TREE FARM LICENCE #48
MANAGEMENT PLAN #5

TIMBER SUPPLY ANALYSIS
DATA PACKAGE

Prepared for:

Canadian Forest Products Ltd

All interested parties are invited to view and comment on the Draft Timber Supply Analysis Data Package for MP 5, from September 4th 2013 through to November 4th 2013. Comments will be accepted until 4:00 pm November 4th, 2013.
For further information, please contact:

Darrell Regimbald, RPF
Planning Coordinator,
Canadian Forest Products Ltd.
Forest Management Group,
P.O. Box 180,
Chetwynd BC V0C 1J0
darrell.regimbald@canfor.com
250 787-3651

Prepared by:

Ecora
Resource Group Ltd.
Prince George, BC

Jay Greenfield, RPF
jay.greenfield@ecora.ca

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AAC	Allowable Annual Cut
AU	Analysis Unit
BEC	Biogeoclimatic Ecosystem Classification
BEO	Biodiversity Emphasis Option
CFLB	Crown Forested Land Base
ECA	Equivalent Clearcut Area
ERA	Ecosystem Representation Analysis
FDU	Forest Development Unit
FPPR	Forest Planning and Practices Regulations
FRPA	Forest and Range Practices Act
FSP	Forest Stewardship Plan
FSW	Fisheries Sensitive Watershed
GWM	General Wildlife Measure
IWA	Interior Watershed Assessment
IWAP	Interior Watershed Assessment Procedures
LRDW	Land and Resource Data Warehouse
M	Modification VQO Classification
MFLNRO	Ministry of Forests, Lands and Natural Resource Operations
MHA	Minimum Harvest Age
MOE	Ministry of Environment
MOF	Ministry of Forests
MP	Management Plan
MPB	Mountain Pine Beetle
NCD	No Channel Defined
NDT	Natural Disturbance Type
NRL	Non-Recoverable Losses
NSR	Not Sufficiently Restocked
OAF	Operational Adjustment Factor
OGMA	Old Growth Management Areas
PFI	Peak Flow Index
PFLB	Productive Forest Land Base
PSI	Potential Site Index
PR	Partial Retention VQO Classification
RESULTS	Reporting Silviculture Updates and Land status Tracking System
RMA	Riparian Management Area
RMZ	Riparian Management Zone
RRZ	Riparian Reserve Zone
SPH	Stems Per Hectare
TEM	Terrestrial Ecosystem Mapping
TFL	Tree Farm Licence
THLB	Timber Harvesting Land Base
TIPSY	Table Interpolation Program for Stand Yields
TSA	Timber Supply Area
TSM	Terrain Stability Mapping
VDYP	Variable Density Yield Prediction Growth and Yield Model
VEG	Visually Effective Green-up Height
VLI	Visual Landscape Inventory
VQO	Visual Quality Objectives

VRI	Vegetation Resource Inventory
VSU	Visually Sensitive Unit
WTP	Wildlife Tree Patch

1.0 BACKGROUND

The timber supply analysis in support of Management Plan #4 (MP4) was completed in 2006, followed by the allowable annual cut (AAC) determination effective May 25th, 2007 in which the AAC was set at 900,000 m^3/year of which 100,000 m^3/year is from deciduous-leading stands.

In November 2011, Canfor completed an analysis (Ecora, 2011) to support a request for an increase in AAC to address the expanding mountain pine beetle (MPB) epidemic on the tree farm. This analysis was undertaken using the MP4 Woodstock forest estate model with modifications to the MPB assumptions. The uplift request was denied based on uncertainty in the degree to which the MPB had impacted Tree Farm Licence (TFL) 48 and the impacts to mid-term timber supply based on the shelf-life assumptions used. Through subsequent discussions between Canfor and the Ministry of Forests, Lands and Natural Resource Operations (MFLNRO) it was mutually agreed that an update to the MP4 analysis would be sufficient to support and expedited timber supply review for TFL 48.

Based on this direction Canfor has initiated an expedited timber supply review for TFL 48 and this document has been prepared to describe the data and assumptions to be used in this timber supply analysis for TFL 48. It should be noted that the majority of data and assumptions from MP4 are utilized in this analysis and as such much of the text from the original MP4 Data Package (IFS, 2006) has been copied directly into this document. The following section describes the updates to the MP4 data and assumptions that have been incorporated into this analysis.

1.1 Updates to the MP4 Analysis

As discussed and agreed upon at a meeting between MFLRNO and Canfor on March 7th, 2013, the following components of the MP4 analysis have been updated to support this analysis:

1.1.1 Mountain Pine Beetle

The current and future state of the MPB infestation has been measured using version 9 the BCMPB projections (British Columbia Forest Service, 2012). On May 7th, 2013 a helicopter flight of the TFL was taken to assess the accuracy of these projections. Overall the flight confirmed that the BCMPB projections represented the spatial location of the most severely impacted areas well but underestimated the overall percent attack. Some areas of low to moderate attack were under-represented in the BCMPB projections. However, overall it was determined that the attack percentages used in this analysis presents a reasonable representation of the state of the MPB infestation on the TFL. Section 4.3.9 provides a complete description of the MPB assumptions used in the analysis.

Additionally, Canfor's FSP was amended in 2012 to create additional flexibility around managing for VQOs in areas affected by MPB. The model will be updated to incorporate this flexibility.

1.1.2 Shelf-Life

Shelf life describes the length of time that a stand of trees remains economically viable following a MPB attack. In Canfor's experience, stands remain economically viable for an average of five years following significant attack. Based on this a shelf life assumption of five years will be used in this analysis. The analysis will also examine the impacts of extending the shelf-life to seven years. Section 4.3.9 provides a complete description of the MPB assumptions used in the analysis.

1.1.3 Inventory Update

The inventory has been updated with harvest history up to December 31st, 2012 and the inventory has been projected to January 1st, 2013, the beginning of the planning horizon.

1.1.4 Visual Landscape Inventory

In 2010 the Visual Landscape Inventory (VLI) layer for the Dawson Creek TSA and portions of TFL 48 was updated. This revised VLI layer has been incorporated into the data set. Sensitivity analysis will test the impacts of the VLI update compared with the VLI layer used in the MP4 analysis.

In 2012 an FSP amendment was approved allowing greater flexibility in managing for VQO in areas affected by MPB. This flexibility will be incorporated into the timber supply model while salvage operations are underway.

1.1.5 Patch Size Targets

Patch size objectives have been incorporated into Canfor's FSP and will be modeled in the base case. These objectives will replace the green-up constraints applied to non-visually sensitive areas in the last management plan analysis.

1.1.6 Peak Flow Index

Assumptions regarding the management of watershed peak flow index (PFI) and equivalent clearcut area (ECA) have been updated to reflect Canfor's most recent Sustainable Forest Management Plan (SFMP) (Canfor, 2011). The impacts of management for peak flow is not part of the base case but is examined through a sensitivity analysis.

1.1.7 Genetic Gains

The availability and genetic gains associated with class A seed have increased on the TFL since the last management plan analysis. Current and anticipated future gains associated with the use of genetically improved stock will be incorporated into the base case.

1.1.8 SIBEC

The Predictive Ecosystem Mapping (PEM) product for TFL 48 had not received final approval from the MFLNO at the time the MP4 analysis was completed and therefore site index by biogeoclimatic classification (SIBEC) site productivity estimates for managed stand yields were not included in the base case. A sensitivity analysis showed that the use of these estimates increases the overall harvest level by over 16% (IFS, 2006b). In his rationale (British Columbia Ministry of Forests, 2007) the Chief Forester included consideration for these productivity estimates and included the increase in cut in the final AAC determination stating,

> *I also noted that I consider the site productivity estimates derived from the PEM work that is currently pending approval to be more representative of actual managed stand productivity than the estimates provided in the inventory. I therefore consider the base case to represent an underestimate of timber supply in the order of 100 000 cubic metres for coniferous-leading stands and 7000 cubic metres for deciduous-leading stands over the forecast period.*

In March 2008 an accuracy assessment of the TFL 48 PEM (Bio-Geo Dynamics Ltd, 2009) was completed demonstrating that the PEM has achieved the minimum accuracy requirement of 65% for inclusion in the base case. As such, PEM-based SIBEC yield curves from the MP4 analysis will be used in the base case for this expedited timber supply analysis.

1.1.9 Ungulate Winter Range and Wildlife Habitat Areas

Ungulate winter range (UWR) and wildlife habitat areas (WHA) have been updated since the MP4 analysis with the passing of orders establishing UWR u-9-002 (MoE, 2006) and u-9-004 (MoE, 2008) and an order establishing several WHA (MoE, 2008a and MoE, 2008b) across the TFL. The THLB has been updated to reflect the no harvest area identified within each of these orders. See Section 3.21 for additional information.

2.0 LAND BASE INFORMATION AND DATA

This section describes the data and information used in the analysis. Table 1 describes the input data layers used in the original MP4 analysis as well as the additional data layers used to update that analysis to 2013.

Table 1: Input Data Layers

Inventory	Standard	Completed	Approved	Approved By	Status
Forest Cover/VRI	VRI Phase 1	2000	2000	Regional Inventory Forester	Updated to for depletion to Dec 31, 2004
	VRI Phase II/NVAF	2004	2005	Provincial Biometrician	Approved – (Age Height and volumes adjusted and projected to 2005)
Visual Landscape	RIC	2005	2005	Regional Manager (2005 consolidated inventory)	Pending: EVQO used in basecase RVQC used in sensitivity
Recreation	RIC	1999	1995/2001	Regional Manager	Approved
Stream	RIC	1997-2000			Pending
Operability	n/a	2000	Dec 2000	Regional Geomorphologist	Approved
Road/trail network	n/a	2000	n/a	n/a	n/a
BEC	MOF	2000	Nov 2000	Regional Ecologist	Approved
Grizzly Habitat	MOELP	2000		District Manager	Approved
Ungulate Winter Range	MOE	2000	2005	MOE	Provided by MOE
Silviculture	MLSIS	2000	yearly	District Manager	Approved
Protected Areas	MOELP	2000	June 29, 2000	Cabinet per Parks FTP Site	Approved
TFL Boundary	N/A	2004	July 27, 2004	Resource Tenures Branch. New boundary included with TFL 48 Instrument 5 document	Approved
PA 10 & 13	N/A	2000	2000	District Manager	Approved
LRMP RMZ's	LUCO	1999	March 1999	Cabinet	Approved
Archeological Sites	N/A	Unknown	June 1999	Ministry of Small Business Tourism and Culture	Approved
Genetic Gain	MoFR	2003	2003	MoFR – Tree Improvement Branch	Approved
Site Series	RIC	2001	Pending	Regional Ecologist	Pending completion of accuracy assessment
Landscape Units	N/A	2001	2004	Minister of Sustainable Resource Management	Approved
Natural Disturbance Units	N/A	2003	2003	Regional Ecologist	Approved
Watersheds	N/A	2005	N/A	N/A	N/A
Agricultural Land Reserve	N/A	2004	2004	Agricultural Land Commission (MSRM)	Approved
New Layers Added June 2013					
Visual Landscape	RIC	2010	Unknown	Regional Manager	
BCMPB Version 9	FAIB	2012	2012	FAIB	
Recent Cutblocks	Canfor	2013	2013	Canfor	All current cutblocks up to December 31st, 2012

The forest inventory conforms to Ministry of Forest's standards. The current forest cover inventory is based on a re-inventory performed by Canfor during the term of MP 2. The photography for this inventory was taken in 1993/94 for TFL Blocks 4 and 5, and in 1997 for TFL Blocks 1, 2 and 3. The inventory exists in the form of a Vegetation Resource Inventory (VRI). Phase I (the re-inventory) has been adjusted to incorporate extensive timber and ecology ground sampling (e.g. the Phase II part of a VRI). Finally, volume decay loss estimates and taper equations have been

localized through a destructive sampling process referred to as "Net Volume Adjustment Factoring" (NVAF). The information gained in the process of completing Phase II and the NVAF revealed that volume estimates were generally underestimated and losses for decay were typically overestimated for many of the stands in TFL 48. This has resulted in both a net increase in the amount of area that will contribute to the timber harvesting land base, and a net increase in the merchantable volume within each stand.

The inventory information of the TFL has been updated to January 1st, 2013, to account for stand aging, harvesting and other area/volume depletions. All constructed roads are now part of the VRI and have been removed from the forested land base. Trails, seismic lines and transmission lines have been removed from the forested land base. Canfor's spatial cut-block-tracking, silviculture and road management system was used as the source for the update and accomplished through ArcInfo™ Geographic Information System (GIS) buffering routines. The results of this buffering were visually inspected on the map products.

3.0 TIMBER HARVESTING LAND BASE DEFINITION

The purpose of Table 2 is to summarize the area reductions made to the total area of the TFL, to arrive at the land base that is available for timber harvesting. The reductions and additions are listed in the order in which they are applied. Each reduction and addition is described in more detail in the appropriate sections that follow. Note that in the term of MP 3, the gross area in the TFL has decreased. This is a result of the removal of the Rice Property fields, addition of the Stewart Lake block (TFL48 Instrument 5) and removal of new or expansion areas for Woodlots. It should be noted that the Woodlots have not formally been removed from the TFL through a legal instrument to amend the TFL.

Table 2: Timber Harvesting Land Base Determination

Classification	Gross Area (ha)	Area (ha)	% Prod. Forest
MP 3 TFL Total Area (incl. Water)		643,511	
Changes to TFL Boundary			
Removed woodlots [1]		794	
Removed "Rice Property" farm fields		1231	
Inclusion of the Stewart Block		1,753	
SFMP 4 TFL Total Area (incl. Water)		**643,239**	
Less: TFL Boundary sliver polygons [1]		112	
Water	3,104	3,104	
Mine Sites (existing and proposed)	2,236	2,236	
Existing Roads	5,567	3,830	
Non-Vegetated Land	971	949	
Vegetated Non-Treed (no disturbance history)	67,171	66,943	
Plus: Sukunka Falls Park [2]	426	330	
Potentially Productive Area		**566,394**	**100.0%**
Less: Inoperable	34,038	34,038	6.0%
NDT 5	14,942	13,765	2.4%
Forested Islands	195	141	0.0%
Wildlife Habitat - Bull Trout	86	74	0.0%
Archaeological Sites	10	10	0.0%
Protected Areas (including parks)	14,853	12,849	2.3%
Recreation	1,270	418	0.1%
Buffers: Lakeshore reserves	28	25	0.0%
Stream/River riparian buffers	31,082	27,597	4.9%
Forested Wetlands	4,001	3,558	0.6%
Forested Wetland Buffers	1,882	1,760	0.3%
Low productivity sites	72,618	55,710	9.8%
Problem Forest types	62,497	48,077	8.5%
Sukunka Falls Park [2]	426	286	0.1%
Visual preservation	723	167	0.0%
Dunlevy Ungulate Winter Range	4,480	1,983	0.4%
Rare Site Series	4,080	2,572	0.5%
New UWR No Harvest Areas	21,918	2,289	0.4%
New WHA No Harvest Areas	22,252	1,395	0.2%
Total Reductions to Productive Forest		206,714	36.5%
Net Land Base		**359,681**	**63.5%**

Notes: 1 Woodlots have not formally been removed from the TFL, however they have been approved and issued by the MoF.
2 Sliver polygons less than 0.001 hectares in size were dissolved and merged with the largest adjacent polygon. As well, 23 ha were removed having no VRI information.
3 The Sukunka Falls Park is wholly encompassed by TFL48 but is not part of the TFL tenure. Comprising a total of 425 ha this park has been included in the Productive Forest Land Base for biodiversity purposes and then excluded from contributing to the THLB.

3.1 Total Area

The total management area of Tree Farm License 48 after reductions for private lands and woodlots that exist within the confines of the TFL is 643,239 hectares. The TFL boundary has changed from the area reported in MP 3, primarily due to the creation of new woodlots, and the addition of the Stewart block in exchange for the removal of the field portion of the Rice Property.

3.2 Non-Vegetated – Water

Non-forest descriptors in the VRI can be broken into two land cover types: non-vegetated land and water.

Water was identified on the VRI file for TFL 48 using BC land classification level 2 (i.e., BCLCS_LEVEL_2). The distribution of water resources relative to BCLCS_LEVEL_5 is shown in Table 3.

Table 3: Non-Vegetated Water

Description	Total Area (ha)
Lakes	1,231
Rivers	1,817
Reservoirs	56
Total	**3,104**

(BCLCS_LEVEL_5 where level 2 = "W")

3.3 Non-Vegetated Land

Non-vegetated land includes areas in the alpine, uplands and wetlands. The area can be further classified as: snow/ice, rock/rubble and exposed land. The area for these items is described in the TFL vegetation resource inventory file. Details are provided in Table 4.

Table 4: Non-Vegetated Land

Cover Type	Landscape Position	Total Area (ha)
Rock	Upland	775
	Alpine	174
Total		**949**

Where BCLCS_level_4 = RO

3.4 Roads

Existing roads occur on the inventory files as polygons. During the term of MP3 roads were classified and buffered based upon average measured widths. The roads occur on the inventory file as non-vegetated land. A total of 3,830 hectares are removed from the productive forest land base area for existing roads.

3.4.1 Classified roads

Roads which have a right-of-way identified on the inventory file by a break in the VRI polygons are identified on the file as "RP" in the non-veg table of the VRI database. Having a non-veg cover type of "RP" being greater than 15% identified the polygons selected for removal from the THLB. These same polygons may have been classified as shrub, herb or some other vegetation type depending on the vegetation contained within the polygon. Typically, paved highways, paved secondary roads, gravel secondary roads and main line roads should have had sufficient width to be typed out in the VRI. During the VRI update completed in February 2005 all roads were buffered by their average width based on road class and included in the VRI as a polygon with the BCLCS Level 4 = "RP". During the term of MP3 Canfor developed a process of tracking all oil and gas activities on TFL 48. These activities have been included in the VRI update described for roads. Included in this classification are all oil and gas well sites, camps, sumps,

road access and borrow pits. From Table 5 we see a total of 3,830 hectares have been classified in this manner.

Table 5: Existing Classified Roads

BCLCS LEVEL 1	BCLCS LEVEL 4	Total Area(ha)
Non-vegetated (N)	Road Surface (RP)	2,654
	Exposed Land (EL)	1,176
	Total	**3,830**

Note: Included in the net-down for existing classified roads is area lost to exiting well sites.
The "classification" of roads does not infer classification of road ownership but rather that the road has been identified, the right-of-way has been buffered and the road now exists as a polygon on the inventory file.

3.4.2 Existing Unclassified roads

There are no existing unclassified roads within the TFL. During the term of MP 2, Canfor completed a comprehensive road inventory. During MP3, the roads in this inventory were buffered for their average width. A road inventory management process keeps the TFL's inventory updated for new road construction.

3.5 Mine Sites

Mining is a significant resource activity within the boundary of TFL 48. Mine sites have been identified in this analysis and excluded from the productive forest land base. This exclusion has occurred because it is difficult to predict the timing and extent of land denudation. As well, how much reclamation will occur and over what time period is unknown. Canfor could assume that when this reclamation occurs, many of these areas will contribute to the productive forest land base and provide an upwards pressure on the long term harvest level. However, for the purpose of this analysis no area has been added back to the forested land base due to current or future reclamation activities. Table 6 describes the TFL area exclude from the productive forest land base due to mining claims.

Table 6: Reduction for Mining

Mine Classification	Land Status (BCLCS_LEVEL_2)	Total Area (ha - including mine roads)
Existing	Treed	98
	Non-treed / land	1,625
Proposed	Treed	479
	Non-treed / land	34
	Total	**2,236**

Mine locations were intersected into the TFL database

3.6 Vegetated Non-Treed

Vegetated non-treed areas were often classified as NCBr in traditional forest cover inventories. These areas have been classified according to their position in the landscape, i.e., wetland, upland or alpine. If disturbance history exists in the upland or wetland areas, it is assumed that the area exists as backlog NSR resulting from a burn, or from logging. In these instances (i.e., when disturbance history exists for these polygons), the area was not netted out. If disturbance history does not exist, the area was netted out of the potentially productive land base. A breakdown of vegetated non-treed area is shown in Table 7.

Table 7: Vegetated Non-Treed

Landscape Position [1]	Cover Type	Total Area (ha)
Wetland	Shrub tall	431.5
	Shrub low	543.2
	Herb	901.2
	Bryoid	7.3
Upland	Shrub tall	12,915.7
	Shrub low	12,892.1
	Herb	22,915.8
	Bryoid	2,569.9
Alpine	Shrub tall	76.0
	Shrub low	4,968.1
	Herb	7,295.8
	Bryoid	1,553.9
Total Vegetated Non-Treed		**67,070.5**
Add-back Upland [2]	Shrub low	127.6
Total Vegetated Non-Treed Reduction		**66,942.9**

1 BCLCS_LEVEL_1 = V, BCLCS_LEVEL_2 = N

2 Area in the uplands with disturbance history (BCLCS_LEVEL_5 = SP) was added back to the productive forest land base

3.7 Inoperable

Over the term of MP 2, Canfor completed a terrain inventory and landslide inventory, as well as slope stability and operability interpretations for TFL 48. This has been completed using Terrain, BEC variant mapping, landslide inventory and slope to predict terrain stability and operability. Using a combination of slope and terrain stability, all areas of the TFL were classified as conventional harvest systems, mixed harvest systems, cable harvest systems, aerial harvest systems and inoperable. The area in the newly acquired Stewart block did not have this work completed. Conventional Dawson Creek TSA operability mapping was used to define conventional, cable and inoperable areas. The coniferous leading inoperable, which includes aerial areas identified in the Operability interpretations have been excluded from the THLB. As well, the deciduous stands existing on mixed and cable ground have been excluded from harvesting. Table 8 and Table 9 describe physical operability within the TFL by slope class and harvest system.

Table 8: Physical Operability by Slope Class and Harvest System

Physical Operability Class		Slope / Area by Harvest System											
		0-10%		10-45%		45-70%		70-80%		80-100%		100%+	
Stability Index	Stable	124,226	Conv	249,776	Conv	218	Cable						
	Moderately Stable			703,02	Conv	3,862	Cable						
	Quasi-stable			508,83	Mix	34,087	Cable	131	Inop	8	Inop		
	Lower Threshold			21,220	Cable	43,300	Cable	8,902	Inop	3,685	Inop	15	Inop
	Upper Threshold			4,647	Inop.	8,033	Inop	2,968	Inop	2,791	Inop	1,539	Inop
	Defended			2,271	Inop	4,411	Inop	1,964	Inop	2,925	Inop	1,412	Inop
Total		**124,226**		**399,099**		**93,911**		**13,965**		**9,409**		**2,965**	
		643,575											

Table 9: Physical Operability Classes by Net Area

Operability	Forest Area (ha)	Excluded Forest (ha) [1]
Conventional	415,123	114,165
Mixed	29,631	7,246
Cable	82,937	46,573
Aerial	5,928	5,928
Inoperable	28,111	28,111
Total	**561,729**	**202,022**

In this analysis, a net-down was not applied to areas having a conventional, mixed or cable operability classification. A net down of the THLB was applied to all coniferous-leading areas identified as aerial or inoperable. In addition, since it is not current practice to harvest deciduous-leading species from mixed, aerial or cable ground, or from the ESSF, the deciduous-leading stands occurring within these locations have also been excluded from the THLB.

3.8 Non-commercial

Non-commercial cover or NC is not identified on the VRI as a polygon attribute.

3.9 Low Productivity Sites Identified for Immature Stands

Table 10 documents the immature area that is not suitable for harvest due to its poor timber growing potential. A site index is the height of a stand measured at breast height age 50 (mbha50). The site indices indicated in Table 10 reflect the minimum site index required for a stand to reach 120 m3/ha at maturity on conventional ground. Similarly, a minimum stand volume of 150 m3/ha and 200 m3/ha is required for mixed and cable ground respectively. The site indices calculated in Table 10 were derived from VDYP. A 50% crown closure was assumed for coniferous timber types and a 60 % crown closure for deciduous. The stands were assumed to reach maturity at the regional priority cutting age (i.e., 101 for Pl, 141 for Sw, 121 for Bl and 81 for At and Cot).

The Ministry of Forests requested that Canfor monitor the harvesting performance in deciduous leading stands, which are currently classified as having a low timber growing potential. However,

as a result of the deciduous manufacturing facility being closed for a significant period of time during MP3 there was no harvesting of deciduous leading stands. With re-opening of this facility and the addition of other deciduous manufacturing capacity in the Peace an increase in the demand for deciduous is anticipated. Due to the lack of new information the site index limits have remained unchanged from MP3.

Table 10: Low Site Index applied to Immature Stands

Timber Types	Site Index Upper Limit of Exclusion by Operability Type			Forest Area (ha)	Net Reduction Area (ha)
	Conventional	Mixed	Cable		
Balsam	9.6	10.9	13.0	37,645	25,447
Spruce	7.5	8.5	12.0	11,504	9,393
Pine	10.4	11.7	14.1	10,605	9,090
Aspen	16.1	0	0	11,029	10,137
Cottonwood	12.4	0	0	1,835	1,643
			Total	**72,618**	**55,710**

3.10 Environmentally Sensitive Areas

Environmentally sensitive areas (ESAs) are no longer identified in Vegetation Resource Inventories. Area management concerns for steep slopes, soils, recreation, visual quality, and wildlife must now be addressed through other land base net downs. Some of these net downs include inventories which were accumulated by Canfor and are specific to resource management objectives other than timber management (e.g., recreation). Specific wildlife habitat areas are now being modeled. Operability information is extensive and addresses steep slopes, soils, and physical operability concerns. Visual information is accounted for along with recreation net downs.

3.11 Riparian Reserves and Management Zones - Streams and Rivers

Since 1995, Canfor has conducted 1:20,000 RIC standard fish and fish habitat inventories throughout the TFL. Over the term of MP3, this detailed modelling exercise has been completed for the entire TFL.

A Stream Classification Tool (SCT)(Hatfield and Ecometrics 2000) was designed to predict stream classes for all reaches in TFL 48. The best fit model used a 20% average reach gradient barrier to upstream fish migration, no fish bearing streams higher than 1300 m in elevation and no fish upstream of a confirmed barrier.

The SCT predicted stream class for more than 30,000 reaches. For the purposes of analysis we established the amount of merchantable volume left in the total Riparian Management Area (RMA). To do this we had to develop a total Riparian Management Area width applied to streams. Riparian Reserve Zone (RRZ) widths are applied as per the Forest Practices and Planning Regulations of the Forest and Range Practices Act. Variable retention of merchantable timber left in the RMZs was based on SPs occurring within the TFL and harvested over the past 5 years.

Management Zone widths were applied using the same methodology as for RRZs. The legislated RMZ width was factored for a percent retention by stream class, as derived from summarizing the

prescribed retention in silviculture prescriptions from 2000 to 2003 (See the TFL48 SFMP Sec 3.7 for additional information). The area was then removed from the timber harvesting land base. The results of the reductions for RRZ and RMZ are shown in Table 11.

Table 11: Riparian Reserve and Management Zones Around Rivers/Streams

Riparian Stream Class	Average Channel Width (m)	Stream Length (m)	FPC Act Reserve Zone Width (m)	FPC Act Mgmt Zone Width (m)	Net Width of Area Buffered (m) [(1)]	Total Buffered Area (ha)	Net Reduction Area
S1	>20 & < 100	145,016	50.0	20	56.1	31,082	27,597
S2	> 5 & ≤ 20	65,095	30.0	20	46.9		
S3	≥ 1.5 & ≤ 5	1,763,049	20.0	20	60.8		
S4	< 1.5	2,136,642	0.0	30	3.4		
S5	> 3	1,484,134	0.0	30	23.2		
S6	≤3	8,001,367	0.0	20	3.1		
Total		**13,595,303**					

For TFL Blocks this is the weighted average reserve width of the stream to one side. Buffers were applied to both sides of every stream or river. Streams in the At BEC were not buffered as these areas were already removed from the THLB.

3.11.1 Forested Islands

Islands that exist primarily within the Sukunka River are often sufficiently large enough that riparian reserves did not capture all of the forest area within the island. Since it is unlikely that Canfor will harvest these areas in the foreseeable future, they were removed from the THLB via a visual inspection of maps of the TFL. The mapsheet polygon numbers were identified and used in the TFL net-down. A gross area of 195 hectares was identified as islands. Net within islands is 141 hectares that would otherwise have contributed to the THLB.

3.11.2 Riparian Reserves - Lakes and Wetlands

Lake riparian reserves were classified according to their size in the VRI. Thirty meter riparian reserves were placed around all lakes having a size between 5 and 1000 hectares.

Wetland classifications were determined using GIS. Complex wetlands were calculated by buffering wetland polygons to determine which wetlands were within the proximity of others. The logic used to complete this buffer was derived using Figure 1, extracted from the Riparian Management Plan Guidebook.

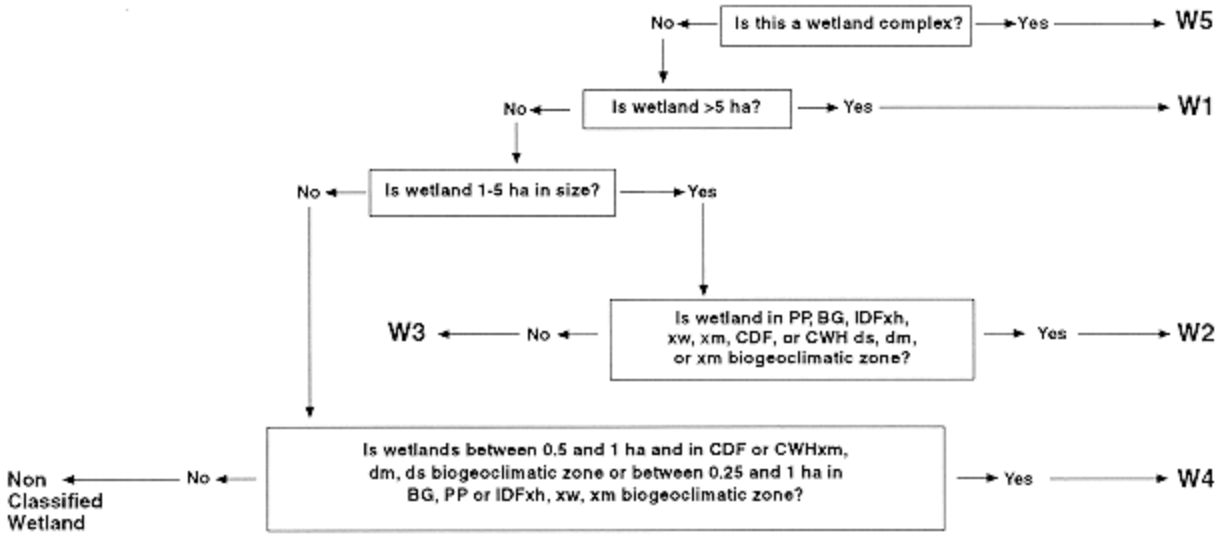

Figure 1: Wetland Classification

Wetlands have a management zone around them of varying widths and stem retention.

Wetlands were defined as vegetated, treed, wetland polygons and vegetated, non-treed, wetland sites and a 10 meter reserve was placed around them. Complex wetlands are a relatively minor occurrence within the TFL as a result of the moderate to steep slopes. Due to the small area affected and the complexity of identifying and excluding these arfeas, wetland complex classifications have not been identified in this analysis. Sensitivity analysis may be used to examine the potential impact of addressing management concerns within these areas.

Table 12 describes the area removed from the timber harvesting land base for lakes and wetlands.

Table 12: Riparian Reserve Zones Around Lakes and Wetlands

Riparian Class	Gross Area	Riparian Reserve Zone		Riparian Management Zone [3]			Total Buffer Width [3] (m)	Gross Area Reserved (ha)	Net Area Reduction (ha)
		Width (m)	% Retention	Width (m)	% Retention	Equivalent Distance Retention			
Lakes [1]		30	100	70	0	0	30	28	25
W1 [2]	2093	10	100	40	40	16	26	1,882	1,760
W3	825	0	0	30	40	12	12		
W5	2584	10	100	40	30	12	22		
Forest Wetlands						n/a		4,001	3,558

[1]Lakes greater in size than 1000 ha or less than 5 ha did not have a buffer applied.

[2]Wetlands were defined as vegetated treed wetland, vegetated non-treed wetland, or non-vegetated wetland in the VRI with an area not less than 5 hectares.

[3]Riparian Management Zone retention estimates are based upon the principle and practice of winching merchantable stems out of riparian management zone areas, where the damage to remaining vegetation is minimized. The Percent retention is a rough approximation of the amount of merchantable volume retained in wetland riparian management zones

3.12 Wildlife Habitat Reductions

In the MP4 analysis, specific reductions were made for bull-trout, and ungulate winter range in the Dunlevy Special Management Area (Butler Ridge, Aylard and Williston Management Units). These area reductions are shown in Table 13.

Table 13: Specific Wildlife Habitat Area Reductions

Critical Habitat	Location	Gross Area (ha)	Forest Area (ha)	Net Area Reduction (ha)
Bull Trout	All	105	86	74
Ungulate Winter Range	Aylard	2461	1661	383
	Butler Ridge	301	199	87
	Williston	2982	2620	1513
	Graham	3704	3408	0 [1]
	Total UWR	9448	7888	1983
Total All Wildlife Reductions		**9553**	**7974**	**2,057**

Note: 768 hectares in the Graham UWR have been excluded from harvesting for other net down reasons.

3.13 Cultural Heritage Resource Reductions

Known cultural heritage resources on TFL 48 have been provided by Archeology Branch, Ministry of Small Business, Tourism and Culture, and mapped by Canfor. As directed by the MOF, the 20 known spot locations have been intersected into the VRI and have been buffered with a 56 m

radius to provide an approximate 1 hectare reserve. This 1 hectare buffer provides some measure of protection at a strategic level. More refined, site-specific buffers will be applied on the ground at the operational level of management. Table 14 provides a listing of the sites and the gross area and forested area affected. Consultations with Regional Archeological staff have indicated that a heritage trail is known to cross the TFL. However, the geographic location of this trail is not known, and therefore has not been incorporated into this analysis.

Table 14: Cultural/Heritage Sites

Landscape Unit	# of sites	Forest Area (ha)	Net Area Reduction (ha)
Boucher	3	2.5	2.5
Carbon	3	0.5	0.5
Highhat	3	3	2.8
Martin Creek	7	3.5	3.5
Wolverine	2	1.1	1.1
Total	**20**	**10.6**	**10.4**

3.14 Other Site Reductions

3.14.1 Protected Areas

Protected Areas resulting from the Dawson Creek LRMP have been removed from the T.H.L.B. Table 15 describes the area within the legislated protected areas within TFL 48.

Protected areas listed in the PAS section include; Bocock Peak, Butler Ridge, Klin-se-za (Twin Sisters), Peace River/Boudreau Lake, Pine/LeMoray, Gwillim Lake/Elephant Ridge, and Sukunka Falls Park in the Parks section. The forest area within all protected areas and the Sukunka Falls Park will contribute to the biodiversity seral stage targets within the zones that they occur.

Table 15: Protected Areas and Parks within TFL 48

Protected Area	Gross Area (ha)	Forest Area (ha)	Net Reduction (ha)
PAS	18,388	14,853	12,849
Parks	426	330	286
Total	**18,814**	**15,183**	**13,135**

3.14.2 Agriculture Land Reserves

Information pertaining to the Agricultural Land Reserve was obtained from the Provincial Land and Resource Data Warehouse. A small part of TFL 48 falls within areas identified under the Agriculture Land Reserve (ALR). Any indicated extractions from the TFL as a result of the ALR would have to be Minister approved upon referral under Sec 60.1B of the Forest Act.

Potential ALR's withdrawals have not been addressed in this analysis. The area within the ALR has been treated the same as the rest of the TFL. If a conversion occurs in the future, it is Canfor's understanding that the government would be responsible for providing compensation in some form. As well, should land conversions occur in the future, the impact on the long-term timber supply will be addressed at the time of the next analysis review.

3.14.3 High Elevation Forests

All forested and non-forested areas within Natural Disturbance Type 5 (NDT 5) were removed from the timber harvesting land base. A total of 43,697 hectares are within NDT5. Contributing to

the productive forest land base are 14,942 ha. After exclusions for operability, 13,765 ha were removed from the timber harvesting land base.

3.14.4 Seismic Lines, Pipelines, Trails and Transmission Lines

All seismic lines, pipelines, trails and transmission lines identified in the TFL data base had been buffered and identified as polygons in the VRI. These polygons were removed as part of the vegetated non-treed lands identified in Table 7.

3.15 Mature Stand Problem Forest Types

Mature problem forest types are stands that exceed the minimum cutting age, are physically operable, but are excluded from the timber harvesting land base due to the stands being too old, too short, have too small a diameter or have insufficient volume. Although many of these stands may be harvested in part, they are not specifically targeted for harvesting at the present time. Changes in timber value, timber availability, and sawmill requirements may change Canfor's perception of the value of these stands in the future. Table 16 documents the areas that are currently considered to be mature problem forest types. The land base deductions are described according to inventory file attributes.

The area removed from the THLB due to mature stand problem forest types significantly changed in SFMP4 versus MP3 due to the completion of the VRI Phase II ground sampling including Net Volume Adjustment Factor.

Height, age, and net merchantable volume were adjusted as a result of the Phase II and NVAF sampling completed on TFL 48. TSR volume is defined as the net merchantable volume at the 12.5cm+ utilization level in lodgepole pine leading stands and the 17.5cm+ level in all other stands. After adjustment, the average height increased by 5%, age decreased by 7% and TSR volume increase by 34%. The TSR volume increased by 18% in the high priority sample areas (those mature areas most likely to contribute to the timber harvesting land base) (JS Thrower & Associates 2005).

Table 16: Problem Forest Types

Leading Species	Characteristics						
	Age/Height/Stocking	Minimum Volume by Operability Class			Reduction Percent	Total Forested Area	Net Area reduction
		Conv.	Mix	Cable			
B, BH	age class ≥ 6 and height class ≤2, or age class ≥ 6 and stocking class = 2	120	150	200	100	12,658	7,531
BS	age class ≥ 6 and height class ≤2	120	150	200	100	12,587	9,914
S	age class 8 and height class ≤ 2	120	150	200	100	4,971	3,881
	All black spruce stands	All	all	all	100	7,362	5,411
Pl	age class ≥ 5 and height class = 1; all stocking class 4; all stands ≤17.5 metres	120	150	200	100	7,935	6,999
AtCon, CotCon AtDec, CotDec	Area within the ESSF, Area within cable or mixed operability	All	All	All	100	7,747	6,395
	age class ≥ 7 or age class ≥ 4 and height class = 1	120	All	All	100	9,039	7,773
Other Species (W, L, Ep)	all	All	all	all	100	198	173
Total						**62,497**	**48,077**

Table 17: Age, Height, Stocking Definitions

Age Class		Height Class		Stocking Class		
#	Age Range (years)	#	Height Range (m)	Class #		Definition
5	81 - 100	1	0 - 10.4	0		immature
6	101-120	2	10.5 - 19.4	1		mature & ≥ 76 stems/ha, 27.5+ cm dbh
7	121-140	3	19.5 - 28.4	2		mature & < 76 stems/ha, 27.5+ cm dbh
8	141 - 250	4	28.5 - 37.4	Sub-div. of 2	3	mature Pl ≥ 311 stems/ha, 17.5+cm dbh and 50% of stems 7.5+ cm dbh are ≥ 12.5+ cm dbh
9	251 +	5	37.5 - 46.4		4	mature Pl <311/ha, 15.5+cm dbh or ≥ 311/ha, 17.5+ cm dbh and <50% stems 7.5+ cm are ≥ 12.5+ cm dbh

3.16 Future roads and trails

During MP3, Canfor undertook a process that used the existing MP3 THLB and terrain information to develop a classified future road network for the entire TFL. Portions of the THLB that will be lost through the construction of future roads and trails were identified by buffering future roads and intersecting the resultant coverage against the THLB identified in MP3. Six classes of future road were developed. Table 18 identifies these classes and the amount of area

that may be lost to future road construction. Because the future road network was built using the MP3 THLB cover, this information is not directly compatible with the larger THLB identified in SFMP 4. To incorporate this information into the current analysis, the future road coverage was intersected against the MP3 THLB to determine the loss in THLB area, by analysis unit for future roads. This loss was divided by the total THLB area to derive a percent reduction for future roads. The loss will be applied as percent area reduction applicable as a one-time loss to all future managed stands.

Table 18: Future Roads

Class	Description	Width (m)	Area (ha)
1	Mainline	25	5,827
2	Operational	20	
3	Block	8	
10	Highway	50	
11	Secondary	30	
12	Gravel Sec	30	
MP3 THLB Area in existing unmanaged stands and existing older managed stands			314,151
Percent area lost in all existing stands			1.9%
Area in older existing managed stands and existing unmanaged stands			347,824
Maximum Loss to future stands in current analysis (348,296 x 1.9%)			6,609

3.17 Visual Landscape Inventories

During the term of MP 2 (1994), an inventory of visual portions of the TFL landscape was completed by Canfor. In 1999 this visual landscape inventory was added to and updated to the 1997 standard. In 2005 the Ministry of Forests consolidated all visual landscape inventories within the previous Dawson Creek Forest District (TFL48 and Dawson Creek TSA). During this process it was discovered that some areas that had been declared and made known were not part of the TFL 48 visual inventory used in MP3. The 2005 consolidated inventory that was provided by the MoFR, and identifies polygons having an existing VQO (EVQO) on the file, is used in the base case for TFL 48.

In the Base Case the net down logic excluded 723 hectares (of which 167 ha was net) of Visual Preservation VQO based upon the 1999 Preservation VQO classification. The subsequent inclusion of the 2005 visual inventory into the analysis increased the total established Preservation VQO to 1342 ha of Productive Forest. This inclusion only affected about 100 hectares of area that was considered part of the THLB. Rather than remove the 99.8 ha of THLB and rework the THLB throughout this document, the preservation VQO area that is included in the THLB will be constrained to ensure there is no harvesting in Preservation VQOs.

The areas added during the 1999 inventory are represented in the 2005 consolidated inventory as recommended VQO's (RVQO). Sensitivity analysis will be carried out that adds 'Recommended' VQOs to the 2005 consolidated visual landscape inventory. The sensitivity

analysis is the cumulative amount of established and recommended VQO's from the 2005 consolidated inventory.

3.18 Recreation

The recreation inventory for TFL 48 was completed in 1994. Based on input from the Dawson Creek Forest District the recreation inventory was updated in 2001. This updated inventory is used in this analysis. Management for recreation concerns within the TFL utilizes this inventory by making reductions to the net operable land base. The rationale for these reductions can be obtained from the Recreation/Landscape Analysis Report for TFL 48. Table 19 describes the reductions for recreation. To summarize, all areas having a recreation management class equal to 0 are excluded from the THLB. The area in recreation class B1 is traditionally modelled with an 80% inclusion factor. In this analysis we applied a 100% inclusion factor. Although this may seem optimistic, Table 19 reveals that the forested land base in areas identified as Recreation Class B1 have, through landbase reductions for operability, low sites, protected areas and problem forest types, already been reduced by 45 percent. Therefore, the application of forest cover constraints or area reductions will not be applied to the Recreation Class B1 areas.

Table 19: Recreation

Significance Feature	Management Class	Total Area (ha)	Forested Area (ha)	Inclusion Factor	Net Area Excluded for recreation (ha)	Total Forest Area Excluded (ha) [1]
B	0	1,316	1,222	0	370	1,222
B	1	39,550	36,486	1	0	16,449
C	0	70	44	0	44	44
C	1	147,490	114,764	1	0	53,172
C	2	13,892	10,409	1	0	4839
D	1	33,603	30,528	1	0	7417
D	2	405,994	366,076	1	0	116716
Recreation Sites		4	4		4	4
Total		**641,919**	**559,533**		**418**	**199,863**

Note 1: Refers to the area removed by recreation classification for all net-down criteria, such as operability, riparian buffers, protected areas, problem forest types, etc.

3.19 Rare Site Series

In this analysis, site series and structural stage is used to identify wildlife habitat areas. As well, site series has been incorporated into the net down and rate, unusual site series have been identified. These areas have been excluded from the THLB.

Table 20: Reductions for Rare Site Series

Representation Cluster Name	BECLABEL	Site Series (Site_S1)	Productive Area (ha)	THLB Area Removed
BWBS subhydric wk1	BWBSwk 1	07	220	74
BWBS subhydric wk1	BWBSwk 1	08	84	13
BWBS subhygric wk1	BWBSwk 1	05	1,033	786
BWBS subhygric wk1	BWBSwk 1	06	306	177
BWBS submesic - mesic wk2-03	BWBSwk 2	03	1,313	728
BWBS xeric wk2-02	BWBSwk 2	02	744	545
ESSF subhygric - hygric mv	ESSFmv 2	06	378	249
ESSF subhygric - hygric mv	ESSFmv 4	05	1	0
		Total	**4,079**	**2,572**

3.20 Area Additions

The forested portions of Sukunka Falls Park were added to the Productive Forest Land Base, since the park is enclosed within the boundaries of the TFL. Many other parks and protected areas are also included in the TFL and are identified on the inventory file as TENURE = TFL48. Sukunka Falls was the exception. The forested area in this park will contribute to visual and landscape biodiversity (as do the other parks and protected areas). The park will not contribute to the timber harvesting land base.

Net-down programming which might typically remove not-satisfactorily-restocked areas (NSR), did not remove these stands in the net-down process. Due to a rapid treatment and regeneration program, all NSR stands have an existing site index and species profile.

The gross productive area of NSR in the TFL is 3,245.2 hectares. Approximately 382.7 hectares are considered “lost” due to land base net downs (e.g. riparian reserves). The remaining 2,862.5 hectares comprises 2,148 hectares of current NSR and 714.5 hectares of backlog NSR.

The majority of the NSR existing within the TFL has been surveyed by Canfor to determine the leading species planted and regenerating and to determine an estimated site index based upon the biogeoclimatic ecosystem classification. Based upon this information, the NSR is added back to the appropriate managed stand analysis units.

In theory, backlog NSR continues to exist on TFL48. However, in reality these areas are now stocked sites that have regenerated to mixedwood stands. The concept of rehabilitating these areas to intensively managed plantations is neither practical nor economical. The “backlog NSR” area has been allocated to 2 analysis units – low-stocking conifer and low stocking-deciduous. The total area in these sites is 924 hectares, of which 714.5 hectares contributes to the THLB. These stands are assumed to grow on old “managed” stand curves that had their stocking adjusted to reflect the current stand density in these polygons. Table 46 in Section 5.8.1 describes the NSR area that gets added to managed stand analysis units.

3.21 New Ungulate Winter Range and Wildlife Habitat Areas

Since the MP4 analysis was completed four new UWR orders have been passed that overlap with the TFL (u-7-003, u-7-006, u-9-002, and u-9-004). There is very little overlap between u-7-003, u-7-006 and the TFL. Within the orders for u-9-002 and u-9-004, several units have general wildlife measures that preclude timber harvesting. These units are shown in Table 21 and the THLB has been updated to exclude these areas from harvest. It is important to note that only 478

ha from the initial UWR netdown overlaps with the current UWR and WHA no harvest areas. The remaining 1,515 ha removed under MP4 is no longer identified as UWR no harvest area. However, due to the expedited nature of this analysis and limits on the available data from the MP4 analysis, this area has remained excluded from the THLB and represents an underestimate in the available timber supply of up to 0.4%.

Table 21: New No Harvest UWR Units

UWR Number	UWR Unit Number	Productive Forest Area (ha)
u-7-003	P-003	12
u-9-002	SPC-001	695
u-9-002	SPC-002	3,766
u-9-002	SPC-003	2,210
u-9-002	SPC-004	3,891
u-9-002	SPC-005	612
u-9-002	SPC-007	3,186
u-9-002	SPC-008	3,208
u-9-004	GR-011	615
u-9-004	GR-012	73
u-9-004	GR-013	9
u-9-004	GR-014	341
u-9-004	GR-020	3
u-9-004	GR-022	9
u-9-004	GR-023	163
u-9-004	GR-025	845
u-9-004	GR-026	4
u-9-004	GR-027	1,656
u-9-004	GR-029	2,094
u-9-004	GR-030	82
u-9-004	GR-031	200
u-9-004	GR-032	195
u-9-004	GR-033	33
u-9-004	GR-034	30
u-9-004	GR-035	16
u-9-004	GR-036	16
u-9-004	GR-037	10
u-9-004	GR-038	5
u-9-004	GR-039	4
u-9-004	GR-040	38
Total		**24,021**

New wildlife habitat areas (WHA) have been updated since the MP4 analysis with the passing of two separate WHA orders (MoE, 2008a and MoE, 2008b). The THLB has been updated to reflect the no harvest area identified within each of these orders and are shown in Table 22.

Table 22: New No Harvest WHA

WHA Number	Productive Forest Area (ha)
9-041	611
9-044	2,691
9-045	166
9-049	69
9-050	3,768
9-051	30
9-055	3,747
9-056	628
9-057	775
9-061	4,358
9-062	401
9-063	3,150
9-064	1,079
9-065	766
9-103	13
Total	**22,252**

4.0 CURRENT FOREST MANAGEMENT ASSUMPTIONS

The following sections describe management objectives not captured through the land base reductions described above.

4.1 Resource Management Zones

Resource management zones represent areas in which specific management objectives are applied, generally to reflect non-timber values on the land base. Each resource management objective has specific forest cover objectives (either retention or disturbance requirements) applied. Detailed modelling information on each objective is provided in the sections below.

Table 23 shows the resource management zones developed through MP4 analysis. In the MP4 analysis each of these classifications is set in Woodstock as a "theme". Patchworks does not use "themes" per se. However, the information contained within each theme will be used to reflect a set of target values in Patchworks and is therefore described below.

Table 23: Modelling Themes

Theme	Label	Description and Application
*THEME {1}	Analysis unit	Based upon Inventory Type group and leading species, site quality and current age – used for associating to yield tables
*THEME {2}	Genetics	Identification of area utilizing Class A Seed for spruce – used for association managed stand yield tables
*THEME {3}	THLB	Classification of the TFL into timber harvesting land base (THLB), non contributing forests (NCLB), Woodlots, private land and non forest.
*THEME {4}	Management	Used to identify the management status of the TFL (ie existing, older (pre 1995) managed, and intensive management (post 1995)) and track transitions from unmanaged to managed forest.
*THEME {5}	Natural Disturbance Unit	Identification of NDUs based upon spatial areas and subdivide into mountain and valley areas by BEC
*THEME {6}	BEC	Biogeoclimatic ecosystem classification
*THEME {7}	Landscape Unit	Landscape units – used for sensitivity analysis
*THEME {8}	VQO	Visual quality area – used for EVQO and RVQO constraints
*THEME {9}	Pulpwood Area	Pulpwood 10 and 13 areas – used for reporting only
*THEME {10}	Recreation Class	Recreation class– used for reporting only
*THEME {11}	Watershed	Used to apply Equivalent Clear-cut area constraints
*THEME {12}	Wildlife Habitat	Used to identify the areas having ungulate winter range habitat values
*THEME {13}	Dunlevy Zone	Used to identify the spatial management areas within the Dunlevy
*THEME {14}	Map stand	Used to identify each mapsheet forest cover polygon within the TFL
*THEME {15}	Remsoft ID	Concatenation of all themes. Used to assign site series and thereby track wildlife habitat ratings (quality and quantity)
Area	Area (ha)	Used to identify the area of each polygon
Age	Age in periods	Used to identify the stand age in 10 year periods; to rate structural stage for the application of wildlife habitat ratings; and to identify carbon amounts as they change by age and analysis unit

4.1.1 Analysis Unit

Table 24 identifies the criteria used to identify analysis units (species, site quality and current age) the associated area. Correlation between analysis units and yield tables also includes an association with Themes 2, 3 and 4 – genetics, THLB and management class

Table 24: Analysis Units

AU #	AU Code	Description	Forest Area (ha)	Type Group	Site Index Criteria	Current Age
1	Bl_all	Balsam - all	43,201	18	all	all
2	Bx_y	Balsam mixed young	34,346	20	all	<=140
3	Bx_o	Balsam mixed old	18,828	20	all	>140
4	Bl_s	Balsam Shelterwood	17,561	20	all	all
5	Sw_yg	Spruce young good	11,913	21	>10	<=140
6	Sw_ym	Spruce young medium	8,738	21	<=10	<=140
7	Sw_og	Spruce old good	9,804	21	>10	>140
8	Sw_om	Spruce old medium	3,551	21	<=10	>140
9	Sc_yg	Spruce conifer young good	45,961	22,24,25	>11	<=140
10	Sc_ym	Spruce conifer young medium	20,675	22,24,25	<=11	<=140
11	Sc_og	Spruce conifer old good	15,284	22,24,25	>11	>140
12	Sc_om	Spruce conifer old medium	33,447	22,24,25	<=11	>140
13	Sd_g	Spruce-deciduous good	16,828	26	>14	all
14	Sd_m	Spruce-deciduous medium	7,853	26	<=14	all
15	Ss_g	Spruce Shelterwood good	9,403	21-25	>14	all
16	Ss_m	Spruce Shelterwood medium	15,188	21-25	<=14	all
17	Pc_yg	Pine Conifer young good	23,826	30	>15	<=140
18	Pc_ym	Pine Conifer young medium	48,469	30	<=15	<=140
19	Pc_og	Pine Conifer old good	5,963	30	>14	>140
20	Pc_om	Pine Conifer old medium	11,897	30	<=14	>140
21	Pd_g	Pine Deciduous good	14,149	31,34	>12	All
22	Pd_m	Pine Deciduous medium	4,484	31,34	<=12	all
23	Pl_g	Pine good	18,389	28,29	>15	all
24	Pl_m	Pine medium	38,470	28,29	<=15	all
25	Ac_g	Aspen conifer good	12,817	41	>15	all
26	Ac_m	Aspen conifer medium	10,000	41	<=15	all
27	Ad_g	Aspen deciduous good	34,211	42	>14	all
28	Ad_m	Aspen deciduous medium	6,723	42	<=14	all
29	Ct_con	Cottonwood-conifer	8,744	35	all	all
30	Ct_dec	Cottonwood deciduous	14,747	37-40	all	all
31	LwStk_c	Low stocking – conifer	292		all	all
32	LwStk_d	Low stocking – deciduous	632		all	all
		Totals	566,394			

Note: Analysis units were allocated based upon the species percent by volume for managed stand and the inventory type group (ITG) for existing unmanaged stands. AU's 4, 15, 16 were identified spatially as two or more layered stands in the ESSF, SBS, and all stands within the ESSF wc3.

4.1.2 Management Classification

Stands within the TFL are divided into four management classifications. These are:

1. Existing unmanaged stands
2. Existing managed stands (harvested pre 1995)

3. Existing managed stands (harvested between 1995 and 2008) – no genetic gains
4. Future managed stands (harvested after 2008) – full genetic gains

After harvesting, the area in existing unmanaged stands and existing managed stand convert to "future" managed stands. Upon conversion, only 98.1 percent of the area is assumed to reforest. The remaining 1.9 percent is assumed to remain as roadway and will no longer contribute to the THLB.

4.1.3 Natural Disturbance Units

Natural Disturbance units applied in this analysis have been developed for the Prince George Forest Region. Table 25 describes the area by NDU. The area in the Boreal Plains and Boreal Foothills – Valley is shown sub-divided into conifer leading stands and deciduous leading stands. This is done for analysis purposes and the application of old-growth targets.

Table 25: Natural Disturbance Units

THEME 5	Total Area (ha)	NCLB Area (ha)	THLB Area (ha)
Boreal Foothills - Mountain	177,424	76,756	100,669
Boreal Foothills - Valley - Conifer	68,121	15,345	52,776
Boreal Foothills - Valley - Decid.	43,814	16,175	27,640
Boreal Plains - Upland - Conifer	125,199	30,248	94,951
Boreal Plains - Upland - Decid.	39,670	19,977	19,692
Omineca - Mountain	13,220	3,708	9,512
Omineca - Valley	6,209	1,815	4,394
Wet Mountain	92,735	42,687	50,048
Total Area (ha)	**566,394**	**206,713**	**359,681**

4.1.4 Biogeoclimatic Ecosystem Classification

TFL 48 Biogeoclimatic Ecosystem Classifications (BEC) has not been updated since MP3. Table 26 describes the area within each BEC across the TFL.

Table 26: Biogeoclimatic Ecosystem Classifications

THEME 6	Total Area (ha)	NCLB Area (ha)	THLB Area (ha)
AT	1,005	1,005	-
BWBSmw1	124,549	40,193	84,355
BWBSwk1	34,648	8,082	26,566
BWBSwk2	12,520	4,477	8,043
ESSFmv2	6,120	6,120	-
ESSFmv4	6,394	6,394	-
ESSFmvp2	1,426	1,426	-
ESSFmvp4	148,997	55,397	93,599
ESSFwc3	11,758	7,032	4,726
ESSFwcp3	57,018	32,415	24,602
ESSFwk2	52,572	15,117	37,454
SBSwk2	109,387	29,051	80,336
Total Area (ha)	**566,394**	**206,713**	**359,681**

1 Edge slivers occurred because the BEC cover used was consistent with the BEC inventory from MP3 that was clipped to the TFL boundary. Though BEC coverage occurs over the entire TFL, this problem was discovered too late in the process to redo.

4.1.5 Landscape Unit

Landscape Units were utilized in MP3 in conjunction with biogeoclimatic zones to ensure that harvesting did not become overly concentrated in any one place in the TFL. Landscape Units were also used for the application of old seral biodiversity constraints and the maintenance of old growth. This analysis will see Landscape units used in sensitivity scenarios. Table 27 describes the area within the Landscape Units in TFL 48.

Table 27: Landscape Units

LU_NAME	Theme7	Total Area (ha)	NCLB Area (ha)	THLB Area (ha)
BURNT-LEMORAY	bl	106,693	46,409	60,284
BOUCHER	bo	35,464	9,645	25,819
CARBON	ca	80,177	36,880	43,297
DUNLEVEY	du	45,440	22,100	23,340
EAST PINE	ep	18,954	4,525	14,429
GETHING	ge	56,094	15,274	40,819
HIGHHAT	hh	87,168	21,640	65,528
MARTIN CREEK	mc	57,692	17,298	40,394
PINE RIVER	pr	1,625	391	1,234
WOLVERINE	wl	77,087	31,414	45,673
Total Area (ha)		**566,394**	**206,713**	**359,681**

4.1.6 Visually Sensitive Areas

Visually sensitive areas within TFL 48 are used to ensure that harvesting within the TFL is planned with sufficient due diligence to minimize the visual impact of harvesting on the scenic landscape. Visually sensitive areas having established visual quality objectives (VQOs) are

utilized in the Base Case for this analysis. The established VQO's are based on the 2010 consolidated Visual Landscape Inventory. Additional scenarios will investigate the effect of recommended VQOs.

Table 28 describes the area within the TFL having Established VQOs. In the forest estate model, VQOs will have forest cover constraints applied to the VQO / landscape unit zonation. See Table 34 for more information.

Table 28: Visually Sensitive Areas

VQO Classification	Total Area (ha)	NCLB Area (ha)	THLB Area (ha)
Established Modification	13,591	4,383	9,208
Established Maximum Modification	17,111	5,294	11,818
Established Preservation	1,345	1,242	103
Established Partial Retention	49,599	17,359	32,240
Established Retention	13,754	6,877	6,877
Recommended Modification	1,652	507	1,145
Recommended Partial Retention	13,873	7,632	6,241
Recommended Retention	74	60	14
Not Visually Sensitive	455,395	163,359	292,036
Total	**566,394**	**206,713**	**359,681**

4.1.7 Pulpwood Area

In MP3 deciduous leading stands outside of Pulpwood Agreement 13, (with the exception of the remaining deciduous-leading stands in TFL Block 3B1 and 3B2 (Rice Property)) were excluded from the T.H.L.B. for SFMP 4, these stands were included as part of the THLB, so long as they are not in the ESSF. Table 29 describes the total area of PA10 and PA13 relative to the TFL. This information is tracked for reporting purposes only.

Table 29: Pulpwood Agreement Area

PA	Total	Forested	Forested Deciduous
Area (ha)	483,758	481,109	81,801

4.1.8 Recreation

Information regarding recreation classifications is provided in Section 3.18 and in Table 19.

4.1.9 Watersheds

Canfor, under its SFMP has committed to maintaining water quality and quantity by ensuring that at least 95% of all watersheds within the TFL are below baseline threshold values. As such watersheds within the TFL are identified and tracked in the model.

4.1.10 Wildlife Habitat Areas & WTPs

Several spatially defined wildlife areas have been delineated for TFL48. Areas pertain to Grizzly habitat, and ungulate habitat. Portions of these areas overlap.

Table 30: Wildlife Habitat

THEME12	Total Productive Forest (ha)
Grizzly	209,504
Ungulate	2,637

The wildlife themes identified here were added to allow for the ability to perform sensitivity analysis if required. In some instances, such as the UWR in the Dunlevy, the areas were used to identify stands for removal from the THLB.

Wildlife Tree Patches (WTPs) in this analysis are not spatially identified. To account for WTPs, the amount of area or volume harvested from each forest stand must be reduced by the amount required to be retained as a WTP. For this analysis, a percent volume reduction was used as a proxy to identify area retained as WTPs.

The proportion of the timber harvesting land base that is in WTPs was derived from an intersection of existing WTPs against the total forested land base identified in MP3. During the MP3 analysis the proportions of all WTPs within and outside the THLB was identified. The results revealed that 55% percent of all spatially established WTPs were inside the THLB and 45% were outside the THLB

Within the TFL, 8.0 percent of the forested area within cut blocks must legislatively be retained in WTPs after the blocks are harvested.

By extension, this equates to 4.4 percent of the THLB (8.0% * 0.55).

To simulate management of WTPs, this analysis will reduce the volume in each harvested stand by 4.4 percent.

Note that in MP3, WTPs were modelled not as volume reduction, but by doubling the area in WTPs and modelling these areas on an extended rotation.

4.1.11 Dunlevy Special Management Area

Forest management considerations for the Dunlevy Special Management Areas are described in the Dunlevy Creek Management Plan. The plan was prepared by the Ministry of Sustainable Resource Management (MSRM), and completed January 24, 2002. Information pertaining to the THLB and other forestry statistics were supplied for the Plan by Canfor, using the TFL 48 Management Plan 3 Data Base. The current analysis has seen an increase in the potential THLB as a result of improvements in inventory information. These increases were utilized to adjust the recommended harvest target for the Dunlevy. Table 31 describes the area within the Dunlevy. These areas have changed in some ways significantly from the 2002 report. The changes are due to the refinement of some of the line work associated with the plan. The Dunlevy theme is used to manage the extent and timing of harvest operations within the Compartments. This is discussed further in Section 0.

Table 31: Dunlevy Creek Management Areas

Compartment	Total Productive Forest (ha)	NCLB Area (ha)	THLB Area (ha)
Adams Creek	6,514	3,190	3,324
Aylard Creek	5,438	2,635	2,804
Butler Ridge	5,357	5,356	1
Dresser Creek	5,903	2,699	3,204
Lower Dunlevy	8,656	4,221	4,436
Upper Dunlevy	3,184	1,598	1,586
Totals	**35,053**	**19,698**	**15,355**

4.2 Resource Management Objectives

The Management Plan 4 analysis (IFS, 2006b) was conducted using the Remsoft Spatial Planning System (Woodstock / Stanley) which "Themes" to classify the land base. The themes themselves are used to represent analysis units, and spatially identify areas within the TFL with specific management objectives - analogous to the AUs, zones and groups used in FSSIM. Although this analysis will be conducted using the forest estate model Patchworks (see Section 4.3.1). These themes provide the information required by Patchworks and will be utilized for this analysis.

For the purposes of modelling forest management across TFL 48, harvesting is conducted with consideration given to the following management restrictions:

1) Minimum harvest age and minimum economic volume
2) A sustainable future THLB growing stock
3) Minimum old-growth constraints applied by natural disturbance unit
4) Limits on the amount of harvesting in visually sensitive areas
5) Limits on the minimum amount of thermal cover in ungulate winter range
6) Limits on the minimum amount of old growth within NDU/BEC Variant
7) Restrictions on access, timing and harvest levels within the Dunlevy Special Management Area
8) Limits on the amount of area below hydrological green up by watershed (ECA)

These management considerations are modelled explicitly within Patchworks. Each of these management considerations are discussed in the sections following.

4.2.1 Old Seral Management

NDU-based seral stage objectives have not been incorporated into an old growth order specific to TFL 48 even though it reflects the best science-based approach to old seral management. Consistent with the Provincial Non-Spatial Old Growth Order (the Old Growth Order), Canfor's FSP commits to old growth management targets by Landscape Unit / BEC variant combination as shown in Table 32 which will be reflected in the base case.

NDU-based seral stage targets will be applied as a sensitivity analysis and are discussed in Section 6.1.

Table 32: Old Seral Targets as per the Provincial Non-Spatial Old Growth Order and Canfor's FSP

Landscape Unit	BEO	BEC Variant	Dominant Tree Type	Age of Old Forest	Percent Old Forest Retention
Boucher	Low	BWBS mw1	Dec	>100	>13
			Con	>140	>11
		BWBS wk1	Dec	>100	>13
			Con	>140	>11
		SBS wk2	All	>140	>11
Burnt-Lemoray	Intermediate	BWBS mw1	Dec	>100	>13
			Con	>140	>11
		ESSFmv2	All	>250	>9
		ESSFwc3	All	>250	>19
		ESSFwk2	All	>250	>19
		SBSwk2	All	>250	>9
Carbon	Intermediate	BWBS mw1	Dec	>100	>13
			Con	>140	>11
		ESSFmv2	All	>250	>9
		ESSFwc3	All	>250	>19
		ESSFwk2	All	>250	>19
		SBSwk2	All	>250	>9
Dunlevy	High	BWBS mw1	Dec	>100	>19
			Con	>140	>16
		BWBS wk1	Dec	>100	>19
			Con	>140	>16
		ESSFmv4	All	>250	>13
East Pine	Low	BWBS mw1	Dec	>100	>13
			Con	>140	>11
Gething	Low	BWBS mw1	Dec	>100	>13
			Con	>140	>11
		ESSFmv2	All	>250	>9
		SBS wk2	All	>250	>9
Highhat	Low	BWBS mw1	Dec	>100	>13
			Con	>140	>11
		BWBS wk1	Dec	>100	>13
			Con	>140	>11
		ESSFmv2	All	>250	>9
		ESSFwc3	All	>250	>19
		ESSFwk2	All	>250	>19
		SBSwk2	All	>250	>9
Martin Creek	Low	BWBS mw1	Dec	>100	>13
			Con	>140	>11
		BWBS wk1	Dec	>100	>13
			Con	>140	>11
		ESSFmv2	All	>250	>9
		SBSwk2	All	>250	>9
Wolverine	Intermediate	BWBS mw1	Dec	>100	>13
			Con	>140	>11
		BWBS wk1	Dec	>100	>13
			Con	>140	>11
		ESSFmv2	All	>250	>9
		ESSFwc3	All	>250	>19
		ESSFwk2	All	>250	>19
		SBSwk2	All	>250	>9
Pine River	Low	BWBS mw1	Dec	>100	>13
			Con	>140	>11
		BWBS wk1	Dec	>100	>13
			Con	>140	>11
		ESSFmv2	All	>250	>9
		SBSwk2	All	>250	>9

4.2.2 Patch Size Objectives

Canfor's FSP commits to attain or maintain a pattern of early forest patches that trend towards or achieve the range of early forest patches shown in Table 33. These patch targets are applied to each NDU. Early forest patches are defined as forested areas where the age is less than or equal to 40 years of age. Areas of forest that are less than or equal to 40 years and within 100m of each other are amalgamated into one early forest patch and their areas summed. Areas harvested using an irregular shelterwood or partial cutting silviculture systems do not contribute to early forest patches.

These targets are established to gradually achieve these targets over time.

Table 33: Early Forest Patch Size Targets

NDU	Percent of Early Forest for Each Patch Size Category	
	50 – 100 ha	100+
Boreal Plains	< 15%	>50%
Boreal Foothills/ Omineca	<20%	>40%
Wet Mountain	<25%	<60%

4.2.3 Visually Sensitive Areas

The MP4 base case utilized the established VQO's as represented in the 2005 consolidated Visual Landscape Inventory (VLI). These are not same inventory used for Management Plan 3. In 2010 an update to the VLI was completed which will be reflected in the base case.

Canfor's management of visually sensitive areas has evolved such that all new harvesting proposed in visually sensitive areas has to be planned using the principles of visual landscape design. In addition, Canfor has taken further actions that effectively address visual landscape management. These include:

- Block layout consistent with visual landscape design and biodiversity requirements which soften block appearance;
- The initial minimum target density on the TFL is 1600 sph. This density exceeds that of the Regional well-stocked stand target of 1200 sph;
- Road and trail deactivation/rehabilitation, grass seeding/reforestation and an acute awareness of dispersed site disturbance have reduced site disturbance well below levels considered normal when VAC denudation percentages were calculated;
- Site preparation methods where used, now emphasize minimal disturbance of the duff in order to maintain a more natural look to the blocks. Broadcast burning is not used and raw planting is the preferred treatment. This minimizes exposed rock and soil;
- Mixed species plantations which avoid monocultures, and improves visual characteristics;
- Increased cable harvesting reduces the presence of skid trails on the steeper visual slopes.

In the past, Canfor has demonstrated performance in the following harvesting methods: Ground-based conventional, cable and aerial systems. Silviculture systems used are selection, shelterwood, irregular shelterwood, patch cut, clearcut and clearcut with reserves. Shelterwood harvesting has been used extensively during the term of MP 2 and MP 3 to ensure regeneration concerns are addressed in higher elevation ESSF balsam and spruce multi-layered stands. Selection logging techniques have also been used in visually sensitive areas to minimize the

impact on visual resources. These actions demonstrate Canfor's commitment to managing the visual resource.

Canfor's FSP was amended in 2012 to create additional flexibility around managing for VQOs in areas affected by MPB. The model will be updated to incorporate this flexibility.

Table 34 describes the area by VQO (2005 version) and the percent constraint applied to each of the designations. Constraints will be applied at the landscape unit level to the total forested area within each VQO.

Table 34: Forest Cover Constraints in Visual Areas

VQO	LU_NAME	Productive Forest (ha)	THLB	Max % < greenup	Years to greenup
Established Modification	Boucher	1,063	429	21.9	24
	Burnt-Lemory	223	156	21.9	24
	Carbon	252	175	21.9	24
	Dunlevey	1,299	582	21.9	24
	Gething	0	0	21.9	24
	Highhat	4,226	2,964	21.9	24
	Martin Creek	1,949	1,588	21.9	24
	Wolverine	1,292	1,058	21.9	24
Established Maximum Modification	Burnt-Lemory	3,286	2,256	25	23
	Highhat	3,589	2,158	25	23
	Martin Creek	10,452	7,344	25	23
Established Partial Retention	Boucher	2,342	1,234	9.9	24
	Burnt-Lemory	6,228	3,619	9.9	24
	Carbon	2,005	1,592	9.9	24
	Dunlevey	3,014	345	9.9	24
	Gething	5,478	3,989	9.9	24
	Highhat	8,349	5,958	9.9	24
	Martin Creek	10,748	7,702	9.9	24
	Wolverine	261	44	9.9	24
Established Retention	Burnt-Lemory	1,647	475	1.6	28
	Carbon	47	-	1.6	28
	Dunlevey	1,967	1,390	1.6	28
	East Pine	2,323	316	1.6	28
	Gething	1,050	464	1.6	28
	Highhat	2,184	1,327	1.6	28
	Martin Creek	542	408	1.6	28
	Wolverine	261	44	1.6	28
Recommended Modification	Burnt-Lemory	11	-	21.9	24
	Carbon	124	37	21.9	24
	Dunlevy	242	191	21.9	24
	Gething	616	537	21.9	24
	Highhat	413	258	21.9	24
	Martin Creek	70	64	21.9	24
	Wolverine	176	58	21.9	24
Recommended Partial Retention	Carbon	6,435	2,536	9.9	24
	Dunlevy	6,235	2,910	9.9	24
	Gething	830	548	9.9	24
	Martin Creek	21	4	9.9	24
	Wolverine	353	243	9.9	24
Recommended Retention	Carbon	74	14	1.6	28

Note: Only established VQOs are applied in the base case scenario. Recommended VQOs are included in sensitivity analysis.

4.2.4 Forest Cover Constraints in Non-Visually Sensitive Areas

In MP4, the impacts of cut blocks size and adjacency requirements on timber supply was approximated using a 33% disturbance limit applied to each landscape unit. Since MP4, Canfor has adopted patch size objectives which have been incorporated into its FSP. Patch size objectives based on the natural range of variability mimic the natural disturbance regime and regulate cut block size and adjacency requirements. This analysis will develop cut blocks that trend towards or achieve the range of early forest patches, as specified in the FSP and described in Section 4.2.2. As such, no further forest cover constraints are required in non-visually sensitive areas.

4.2.5 Ungulate Winter Range

Management for ungulate winter range (UWR) within UWR units identified as "No Harvest" is addressed through the removal of these areas from the THLB and is discussed in Section 3.12. UWR unit numbers for which general wildlife measures other than "No Harvest" have been identified in the orders are shown in Table 35. The modeling approach used to approximate these measures is also shown in Table 35.

Table 35: New No Harvest UWR Units

UWR Number	UWR Unit Number	Productive Forest Area (ha)	General Wildlife Measures[1]	Modelling Approach
u-9-002	SPC-009	1	Primary forest activities: 1. Will result in the maintenance or enhancement of the productivity of key lichen communities 2. Will result in large patches and at least equivalent size connected leave areas of appropriate forest stand types as suitable for the natural disturbance regime for the area. 3. Will result in a maximum allowable disturbance of 33% of the Crown forest area being less than 3 metres. 4. Will result in maintaining the species composition of pine-leading stands.	None – small area precludes application of forest cover constraint
u-9-004	GR-024	0	Primary forest activities: 1. Will result in sequential development 2. Will not result in material adverse disturbance to the productivity of key terrestrial lichen communities. 3. Will result in a network of connected forest cover, which provides visual screening and snow interceptions, to facilitate caribou movement. 4. Will result in pre-harvest pine-leading stands to be re-established as pine-leading stands. 5. Will be completed in as short a time frame as practicable to a maximum of 5 years from initiation. 6. Will not result in the use of domestic sheep or goats.	No specific modelling approach. Operationally, harvesting will be conducted in order to preserve key terrestrial lichen communities. As migration corridors are established they will in incorporated into future timber supply analyses.
u-9-004	GR-029	2,094		

[1] *Only General Wildlife Measures pertaining to harvesting and silviculture activities are specified here. Other measures may affect access and the timing of activities and can be found in the order itself located at* http://www.env.gov.bc.ca/wld/frpa/uwr/approved_uwr.html

The West Moberly First Nation has recently published a draft Caribou recovery strategy, *Action Plan for the Klinse-Za Herd of Woodland Caribou (Rangifer tarandus caribou) in Canada* (McNay et. al. 2013). The plan provides a series of recommendations for recovery of the *Klinse-Za Herd of Woodland Caribou* with some of the plan area overlapping with TFL 48. From the maps provided in the draft action plan it appears that much of the area identified as high elevation winter range coincides with the additional areas of high value caribou habitat identified in Figure 2 of this report and are removed from THLB. It is likely that other habitat values identified in the plan overlap with many of the other land base reductions and non-timber management objectives addressed in this analysis however without the data corresponding to this plan this is difficult to quantify. In the event that future UWR orders are developed and / or amended to include components this action plan they will be incorporated into future timber supply analyses.

4.2.6 Other Land Base Objectives

Recreation

The following recreation sites have been removed from the timber harvesting land base:

- Boulder Lake
- Carbon Lake
- Gething Creek
- Wright Lake

Wildlife Tree Patches

Refer to Section 4.1.10 for details and rationale.

Higher Level Plans

TFL 48 falls entirely within the Dawson Creek Land and Resource Management Plan (LRMP). The Dawson Creek LRMP was officially approved with direction to implement on March 30, 1999.

New protected areas that were proposed in the LRMP have received official designation under an Order-In-Council (OIC). These areas have been excluded from the THLB.

Resource management zones, which were defined as part of the LRMP process will not have specific forest cover constraints applied to them. Canfor believes that all of the activities and concerns associated with the resource management zones can and will be addressed at the operational level of management, rather than at the strategic level. Landscape Unit, biogeoclimatic zone, variant biodiversity objectives provide sufficient levels of spatial resolution to ensure that multi-resource management objectives are being addressed.

The LRMP recognizes the Twin Sisters RMZ as an area of profound spiritual significance and traditional use value to the First Nations people of northeastern BC. Due to the low levels of THLB within the RMZ's and the management of visual areas from the Twin Sisters Protected Area, no additional forest cover constraints are necessary to meet the objectives stated in the LRMP section 4.13.

Dunlevy Creek Management Plan

During the term of MP3, a special management plan for the Dunlevy block of the TFL was developed (January 24, 2002) and prepared by the Ministry of Sustainable Resource Management and subsequently received Government endorsement. The Plan divides the Dunlevy into several compartments and identifies specific operational guidelines around which harvesting and mineral extraction may occur. The information used to determine that amount of harvesting in each compartment was based upon the MP3 THLB. Since the THLB has changed

for in this analysis, the area targets are adjusted accordingly and in keeping with the relative amount of harvest area to THLB area.

4.3 Modelling Approach

4.3.1 Forest Estate Model

Forest estate modelling will be conducted using the spatially explicit optimization model Patchworks. Patchworks is developed by Spatial Planning Systems in Ontario (www.spatial.ca) and allows the user to explore trade-offs between a broad range of conflicting management goals while considering operational objectives and limitations into strategic-level decisions. The model provides an easy to use interface that allows users to access and understand information in real-time.

The model has been formulated using five-year planning periods over a 250-year planning horizon.

4.3.2 Harvest Flow Objectives

The biological capacity of the land base as well as forest cover and green-up requirements dictate the sustainable harvest level for a particular land base. There are a number of alternative harvest flows possible. In this analysis, the harvest levels will reflect the following objectives:

- Maximize the salvage and recovery of MPB-affected stands while minimizing the impact and risk to mid-term timber;
- Following salvage, decrease to a non-declining mid-term harvest level that reflects the productive capability of the land base; and
- Increase to an even-flow long-term harvest level over a 250-year planning horizon.

Alternative initial, mid-term and long-term harvest levels will also be considered in sensitivity analyses. For example, a lower initial harvest level (at or below the current AAC) will be applied to assess the impacts of this lower harvest level on mid and long-term timber supply.

4.3.3 Minimum Harvest Age

Minimum harvest age (MHA) for both existing natural, existing managed and future managed stands is derived for each analysis unit based on the age at which the stand achieves both 95% of culmination MAI and has achieved at least 140 m3/ha.

4.3.4 Operability

The majority of harvesting on the TFL takes place with conventional, ground-based equipment. This reflects the generally favorable operating conditions in the area. Non- conventional methods such as overhead cable systems and helicopter logging are used as required, to harvest steeper ground to meet terrain stability requirements or to expand summer harvesting opportunities on areas with sensitive soils. Historically, approximately 40% of harvesting activities within the TFL utilize cable systems. The increased use of this system has occurred as a result of the backlog of cable ground accessible from existing roads. This component of cable logging will decrease to a lower level over time.

Utilizing any and all of these systems where applicable has resulted in there being very few physically inoperable areas within the TFL

Economic operability has been estimated using a combination of the age/height/stocking attributes of a forest stand, and an indication of site quality. Although these areas are excluded at this time from the timber harvesting land base, this does not preclude Canfor's harvesting within them some time in the future. Estimates of future market conditions are typically difficult to

predict. Economic operability is also addressed through minimum volume criteria applied to stands existing where mixed and cable harvesting systems are required.

4.3.5 Harvest Rules

Optimization models such as Woodstock and Patchworks do not require the specification of harvest rules required in simulation models such as FSSIM. Optimization models sort and harvest stands based on the harvest decisions that best achieve the overall modelling objectives. The only real harvest rules in optimization models are minimum harvest ages that prevent the model from harvesting stands below their economic threshold. As such harvest rules are driven by the objectives:

1) Maximize MPB salvage in the short-term;
2) Minimize the impacts to mid-term timber supply;
3) Maximize the evenflow deciduous harvest;
4) Maintain a sustainable long-term conifer and deciduous harvest level; and
5) Ensure that non-timber management objetives are achieved wherever possible.

4.3.6 Harvest Profile

The harvest profile will be divided between the deciduous land base and the coniferous land base. In MP3, the deciduous harvest came solely from the pulpwood portion of the TFL. In SFMP 4, this harvest is expanded to include the merchantable deciduous across the entire TFL.

4.3.7 Silviculture Systems

Clear cutting is the system of choice on the TFL. Irregular shelterwood harvesting is also occurring on approximately 9.4% of the timber harvesting land base. This is represented by analysis units 4, 15, 16 in the Base Case.

4.3.8 Non-Recoverable Losses

Non-recoverable losses (NRL) are timber volumes that are being destroyed on an annual basis by natural causes. Estimated annual losses are deducted from the gross harvested volume in the model to determine the net volume of timber that could be harvested over time.

In the Data Package for MP 3, a calculated NRL number based on the forest cover inventory was summarized by non-logging disturbances. This estimate will be used in the analysis for SFMP 4 as well. The estimates are split for coniferous and deciduous species:

Table 36: Non-Recoverable Losses

Cause	Net Loss (m3/year)
Fire	44,605
Insects / Disease	4,367
Windthrow (and other natural causes)	7,174
Total	**56,146**

Reduction for Non-Recoverable Coniferous Losses: 49,700 m^3/year

Reduction for Non-Recoverable Deciduous Losses: 6,400 m^3/year

The TFL 48 MP3 Management Plan approval letter written by the Deputy Chief Forester indicated that NRL's may be overestimated and asked Canfor to work with the MOF to confirm or vary this

estimate. See Table 26 in Section 3.16 of the SFMP for the results for the work done to-date. Over the past 5 years it is estimated that there has been significantly less NRL's than what is currently being modelled (e.g. 4,395m^3/year). However, in consideration of the MPB outbreak currently on TFL48, Canfor has chosen not to adjust downward the NRL estimate at this time.

Non-recoverable losses due to MPB will be modelled explicitly as described below. Once the analysis is complete, this information may provide a rationale for reducing the NRL identified above.

4.3.9 Mountain Pine Beetle

The mountain pine beetle has continued to expand on the TFL over the last several years. The MP4 analysis included an increase in the AAC from 580,000 m3/yr (in 2001) to 900,000 m3/yr, the management of the MPB infestations one of the reasons for the increase.

MPB Projections

Since 1999, the MOFR has been projecting the spread of MPB throughout the province and recalibrating the projections each year using the forest health overview survey data (BCMPB Projections). As of the start of this analysis BCMPB Version 9 (2012) was the most current version of this data set and Figure 2 shows the progression of the MPB since 2000 and its projected change until 2026. Overall, the most significant growth of the infestation occurred between 2006 and 2009, after the MP4 analysis had been completed. The data shows that in 2012, 49% of the TFL area has some level of MPB attack. Beyond 2012 the MPB severity is projected to increases slightly but overall the area impacted remains largely the same.

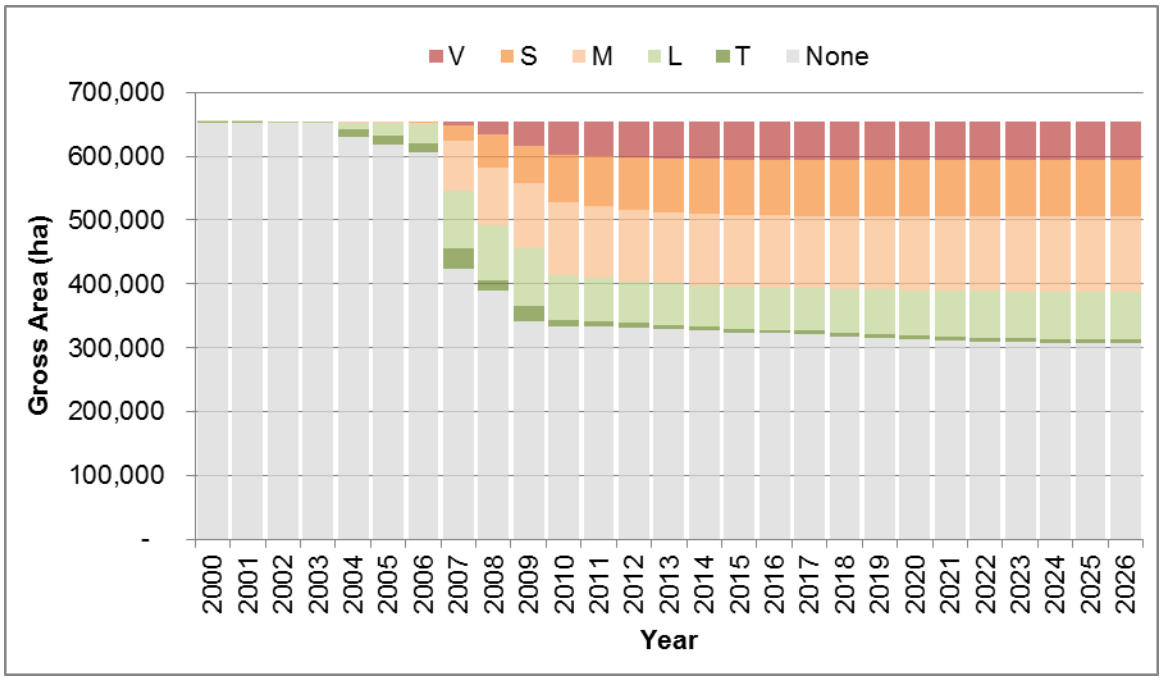

Figure 2: BCMPB Version 9 (2012) Projections for TFL 48.

The percent of the stand affected has been classified using the forest health overview (FHO) classification system. This classification system is shown in Table 37.

Table 37: MOFR Severity Class Definition.

Classification	Classification Abbreviation	% of stand attacked by MPB
Trace	T	0 – 1 %
Light	L	1 – 10 %
Moderate	M	10 -30 %
Severe	S	30 – 50 %
Very Severe	V	> 50 %

In order to increase the spatial accuracy of the BCMPB projections and to maintain consistency with the inventory information, the BCMPB classifications are overlaid with the pine percentages from the VRI. Overall attack percentages are then corrected based on the percentage of pine within each VRI polygons such that the attack percent is never greater than the overall pine percent in a polygon. The attack percent is then combined with the THLB layer, inventory species and merchantable volume to produce Figure 3 showing the attacked (dead) volume by pine percentage class compared with the overall conifer and overall pine volume. Of the 73.1 million m3 of conifer volume on the TFL, 27.3 million m3 (37%) is pine and of this, 18.6 million m3 (25% of the total conifer and 68% of pine volume) is attacked.

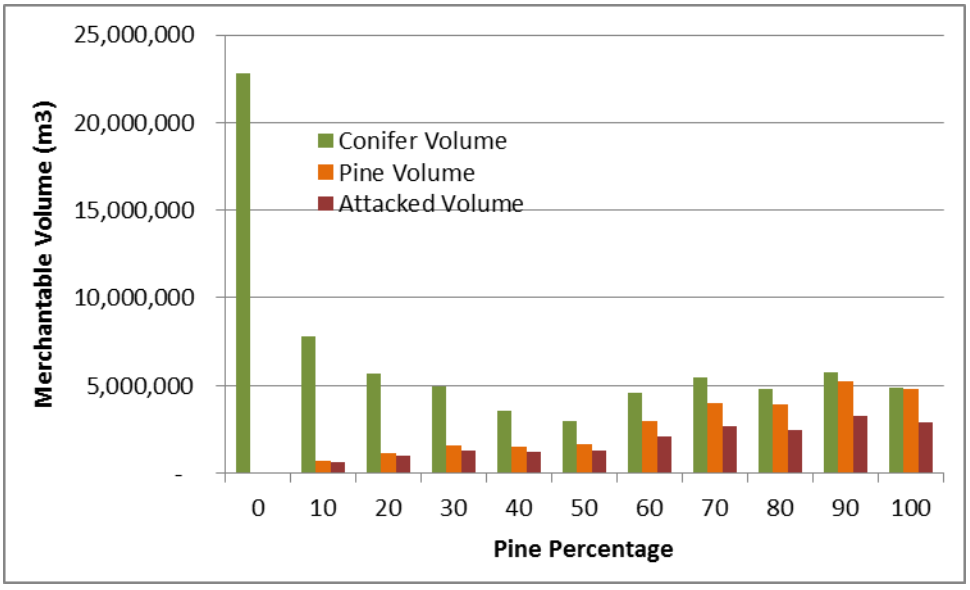

Figure 3: Merchantable Volume by Pine Percent.

On May 7th, 2013 a helicopter flight of the TFL was taken to assess the accuracy of these projections. Overall the flight confirmed that the BCMPB projections represented the spatial location of the most severely impacted areas well but underestimated the overall percent attack. Some areas of low to moderate attack were under-represented in the BCMPB projections. However, overall it was determined that the attack percentages shown in Figure 3 presents a reasonable representation of the state of the MPB infestation on the TFL and have been used in this analysis.

Shelf life Assumptions

Shelf life is defined as the time a stand will remain economically viable for harvest following MPB attack. The death age of a stand is the year in which the BCMPB classification reaches its maximum level. Based on licencees experience in harvesting MPB-affected stands on the TFL, a five-year shelf life assumption will be used. Stands will maintain 100% of their merchantable volume for five years after death and after 5 years 100% of the pine volume within a stand will be

lost – captured as a non-recoverable loss. Stands in which the merchantable volume falls below the minimum economic threshold of 140 m3/ha will become unsalvageable until such time that the remaining live portion of the stand grows up over 140 m3/ha. Stands that do not achieve this minimum economic threshold will remain unavailable for harvest throughout the planning horizon.

5.0 GROWTH AND YIELD

Yield curves for MP4 were submitted and approved by MFLNRO staff. These yield curves have been utilized for this analysis and have only been adjusted to incorporate shelf life assumptions as described above.

5.1 Site Index Assignments

Site indices for existing natural stands were assigned using the MOF's Variable Density Yield Prediction Model, batch version 6.6d.

Site indices for existing managed stands were assigned using the site index assigned to the VRI file from Canfor's Silviculture Management System. The site index was based upon the biogeoclimatic ecosystem classification (BEC) in which each managed stand belonged, which was in turn based on the silviculture survey. Each silviculture strata is assigned a site index based on either SIBEC or growth intercept during the silviculture survey. Current NSR stands are assigned a site index based on SIBEC. The spatial and attribute information was then updated into the VRI.

5.2 Genetics Gains for Managed Stands

Class 'A' spruce seed is available and utilized for much of the TFL. According to Seed Planning and Registry (SPAR) reports provided by the Ministry of Forests, Range and Natural Resource Operations (MFLNRO), summarized in Table 38, 55.5% of all planted spruce stock over the last five years is from class 'A' seed with an average genetic gain of 11.4%. This weighted genetic gain takes into account the proportion of class 'A' / class 'B' spruce seed planted as well as the overall spruce genetic gains and will be applied to the managed stand yields for all spruce planted since 2009 and to all future managed stands. The availability of class 'A' pine seed is limited to the Prince George seed planning unit and the majority of the pine seedlings planted are class 'B' from the Hudson Hope seed planning unit. As such no genetic gains have been applied for pine.

Table 38: Genetic Gains for Managed Stands Planted Between 2003 and 2013

Sewing Year	Class A	Class B	Total	Genetic Worth (%)	% GI Stock	Weighted Genetic Gains (%)
Pine Seedlings (1,000s Seedlings Requested)						
2013		1,380	1,380			
2012		950	950			
2011	32	1,093	1,125	9%	3%	0.3%
2010		77	77			
2009		434	434			
2008						
2007		1,800	1,800			
2006		950	950			
2005		1,220	1,220		0%	0.0%
2003		800	800		0%	0.0%
2004		925	925		0%	0.0%
Pine Total	**32**	**7,324**	**7,356**		**0%**	**0.0%**
Spruce Seedlings (1,000s Seedlings Requested)						
2013	280	300	580	19%	48.3%	9.2%
2012	1,236	300	1,536	22%	80.5%	17.7%
2011	238	1,164	1,402	19%	16.9%	3.2%
2010	136	14	150	19%	90.7%	17.2%
2009	387	50	437	19%	88.6%	16.8%
2008						0.0%
2007	400	830	1,230	19%	32.5%	6.2%
2006	200	1,900	2,100	25%	9.5%	2.4%
2005		1,168	1,168		0.0%	0.0%
2004	1,073	2,100	3,173	16%	33.8%	5.4%
2003	400	1,580	1,980	16%	20.2%	3.2%
Spruce Total (Last 2003 - 2013)	**4,349**	**9,406**	**13,755**		**31.6%**	**6.0%**
Spruce Total (Last 5 Years)	**2,277**	**1,828**	**4,105**		**55.5%**	**11.4%**

Table 39 shows the future projected genetic gains associated with the seed planning units in the TFL. Overall genetic gains do not change substantially from the 2012 values and therefore no changes to the genetic gains values have been applied to future managed stands.

Table 39: Projected Future Genetic Gains

SPU	Species	Elevation Band	THLB Area (ha)	Projected Genetic Gains in Year										
				2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022 +
CP	PLI	LOW	76,489	13%	14%	15%	16%	18%	19%	21%	21%	21%	21%	21%
PG	PLI	LOW		12%	12%	13%	13%	14%	14%	14%	15%	16%	16%	16%
PG	SX	HIGH		14%	14%	14%	15%	15%	15%	16%	16%	16%	16%	16%
PG	SX	LOW		26%	26%	26%	26%	26%	26%	26%	26%	27%	27%	28%
PR	SX	LOW	286,875	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%
PR	SX	MID		23%	23%	23%	23%	23%	23%	23%	23%	23%	23%	23%

5.3 Utilization Levels

During the term of SFMP 4 harvesting will be conducted to the utilization standards indicated in Table 40.

Table 40: Utilization Levels

Species	Utilization			
	Minimum Dbh (cm)		Maximum Stump Height (cm)	Minimum Top dib (cm)
	Natural Stands	Plantations		
Spruce	17.5	17.5	30.0	10.0
Balsam	17.5	17.5	30.0	10.0
Lodge pole Pine	12.5	12.5	30.0	10.0
Deciduous	12.5	12.5	30.0	10.0

5.4 Decay Waste and Breakage for Unmanaged Stands

To obtain net volumes per hectare, Ministry of Forests' decay, waste and breakage factors provided in the Variable Density Yield Prediction Model (VDYP) for Forest Inventory Zone (FIZ) L and Special Cruise 474 were used.

5.5 Operational Adjustment Factors for Unmanaged and Managed Stands

Operational adjustment factors for managed stands were applied to all managed stand yield tables. Factors of 15% OAF 1 and 5% OAF 2 were used. An additional 5% OAF was applied to the managed portion of shelterwood stands to reflect their slower growth under a canopy.

5.6 Volume Adjustments

An adjustment to the volume in unmanaged stands was applied to several coniferous analysis units that exist in the ESSF. To reflect Canfor's practice of retaining deciduous stems within the ESSF, the deciduous component of leading coniferous-mixed-wood stands within the ESSF was removed from the VDYP generated volume curve for each of these AU's.

Table 41 shows the amount of volume removed for existing unmanaged Analysis units for the deciduous component of coniferous leading stands in the ESSF.

Table 41 Volume adjustments for Stands in the ESSF

Unmanaged AU [1]	Description	Percent Reduction
13 - Sd_g	Spruce deciduous stands in good sites	20
14 - Sd_m	Spruce deciduous stands in medium site	25
21 - Pd_g	Pine deciduous stands in good sites	20
22 - Pd_m	Pine deciduous stands in medium sites	18

1: Four yield tables were added to the analysis to reflect this volume adjustment for stands in the ESSF.

5.7 Yield Table Development

5.7.1 Aggregated Yield Tables

Yield tables are initially created such that a natural stand yield table exists for every forest polygon within the TFL. These polygons are then assigned to an analysis unit and the yield tables area-weighted to produce one table for each analysis unit. Zone specific' yield curves exist a) in the form of future managed stand yield tables where genetic seed is currently available for spruce; and b) in for natural stands in the ESSF where the deciduous component of these stands is not harvested.

5.7.2 Yield Tables for Existing Unmanaged Stands

Yield tables for natural stands were generated using the Variable Density Yield Prediction (VDYP) 'batch' model, version 6.6d.

Separate curves were produced for some of the natural mature stands versus natural immature stands. This was done in cases where significant amounts of area existed for natural stands both in an immature and over-mature (>140 years) state. A review of the area distribution by age class and inventory type group revealed that this was particularly evident in spruce-leading stands.

A temporary yield curve was created for each forest polygon in the TFL. The yield curves were then grouped by analysis unit and area-weighted to provide one curve for each analysis unit. All of the net area in each analysis unit was used in the generation of the curves. With the exception of the deciduous volume reduction to coniferous mixed-wood stands in the ESSF, and the effect of class A seed on future managed stand in the "genetic zone", the same set of curves were applied across the TFL 48.

As part of the original approval process for Management Plan #4, copies of the curves were forwarded to Mr. Robb Drummond at the MOF Resources Inventory Branch for approval.

5.7.3 Existing Timber Volume Check

To verify that significant error did not occur in the aggregation of polygons into analysis units, the total net volume of the current inventory using VDYP polygon specific volumes was compared to the total net volume of the current inventory using the aggregated analysis unit volumes from the VRI file.

Table 42: Total TFL Empirical Volume

	Method Used		
	Polygon Specific (m3)	Analysis Unit (m3)	% difference
Total Empirical Volume (m3)	80,707,931	81,279,857	0.71%

The calculations are performed as follows:

1) Total polygon specific inventory volume: Σ(all unmanaged polygons in the T.H.L.B. (projected VDYP volume/ha 'multiplied by' net polygon area))

2) Total analysis unit volumes: Σall analysis units (Σall age classes (analysis unit area in age class N 'multiplied by' VDYP estimated volume @ age class N))

5.7.4 Yield Tables for Managed Stands

Managed stand yield tables are created using the Table Interpolation Program for Stand Yields (TIPSY) (Version 4.1) for balsam, spruce, and lodgepole pine. Mixed-wood stands will have their managed stand yield tables blended as a portion of both VDYP and TIPSY. The species distribution derived for the natural mixed-wood stand curves was used to determine the percentage of deciduous to be blended with the coniferous.

Stands harvested prior to 1995 will also grow along TIPSY MSYT, but will utilize a combination of natural and planted regeneration histories, longer regeneration delays, and reduced stocking. Table 43 shows the amount of area with a harvest year that is pre 1995 and will be assumed to be growing on the MSYT. The combination of increased regeneration delay, reduced stocking levels, increased proportion of naturals and Canfor's historic activities of a) monitoring stocking levels, b) fill planting, c) brushing and d) thinning activities, make TIPSY a more appropriate model than VDYP to use to estimate the growth and yield of these stands.

The Prince George and Peace River Class A seed planning units (SPU) occur within TFL 48 and class 'A' spruce seed is available within both SPU. Stands harvested after 2009 and into the future will incorporate the improved class 'A' spruce seed across the TFL as described in Section 5.2. Canfor intends to use improved seed where available, for all spruce planted in the future.

Managed stand yield tables have been regenerated for this analysis in order to capture updates in the availability of genetically improved seed for the TFL whereas natural stand yield tables from the MP4 analysis have been used as-is.

Silviculture Systems

The mature and over-mature even-aged stands in TFL 48 are predominantly spruce, spruce-balsam and spruce-lodgepole pine. Clear-cutting will generally be the prescribed harvesting system for these timber types.

The mature and over-mature uneven-aged, two-layered stands in the ESSF and SBS in TFL 48 are predominately balsam with a spruce-balsam under-story, or spruce with a spruce-balsam under-story. These stands will be harvested using an irregular shelterwood harvesting system. Historic regeneration problems which occurred in these sites as a result of clear cut harvesting suggest that this is a more appropriate silviculture system. Typically the stands have a top layer of 200 year-old plus stems with a bottom layer of stems aged 50-70 years. Canfor currently harvests these stands in the winter by removing the top layer. Approximately 40-45% of the area is accessed through a trail system. The existing regeneration is left to become mature. The trails are regenerated within 2 years with spruce seedlings at a density of 1600 stems per hectare

(sph). Once the regenerated stand becomes mature, the stand will once again be treated to an irregular shelterwood system. The system was modelled using the following assumptions.

- Unmanaged shelterwood stands are harvested by removing 90% of their mature volume.
- After harvesting the area reverts to a managed shelterwood stand. This stand has a structural stage equivalent to a 65 year old stand.
- The managed shelterwood stand yield table is comprised of 45 percent MSYT as defined by TIPSY and 55% advanced regeneration as defined by VDYP.
- The stand will be eligible for re-harvesting when the MSYT portion of the stand reached maturity. This will occur when the stand reaches an age equivalent of 65 + the culmination age of the MSYT portion of the stand.
- Harvesting will remove 90 percent of the managed shelterwood stand.

Silviculture Management Regimes

The TIPSY model does not contain data for the managed growth of deciduous stands. Since portions of conifer-deciduous and deciduous-coniferous stands are assumed to regenerate naturally, the portion which remains deciduous will regenerate to the original VDYP curve. The coniferous portion will grow on a TIPSY curve which is blended to the VDYP curve.

Aggregated Yield Tables

Within TFL 48, the forest cover polygons comprising the THLB. were aggregated into analysis units based on leading species, secondary species, site index and current age.

Regeneration Delay

Regeneration delay by analysis unit is shown in Table 44 and Table 45. The regeneration delay was applied as an input directly into the TIPSY model during the creation of the post-1995 managed stand yield tables.

Regeneration Assumptions

Table 20, Table 44 and Table 45 describe the regeneration assumptions used to create managed stand yield tables. Three sets of managed stand yield tables are used to represent the TFL. The first set applies to stands harvested prior to 1995. The second set applies to all stands harvested on or after 1995. The third applies to all future stands harvesting in the portion of the TFL where Class A seed is currently available.

Species Conversion

Operating under the principle that there will be no significant net gain or loss of deciduous in the TFL, mixed-wood stands will regenerate to their original proportions of coniferous and deciduous. The managed deciduous component will be assumed to grow on VDYP curves. The coniferous component will be assumed to grow on the TIPSY curve.

Table 43: Regeneration Assumptions (Stands Harvested prior to 1995)

AU #	AU description	Existing managed area	Weighted SI	Species %	Regen method [4]	Regen Density [3]	yield table source [5]
1	BL_all	487	14.7	Sw 100	P 60 N 40	1300	TIPSY
2	Bx_y	1,222	14.6	Sw 100	P 60 N 40	1300	TIPSY
4	Bl_s	8	15.0	Sw 100	P45 N 55	1300	TIPSY
6	Sw_ym	1300	9.0	Sw 100	P 60 N 40	1300	TIPSY
9	Sc_yg	7,823	16.8	Sw 80 Pl 20	P 20 N 80	1300	TIPSY
10	Sc_ym	6	9.0	Sw 80 Pl 20	P 50 N 50	1300	TIPSY
13	Sd_g	3,493	18.3	Sw 53 At 47	P 53 N 47	1300	TIPSY / VDYP
14	Sd_m	237	12.0	Sw 64 At 36	P 64 N 36	1300	TIPSY / VDYP
15	Ss_g	35	13.5	Sw 100	P45 N 55	1300	TIPSY / VDYP
16	Ss_m	311	12.0	Sw 100	P45 N 55	1300	TIPSY / VDYP
17	Pc_yg	4,075	19.3	Pl 80 Sw 20	P 20 N 80	1300	TIPSY
18	Pc_ym	665	14.5	Pl 80 Sw 20	P 50 N 50	1300	TIPSY
23	Pl_g	494	18.8	Pl 100	P 20 N 80	1300	TIPSY
24	Pl_m	76	14.4	Pl 100	P 50 N 50	1300	TIPSY
25	Ac_g	21	21.0	At 70 Sw 17 Pl 13	N 70 P 30	1300	VDYP / TIPSY
26	Ac_m	57	15.0	At 69 Sw 13 Pl 18	N 89 P 31	1300	VDYP / TIPSY
27	Ad_g	339	18.3	At 100	N 100	3000	VDYP
29	Ct_con	6	17.0	At 70 Sw 25 Pl 5	N 70 P 30	1300	VDYP / TIPSY
31	LwStk_c	257	17.7	Sw60 Pl10 Ac30	N100	550	VDYP
32	LwStk_d	458	19.2	At45 Ct30 Sw20 Pl 5	N 100	700	VDYP
		21,370	16.8				

1 Proportions of deciduous in coniferous leading stands were obtained based upon the current percent species distribution.

2 Operational Adjustment Factors of 15% and 5% were applied to all managed stand yield tables when TIPSY was used.

3 Regeneration Density refers to TIPSY inputs only. In instances where the yield table source is VDYP, the regeneration density is assumed to follow the change in density and volume predicted by natural stand yield tables

4 'Regen method' refers to the proportion of analysis unit area that is planting (P) versus natural (N). The 'P' always refers to a TIPSY input. The 'N' may refer to a TIPSY input or a VDYP input depending on the 'yield table source'. With the exception of AU27 all resultant yield tables are blended. Where the yield table source is just TIPSY, the resultant table is a blend of planting and naturals using the 'regen method' proportions. Where yield table source is TIPSY and VDYP, the resultant yield table is a blend of TIPSY input, and the original unmanaged aspen tables (Aus 27 and 28) depending on site quality)

5 Species % cells that indicate an At component describe the proportion of the resultant AU the comes from unmanaged AU 27 or 28.

Table 44: Regeneration Assumptions (Stands Harvested between 1995 and 2008)

AU#	AU_decip	Area_ha	Site index	SIBEC	Species %	TIPSY Regen Density	Regen method	Regen Delay	Yield Table Source
1	BL_all	1,940	11.7	12.6	Bl 100	1600	P 100	2	TIPSY
2	Bx_y	9,641	12.6	12.6	Bl 100	1600	P 100	2	TIPSY
3	Bx_o	4,035	9.7	12.6	Bl 100	1600	P 100	2	TIPSY
4	Bl_s	919	11.6	13.9	Bl 100	1600	P45 N55	0	TIPSY
5	Sw_yg	9,394	16.5	16.6	Sw100	1600	P 100	2	TIPSY
6	Sw_ym	2,367	14.4	17.1	Sw100	1600	P 100	2	TIPSY
7	Sw_og	5,423	14.0	17.7	Sw100	1600	P 100	2	TIPSY
8	Sw_om	2,224	9.2	17.2	Sw100	1600	P 100	2	TIPSY
9	Sc_yg	34,547	15.3	16.7	Sw80 Pl20	1600	P 100	2	TIPSY
10	Sc_ym	9,050	11.2	15.6	Sw80 Pl20	1600	P 100	2	TIPSY
11	Sc_og	10,673	13.7	17.3	Sw80 Pl20	1600	P 100	2	TIPSY
12	Sc_om	16,200	9.2	15.8	Sw80 Pl20	1600	P 100	2	TIPSY
13	Sd_g	13,729	17.4	17.4	Sw65 At35	1600	P 65 N 35	2	TIPSY/VDYP
14	Sd_m	5,443	13.0	17.1	Sw65 At35	1600	P 65 N 35	2	TIPSY/VDYP
15	Ss_g	2,041	12.1	15.5	Sw 100	1600	P45 N 55	0	TIPSY
16	Ss_m	2,192	8.2	15.2	Sw 100	1600	P45 N 55	0	TIPSY
17	Pc_yg	20,360	17.7	17.9	Pl80 Sw20	1600	P 100	2	TIPSY
18	Pc_ym	31,298	13.3	16.6	Pl80 Sw20	1600	P 100	2	TIPSY
19	Pc_og	4,432	16.4	18.2	Pl80 Sw20	1600	P 100	2	TIPSY
20	Pc_om	7,871	12.1	16.6	Pl80 Sw20	1600	P 100	2	TIPSY
21	Pd_g	11,502	15.9	17.4	Pl65 At35	1600	P 65 N 35	2	TIPSY/VDYP
22	Pd_m	1,986	11.6	17.2	Pl65 At35	1600	P 65 N 35	2	TIPSY/VDYP
23	Pl_g	13,350	17.4	17.1	Pl100	1600	P 100	2	TIPSY
24	Pl_m	30,001	13.1	16.4	Pl100	1600	P 100	2	TIPSY
25	Ac_g	7,235	17.8	17.5	At70Sw17Pl13	1600	N 70 P 30	2	VDYP/TIPSY
26	Ac_m	3,622	14.4	17.4	At70Sw17Pl13	1600	N 70 P 30	2	VDYP/TIPSY
27	Ad_g	22,040	18.4	18.4	At100	n/a	N 100	2	VDYP
28	Ad_m	2,453	12.9	12.9	At100	n/a	N 100	2	VDYP
29	Ct_con	4,230	16.0	18.1	ACT73Sw17P10	1600	N 73 P27	2	VDYP/TIPSY
30	Ct_dec	8,404	15.6	15.6	ACT100	n/a	N 100	2	VDYP
31	LwSTK_c	257	17.7	17.7	Pl 55 Sw 45	1600	P 100	2	TIPSY
32	LwStk_d	458	19.2	19.2	At 55 Sw 45	1600	N 55 P 45	2	VDYP/TIPSY
		299,317	14.6	16.7					

Notes:

1. Operational Adjustment Factors (OAFs) of 15% and 5% were applied to TIPSY managed stand yield tables .
2. See footnotes under Table 43 for additional information
3. The logic used to create the shelterwood yield tables is provided in Appendix II
4. The SIBEC column indicates the area-weighted site index determined using the MOF's *Site Index Estimates by Site Series*, May 2006. This information was used in sensitivity analysis.

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Table 45: Regeneration Assumptions (Stands Harvested after 2008)

AU#	AU_decip	Area_ha	Site Index	SIBEC	Species	Density	Regen Planted	Regen Delay	Sx/Sw Genetic Gain (%)	Yield Table Source
1	BL_all	3,251	10.2	12.6	Bl 100	1600	P 100	2	n/a	TIPSY
2	Bx_y	3,310	12.4	11.9	Bl 100	1600	P 100	2	n/a	TIPSY
3	Bx_o	5,078	9.7	12.6	Bl 100	1600	P 100	2	n/a	TIPSY
4	Bl_s	13,031	9.9	13.8	Bl 100	1600	P45 N55	0	n/a	TIPSY
5	Sw_yg	377	14.4	14.6	Sw100	1600	P 100	2	11.4	TIPSY
6	Sw_ym	109	12.7	14.2	Sw100	1600	P 100	2	11.4	TIPSY
7	Sw_og	342	11.9	14.3	Sw100	1600	P 100	2	11.4	TIPSY
8	Sw_om	584	9.0	13.1	Sw100	1600	P 100	2	11.4	TIPSY
9	Sc_yg	2,672	14.5	14.0	Sw80 Pl20	1600	P 100	2	11.4	TIPSY
10	Sc_ym	1,394	10.0	14.0	Sw80 Pl20	1600	P 100	2	11.4	TIPSY
11	Sc_og	1,248	13.0	13.4	Sw80 Pl20	1600	P 100	2	11.4	TIPSY
12	Sc_om	6,893	8.8	13.6	Sw80 Pl20	1600	P 100	2	11.4	TIPSY
13	Sd_g	66	17.9	14.9	Sw65 At35	1600	P65 N35	2	11.4	TIPSY/VDYP
14	Sd_m	81	10.5	14.5	Sw65 At35	1600	P65 N35	2	11.4	TIPSY/VDYP
15	Ss_g	5,825	11.6	14.0	Sw 100	1600	P45 N55	0	11.4	TIPSY
16	Ss_m	10,367	8.1	14.2	Sw 100	1600	P45 N55	0	11.4	TIPSY
17	Pc_yg	702	16.8	14.9	Pl80 Sw20	1600	P 100	2	11.4	TIPSY
18	Pc_ym	3,667	12.9	14.6	Pl80 Sw20	1600	P 100	2	11.4	TIPSY
19	Pc_og	685	16.2	14.7	Pl80 Sw20	1600	P 100	2	11.4	TIPSY
20	Pc_om	1,646	11.8	14.4	Pl80 Sw20	1600	P 100	2	11.4	TIPSY
21	Pd_g	72	14.6	12.8	Pl65 At35	1600	P65 N35	2	n/a	TIPSY
22	Pd_m	57	11.3	17.3	Pl65 At35	1600	P65 N35	2	n/a	TIPSY
23	Pl_g	369	16.5	15.3	Pl100	1600	P 100	2	n/a	TIPSY
24	Pl_m	2,130	12.7	15.1	Pl100	1600	P 100	2	n/a	TIPSY
25	Ac_g	12	16.0	17.5	At70Sw17Pl13	1600	N70 P30	2	11.4	VDYP/TIPSY
26	Ac_m	49	10.8	17.4	At70Sw17Pl13	1600	N70 P30	2	11.4	VDYP/TIPSY
27	Ad_g	4	16.1	16.1	At100	n/a	N 100	2	n/a	VDYP
28	Ad_m	18	10.4	10.4	At100	n/a	N 100	2	n/a	VDYP
29	Ct_con	6	13.5	17.5	Ct73Sw17P10	1600	N73 P27	2	11.4	VDYP/TIPSY
30	Ct_dec	4	7.3	7.3	Ct100	n/a	N 100	2	n/a	VDYP
		64,049	10.6	13.8						

Notes:

5. Operational Adjustment Factors (OAFs) of 15% and 5% were applied to TIPSY managed stand yield tables See footnotes under Table 43 for additional information
6. The logic used to create the shelterwood yield tables is provided in Appendix II
7. The SIBEC column indicates the area-weighted site index determined using the MOF's *Site Index Estimates by Site Series*, May 2006.

5.8 Silviculture History

5.8.1 Current NSR and Low Stocking Sites

Low stocking sites were previously considered backlog NSR that had been logged prior to 1987. All other NSR is current NSR. A breakdown of the amount of NSR by analysis unit and management class is provided in Table 46.

Current NSR is created from harvesting operations. It is treated under silviculture prescriptions. The regeneration delay of 2 years or less keeps the amount of current NSR relatively small.

Areas with a logging history before 1987 and do not currently meet the backlog free growing standard due to low stocking are included in the "LwStk" analysis units. Due to the amount of stocking present and the dispersed nature of the areas no additional treatments are proposed. Only a small amount of area remains within theTFL48 of this nature. These areas will grow under

a managed stand yield table that has had its initial stocking adjusted to reflect the actual stocking that is present in these stands; see AU's 31 and 32.

Table 46: Current NSR and Low stocking sites

AU# [1]	Description	Current NSR Area (ha)	Low Stocking (only Aus 31 and 32)
5	Sw_yg	512	
6	Sw_ym	5	
9	Sc_yg	435	
10	Sc_ym	32	
13	Sd_g	5	
14	Sd_m	81	
15	Ss_g	17	
16	Ss_m	142	
17	Pc_yg	500	
18	Pc_ym	96	
23	Pl_g	41	
24	Pl_m	210	
27	Ad_g	64	
29	Ct_con	8	
31	LwStk_c	0	257
32	LwStk_d	0	458
	Total	**2,148**	**714**

6.0 SENSITIVITY ANALYSIS

Sensitivity analysis provides information on the degree to which uncertainty in the base case data and assumptions might affect the proposed harvest level for the TFL. The magnitude of the change in the sensitivity variable(s) reflects the degree of risk associated with a particular uncertainty – a very uncertain variable that has minimal impact on the harvest forecast represents a low risk. By developing and testing a number of sensitivity issues, it is possible to determine which variables most affect results and to provide information to guide management decisions in consideration of uncertainty.

Each of the sensitivities shown in Table 47 test the impact of a specific variable with impacts measured relative to the base case harvest forecast. The list of sensitivities may be amended as the analysis is completed and other issues arise.

Table 47: Sensitivity Analyses.

Sensitivity	Range Tested
Mountain Pine Beetle	Assess the impacts of various levels of MPB salvage on mid and long-term timber
Shelf Life	Assess the impacts of changing the shelf life of MPB killed stands from 5 to 7 years.
New VLI	Compare the previous version of the VLI with the new version.
Old Seral Management	Utilize NDU seral stage targets
Peak Flow Index	Examine impacts of applying watershed PFI constraints as per SFMP.

6.1 Old Seral Management

Work completed within the Prince George Forest Region by the Regional Ecologist has seen the establishment of natural disturbance units (NDU). NDUs were developed through a scientific process to replace the Provincial identification of Natural Disturbance Types, as defined by the Forest Practices Code Act Biodiversity Guidebook. The rationale to support NDUs is documented by the Ministry of Forests Northern Interior Forest Region office. Further information is also provided in the Section 3.3 of SFMP4, where a detailed discussion occurs around late seral Forest Indicators and the targets.

The base case will utilize the old seral targets defined by the Provincial Non-Spatial Old Growth Order. This sensitivity will utilize NDU-based seral stage constraints using the minimum natural range of variation for stands greater than 140 years of age (100 years for deciduous in the Boreal Plains and Boreal Foothills - Valley). Table 48 describes the area within each NDU zone and subzone as well as the minimum NRV target applied to each of these areas as a percent and in equivalent area.

Table 48: Natural Disturbance Units – Natural Range of Variation

NDU	Total Forest Area (ha)	NRV % Target
Boreal Foothills – Mountain	177,423	33
Boreal Foothills – Valley - Conifer	125,200	23
Boreal Foothills – Valley – Decid.	39,669	10
Omineca – Mountain	13,220	58
Omineca – Valley	6,210	23
Wet Mountain	92,738	84
Boreal Plains - Upland – Conifer	68,120	17
Boreal Plains - Upland – Decid.	43,814	10
Total Area (ha)	566,394	

Due to the large size of NDUs and the desire that there is some representation of old growth by BEC, the constraints identified in Table 48 have been expanded to include NDU/BEC combinations. Table 49 identifies the proportion of forest area designated as old growth (above 140 years for conifer and 100 years for deciduous) that will be applied to each NDU/BEC across the TFL.

Note that portions of Parks that are within the TFL have been excluded from the timber harvesting land base, but are retained in the model as these areas contribute to biodiversity and seral stage targets. These areas were identified in Table 15.

Table 49 NDU/BEC old growth constraints

Natural Disturbance Unit	BEC	Late Seral Target	Forest Area (ha)
Boreal Plains - Deciduous	BWBSmw1	10%	39028
	BWBSwk1	10%	4217
	ESSFmv2	10%	510
	SBSwk2	N/A	41
Boreal Plains Deciduous - Total		10%	
Boreal Foothills – Valley - Deciduous	BWBSmw1	10%	23129
	BWBSwk1	10%	1606
	BWBSwk2	10%	5082
	SBSwk2	10%	9866
Boreal Foothills – Valley - Deciduous - Total		10%	
Boreal Plains - Conifer	BWBSmw1	5%	31425
	BWBSwk1	5%	23531
	ESSFmv2	5%	12959
	SBSwk2	N/A	202
Boreal Plains – Conifer - Total		17%	
Boreal Foothills – Valley - Conifer	BWBSmw1	7%	30912
	BWBSwk1	7%	5294
	BWBSwk2	7%	7438
	SBSwk2	7%	81537
Boreal Foothills – Valley – Conifer - Total		23%	
Boreal Foothills – Mountain	ESSFmv2	10%	106082
	ESSFmv4	10%	11756
	ESSFwc3	10%	24543
	ESSFwk2	10%	26406
Boreal Foothills – Mountain - Total		33%	
Omineca Valley	BWBSmw1	N/A	31
	SBSwk2	7%	6179
Omineca Valley - Total		23%	
Omineca Mountain	ESSFmv2	17%	13188
Omineca Mountain - Total		58%	
Wet Mountain	ESSFmv2	25%	16256
	ESSFwc3	25%	32389
	ESSFwk2	25%	26163
	SBSwk2	25%	11558
Wet Mountain- Total		84%	

6.2 Peak Flow Index

Canfor, under its SFMP has committed to maintaining water quality and quantity by ensuring that at least 95% of all watersheds within the TFL are below baseline threshold values. Peak flow index (PFI) is a measure of the proportion of a watershed that has not yet achieved hydrological green-up, placing a higher weight on disturbances occurring at higher elevations (above the H60 line) and represents an indicator of how this objective is being achieved.

Equivalent clearcut area (ECA) is calculated using the area harvested within a watershed multiplied by the hydrological recovery of each stand. As stand height increases, hydrological recovery increases with full recovery achieved once the stand reaches 12 meters in height as shown in Table 50. Area above the H60 line[2] contributes 1.5 times the area to the ECA calculation. Peak flow index (PFI) is a measure of the ratio of ECA to total watershed area. PFI

[2] *The elevation line above which 60% of the watershed area exists.*

threshold values are shown in Table 51 and will be enforced as targets in the model in a sensitivity analysis scenario.

Table 50: Hydrological Recovery

Stand Height (m)	Hydrological Recovery (%)
<3	0
3 to < 5	25
5 to < 7	50
7 to < 9	75
9 to < 12	90
12 +	100

Table 51: Peak Flow Index Maximum Threshold Values

Watershed Name	PFI (%)	Total Forest (ha)	NCLB (ha)	THLB (ha)
Eleven Mile	43	17,834	9,688	8,146
Seven Mile	43	6,705	2,553	4,152
Basin "862"	43	2,006	263	1,744
Adams Creek	43	5,356	2,080	3,276
Aylard Creek	37	5,078	2,292	2,786
Beany Creek	37	3,361	1,177	2,184
Brazion Creek	37	27,568	9,297	18,271
Burnt Creek	37	49,032	19,412	29,620
Cameron Creek	50	2,430	647	1,783
Dunlevy Creek	31	15,607	7,317	8,290
Gaylard	31	14,800	4,018	10,782
Gething	31	17,045	5,333	11,712
Gwillim	43	3,446	1,034	2,412
Hasler Creek	37	18,202	4,896	13,306
Highat Creek	43	14,737	3,677	11,060
Johnson	37	11,195	2,314	8,880
Lower Carbon	50	10,770	3,208	7,562
Lower Murray	37	15,846	4,419	11,427
Lower Peace Reach	50	13,066	3,341	9,725
Lower Pine Residual	43	15,311	3,168	12,143
Lower Sukunka	43	47,476	13,742	33,734
Lower Wolverine	37	19,943	8,265	11,678
Lebleu Creek	50	1,771	564	1,207
LeMoray Creek	37	9,287	5,210	4,077
Middle Wolverine	43	14,175	7,612	6,563
Medicine Woman Creek	35	1,698	359	1,339
North Peace Residual	50	8,670	6,942	1,728
Ruddy Creek	31	5,354	2,025	3,329
Trapper Creek	37	6,401	2,602	3,800
Upper Carbon	37	38,591	19,956	18,635
Upper Murray	37	13,901	5,599	8,302
Upper Pine Residual	37	36,200	14,307	21,893
Upper Sukunka	43	21,926	7,316	14,610
Upper Wolverine	37	13,220	6,654	6,566
No watershed identified	n/a	58,387	15,427	42,961
Total		**566,394**	**206,713**	**359,681**

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