

Fort St. John Timber Supply Area Timber Supply Review

Data Package

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Table of Contents

1.	Overview of the Fort St. John TSA Timber Supply Review.....	4
2.	Introduction	5
2.1	Overview of the Fort St. John Timber Supply Area.....	5
2.2	First Nations	6
2.2.1	Treaties and treaty negotiations	6
3.	Current Forest Management Considerations and Issues.....	7
3.1	Base case management assumptions	7
3.2	Major forest management considerations and issues	7
3.3	Current allowable annual cut.....	9
4.	Inventories.....	10
4.1	Background information.....	10
5.	Division of the Area into Management Zones.....	13
5.1	Management zones and tracking of multiple objectives (grouping)	13
5.2	Analysis units	13
5.3	Small pine.....	14
5.4	Mixed-wood stands	14
5.5	Agricultural land reserve	14
6.	Timber Harvesting Land Base Definition	15
6.1	Non-forest.....	15
6.2	Land not administered by FLNR for TSA timber supply.....	15
6.3	Inoperable areas.....	16
6.3.1	Unstable terrain.....	16
6.3.2	High slope	17
6.3.3	Economically inoperable areas	17
6.4	Sites with low timber growing potential.....	17
6.5	Problem forest types	18
6.6	Cultural heritage resource reductions	18
6.7	Experimental and permanent sample plots.....	18
6.8	Established recreation sites and trails	18
6.9	Roads, trails and landings.....	19
6.10	Other linear features	20
6.11	Oil and gas imprint	20
6.12	Exclusion of specific, geographically defined areas	20
6.13	Ungulate winter range (UWR) reductions.....	21
6.14	Wildlife habitat area reductions.....	22
6.15	Riparian reserve zones.....	23
6.16	Range and wildlife burns.....	25

7.	Current Forest Management Assumptions	26
7.1	Harvesting	26
7.1.1	Harvest Priorities	26
7.1.2	Utilization levels.....	26
7.1.3	Incidental deciduous in managed coniferous stands	26
7.1.4	Minimum harvestable criteria	26
7.1.5	Logging method.....	26
7.1.6	Silvicultural systems	26
7.2	Mountain pine beetle	27
7.2.1	Shelf life.....	27
7.2.2	Unsalvaged MPB stands	27
7.3	Unsalvaged losses.....	27
7.4	Silviculture	28
7.4.1	Regeneration activities in managed stands	28
7.4.2	Not satisfactorily restocked (NSR) areas	29
7.4.3	Immature plantation history	29
7.4.4	Regeneration delay	29
7.5	Forest cover requirements	30
7.5.1	Objectives for visual resources	30
7.5.2	Objectives for landscape-level biodiversity	31
7.5.3	Objectives for stand-level biodiversity	32
8.	Sensitivity Analyses to be Performed.....	33
9.	Appendix 1: Calculating Stream Order Buffer Widths.....	34

Table of Contents

Tables

Table 1.	Major forest management considerations in the Fort St. John TSA.....	7
Table 2.	Inventory information.....	10
Table 3.	Objectives or zones to be tracked	13
Table 4.	Small pine stand definition.....	14
Table 5.	Land ownership classification and THLB contribution.....	16
Table 6.	Description of sites with low timber growing potential	17
Table 7.	TSA 40 recreation sites	19
Table 8.	TSA 40 recreation trails.....	19
Table 9.	Established ungulate winter ranges	21
Table 10.	Summary of established WHAs for the Fort St. John TSA.....	22
Table 11.	Stream class buffers.....	23
Table 12.	Stream order buffers	24
Table 13.	Minimum widths of riparian reserve zones and riparian management zones for wetlands.....	24
Table 14.	Minimum widths of riparian reserve zones and riparian management zones for lakes.....	24
Table 15.	Unsalvaged losses – timber harvesting land base.....	28
Table 16.	Managed stand density averages	29
Table 17.	Regeneration delay by leading species group.....	29
Table 18.	Visual quality objectives percent alterations for clearcut silvicultural systems	30
Table 19.	Predicted P2P ratios for slopes 0% - 70%	31
Table 20.	Landscape-level biodiversity seral and early patch targets from SFMP	31
Table 21.	Landscape unit WTP retention requirements from SFMP	32
Table 22.	Sensitivity issues	33
Table 23.	Stream order to class and buffer width calculation in BWBS and SWB zones.....	34
Table 24.	Stream order to class and buffer width calculation in ESSF and BAFA zones.....	35

1. Overview of the Fort St. John TSA Timber Supply Review

Under Section 8 of the *Forest Act* the chief forester must review the timber supply for each timber supply area (TSA) at least once every 10 years. Under the same section the chief forester may extend the current allowable annual cut (AAC) up to 15 years if the current timber supply is stable and any new developments would not likely change the AAC. More information about the AAC process is available in the *Timber Supply Backgrounder* (Forest Analysis and Inventory Branch, 2013).

The completed data package contains those inputs that represent current performance for the TSA. For the purpose of the timber supply review (TSR), “current performance” can be 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;
- fully implemented land-use plans;
- land-use decisions approved by Cabinet;
- applicable orders issued through the *Government Actions Regulation* (GAR) of the *Forest and Range Practices Act* (FRPA);
- Fort St. John Land and Resource Management Plan (LRMP);
- Fort St. John Pilot Project (FSJPP);
- FSJPP Sustainable Forest Management Plan (SFMP);
- approved higher level plans under the *Forest Practices Code of British Columbia Act*.

The primary purpose of the timber supply review program is to model “what is” not “what if”. Changes in forest management objectives and data, when and if they occur, will be captured in future timber supply analyses.

Each section of this data package includes:

- a short explanation of the data required;
- a data table or lists of modelling assumptions;
- a description of data sources and other comments.

The information in this data package represents the best available knowledge at the time of publication, but is subject to change. A First Nations consultation and public review period has been established to allow submission of comments and concerns about the data package to the Ministry of Forests, Lands and Natural Resource Operations (FLNR). The information and assumptions in the data package that have been revised to incorporate First Nations and public input will be used to determine the timber harvesting land base (THLB) - the productive Crown forest land in the TSA available for timber harvesting. Until the THLB is determined, it is not possible to finalize the values shown in some of the tables in this document. In addition, should any major changes in management practices occur during the next few months, the timber supply analysis will attempt to capture them.

2. Introduction

2.1 Overview of the Fort St. John Timber Supply Area

The Fort St. John timber supply area is located within the northeast part of the province and is administered by the Peace Natural Resource District. It is the sixth largest timber supply area in British Columbia and covers approximately 4.6 million hectares. The timber supply area is bounded by the Peace River and TFL 48 in the south, the Alberta border to the east, the Fort Nelson timber supply area to the north and the height of the Rocky Mountains to the west.

A vast plateau dominates the eastern part of the timber supply area and rises westward to the foothills and the steeper terrain of the Rocky Mountains. Rivers are the dominant water feature as the lakes tend to be small and shallow. The major rivers include the Sikanni Chief, Beatton, Halfway, Chowade, Graham, Ettithun and Fontas.

Four biogeoclimatic zones occur in the TSA: the Boreal White and Black Spruce (BWBS) zone in the plateau and lower elevations; the Englemann Spruce-Subalpine Fir (ESSF) and Spruce-Willow-Birch (SWB) zones at medium to high elevation in the mountains and foothills; and the Alpine Tundra (AT) zone at higher elevations. White spruce, lodgepole pine, aspen, and black spruce are the dominant tree species in the area. Minor amounts of subalpine fir, birch, balsam poplar and larch are also present in the forest.

Nationally and internationally recognized wildlife resources are an important feature in much of the western portion of the TSA. The TSA incorporates the southern portion of the Muskwa-Kechika Management Area (MKMA). The *Muskwa-Kechika Management Area Act* was passed in June 1998, and establishes management intent for a series of protected areas and special management areas in the northern Rockies.

The Fort St. John TSA is unique in several ways. Oil and gas exploration and development has occurred throughout most of the planning area over the past few decades. The southern and southeastern portion of the TSA is predominantly used for agriculture and has a high concentration of private land. Forest harvesting and management, although a major part of the current local economy, is relatively recent with some areas yet to be developed for timber harvesting. Energy development is the largest economic sector in the TSA, with agriculture and forestry ranking second and third respectively, in terms of local employment.

BC Hydro's proposed Site C development to create a reservoir along a portion of the Peace River that is downstream of Hudson's Hope and upstream of Taylor is mainly along the border between the Dawson Creek and Fort St. John TSAs. A Joint Review Panel Report with recommendations was submitted to the BC Environmental Assessment Office and the Federal Minister of Environment. Environmental approval was received in October of 2014. If all required permits and authorizations are received, construction will take about seven years. The reservoir would occupy 9330 hectares, and would be managed in coordination with comparatively vast Williston Reservoir upstream as well as the smaller Dinosaur Reservoir.

The city of Fort St. John is the largest community in the TSA, with about 60% of the TSA population. According to BC Statistics, the 2011 census population for Fort St. John was 18,609, and 1,373 for Taylor. That is an increase of about 7% from 2006 in Fort St. John, and about a 0.8% decrease for Taylor. Hudson's Hope, just outside the TSA, has a population of 970.

First Nations communities in the TSA include Halfway River First Nation, Blueberry River First Nations, Doig River First Nation and Kahntah. The general TSA area falls within the provisions of Treaty 8. An additional four First Nations assert traditional territory within the TSA: Prophet River First Nation, Dene Tha' First Nation (from Alberta) and West Moberly First Nations.

The Fort St. John Pilot Project (FSJPP) was implemented across the Fort St. John TSA in 2001 as a pilot project for an improved regulatory framework for forest practices. The main components of the project include regulatory flexibility to facilitate adaptive approaches to forest management, landscape-level planning through a sustainable forest management plan (SFMP), ongoing public involvement through a public advisory group (PAG) and the adoption and implementation of certification systems as surrogates for the existing administrative process.

The FSJPP participants include BC Timber Sales (BCTS), Cameron River Logging Ltd., Canadian Forest Products Ltd. (Canfor), Peace Valley OSB, Dunne-Za Ventures, LP Louisiana-Pacific Canada Ltd., and Paper Excellence. However, all field operations along with planning are carried out by Canfor and BCTS. All of the participants have consented in writing to take part in the pilot project and be subject to the terms and conditions of the *FSJPP Regulation*. The defined forest area covers approximately 4.1 million hectares within the Fort St. John TSA which excludes private land and woodlots.

2.2 First Nations

When determining an AAC, the chief forester must consider all relevant social and economic factors including information about First Nations' Treaty rights. Treaty rights negotiated under Treaty 8 are for hunting, trapping and fishing.

The Fort St. John timber supply area lies within the area described as Treaty 8 Territory. Three First Nations in the timber supply area who are signatories to Treaty 8 have reserve lands and traditional territories within the timber supply area: Blueberry River First Nations, Doig River First Nations and Halfway River First Nation. Other Treaty 8 signatories have traditional territory in the TSA, but their reserve lands are outside the TSA, these include: Fort Nelson First Nations, Prophet River First Nations, and West Moberly First Nations. Dene Tha First Nations are also Treaty 8 signatories with traditional territory in the Fort St. John TSA, and their reserve lands are in Alberta. Depending on where the traditional territory is within the Fort St. John TSA, there will be potentially different impacts to First Nations communities.

There is an economic benefits agreement (EBA) between the province and the three First Nations (Prophet River First Nations, West Moberly First Nations and Doig River First Nations). Consultation is conducted under the Forests and Range Resource Management Agreement (FRRMA) and Decision Matrix. Negotiations are underway with three First Nations (Doig, Halfway and Blueberry) on new Government-to-Government Agreements. These nations all carry expectations that there will be land use decisions as part of the agreement that will favour the practice of Treaty Rights.

2.2.1 Treaties and treaty negotiations

Treaty 8 was originally a treaty settlement negotiated between the Government of Canada and First Nations in northern Alberta, northwest Saskatchewan and the southern Northwest Territories. In 1899, the treaty was extended into British Columbia to include eight First Nations in the northeast part of the province.

Currently, the Government of Canada is negotiating treaty land entitlement claim areas with all Treaty 8 First Nations, including areas within the Fort St. John TSA. Although not part of the Treaty 8 negotiations, areas of importance to First Nations communities within the Fort St. John TSA have been identified, and negotiations are taking place with the provincial government regarding these significant areas.

3. Current Forest Management Considerations and Issues

3.1 Base case management assumptions

The timber supply analysis base case assumptions reflect current performance with respect to the status of forest land, forest management practices, and knowledge of timber growth and yield. The harvest forecast developed from these assumptions is termed the base case harvest forecast and will be used as a reference to which other development scenarios are compared. Uncertain assumptions will be quantitatively examined through sensitivity analysis which assesses the potential timber supply implications of different assumptions (see Section 8).

Since the licensees are all members of the FSJPP and have thereby agreed to adhere to the SFMP, the base case will be consistent with the SFMP.

3.2 Major forest management considerations and issues

The major forest management issues to be considered in this timber supply review are listed in Table 1. Where possible, the issues will be assessed directly in the timber supply analysis. If an issue does not fall within the definition of current management as described in Section 1, the related timber supply impacts will still be considered during the AAC determination.

Table 1. Major forest management considerations in the Fort St. John TSA

Consideration/issue	Description
Land base designations	Private land and established area-based forest tenures (such as woodlots, community forests, and First Nation's Woodland Licences (FNWL)) will be excluded from the timber supply analysis. Provincial protected areas and regional parks will be considered no-harvest areas but will contribute to the non-timber objectives tracked in the analysis.
Landscape-level biodiversity	According to the Fort St. John TSA SFMP, landscape-level biodiversity in the North Peace is managed and evaluated according to natural disturbance unit (NDU), seral-stage objectives and early-seral patch size distribution objectives. These objectives will be modelled in the TSR analysis.
Wildlife habitat areas (WHA)	Six WHAs have been established for Bull Trout spawning areas within the Fort St. John TSA. These WHAs are data sensitive, so specific boundaries are not available to the public. These WHAs will be excluded from the THLB.
Canadian Boreal Forest Agreement	The Forest Product Association of Canada (FPAC) members (including Canfor) and nine leading environmental organizations signed the Canadian Boreal Forest Agreement (CBFA). Part of this is a no-harvest area in the Fort St. John TSA. This area will be not excluded from the base case forecast since it is not a legally established protected area. Sensitivity analyses will assess timber supply implications of deferring harvesting in the area.

(continued)

Table 1. Major forest management considerations in the Fort St. John TSA (concluded)

Consideration/issue	Description
Resource review area	In June 2010, government approved the implementation of management activities for Boreal Caribou including the establishment of 550 000 hectares of resource review areas (RRAs) and enabling habitat restoration and mitigation actions within Boreal Caribou range. Harvest and other forest activities are not precluded or prevented by the RRA. No net area removal specific to RRAs will be applied.
Ungulate winter range (UWR)	Government Actions Regulation (GAR) Orders U-9-010 for boreal caribou winter range, and U-9-004 for northern caribou and Stone's sheep have been established to maintain ungulate habitat. The General Wildlife Measures (GWM) of all established UWRs will be modelled in the timber supply analysis.
Riparian management	The Fort St. John TSA contains an enormous network of freshwater streams, lakes and rivers, providing valuable habitat for resident fish species. Wetlands are also numerous and provide valuable fish, amphibian and bird habitat.
Riparian management areas (RMAs) will be defined along streams, lakes and wetlands consistent with management practices and removed from the THLB.	
Visual resource management	The visual landscape inventory (VLI) will be used to model existing VQOs in the base case. The inventory year was 2007. These were established under GAR in 2005.
Silviculture system	The predominant silviculture system in the Fort St. John TSA is clearcutting with reserves; the analysis will assume this system will be applied across the TSA.
Known archeological sites	Archaeological sites identified through use of the RAAD will be excluded from the THLB in the analysis.
Cutblock size and adjacency	There are no adjacency requirements stipulated by the Fort St. John SFMP other than to emulate the temporal and spatial characteristics of natural disturbance for the area, which is primarily caused by fire. However, adjacency concerns are considered within visual corridors.
Landscape-level biodiversity in the North Peace is evaluated and managed according to natural disturbance unit (NDU) seral-stage requirements and also early-seral patch size distribution objectives.	

3.3 Current allowable annual cut

In March 2003, the chief forester determined a new allowable annual cut (AAC) for the Fort St. John TSA. The AAC effective March 1, 2003, is 2 115 000 cubic metres with the following two partitions:

- 1 200 000 cubic metres per year for coniferous-leading stands; and
- 915 000 cubic metres per year for deciduous-leading stands.

On December 5th of 2007, the chief forester, by way of postponement order, extended the AAC as it was determined in 2003. The starting point for the base case forecast will be the current AAC and will include the deciduous-leading and conifer-leading partitions. Alternative harvest flows will be evaluated and these may include forecasts in which there is no partition.

4. Inventories

4.1 Background information

Table 2 lists the inventories that will be used to determine the THLB and to model forest management activities.

Table 2. Inventory information

Data	Source	Vintage	Date of compilation (last update)
Fort St. John TSA administrative boundary	FLNR Forest Tenures Branch(FTB)	2013	2013
Woodlots	FTB	2013	2013
Tree farm licences	None		
Parks and protected areas	Generalized Forest Ownership, Peace Natural Resource District (DPC)	2013	2013
K'IhTsaa?Dze tribal park proposal	Peace Natural Resource District (DPC)	2013	2013
Ownership and land administration	FLNR Forest Analysis and Inventory Branch (FAIB)	2012	2013
Timber licences	None		
Vegetation resources inventory (VRI) - forest cover	FAIB	Projected to 2014	2013
Harvest depletion mapping - RESULTS	FAIB	2012	2013
Operability mapping	None		
Registered archaeological sites	Remote Access to Archaeological Data (RAAD)	2014	2014
Established recreation sites and trails	FTB	2013	2013
Approved old-growth management areas	None		
Approved wildlife habitat areas	FLNR	2005-2011	2013
Resource features - karst area	None		
Ungulate winter range U-9-004 Northern Caribou and Stone's Sheep	FLNR	2008	2014

(continued)

Table 2. Inventory information (concluded)

Data	Source	Vintage	Date of compilation (last update)
Ungulate winter range U-9-010	FLNR	2011	2014
Boreal Caribou winter range			
Permanent sample plots (PSP) and research plots	FAIB	2013	2013
Landscape unit boundaries	BC Geographic Warehouse (BCGW)	2013	2008
Visual landscape inventory and visual quality objectives and scenic areas (updated 2013)	BCGW	2013	2013
Community watersheds	None	N/A	N/A
Roads, trails and landings	FLNR	2013	2013
Power-lines, hydro-lines, transmission lines	Tantalis	2014	2013
Oil and gas	Oil and Gas Commission (OGC)	2013	2013
Riparian management area	Fresh Water Atlas (FWA) -FAIB derived	2013	2013
Wildlife habitat areas - Mountain Goat, Northern and Boreal Caribou	MOE	2013	2013
Wildlife habitat areas - Bull Trout	MOE	2014	2014
Eco-sections	MOE		2014
Terrestrial ecosystem information (TEI)	MOE	2014	2014
Range and wildlife burn areas	Northeast Region	2014	2014
Site productivity	FAIB	2013	2014
Provincial road map for TSR	BCGW DRA	2014	2014
BC Mountain Pine Beetle (BCMPB)	FAIB	2013	2013
Agricultural land reserve	BCGW	2014	2014
Region compartment	BCGW	2014	2003
Treaty land entitlements	MARR	2014	2014
Non-recoverable loss (NRL) estimates from aerial overview surveys	FAIB	2014	2014
First Nations Areas of Interest	GeoBC	2015	2015
Canadian Boreal Forest Agreement - Boreal Caribou Harvest Deferral	Canfor	2015	2015
Boreal Caribou Resource Review Areas (RRAs)	MOE	Unknown	Unknown

Data source and comments:

Spatial data for the Fort St. John TSA will be extracted from the BC Geographic Warehouse or from the Peace Natural Resource District (DPC) data library (non-standard) and converted to ESRI's Arc GIS feature classes format in preparation for the timber supply analysis.

A vegetation resource inventory (VRI) was completed for the Fort St. John TSA based on 1997, 1999, 2001, 2005 and 2006 aerial photography. The VRI has had stand attributes projected to 2012 and stand disturbances (including harvesting) updated to 2013. The RESULTS data set was used to augment inventory depletion information. Note that a VRI Phase 2 project was completed that statistically adjusted some inventory attributes.

5. Division of the Area into Management Zones

5.1 Management zones and tracking of multiple objectives (grouping)

The concept of management zones is used to differentiate areas with different management objectives. For example, a zone may be based on a harvesting or silviculture system, visual quality objective or wildlife consideration or more than one management objective. In the timber supply analysis, each type of zone can be tracked separately, thereby allowing application of overlapping management objectives. Forest land that is unavailable for timber harvesting may contribute toward meeting objectives for other forest values.

Table 3 outlines the zones or objectives incorporated into the timber supply model. Further information on the forest cover requirements to be applied to these areas can be found in Section 7.5, “Forest cover requirements”.

Table 3. Objectives or zones to be tracked

Objective or zone	Inventory definition
Landscape-level biodiversity	Landscape-level biodiversity in the North Peace is managed and evaluated according to Natural Disturbance Unit (NDU) seral stage requirements and also early seral patch size distribution objectives.
Visual quality objectives (VQO)	Visual polygons will be modelled by VQO and assigned visual absorption capacities (VAC) using plan-to-perspective ratios. VQOs include retention, partial retention and modification. VAC include low, medium and high.
Cutblock adjacency	There are no adjacency requirements. Instead, the natural disturbance regime is emulated to an extent stipulated in the SFMP.
Wildlife habitat areas	There are WHAs in which harvest is not allowed. These are in place for Bull-TROUT, mountain goat and northern caribou. There is also a northern caribou WHA (9-049) in which harvest is allowed but is restricted.
UWR for Northern Caribou, Stone's Sheep Boreal Caribou	U-9-010 prevents harvest in Boreal Caribou Winter Range. U-9-004 prevents harvest in Northern Caribou and Stone's sheep habitat. In U-9-009, harvest will be prevented in Type A UWR, and allowed with special management considerations in Type B UWR. Northern Caribou UWRs GR-010 and GR-017 provide mid to low-elevation winter range and allow harvest with special management considerations.
Range and wildlife burn areas	Maintained as early seral and non-forested. These areas will be removed from the THLB.

5.2 Analysis units

An analysis unit is a combination of stands with similar tree species composition, timber growing potential and treatment regimes. Each analysis unit will be assigned its own set of timber volume projections (yield tables) for existing and for future stands. Yield tables for existing natural stands will be derived using the Variable Density Yield Prediction (VDYYP) version 7. Yield tables for existing managed stands and future stands will be derived using the Table Interpolation Program for Stand Yields (TIPSY).

In this analysis, the volumes of VRI stand older than 30 years of age will be estimated using individual stand yield curves generated using VDYP version 7. Existing managed stands and future managed stands (those currently 30 years old and younger, and future regenerated stands) will be aggregated into analysis units based on first, second and third species, site index and biogeoclimatic zone. Yield curves for these stands will be derived using the Table Interpolation Program for Stand Yields (TIPSY).

5.3 Small pine

Pine-dominated stands that are considered marginal quality timber due to the small size of the trees, even when mature, are known as small-pine stands. These will be identified and tracked in the analysis in order to assess their contribution to the harvest forecasts. The definition of the small-pine stands shown in Table 4 will be applied unchanged from the previous TSR analysis. Under this definition, 15 300 hectares of Crown managed forest and about 13 400 hectares of provisional THLB (subject to change) will be classified as small-pine stands.

Table 4. Small pine stand definition

Species composition	>80% pine
Stand height	$\geq 17.7, \leq 19.4$ m
Stand diameter	>9cm
Stand volume	>140m ³ /ha

In the previous TSR analysis, small-pine stands contributed 100 000 cubic metres per year to the harvest forecast. Nearly four times as much area was identified as small pine then, and the difference is likely due to the use of a Phase II adjusted VRI for the current analysis, and the projected growth of some small pine stands into regular pine stands.

5.4 Mixed-wood stands

Mixed-wood stands will be tracked in the analysis. These stands will be defined as stands with a cover composition of at least 25% deciduous and at least 25% coniferous. Approximately 11% of the Crown managed forest and approximately 20% of the THLB meets this definition of mixed wood. Usually when mixed-wood stands are harvested, they do not regenerate as mixed stands. Instead, a similar proportion of deciduous and coniferous cover is regenerated, but as distinct conifer and deciduous strata. The managed stand yield curves for these stands will be generated from a blend of deciduous and coniferous components. The deciduous component curve will assume a naturally regenerated distribution of stems, and the coniferous component curve will assume a planted distribution of stems. The two components curves will be blended according to the original proportions of the stand. The minimum harvest age of the regenerating forest polygon will be based on the blended curve. Since there is some uncertainty around the merchantability of regenerating mixed-wood stand, sensitivity analyses will be done to explore the effects of higher and lower minimum harvest age assumptions.

5.5 Agricultural land reserve

There is approximately 150 000 hectares of THLB within the agricultural land reserve (ALR) in the south of the TSA. Historically, areas harvested within the ALR have been regenerated for the production of timber despite the designation. Therefore, in the base case, harvested areas within the ALR will be modelled as regenerating to a forested condition and continue to be available for harvest in the long term. However, the ALR designation creates an uncertainty that these areas can be converted to pasture or other agricultural purposes. Therefore, a sensitivity analysis will also be conducted to assess the timber supply implications of converting ALR to non-forest use following timber harvesting.

6. Timber Harvesting Land Base Definition

This section outlines the steps used to identify the timber harvesting land base (THLB) which is the productive forest expected to support timber harvesting within the Fort St. John TSA. Land may be unavailable for timber harvesting for three principle reasons:

- it is not administered by the FLNR for TSA timber supply purposes (e.g., private land, parks, etc.);
- it is not suitable for timber production purposes (e.g., non-forested areas); or
- it is unavailable for timber harvesting (e.g. recreation areas).

Land may also be added to the THLB in the following situations:

- by management activities or changed conditions which improve productivity or operability (e.g., the stocking of land currently classified as non-commercial brush); or
- by the acquisition of productive forest land (e.g., timber license reversions).

The THLB for the Fort St. John TSA will be determined by a process of delineating the categories of land (described in subsections below) that are not expected to contribute to timber harvesting in the TSA. Land will be considered outside the THLB only where no harvesting is expected. Any area in which some timber harvesting will occur will remain in the THLB, even if the area is subject to other management objectives such as wildlife habitat and biodiversity objectives. The management objectives will be modelled in the timber supply analysis. In most cases the Crown forested land base outside of the THLB will also contribute to management objectives.

It is not uncommon for specific areas to be identified by more than one land category; for example, deciduous stands within riparian reserve zones. These areas will be classified as deciduous, prior to the riparian classification. Another example is where a patch of culturally modified trees (CMT) provides the “anchor” for co-location of a wildlife tree retention (WTR). Therefore, in most cases the net area reduction for a particular category will be less than its gross area due to overlap with areas previously excluded from the THLB under other categories.

6.1 Non-forest

The VRI data fields providing BC Land Classification System designations will be used to identify and remove non-forested areas from the THLB.

Areas classified as not forest management land base (FMLB= ‘N’) in the VRI will be excluded from the forest land base unless they have been previously harvested. This means that areas classified as ‘non-tree’ as well as alpine forest, wetland, lakes, rocks, shrubs, etc. are excluded from the forest land base wherever these attributes are available in the inventory. Areas are also excluded where the site index is less than five metres at breast height age 50 years

6.2 Land not administered by FLNR for TSA timber supply

Land not administered by FLNR for timber supply in the TSA includes private, municipal and federal lands, Indian Reserves, woodlot licences, parks and ecological reserves. TFLs and CFAs would be excluded but there are none within the TSA. Generalized forest cover ownership codes augmented with legal boundary maps, will be used to identify whether or not land contributes to the timber supply for the TSA. Parks, protected areas and other miscellaneous reserves within the TSA will be excluded from the THLB but will be included within the crown forest management land base (CFMLB) and will contribute to towards non-timber objectives (e.g., biodiversity and wildlife habitat objectives). Table 5 shows the potential contribution of each ownership code to the THLB.

Table 5. Land ownership classification and THLB contribution

	Ownership schedule code	Ownership description	Schedule description	THLB inclusion
1	40N	Private - Crown Grant	Not long-term IRM land	No
2	52N	Indian Reserve	Not long-term IRM land	No
3	60N	Crown Ecological Reserve	Not long-term IRM land	No
4	61C	Crown UREP	Long-term IRM land	Yes
5	61N	Crown UREP	Not long-term IRM land	No
6	62C	Crown TSA	Long-term IRM land	Yes
7	63N	Crown Prov Park Class A	Not long-term IRM land	No
8	69C	Crown Misc Reserve	Long-term IRM land	Yes
9	69N	Crown Misc Reserve	Not long-term IRM land	No
10	72B	Crown and Private Schedule "A" and "B" Lands	Sched "B" land - TFL	Yes
11	77A	Crown and Private Woodlot Licence	Sched "A" land - TFL	No
12	77B	Crown and Private Woodlot Licence	Sched "B" land - TFL	No
13	99N	Crown Misc. Lease	Not long-term IRM land	No

Data source and comments:

The ownership and land administration data set, along with the vegetation resource inventory are the primary data sets used to determine land classified as Crown forest management land base.

6.3 Inoperable areas

Generally, operability mapping is used to describe the presence or absence of physical and economic barriers to timber harvesting. Since no such operability mapping is available for the Fort St. John TSA, alternative information sources will be used to identify areas that are unlikely to be harvested due to difficult operating conditions caused by unstable terrain and steep ground. The following two sections describe the procedures for doing this.

6.3.1 Unstable terrain

The occurrence of unstable terrain was estimated using information collected through bioterrain studies and predictive ecosystem mapping (PEM) projects that cover a substantial proportion of the TSA (the Blueberry and Sikanni VRI bioterrain studies and the Besa Prophet TEM and Muskwa-Kechika PEM). In 2013, the provincial bioterrain specialist from the Ecosystem Branch of the Ministry of Environment used land attributes developed in those studies to identify unstable and potentially unstable slopes, including slow or rapid mass movement zones, which will be removed from the THLB.

Within the bioterrain study areas, slow or rapid mass movement zones were identified and removed from the THLB. However, the amount of unstable and potentially unstable ground identified using this approach may be an underestimate of the actual total. Some additional unstable and potentially unstable areas such as run-out zones where mass movement processes may impact operations or infrastructure, or slow mass movement run-out such as earth flow.

In order to estimate a THLB reduction for areas outside of the bioterrain study areas, the proportion of failing slopes within the study area was calculated by eco-section which are areas identified with similar ecological properties. Those proportions will be applied as a reduction to the THLB to the eco-sections outside of the study area.

The amount of unstable and potentially unstable ground identified using this approach may be underestimated since some potentially unstable areas were not identified, such as run-out zones where mass movement processes may impact operations. Sensitivity analysis will be used to assess the implications of greater netdowns for unstable terrain.

6.3.2 High slope

A THLB reduction factor for steep areas was created based on areas harvested in a range of slope classes. The amount of area harvested in each slope code was evaluated using RESULTS data collected since 2002. The evaluation found that 98% of the area harvested occurred on slopes less than 30%. Given this result, forested areas with a slope greater than 30% will be removed from the THLB.

6.3.3 Economically inoperable areas

There are no economic operability mapping projects completed for the TSA, so no stands will be removed from the THLB entirely for economic reasons. Sensitivity analyses will assess the implications of excluding lower value stands from the harvest forecast. Low-value stands will be identified using data from the Electronic Commerce Appraisal System (ECAS) and BCTS market pricing system (MPS).

6.4 Sites with low timber growing potential

Two methods will be used in combination to identify sites with low timber growing potential which will be removed from the THLB. The first method will apply the criteria used in the previous TSR to identify unharvested stands with low timber potential. The second method involves identifying the least productive stands that have been recently harvested, assuming that less productive sites are unlikely to be harvested, and removing stands of lower productivity from the THLB.

Method 1

Sites may have low productivity either because of inherent site factors (e.g., poor nutrient availability or excessive moisture) or because they are not fully occupied by commercial tree species. Typically, these stands are inter-mixed with other stands within the forested land base. As these stands are not considered to be harvestable, they will be identified and removed from the THLB according to the definitions shown in Table 6.

Table 6. Description of sites with low timber growing potential

Leading species	Identifying attributes
Spruce	Older than 120 years; and existing volume less than 140 m ³ /hectare OR height less than 17.5 m.
Pine	Older than 80 years; and existing volume less than 140 m ³ /hectare OR height less than 17.7 m.
Balsam	Older than 120 years and existing volume less than 140 m ³ /hectare.
Deciduous	Older than 80 years and existing volume less than 140 m ³ /hectare.

Data source and comments:

The above criteria were selected to broadly identify stands with low timber growing potential for strategic timber supply analysis. It is recognized that at the operational level there are stands below the specified thresholds that are harvested and stands above the thresholds that are not harvested. The expectation is that these thresholds reasonably reflect the general productivity levels of stand currently harvested in the TSA.

Method 2

Based on recent harvest information, stands which are very unlikely to be harvested will be characterized and removed from the THLB. The review will identify the lowest site index found within the top 98% of harvested area over the last 10 years. Stands below this lower limit of site productivity will be excluded from the THLB. Only stands older than 30 years will be included in this assessment so areas that have been previously logged will not be removed from the THLB as stands with low timber potential.

6.5 Problem forest types

Problem forest types are stands which are physically operable and exceed low site criteria yet are not currently utilized or have marginal merchantability. The following tree species will be excluded from the THLB based on criteria applied in the previous TSR:

- Stands with >30% black spruce (Sb);
- Aspen-leading stands with < 30% aspen;
- Birch-leading stands;
- Cottonwood-leading stands;
- Larch-leading stands.

6.6 Cultural heritage resource reductions

Cultural heritage values include trapping areas, and sites of archaeological or traditional use. Known archaeological sites are identified in an inventory supplied by the Archaeology Branch, FLNR. These known archaeological feature areas will be removed from the THLB.

Traditional use studies (TUS) provide information that may be considered in the TSR process. However, no traditional land use areas have been delineated in this TSA.

6.7 Experimental and permanent sample plots

Each experimental and permanent sample plot will receive a 100-metres buffer and the total area will be excluded from the THLB.

6.8 Established recreation sites and trails

There are features on the land base that are important for public and commercial recreation activities. These features, such as wildlife viewing areas and camp sites, can result in the exclusion of harvest activities even if harvest activities are not legally prohibited.

Legally established recreation sites, trails and interpretive forests have very high recreation values. In the timber supply analysis, small recreation sites identified in the Forest Tenures recreation map for trails for small motor vehicles, and a mountain biking trail will be buffered and excluded from the THLB.

The recreation areas listed in Table 7 will have a 20-metre buffer applied and will be excluded from the THLB in the analysis.

Table 7. TSA 40 recreation sites

Map label	Project name	Area (hectares)
REC97707	LIMESTONE CAMP	12
REC97884	ISLAND'S END	22
REC32914	EAGLES NEST	6
REC32916	BIRCH CAMP	2
REC191774	CACTUS TRAILS - BLIZZARD MOUNTAIN BIKE POLY	69
REC32922	CURL CAMP	6
REC32904	HAWK ISLAND	41
REC32906	ROTARY	22
REC32908	BEAVER HOUSE	3
REC6165	DUHU LAKE	14
REC202995	GLEAM FIRE TOWER AND CABIN	0
REC192053	Northland Emergency Shelter	8
REC106557	CRYING GIRL PRAIRIE CAMP	90
REC1376	HALFWAY RIVER*	50
REC1118	HALFWAY-GRAHAM	101
REC1354	INGA LAKE	12
Total		457

The recreation trails listed in Table 8 will be buffered by 10 metres on each side and removed from the THLB for the analysis.

Table 8. TSA 40 recreation trails

Trail name	Type
Cactus Trails - Blizzard Mountain Bike Lines	No motoring
Sikanni Chief River	Motoring
Redfern	Motoring
Christina Falls	Motoring
North West Mounted Police	Motoring
Cypress Creek	Motoring
Halfway River	Motoring

6.9 Roads, trails and landings

Separate estimates are made to reflect the loss in productive forest from existing and future roads, trails and landings (RTL). Existing RTL estimates are applied as reductions to the current productive forest considered available for harvesting and future RTL reductions are applied as the primary forest is harvested for the first time in the simulation model.

Existing roads, trails, landings and other features are recorded in various geographic information system (GIS) files. The recently updated digital road atlas will be used as a primary resource for these linear features. These features will be buffered and the productive forested area will be removed from the THLB. As was done in the previous TSR, 20-metre buffer widths (10-metres on each side) will be used for the following road types: cut permit roads, Forest Service roads, non-status roads, petroleum development roads, and road permit roads.

6.10 Other linear features

Other features include seismic lines, power lines, pipelines, railways and well sites. Consistent with the previous TSR, the following linear feature buffers will be produced and removed from the THLB:

Trails 5 metres;

Power lines 20 metres;

Railways 20 metres.

6.11 Oil and gas imprint

Oil and Gas Commission (OGC) data identifies the location of oil and gas development. These will be removed from the THLB. A map of disturbance areas was developed using seismic line information obtained from the OGC. Although future forest depletion due to seismic activity is likely, it is not possible to accurately estimate the extent and location of these losses. Nor is it possible to predict when and to what extent existing seismic line area will begin growing a fully functioning forest. For this analysis, the new area of seismic activity will be assumed equal to the currently regenerating area throughout the timber supply forecast. This will be accomplished by maintaining all existing seismic line area in a young forest condition.

In this analysis, the total disturbance width of pipelines will be represented as 20 metres. The total disturbance width of seismic lines will be represented as seven metres for older lines, and 1.5 metres for lines created since the year 2000 when technological advancement reduced the width of disturbance. The area within pipeline buffers and the area within the seismic buffers will be modelled as non-forest. Each well site (which includes sumps and borrow pits) will be assigned an area of five hectares and removed from the forested area.

6.12 Exclusion of specific, geographically defined areas

Region compartments

Harvesting is not viable in certain areas in the westernmost portion of the TSA that exceed maximum delivered wood costs and, based on current practice, these areas will be excluded from the THLB. The areas will be delineated for removal using regions and compartments. Regions are large drainages encompassing groups of small drainages known as compartments. Compartments 104 and 105 within region 78, and compartments 178, 182, and 183 within region 79 will be excluded from the THLB as was done in the previous TSR. These are in the westernmost portion of the TSA. All five of these compartments are entirely within the Muskwa-Kechika Management Area (MKMA).

Muskwa-Kechika Management Area

The Muskwa-Kechika Management Area was defined in Bill 37-1998, the *Muskwa-Kechika Management Area Act*, and the preamble of the *Act* noted it as an ‘area of unique wilderness in northeastern British Columbia that is endowed with a globally significant abundance and diversity of wildlife.’ The management intent for the MKMA is to maintain in perpetuity the wilderness quality and the diversity and abundance of wildlife and the ecosystems on which it depends while allowing resource development and use in those parts designated for those purposes. These areas specifically allowed for timber harvesting, however Section 8(1) of the *Act* specifies that a prerequisite to the approval of a forest

development plan in the MKMA is an approved landscape-unit objective. To date, no landscape-unit objectives have been proposed or approved for the MKMA.

The MKMA will not be excluded from the THLB. Sensitivity tests will also be conducted in which harvest is not allowed in the MKMA, which will assess impact of continued deferral of these areas.

Treaty land entitlements

There are several Treaty Land Entitlements areas (TLE) within the TSA. These are areas that are the subject of separate negotiations between the federal government and two First Nations: Halfway River First Nation and Doig River First Nation.

Treaty Land Entitlements will not be excluded from the THLB in the base case. A sensitivity test will be conducted to evaluate the effect on timber supply of removing the TLEs from the THLB.

K'IhTsaa?Dze

As mentioned in Section 6.2, existing parks and protected areas will be excluded from the THLB for the base case. K'IhTsaa?Dze is an area that has been declared a tribal park by the Doig River First Nation. The Province has not recognized it as a park. In the future, some undetermined portion may be recognized as a park or a designated area which would be considered non-THLB. In the base case, K'IhTsaa?Dze will not be excluded from the THLB, but a sensitivity analysis will be undertaken to evaluate the effect on timber supply of removing this area.

6.13 Ungulate winter range (UWR) reductions

As indicated in Table 9, three GAR Orders have established habitat areas for northern caribou and Stone's Sheep, and for Boreal Caribou winter range in the Fort St. John TSA. Each order includes a set of General Wildlife Measures (GWMs) that prohibit or constrain primary forest activities within each UWR unit. Documentation supplied with the orders provides background information and support to the legal order. The GWMs will be modelled in the timber supply analysis by applying appropriate THLB exclusion factors and management constraints. U-9-009 Boreal Caribou GAR: The GWMs for Type A habitat precludes harvest and this habitat will be removed from the THLB. The GWM for Type B UWRs does allow for harvest with special management considerations. Type B habitat will not be excluded from the THLB.

U-9-004 Stone's Sheep GAR: The GWMs specify that in the high elevation winter range for Northern Caribou and Stone's Sheep there will be no construction of roads, development of recreation trails, removal of forest cover or use of domestic sheep or goats. This area will be removed from the THLB.

Table 9. Established ungulate winter ranges

Species	Order	Order date	Approximate area (hectares)
Northern caribou and Stone's sheep	U-9-004	May 20, 2008	64,475
Boreal caribou winter range	U-9-010	January 11, 2011	5,014
Boreal caribou	U-9-009 Type A	March 25, 2013	225,984
Boreal caribou	U-9-009 Type B	March 25, 2013	322,038

U-9-010 Boreal caribou winter range: The GWMs prohibit primary forest harvesting and require the retention of all forest and vegetative cover within the UWR. New roads, trails and linear corridors are also prohibited. Therefore, in the entire U-9-010 Boreal Caribou winter range will be excluded from the THLB.

U-9-009 Boreal Caribou GAR: General Wildlife Measures (GWM) for Type A habitat preclude harvest. Type A habitat will be removed from the THLB. The GWM for Type B UWRs does allow for harvest with special management considerations. Type B habitat will not be excluded from the THLB.

There are two polygons containing mid- to low-elevation winter range for Northern Caribou in which harvesting is permitted with special management considerations. These (GR-010, and GR-017) will not be removed from the THLB.

U-9-004 Stone's Sheep UWR. The GWM for U-9-004 specifies that the building of roads and trails is not permitted. Removal of forest cover is also not permitted. These areas will be removed from the THLB for the TSR analysis.

6.14 Wildlife habitat area reductions

The Identified Wildlife Management Strategy (IWMS), which was announced in the spring of 1999, outlines a process to identify and establish WHAs and associated GWM to protect rare and/or endangered species. Table 10 lists the number of WHAs established for each species, the total gross area, and provides a description of the restrictions on harvesting within the WHAs. Established WHAs with harvest restrictions will be excluded from the THLB in the base case.

Table 10. Summary of established WHAs for the Fort St. John TSA

Species	Number of WHAs	Gross area (ha)	Management activity
Bull trout	6	177	No harvest zones
Mountain Goat	8	398	No harvest zones
Northern Caribou	18	42,686	No harvest zones
Northern Caribou	1	1,266	Harvest allowed with management considerations
Boreal Caribou	9	151,800	No harvest allowed

Data source and comments:

There are two WHA containing mid- to low-elevation winter range for Northern Caribou in which harvesting is permitted with special management considerations. There are restrictions on harvesting and road construction and use, but some is allowed. These WHA (GR-010 and GR-017) will not be removed from the THLB.

The following bull trout WHAs within the Fort St. John TSA are data sensitive, so specific boundaries are not available to the public: 9-(025, 026, 027, 028, 030, 031). They remain in effect from the *Forest Practices Code* era.

The following WHAs within the Fort St. John TSA are considered core mountain goat habitat with legal boundaries, and also remain in effect from the *Forest Practices Code* era: 9-(005, 006, 007, 008, 009, 010, 016, 017). The GWM management objectives include maintaining the WHA in a natural state, minimizing access to control and prevent human disturbance, avoiding invasions of non-indigenous plants into grassland communities, and avoiding disturbance to natal areas. Roads are not to be constructed unless the District Manager (DM) approves. Such roads must be deactivated after use.

The following WHAs within the Fort St John TSA were established by GAR for northern caribou: 9-(032, 033, 034, 041, 042, 044, 045, 046, 047, 048, 049, 102, 103, 104, 105, 106). The GWMs for most of these is that forest cover must not be removed, and will be excluded from the THLB accordingly. The exception is 9-049 in which harvesting is permitted with some special management considerations. The 9-049 WHA will not be excluded from the THLB.

The following WHAs within the Fort St. John TSA were established by GAR for boreal caribou: 9-(087, 089, 090, 091, 092, 093, 094, 095, 096). The GWM for this area stipulates that no timber harvest may occur, and it will therefore be excluded from the THLB.

6.15 Riparian reserve zones

Schedule D of the *Fort St. John Pilot Project Regulation* specifies the buffer requirements for lakes, rivers, streams and wetlands.

Stream buffers

Riparian management area (RMA) requirements will be represented in the analysis as stream buffers applied according to the stream class, Riparian reserve zones (RRZ) and Riparian management zones (RMZ) (see Table 11).

Table 11. Stream class buffers

Fort St. John Pilot Project Regulation Schedule D – Stream Buffers					
Stream class	RRZ (metres)	RMZ (metres)	RMA (metres)	RMZ retention (%)	Effective RMA (metres)
S1	50	20	70	50	60.0
S2	30	20	50	40	38.0
S3	20	20	40	50	30.0
S4	0	30	30	25	7.5
S5	0	30	30	15	4.5
S6	0	20	20	5	1.0

There is no comprehensive streams mapping identifying the classes of the streams, and there is currently no project in place to map stream classes. However, stream order information is available and Canfor has a large amount of data collected that enables a correlation between stream order and class. Using that correlation, buffer widths were calculated to be applied according to the available stream order information. Appendix 1 provides some detail of the calculations used in finding buffer widths for stream classes. Table 12 shows the results of those calculations which are the stream buffers that will be used in the analysis by BEC zone.

Table 12. Stream order buffers

Stream order	ESSF and BAFA buffer widths (metres)	SBS and BWBS buffer widths (metres)
1	1.0	2.2
2	1.6	6.4
3	7.3	17.1
4	24.4	28.0
5	N/A	37.1
6	N/A	60.0

Note:

ESSF - Englemann Spruce Subalpine Fir;
BAFA - Boreal Altai Fescue Alpine;
SWB - Spruce Willow Birch;
BWBS - Boreal White and Black Spruce.

Riparian classes of wetlands

Wetlands are classified into the following riparian classes: W1 if greater than five hectares in size, W3 if between one and five hectares, and W5 if the area consists of two or more individual wetlands with overlapping riparian management areas and the combined size of the wetlands is five hectares or larger. Table 13 shows the effective RMA that will be excluded from the THLB for wetlands.

Table 13. Minimum widths of riparian reserve zones and riparian management zones for wetlands

Riparian class	RRZ (metres)	RMZ (metres)	RMA (metres)	RMA basal area retention	Effective RMA (metres)
W1	10	40	50	25%	20
W3	0	30	30	25%	7.5
W5	10	40	50	25%	20

Riparian classes of lakes

Lakes are classified into the following riparian classes: L1 if greater than five hectares in size and L3 if between one and five hectares. Table 14 shows the effective RMA that will be excluded from the THLB for lakes.

Table 14. Minimum widths of riparian reserve zones and riparian management zones for lakes

Riparian class	RRZ (metres)	RMA (metres)	RMA (metres)	RMA basal area retention	Effective RMA (metres)
L1	10	40	50	25%	20
L3	0	30	30	25%	7.5

Double-line rivers

Large rivers classified as S1 will be buffered by 100 metres. Other double-lined rivers (featured as polygons) will be buffered by 60 metres. These buffers will be excluded from the THLB in the analysis.

6.16 Range and wildlife burns

Within the TSA, there are areas that are burned periodically to provide forage for range animals and wildlife. Mapping of the range and wildlife burn areas was provided by a wildlife biologist with the Northeast Natural Resource Region. These areas will be excluded from the THLB.

7. Current Forest Management Assumptions

7.1 Harvesting

7.1.1 Harvest Priorities

Within the FSJPP, a legal requirement exists to lay out six years of harvest. The first priority for harvest scheduling in the base case will be six years of Forest Operations Schedule (FOS) planned harvest.

7.1.2 Utilization levels

Utilization levels define the maximum stump height, minimum top diameter (diameter inside bark (DIB)) and minimum diameter at breast height that are used to calculate merchantable volume. For all species, a minimum diameter at breast height of 12.5 cm, maximum stump height of 30 cm and a minimum top diameter inside bark of 10 cm will be used to define the utilization level.

7.1.3 Incidental deciduous in managed coniferous stands

Coniferous-leading analysis units with greater than 80% coniferous volume have minimal merchantable deciduous volume at rotation age under current management. Deciduous volumes in such stands do not need to be modelled separately in the analysis. Incidental deciduous volumes harvested in the analysis from managed coniferous-leading stands will contribute to the harvest target of the coniferous partition.

7.1.4 Minimum harvestable criteria

Analysis units will be developed through groupings of stands with similar species associations, levels of productivity and growth characteristics. Minimum harvestable criteria can be defined by a product goal which achieves “optimal” stand level management. These are simply minimum criteria. While harvesting may occur in stands when the minimum requirements are achieved, some stands may not be harvested until well past “optimal” timber production ages in order to accommodate other resource values (e.g., requirements for the retention of older forest for wildlife habitat).

A minimum of 140 cubic metres per hectare will be required for all stands regardless of leading species. Pine- and aspen-leading stands will require a 12.5 cm average diameter, while 17.5 cm will be required for stands with other leading species. Pine-leading stands will have an additional criteria of having achieved height class 3. In order to prevent modelling premature harvest of rapid growing managed stands, a minimum MHA of 80 years will apply to managed stands which reach the minimum volume and diameter requirements earlier than that.

7.1.5 Logging method

Conventional ground-based logging methods are the dominant harvesting systems within the Fort St. John TSA. A minimal amount of helicopter logging has occurred, but none has been recorded in the last 10 years of RESULTS data.

7.1.6 Silvicultural systems

Clearcuts and clearcuts with reserves are the dominant harvest systems in the TSA. These silviculture systems will be modelled in the analysis.

7.2 Mountain pine beetle

The mountain pine beetle infestation has reached the Fort St. John TSA in recent years and is causing pine mortality. The BC Provincial Scale Mountain Pine Beetle Model (BCMPB) was developed by Forest Analysis and Inventory Branch (FAIB) to assess the impacts of mountain pine beetle outbreak and management interactions across the entire province. The model uses forest cover data, the Provincial Aerial Overview Survey of Forest Health and information from a stand-level mountain pine beetle (MPB) population model to estimate the current extent of pine mortality, and to project a possible course of the infestation into the future.

Annual updated versions have been developed to incorporate new infestation data and refine mortality projections. This TSR will utilize resultant data from the BCMPB v11 model. The model generates annual and cumulative mortality grids at a 16 hectares resolution. These grids are incorporated into the timber supply analysis to help define harvest flow projections.

7.2.1 Shelf life

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. Shelf life will not be modelled in this analysis since these factors are product specific and can change widely over short-time frames. Instead, it will be assumed that the dead trees have some commercial use as long as the trees are standing. Dead trees will be assumed to remain standing for 15 years after attack. Once the trees fall to the ground it will be assumed the stems quickly rot and will have no commercial use.

To examine the possible impacts and contribution to the harvest forecast of volume from dead trees, the analysis will display forecasts for grouped periods of *years since death* (YSD): two years or less, three to five years, six to ten years, and 11-plus years. These classes can be used to approximate the amount of volume available within the shelf life period for various products.

7.2.2 Unsavaged MPB stands

MPB-impacted stands that remain unsavaged will continue to grow and develop as complex stands. The stand structure will be highly variable depending on the number and distribution of residual live trees and the amount of understory advance regeneration. The ability to model stand development following a major disturbance. If a MPB-impacted stand is not salvaged the residual live component will be modelled to continue to grow as a poorly stocked stand. No release, advance regeneration or ingress will be modelled because of the great uncertainty around residual stand conditions. If the live volume component is above the minimum harvest criteria (or eventually grows to achieve the minimum) the stand may contribute to the timber supply. The contribution of these stands to the harvest forecast will be tracked.

7.3 Unsavaged losses

Volume loss estimates were produced for each TSA by FAIB from aerial overview surveys from 2000 through 2013. Table 1Table 15 shows the estimated average annual unsavaged volume loss due to epidemic events such as insect infestations, fires, or other agents. Fire, drought and flood disturbances apply to all species. Western Balsam Bark Beetle (IBB) and Spruce Beetle (IBS) are specific. The mountain pine beetle losses were surveyed by the same method, and the catastrophic epidemic will be included in the SELES model according to the previous section. Long-term endemic unsavaged losses

for mountain pine beetle are not represented in Table 15 since the current MPB outbreak is catastrophic and modelling its reoccurrence would provide unreasonable results.

The monitoring of losses has been mainly restricted to the coniferous component of the TSA as the harvest history and monitoring of unsalvaged deciduous species has only started recently in the TSA. There are no known issues associated with unsalvaged deciduous losses.

Table 15. Unsalvaged losses – timber harvesting land base

Cause of loss	Annual loss within the THLB (m ³ /year)	Annual unsalvaged loss within the THLB (m ³ /year)	Salvage rate %
IBB	436	433	1
IBS	4,947	4,879	1
Drought	391	391	0
Flood	6,569	6,480	1
Fire	29,523	27,034	8
Total	41,866	39,217	

7.4 Silviculture

7.4.1 Regeneration activities in managed stands

Recent plantations and future stands will be grown on managed stand yield tables (MSYTs) produced using the TIPSY growth and yield model. Deciduous-leading managed stands will be represented with TIPSY yield curves with natural distributions which are random and somewhat clumped. Coniferous-leading managed stands will be represented with TIPSY yield curves with planted (more even and regular) distributions. This is consistent with information in the RESULTS (Reporting Silviculture Updates and Land status Tracking System) data for the Fort St. John TSA.

Species composition of managed stands will be consistent with that of the stand on the site prior to harvest.

Operational adjustment factors (OAF) will use provincial default values as was done in the previous TSR. The default for OAF 1 is 15% and OAF 2 is 5%.

Site productivity values for managed stands will be based on the newly available provincial site productivity layer. The Site Productivity Dataset provides site index estimates province-wide for commercial tree species. The estimates are based on available ecosystem data (spatial delineations and descriptions) from existing PEM (Predictive Ecosystem Mapping) and TEM (Terrestrial Ecosystem Mapping) datasets, coupled with SIBEC (Site Index Estimates by BEC Site Series: 2013 Approximation) data. In areas where no PEM or TEM data are available, site index estimates are based on biophysical data and species ranges. Analysis units will be created by aggregating stands according to species composition, site productivity, and BEC zone. The first four species will be used in the groupings, though species two, three and four may be blank. Density values will be averaged from RESULTS data using matching leading species and BEC zone groupings. Table 16 shows the densities to be used for managed stand yield curves in this analysis.

Table 16. Managed stand density averages

Leading species	Zone	Distribution	Hectares	SPH
Aspen	BWBS	Natural	15,422	5,133
Pine	BWBS	Planted	16,550	1,348
Pine	ESSF	Planted	1,015	1,186
Pine	SWB	Planted	35,244	1,338
Spruce	BWBS	Planted	37,940	1,167
Spruce	ESSF	Planted	1,123	1,070

7.4.2 Not satisfactorily restocked (NSR) areas

According to 2013 RESULTS data, there are approximately 15 000 hectares classified as NSR within the TSA, with an average density of approximately 430 stems per hectare. These appear to consist almost entirely of recently harvested areas which can be expected to regenerate consistent with the regeneration activities for managed stands described above. All Not Satisfactorily Restock (NSR) areas and will be managed under MSYTs.

7.4.3 Immature plantation history

All existing regenerating stands that are represented in the RESULTS data set will be modelled according to the available stand information with MSYTs. Other stands within the THLB that are less than 30 years old will also be modelled as existing managed stands with MSYTs.

7.4.4 Regeneration delay

RESULTS data were investigated to discover appropriate regeneration delay values by leading species group. For each forest opening and leading species, a regeneration delay value was calculated by subtracting the silviculture reference year from the opening's harvest end date plus leading species age. Cases in which the answer had an absolute value greater than 10 were filtered out of the remaining calculations under the assumption that portions of in-block reserves and other types of information interference such as possible recording errors were creating these results. For the approximately 52 000 hectares of provisional THLB remaining, the regeneration delays from those openings were area-weighted averaged for three species groups; deciduous-leading, pine-leading and spruce-leading.

Table 17 shows the approximate area involved in the calculation once outliers were removed, the area-weighted average regeneration delay, and the whole number value to be used in the analysis.

Table 17. Regeneration delay by leading species group

Leading species	RESULTS area (hectares)	Area-weighted average regeneration delay	Regeneration delay for TSR (years)
Deciduous	12,000	1.67	2
Spruce	28,000	1.39	1
Pine	12,000	1.87	2

7.5 Forest cover requirements

There are multiple objectives and forest cover requirements that overlap according to their resource maps. There are objective for maintaining visual quality for certain landscapes, objectives for the distribution of patches of early seral forest, as well as the maintenance of a minimum proportion of old seral forest.

7.5.1 Objectives for visual resources

The timber supply analysis will apply forest cover objectives that are consistent with the established visual quality objectives (VQO). In the current version of the visual landscape inventory for the Fort St. John TSA, there are two references given for the existing visual quality objectives where the objectives are “made known”. Some of the VQOs are attributed to FRPA 181, and some to GAR 17. Both are referred to in a March 21st, 1997 District Manager letter. Only polygons that are “made known”, having established VQO ratings in place, will be included in the base case.

The permissible percent denudation will be applied to each visual polygon based on its assigned VQOs. Consistent with the previous TSR, a green-up height of five metres will be used. Using plan-to-perspective ratios for modelling visuals, a percent visible disturbance figure will be established for each visual area. This method is described in the document, *Bulletin – Modelling Visuals in TSR III*. The permissible percent alteration in perspective view will be taken from the mid-point of the ranges shown in Table 18 based on the VQO of each visually sensitive area. Next, the area-weighted average slope within each visually sensitive area will be calculated, and used to select the appropriate plan to perspective (P2P) ratio from Table 19. Then the P2P ratio will be multiplied by the permissible percent alteration value to calculate the maximum percent of each VQO that is allowed to be below five metres in height.

Table 18. Visual quality objectives percent alterations for clearcut silvicultural systems

VQO	Permissible % alteration in perspective view (and mid-point)
Preservation	0
Retention	0 to 1.5 (0.75)
Partial retention	1.6 to 7.0 (4.3)
Modification	7.1 to 18.0 (12.55)
Maximum modification	18.1 to 30.0 (24.01)

Data source and comments:

A VQO is a resource management objective established for an area that reflects the desired level of visual quality based on the physical characteristics and social concern for the area. Several classes have been defined in the Fort St. John TSA:

- Maximum modification (MM): consisting of an altered forest landscape in which the alteration, when assessed from a significant public viewpoint, (i) is very easy to see, and (ii) is (a) very large in scale, or (b) rectilinear and geometric in shape, or (c) both;
- Modification (M): consisting of an altered forest landscape in which the alteration, when assessed from a significant public viewpoint, (i) is very easy to see, and (ii) is (a) large in scale and natural in its appearance, or (b) small to medium in scale but with some angular characteristics;
- Partial retention (PR): consisting of an altered forest landscape in which the alteration, when assessed from a significant public viewpoint, is (i) easy to see, (ii) small to medium in scale, and (iii) natural and not rectilinear or geometric in shape;

- Retention (R): consisting of an altered forest landscape in which the alteration, when assessed from a significant public viewpoint, is (i) difficult to see, (ii) small in scale, and (iii) natural in appearance.

Table 19. Predicted P2P ratios for slopes 0% - 70%

Slope	0%	10%	20%	30%	40%	50%	60%	70%+
P2P	4.68	3.77	3.04	2.45	1.98	1.6	1.29	1.04

7.5.2 Objectives for landscape-level biodiversity

Landscape-level biodiversity in the TSA is managed and evaluated according to natural disturbance unit (NDU) seral-stage requirements as stipulated in the SFMP and also early seral-patch size distribution objectives. Table 20 shows values describing natural disturbance units occurring in the Fort St. John TSA. The old seral requirement of the SFMP will be modelled at the NDU level. A minimum proportion of the crown forested area will be maintained above an age of 140 years (except in the Boreal Plains Upland deciduous-leading stands which will use a 100 year old age definition). The model will also target the early patch size distribution described in Table 19 for each NDU. Emulating the natural disturbance regime through harvest activities requires that most openings be larger than 100 hectares.

Table 20. Landscape-level biodiversity seral and early patch targets from SFMP

Natural disturbance unit	Early (<40 years), patch size target (%) (acceptable range)			Late seral min age (years)	Late seral retention target (%)
	>100 ha	51-100 ha	<50 ha		
Boreal Plains Uplands	90 (65 to 90)	5 (5 to15)	5 (5 to15)	140 Conif, 100 Decid	16
Boreal Foothills Valley	70 (55 to 85)	10 (5 to 15)	20 (15 to 25)	140	23
Boreal Foothills Mountain	70 (55 to 85)	10 (5 to 15)	20 (15 to 25)	140	33
Northern Boreal Mountains	90 (65 to 90)	5 (5 to15)	5 (5 to15)	140	37
Omineca Mountains	70 (55 to 85)	10 (5 to 15)	20 (15 to 25)	140	41
Omineca Valley	90 (65 to 90)	5 (5 to15)	5 (5 to15)	140	16

7.5.3 Objectives for stand-level biodiversity

The approved SFMP of 2010 identifies the cumulative wildlife tree patch (WTP) retention percent that licensees agree to meet or exceed by landscape unit. In the base case, these percentages (shown in Table 21) will be applied as reductions to the remaining mature THLB at the end of the netdown process. However, portions of the CFMLB already reserved in other netdown categories such as riparian buffers, recreation areas, problem forest types, and unstable terrain will be considered to contribute to the WTP requirements. The total area of forest retention within each THLB polygons will be counted towards meeting the WTP retention requirement. Where the retention area is insufficient to meet percent WTP target, an incremental WTP netdown will be applied to increase the total retention to the amount listed in Table 21.

Table 21. Landscape unit WTP retention requirements from SFMP

WTP %	Landscape unit (s)
3	Halfway, Tommy Lakes
4	Graham, Sikanni
5	Kobes, Trutch
6	Blueberry, Milligan, Crying Girl
7	Kahntah
8	Lower Beatton

8. Sensitivity Analyses to be Performed

Sensitivity analysis are evaluations of the harvest forecast's responsiveness to changing management assumptions or data inputs. By developing and testing a number of sensitivity analyses, it is possible to determine which variables most strongly influence the timber supply forecast. Table 22, 'Sensitivity issues' lists the sensitivity analyses to be undertaken as part of this timber supply review.

Table 22. Sensitivity issues

Issue to be tested	Sensitivity levels	Data source / justification
Harvest flow alternatives	Alternative short-term and/or mid-term harvest levels	Section 8.8(b) of the <i>Forest Act</i> assess the short- and long-term implications of alternative rates of timber harvesting.
Minimum harvestable age	Increase and decrease MHA by 10 years	Uncertainty of harvest cycle periods for managed stands.
Land base changes	Increase / decrease the THLB by 10%	Adjustment to test uncertainty in land base classification.
Site index estimate for managed stands	Increase and decrease site index by two metres	Uncertainty with the site index adjustment ratios.
Visual quality objectives	Set VQO polygons that have RVQC values, but are not 'made known' to 'made known'	Potential increase of area subject to visual quality objectives.
Phase II VRI adjustment to natural stand yield tables	Make adjustments to volume according to the strata identified in the Phase 2 VRI study	Uncertainty with the VRI phase II adjustment ratios.
MKMA deferred	Indefinitely vs. for 10 years in base case	This area may become unavailable to forest industry long term.
First Nations land use	Exclude Treaty Land Entitlement and K'IhTsaa?Dze tribal park from THLB	These areas may become unavailable to forest industry long term.
Agricultural land reserve	Convert ALR to non-forest upon harvest	Forest in the ALR is convertible to non-forest.
Canadian Boreal Forest Agreement - Boreal Caribou Harvest Deferral	Defer these areas	
Net area removal of areas that may economically inoperable	To be based on ECAS evaluation	ECAS. Some areas may be economically inoperable.
Unstable and potentially unstable terrain	Increase the net area removed by 50%	The unstable ground netdown may represent an underestimate.

9. Appendix 1: Calculating Stream Order Buffer Widths

Table 23. Stream order to class and buffer width calculation in BWBS and SWB zones

Sample distribution by class and order in BWBS_SBS in TSA 40 (count)									
ORDER\class	S1	S2	S3	S4	S1-S4	S5	S6	S5-S6	Total
1	22	5	21	28	17	6	423	1397	1919
2	5		89	57	1	9	170	273	604
3		43	202	54	10	26	79	76	490
4	2	207	146	5	1	36	41	12	450
5		83	1	1				1	86
6	1								1
Total	30	338	459	145	29	77	713	1759	3550

Sample distribution by class and order in BWBS_SBS in TSA40 (as %)									
ORDER\class	S1	S2	S3	S4	S1-S4	S5	S6	S-S6	Total
1	1%	0%	1%	1%	1%	0%	22%	73%	100%
2	1%	0%	15%	9%	0%	1%	28%	45%	100%
3	0%	9%	41%	11%	2%	5%	16%	16%	100%
4	0%	46%	32%	1%	0%	8%	9%	3%	100%
5	0%	97%	1%	1%	0%	0%	0%	1%	
6	100%	0%	0%	0%	0%	0%	0%	0%	

Stream order buffer widths calculated from stream class buffer widths (m)									
Stream class	S1	S2	S3	S4	S1-S4	S5	S6	S5-S6	
Stream class effective RMA	60	38	30	7.5	0	4.5	1	1.0	

Stream order	Proportion * Width = Contribution								Stream order buffer
1	0.7	0.1	0.3	0.1	0.0	0.0	0.2	0.8	2.2
2	0.5	0.0	4.4	0.7	0.0	0.1	0.3	0.5	6.4
3	0.0	3.3	12.4	0.8	0.0	0.2	0.2	0.2	17.1
4	0.3	17.5	9.7	0.1	0.0	0.4	0.1	0.0	28.0
5	0.0	36.7	0.3	0.1	0.0	0.0	0.0	0.0	37.1
6	60.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	60.0

Table 24. Stream order to class and buffer width calculation in ESSF and BAFA zones

Sample distribution by class and order in ESSF_BAFA in TSA40 (count)										
ORDER\class	S1	S2	S3	S4	S1-S4	S5	S6	S5-S6	Total	
1						191	466	657	75.2%	
2			3	1		68	88	160	18.3%	
3			8	9		3	14	14	5.5%	
4		1	6				2	9	1.0%	
5								0	0.0%	
6								0	0.0%	
Total	0	1	17	10	0	3	273	570	874	100.0%

Sample distribution by class and order in ESSF_BAFA in TSA40 (as %)									
ORDER\class	S1	S2	S3	S4	S1-S4	S5	S6	S5-S6	Total
1	0%	0%	0%	0%	0%	0%	29%	71%	100%
2	0%	0%	2%	1%	0%	0%	43%	55%	100%
3	0%	0%	17%	19%	0%	6%	29%	29%	100%
4	0%	11%	67%	0%	0%	0%	0%	22%	100%
5									
6									

Stream order buffer widths calculated from stream class buffer widths (m)									
Stream class	S1	S2	S3	S4	S1-S4	S5	S6	S5-S6	
Stream class Effective RMA	60	38	30	7.5	0	4.5	1	1	

Stream order	Proportion * Width = Contribution								Stream order buffer
1	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.7	1.0
2	0.0	0.0	0.6	0.0	0.0	0.0	0.4	0.6	1.6
3	0.0	0.0	5.0	1.4	0.0	0.3	0.3	0.3	7.3
4	0.0	4.2	20.0	0.0	0.0	0.0	0.0	0.2	24.4
5									
6									

Note: Streams with an order > 4 would also have 24.4 m buffers.