Williams Lake Timber Supply Area
Timber Supply Review

Data Package

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1. Introduction

The data package for the Timber Supply Review (TSR) program is simply an organized and consistent format for supplying the basic inputs required for a timber supply analysis.

This data package summarizes the information and assumptions that will be used to conduct timber supply analysis for the Williams Lake Timber Supply Area (TSA). The information and assumptions represent "current performance", which is defined by:

- 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 guidelines used in the area;
- in the standards used to approve or reject operational plans or prescriptions;
- in land-use plans approved by Cabinet (e.g., Cariboo-Chilcotin Land Use Plan);
- in legal objectives established under the *Forest and Range Practices Act* and the *Land Act* (e.g., Land Use Objectives for the Cariboo-Chilcotin Land Use Plan); and
- in other approved provincial government and joint agency natural resource management practices and policy.

This idea of current performance (the last five to ten years) should be kept in mind at all times when reviewing the data package. In other words, the 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. This data package, while representing the best knowledge and information available today, is subject to change.

Each section of this data package is generally organized in the following way:

1) a short explanation of the data used in the data table;
2) a data table; and
3) an area for comments and the source of the data.

This *Williams Lake TSA Timber Supply Review Data Package* is being released for public review and comment, and to support First Nations consultation. Significant comments that change data inputs or descriptions of current practices that influence the analysis will be noted in the final timber supply review documents such as the Timber Supply Analysis Public Discussion Paper and Chief Forester's Rationale for the Allowable Annual Cut Determination.

2. Current Forest Management Considerations and Issues

2.1 Base case management assumptions

These assumptions reflect current performance with respect to the status of forest land, forest management practices and knowledge of timber growth and yield. The base case harvest forecast is developed from these assumptions and is used as a baseline for assessing the impacts of uncertainties. Section 7, "Sensitivity Analyses" identifies areas of uncertainty in data and assumptions and outlines intended sensitivity analyses that are carried out. Additional sensitivity analyses may be performed if the initial results highlight areas of risk to timber supply.

2.2 Major forest management considerations and issues

Table 1 lists major forest management considerations and issues. Where possible, the issues are assessed directly in the timber supply analysis. If the issue does not fall within the definition of current management as described in Section 1, “Introduction”, the related timber supply impacts are assessed in a sensitivity analysis. There may be significant uncertainties in defining some current management issues. In such cases, sensitivity analysis can assist in assessing the timber supply implications and assigning degrees of risk to timber supply during allowable annual cut (AAC) determination.

Table 1. Major forest management considerations and issues

Consideration/issue	Description
Cariboo-Chilcotin Land Use Plan (CCLUP)	The Cariboo-Chilcotin Land Use Plan (CCLUP) was announced by government in October, 1994. The Cariboo-Chilcotin Land Use Plan 90-Day Report (March 3, 1995) has been accepted by government and the objectives have been reflected in a higher level plan order. The Cariboo-Chilcotin Land Use Plan Integration Report (CCLUPIR), which demonstrated the CCLUP objectives could be achieved given some specific adjustments to the strategies, was confirmed as "official government policy" in a June 22, 1999, memorandum signed by deputy ministers. This direction has been further refined through a series of land use planning processes. These include the Anahim Round Table, Sub-Regional Management Plans. In June, 2010, land use objectives were established by order under the Land Use Objectives Regulation of the *Land Act*. The Land Use Order (LUO) includes objectives for wildlife tree retention, old growth management areas, critical habitat for fish, community areas of special concern, lakes management, stream, wetland and lake riparian areas, mature birch retention, grasslands, scenic areas, trails, high value wetlands for moose, and grizzly bear. All objectives specified in the land use order are addressed in the analysis.
Landscape and Stand-Level Biodiversity	The establishment of old growth management areas (OGMAs) and wildlife tree retention requirements under the CCLUP LUO addressed many of the landscape-level biodiversity components of the CCLUP and in conjunction with recommended Biodiversity Conservation Strategy seral targets, as modified by the CCLUPIR, are considered by the district managers to be appropriate for achieving biodiversity objectives outlined in the CCLUP.

(continued)

Table 1. Major forest management considerations and issues

Consideration/issue	Description
Mountain Pine Beetle (MPB) Salvage Harvesting	The TSA was significantly impacted by the recent MPB infestation. High MPB population levels resulted in extreme beetle behavior; a significant amount of mature pine in the TSA has been killed and various levels of mortality have been detected in stands younger than 60 years. However, no measurable levels of MPB activity have been detected in age class 1 stands. An expedited AAC determination was done in 2007 to facilitate salvage planning. At that time it was projected that more than 80% of the merchantable pine would be killed by MPB. More recent projections (2012) estimate that the epidemic has killed approximately 60% of the pine in the TSA and it is unlikely that significant additional amounts are likely to be killed in the foreseeable future. From 2001 to 2010, about 74% of the harvest was lodgepole pine. See Section 6.2.6, "Mountain pine beetle (MPB) attacked stands".
Guidance on Landscape- and Stand-level Structural Retention in Large-Scale Mountain Pine Beetle Salvage Operations	In December 2005, the chief forester released guidance on landscape and stand-level structural retention in large-scale mountain pine beetle (MPB) salvage operations (Snetsinger 2005). This guidance recommended increased stand retention in areas subject to large-scale MPB salvage. However, as it was assumed that the retained areas would become available for harvest in 20-60 years these areas will not be excluded from the timber harvesting land base (THLB).
Site Productivity	In this analysis, site index adjustments will be applied to existing stands following harvest in the timber supply model using new site index estimates from Site Index by Biogeoclimatic Ecosystem Classification (SIBEC). The average site index of natural stands is 12.1; after harvest the SIBEC site index average is 16.1, a difference of +32%. This information is presented here for general knowledge.
Site Productivity of Interior Dry belt Douglas-fir Stands	The productivity of interior Douglas-fir stands in the drier ecosystems of the TSA has been shown to be underestimated. However, additional analysis is required prior to adjusting the site productivity estimates. In the event this new information is available prior to the AAC determination a sensitivity analysis will model the impact of a potential increase in mean annual increment (MAI).
Caribou No-Harvest Area	In 2007, as part of the Mountain Caribou Recovery Strategy, Cabinet directed that 95% of high capability caribou winter habitat be protected from harvesting. These areas centered around Quesnel Lake and will be excluded from the THLB as wildlife habitat areas.

(continued)

Table 1. Major forest management considerations and issues

Consideration/issue	Description
Marginally Economic Forest Types	Recommendation 2.1 from the report of the Special Committee on Timber Supply, "Growing Fibre, Growing Value" was to review marginally economic forest types to explore opportunities to mitigate mid-term timber supply deficits. A sensitivity analysis will be carried out to examine the effect of creating a partition aimed at harvesting stands that are below the minimum harvestable stand volume and greater than 65 m^3/ha.
Economic Operability/Low-Volume Stands	In the previous TSR, it was assumed that the minimum harvestable stand volume for lodgepole pine was 65 m^3/ha. However a review of actual harvest volumes for the period 1997 to 2009 showed that 90% of the harvest in lodgepole pine-leading stands was in stands with volumes over 87 m^3/ha; and 95% was in stands over 73 m^3/ha. As a result, in this analysis it is assumed that minimum stand harvest volume for lodgepole pine is 80 m^3/ha. A sensitivity analysis will be carried out to examine the effect of using 65 m^3/ha for pine.
Goal 2 Areas	The CCLUP was declared as a higher level plan on January 23, 1996. The land-use plan specified 12% of the Cariboo-Chilcotin would be protected through establishment of additional parks and protected areas. There was 11.75% established as Goal 1 parks. The remaining 0.25 of the CCLUP area (22 000 hectares) was retained and is to be used to protect relatively small special features. A list of candidate areas was developed through the Sustainable Resource Management Planning process and the accepted list is now known as the Goal 2 Protected Areas. On February 14, 2013, it was announced that Goal 2 areas would be established as Class A Parks. These areas are excluded from the THLB.
Area-Based Tenures	At least four new area-based tenures are proposed in the Williams Lake TSA. These include two or three First Nation Woodland Licences (FNWL), one or two Community Forest Agreements (CFA) and one woodlot. The effect on timber supply for the remaining TSA will be explored in sensitivity analysis.
Partition: Three Western Supply Blocks	Due to the distinct differences in timber types, economic conditions, and levels of community dependence prevailing in the three western supply blocks (Chilcotin, Tatla and Anahim Supply Blocks) relative to those in the main TSA, the chief forester specified a partition for these areas in his previous AAC determinations. These blocks will be included in the THLB and their volume contribution to the base case harvest levels will be reported.
Pulpwood Agreement (PA) #16	In previous TSRs, a partition of 107 000 cubic metres per year was set for PA 16. The focus of this partition is on pulpwood stands with little sawlog value, although this commitment exists there has been little activity within this TSA. This agreement will expire on April 30, 2015. There is currently no harvest under PA 16, and none is anticipated for the remainder of this agreement. There will be no analysis unit assigned to PA 16.

(continued)

Table 1. Major forest management considerations and issues (concluded)

Consideration/issue	Description
Unsalvageable Losses	Non-pine losses due to fires, beetles and abiotic factors have been revised since the previous TSR. The mountain pine beetle epidemic has essentially run its course in the TSA. No further catastrophic losses due to this pest are expected, unless large tracts of lodgepole pine are allowed to mature in the future. Other forest health factors have been re-analyzed and their potential impact on future timber supply has been estimated. The years 2003, 2009, 2010 saw catastrophic losses due to wildfire. The inventory used in the analysis will be updated to reflect these events. For this TSR, it is assumed that due to climate change, similar losses are likely in the future. Therefore, future unsalvageable loss estimates due to fire, including the recent catastrophic fires, will be based on the 15-year fire history.
Wildfire and MPB Reforestation	There are large ongoing projects in the TSA aimed at reforesting areas which have experienced catastrophic wildfire and mountain pine beetle infestation. All areas which were managed forests prior to wildfire are being assessed and treated, as appropriate to ensure appropriate, ongoing management of these stands.
Habitat Supply Modelling	Independent of the timber supply analysis, agencies including the Ministry of Forests, Lands and Natural Resource Operations (FLNR) and the Ministry of Environment, in conjunction with the Forest Analysis and Inventory Branch (FAIB), are developing an approach to habitat supply modeling that will assess habitat availability for a number of wildlife species through both time and space. For this TSR, habitat supply modeling will be used to assess the effect of the base case harvest levels on the habitat for a number of wildlife species. This process will be used to examine the change in habitat supply that could occur. The list of species and their habitat requirements have been developed by a diverse group of experts. These species are intended to give a sense of how timber harvest projections will affect important habitat components. This modelling will provide the chief forester with information on how the base case harvest levels could impact a variety of representative species and help to support information sharing with First Nations.
Hydrological Impacts	The mountain pine beetle outbreak, salvage harvesting and catastrophic wildfires have combined to affect watersheds, in particular in the western part of the TSA. The effects of harvest levels on Equivalent Clearcut Areas (ECAs) will be modelled by landscape unit and reported on as part of the TSA analysis.

3. Inventories

3.1 Background information

The inventories that will be used to define the THLB and model forest management activities are listed in Table 2. The source and vintage of the information are also shown.

Table 2. Inventory information

Spatial data	Source	Feature name	Vintage/ download
Timber Supply Areas	BCGW	WHSE_ADMIN_BOUNDARIES.FADM_TSA	2011
Landscape Units	BCGW	WHSE_LAND_USE_PLANNING.RMP_LANDSCAPE_UNIT_SVW	2011
Ownership	BCGW	WHSE_FOREST_VEGETATION.F_OWN	2011
Protected Areas: Parks and Ecological Reserves	BCGW	WHSE_TANTALIS.TA_PARK_ECORES_PA_SVW	2011
Community Watersheds	BCGW	WHSE_WATER_MANAGEMENT.BC_COMMUNITY_WATERSHEDS	2011
Managed Licences	BCGW	WHSE_FOREST_TENURE.FTEN_MANAGED_LIC_POLY_SVW	2011
Indian Reserves	BCGW	WHSE_ADMIN_BOUNDARIES.CLAB_INDIAN_RESERVES	2011
First Nations Agreement Boundaries	BCGW	WHSE_HUMAN_CULTURAL_ECONOMIC.FNIRS_AGREEMENT _BOUNDARY_SVW	2011
BCTS Operating Area	BCGW	WHSE_ADMIN_BOUNDARIES.FADM_BCTS_AREA_SP	2011
Biogeoclimatic Ecosystem Classification	BCGW	WHSE_FOREST_VEGETATION.BEC_BIOGEOCLIMATIC_POLY	2011
Provincial Site Productivity Layer	FAIB	SITE_PROD_BC	2012
Vegetation Resource Inventory	BCGW	WHSE_FOREST_VEGETATION.VEG_COMP_LYR_R1_POLY	2010
RESULTS Data	FAIB	Silviculture Activities History	2011
Forest Depletions	FAIB	CONSOLIDATED_CUTBLOCKS_2011	2011
Protected Areas: Goal 2	BCGW	WHSE_LAND_USE_PLANNING.RMP_PLAN_NON_LEGAL_POLY_SVW	2011
Terrain Stability Mapping	BCGW	REG_LAND_AND_NATURAL_RESOURCE.TERRAIN_STABILITY_ CAR_POLY	2011
Ungulate Winter Ranges	BCGW	WHSE_WILDLIFE_MANAGEMENT.WCP_UNGULATE_WINTER_RANGE _SP	2011
Visual Landscape Inventory	BCGW	WHSE_FOREST_VEGETATION.REC_VISUAL_LANDSCAPE_ INVENTORY	2011
Protected Areas: Wildlife Management Areas	BCGW	WHSE_TANTALIS.TA_WILDLIFE_MGMT_AREAS_SVW	2011
Wildlife Habitat Areas	BCGW	WHSE_WILDLIFE_MANAGEMENT.WCP_WILDLIFE_HABITAT_AREA_ POLY	2011

(continued)

Table 2. Inventory information (concluded)

Spatial data	Source	Feature name	Vintage/ download
Proposed Wildlife Habitat Areas	BCGW	REG_LAND_AND_NATURAL_RESOURCE.WLD_WHA_PROPOSED_SP	2011
Caribou Habitat	BCGW	WHSE_WILDLIFE_MANAGEMENT.WCP_WILDLIFE_HABITAT_AREA_POLY	2011
Fire Perimeters	BCGW	WHSE_LAND_AND_NATURAL_RESOURCE.PROT_CURRENT_FIRE_POLYS_SP	2011
Old Growth Management Areas	BCGW	WHSE_LAND_USE_PLANNING.RMP_OGMA_LEGAL_CURRENT_SVW	2011
CCLUP Birch Areas	BCGW	WHSE_LAND_USE_PLANNING.RMP_PLAN_LEGAL_POLY_SVW	2011
CCLUP Community Areas of Special Concern	BCGW	WHSE_LAND_USE_PLANNING.RMP_PLAN_LEGAL_POLY_SVW	2011
CCLUP Critical Fish Habitat	BCGW	WHSE_LAND_USE_PLANNING.RMP_PLAN_LEGAL_POLY_SVW	2011
CCLUP Grizzly Bear Capability	BCGW	WHSE_LAND_USE_PLANNING.RMP_PLAN_LEGAL_POLY_SVW	2011
CCLUP L3/L1 Lakes	BCGW	WHSE_LAND_USE_PLANNING.RMP_PLAN_LEGAL_POLY_SVW	2011
CCLUP Lake Management Classes	BCGW	WHSE_LAND_USE_PLANNING.RMP_PLAN_LEGAL_POLY_SVW	2011
CCLUP High Value Wetlands for Moose	BCGW	WHSE_LAND_USE_PLANNING.RMP_PLAN_LEGAL_POLY_SVW	2011
CCLUP Scenic Areas	BCGW	WHSE_LAND_USE_PLANNING.RMP_PLAN_LEGAL_POLY_SVW	2011
Trail_buffer	BCGW	WHSE_LAND_USE_PLANNING.RMP_PLAN_LEGAL_POLY_SVW	2011
Cariboo-Chilcotin Land Use Plan Legal Order Boundary	BCGW	WHSE_LAND_USE_PLANNING.RMP_STRGC_LAND_RSRCE_PLAN_SVW	2011
Mountain Pine Beetle Projected Kill	FAIB	BCMPB.V9.CUMKILL.PROJECTED	2012
Elevation Points	BCGW	WHSE_BASEMAPPING.TRIM_CONTOUR_POINTS	2011
Slope Classification	FAIB	Derived using TRIM elevation points	2011
Chilcotin Demonstration Area/Community Forest	DCC	WL_PROP_COMM_FOREST	2011
Licensee Operating Areas	DCC	CARIBOO_OPERATING_AREAS	2011
Cycle time /Distance to Mill	DCC	CYCLE_TIME_WL_TSA_CONTOUR	2011
Wetland Management Zones (Buffers)	BCGW	REG_LAND_AND_NATURAL_RESOURCE_WETLAND_MGMT_CAR_POLY	2005
Stream Management Zones (Buffers)	BCGW	REG_LAND AND NATURAL_RESOURCE_STREAM MANAGEMENT_CAR_POLY	2005
Proposed Area Based Tenures	DCC	District Mapped Information	2013

Data source and comments:

There are generally three sources of data for the analysis; corporate level data that resides in the provincial geographic data warehouse (BCGW), data maintained by the Forest Analysis and Inventory Branch (FAIB) and local data that is stored at the branch, region or district level (DCC). One exception is the RESULTS information; which is maintained by Resource Practices Branch.

3.2 Forest cover inventory

The original forest cover inventory for Williams Lake TSA was developed from air photos acquired in the 1980s and 1990s for the western portion of the TSA and in the late 2000s for eastern portion of the TSA. Along the western boundary of the TSA some inventory dates from the 1960s. In the eastern portion of the TSA, the forest cover attributes conform to the Vegetation Resource Inventory (VRI) standard. In the western portion of the TSA, the forest cover attributes conform to the FIP standard.

The inventory has been updated annually to reflect changes from disturbance (fire and harvesting) through electronic data submissions from licensees and government. Satellite imagery has also been used to detect and update the inventory for any additional changes in forest cover not recorded in the data submissions. The inventory file has been projected to 2011 and polygon volumes have been adjusted to reflect MPB mortality observed in the 2010 forest health overview flight.

Inventory information has not been updated for recent, large wildfires. The approach described in Table 3 is taken to update the forest inventory impacted by 2009 and 2010 wildfires.

Table 3. Inventory updates for 2009 and 2010 fire disturbance

Stand types	Pre-fire disturbance group	Stands selected	Post-fire attribute adjustments
Douglas-fir (Fd) Leading Stands	Live - 70%	Randomly select 70% of the mature stands by area	None
	Dead - 30%	Select all remaining Fd stands	• Stand ages set to zero • Regeneration delays of 30 years applied to stands >=40 years. • Regeneration delays of 7 years applied to stands <40 years • Burnt plantations are assumed to be re-planted within 7 years of the fire date
Other Stands	Live - 10% (2009 fires only)	Randomly select 10% of the mature stands by area	None
	Live - 20% (2010 fires)	Randomly select 20% of the mature stands by area	None
	Dead – remaining area (90% or 80%)	Select all remaining non-Fd stands	• Stand ages set to zero • Regeneration delays of 30 years applied to stands >=40 years. • Regeneration delays of 7 years applied to stands <40 years • Burnt plantations are assumed to be re-planted within 7 years of the fire date

Data source and comments:

Fire disturbance levels for these stand types were estimated by the district and licensee staff, and where required, stand ages were adjusted based on the fire disturbance date. The overall effect of this update approach is that all of the randomly-selected live stands remain unchanged while all of the dead stands selected are totally excluded.

For the eastern portion of the TSA, a VRI re-inventory is scheduled be completed in early 2013. Where new VRI data becomes available, it will be used in the timber supply analysis.

A Landscape Vegetation Inventory (LVI) was initiated in 2012 for the western portion of the TSA. LVI utilizes Landsat data and high resolution digital photography to map forest cover polygons and assign attributes. Although the LVI will not be completed in time for use in the timber supply analysis results of the high-resolution photo samples will be available to compare to the existing VRI data.

3.3 Provincial site productivity layer

The provincial site productivity layer provides site index estimates for commercial tree species. The estimates are based on available ecosystem data (spatial delineations and descriptions) from existing Predictive Ecosystem Mapping (PEM) and Terrestrial Ecosystem Mapping (TEM) datasets, coupled with SIBEC data. In the Williams Lake TSA the estimates are primarily based on PEM. Where no PEM data is available, site index estimates are based on biophysical data and species ranges.

Data source and comments:

The site indices provided in provincial site productivity layers are more appropriately used for strategic analysis, such as TSR, as opposed to operational purposes. The estimates are derived from best known and most current information as of 2011/12. They are not intended to replace more accurate site specific data where it is available.

4. Division of the Area into Management Zones

4.1 Management zones and tracking of multiple objectives

The concept of management zones is used to differentiate areas with distinct management emphasis. For example, a zone may be based on a harvesting system, silviculture system, visual quality objectives or wildlife consideration. An area of forest may be subject to more than one management objective. Each objective can be tracked separately in the timber supply model. Land considered unavailable for timber harvesting can contribute to the achievement of other forest management objectives.

Table 4 outlines the zones or objectives that will be incorporated in the timber supply model. It does not list objectives that will be modelled by excluding areas from the THLB (e.g., riparian areas and wild life tree areas). Further information on the forest cover requirements to be applied to these areas can be found in Section 6.1.5, "Integrated resource management".

Table 4. Management zones and objectives to be tracked

Management zone/objective	Source	Issue
Landscape Units (LU) and Seral Stage Targets by BEC Subzones	GeoBC	Landscape-level biodiversity
Wildlife Habitat Areas	Non-standard map layer	General wildlife measures
Ungulate Winter Range	CCLUP	Silviculture systems
Scenic Areas	CCLUP	Visual quality objectives
Western Supply Blocks	TSB boundaries	AAC partition
Lakeshore Management Zones	CCLUP	Visual quality objectives
Grasslands	CCLUP	Restoration of open grassland condition

Data source and comments:

Sources of information include both non-standard local map information in addition to provincial level GIS data stored in the corporate data warehouse. Origins of the data include higher-level plans, local resource management plans and ministerial orders.

4.2 Analysis units

An analysis unit is composed of forest stands with similar tree species composition, timber growing potential and treatment regimes. Each analysis unit is assigned its own timber volume projection (yield table) for existing and future stands. Yield tables for existing ―natural stand analysis units are derived using the Variable Density Yield Prediction (VDYP) model. Yield tables for managed stand analysis units (i.e., recent plantations and future stands) are derived using the Table Interpolation Program for Stand Yields (TIPSY).

Table 5. Definition of analysis units

Analysis unit	Pre-harvest leading species	Additional criteria	Site index range (height in metres at 50 years)
Mule Deer Winter Range (MDWR) fir stands in Transition and Deep Snowpack zones	Fd>=40%		>=7.0
Dry belt fir stands and fir stands in Mule Deer Winter Range (MDWR) Shallow and Moderate Snowpack zones; With selection harvesting history	Fd>=40%	Dry belt: IDF and SBPS BEC zones	>=7.0
Dry belt fir stands and fir stands in Mule Deer Winter Range (MDWR) Shallow and Moderate Snowpack zones; Without selection harvesting history	Fd>=40%	Dry belt: IDF and SBPS BEC zones	>=7.0
Wet belt selection harvesting fir stands	Fd>=40%	Within SBS and, ICH BEC zones and MDWR	>=7.0
Mule deer winter range, even-aged	All	Within MDWRs with Fd< 40%	>=7.0
Itcha Ilgachuz modified harvest caribou area — terrestrial lichen sites	All	Irregular group shelterwood (80% of the Caribou modified harvest area)	>=7.0
Itcha Ilgachuz modified harvest caribou area — arboreal lichen sites	All	Partial cut (20% of the Caribou modified harvest area)	>=7.0
Fd (poor, non-selection)	Fd	Outside of IDF, SBPS and MDWR	7.0 – 12.0
Fd (good/medium, non-selection)	Fd	Outside of IDF, SBPS and MDWR	>12.0
Cw, Hw (poor)	Cw, Hw		7.0 – 12.0
Cw, Hw (medium)	Cw, Hw		12.1-17.0
Cw, Hw (good)	Cw, Hw		>17.0
Sx, Bl (poor)	Sx, Bl		7.0 – 12.0
Sx, Bl (medium)	Sx, B		12.1-17.0
Sx, Bl (good)	Sx, Bl		>17
Pl (poor)	Pl		7.0 – 12.0
Pl (medium)	Pl		12.1-17
Pl (good/medium)	Pl		>17

Data source and comments:

The analysis units for pine-leading stands will be further stratified by the analyst according to the severity of the current beetle attack and the age in order to model the beetle attack properly and keep track of dead pine volume over time.

Twenty percent of the Itcha Ilgachuz modified harvest area outlined in the northern caribou strategy

will be assigned to the arboreal-lichen analysis unit. The remaining 80% is assigned to the terrestrial-lichen analysis unit.

Site index classes will be assigned using SIBEC site index values where they are available. The proposed site index ranges for analysis units were set to generally align with site classes defined in the forest inventory site index groups with adjustments made to achieve a balanced distribution of area among site classes.

5. Timber Harvesting Land Base Definition

5.1 Identification of the timber harvesting land base

This part of the data package outlines the steps used to identify the Crown forest land base, gross harvesting land base and timber harvesting land base. The Crown forest land base (CFLB) is the portion of the total area with forest cover that contributes to Crown forest management objectives in the context of TSA timber supply, such as landscape-level biodiversity or visual quality objectives. The CFLB excludes:

- private land;
- federal reserves;
- long-term leases;
- area-based forest tenures;
- non-forested lands.

The gross harvesting land base (GHLB) is the portion of the CFLB where timber harvesting is permitted, subject to forest management objectives and constraints. The GHLB excludes:

- miscellaneous provincial crown land not contributing to timber supply;
- federal and provincial protected areas;
- areas with legally established boundaries where timber harvesting is incompatible with management objectives for other resource values.

The timber harvesting land base (THLB) is the portion of the GHLB where timber harvesting is projected to occur over the long term. The THLB excludes:

- areas that are not suitable or uneconomic for timber production; and
- areas without legally established boundaries where timber harvesting is incompatible with management objectives for other resource values.

Land is considered outside the THLB only where harvesting is not expected to occur. Any area in which some timber harvesting will occur remains in the THLB, even if the area is subject to other management objectives, such as wildlife habitat and biodiversity. These objectives are modelled in the timber supply analysis, as forest cover constraints. The CFLB outside of the THLB also contributes to these other objectives.

Community Forest Agreements and other area-based tenures (woodlot licences, for example) are excluded from the CFLB and the THLB because the AACs for these areas are determined under a separate process.

The current timber harvesting land base may increase in size over time in the following situations:

- where management activities improve productivity or operability (e.g., the stocking of land currently classified as non-commercial brush with commercial tree species);
- through the acquisition of productive forest land (e.g., timber licence reversions).

or decrease in size where:

- management activities prevent the reestablishment of a productive forest (e.g., future permanent roads).

5.2 Details on land base classification

5.2.1 Land not administered by the Crown for TSA timber supply

Land is excluded from the Crown forest land base when it does not contribute to TSA objectives for wildlife habitat, biodiversity or visual quality in the context of timber supply. Such land includes private land, municipal land, federal land and Indian Reserves.

A spatial data set of land ownership was developed using information from the Crown Land Registry and the Integrated Cadastral Information Society. Table 6 shows the contribution of each ownership to the forest management land base and the gross harvesting land base.

Table 6. Ownership contributions

Ownership code	Forest management land base	Timber harvesting land base
40 Private – Crown Grant	No	No
50 Federal Reserve	No	No
52 Indian Reserve	No	No
60 Crown Ecological Reserve	Yes	No
61 Crown UREP (Use, Recreation and Enjoyment of the Public) Reserves	Yes	Schedule C: Yes Schedule N: No
62 Crown Forest Management Unit (TSA)	Yes	Schedule C: Yes Schedule N: No
63 Crown Provincial Park Class A	Yes	No
69 Crown Miscellaneous Reserves	Yes	Schedule C: Yes Schedule N: No
67 Crown Provincial Park equivalent or Reserve	Yes	Schedule C: Yes Schedule N: No
70 Crown Active Timber Licence in a TSA	Yes	No
77 Crown and Private Woodlot Licence	No	No
79 Community Forest	No	No
99 Crown Misc. lease	No	No

Data source and comments:

The forest cover ownership and land administration data set, along with the VRI are the primary data sets used to determine land classified as Crown forest.

Area-based forest tenures such as established Community Forest Agreements and Woodlot Licences are excluded from the forest management land base because they have their AAC determined independently of the timber supply review process for the TSA. These areas are listed in Table 6 above.

5.2.2 Land classified as non-forest

The British Columbia land classification system (BCLCS) and site index within the VRI will be used in conjunction with past logging to identify areas of non-forest. Table 7 shows the criteria used to remove non-forested areas from the THLB.

Table 7. Description of non-forest areas

Attributes	Description
VRI BCLCS level 1 equal to 'N' and no logging history	Non-vegetated
BCLCS level 2 = 'N' and no logging history	Non-treed
BCLCS level 3 = 'A' and no logging history	Alpine
Projected Height < 5 m and no logging history	Forested but does not contribute to biodiversity and habitat objectives
Existing roads, trails and landings	See Sections 5.2.3 and 5.2.4

Data source and comments:

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

Logged areas (excluded from the THLB reductions) are identified using the consolidated harvest depletion layer produce by FAIB.

Some areas in the Williams Lake TSA are comprised of forest with no harvest history and very low tree height. These areas are excluded from both the CFLB and the THLB because they were determined to be unsuitable for achievement of landscape-level biodiversity and wildlife habitat objectives.

5.2.3 Roads and landings

The purpose of this section is to identify that portion of the land base that will be occupied by roads, trails and landings constructed to access and facilitate harvest operations.

Separate estimates are made to reflect the loss in productive forest land due to 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 after stands are harvested for the first time in the timber supply model.

Road areas listed in Table 8 were estimated including landings by multiplying the length of road in each class with its respective road width.

Table 8. Width and area of existing road

Road class	Length (km)	Width (m)	Hectares
Forest Service Roads	2924	25	7310
Public Road (non-excluded portion only)	940	25	2350
Road Permit	13 359	15	20 040
Non-status	3268	15	4900
On-block Road (temporary)	18 988	0	0

Based on the information in the table above, the total area of existing roads is 34 600 hectares. To account for existing RTL, this area will be converted to a common factor that will be applied to all stands less than 70 years old (based on district experience, assumed to be previously roaded) that will be applied to remove an area equal to 34 600 hectares from the non-excluded portion of the TSA.

Reductions factors for future RTL were calculated based on the average amount of on-block permanent access structure that has been observed in the five-year period from January 2007 to November 2012. These factors are 3.4% for DCC and 2.4% for DCH. The yields of all stands aged 70 years and above will be reduced by these factors after they are harvested.

Data source and comments:

The road lengths were derived from the following data sets from the BCGW.

- Road Atlas: WHSE_BASEMAPPING.DRA_DIGITAL_ROAD_ATLAS_LINE_SP;
- Forest Service Roads and Road Permits: WHSE_FOREST_TENURE.FTEN_ROAD_LINES;
- Public Roads: WHSE_IMAGERY_AND_BASE_MAPS.MOT_ROAD_FEATURES_INVNTRY_SP;
- On Block Roads: WHSE_BASEMAPPING.DRA_DIGITAL_ROAD_ATLAS_LINE_SP clipped to results and FTA cutblocks; and
- Non-Status Roads: WHSE_BASEMAPPING.DRA_DIGITAL_ROAD_ATLAS_LINE_SP less the FSR , road permits, public roads and on block roads.

5.2.4 Trails

The CCLUP dictates 50 metre management zones on either side of identified trails be maintained, with the treed area inside the management zones managed to the combined minimum basal area retention of 85%. Eighty-five percent of area within the 100 m corridor along trails will not be available for harvest.

Data source and comments:

The land base reduction for identified trails reflect the Land Use Order (LUO) for the Cariboo-Chilcotin Land Use Plan, May 19, 2010. Amended April 18, 2011. Map 10. The LUO specifies that a 50-metre management zone be maintained either side of identified trails. Up to 15% of the management zone can be harvested for insect control and blowdown management.

5.2.5 Non-commercial cover

Those areas that the VRI shows as having non-commercial species growing on them are considered unlikely sites for timber production and will be excluded from the timber harvesting land base.

Data source and comments:

Non-commercial brush areas, as identified by the non-forest descriptor codes of “NC” or “NCBR” in the VRI are also excluded from the THLB.

5.2.6 Old-growth management areas

An old-growth management area (OGMA) is defined in the *Forest Practices Code of British Columbia Act Operational Planning Regulation* as an area established under a higher-level plan which contains or is managed to replace structural old-growth attributes. The objectives for OGMA are to retain old forests and natural successional processes within unharvested areas. OGMAs contribute to biodiversity objectives and will be managed as per direction in the LUO. Many OGMAs overlap with other resource management values such as: riparian reserves, critical fish habitat, wildlife habitat area (WHA), goal 2 protected areas, etc. There are three types of OGMAs described under the LUO: transitional, rotating and permanent.

In accordance with the LUO, transitional OGMAs only exist until 2030. They are considered no-harvest areas until that date. Rotating OGMAs and permanent OGMAs are excluded from the THLB.

Conditional harvesting is allowed in OGMAs for forest health reasons as described in the LUO and supporting direction from the Regional Biodiversity Committee.

Data source and comments:

The land base reduction for OGMAs reflect the LUO for the Cariboo-Chilcotin Land Use Plan, May 19, 2010. Amended April 18, 2011. Map 3.

5.2.7 Wildlife habitat areas

There are a number of wildlife habitat areas (WHAs) in the Williams Lake TSA. These include areas identified for specific management of caribou, prairie falcon, American white pelican, and grizzly bear. The impact to timber supply from these WHAs is low and is expected to be mitigated through thoughtful location of wildlife tree retention and other land use constraints such as OGMAs, riparian protection, lakeshore management zones, and Goal 2 Protected Areas. These WHAs will not be excluded from the THLB with the exception of 1949.6 hectares of grizzly bear WHA along the Chilko River.

It is likely that several more WHAs will be established prior to the next TSR for the management of Fisher, and the maintenance of several rare or endangered plant communities.

The areas identified for the management of caribou are dealt with in other sections of the document.

Data source and comments:

The mapped boundaries established WHAs were obtained from the corporate data warehouse and management direction were obtained from the Rare and Endangered Species Specialist; FLNR, Fish and Wildlife, Williams Lake.

5.2.8 Community areas of special concern

Community areas of special concern are spatially delineated areas that have been designated as no-harvest areas in the LUO to address a mix of CCLUP objectives.

Community areas of special concern are excluded from the THLB.

Data source and comments:

The community areas of special concern boundaries are from the Land Use Order Objectives for the Cariboo-Chilcotin Land Use Plan, May 19, 2010. Amended April 18, 2011. Map 5.

5.2.9 Critical habitat for fish

Critical habitat for fish are spatially delineated areas that require protection and site specific management actions. The LUO specifies that the areas are to be maintained as no-harvest areas.

Critical fish habitats are excluded from the THLB.

Data source and comments:

Critical fish habitat area boundaries are from Land Use Order Objectives for the Cariboo-Chilcotin Land Use Plan, May 19, 2010. Amended April 18, 2011. Map 4.

5.2.10 Riparian reserve zone (RRZ) and riparian management zone (RMZ) reductions

Riparian habitat occurs along streams and around lakes and wetlands. Table 9 lists the area reductions to be applied to account for riparian reserve zones and riparian management zones.

Table 9. Riparian management areas

Description	Class	Reserve zone width (metres)	RRZ reduction (%)	Management zone width (metres)	RMZ reduction (%)
Streams	S1-A	0	—	100	20
	S1-B	50	100	20	50
	S2	30	100	20	50
	S3	20	100	20	50
	S4/S5	0	—	30	25
	S6	0	—	20	5
Wetlands	W1/W5	10	100	40	25
	W2	10	100	20	25
	W3/W4	0	—	30	25
Lakes	L1-B	10	100	0	—
	L2	10	100	20	25
	L3/L4	0	—	30	25

Data source and comments:

A previously conducted GIS project mapped riparian reserve zones and riparian management zones for streams, lakes, and wetlands in the Cariboo Region. Each stream, lake, and wetland class was spatially identified, classified and then buffered in accordance with Table 9 criteria to create a reserve zone and management zone**.**

For this analysis, riparian zones will be intersected with forest inventory and a riparian retention amount will be calculated for each resultant polygon based on the reserve widths and percent retention amounts listed in Table 9. Each intersecting resultant polygon will be netted down based on the calculated amount of riparian retention.

5.2.11 Cultural heritage and archaeological resources

Archaeological Overview Assessments (AOA) and band specific Traditional Use Studies (TUS) have been completed within the Williams Lake TSA. First Nations consultation occurs during the cutting permit adjudication process, on a site specific level.

Most known archeological sites are small and many are found in areas with additional ecological or environmental constraints. These sensitive lands are typically excluded from the THLB through the placement of reserve or no-harvest zones. Discussion with district staff indicates that additional area over and above that already excluded to account for other values is anticipated to be minimal. Therefore, no specific additional land base reduction will be applied for cultural heritage resources.

5.2.12 Areas considered inoperable

Terrain classification, steep slopes and site productivity criteria were used to identify areas deemed to be inoperable and unsuitable for conventional timber harvesting. Using terrain stability mapping where it was available in the TSA, any unstable (U or 5), potentially unstable (P or 4) terrain was 100% excluded.

Steep slopes that are unlikely to be harvested were also entirely excluded from the THLB, these areas were identified as follows:

1. Landscape units within the (retired) Horsefly Forest District where slopes exceed 70%. These landscape units have forest types suitable for cable harvesting on slopes between 40% and 70%, and cable harvesting has been employed in this area.

2. The remainder of the landscape units in the Williams Lake TSA (outside of the Horsefly area) where slopes exceed 40%. Forest types and various constraints make this portion of the TSA unsuitable for harvesting on slopes greater than 40%.

Data source and comments:

Slope classification mapping was used to identify areas of the TSA where the slope is greater than 40%.

Landscape units in the (retired) Horsefly Forest district were identified and used to determine where harvesting may occur on slopes greater than 40% based on forest types and historical practices.

5.2.13 Low site exclusions

Sites may have low productivity either because of inherent limiting site factors (nutrient availability, exposure, excessive moisture, etc.) 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 economically harvestable, they are identified for exclusion from the timber harvesting land base.

The following table will be used to generate a site index which will define low sites, where merchantable volumes will never reach the minimum harvestable criteria identified in Section 6.1.3. These sites, in unharvested areas, will be excluded from the THLB but will contribute to other values.

Table 10. Description of sites with low timber growing potential

Zone/ group	Inventory type group	Age	Characteristics			
			Height	Volume (m^3)	Site index	Reduction (%)
All	Pli	> 160	N/A	< 80		100
All	Fdi, Sx/Se, Bl	> 160	N/A	< 120		100

Pli: lodgepole pine, Fdi: interior Douglas-fir, Sx/Se: spruce, Bl: subalpine fir.

Data source and comments:

The VDYP version 7 growth model for natural stands will be used to calculate a cut-off site index for each species using the age and volume criteria in the table above. The minimum volumes of 80 m^3/ha and 120 m^3/ha have been used to identify low site characteristics and reflect the minimum harvest volume criteria used in Section 6.1.3. The age 160 years is used because it is assumed that most stands will be at, or past, their maximum volume at that age. Forest cover polygons with inventory site index below the calculated site index will be excluded from the THLB.

5.2.14 Deciduous stands

Hardwood volume from the Williams Lake TSA is utilized by mills. However, this volume is a relatively minor and largely incidental component of the current harvest profile. Discussion with licensees and tenures staff indicates that hardwoods are not specifically targeted for harvesting and that the bulk of aspen is being retained on site. Harvesting data from the Harvest Billing System (HBS) indicates that 14 783 cubic metres of deciduous has been scaled in the Williams Lake TSA over the last two years.

Aspen will be included where it is a minor component of the stand as it is often harvested incidentally in conifer-leading stands. See Section 6.1.2.

Deciduous-leading stands are excluded from the THLB. Incidental deciduous volume harvesting will be accounted for by including the deciduous volume in mixed stands leading in coniferous species.

Data source and comments:

Historic harvested volumes reported in the HBS reporting was used to determine the current level of deciduous volume harvested. There is currently no harvest under PA 16, and none is anticipated for the remainder of this agreement. There will be no analysis unit assigned to PA 16.

5.2.15 Wildlife trees and wildlife tree patches

The LUO specifies the minimum percentage of harvested areas for wildlife tree retention by landscape unit and BEC (Schedule 1 of the LUO). These wildlife tree retention targets include contribution from riparian management and reserve zones. In the analysis the wildlife tree retention requirements were reduced by the total amount of the riparian reserve area in each polygon. Wildlife tree retention percentages were excluded from harvest over the entire rotation.

The chief forester provided “Guidance on Landscape- and Stand-level Structural Retention in Large-Scale Mountain Pine Beetle Salvage Operations” (December 2005) which recommended increased levels of stand-level retention in large mountain pine beetle cutblocks. Since this increased retention was not intended to be reserved for the entire rotation no incremental land base reduction will be applied

Data source and comments:

Land Use Order Objectives for the Cariboo-Chilcotin Land Use Plan, May 19, 2010. Amended April 18, 2011.

Forest and Range Evaluation Program. Stand-Level Biodiversity survey results for Williams Lake TSA. Surveys conducted from 2006-2011.

6. Current Forest Management Assumptions

6.1 Harvesting

Currently, harvest in the Williams Lake TSA is predominantly concentrated in MPB impacted, pine-leading stands. Modelling will reflect the current practice by focusing the short-term harvest on mature pine-leading stands that meet minimum harvest criteria as defined in Section 6.1.3, and that have less than 80 m^3 live volume. This will also reserve stands with more than 80 m^3/ha live volume for harvesting during the mid term.

As timber supply declines following completion of MPB harvesting the model will then shift to harvest existing non-pine stands. The harvesting model will revert to a long-term harvest flow when more than 50% of harvesting volume is generated from managed stands.

There will be no specific harvesting sequence rule (e.g., relative oldest first) or harvest priority applied in the analysis, but the optimization model will select the harvesting sequence that is optimal for the harvest flow under the constraints applied (e.g., VQO, mature+old requirements and minimum harvesting criteria).

6.1.1 Merchantable timber specifications

The merchantable timber specifications define the maximum stump height, minimum top diameter inside bark (dib) and minimum diameter at breast height (dbh) by species and are used in the analysis to calculate merchantable volume. The merchantable timber specifications are described in Table 11.

Table 11. Merchantable timber specifications

Analysis unit	Utilization		
	Minimum diameter at dbh (cm)	Maximum stump height (cm)	Minimum top dib (cm)
All	12.5	30	10.0

Data source and comments:

The Interior Timber Merchantability Specifications of the Provincial Logging Residue and Waste Measurement Procedures Manual, specifies a minimum diameter at dbh of 12.5 cm for pine and 17.5 for all other species in the interior. However, discussions with licensees, and harvest data reveals that actual utilization in the Williams Lake TSA is a minimum diameter of 12.5cm for all species in the TSA.

6.1.2 Volume exclusions for mixed-species stands

Deciduous species are included in the analysis where they comprise a minor component of the stand. Aspen is a managed species within the TSA and, it is included in the appraisal when identified in the cruise.

However, this volume is a relatively minor and largely incidental component of the current harvest profile.

Discussion with major licensees and tenures staff indicates that hardwoods are not specifically targeted for harvesting and that the bulk of aspen is being retained on site. Harvesting data from HBS indicates that 14,783 deciduous has been scaled in the Williams LakeTSA over the last two years.

Data source and comments:

FLNR Harvest Billing System reporting was used to determine the current level of deciduous volume harvested.

6.1.3 Minimum harvestable criteria

Minimum harvestable ages are, as the term implies, the minimum age at which harvesting is expected to be feasible. While harvesting may occur in stands at the minimum requirements in order to meet forest level objectives (e.g., avoiding large inter-decadal changes to harvest levels), most stands will not be harvested until well past the minimum ages because other resource values take precedence (e.g., requirements for the retention of older timber).

To be eligible for harvesting a stand must meet both the age and volume requirements indicated in Table 12. These criteria were derived using information compiled from cruise reports for the period between 1997 and 2009. These reports suggested a minimum merchantable harvest volume of 80 m³/ha for pine-leading stands and 120 m³/ha for non-pine leading stands.

Table 12. Minimum harvestable age criteria

Analysis unit	Minimum criteria			Minimum harvest age (years)
	Height class	Diameter cm	Volume m³	
Pine	All	12.5	80	60
Non-pine	All	12.5	120	80

Data source and comments:

The Electronic Commerce Appraisal System (ECAS) was used to determine harvested volume (m³/ha) for the years from 1997 to 2012. The results are in Table 13. The table demonstrates that 90% of the pine-leading stands harvested in the years 1997 to 2009, had greater than 93 m³/ha volume, and overall, 90% of all stands harvested were greater than 95 m³/ha volume. Non-pine leading stands are generally higher in volume and 90% of all non-pine stands had cruised volumes greater than 138 m^3. Numbers were rounded to 80 m³/ha and 120 m³/ha respectively.

While the model may project harvesting in stands when the minimum requirements are achieved in order to meet forest level objectives (e.g., maintaining overall harvest levels for a short period of time or avoiding large inter-decadal changes in harvest levels), harvest of some stands may not be modelled until well past optimal timber production ages when management of other resource values takes precedence (e.g., requirements for the retention of older forest).

The optimal harvest management objective is to avoid harvesting stands until culmination age[1] to maximize merchantable volumes.

Sensitivity analyses will examine the affects of alternative minimum volume criteria.

Table 13. Harvest volume (m³/ha) in Williams Lake TSA (1997-2012) based on cruise information

Timber mark	Harvest volume (m³)/ha by percentile									
	1%	5%	10%	25%	50%	75%	90%	95%	99%	100%
Pine leading	66	80	93	117	172	211	282	312	357	471
Other leading	17	37	138	268	300	345	384	436	462	560
Overall	57	80	95	122	180	240	310	341	410	560

[1] The age at which the mean annual volume production begins to decline.

6.1.4 Silvicultural systems

There are two primary silvicultural systems used in the TSA. Due to species composition of forests in the Williams Lake TSA, even-aged silvicultural systems, primarily clearcutting with various levels of retention, are predominant. Levels of retention will be modelled to be consistent with Schedule 1 of the LUO. Selection harvesting will be modelled in drybelt Douglas-fir leading stands (IDF/SBPS fir-leading stands outside of mule deer winter range), Douglas-fir leading mule deer winter range and caribou habitat. Natural stand yield curves will be used for areas that will be selectively harvested in the drybelt Douglas-fir and low to moderate snowpack zone MDWRs.

As per the previous timber supply review (TSR), the normal drybelt Douglas-fir selection harvesting prescription is to remove 50% of the stand volume in the first entry and re-enter the stand every 30 years thereafter to remove the volume growth that has occurred in the 30-year interval. The growth between entries will be modelled at one m^3/ha/year consistent with the previous TSR.

Data source and comments:

There is uncertainty about the actual growth rate, so a sensitivity analysis will be performed to examine the impact of growth rates of two m^3/ha/year and three m^3/ha/year.

6.1.4.1 Mule deer winter range: transition and deep snowpack zone MDWRs

MDWRs in the transition and deep snowpack zones are managed utilizing a group selection system. A timber flow expectation from each of the habitat classes is described in the table below. It can be further refined in the following terms: Low = 100%, Moderate = 75%, and High = 60% based on a 120 year modelled rotation. Cutting cycles will be a minimum of 40 years. For the low, moderate and high stand structure habitat classes, respectively, 33%, 25% and 20% of the area will be harvested each cutting cycle.

Table 14. Transition and deep snowpack zones MDWRs

Stand structure habitat class	Volume expected (expressed as a % of typical flow for stands outside of MDWRs and drybelt Fdi)
Low	100
Moderate	75
High	60

The model applies the above factors to each stand with >40% Douglas-fir within transition and deep snowpack zone winter ranges.

Data source and comments:

The volume flow assumptions for transition and deep snowpack zone MDWRs were derived from the Land Management Handbook 59: Management Strategy for Mule Deer Winter Ranges in the Cariboo-Chilcotin Part 1b: Management Plan for Transition and Deep Snowpack Zones. Forest Science Program. 2006.

6.1.4.2 Mule deer winter range: shallow and moderate snowpack zone MDWRs

Management of MDWRs specify long-term stand-level objectives for winter range management which are achieved through uneven-aged selection harvesting using basal area control and a minimum 30 year cutting cycle. Each winter range has a specified mix of low, moderate, and high habitat types which are located based on their value to over wintering mule deer and a mix of higher-level plan direction.

Timber flow expectations for stands with >40% Douglas-fir are shown in the table below for each of the habitat types.

Table 15. Shallow and moderate snowpack zone MDWRs

Stand structure habitat class	Volume expected (expressed as a % of typical uneven-aged dry belt fir management)
Low	100
Moderate	80
High	60

There has been concern noted that portions of the IDFxm may not represent a viable harvest opportunity. Parts of this BEC subzone have very low moisture availability, are steep and have been noted to have poorly formed trees from a timber harvest perspective. Although this cannot be said of the entire subzone, these conditions do occur on a substantial portion of the subzone. To address this concern we will report the amount of volume that the model projects to be available from the IDFxm in Chilcotin District through time.

Data source and comments:

The volume flow assumptions for shallow and moderate snowpack zone MDWRs were derived from the Land Management Handbook 60: Part 1a: Management Plan for Shallow and Moderate Snowpack Zones. Forest Science Program. 2006. 2007.

6.1.4.3 Caribou habitat

Eastern and Itcha-Ilgachuz caribou habitat areas will be modelled in accordance with the CCLUP Caribou Strategy, CCLUP Integration Report and the management recommendations of the Mountain Caribou Strategy, October 2000 (modified by the Mountain Caribou Recovery Program) and the Northern Caribou Strategy, March 2002 (updated 2011). The silviculture systems for caribou areas are summarized in Table 16. The caribou habitat boundaries were legally designated as a WHA in 2004/2011 and General Wildlife Measures for these areas were established in 2005 under Government Action Regulations.

Modelling will reflect the General Wildlife Measures. The analysis will track the volume coming from the modified harvest area over time.

Table 16. Silviculture systems-caribou areas

Management emphasis	Silvicultural system	Planned rotation (years)	Years between entries	Volume exclusion per entry
Itcha Ilgachuz caribou area — terrestrial lichen sites	Irregular group shelterwood (80% of the modified harvest area)	140	70	50% volume exclusion
Itcha Ilgachuz caribou area — arboreal lichen sites	Partial cut (20% of the modified harvest area)	240	80	33% volume exclusion
Mountain Caribou modified harvest polygons	Group selection	240	80	33% area exclusion

Data source and comments:

The modelling assumptions for eastern and Itcha-Ilgachuz caribou habitat areas are consistent with the following planning documents:

- Cariboo-Chilcotin Land Use Plan Mountain Caribou Strategy, 2000 and Cariboo-Chilcotin Land Use Plan — Northern Caribou Strategy, 2002;
- ORDER — Wildlife Habitat Areas #5-088 to 5-117. Mountain Caribou-Quesnel Highlands Planning Unit. December, 2009; and

- AMENDED ORDER — General Wildlife Measures; Wildlife Habitat areas #5-087, 5-087, 5-118, 5-872 and 5-873. May, 2011.

6.1.5 Integrated resource management

Mature plus old-seral requirements, visual quality objective (VQO) requirements, and cover constraints on community watershed requirements will be modelled in this analysis.

6.1.5.1 Mature plus old-seral requirements

The CCLUP establishes biodiversity targets for "old forest" and "mature/old forest" in each resource development zone. The CCLUP Biodiversity Conservation Strategy defines landscape units and biodiversity emphasis options (BEO) for seral stage distribution.

Seral stage distribution requirements will be applied in the analysis for each landscape unit and BEC zone in keeping with the CCLUP Biodiversity Conservation Strategy and updates. Non-THLB forested area and defined retention patches will contribute towards "mature plus old" biodiversity objectives. In order to mimic the natural disturbances, the timber supply model will remove all stands older than 350 years and regrow them.

Old-growth seral requirements have been met through the establishment of OGMAs.

Mature plus old-seral requirements will be applied to the Crown forest land base by NDT/BEC/landscape unit.

The percentages are listed in the following table.

Table 17. Mature plus old-seral requirements (%) by NDT/BEC/LU in Williams Lake TSA

		Mature plus old-seral requirement by biodiversity emphasis		
NDT	**BEC zone**	**Low**	**Intermediate**	**High**
1	CWH	18	36	54
1	ICH	17	34	51
1	ESSF	19	36	54
1	MH	19	36	54
2	CWH	17	34	51
2	ICH	15	31	46
2	SBS	15	31	46
2	ESSF	14	28	42
3	SBPS	8	17	25
3	SBS	11	23	34
3	MS	14	26	39
3	ESSF	14	23	34
3	ICH	14	23	34
4	ICH	17	34	51
4	IDF – Fd	22	43	65
4	IDF – other	11	23	34

L=low biodiversity emphasis; I=intermediate biodiversity emphasis; H=high biodiversity emphasis.

Data source and comments:

Table derived from the Biodiversity Conservation Strategy for CCLUP, July, 1996.

6.2 Volume reductions

6.2.1 Scenic areas

Management for visual quality is based on visual quality objectives (VQOs) that have been legally established for the TSA through the CCLUP. One of four VQO ratings has been assigned to each visual polygon; these are: preservation, retention, partial retention, and modification. Forest cover requirements will be applied to limit the allowable disturbance (denudation) within each visual polygon to the mid-point of the ranges indicated in Table 18. The visually effective green-up (VEG) height for each VQO is also listed in Table 18.

Table 18. Forest cover requirements for visual resource management areas within each landscape unit

VQO	Area (ha)	Percent allowable denudation (clearcut) less than green-up height and midpoint (%)	Visually effective green-up height (metres)
Preservation	14 056	0-1 (0.5)	7
Retention	135 682	1.1-5 (3.0)	6
Partial retention	511 160	5.1-15 (10.5)	5.5
Modification	274 927	15.1-25 (20.5)	5

Scenic corridors have been spatially identified through the LUO. Harvest design is intended to mimic natural openings and vegetation patterns. There is no harvesting reduction applied to these areas and they are not excluded from the THLB.

Data source and comments:

Scenic polygon boundaries and VQO assignments are consistent with the Land Use Order Objectives for the Cariboo-Chilcotin Land Use Plan, May 19, 2010, amended April 18, 2011.

The VQO denudation ranges listed in Table 18 were derived from the document, "Procedures for Factoring Visual Resources into Timber Supply Analysis". The midpoint of each range is used for the analysis

A GIS analysis of slope in the TSA was performed to determine the area and slope of each VQO class by landscape unit in the TSA. Based on the "Procedures of Factoring Visual Resources into Timber Supply Analysis", 1998, a weighted average green-up height was calculated for each VQO.

Previous TSR's assigned green-up height separately for eastern and western proportions of the TSA. The GIS analysis of slopes in areas with established VQOs showed that there would not be a significant difference in green-up height required in different parts of the TSA.

The actual visually effective green-up height (VEG) will vary by site and visual viewpoint.

6.2.2 Lakeshore management zones

The CCLUP identified areas around key lakes that must be managed according to specific visual quality objectives. Accordingly, the model will be configured to apply clearcut treatments with maximum disturbance limits as shown in Table 19, page 27. To simplify this constraint, these limits will be applied for lakeshore management class and landscape unit combination rather than each individual lakeshore management zone. The visually effective green-up heights are the same as those used for scenic areas. Lakeshore management class "A" zones were excluded from the land base during the netdown process.

Table 19. Maximum percent denudation by lakeshore management class

Lakeshore management class	Visual quality objectives	Percent allowable denudation (partial cut) less than green-up height (%)	Percent allowable denudation (clearcut) less than green-up height (%)	Visually effective green-up height (m)
A	Preservation	0%	0%	N/A
B	Retention	20%	10%	6.0
C	Partial retention	40%	20%	5.5
D	Modification	60%	30%	5.0
E	Modification	100%	50%	5.0

Data source and comments:

Lakeshore management zone assumptions are from the LUO for the Cariboo-Chilcotin Land Use Plan, May 19, 2010. Amended April 18, 2011. Maps 6a and 6b.

6.2.3 Community watersheds

Four community watersheds have been designated within the Williams Lake TSA: Harold (Dog Creek), Nemiah, Rim Rock and Weetman. Community watersheds provide water for human consumption and require special management. Government may establish water quality objectives for community watersheds to conserve the quality, quantity and timing of water flow, or to prevent cumulative hydrological effects that would have a material adverse effect on the water.

Operationally, watershed assessments are conducted by hydrologists in community watersheds to determine whether planned operations can be conducted without a material adverse effect on the water. A watershed assessment considers the cumulative effects of forest practices on the watershed hydrology. Using the results of an assessment, forest managers can make recommendations concerning the level of further harvesting, if any, in the watershed.

In the timber supply analysis, a forest cover constraint will be applied which will limit the amount of harvesting within each watershed to 10% of the productive Crown forest land base within each decade.

Data source and comments:

Community watershed boundaries are from the corporate data warehouse.

The rate of harvest constraint is based on guidance in the *Community Watershed Guidebook* that indicates that in the absence of completed watershed assessment, harvesting activity should be limited to five percent of the productive forest area over a five-year period.

6.2.4 Mature birch retention

The CCLUP LUO identifies that at least 40% of the existing mature birch be retained for First Nations cultural use.

Deciduous-leading stands have been excluded from harvest (Section 5.2.14). No further reductions are required to address this value.

6.2.5 Disturbance outside of the timber harvesting land base

Some forest cover requirements described (above) apply to the forest management land base, which includes forest outside of the THLB. Forest outside of the THLB can undergo natural disturbance that affects its age class distribution and its contribution to forest cover requirements. This natural disturbance outside the THLB will be accounted for in the analysis, to prevent this forest from contributing inappropriately to forest cover requirements. In this analysis, the current age class distribution outside the THLB will be held constant.

6.2.6 Mountain pine beetle (MPB) attacked stands

Harvesting in the Williams Lake TSA has been primarily focused on salvaging stands killed by the mountain pine beetle for the last decade. An emergency AAC determination was completed in 2007 in an attempt to maximize the ability to salvage these stands and expedite reforestation of killed MPB stands.

The extent and severity of the MPB infestation will be modelled based on the BC Mountain Pine Beetle Model (BCMPB) version 9. The BCMPB v9 provides an estimate of the year of death and the proportion of the pine within a stand that was killed.

It is now projected that by 2017 approximately 60% of the pine volume in the Williams Lake TSA will have been killed. This is significantly less than the 78% projected mortality that was projected in earlier version of the BCMPB. For the Williams Lake TSA it is now estimated that as of 2011, 60% of the merchantable pine volume has been killed. Beetle projection modelling will be used in conjunction with the updated inventory to calculate the expected volume decline due to MPB.

Table 20 Cumulative volume (millions of m³) and percentage of mature pine on the THLB in 1999 projected to be killed (red- and grey-attack) in the Williams Lake TSA during selected years, BCMPB v9

2012	2017	2022
86.4 (60%)	86.6 (60%)	87.4 (61%)

Data source and comments:

Source (Provincial-Level Projection of the Current Mountain Pine Beetle Outbreak:
Update of the infestation projection based on the Provincial Aerial Overview Surveys of Forest Health conducted from 1999 through 2011 and the BCMPB model (year 9).

6.2.7 Shelf life of mountain pine beetle impacted timber

No specific sawlog shelf life will be applied in this analysis. Instead, MPB killed trees within 20 years of death will contribute to the harvest flow, based on the assumption that they will be utilized either as sawlog or other products, such as bioenergy. The analysis will report volume contributions to the harvest flow from trees with different time-since-death amounts. The information can later be used to assess sawlog and non-sawlog opportunities with various assumptions about the length of sawlog shelf life.

The time since death will be tracked on a tree level rather than on stand level. For example, if 10% of a stand is killed in one year and 20% of the same stand is killed in another year, the lengths since death of these two cohorts will be tracked and reported separately.

In the model, harvested areas will regenerate as managed stands. Adjacency (green-up) and selection harvest rules will not be applied within these mountain pine beetle attacked areas until after harvest. After harvest, the areas will be grouped with adjacent unattacked areas, and be subjected to appropriate forest cover constraints that reflect adjacency guidelines, or assigned to an analysis unit with a selection management regime.

Data source and comments:

There is no reliable shelf-life value to broadly apply to mountain pine beetle impacted timber because the climate and end products for the wood are variable. Estimates of the utility of mountain pine beetle impacted wood range from 7-25 years depending on the ecosystem and the end product to be produced from the timber. Lumber market and costs to harvest also play a role in how much dead timber is utilized.

6.2.8 Operational adjustment factors

Operational adjustment factors (OAFs) are used to adjust volume estimates from TIPSY to account for factors that affect achievement of optimal growth. The yield tables generated by TIPSY reflect the growth relationships observed in research plots established by FLNR and industry. Research plots were generally located in fully stocked, even-aged stands of uniform site and in forests with little or no pest activity. The influence of stand density on yield is reflected in the yield tables, but full stocking is assumed. As a result, TIPSY yields reflect the potential yield of a specific site, species and management regime given full stocking. OAFs are required to adjust these potential yields to better reflect actual conditions.

Two types of OAF are available in TIPSY to account for elements that reduce potential yields. The base case will use the standard OAF 1 value of 15% — to account for less than ideal tree distributions, small non-productive areas, endemic pests and disease, and random risks (e.g., windthrow) and OAF 2 value of 5% — to account for decay, waste and breakage.

Insect and disease problems are not part of standard OAF 2, but in some cases, OAF 2 is increased to a higher value to reflect volume loss to diseases.

6.2.9 Unsalvaged losses

6.2.9.1 Current unsalvaged losses

Table 21 shows the estimated average annual unsalvaged volume loss to catastrophic events such as insect epidemics, fires, wind damage or other agents over the long term on the THLB which are not accounted for by OAFs. The unsalvaged loss column reflects only those volumes that will not be recovered or salvaged. Losses due to the recent mountain pine beetle epidemic are considered salvageable and thus are not included in the insect unsalvaged losses.

Annual harvest volume is reduced by 149 553 m^3 to account for unsalvaged losses.

Table 21. Unsalvaged losses

Analysis unit	Cause of loss	Annual unsalvaged loss (cubic metres per year)
All	Fire (15 year average)	35 480
All	Douglas-fir beetle	18 846
All	Spruce beetle	31 000
All	Western spruce budworm	55 543
All	Wind	8 684
	Total	149 553

Data source and comments:

Forest cover information was used to derive impacted merchantable volume within areas mapped in annual overview flights.

Fire: Unsalvaged losses were determined by district staff based on the15-year fire history for the Williams Lake TSA. Estimated volume losses from fire are Douglas-fir and spruce only (pine loss has already been accounted for through mountain pine beetle assumptions) and exclude stands in OGMAs and Caribou no-harvest

areas. Unsalvaged loss is estimated at 25% of the total impacted volume of merchantable timber within mapped fire perimeters.

Bark Beetles and Wind losses: Unsalvaged losses were calculated by district staff using a volume loss percentage based on the mid-point of the percent mortality severity level mapped in the aerial overview survey. Five-year averages (2006-2010) were used to calculate the impacted volumes and harvested volumes were excluded from the calculation. Impacted stands in OGMAs, Caribou no-harvest areas and area based tenures were not included in the calculations. However, adjustments were not made for other constrained areas such as riparian or MDWR. The spruce NRL was netted down by 50% to compensate for a number of uncertainties, including the difficulty of mapping spruce beetle from the air.

Western Spruce Budworm: The impact of western spruce budworm was determined by regional staff from the five-year average (2007-2011) area of moderate and severe Western spruce budworm defoliation as reported in the aerial overview surveys. The mean area of moderate and severe western spruce budworm defoliation within the THLB for the last five years was 11 108.6 hectares. Two percent of this area multiplied by an assumed volume of 250 m^3/ha gives an annual estimated loss of 55 543m^3/year.

6.2.9.2 Condition of MPB-impacted young stands

Aerial and ground surveys conducted by the district indicate that stands as young as 20 years old have been attacked by mountain pine beetle. This has been confirmed through both aerial and ground surveys. Table 24 shows the results of the 2008 young pine stand MPB aerial overview assessments for the Williams Lake TSA.

For stands younger than 55 years where the lodgepole pine is greater than 80% of the stand volume, the pine volume in the model will be reduced by the amount stated in Table 22. For pine-leading stands age 31-55 years with less than 80% pine the model will assume 20% pine volume loss. For all stands less than 30 years of age and less than 80% pine the model will assume natural ingress and zero volume loss.

Since there is uncertainty of the actual harvestable volume loss which will result from the projected volume losses in young pine, a sensitivity analysis will be performed to determine the impact of loss projected by this modelling assumption.

Table 22. Pine volume losses in young stands where pine comprises >80% of the stand volume

Stand age	% of stands with MPB attack DCC	Average attack level in DCC (of affected stands)%	Estimated volume loss by % for DCC	Estimated volume loss by % for DCH
20-25	87.9	24.7	20	0
26-30	95.7	38.2	35	15
31-40	100	40.0	40	20
41-50	100	42.1	40	20
51-55	100	38.0	40	20

Data source and comments:

The 2008 young pine stand MPB aerial overview assessments for the Williams Lake TSA is documented in, "Determining susceptibility of young pine stands to the mountain pine beetle, Dendroctonus ponderosae, and manipulating future stands to mitigate losses".

The estimated percent volume loss is determined by multiplying the percentage of stands attacked by the average attack level and rounding off to the nearest five percent.

The percentage of stands with MPB attack and the average attack level in the Central Cariboo District (DCC) is based on 2008 survey data. No surveys were conducted in young stands in the Chilcotin District (DCH) in 2008. Based on 2007 survey results, mountain pine beetle impacts in young stands in DCH were 20% less on

average than young stands in DCC. The estimated volume loss for the DCH was determined by subtracting 20% from the DCC numbers.

6.3 Silviculture

In the Williams Lake TSA silviculture activities are carried out to ensure the regeneration of young forests on harvested areas, enhance tree growth or improve wood quality in selected stands. Activities include site rehabilitation and preparation, and planting. The following sections outlined the silviculture assumptions to be applied in the timber supply model.

6.3.1 Regeneration activities in even-aged managed stands

Stands regenerated after 1965, and in the future, are considered managed stands. Table 23 lists the general regeneration assumptions for managed stand analysis units. This information will be used as inputs to produce yield curves for these units using the Table Interpolation Program for Stand Yields (TIPSY) growth and yield model.

Regular spacing is assumed (i.e., the ―planted option in TIPSY) for all yield curves so the initial density was based on *total well-spaced trees* where available, otherwise *well-spaced* was used. Since yield curves are based on the stand condition at free growing, the actual method of stand establishment is no longer considered except for estimating genetic gains (Section 6.3.3).

Table 23. Regeneration assumptions for even-aged managed stands by pre-harvest leading species

Leading species	Regen delay (years)	Regen method	Percent regen method (%)	Expected species	Expected percent composition (%)	Average total well-spaced density (stems/ha)
Fd (poor, non-selection)	2	Plant	50	Pl/Fd/decid_m/Sx	52/28/14/6	1026
Fd (poor, non-selection)	2	Natural	50	Pl/Fd/decid_m/Sx	52/28/14/6	1026
Fd (medium/good, non-selection)	3	Plant	90	Pl/Fd/decid_m/Sx/Bl	42/24/17/15/3	1139
Fd (medium/good, non-selection)	3	Natural	10	Pl/Fd/decid_m/Sx/Bl	42/24/17/15/3	1139
Cw (poor)	2	Plant	100	Sx/Pl/Fd/Cw/He/Bl/ decid_M	41/23/9/9/6/6/6	1152
Cw (medium/good)	1	Plant	100	Sx/Pl/Fd/Cw/decid_m/ Hw/Bl	51/18/18/8/3/2/1	1481
Sx (poor)	2	Plant	100	Sx/Pl/Bl/decid_m/Fd	53/32/9/4/1	1173
Sx (medium/good)	2	Plant	100	Sx/Pl/decid_m/Bl/Fd	49/28/9/8/6	1255
Pl (poor)	4	Plant	30	Pl/decid_m/Fd/Sx	87/10/1/1	1001
Pl (poor)	4	Natural	70	Pl/decid_m/Fd/Sx	87/10/1/1	1001
Pl (medium/good)	2	Plant	85	Pl/decid_m/Sx/Fd/Bl	62/17/10/8/3	1133
Pl (medium/good)	2	Natural	15	Pl/decid_m/Sx/Fd/Bl	62/17/10/8/3	1133

Data source and comments:

Expected species composition and average well-spaced densities were extracted from RESULTS by Forest Analysis and Inventory Branch for the mid-term timber supply analysis. The percentage of planted *versus* natural regeneration are estimates based on previous TSR assumptions.

6.3.2 Regeneration in selectively harvested stands

Natural stand yield curves will be used for areas that will be selectively harvested in the drybelt-fir and MDWR area. The growth between entries will be assumed as one m^3/ha/year (consistent with previous TSRs).

Data source and comments:

There is uncertainty about the actual growth rate, so a sensitivity analysis will be performed to examine the effect of assuming a growth rate of two m^3/ha/year and three m^3/ha/year, rather than one m^3/ha/year in drybelt-fir stands (see Section 7).

6.3.3 Genetic gain

Genetic gains are applied to both existing managed stands (Table 24) and future managed stands (Table 25) for the proportion of stands where the regeneration method is planting.

Table 24 Genetic gains for existing managed stands

Description	Fdi	Pli	Sx
Percent of tree species planted from class A seed (1974-2010)	7.9%	1.5%	39.7%
Genetic worth estimated by seedlot (1974-2010)	3.4%	3.6%	13.1%
Genetic gains modelled	1.7%	0.1%	5.7%

Data source and comments:

Genetic gain assumptions for existing managed stands were based on historical Class "A" seed use and genetic gain history records.

Genetic gain assumptions for future managed stands were derived from a review of both current and future estimates of seed use and genetic gain projected over the next 10 years. Forecast seed production and genetic gain estimates were identified for all seed planning units falling within the TSA (Forest Genetics Council of BC 2012/13 species plans). The production forecast of class "A" seed over the next 10 years was used to weight the estimated gains for each seed planning unit relative to demand. To provide average gains for the TSA, the production weighted gains were further weighted by the proportion of each seed planning unit within the Williams Lake TSA. Table 25 includes a summary of the information used to calculate the anticipated genetic gains for future managed stands.

Table 25 Genetic gain for future managed stands

Seed planning unit	Seedling need (million)	Production forecast (million)	Estimated gain 2012	Production weighted gain	Area weighting	Applied genetic gain
19 FDCSMLOW	0.8	0.8	19%	16%	0%	
37 FDIQLLOW	1.0	1.0	26%	24%	27%	Fdi 9.7%
43 FDICTLOW	1.0	1.4	14%	14%	24%	
12 PLIPGLOW	29.6	17.2	14%	8%	24%	
17 PLIBVLOW	21.4	12.9	13%	8%	1%	Pli 3.0%
Class B+	20.9	20.9	3%	1%	75%	
14 SXPGLOW	28.0	12.7	26%	12%	5%	
28 SXTOHIGH	4.6	5.1	15%	14%	9%	
30 SXTOLOW	2.7	2.6	19%	17%	49%	
35 SXBVLOW	9.3	11.6	24%	24%	1%	Sx 12.8%
42 SXPGHIGH	2.4	3.5	15%	14%	0%	
44 SXNELOW	0.8	2.4	24%	24%	12%	
4 SXNEMID	6.4	9.4	15%	15%	1%	
5 SXNEHIGH	1.0	6.9	15%	15%	0%	

Data source and comments:

Gains for some seed planning units were dropped because they were located outside of the THLB (e.g., FDC SM LOW). The eastern portion of the TSA is classified as a zone of overlap (i.e., PGN). Zones of overlap or 'transition areas' allow for seed selection choices from either of the 'mother' seed zones (e.g., PG or NE orchards).

Over the past five years, 40% of the pine planted used "B+" seed (seed from natural stand superior provenances). While estimated gains for this material may be higher, three percent gain was used as provided by the current standards. As the production weighted gain was assumed to be 40% of the total gain, the "B+" class seed contributed an additional 0.9% to the applied genetic gain.

6.3.4 Grassland benchmark areas

The CCLUP and the LUO specifies that silvicultural practices that facilitate the restoration of open grassland condition be implemented in the spatially delineated grassland benchmark area.

Modelling will exclude grassland benchmark areas after the first harvest.

Data source and comments:

Data source and comments: Land Use Order Objectives for the Cariboo-Chilcotin Land Use Plan, May 19, 2010. Amended April 18, 2011. Map 8 and Spatial Dataset, Cariboo-Chilcotin Grassland Benchmark Areas.

6.3.5 Not satisfactorily restocked (NSR) areas

Lands classified in the VRI as *not satisfactorily restocked* (NSR) are included in the current timber harvesting land base. The purpose of this section is to identify the total area of NSR currently existing in the timber harvesting land base, and the estimated rate at which the NSR area will be restocked.

The backlog NSR (pre-1987) area is based on RESULTs data. A *Forests for Tomorrow* (FFT) survey project is currently underway to inventory the backlog NSR, and it is expected all backlog area will be treated or declared "free-growing" by 2015.

Current NSR includes areas recently harvested by major licensees, BCTS, non-renewable forest licences and small-scale salvage. Approximately 1320 hectares of NSR are in areas harvested by now bankrupt licensees that have exceeded seven years. These areas are included in the current NSR category. Of this area it is expected that 70% will reforest naturally within a normal seven year regeneration window. These areas are currently being assessed for reforestation needs by FLNR and all will be treated, as needed, to achieve sufficient stocking.

For the purposes of the model, it is assumed that all current and backlog NSR areas will be sufficiently restocked as planned.

Data source and comments:

The current NSR is based on the RESULTS Forest Cover Report and is comprised mainly of recently harvested stands but also includes other categories of managed stands that are NSR in the RESULTS database.

RESULTS Data shows that there are 194 hectares of SP exempt stands. These areas are expected to regenerate naturally. This area is considered insignificant and unlikely to impact TSR outcome.

6.3.6 Non-salvaged MPB impacted stands

If the volume (live volume plus volume within shelf life) of a MPB impacted pine-leading stand decreases below 80 m^3/ha, the minimum harvestable criteria, the stand will revert to age 40 after 20 years, and be regrown along the original VDYP curve. The reverted young stand will still contribute to cover constraints including mature requirements. The assumption is that there will be advanced regeneration in the stand at that time.

Data source and comments:

The regrowth assumptions for non-salvaged MPB impacted stands are based on the professional opinion of staff at Forest Analysis and Inventory Branch.

6.3.7 Fire area

The years 2003 to 2010 saw destruction of over 100 000 hectares of forest in the THLB by fire in the Williams Lake TSA.

A description of forest cover updates to account for recent catastrophic fires is outlined in Section 3.2.

All areas which were harvested prior to wildfire will be reforested and treated as managed stands. Current plans are for major licensees, BCTS and FLNR to re-plant approximately 19 000 to 24 000 hectares of fire impacted managed stands over the next five years.

The following approach was used for all stands in the mapped fire perimeters. Yield curves were assigned accordingly:

- Unlogged, killed stands: existing natural yield curve (VDYP) with 15 year regeneration delay from the year of disturbance;
- Logged, killed stands (plantations): existing managed curve (TIPSY) with seven year regeneration delay from the year of disturbance.

7. Sensitivity Analyses Modelling and Reporting

7.1 Sensitivity analyses to be performed

Sensitivity analysis can provide a measure of the timber supply impact if uncertainty in management assumptions and/or data integrity exists. The magnitude of the increase or decrease in a particular variable should reflect the degree of uncertainty surrounding the assumption. Sensitivity analysis may indicate that a small reduction in these attributes may alleviate or exacerbate anticipated harvest level reductions in the future. By conducting a number of sensitivity analyses, it is possible to determine which variables have the most impact on the base case harvest levels. Table 26 presents the standard sensitivity analyses that are generally performed in all analyses. Additional sensitivities may be included after the base case has been completed and if significant new uncertainties are identified.

Table 26. Sensitivity analyses to be performed

Issue to be tested	Sensitivity levels
Mean annual increment of drybelt Douglas-fir stands	2 m³ and 3 m³ volume increments
Minimum harvest age	Plus and minus 10 years
Proposed area based tenures	Proposed community forest and First Nations woodland licences removed
Minimum harvest volume / marginal timber types (increase THLB to include marginal)	Decrease MHV from 80 m^3/ha to 65m³/ha for pine
Alternative harvest flows	
Harvesting in MDWR — high structure class is very unlikely because of the poor economics (partial harvest at low volumes ~20%)	Exclude high structure class
Scenic areas: assessment of green-up heights	Plus and minus one metre in green-up height
Volume loss projected in MPB impacted young stands	Exclude projected volume loss due to MPB attack

7.2 Modelling and reporting

In order to test the reliability of the base case, projected by the Woodstock model, an optimization model (Woodstock-Stanley) will be used with constraints to provide a spatially representation, in five-year periods by landscape unit, of the projected harvest. The information will be provided for the first 20 years of the analysis period, and will be summarized for each landscape unit by area harvested and species (Pl and non-Pl).

Table 27. Sample of reports to be generated

Harvest volume projected from IDF xm volume in MDWR	Reporting
Impact of large scale MPB salvage and wildfire on hydrology	The effects of harvest levels on equivalent clearcut areas (ECAs) by landscape unit
The analysis will report volume contributions to the harvest flow from trees with different time since death	Reports will show volume contribution from trees grouped by years since death: 0-8, 9-10, 11-12, and 13-20

8. Habitat Supply Analysis

This timber supply review will include a habitat availability analysis for a select group of wildlife species. For this analysis, a habitat supply model will be used to project the amount of suitable habitat available for each of the species selected if harvesting occurs at the levels projected in the base case and if forest management and harvest priorities are the same as assumed in the base case.

Some modelling assumptions are required in order to establish a baseline for this process. For the Williams Lake TSA it is assumed that OGMAs will age throughout time without periodic disturbance and will therefore provide old forest attributes once they meet the old forest age criteria.

Each species modelled will be reported out in a graphical format showing how habitat supply (in hectares of suitable habitat) is influenced by the projected timber harvesting. An example of this is shown in Figure 1.

The species to be modelled are: moose, grizzly bear, marten, lynx, and northern goshawk. The objective for selecting these species was to evaluate a number of focal species that occur across the TSA which have life requisites which can be measured by available forest inventory information. Mule deer and caribou have been left out of this analysis because the CCLUP has specific direction to address their habitat requirements. In the case of mountain caribou the protection has been strengthened through the provincial species at risk recovery process.

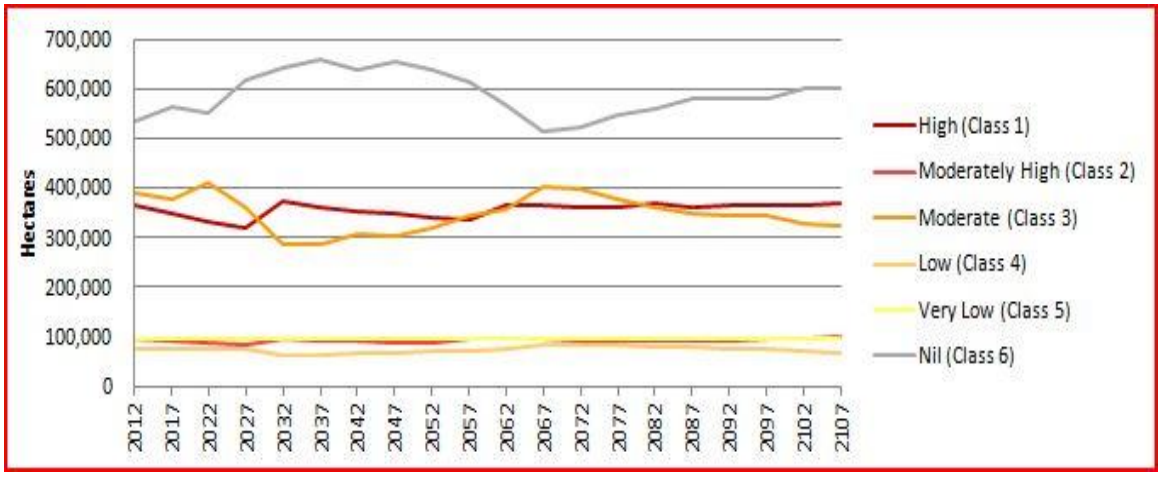

Figure 1. Example of a report on suitable habitat availability over time.