cm)	Minimum diameter at stump height (cm)	Maximum stump height (cm)	Minimum top DIB (cm)
Pine	12.5	15.0	30	10
Cedar > 141 years	17.5	20.0	30	15
All other	17.5	20.0	30	10

Data source and comments:

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

7.1.3 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 90% of the 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 150 cubic metres per hectare by that age; if the 150 cubic metres per hectare threshold is not reached, the minimum harvestable criteria will be the age that 150 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 might use younger stands. Sensitivity analyses investigate lowering and raising the minimum harvestable criteria.

A sample of all cutting permits within the Okanagan TSA submitted into the ministry database Electronic Commerce Appraisals System (ECAS) from January 2012 to April 2017 shows BCTS and licensees harvesting a minimum of 156 cubic metres per hectare, a maximum of 799 cubic metres per hectare, and an average of 350 cubic metres per hectare.

7.1.4 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.

The mountain pine beetle epidemic peaked in 2008 within the TSA and are now endemic therefore harvest scheduling priority in the base case is modelled as the traditional relative oldest first harvest priority. As a sensitivity option, concentrated harvest in the north of the TSA will be investigated to address a concern about greater harvest in the north of the TSA as identified during discussion with First Nations.

7.1.5 Log grade definition

On April 1, 2006 updated 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).

The growth and yield model VDYP, that is used for projection of the volume of existing natural stands does not include dead potential volumes. As such, VDYP based volume tables underestimate the projected volumes.

The inventory audit data from 2010 indicated that dead potential volume was about five% of the green volume for stands older than 60 years. Data from the provincial harvest billing system for the period 1995 to 2004 show that grade 3 endemic and grade 5 totalled about 8%% of the cut-accountable volume. In the 2012 rationale the chief forester concluded that the short- and mid-term harvest levels projected in the base case were underestimated by about 5%.

Information, including the 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.

7.1.6 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.

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

7.2 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.

7.2.1 Silvicultural systems

For the base case all stands will be modelled using a clearcut silviculture system assumption. OSNRD expects an increase in the use of partial or selection silviculture systems as licensees move from MPB harvest to areas such as the dry belt.

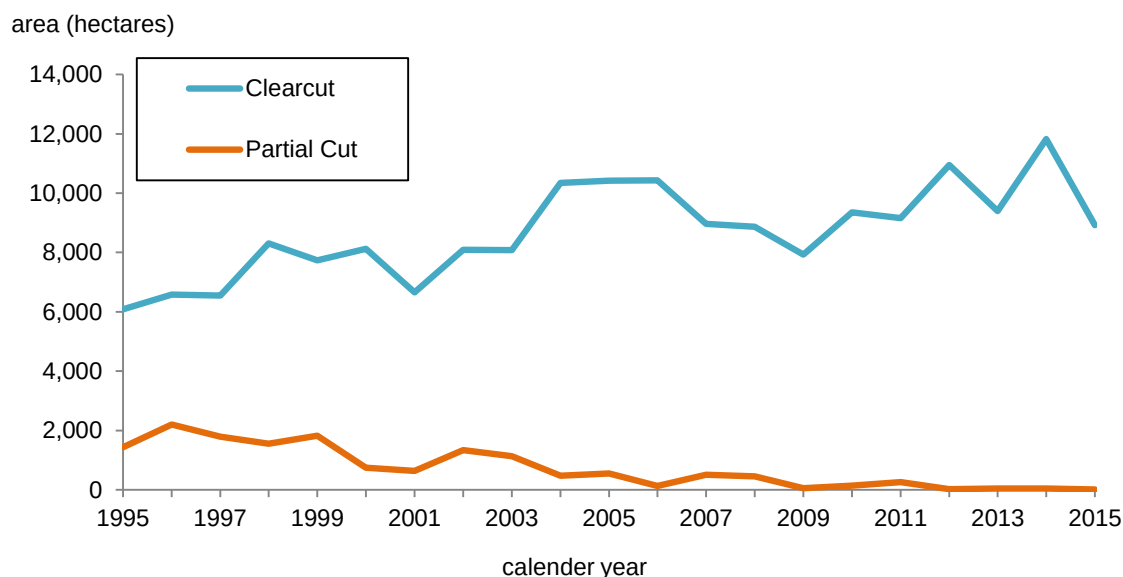


Figure 2. Silviculture systems in the Okanagan TSA.

7.2.2 Dry belt zone

OSNRD staff requested that a dry belt zone factor be added to the data package to better understand the dry belt zone and harvesting that may occur within it. A selection harvest system within the zone is desired given regeneration can be more difficult than in moister biogeoclimatic zones. OSNRD staff provided a definition of dry belt zone which included both dry and very dry zones in the bunchgrass, interior Douglas-fir and ponderosa pine biogeoclimatic zones. The total area of the dry and very dry belt zone is 617 429 hectares of which 3443 hectares (< 1%) has been harvested.

Predictive ecosystem mapping² (PEM) was completed in the Okanagan TSA. The table below indicates that very little to no harvest occurs in the very dry bunchgrass and ponderosa pine zones however about 1% of the interior Douglas-fir very dry zone has been harvested between 2010 and 2014. A sensitivity analysis will be conducted that applies a volume decrease of 50% to the dry belt zone.

Table 27. Dry and very dry belt zones in the Okanagan TSA

Dry belt zone by BEC in the Okanagan TSA ³						
Biogeoclimatic zone	Code	Subzone code	Dry or very dry belt zone	Area (hectares)	Area harvested between 2010 and 2014 (hectares)	Percent harvested
Bunchgrass	BG	xh1	Very dry	30 542	0	0%
Interior Douglas-fir	IDF	dk1, dk1a, dk1b, dk2, dk2b, dm1	Dry	192 029	2 483	1%
Interior Douglas-fir	IDF	xh1, xh1a, xh2, xh2a	Very dry	252 376	960	<1%
Ponderosa Pine	PP	xh1, xh1a, xh2	Very dry	142 482	0	0%

A review of RESULTS for current harvest levels indicates that over a five-year period, from 2010 to 2014, there were 2522 hectares of dry or very dry belt zone harvested. An average of 105 hectares is partially harvested and 400 hectares is clearcut annually within the zones. During the same five year period a total area of 67 373 hectares, or 13 475 hectares annually, was harvested in the TSA. As less than one percent of the area harvested is partial cut, the analysis will model all stands as clearcut silviculture systems.

7.2.3 Regeneration impediments

Forest licensees are required to reforest harvested stands. In the Okanagan 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.

² Okanagan TSA Predictive Ecosystem Mapping (PEM) Compilation Project Final Report. March 05, 2010. Timberline Natural Resource Group Ltd.

³ Ted McRae, DOS Stewardship Officer. Email Feb 14/17.

A delay will 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 slightly less than two 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 is 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.

A RESULTS query indicated that in 2015 there were 834 hectares of direct seeding using B class seed in the TSA and an expected increased area of direct seeding in 2016. As the area of direct seeding is limited at this time no consideration for this regeneration method will be considered in the base case. It is recommended that this issue be re-examined in the next TSR to determine the extent of the area and characteristics of the regeneration stands (e.g., timeline for establishing stands, seedling distribution) and whether the base case analysis should address direct seeding within modelled yield tables.

7.2.4 Immature plantation history

The young stand monitoring (YSM) program (an independent random sample of permanent sample plots) was established in 2012 with the intent to check the accuracy of the growth and yield predictions (assumptions) of key timber attributes of young stands used in the timber supply review of a management unit. The program started with high-risk units affected by the MPB infestation.

The YSM program targets 15- to 50-year-old stands that are likely to contribute to a management unit's future timber supply. The attributes collected include height, site index, density, diameter, basal area, basal area growth, gross/net merchantable volume, five-year gross/net merchantable volume, pest and disease incidence, and tree mortality and cause. Between 2014 and 2015 the YSM program established 45 ground samples in the Okanagan TSA. The YSM growth data were projected to rotation and compared against the previous TSR volume projections. For the Okanagan TSA, the TSR volume projections fall within YSM's 95% confidence interval; therefore it is reasonable to assume that young stands will meet TSR expectations at rotation.

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.

7.2.5 Not satisfactorily restocked (NSR) areas

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. In the previous TSR approximately 300 hectares of backlog NSR in the Okanagan TSA were identified. A recent review indicated there were 58 hectares of backlog NSR remaining in the Okanagan TSA, however, those areas were reviewed by the district and were found to be stocked or were reclassified in RESULTS. As such, no consideration will be made for backlog NSR given the low amount present. Volume projections for these stands will be based on the VRI attributes and projections with the growth and yield model VDYP.

7.2.6 Incremental silviculture

Incremental silviculture practices are activities that provide benefit to stands beyond the practices required to meet basic silviculture obligations such as juvenile spacing and fertilization. In the Okanagan TSA during 2011-2015, spacing (primarily mechanical mulching in dense pine) was carried out over 200 hectares. No operational fertilization, pruning, or other enhanced treatment were carried out and documented in the RESULTS database. Although some limited spacing is expected in the future, it is expected that the level of incremental silviculture will remain 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.

7.3 Integrated resource management

The Crown forests of the Okanagan 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 Okanagan TSA. This process resulted in a provincially approved Land and Resource Management Plan (OSLRMP) in 2001.

A Land Use Order for the Okanagan-Shuswap was approved in 2007 and created 11 legal objectives that applied to: basic levels of coarse woody debris areas, basic and enhanced levels of coarse woody debris areas, intensive recreation areas, regionally significant trail corridors, tourism areas, elk areas, marten areas, fisher areas, bighorn sheep areas, all of the OSLRMP area, and Williamson's sapsucker.

Within the Okanagan TSA all approved FSPs prepared by major forest licence holders are required to state results and strategies that meet the 11 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.

7.3.1 Forage supply and livestock use

Managing and conserving range and forest resources to encourage maximum productivity of these resources while maintaining healthy ecosystems are important in meeting the economic and social objectives of BC. Growing trees and forage together on cutblocks helps to sustain a viable and competitive beef industry in addition to the forest industry. Livestock grazing on cutblocks can be successfully integrated through effective livestock management and obstacle tree planting. With successful integration there is minimal to no impacts to timber supply.

Forage supply is directly correlated with timber supply in forested areas. Forage opportunities can increase for the first 10 to 15 years after timber harvesting with the increase of native forage species or with domestic forage species through seeding cutblocks in wetter forest types where native species are less palatable. Forage supply can be negatively impacted by the timing of timber harvesting where a consistent forage supply is not maintained over the timber rotation within grazing areas. In wetter forest types, timber harvesting practices often result in high slash/debris levels that restricts livestock access and minimal soil exposure that precludes the use of forage enhancement to meet forage supply objectives. Encouraging timber harvesting practices that meet forage supply and livestock use objectives is critical in many range areas to avoid forage shortfalls and maintain a viable beef industry.

The objective of including forage supply as a factor in this TSR is to recommend that forage supply objectives for livestock and wildlife be incorporated into future TSRs to encourage timber harvesting practices that promote forage supply to meet district forage supply objectives. The District's approved forage strategy and forage supply objective of 95 000 AUMs. In order to achieve the forage objective, the district has been working with licensees to selectively strip harvest and grass seed through a range of BEC zones in the TSA. At this time the area affected is limited; however this issue should be re-examined in the next TSR to determine the extent of the area and impact to the THLB.

7.3.2 Adjacency, green-up, and patch size distribution

Regulations are identified within FPPR Section 65 to address harvesting adjacent to another cutblock and Section 64 addresses maximum cutblock size. The general practice is that new cutblocks are to be at least two tree lengths from existing cutblocks that have not met stocking and height requirements. Further qualifications relate to distance from groups of reserved trees, basal area retention, and forest health exclusions.

As a surrogate to the spatial adjacency requirements, adjacency requirements will be modelled based on a maximum disturbance of 30% on the THLB for a landscape unit BEC subzone combination permitted to be below two metres height. This requirement applies only to THLB not otherwise constrained by another management objective (e.g., visuals, ungulate winter range).

The Okanagan 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.

During the recent mountain pine beetle infestation, adjacency requirements were relaxed for forest health needs under Section 65 (4) of the FPPR of the *FRPA*, resulting in larger cutblocks. The OSNRD district manager expects cutblock size to decrease from the current average cutblock size of 105 hectares as licensees move from MPB harvest into areas with constraints such as visuals, wildlife and dry sites. No modelling considerations for this MPB period relaxation will be included in the base case.

Current research in flat pine dominated forests on hydrologic recovery curves⁴ indicates that the two metres minimum hydrological recovery height for regenerating stands is not sufficient and that five metres should be the minimum recovery height. The five metres minimum recovery height is not legislated nor has it been provided as guidance by designated decision makers to licensees therefore it is not current practice. However in a post-MPB environment, hydrological recovery is a concern therefore a sensitivity analysis will be conducted that replaced the above modelling surrogate with 30% maximum disturbance under five metres.

7.3.3 Community watersheds

Water in community watersheds is a value identified under the *Forest and Range Practices Act*. Under *FRPA*, licensees are required to specify results and strategies that meet the objective set by government for water quality. Objectives for water in community watersheds are established under Section 8.2 of the *Forest Planning and Practices Regulation* of the *FRPA*.

There are 57 designated community watersheds within the Okanagan TSA covering 358 371 hectares. Management constraints for community watersheds are not standardized but are typically based on hydrological assessment of the watershed. At present, licensees in the Okanagan TSA have FSP commitments requiring them to complete hydrologic assessments and to abide by the recommendations of the assessment.

In the previous TSR that reflected management in light of the mountain pine beetle infestation, the modelled constraint permitted harvesting to exceed 30% equivalent clearcut area (ECA) in community watersheds that were lodgepole pine-leading with MPB infestations. In community watersheds, that were non-lodgepole pine-leading, the modelled IRM constraint was modelled simply as a maximum of 30% of the THLB could be less than two metres. However, in earlier TSR, harvest was more restrictive as a maximum disturbance of 30% of stands less than six metres was applied.

⁴ Extension Note 116. Revised Snow Recovery Estimates for Pine-dominated Forests in Interior British Columbia. September 2015.

In the current base case community watersheds will be simply modelled by restricting harvest to a maximum disturbance of 30% permitted to be below six metres in height within the community watershed boundaries. As sensitivity analysis, a maximum disturbance of 30% of the THLB being less than two metres will also be applied.

Table 28. Community watersheds within the Okanagan TSA

Community watersheds	Gross land base (hectares)	CFMLB	THLB
Affleck Community Watershed	373	Yes	Yes
Alocin Community Watershed	388	Yes	Yes
Anglemont Community Watershed	133	Yes	Yes
B.X. Community Watershed	7 078	Yes	Yes
Bass Community Watershed	258	Yes	Yes
Bastion Community Watershed	1 135	Yes	Yes
Brash Community Watershed	3 093	Yes	Yes
Chute Community Watershed	1 889	Yes	Yes
Coldstream Community Watershed	6 680	Yes	Yes
Corning Community Watershed	3 024	Yes	Yes
Duteau Community Watershed	21 275	Yes	Yes
East Canoe Community Watershed	1 988	Yes	Yes
Ellis Community Watershed	15 292	Yes	Yes
Farleigh Community Watershed	2 154	Yes	Yes
Fortune Community Watershed	4 277	Yes	Yes
Glanzier Community Watershed	850	Yes	Yes
Gordon Community Watershed	2 013	Yes	Yes
Hobson Community Watershed	323	Yes	Yes
Hope Community Watershed	153	Yes	Yes
Hudson Community Watershed	438	Yes	Yes
Hydraulic Community Watershed	9 379	Yes	Yes
Irish Community Watershed	865	Yes	Yes
Kelowna Community Watershed	7 657	Yes	Yes
Kendry Community Watershed	430	Yes	Yes
Keremeos Community Watershed	121	Yes	Yes
King Edward (Deer) Community Watershed	2 031	Yes	Yes
Klim Community Watershed	4	Yes	Yes
Klo Community Watershed	4 974	Yes	Yes
Kruly Community Watershed	385	Yes	Yes
Lambly Community Watershed	22 412	Yes	Yes
Maid Community Watershed	486	Yes	Yes
Meighan Community Watershed	389	Yes	Yes
Mission Community Watershed	60 153	Yes	Yes
Naramata Community Watershed	3 387	Yes	Yes
Newsome Community Watershed	1 810	Yes	Yes
Norris Community Watershed	170	Yes	Yes
Olalla Community Watershed	2 666	Yes	Yes
Oyama Community Watershed	4 223	Yes	Yes
Peachland Community Watershed	12 470	Yes	Yes
Penticton Community Watershed	17 391	Yes	Yes
Pooley Community Watershed	1 869	Yes	Yes
Powers Community Watershed	13 596	Yes	Yes

Community watersheds	Gross land base (hectares)	CFMLB	THLB
Rancher Community Watershed	444	Yes	Yes
Robinson Community Watershed	1 942	Yes	Yes
Rose Valley Community Watershed	944	Yes	Yes
Shingle Community Watershed	4 550	Yes	Yes
Sicamous Community Watershed	6 487	Yes	Yes
Silver Community Watershed	1 739	Yes	Yes
Skiing Brook Community Watershed	122	Yes	Yes
Swayne Community Watershed	12	Yes	Yes
Trapping Creek community watershed	38	Yes	Yes
Trepanier Community Watershed	23 437	Yes	Yes
Trout Community Watershed	69 650	Yes	Yes
Vernon Community Watershed	8 568	Yes	Yes
Wade Community Watershed	8	Yes	Yes
Wiseman Community Watershed	529	Yes	Yes
Total	358 372		

Data source and comments:

BCGW file: WHSE_WATER_MANAGEMENT.WLS_COMMUNITY_WS_PUB_SVW.

7.3.4 Other watersheds

Hydrological assessments may be completed by licensees in watersheds other than formal community watersheds. The regional hydrologist has indicated that ability to harvest in watersheds requiring assessments may be limited in the near future if the newly recommended five metres recovery height of regenerating stands and increased harvest for MPB over the last decade.

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.

7.3.5 Ungulate winter range

The Okanagan TSA includes critical winter range for several ungulate species. The Okanagan LRMP identified the location of important habitat and measures to minimize adverse impact and for maintaining or increasing forage. The LRMP also identified the need for movement corridors, security cover, and reduction of conflict with recreational users. These values were identified for California bighorn sheep, elk, moose, mountain caribou, mountain goat, and mule deer. Discussion on mountain caribou is addressed in a separate section.

Subsequently ungulate winter ranges (UWR) and general wildlife measures are formally established within the Okanagan TSA under various GAR Orders for Mule Deer, Mountain Goat and Moose and Mountain caribou. In the base case scenario the objectives for ungulate winter range will be modelled as constraints to the THLB.

- U-3-003 (Mule Deer) will not be addressed in the base case as only 15 hectares of the unit is in the Okanagan TSA while 280 123 hectares is in the Merritt TSA.
- U-8-001 (Mule Deer) established in 2006 identifies 12 general wildlife measures. The primary modelling considerations is to maintain the identified snow interception cover retention percentage consistent with age requirement identified in Table 30 by planning cell.
- U-8-005 (Mountain Goat) established in 2006 identifies five general wildlife measures. This UWR is primarily in the non-THLB however the area within the THLB, less than 1000 hectares, will be modelled as a minimum retention of 33% of stands older than 100 years.
- U-8-006 (Moose) established in 2006 identifies six general wildlife measures. Modelling will constrain each moose unit to have at least 33% of the gross forested area maintained as mature cover in stands 16 metres or taller. If these conditions cannot be met then the model will choose from the next lower classes to meet the conditions. Modelling will also constrain each moose unit in ICH and IDF units to have a minimum 15% of the CMFLB less than 25 years and MS and ESSF units to have a minimum 15% of net forested land base less than 35 years.

Table 29. Ungulate winter range in the Okanagan TSA

Ungulate winter range number	Species	Gross land base (hectares)	Modelled	CFMLB	THLB
u-3-003	Mule Deer	15	No	Yes	Yes
u-8-001	Mule Deer	397 385	Yes	Yes	Yes
u-8-005	Mountain Goat	49 821	No	Yes	Yes
u-8-006	Moose	323 167	Yes	Yes	Yes

Table 3. Snow interception cover attributes by snowpack zones

Snowpack zone	Biogeoclimatic units	Constraint		
		Dominant tree species	Minimum stand age (years)	Canopy closure
Shallow	BG PP IDFxh	Douglas-fir	Not less than 140	None specified Small patches, clumps or 'vets' acceptable
Moderate	IDFdk IDFdm IDFmw MS ICHdw	Douglas-fir	IDFmw - not less than 140 All other units - not less than 175; or not less than 40cm dbh	At least 36%
Deep	ICH (except ICHdw)	Douglas-fir	Not less than 100, or not less than 40cm dbh	At least 46%

Data source and comments:

BCGW file: WHSE_LANDUSE_PLANNING.RMP_PLAN_LEGAL_POLY_SVW on 10 July 2014.

7.3.6 Visual quality objectives

Visual quality is one of the 11 values to be managed under the *Forest and Range Practices Act*. On October 1st, 2001 the Vernon, Salmon Arm, and Penticton Forest District managers made it known to the licensees that the Zone 1 visual zone was a “scenic area” with established visual quality objectives via Sections 180(c) and 181 of FRPA. Zone 2 was to be a non-scenic area with no visual quality objectives. Zone-3 required visual management in the foreground for recreational use (e.g., trails).

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% alteration ranges for each VQO modified by Visual Absorption Capability (VAC) rating of each visual polygon (Table 31). This approach is preferred over a single% alteration for each VQO to better reflect the wide variation in landscape conditions.

Table 31. Assignment of visual quality objectives by planimetric view and visual absorption capability (VAC)

Established VQO	Gross land base (hectares)	% alteration by VAC (planimetric view)		
		Low	Medium	High
Preservation	12 628	0.17	0.50	0.83
Retention	141 171	2.0	3.0	4.0
Partial retention	432 046	6.7	10.0	13.3
Modification	190 039	16.7	20.0	23.3

Data source and comments:

BCGW file: WHSE_FOREST_VEGETATION.REC_VISUAL_LANDSCAPE_INVENTORY.

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

The procedures also identified determining a weighted visually effective green-up (VEG) height for each visual unit based on slope classes (Table 32). 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 three metres m to demonstrate a lower bound of VEG height.

Table 32. 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 (metres)	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 source and comments:

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

7.4 Forest Health

7.4.1 Mountain pine beetle

The mountain pine beetle infestation in the interior of BC started in 1999 and peaked in 2005 resulting in the death of over 700 million cubic metres of merchantable pine volume in British Columbia. The infestation reached the Okanagan TSA in 2002 and peaked in 2008. By 2016 the currently affected areas were down to 903 hectares in scattered patches of trace or light infestation, along the eastern boundary of the Okanagan TSA. FAIB projections, based on the BCMPBv13 model, suggest that about 10 000 000 cubic metres or 17-18% of the pine volume that existed in 1999 inventory of the Okanagan TSA has been killed.

The 2016 projection of the VRI used in this analysis includes adjustments for the MPB infestations and provides separate live and dead layers. The dead layer was created based upon the provincial mountain pine beetle model that uses aerial survey information of the infestation. The live layer updates the attributes of the VRI to reflect the mortality contained in the dead layer.

Pine trees impacted by MPB start to degrade upon death. The loss of quality affects the value of the timber and the products that may be produced from the fibre. It is generally accepted that the quality of the wood from infested trees moves from dimension lumber quality through to pulp and secondary products, such as biofuels, in the years following death.

Shelf life is the length of time since death during which a specific merchantable product can be produced from the dead pine. It is dependent on several factors, including market access and conditions, and available milling technology. In this analysis shelf life is defined as the time a stand (or portion of a stand) remains economically viable for sawlog harvesting.

In the previous TSR a specific shelf life was not provided instead pine volumes were reported in the model according to its year of death. In this TSR shelf life will be assumed to be 10 years. The base case will use the MPB submodel of the spatial timber supply model (STSM) to model the harvest and shelf life of standing dead stands. Further sensitivity analysis will explore declining merchantability from time since death. Although MPB mortality due to the recent epidemic is captured in this analysis, endemic losses into the future are not captured; future TSRs will include MPB endemic losses in the non-recoverable losses section.

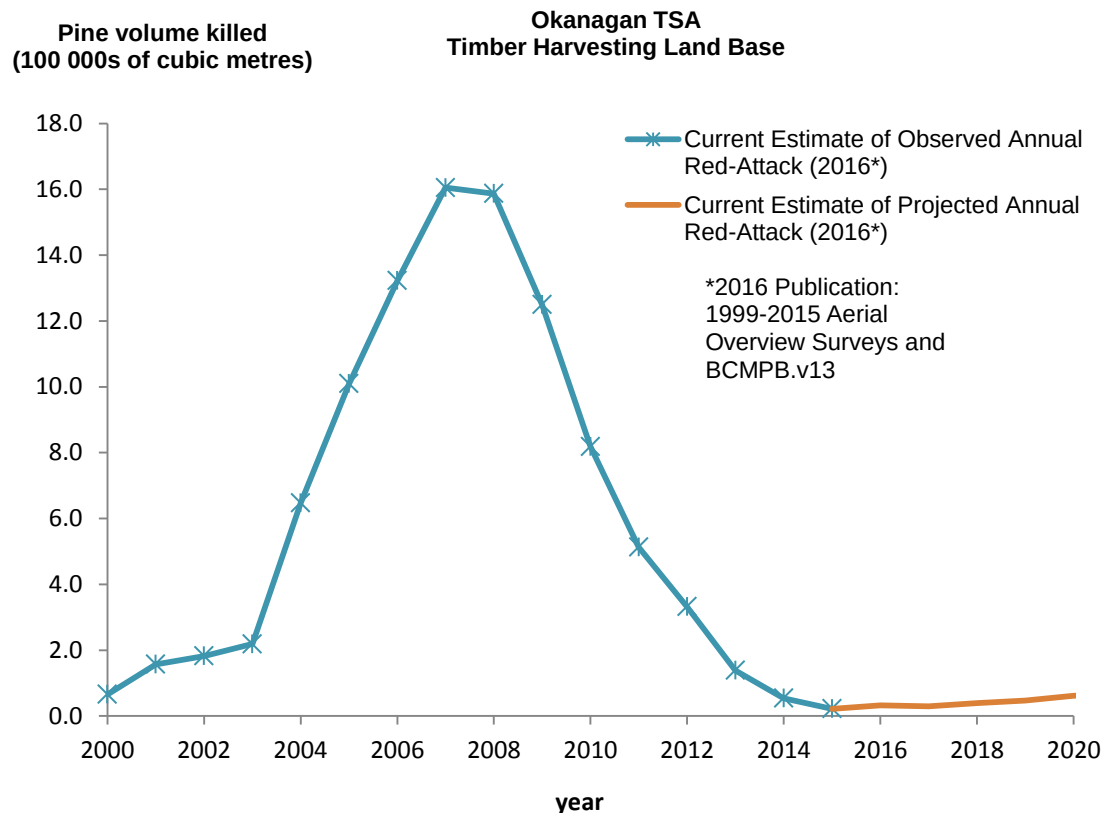


Figure 3. Observed and projected annual volume of pine killed by Mountain pine beetle (red attack)

Data source and comments:

Documents and data sets for the FLNR provincial level projection of the current mountain pine beetle outbreak are found at www.for.gov.bc.ca/hre/bcmpb/.

7.4.2 Other forest health issues

Many forest health damaging agents are present within the Okanagan 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 2016 the aerial overview surveys of the Okanagan TSA indicated:

- Increased patch areas (1634 hectares) of Douglas-fir beetle;
- Western balsam bark beetle continues to affect subalpine fir at high elevation areas (80 019 hectares) across the TSA. However infestation incidence remains at trace to light levels;
- Spruce beetle activity remains static (110 hectares primarily in the south west area of the TSA);
- Mountain pine beetle activity is down to 903 hectares of attack;
- Defoliation from western spruce budworm remains very low (16 hectares);
- Dothistroma needle blight damaged 184 hectares of lodgepole pine plantations; and,
- A number of interface fires burned in the TSA in 2015 (Testalinden, west of Oliver) was over 4500 hectares however only a small area was burned in 2016.

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

In the timber supply analysis, the timber supply impact of an endemic level of pests is modelled through both the volume tables (e.g., empirical basis of growth and yield model VDYP and operational adjustments in TIPSy) and the identification of non-recoverable losses. Additional information sources such as young stand monitoring and stand density monitoring, as well as advice from forest health experts are presented to the chief forester for consideration.

7.4.3 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 incorporated within growth and yield model projections or epidemic losses specifically modelled (such as how the MPB epidemic was modelled in past timber supply reviews).

For the Okanagan TSA timber supply analysis these future non-recoverable losses are accounted for by estimating an average annual non-recoverable loss and deducting this amount from the harvest projection throughout the planning horizon of the TSR (Table 33). Values were calculated based on procedures outlined by the FLNR Resource Practices Branch. MPB mortality is captured in this analysis however endemic losses into the future are not captured; future TSRs will incorporate MPB into non-recoverable losses.

Table 33. *Estimated average non-recoverable losses in the Okanagan TSA. Mountain pine beetle is modelled separately*

Cause of loss	Annual unsalvaged loss (m ³ /year)
Spruce Bark Beetle	2 401
Douglas-fir Bark Beetle	7 641
Balsam Bark Beetle	5 975
Drought	5 027
Wildfire	20 056
Total	41 100

8. Growth and Yield

8.1 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 known regeneration characteristics.

To enable modelling of the volume available from a forest stand over time, volume tables are created based on common forest stand inputs, growth characteristics, and the most suitable growth and yield model. Volume tables where detailed input information is available may be based on information at a forest polygon or silvicultural opening level; however, where detailed information is not available (e.g., for future stands) a volume table may reflect an aggregation of stands. The current analysis will make greater use of existing silviculture survey information at a stand level than have been used in past timber supply reviews.

8.2 Growth and yield models

8.2.2 Variable density yield prediction model (VDYP7)

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

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

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

8.2.3 Table interpolation program for stand yields (TIPSy)

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

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

In the analysis, TIPSy version 4.4 is expected to be used. This version uses a database of TASS II generated yield tables.

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

The Tree and Stand Simulator, version TASS II, developed by FLNR, is an individual tree level model for commercial species of British Columbia. TASS predicts the potential growth and yield of even-aged and single species stands by modelling individual tree crown dynamics and the crown relationship to bole growth and wood quality. The individual tree and crown focus makes TASS well suited for predicting the response to many silviculture treatments and the exploration stand dynamics. TASS III is a recently released version, with limited species, that extends TASS into more complex stand structures and multiple-species and multi-age cohorts.

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

8.3 Volume table types

Volume table types are determined by (1) if and when a stand is harvested; and, (2) the source and the availability information for regeneration, forest inventory and management.

Volume tables for stands that have not been harvested are to be modelled with VDYP using input from VRI attributes for the stands. These volume tables are often referred to as existing natural stands.

All existing stands that have a history of harvesting or stands harvested in the future will be modelled with TIPSy where appropriate input information is available. The following descriptions provides a generalization of the derivation of different harvested stand volume table types; however given the complexity of the information sources, the descriptions are unlikely to fully describe all volume table types.

- For stands harvested prior to the 1987 legislated requirements for basic silviculture the TIPSy species composition will be based on the VRI species composition aggregated within an opening and a natural regeneration method⁵.
- For stands harvested between 1987 and 2017⁶ with RESULTS information showing planting, the TIPSy species composition will be based on an aggregation of the RESULTS planting record within an opening and a TIPSy planted regeneration method will be used.
- For stands harvested between 1987 and 2017 with RESULTS information showing natural regeneration, the TIPSy species composition will be based on an aggregation of the VRI species composition within an opening and a TIPSy.
- For stands harvested between 1987 and 2017 where RESULT information is missing, the TIPSy species composition will be an aggregation from either VRI or RESULTS dependent on information identifying if regeneration method was natural or planted.
- For stands harvested in the future, the TIPSy species composition for planted stands will be an aggregation of RESULTS planting records over the last seven years to the BEC subzone level and for natural stands the TIPSy species composition will be an aggregation of VRI information over the last 10 years to the BEC subzone level.

⁵ 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 be best reflected by a TIPSy natural distribution.

⁶ Due to information entry lags some stands harvested in 2017 might not have been updated.

8.4 Site index

Site index, for a reference age of 50 years, is the most common measure of forest site productivity used in British Columbia. The growth and yield models TASS and TIPSy require potential site index as a required input to develop volume tables.

The Ministry has developed formalized standards for deriving site index for the potential productivity of a site. Site indices based on simpler methods (e.g., age and height relationships for forest inventory photo classification) often have biases such that the potential site index is not found.

For the base case scenario, potential site indices are derived from the FLNR provincial layer of site productivity. In the Okanagan TSA, the provincial layer is based upon SIBEC based site index estimates tied to site series from predictive ecosystem mapping (PEM). In the Okanagan TSA, a PEM had been completed and conditionally approved by the ministry for timber supply analysis in the Okanagan TSA for the “wet belt” and “dry belt” zones. This PEM was completed by licensees under the Innovative Forestry Practices Agreement program,

To understand the importance of potential site index to the timber supply, a sensitivity analysis changes the site index plus and minus two metres.

Data source and comments:

Site_Prod_Okanagan.gdb provided by Graham Hawkins, FAIB. Also available as FLNR Provincial Site Productivity Layer TEM/PEM-SIBEC and Biophysical Analysis (version 5.0 April 6, 2016) from https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/stewardship/forest-analysis-inventory/site-productivity/flnr_provincial_site_productivity_layer_v5_final_2016.pdf.

8.5 Tree improvement

Licensees are obliged to use the best available seed source when regenerating sites with planted stock. Planted stock may have faster growth than natural trees that 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 Forest Improvement and Research Management Branch (see <https://www2.gov.bc.ca/gov/content/industry/forestry/managing-our-forest-resources/tree-seed/seed-planning-use/spar>). RESULTS information provides a seed source for individual plantations and thus enables linkage to the genetic gain database.

Genetic worth is used as input into the growth and yield model TIPSy for stands where regeneration type is planted. The applicable genetic worth will be calculated based on the aggregation assigned to the volume table. No modelling considerations are made for expected future improvements in genetic worth.

8.6 Operational adjustment factors

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

In TIPSy, there are two operational adjustment factors (OAFs) that are used to modify the potential yields. These OAFs differ in their application. OAF 1 is a static reduction across all time periods and may reflect non-productive openings within a forest. OAF 2 is dynamic reduction that increases over time and may reflect a forest health issues that increases as a stand ages. Standard OAFs values of 15% for OAF 1 and 5% for OAF 2 are utilized unless localized OAFs have been developed.

In the previous TSR the chief forester accepted a non-standard OAF 2 value OAF 2 in Douglas-fir leading stands to account for higher incidence of *Armillaria* and instructed that work be completed on refining this value. Localized OAF 2 work has not been done but as these stands are recognized by pathologists to have increased *Armillaria* root rot an OAF 2 of 10% will be utilized in these stands.

OAF 1 of 15% and OAF 2 of 5% will be utilized except in Douglas-fir and cedar-leading stands.

In addition, a sensitivity analysis will be completed within the moist ICH Douglas-fir leading stands to model “clumped” rather than “natural” spatial distribution pattern to further assess the impact of *Armillaria* volume losses on timber supply. It is believed that “clumped” distribution more closely simulates the currently observed distribution pattern of *Armillaria* tree mortality.

9. Forest Estate Modelling

9.1 Forest estate model

The SELES Spatial Timber Supply Model (STSM) will be used for this analysis. STSM is a model developed using the Spatially Explicit Landscape Event Simulator (SELES). STSM has been used for the TSR timber supply analysis of multiple management units. The model will be set to examine spatial forest inventory data on an one-hectare grid level.

9.2 Base case scenario

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

For the current TSR in the Okanagan 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 is selected, that in conjunction with sensitivity analyses, to represent timber supply dynamics.

9.3 Sensitivity analysis

Sensitivity analysis can help to understand the implications of uncertainty around data and management assumptions and can be used to determine which variables have the greatest influence on harvest forecasts. Specific issues can also be investigated to enhance understanding of possible impacts on timber supply. Table 34 lists the base sensitivity analyses to be performed. Further sensitivity analyses may be completed as needs are identified.

Table 34. 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.
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.
Harvest priorities	Alternative harvest priorities available within the timber supply model.
Shelf life of MPB-killed timber	Higher and lower decay rate assumptions of +/- 5 years for shelf life will be explored.
Site productivity for older stands	Change site index by +/- 2 m.
Terrain stability	Sensitivity to account for conservative approach to identifying potentially unstable areas. Account for up to a potential 20% reduction to harvest in potentially unstable classes P and IV. Also 20% of DOS does not have terrain stability mapping.
Problem forest type	Problem forest types will not be excluded from the THLB.
Natural disturbance	Sensitivity to account for natural disturbance in the landscape.
Williamson's Sapsucker	Implication of implementing critical habitat protection.
Mountain caribou	Implication of implementing critical habitat protection and of current management practices on habitat disturbance levels in caribou range.
Hydrological recovery	Maximum disturbance of 30% on the THLB for a landscape unit BEC subzone combination permitted to be below two metres in height.

10. Associated Analysis and Reporting

The primary focus of the TSR will be to develop a timber supply analysis of the current TSA land base and forest management practices. The data package is an initial document that describes available information and the direction for future analysis and information collection. The following work will be completed to and reports will be prepared.

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 discussion paper, further analysis may be needed to complete, refine existing analysis, or address issues identified during the consultation and review process.

A public review period has been established to allow submission of comments and concerns about the data package and subsequently the discussion paper to FLNR. Submissions and new information made available prior to the analysis may lead to changes in the data listed in this package. Until the timber harvesting land base (THLB) is determined, it is not possible to finalize the values shown in some of the tables in this document. The updated data package will incorporate the finalized values.

First Nations engagement and consultation is an important component of the information considered by the chief forester. Information received from First Nations timber supply review, where possible is incorporated into the data package and analysis. All information and comments received from First Nations are documented and presented in a summary document to the chief forester for consideration.

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

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12. 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 Okanagan TSA.

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

Your comments will be accepted until March 6, 2018 for consideration with respect to the data package. A further comment period will be made available following the release of a *Discussion Paper* that outlines the results of a timber supply analysis.

You may identify yourself on the response if you wish. If you do, you are reminded that responses will be subject to the *Freedom of Information and Protection of Privacy Act* and may be made public. If the responses are made public, personal identifiers will be removed before the responses are released.

For more information or to send your comments, contact:

Okanagan Shuswap Natural Resource District
Ministry of Forests, Lands, Natural Resource Operations and Rural Development
2501 – 14th Avenue,
Vernon, B.C. V1T 8Z1

Telephone: 250-558-1700

If you have any comments or questions, contact:

Jill Werk, Stewardship Forester
Okanagan Shuswap Natural Resource District
Ministry of Forests, Lands, Natural Resource Operations and Rural Development
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For information on the Timber Supply Review visit the Timber Supply Review & Allowable Annual Cut web site at <https://www2.gov.bc.ca/gov/content/industry/forestry/managing-our-forest-resources/timber-supply-review-and-allowable-annual-cut>

Further information regarding the technical details of the timber supply review process and timber supply analysis is available on request by contacting Forests.ForestAnalysisBranchOffice@gov.bc.ca