Revelstoke Community Forest Corporation
Management Plan #4

Information Package

Version 2.0

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Table of Contents

List of Tables

List of Figures

1.0 Introduction

Revelstoke Community Forest Corporation (RCFC), the holder of Tree Farm Licence (TFL) #56 is currently in the process of producing Management Plan #4. This document outlines the basic information and assumptions that are proposed for use in the Timber Supply Analysis that will be completed to support the Annual Allowable Cut (AAC) determination process. The purpose of timber supply analysis is to examine the short- and long-term effects of current forest management practices on the availability of timber for harvesting.

A review of this type is normally completed at least once every five years in order to capture changes in data, practices, policy, or legislation influencing forest management in the TFL. The previous review (MP3) was completed in October, 2000 with a final Annual Allowable Cut (AAC) determination on April 18, 2001. Based on this, a new timber supply review process should have been initiated in 2004. However, a postponement order was issued on December 13, 2005 by the Deputy Chief Forester that effectively delayed the requirement for another 5 years (until 2011) because he felt that a new AAC determination would not result in a significant change in the AAC. Considering this direction and RCFC's desire to align the TFL's Timber Supply Review process with its Management Plan timelines, this review has been initiated well before the 2011 deadline. The goal is to have an AAC determination and approved MP in place by May 31, 2009.

The purpose of this information package is to:

- Provide a detailed account of the land base, growth and yield, and management assumptions related to timber supply that the chief forester must consider under the *Forest Act* when determining an allowable annual cut (AAC) for TFL 56 and how these will be applied and modeled in the timber supply analysis;
- Provide the evidentiary basis for the information used in the analysis.
- Provide Forest Service staff with the opportunity to review data that will be used in the timber supply analysis.
- Ensure that all relevant information is accounted for in the analysis to a standard acceptable to Forest Service staff.
- Reduce the risk of having an analysis rejected because assumptions were not agreed upon in advance.

Following acceptance of this information package by Ministry of Forests and Range (MoFR) staff the timber supply analyses will be completed and documented in a Timber Supply Analysis Report. A Twenty Year Plan (20YP) will also be produced to illustrate the feasibility of the wood supply predicted by the timber supply model.

The analysis will focus on a single forest management scenario that reflects current management practices in the TFL. In addition to the current management or "Base Case" scenario, an assessment of how results might be affected by uncertainties is completed using a number of sensitivity analyses. Together, the sensitivity analyses and the Base Case form a solid foundation for discussions about future timber harvest levels.

Several assumptions and information sources have changed from the last Management plan. For a summary of the differences from MP3 assumptions and information, please refer to Section 12.0.

2.0 Description of the Land Base

TFL 56 covers an area of 119,823 hectares and is situated north of Revelstoke. It is bounded on the west by the Lake Revelstoke reservoir, on the east by the height-of-land of the Selkirk Mountains, on the north by the Goldstream River and on the south by the Downie-Carnes height-of-land. The nearest settlement is Revelstoke, 40 kilometres to the south.

The land is extremely rugged and dominated by two roughly east-west valleys – those of Downie Creek and Goldstream River – and one north-south valley, that of the Columbia River (Lake Revelstoke Reservoir). Elevation ranges from 573 metres at reservoir level to 3050 meters at Carnes Peak. The ecosystems present are shown in Figure 1 below. Figure 2 shows the areas associated with each of the biogeoclimatic variants that exist in the TFL as well as their corresponding natural disturbance types (NDTs)

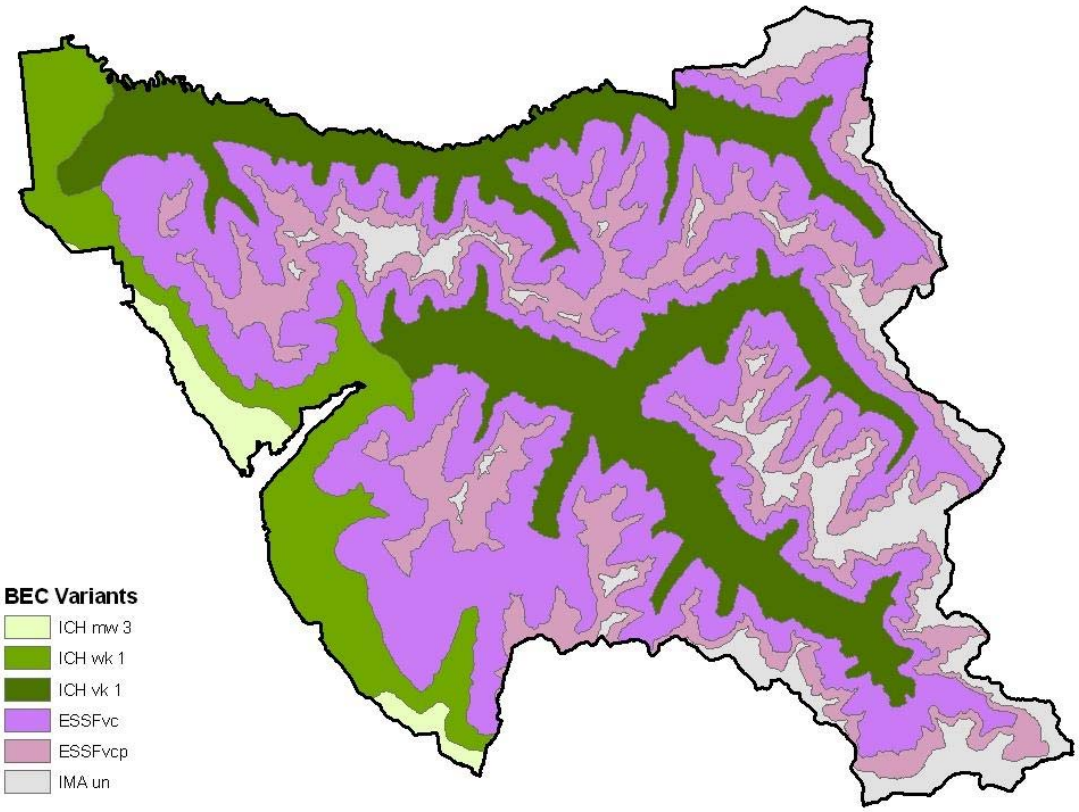


Figure 1. Biogeoclimatic variants present in TFL 56

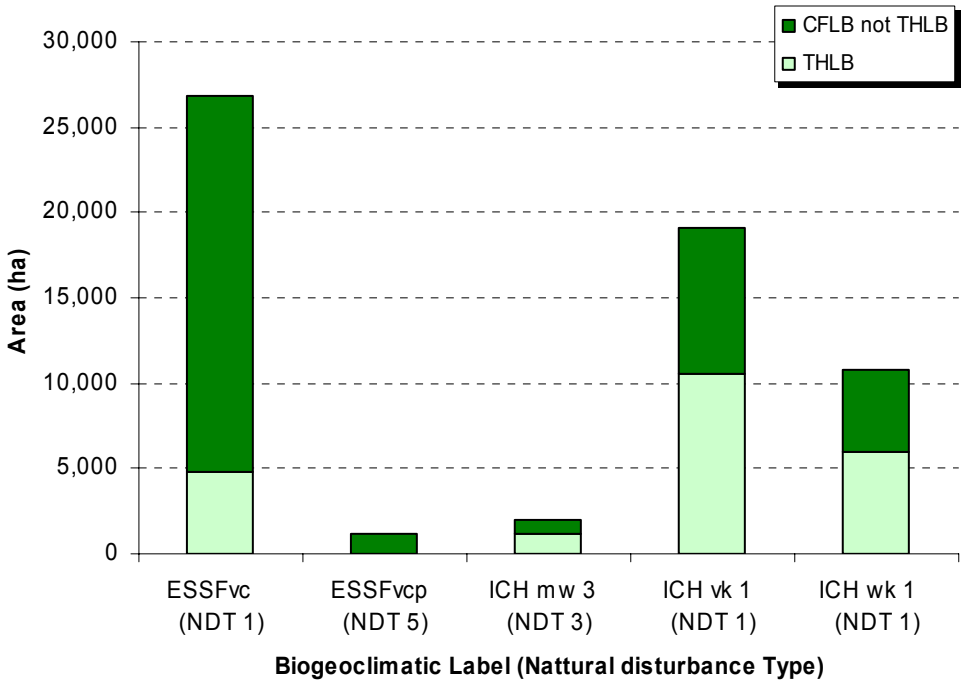


Figure 2. Biogeoclimatic variant and Natural Disturbance Type by land classification.

The Crown Forested Land Base (CFLB) is a relatively small proportion of the total area and the Timber Harvesting Land Base (THLB) is even a smaller proportion still. Most harvesting is confined to valley bottoms and sidewalls. The remaining "high country" is too rugged or does not support marketable timber.

The ruggedness has minimized human use, hence there are no settlements, little private land, and until recently little recreation use. One highway (Hwy 23N) traverses the TFL. Traffic is light and dominated by logging and other industrial traffic. Recreation use has increased in recent years and is dominated by three major groups. The first group consists of sport fishers and hunters. The second group consists of helicopter skiers and the third major group is composed of snowmobile recreationists. A fourth user group composed of self-propelled backcountry users is increasing as the area becomes more widely known and nearby parks become increasingly crowded.

Wildlife use in the TFL is extensive. Grizzly bears, black bears, moose, deer, and caribou are common. Caribou have become a very important management issue because they have been extirpated over much of their former range.

2.1.1 Age Class Distribution

An overview of the age class distribution for TFL 56 in 2008 is provided in Figure 3.

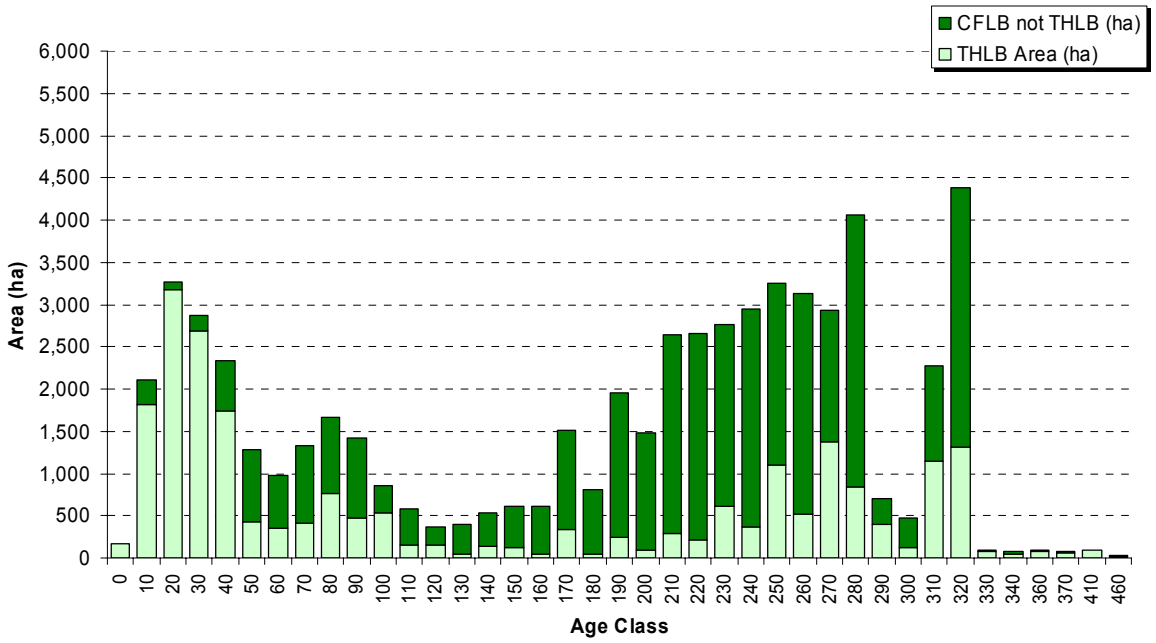
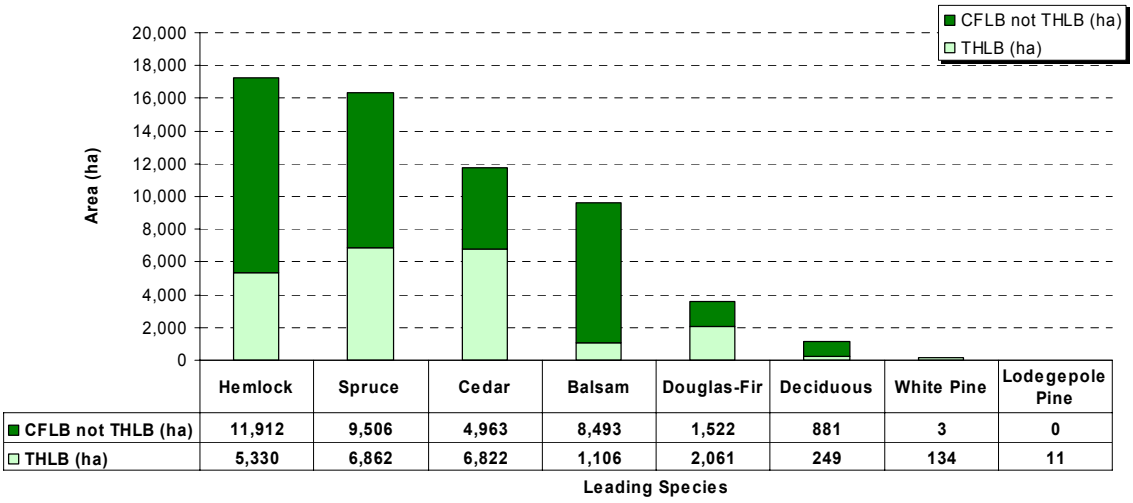


Figure 3. TFL 56 age class distribution in 2008

2.1.2 Species Distribution

An overview of the area by leading species for TFL 56 in 2008 is provided in Figure 4



	Hemlock	Spruce	Cedar	Balsam	Douglas-Fir	Deciduous	White Pine	Lodegepole Pine
CFLB not THLB (ha)	11,912	9,506	4,963	8,493	1,522	881	3	0
THLB (ha)	5,330	6,862	6,822	1,106	2,061	249	134	11

Figure 4. TFL 56 current area by leading species

2.1.3 Site Index Distribution

An overview of the site index distribution as provided in the TFL 56 inventory data is provided in Figure 5 while the adjusted site index distribution is shown in Figure 5[1]. Overall, the weighted average inventory site index on the THLB is 16.7m. This increases by 2.5m to 19.2m when SIBEC adjusted SI's are used for all ICH stands. This later average would only be relevant when all of these stands have transitioned to managed stand yield curves.

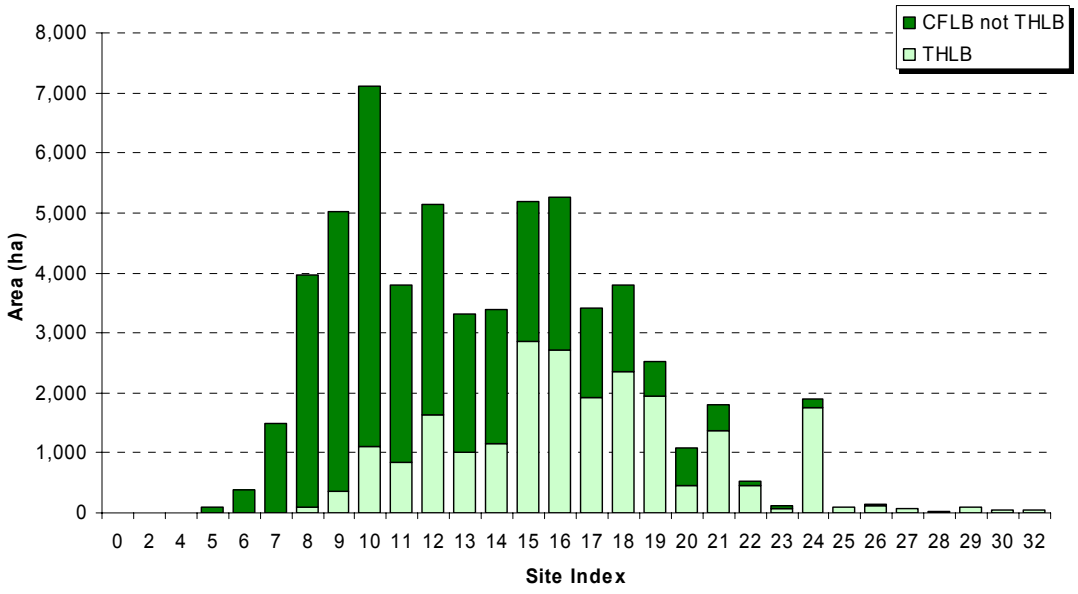


Figure 5. TFL 56 site index distribution (inventory).

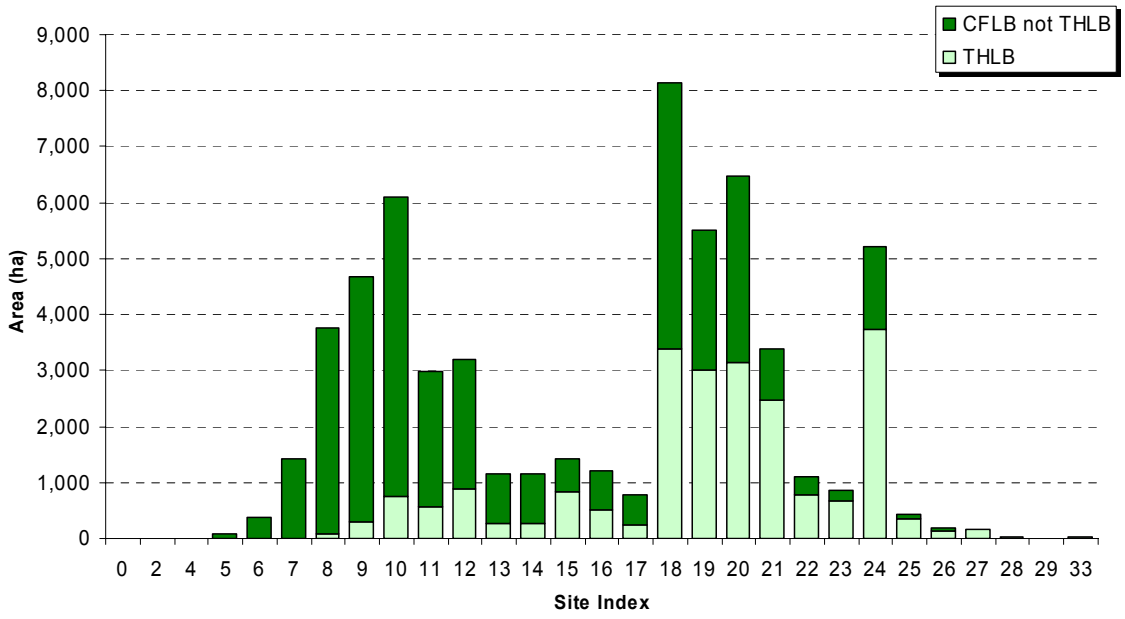


Figure 6. TFL 56 SIBEC adjusted site index distribution (only ICH stands adjusted)

[1] Only the ICH portion of the landbase was adjusted (described in detail in section 6.2.3)

3.0 Thematic Data Sources

Issue or Data	Description, Source	Version or Date Stamp
Administrative Linework		
Landscape Units	Landscape Unit Boundaries, MoAL-ILMB	2001
TFL boundary	TFL 56 boundary , MoAL – ILBM	Pre 2000
LRUP Zones / Bdy	Keystone LRUP, MoFR	2000
Operability	Operability Mapping 2008, RCFC	May 2008
Inventories		
BEC Variants	Biogeoclimatic mapping (v 7)	May 2008
NDT Types	Natural Disturbance Types calculated based on BEC, Forsite	May 2008
Forest Cover	VRI for TFL 56, LRDW	2002
Logged Blocks	Areas harvested since 2002, RCFC	Jun 2008
Terrain Classification	Terrain Stability Mapping, RCFC	1996-2000
ESA's	Environmentally Sensitive Areas, FIP Forest Cover	Pre2000
Arch Sites	Registered Heritage / Arch Sites, Arch Branch	Jun 2008
Total Chance Mapping	Harvest System Mapping (5000 scale), RCFC	1996-2003
Roads	Existing roads, RCFC	Jun 2008
Management Guidelines		
BEO's	Biodiversity Emphasis Option, MOAL – ILBM	2001
OGMA / MMAs	Spatial old and mature reserves, MoAL- ILMB	Apr 2008
Caribou Reserves	Status Quo and Incremental Reserves, SaRCO Caribou Recovery Team	May 2008
Riparian Management Areas	20:000 scale streams, wetlands, lakes buffered according to classifications, Forsite	Jun 2008
WHA's	Wildlife Habitat Areas, MoAL-ILMB	Jun 2008

4.0 Forest Cover Inventory

The forest cover inventory is a key input to the timber supply review. The current vegetation inventory in TFL 56 meets VRI standards and has the following characteristics:

- Updated in 2002 to Vegetation Resource Inventory (VRI) Standards using 1997 photos. This file has been updated for disturbances to Jan 2008 using RCFC data for logged areas. All logged areas were set to an age of 2 years and placed on existing managed yield curves.
- The forest cover attributes have been projected to January 1, 2008.
- No VRI Phase 2 adjustments currently exist for the inventory.
- Site index adjustments for managed stands are discussed in section 6.2.

5.0 Land Base

5.1 Land Base Definition

The Crown Forest Land Base (CFLB) is the subset of the TFL that is considered forested and able to contribute toward non timber values such as biodiversity. The CFLB excludes non-crown land, woodlots, non-forest and non-productive areas. It also generally excludes federal crown lands such as First Nation Reserves. TFL 56 is composed almost entirely of Schedule B land (provincial land in TFL) but also contains a small amount of Schedule A land (5 small Timber Licenses) covering 1190 ha (approx 103 ha of un-reverted THLB). Table 1 shows the timber licenses within TFL 56 with associated areas. RCFC is currently in the process of eliminating all TL's in the TFL.

Table 1. Timber Licences within TFL 56.

Timber Licence	Gross Area (ha) Within TFL 56	THLB Area (ha)	THLB Area ≥ 50 years (i.e. Non-reverted area)
T0617	221	83	6
T0646	259	63	27
T0648	236	121	1
T0658	215	98	53
T0662	259	94	17
Sum	**1,190**	**459**	**103**

The Timber Harvesting Land Base (THLB) is the subset of the TFL where timber harvesting is anticipated to occur now or in the future. The timber harvesting land base excludes areas that are inoperable or uneconomic for timber harvesting, or are otherwise reserved for non-timber values. The THLB is contained entirely within the CFLB. Table 2 summarizes the land base for TFL 56 and includes both Schedule A and B land. Differences from MP3 are summarized in Section 12.0.

Table 2. Timber harvesting land base area netdown summary

Factor	Total area (ha)	Effective Area (ha)*	% of TFL	% of Crown forest
Total TFL Area		**119,823**	**100.0%**	
Non-forest / Non-productive forest		58,822	49.0%	
Existing roads, trails and landings		1,146	1.0%	
Total Crown Forested Land Base (CFLB)		**59,855**	**50.0%**	**100.0%**
Less:	In CFLB:			
Parks / LRUP Reserves		0	0.0%	0.0%
Inoperable/Inaccessible	23,770	23,770	19.8%	39.7%
ESAs / Unstable Terrain	1,822	1,741	1.5%	2.9%
Low Productivity Sites	3,540	360	0.3%	0.6%
Non-Merchantable Forest Types	2,503	1,725	1.4%	2.9%
Riparian Reserves	1,492	1,124	0.9%	1.9%
Backlog NSR	0	0	0.0%	0.0%
Wildlife Habitat Areas	2	2	0.0%	0.0%
Cultural heritage resources	0	0	0.0%	0.0%
Downie Saltlick	19	14	0.0%	0.0%
Mountain Caribou Reserves	10,611	7,984	6.7%	13.3%
Isolated THLB	123	123	0.1%	0.2%
Site Specific Inoperable Areas	669	437	0.4%	0.7%
Timber Harvesting Land Base –THLB (ha)		**22,575**	**18.8%**	**37.7%**
Less Other Removals:				
Estimate of Future Roads, Trails, and Landings		459	0.4%	0.8%
Wildlife Tree Patches		388	0.3%	0.6%
Old Growth Management Areas**		355	0.3%	0.6%
Effective Long-term THLB (ha)		**21,372**	**17.8%**	**35.7%**

* Effective netdown area represents the area that was actually removed as a result of a given factor. Removals are applied in the order shown above, thus areas removed lower on the list do not contain areas that overlap with factors that occur higher on the list. For example, the unstable terrain netdown only removes area from the crown, operable forested land base.

** The use of spatial OGMAs for the first 80 years serve to further decrease the THLB by 355 ha for an effective short-term THLB of 22,219 or long term THLB of 21, 372 ha. More detail on how landscape level biodiversity is modeled can be found in Section 10.5.1.

5.2 Exclusions from the Crown Forested Land Base

5.2.1 Non-forest and non-productive forest

VRI standard vegetation mapping uses the B.C. Land Cover Classification Scheme in place of the old Non-Productive and Non-Forest Descriptor fields. Using this scheme and associated attributes the following logic was used to identify stands as non-forest and non-productive forest.

Table 3. Classification of Non-Forest using the B.C. Land Cover Classification Scheme.

BCLCS 1	BCLCS 2	BCLCS 3	BCLCS 4	Other Attributes	Netdown
Unclassified	*	*	*		Unclassified
Non Vegetated* (N)	Water	*	*		Water
	Land	*	Snow/Ice (SI)		Snow/Ice
		*	Rock (RO)		Rock
		*	Exposed Land (EL)	No Previous Logging	Exposed Land (NP)
Vegetated* (V)	Non Treed* (N)	*	*	No Previous Logging	NP Brush
	Treed* (T)	Wetland (W)	*		NP Forest
		Alpine (A)	*		NP Forest
		Upland (U)	*	CC< 40 and Age >50yrs	NP Forest
			*	SI < 6	NP Forest

* Vegetated has >=5% vegetation in polygon, Treed has >=10% crown closure

This definition of productive forest was reviewed against high resolution orthophotos and was found to give a reasonable representation of productive forest. It differs from the old inventory designation but is considered to be more accurate. Table 4 provides the areas associated with each of the categories.

Table 4. Non-forest/non-productive area

Category	Description	Gross Area (ha)	Netdown Area (ha)
Non-Forest	Unclassified	224	224
	Water	653	653
	Ice/Snow	7,045	7,045
	Rock	15,680	15,680
	Exposed Land (NP)	32	32
Non-Productive Forest	NP Brush	24,521	24,521
	NP Forest	10,666	10,666
	Total	**58,822**	**58,822**

5.2.2 Roads, Trails, and Landings (RTL's)

The purpose of this section is to quantify the proportion of the TFL that has, or will be, converted to roads, trails and landings. These areas are expected to remain non-productive unless they are permanently deactivated and reclaimed. RCFC does not plan to do significant amounts of road reclamation. RCFC generally considers roads to be an investment in the land base and thus will be protected like any other forest investment until the next entry.

5.2.2.1 Existing Roads, Trails, and Landings

Large roads, gravel pits, etc are identified in the forest cover inventory and removed as non productive forest areas. However, the bulk of the roads on the landbase are identified using a GIS

dataset. These roads are "buffered" in the GIS in order to represent the unproductive area of these features.

Two classes of road are recognized here, the two mainlines – Goldstream and Downie – will use average road widths of 20 metres. The remaining roads will have a width applied that will represent the productive area lost to roads, trails and landings. The average road width, obtained by sampling road widths within the TFL (see MP3 Appendix 4), was increased by an amount that represents the area in trails and landings. Table 5 summarizes road width data.

Table 5. Existing roads, trails and landings netdowns

Road Type	Width (m)	Length (km)	Gross Area (ha)	Netdown Area (ha)
Primary logging roads (Goldstream FSR 0-40 km, Downie FSR 0-36 km)	20	151.2	255	139
Secondary logging roads (all roads except those mentioned above)	15.9			
Additive for landings (0.14 ha every 500 meters of road in blocks) – As per MP3	2.8			
Additive for skid trails (0.5% occupancy per ha logged) – As per MP3	0.8			
Total secondary road width to use in buffering	19.5	611.9	1,151	1,007
Total			**1,406**	**1,146**

5.2.2.2 Future roads, trails, and landings

Future roads, trails and landings are, as the name implies, those that will be built to harvest undeveloped timber. Roads in these areas will be similar to the existing roads and will not be deactivated. Field sampling of existing roads as well as a review of Silviculture prescriptions was undertaken in MP3 to estimate the site occupancy of these structures. Statistics for road width, road percent occupancy, landing size, landing percent occupancy, skid trail width, and skid trail percent occupancy were compiled. Table 6 summarizes the results of the sampling conducted for MP3.

Table 6. Determination of site degradation

Category	Average amount	Percent %
Average landing size	0.14 hectares	
Average road width	15.9 metres	
Average road site occupancy:		5.0%
Average landing site occupancy:		1.4%
Average permanent skid trail width:	4.0 metres	
Average permanent skid trail site occupancy:		0.5%
Average total site degradation		**6.9%**

This site degradation was applied to the un-logged landbase that was >250m from existing roads. Once this area was determined (Table 7) it was expressed as a percentage of all area assigned to natural stand yield curves and then this reduction factor was applied to all future managed stand yield curves. This ensures that full volumes are recognized when areas are logged for the first time and then subsequent entries have reduced volumes reflecting the loss of productive area to roads, trails, and landings.

Table 7. Future roads, trails, and landings

Reduction Type	Area Still to be Roaded (ha)	Percent Future RTL's	Area of Future RTL's	% of Natural Stand AU Area
Future Roads, Trails, Landings	6,658	6.9	459.4	3.1

5.3 Exclusions from the Timber Harvesting Land base

5.3.1 Parks / LRUP Reserves

No parks or other geographically defined reserves exist within the TFL. The Keystone Standard Basin - Local Resource Use Plan (LRUP) has not been made legal and is now considered to be defunct. It is important to note that, although no reductions were made for the LRUP zones directly, the new caribou reserves effectively excludes harvesting from the same areas that were removed in MP3.

5.3.2 Inoperable/inaccessible

Inoperable areas are areas that are not available for timber harvesting because of physical limitations or unsuitable economics resulting from steep slopes, unfeasible road access or uneconomic yarding or flight distance. In TFL 56, operability has been reviewed several times. During the development of MP#3, a new operability line was determined (1999 operability) that replaced the 1994 operability line. Recently, operability has been re-evaluated and a new operability line has been derived (2008). As a result of this update the operable landbase has diminished slightly from previous assessments. Key reductions occurred on the Keystone face, the back end of the Downie, and the back end of Sorcerer.

Table 8. Inoperable land base

Criteria	Total Forested Area (ha)	Netdown Area (ha)
Inoperable Areas	23,770	23,770

5.3.3 Environmentally Sensitive Areas

The Environmentally Sensitive Area (ESA) designations assigned to the old inventory polygons can be used to identify areas that are environmentally sensitive or particularly valuable for other resource values. In this analysis, the issues addressed by ESAs were either better addressed through other datasets or were not considered appropriate to indicate harvest exclusions.

- Soils concerns are addressed using terrain stability mapping (with some consideration of ESA soils designations).
- Plantability or regeneration concerns were not recognized as netdown because RCFC has not encountered problems with regenerating these sites in the past.
- RCFC has completed detailed avalanche hazard mapping and uses this information to develop block level management strategies to address avalanche concerns. This rarely results in any long term retention so no netdowns were implemented.
- All other ESA categories (recreation, water, wildlife) are addressed through other netdowns and/or other IRM considerations therefore, these areas were not considered for netdowns.

5.3.4 Unstable Terrain

RCFC has completed Terrain Stability Mapping (TSIL D) covering the entire TFL and it is considered the best available information to identify unstable terrain that should be excluded from the THLB. The areas designated as unstable under this mapping were meant to raise a warning flag for closer scrutiny in the field. In order to estimate the actual area that will be excluded from harvesting due to soils concerns, a map was created showing TSIL D "unstable" polygons and where there was overlap with Es polygons. All of the overlap areas were removed from the land base and the remaining TSIL D "unstable" polygons were reviewed by RCFC based on past road building experience, harvesting experience, more detailed field assessments (TSIL A), and possibilities for alternative harvest systems. Those deemed unlikely for harvesting were flagged for exclusion. This netdown is the same as that used in MP3.

Table 9. Area reductions for unstable terrain.

Criteria	Total Forested Area (ha)	Netdown Area (ha)
Unstable Terrain	1,822	1,741

5.3.5 Low productivity sites

Low productivity sites are areas that are not suitable for timber harvesting due to low timber growing potential. These stands have suitable species for timber harvesting but are not expected to contribute to the THLB because they take too long to grow a commercial crop of trees. TFL 56 generally has very good growing conditions so there are few areas that are not "suitable for harvest" due to low site quality. The netdown criteria shown in Table 10 remain unchanged from MP3 and reflect the higher stand values required to support helicopter logging.

Table 10. Low site netdowns

Harvest System	Site index to be removed	Percent Reduction	Total Forested Area (ha)	Netdown Area(ha)
Aerial	< 9	100%	229	200
Non-aerial	< 8	100%	3,311	159
		Total	**3,540**	**360**

The stands just above this threshold are old and currently have enough volume on them to be merchantable. The managed stands that will regenerate are very likely to have higher site indices (based on local growth intercept surveys and MoF – SIBEC research).

5.3.6 Non-merchantable forest types

Non-merchantable forest types are stands that contain tree species not currently utilized, or timber of low quality, small size and/or low volume. Table 11 provides definitions of these stands and their areas. Pure old hemlock stands are recognized as having difficult economics due to the high percentage of pulp so they have been limited where high cost logging systems are required. For other harvest systems, this issue will be managed by limiting the amount of pulp that can be logged in a given decade to a level consistent with historical performance. See section 11.4 for more detail.

Table 11. Non-merchantable forest types

Species	Inventory type group	Stocking Class	Percent Reduction	Total Forested Area (ha)	Netdown Area (ha)
All species	All	≥ 2	100%	286	47
Hw + Hm > 50% and Heli harvest system*	12-17	N/A	100%	1,387	992
Deciduous leading	35-42	N/A	100 %	830	687
			Total	**2,503**	**1,725**

* This area has been identified in the RCFC total chance plan

5.3.7 Riparian Reserve and Management Zones

RCFC's management of riparian reserve zones follows the practices outlined in their approved Forest Stewardship Plan (FSP). Riparian classifications were assigned to all water features in the TFL and then buffered with a reserve width that represented the reserve zone and the effective width of the management zone. This effective reserve area was then entirely removed from the THLB. See the following 2 sections for details.

5.3.7.1 Streams and Rivers

The classified stream network developed during MP3 was used along with the net reserve buffer widths by stream class shown in Table 12.

Table 12. Riparian reserve and management zones — streams

Location	Riparian Class	Reserve width RRZ (m)	Management zone width RMZ (m)	RMZ Retention %	Net Reserve Width * (m)	Total Forested Area (ha)	Netdown Area (ha)
S1 streams	S1	50	20	50%	60	1,305	1,008
S2 streams	S2	30	20	50%	40		
S3 streams	S3	20	20	50%	30		
S4 streams	S4	0	30	50%	15		
S5 streams	S5	0	30	17%	5		
S6 streams	S6	0	20	5%	1		
Sorcerer Crk	S5	0	30	50%	15		
Brewster Crk	S5	10	20	50%	15		
					Stream Totals	**1,305**	**1,008**

* Net Reserve Width = RRZ + (RMZ * (% retention / 100)). This width is applied to both sides of the stream.

5.3.7.2 Lakes and Wetlands

Similar to the riparian reserves around streams, a buffer around each lake / wetland was created to represent the area deducted from the timber harvesting land base. See Table 13 below for the effective buffer width around each class of lake or wetland as well as the area affected by these buffers.

Table 13. Riparian reserve and management zones — wetlands and lakes

Location	Riparian Class	Reserve Width RRZ (m)	Management Zone Width RMZ (m)	RMZ Retention %	Net Reserve Width* (m)	Total Forested Area (ha)	Netdown Area (ha)
Wetlands							
W1 wetlands	W1	10	40	25%	20	117	51
W3 wetlands	W3	0	30	34%	10		
W5 wetland complexes	W5	10	40	25%	20		
Lakes							
Lake Revelstoke	L1a >1000 ha	0	20	100%	20	70	65
L1 Lakes	L1b < 1000	10	200	25%	60		
L3 Lakes	L3	0	30	50%	15		

* Net Reserve Width = RRZ + (RMZ * (% retention / 100)). This width is applied to both sides of the stream.

5.3.8 Backlog NSR - unproductive sites

All backlog areas in the TFL were surveyed and have had prescriptions formulated. Most were planted or brushed to bring them up to standard. Some were accepted at lower stocking standards or had no practical treatments that could bring them up to sufficient stocking levels. There are now no areas classified as "backlog NSR" although there are some areas with low stocking of conifers. Approximately ~1018 ha have been identified as meeting this low stocking condition however, only ~638 ha of the area identified remained in the THLB after other netdowns were applied. These areas will remain in the THLB and be assigned to a low stocking yield curve based on the average stocking levels of these sites (~468 well-spaced stems per hectare). Table 14 summarizes these areas.

Table 14. Backlog NSR - unproductive sites

Description	Percent Reduction	Total Forested Area (ha	Netdown Area (ha)
Backlog NSR – Low Stocking	0%	1018	0

5.3.9 Wildlife habitat deductions – Identified Wildlife

The provincial *Identified Wildlife Management Strategy* provides for the creation of Wildlife Habitat Areas (WHAs) to protect key habitat features of listed wildlife species. Currently, the only species for which a legal WHA has been created is the Coeur d'Alene salamander (*Plethodon idahoensis [Plethodon vandykei idahoensis]).* This area will be removed from the THLB.

Table 15. Deductions for Identified Wildlife

Criteria	Total Forested Area (ha)	Netdown Area (ha)
Coeur d'Alene Salamander WHA	2	2

5.3.10 Cultural heritage resources

A cultural heritage resource is an object, site, or location of a traditional societal practice that is of historical, cultural or archaeological significance to the province, a community, or an aboriginal people. Cultural heritage resources include archaeological sites, structural features, heritage landscape features and traditional use sites. Archaeological Overview Assessments and Traditional Use Surveys are conducted as required to ensure the protection of cultural heritage resources. Many known archaeological sites occur in riparian areas that are already deducted from the timber harvesting land base, and where this does not occur, sensitive sites are currently protected using management practices such as wildlife tree retention, machine free zones, or winter logging. RCFC actively participates in information sharing with First Nations. To date, there has been 14 areas that have had Archaeological Impact Assessments (AIA) conducted which have found no significant archaeological sites. Experience demonstrates that in the timber supply analysis, most archaeological and cultural heritage concerns can be addressed by management practices and land base deductions for other factors. Existing netdowns and management practices provide a range of habitats, seral stages, plants and animals that support traditional uses of the landbase. As a result, additional land base deductions specific to cultural heritage are not applied in this timber supply analysis.

5.3.11 Downie Salt lick

There is a salt lick near the confluence of the Downie and Sorcerer creeks. RCFC has committed to reserving this special area.

Table 16. Deductions for the Downie salt lick

Criteria	Total Forested Area (ha)	Netdown Area (ha)
Downie Salt Lick	19	14

5.3.12 Mountain Caribou

While the mountain caribou guidelines under the Higher Level Plan Order are currently legal management direction, it is assumed that the Species at Risk Coordination Office (SaRCO) caribou reserves (Draft GAR Order #U-3-005) will be legal by the time an AAC determination is made for TFL56. Thus, these reserves will be used in the Base Case.

Status Quo reserves were defined to spatialize the habitat requirements specified under the HLPO. In addition, incremental reserves were identified in an effort to improve population survival rates. Both sets of reserves will be excluded from harvesting for the duration of the planning horizon.

Table 17. Deductions for mountain caribou

Criteria	Total Forested Area (ha)	Netdown Area (ha)
SaRCO Caribou Reserves – Status Quo	9,106	6,668
SaRCO Caribou Reserves – Incremental	1,505	1,316
Total	**10,611**	**7,984**

5.3.13 Isolated THLB

Upon review of the THLB defined using the assumptions listed above and considering the current version of spatial OGMAs, small areas of isolated THLB were identified by RCFC staff as being impractical for harvest and were therefore removed from the THLB. These isolated areas arose

primarily as a result of the spatially explicit caribou reserves and to a lesser extent the spatial OGMAs. These reserves essentially created areas of THLB that are isolated and can no longer be accessed because of their size, location, or lack of proximity to other harvestable stands.

Table 18. Deductions for isolated THLB

Criteria	Total Forested Area (ha)	Netdown Area (ha)
Isolated THLB	123	123

5.3.14 Site Specific Inoperable Areas

As part of the detailed Total Chance Planning that has previously been completed for the TFL, several areas below the operability line were identified as inoperable because of access and other operational limitations. In preparation of MP4, these areas were again reviewed by RCFC staff and a subset of this area was selected to remain as inaccessible.

Table 19. Deductions for Site Specific Inoperable Areas

Criteria	Total Forested Area (ha)	Netdown Area (ha)
Total Chance Plan Reserves	669	437

5.3.15 Wildlife Tree Patches

An estimate of the wildlife tree patch area in the TFL was determined using the calculation steps outlined in Section 10.5.2. This analysis found that approximately 388 hectares will need to be reserved in order to achieve RCFC's wildlife tree retention commitments (7%). This was applied as a yield curve reduction of 1.75 % (388 ha requirement / 22,219 ha [THLB less OGMAs]) to all yield curves.

Table 20. Wildlife Tree Retention.

Reduction Type	Area requiring WTP's (ha)	Wildlife Tree Retention Commitment	Area of Future RTL's	% of THLB (less OGMAs)
Wildlife Tree Retention	5,548	7.0	388	1.75

6.0 Growth and Yield

The data sources, assumptions, and methods for generating growth and yield projections for both existing and future stands, under both unmanaged and managed conditions are described in this section.

6.1 Analysis units

In order to reduce the complexity and size of the model, like stands are grouped based on management regime, species, age, and site index. Each analysis unit is assigned a yield curve, minimum harvest age, and a regeneration yield curve to follow after treatment.

Three sets of analysis units have been created to represent the level of forest management associated with various time frames.

Existing Natural Stands (100 series)

These are stands where forest management (planting/spacing) has been generally absent. This was defined as stands currently greater than 28 years old (established prior to 1980) in the forest inventory files. These stands will be assigned VDYP yield curves and once harvested, will regenerate on future managed stand yield curves (200 series).

Existing Managed Stands (500 series)

These are stands where forest management (e.g. planting/spacing) has had a positive impact on the regeneration/growth of the stand. This was defined as stands harvested on or after 1980 (<= 28yrs old). These stands will be assigned TIPSY yield curves. Once harvested, these stands will regenerate on future managed stand yield curves (600 series).

Future Managed Stands (200 / 600 series)

Once existing stands are harvested in the model, they will be assigned to one of these analysis units. These TIPSY curves are meant to capture current management/regeneration practices, including the benefits of planting class A seed.

Analysis unit definitions are provided in Table 21 for all existing stands (natural and managed) as well as their associated future managed stands. For this analysis, all AU's follow a clearcut silviculture regime (see section 7.1 for more detail).

Table 21. Analysis unit definitions

AU Type	Analysis Unit Description	Existing Stand AU#	Future Stand AU#	Wtd. Avg. Inventory SI	Wtd. Avg. Managed SI	THLB Area (ha)	Inv. Type Groups	Age Range	SI Range
Existing Natural Stands	Nat - Fd-Good	101	201	23.6	24.8	300	1-8, 27,28	28+	>21
	Nat - Fd-Med	102	202	18.2	23.7	941			16-21
	Nat - Fd-Poor	103	203	15.1	24.7	138			<16
	Nat - Bl Good <141	104	204	16.5	16.4	215	18-20	28-140	14+
	Nat - Bl-Med <141	105	205	12.3	12.3	68			<14
	Nat - Bl Good 141+	106	206	14.5	14.5	36	18-20	>140	14+
	Nat - Bl-Med 141+	107	207	10.7	10.7	546			<14
	Nat - Cw Good <141	108	208	19.7	19.9	732	9-11	28-140	>18
	Nat - Cw Med <141	109	209	17.4	19.9	247			14-18
	Nat - Cw Poor <141	110	210	12.9	18.9	132			<14
	Nat - Cw Good 141+	111	211	18.6	20.4	110	9-11	>140	>18
	Nat - Cw Med 141+	112	212	16.1	19.8	3,275			14-18
	Nat - Cw Poor 141+	113	213	13.3	18.9	199			<14
	Nat - Hw Good <141	114	214	19.2	19.4	1,212	12-17	28-140	>16
	Nat - Hw Med <141	115	215	14.6	19.2	182			13-16
	Nat - Hw Poor <141	116	216	11.6	17.8	148			<13
	Nat - Hw Good 141+	117	217	17.8	18.1	295	12-17	>140	>16
	Nat - Hw Med 141+	118	218	14.5	18.0	1,294			13-16
	Nat - Hw Poor 141+	119	219	11.2	15.1	1,519			<13
	Nat - Sx Good <141	120	220	25.3	23.0	239	21-26	28-140	>21
	Nat - Sx Med <141	121	221	17.6	19.6	746			15-21
	Nat - Sx Poor <141	122	222	12.2	18.1	274			<15
	Nat - Sx Good 141+	123	223	22.3	23.2	62	21-26	>140	>21
	Nat - Sx Med 141+	124	224	16.9	21.0	537			15-21
	Nat - Sx Poor 141+	125	225	11.5	13.0	1,555			<15
	Natural Totals			**15.6**	**18.4**	**15,003**			
Existing Managed Stands	Low stocking	501	601	17.9	20.4	550	Any	Any	7+
	Man - CwHw Good	502	602	19.4	19.7	1,320	9-17	<28	18+
	Man - CwHw Med	503	603	15.3	18.9	1,494			<18
	Man - Fd	504	604	22.6	24.4	684	1-8,27-34	<28	>7
	Man - SxBl Good	505	605	22.1	22.6	2,382	18-26	<28	18+
	Man - SxBl Med	506	606	14.1	18.0	1,141			<18
	Managed Totals			**18.7**	**20.7**	**7,571**			
TOTAL THLB				**16.7**	**19.2**	**22,575**			

6.2 Site index

Estimates of site productivity are required to predict the rate of growth that will occur on each site throughout the TFL. The height of a "site" tree at age 50 (measured at breast height) is one measure of site productivity and is commonly referred to as "site index". The forest inventory data used in this analysis includes estimates of site index derived from the current age and height of each stand.

6.2.1 Site curves

For each tree species, site curves are available to illustrate the relationship between stand height and age for a range of site indices. This analysis will use the standard site curves recommended by the BC Ministry of Forests for all growth and yield work. They are as follows:

Table 22. Site index source

Species	Source
Douglas Fir (Fdi) + (Pw, Py, Lw)	Thrower and Goudie (1992ac)
Lodgepole Pine (Pl)	Thrower (1994)
Western Red Cedar (Cw)	Nigh (2000)

Species	Source
Western Hemlock (Hw)	Nigh (1998)
White Spruce (Sw) + (Se, Sx, Bl)	Goudie (1994ac)

Note: Species surrogates as used in TIPSY are indicated by the "+ (_)" in the species column.

6.2.2 Forest Inventory Site Index

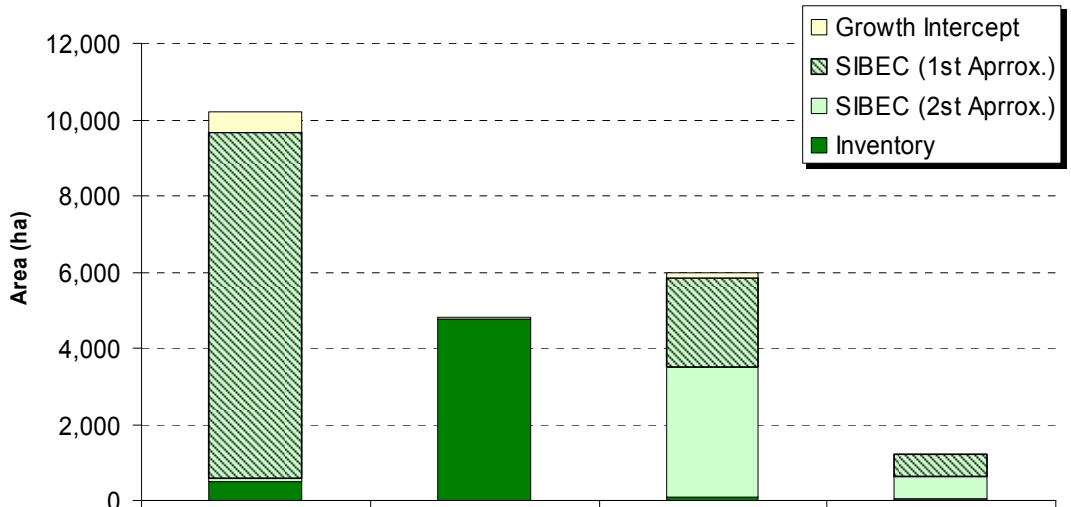
The forest inventory age, height and site index values will be used to predict the yields for all natural and managed stands unless specified otherwise. This site index is generated from the site curves described above using inventory polygon ages and heights.

6.2.3 Site Index Adjustments

Where better site indexes were available, they were used to derive managed stand yields only (i.e. TIPSY yeilds). Where several options existed, they were prioritized as follows:

1. Growth intercept from regeneration surveys
2. SIBEC 2nd approximation estimates
3. SIBEC 1st approximation estimates
4. Forest Cover Inventory Estimates.

SIBEC adjustments were applied using the Revelstoke Predictive Ecosystem Mapping (PEM) project (Jones, C. et. al., 2008) and SIBEC data supplied by the MoFR Research Branch. Results from an interim accuracy assessment report (Timberline, 2008) of the PEM data indicate that when ESSF ecosystems are not considered, the PEM met minimum requirements for sample size and accuracy as set out by Forest Analysis and Inventory Branch.[2] Therefore, for the purpose of MP4, the base case analysis will include SIBEC adjustments to stands in ICH ecosystems only.



	ICH vk 1	ESSFvc	ICH wk 1	ICH mw 3
Growth Intercept	565	68	138	0
SIBEC (1st Aprrox.)	9,053	0	2,338	583
SIBEC (2st Aprrox.)	95	0	3,433	578
Inventory	493	4,744	87	43

Figure 7. Summary of site index source by THLB area

[2] Deb Mackillop / Del Meidenger's email approving the use of the Revestoke PEM to adjust ICH stands. (Title: Accuracy Assessment of the Revelstoke PEM for use in TSR. Sent: November 18, 2008 by Deb Mackillop)

6.3 Utilization level

Utilization levels define the maximum height of stumps that may be left on harvested areas, the minimum top diameter (inside bark), and the minimum diameter at breast height (dbh) of stems that must be removed from harvested areas. These factors are needed to calculate merchantable stand volume for use in the analysis. There is currently no utilization of deciduous species in the TFL, therefore it will not be considered in the yield analysis.

Table 23. Utilization levels

Species	Utilization			
	Minimum dbh (cm)	Maximum stump height (cm)	Minimum top dib (cm)	Firmwood standard (%)
Cedar >140 yrs	17.5	30	15	50%
Lodgepole pine	12.5	30	10	50%
Other coniferous species and cedar ≤ 140 years	17.5	30	10	50%
Deciduous species	Currently not utilized			

6.4 Decay, waste and breakage for unmanaged stands

Decay, waste and breakage factors are applied to unmanaged stand yield tables to obtain net harvest volumes per hectare. The default values incorporated into the Variable Density Yield Prediction model (VDYP v6) were utilized.

6.5 Operational Adjustment Factors for Managed Stands

Operational Adjustment Factors (OAFs) will be applied in order to adjust potential yields generated by the TIPSY growth and yield model down to net operational volumes. This includes reductions for such things as gaps in stands, decay/waste/breakage, and endemic forest health losses.

There are two types of OAFs used in the TIPSY model. OAF 1 is a constant percentage reduction to account for openings in stands, distribution of stems or clumpiness, endemic pests and diseases, and other risks to potential yield. OAF 2 is an increasing percentage reduction that can be applied to account for decay, waste and breakage or forest health losses that increase with age. OAF 2 is applied after OAF 1 and increases linearly over time from 0 percent at age 0 to the specified percentage at 100 years of age.

In his last AAC determination, the Deputy Chief Forester expressed concern over the lack of quantifiable volume losses due to *Armillaria* root rot (DRA) and requested that local data be collected to refine the estimates of volume loss attributable to root disease. However, no research has been conducted to date. In a recent determination for another management unit in the Southern Interior (Arrow TSA), the Chief Forest applied a 7% reduction to the long-term harvest level to account for volume losses due to root rot based on results of a sensitivity that explored the potential affects of root rot within managed stands (Stearns-smith, S. et. al., 2004). This result is specific to the distribution of stand types and ecosystems that occur in the Arrow TSA.

The OAF1 and OAF2 values used in the base case analysis will be the provincial defaults 15% and 5% respectively, as no localized values are available. This is consistent with the approach taken in adjacent management units (e.g. Revelstoke TSR2) in the past. A sensitivity analysis will be run to explore the potential impact of DRA using the Armillaria OAF's built into TIPSY. Even though it is felt to overestimate the prevalence, the low severity rating will be applied to all Douglas-fir within the ICH variants. This will effectively reduce the Fd volumes in these stands by ~30% at age 100.

6.6 Deciduous Exclusion

Deciduous volumes are not currently utilized in TFL 56. Thus, any deciduous volumes have been ignored during the compilation of yield curves.

6.7 Natural Stand Volume Projections

Yield tables were derived for existing natural stands using VDYP Batch v.6.6d. A yield table was generated for each polygon and then aggregated into one table for each Analysis Unit (AU) using area weighted averages.

As discussed in section 10.5.2, all yield estimates were reduced by a further 1.75% to reflect the anticipated net impact of wildlife tree retention. These effective yield tables were used during modeling and are provided in Appendix 2.

6.8 Managed Stand Yield Tables

Existing managed stand yields were derived using the average site index for the unit and the regeneration assumptions outlined in Section 7.2. Existing managed stands are those that are currently under 28 years of age.

All future managed stand AU's had an associated existing stand AU from which it inherited stand attributes when it was logged. These future managed stand AU's used the adjusted managed stands site indexes (Table 21) and the regeneration assumption outlined later in this document (Section 7.2). These values were used as inputs into Batch TIPSY 4.1d to generate yield curves for each AU.

The regeneration assumptions required to model managed stands in TIPSY consist of:

- Species composition (Section 7.2),
- Initial density (Section 7.2),
- Regeneration method (Section 7.2),
- Operational adjustment factors (Section 6.5),
- Regeneration delays (Section 7.3) , and
- Class A seed use (Section 7.4).

Once net stand yields were obtained from TIPSY, yield estimates were further reduced to reflect the anticipated impact of wildlife tree patches (1.75 %, Section 10.5.2), and future roads (3.1%, Section 5.2.2.2). These 'effective' yield tables used during modeling are provided in Appendix 2.

6.9 Existing timber volume check

To verify that no errors were made in aggregation and that no significant aggregation bias exists, the total volume of the current (starting) inventory using polygon-specific inventory volumes has been compared to the total volume of the current inventory based on analysis unit volumes. The results for existing natural (VDYP) AU's are shown in Table 24 by AU and in Table 25 by age class.

Table 24. Existing timber volume check by AU

VDYP AU	THLB Area less OGMAs (ha)	Volume (m^3) derived from		Difference	
		Inventory	Yield tables (AU)*	Volume (m^3)	Percent (%)
101	300	32,757	33,640	883	2.6%
102	937	166,341	168,428	2,087	1.2%
103	137	43,600	43,508	-92	-0.2%
104	215	20,348	20,123	-225	-1.1%
105	68	4,699	4,786	86	1.8%
106	36	11,356	11,190	-166	-1.5%
107	537	127,999	128,733	734	0.6%
108	732	41,919	42,353	434	1.0%
109	247	9,411	9,779	368	3.8%
110	132	2,791	3,130	340	10.8%
111	110	67,492	68,082	589	0.9%
112	3,156	1,559,912	1,593,552	33,640	2.1%
113	190	73,114	72,851	-263	-0.4%
114	1,212	162,639	170,007	7,368	4.3%
115	182	32,680	32,804	123	0.4%
116	148	3,089	3,759	671	17.8%
117	241	130,700	130,724	24	0.0%
118	1,206	561,978	584,619	22,641	3.9%
119	1,508	620,717	620,686	-31	0.0%
120	237	19,851	30,110	10,259	34.1%
121	746	92,236	100,764	8,528	8.5%
122	273	22,181	23,256	1,075	4.6%
123	46	24,978	24,961	-17	-0.1%
124	511	237,094	238,257	1,163	0.5%
125	1,546	576,510	576,394	-117	0.0%
All VDYP	**14,653**	**4,646,392**	**4,736,497**	**90,104**	**1.9%**

* Actual yields used in the model are lower because of reductions for WTP's, and future RTLs. The volumes reported here are meant to be consistent with the inventory volumes reported for each polygon.

TIPSY AU's are not shown here because volume comparisons with VDYP have little value. Overall, the volumes being generated from the AU yield tables correlate well with the inventory (1.9 % difference).

Table 25. Existing timber volume check by age class.

Age Class	THLB Area less OGMAs (ha)	Volume derived from:		Difference From Inv	
		Yield tables (AU)	Inventory	Volume (m^3)	Percent (%)
0-20	153	0	0		
21-40	2,142	48,301	45,272	-3,029	-6.7%
41-60	680	70,884	67,347	-3,537	-5.3%
61-80	1,143	175,187	190,192	15,005	7.9%
81-100	832	181,904	199,165	17,261	8.7%
101-120	310	83,570	87,713	4,143	4.7%
121-140	187	54,823	54,044	-779	-1.4%
141-250	3,420	1,234,229	1,270,994	36,765	2.9%
250+	5,786	2,797,495	2,820,705	23,210	0.8%
All VDYP	**14,653**	**4,646,392**	**4,735,432**	**89,040**	**1.9%**

7.0 Silviculture

7.1 Silvicultural Systems

The clearcut silviculture system will continue to be the dominate silviculture system used in TFL 56 and the only one modeled in this analysis. The analysis for MP3 modelled group selection however, this practice was primarily focused on caribou areas and is no longer common practice in these areas. Explicit caribou reserves have been defined and the areas outside of the reserves will be managed using clearcut with reserves silviculture systems. RCFC still intends to use a wide range of clearcut sizes in its operational practice, but the openings will be larger than what would be considered 'partial cutting'. RCFC also has completed operational trials of commercial thinning on thrifty Douglas-fir sites, but these are not considered significant enough to warrant modeling in this analysis.

7.2 Regeneration Assumptions

After harvest, stands in the TFL follow various silvicultural management regimes depending on originating stand type. All stand types are planted shortly after harvest and Table 26 provides a summary of the regeneration assumptions used in TIPSY to produce managed stand yield curves.

Table 26. Regeneration assumptions (TIPSY input parameters)

Regen AU	Description	Regen Method	Regen Species and Weightings	Avg. SI	Initial Density (sph)	OAFs	Regen Delay	Select Seed Gains
Future Managed Stands								
201	Nat-Fd-Good	Plant	$Fd_4\ Sx_3\ Cw_1\ Hw_1\ Pw_1$	24.8	1400	15/5	2	Fd=1.4 Sx=11.4
202	Nat- Fd-Med	Plant	$Fd_4\ Sx_3\ Cw_1\ Hw_1\ Pw_1$	23.7	1400	15/5	2	Fd=1.4 Sx=11.4
203	Nat- Fd-Poor	Plant	$Fd_4\ Hw_3\ Sx_2Cw_1$	24.7	1400	15/5	2	Fd=1.4 Sx=11.4
204	Nat- Bl Good <141	Plant	$Sx_5\ Bl_3\ Hw_2$	16.4	1400	15/5	2	Sx=11.4
205	Nat- Bl-Med <141	Plant	$Sx_5\ Bl_3\ Hw_2$	12.3	1400	15/5	2	Sx=11.4
206	Nat- Bl Good 141+	Plant	$Sx_5\ Bl_3\ Hw_2$	14.5	1400	15/5	2	Sx=11.4
207	Nat- Bl-Med 141+	Plant	$Sx_5\ Bl_3\ Hw_2$	10.8	1400	15/5	2	Sx=11.4
208	Nat-Cw Good <141	Plant	$Cw_6\ Sx_3\ Hw_1$	19.9	1400	15/5	2	Sx=11.4
209	Nat-Cw Med <141	Plant	$Cw_6\ Sx_3\ Hw_1$	19.9	1400	15/5	2	Sx=11.4
210	Nat- Cw Poor <141	Plant	$Cw_5\ Sx_3\ Hw_2$	18.9	1400	15/5	2	Sx=11.4
211	Nat-Cw Good 141+	Plant	$Cw_6\ Sx_3\ Hw_1$	20.4	1400	15/5	2	Sx=11.4
212	Nat- Cw Med 141+	Plant	$Cw_6\ Sx_3\ Hw_1$	19.7	1400	15/5	2	Sx=11.4
213	Nat- Cw Poor 141+	Plant	$Cw_5\ Sx_3\ Hw_2$	18.9	1400	15/5	2	Sx=11.4
214	Nat-Hw Good <141	Plant	$Cw_4\ Sx_3\ Hw_3$	19.4	1400	15/5	2	Sx=11.4
215	Nat-Hw Med <141	Plant	$Cw_4\ Sx_3\ Hw_3$	19.2	1400	15/5	2	Sx=11.4
216	Nat-Hw Poor <141	Plant	$Cw_4\ Sx_3\ Hw_3$	17.8	1400	15/5	2	Sx=11.4
217	Nat-Hw Good 141+	Plant	$Cw_4\ Sx_3\ Hw_3$	18.1	1400	15/5	2	Sx=11.4
218	Nat-Hw Med 141+	Plant	$Cw_4\ Sx_3\ Hw_3$	18.0	1400	15/5	2	Sx=11.4
219	Nat-Hw Poor 141+	Plant	$Cw_3\ Sx_3\ Bl_2\ Hw_2$	15.1	1400	15/5	2	Sx=11.4
220	Nat-Sx Good <141	Plant	$Sx_4\ Bl_2\ Hw_2\ Cw_2$	23.0	1400	15/5	2	Sx=11.4
221	Nat-Sx Med <141	Plant	$Sx_4\ Bl_2\ Hw_2\ Cw_2$	19.6	1400	15/5	2	Sx=11.4
222	Nat-Sx Poor <141	Plant	$Sx_4\ Bl_3\ Hw_3$	18.1	1400	15/5	2	Sx=11.4
223	Nat-Sx Good 141+	Plant	$Sx_4\ Bl_2\ Hw_2\ Cw_2$	23.5	1400	15/5	2	Sx=11.4
224	Nat-Sx Med 141+	Plant	$Sx_4\ Bl_2\ Hw_2\ Cw_2$	20.9	1400	15/5	2	Sx=11.4
225	Nat-Sx Poor 141+	Plant	$Sx_4\ Bl_3\ Hw_3$	13.0	1400	15/5	2	Sx=11.4
Existing Managed and Associated Future Managed Stands								
501	Low stocking	Natural	$Sx_3\ Cw_3\ Hw_3\ Fd_1$	20.4	468	25/5	5	N/A
502	Man-CwHw Good	Plant	$Cw_5\ Sx_3\ Hw_2$	19.7	1400	15/5	2	N/A
503	Man-CwHw Med	Plant	$Cw_4\ Hw_4\ Sx_2$	18.9	1400	15/5	2	N/A
504	Man-Fd	Plant	$Fd_5\ Cw_2\ Hw_2\ Pw_1$	24.4	1400	15/5	2	N/A
505	Man-SxBl Good	Plant	$Sx_7\ Bl_1\ Hw_1\ Cw_1$	22.6	1400	15/5	2	N/A
506	Man-SxBl Med	Plant	$Sx_6\ Bl_2\ Hw_1\ Cw_1$	18.0	1400	15/5	2	N/A
601	Low stocking	Natural	$Sx_3\ Cw_3\ Hw_3\ Fd_1$	20.4	1400	15/5	5	Fd=1.4 Sx=11.4
602	Man-CwHw Good	Plant	$Cw_5\ Sx_3\ Hw_2$	19.7	1400	15/5	2	Sx=11.4

Regen AU	Description	Regen Method	Regen Species and Weightings	Avg. SI	Initial Density (sph)	OAFs	Regen Delay	Select Seed Gains
603	Man-CwHw Med	Plant	$Cw_4\ Hw_4\ Sx_2$	18.9	1400	15/5	2	Sx=11.4
604	Man-Fd	Plant	$Fd_5\ Cw_2\ Hw_2\ Pw_1$	24.4	1400	15/5	2	N/A
605	Man-SxBl Good	Plant	$Sx_7\ Bl_1\ Hw_1\ Cw_1$	22.6	1400	15/5	2	Sx=11.4
606	Man-SxBl Med	Plant	$Sx_6\ Bl_2\ Hw_1\ Cw_1$	18.0	1400	15/5	2	Sx=11.4

7.3 Regeneration delay

Regeneration delay is the time elapsed between harvesting and the time when stand growth begins. The delay incorporates both the time taken to establish a stand, and the age of seedling stock planted, if applicable. Regeneration delay was determined to be 2 years at the time of MP3 and it has remained at this level. A regeneration delay of 2 year was used in TIPSY when deriving the managed stand curves.

7.4 Gene resources — Use of Class 'A' Seed

As required by the *Chief Foresters Standards for Seed Use*, if seed or vegetative material with a genetic worth of 5% or greater is available, it is required that it be used for post-harvest stand establishment. This section describes the yield adjustments applied to future managed stands for the use of select seed (i.e. orchard & superior provenance seed with a known genetic gain as measured by Genetic Worth [GW]).

Seed Planning Units (SPUs) are polygon features that geographically delineate the appropriate area of seedling use for stock originating from specific seed orchards throughout the province[3]. Each SPU identifies the area and elevation range in which seedlings of a given orchard may be used for regeneration. The select seed SPUs for TFL 56 are shown in Table 27. Estimates of future genetic worth and seedling availability are provided at the SPU level in Table 28.

Table 27. Seed Planning Units within TFL 56 (Class A seed)

Species	Genetic Class "A" Seed Planning Zone	Seed Planning Unit	Elevation Band (m)	
			Min	Max
Douglas-fir	Nelson	FDI NE LOW	400	1,000
		FDI NE HIGH	1,000	1,600
Spruce	Nelson	SX NE LOW	1	1,000
		SX NE MID	1,000	1,500
		SX NE HIGH	1,500	1,900

* Note: The Quesnel Lakes/Nelson Fd zone applies to the upper northern half of the TFL but management has focused on use of only the Nelson SPZ for Fd.

Table 28. Seed Planning Units (Class A seed) genetic worth and seed availability

SPU	THLB Area (ha)	Percent of Total THLB	Planned GW for 2008	% of Projected SPU Seed Need Met in 2008	Projected Future Genetic Worth % (2018)	% of Projected SPU Seed Need Met in (2018)
FDI NE LOW	9,731	44%	25%	25%	25%	100%
FDI NE HIGH	11,658	52%	29%	18%	32%	100%
SX NE LOW	4,836	22%	20%	45%	26%	100%
SX NE MID	14,331	65%	12%	100%	15%	100%
SX NE HIGH	3,039	14%	12%	100%	15%	100%

Class A seed for Spruce has been used almost exclusively on the TFL over the past 5 years (~95%). Douglas-fir Class A seed was purchased and sown for the first time in 2008 and will be planted in 2009.

[3] Genetic worth and seed need related to Seed Planning Units provided by Matthew LeRoy MoFR Tree Improvement branch.

Table 29 illustrates the assumed GW potential for each species [A], the percent Class A seed used for each species [B], and the resulting net GW for each species [C]. The Net GW is calculated by multiplying [A] x [B]. Class A Seed Use for 2008 [B] was provided by RCFC's silviculture consultant (Mike Rooney) based on actual use. Table 28 indicate that seed needs are expected to be fully met in 2018, a 5% reduction was applied due to the uncertainty of access to improved seed.

Table 29. Calculation of net genetic worth by species in TFL 56.

Year	Wtd. Avg GW by Species (Class A) **[A]**		% Class A of Total Seedlings Planted **[B]**		Net GW by Species **[C]**	
	Fd	Sx	Fd	Sx	Fd	Sx
2008	27%	14%	5%	95%	1.4%	13.0%
2018	29%	17%	95%	95%	27.4%	16.5%

Since Class A seed has only been substantially used in the TFL in the past 5 years, there was no attempt to apply genetic gains to existing managed stands. However, future managed stands will have the 2008 Net GW's for Sx (11.4%) and Fd (1.4%) used for the base case. A sensitivity is planned to explore the implication of applying forecasted 2018 GS's based on projected orchard gains and projected seed availability (orchard production) for Sx and Fd. The projected Net GW for each species will be based on the values shown in Table 29.

Genetic gains will be incorporated into the growth and yield curves through TIPSY model functionality. Whenever a species identified in Table 29 is included in a managed stand AU, its associated Net GW will be input into TIPSY. This Net GW reflects the genetic gain associated with all seedlings of a given species planted in a typical year.

7.5 Silviculture History

Stands established less than 28 years ago (1980-2008) have had effective planting, stocking control, and competition control and so are considered managed stands in this timber supply analysis. Yields for stands established prior to 1980 are determined using natural stand curves. The planting history in TFL 56 since 1964 is shown in below. The average area harvested between 1980 and 2007 is 219 ha while the average area planted between 1981 and 2007 is 220 ha. A one year lag is incorporated as planting activities are typically carried out at least one year after harvesting is completed.

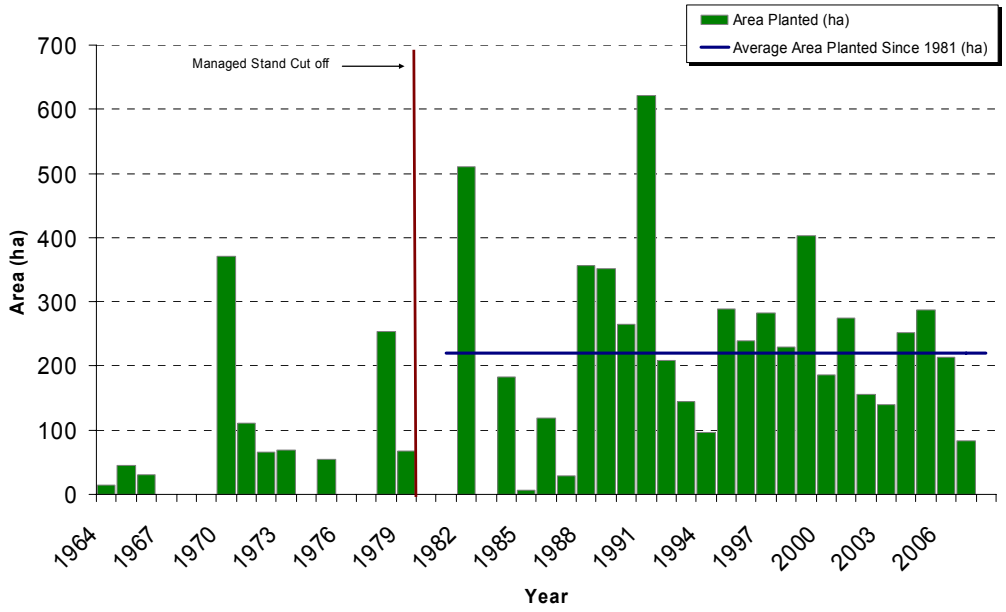


Figure 8. Planting history in TFL 56.

7.6 Backlog and Current NSR

Historically, there has been significant effort to eliminate all Backlog Not Satisfactorily Restocked (NSR) sites within TFL 56. As of 1999, all backlog areas had been brought up to standard or had been accepted at lower stocking levels because there was no practical treatment that would result in full stocking. This effectively eliminated all areas from the Backlog NSR classification.

A review of low stocking areas was conducted for this analysis, and approximately 997.8 ha have been identified as having low stocking levels. The average stocking level of these areas (468 ws sph) will be used as the initial density input for TIPSY to generate a low stocking yield curve (AU 501).

Current NSR will be modeled as per current inventory attributes.

8.0 Timber Harvesting

8.1 Minimum harvestable age / merchantability standards

For this analysis, minimum harvestable ages were defined by the following criteria:

1. Minimum volume of 150m^3/ha, and
2. Minimum diameter of 25cm dbh (largest 250 trees), and
3. At least 95% of maximum Mean Annual Increment (MAI) has been achieved.

Within the timber supply model, a stand can be considered for harvesting once it achieves its defined minimum harvest age. Note that these are minimum criteria, not the actual ages at which stands are forecast for harvest. Some stands may be harvested at the minimum thresholds to meet forest-level objectives (e.g., maintaining overall harvest levels for a short period of time or avoiding large fluctuations in harvest levels). However, other stands may be not be harvested until well past these "optimal" timber production ages due to management objectives for other resource values.

The minimum harvest age to be utilized for each analysis unit in the Base Case (with SIBEC adjusted yields) is defined in Table 30.

Table 30. Minimum harvest ages (adjusted site indices for managed AU's)

Existing AU's	Description	Age to Reach			MHA		Future AU's	Age to Reach			MHA
		Min DBH	Min Vol.	95% MAI				Min DBH	Min Vol.	95% MAI	
101	Nat-Fd-Good	60	60	80	**80**		201	40	40	60	**60**
102	Nat- Fd-Med	70	80	90	**90**		202	50	50	70	**70**
103	Nat- Fd-Poor	90	90	100	**100**		203	40	40	70	**70**
104	Nat- Bl Good <141	70	80	80	**80**		204	60	70	90	**90**
105	Nat- Bl-Med <141	90	110	100	**110**		205	80	90	120	**120**
106	Nat- Bl Good 141+	80	90	80	**90**		206	70	70	100	**100**
107	Nat- Bl-Med 141+	110	130	130	**130**		207	90	100	130	**130**
108	Nat-Cw Good <141	60	60	70	**70**		208	50	50	80	**80**
109	Nat-Cw Med <141	60	70	70	**70**		209	50	50	80	**80**
110	Nat- Cw Poor <141	90	90	80	**90**		210	50	50	80	**80**
111	Nat-Cw Good 141+	60	60	80	**80**		211	50	50	80	**80**
112	Nat- Cw Med 141+	70	70	80	**80**		212	50	50	80	**80**
113	Nat- Cw Poor 141+	90	90	80	**90**		213	50	50	80	**80**
114	Nat-Hw Good <141	60	60	70	**70**		214	50	50	80	**80**
115	Nat-Hw Med <141	80	80	90	**90**		215	50	50	80	**80**
116	Nat-Hw Poor <141	90	100	120	**120**		216	60	60	90	**90**
117	Nat-Hw Good 141+	70	60	80	**80**		217	50	60	90	**90**
118	Nat-Hw Med 141+	80	80	90	**90**		218	60	60	90	**90**
119	Nat-Hw Poor 141+	100	100	120	**120**		219	70	70	100	**100**
120	Nat-Sx Good <141	60	60	70	**70**		220	40	40	60	**60**
121	Nat-Sx Med <141	70	70	80	**80**		221	50	50	80	**80**
122	Nat-Sx Poor <141	100	100	120	**120**		222	50	60	80	**80**
123	Nat-Sx Good 141+	60	60	70	**70**		223	40	40	60	**60**
124	Nat-Sx Med 141+	70	80	90	**90**		224	50	50	70	**70**
125	Nat-Sx Poor 141+	100	110	130	**130**		225	80	80	110	**110**
501	Low stocking	60	70	110	**110**		601	50	50	80	**80**
502	Man-CwHw Good	50	60	80	**80**		602	50	50	70	**70**
503	Man-CwHw Med	50	60	90	**90**		603	50	50	90	**90**
504	Man-Fd	50	50	80	**80**		604	50	50	80	**80**
505	Man-SxBl Good	40	50	70	**70**		605	40	50	60	**60**
506	Man-SxBl Med	60	60	90	**90**		606	50	60	80	**80**

8.2 Harvest Systems

TFL 56 has a wide range of terrain and requires numerous harvest systems to be employed. RCFC has used regular skyline yarding, long line systems, and helicopter logging to access the steeper ground in the TFL, while ground based skidding equipment is used on the gentler terrain.

Through the detailed Total Chance Planning that has been completed for the TFL, an approximate harvest system profile can be defined (Figure 9) for the TFL's THLB area. Portions of this THLB area will still need to be reserved to meet non timber objectives. Further detail on harvest rules and priorities for these harvest systems can be found in Section 11.4.

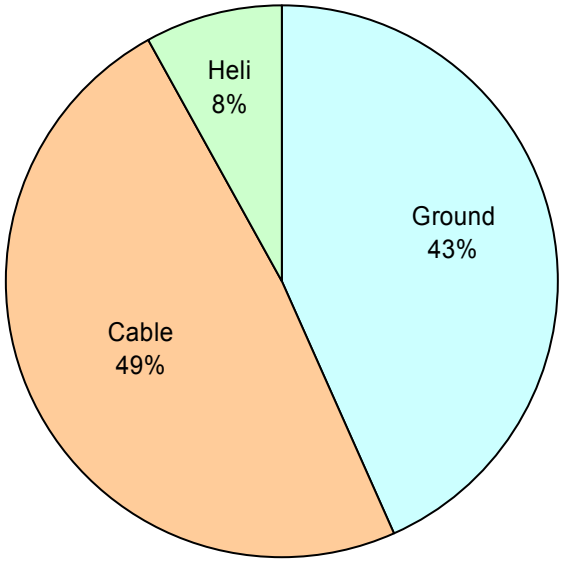


Figure 9. Approximate harvest system profile for TFL 56

9.0 Natural Forest Disturbance

9.1 Unsalvaged Losses

Unsalvaged losses provide an estimate of the average annual volume of timber that will be damaged or killed on the THLB and not salvaged or accounted for by other factors. These losses are result from atypical (epidemic) events related to a number of factors that cause tree mortality, including insects, disease, blowdown, snowpress, wildfires, etc. Endemic pest losses are dealt with through factors applied in the growth and yield models as noted below:

TIPSY: The OAF2 of 5% reduces gross volumes to account for losses toward maturity such as decay, and endemic forest health issues like minor infestations.
VDYP: The model predicts actual average yields from appropriate inventory ground plots. Endemic losses are inherently recognized in the model data.

Unsalvaged losses calculated for the TFL are summarized in Table 31. Appendix 3 contains the memorandum completed by RCFC that provides further detail on how unsalvaged losses were calculated.

Table 31. Unsalvaged losses

Description	Gross annual losses (ha/yr or m³/yr)	Conversion Factor / Assumptions			Annual Unsalvaged volume (m³/year)
		Rate of Salvage (%)	Proportion of Forested Landbase that is in THLB	Conversion	
Fire losses (29 year average)	34.4 ha/yr	80.0	25.6	364 m³/ha	655
Windthrow (12 year average)	516 m³	78.6	N/A	N/A	110
Pest (12 year average.)	1,206 m³/yr	85.6	N/A	N/A	173
Other	0	N/A	N/A	N/A	0
				Total	**938**

9.2 Disturbance in the Non-THLB

9.2.1.1 Disturbance of Areas Outside the THLB

As crown forested stands in the non-THLB contribute toward several forest cover objectives (i.e. landscape level biodiversity), it is important that the age class distributions in these stands remain consistent with natural processes. By implementing disturbance in these stands, a natural age class distribution can be maintained in the model and a realistic contribution toward seral goals ensured.

Assuming that disturbance occurs independently of stand age, a constant area will be disturbed annually in each LU/NDT combination on a random basis. The amount of disturbance in each LU/NDT combination is based on the BEC variants present and their associated natural disturbance intervals and old seral definitions as outlined in the *Biodiversity Guidebook* (September 1995) and Table 32

Using the negative exponential equation, the proportion of the forest that would typically occur as old seral forest can be calculated based on the disturbance interval (% area old = exp(-[old age / interval]). Using this % area in old, the calculation of an effective rotation age associated with this seral distribution is possible (Effective rotation age = interval / (1 – proportion old)). The effective rotation age can then be used to define an annual area of disturbance. For example, ESSF variants

in NDT3 have a disturbance interval of 150 yrs and an old definition of 140 yrs. This translates into a typical age class distribution where 39% of the area is "old" (>140 yrs) and the oldest stands are around 230 years. Thus 1/230th of the area needs to be disturbed each year to maintain this age class distribution.

The Base Case will include annual disturbance of the Non-THLB area in each LU as shown in Table 33. The stands to be disturbed will be randomly selected (without replacement) whenever possible and will be modeled at the LU/NDT level.

This methodology is a slight simplification of Option 4 in *Modeling Options for Disturbance Outside the THLB - Working Paper* (MoF, June 2003). Modeling of disturbance at the LU/BEC variant level was simplified to the LU/NDT level in order to minimize the number of modeled zones while ensuring that each zone has would have a single old seral age.

Table 32. Calculation of area to be disturbed annually in forested non-THLB by BEC/NDT

BEC *	NDT*	Disturbance Interval (yrs)	"OLD" Defn (yrs)	% Area > OLD**	Effective Rotation Age (yrs)**	Contributing Non-THLB Area (ha)	Annual Area Disturbed (ha)***
ESSF	1	350	250	49%	686	21,994	32
ICH	1	250	250	37%	395	13,619	34
ICH	3	150	140	39%	247	834	3
Totals						**36,447**	**70**

* Variants within the BEC/NDT combinations shown are treated the same.
** % area old = exp (-[old age / disturbance interval]), Effective rotation age = interval / (1 – % area old)
*** Annual area disturbed = Non-THLB area / effective rotation age

Table 33. Areas to be disturbed annually in the forested non-THLB by LU

LU	Annual Area Disturbed (ha)
Downie	51
Goldstream	19
Total	**70**

10.0 Integrated Resource Management

In order to accommodate the range of timber and non-timber resource objectives that occur within the TFL, forest cover requirements are applied within the timber supply model. These requirements maintain appropriate levels of specific forest types as needed to satisfy objectives for wildlife habitat, biological diversity, etc. This section of the document summarizes the types of management zones that occur in the TFL and the forest cover requirements that are applicable in to them. Forest cover requirements are typically expressed as:

- a maximum amount of forest that can be younger than age X (or shorter than height Y);
- a minimum amount of forest that must be older than age W (or taller than height Z);

Areas within the TFL can be subject to several overlapping management objectives. For example, a stand can be within an area managed for intermediate biodiversity and also be within a caribou habitat area. Overlapping objectives are modeled in such a way that ensures all requirements have been satisfied before harvest is allowed.

10.1 Visual resources

Although there are no legally established visual quality objectives within TFL 56, RCFC continues to engineer new harvesting areas with basic visual principles in mind. These principles involve the shape and configuration of cutblocks but not the overall percentage of viewscapes that may be modified and as such the overall AAC are not affected. Thus, no accounting for visual quality will be considered in this analysis.

10.2 Mountain Caribou

While the mountain caribou guidelines under the Higher Level Plan Order are currently legal management direction, it is assumed that the Species at Risk Coordination Office (SaRCO) caribou reserves will be legal by the time an AAC determination is made for TFL56. These new caribou reserves work to spatialize the requirements of the current HLP (status quo reserves) and then capture additional critical habitat areas (incremental reserves) in an effort to improve population survival rates. Both sets of reserves will be excluded from harvesting for the duration of the planning horizon in the Base Case. See section 5.3.12 for more information.

10.3 Grizzly Bear

The Revelstoke Higher Level Plan requires management for grizzly bear through the retention of forest cover adjacent to high value habitat (avalanche chutes). These 50 m buffers on one side of key avalanche chutes have not been explicitly modeled here because the high value habitat areas have not been identified spatially and the impact of these areas is meant to be captured in the old and mature seral retention impacts.

10.4 Wildlife Habitat Areas (WHAs)

Wildlife Habitat Areas (WHA's) are established by the Ministry of Environment to protect key habitat areas of red or blue listed species. Within the TFL, the only species for which a WHA has been established is for the Coeur d'Alene salamander *(Plethodon vandykei idahoensis).* See section 5.3.9 for more information.

10.5 Biodiversity

Biodiversity is managed at the landscape and stand levels. The primary mechanism for landscape-level management is retention of old and mature seral forest. Stand-level biodiversity is protected through retention of wildlife trees and wildlife patches. The following sections outline how retention of old and mature forest and wildlife trees/patches will be modeled.

10.5.1 Landscape-level biodiversity

Part 1, Section 1 and 2 of the Revelstoke Higher Level Plan Order (March 2005) specify the amount of old and mature forest that must be maintained within each BEC variant inside each Landscape Unit (LU). The requirement must be met independently above and below the operability line, so only the operable portion has been modeled here as it is the only area management has any influence. The RHLPO does not indicate the vintage for the operability line to be used for old seral requirements therefore, the most recent operability will be used (May 2008). Landscape units have been legally established along with Biodiversity Emphasis Option (BEO) assignments that guide the target level of old/mature forest in each BEC variant. The order states that in low biodiversity emphasis areas in TFL's 55 and 56, no mature seral objectives are required and old seral objectives can be reduced to 1/3 of target values, as long as full old targets are met within 240 yrs. The achievement of the old seral retention targets will be accomplished by using spatial OGMAs for the first 80 years of the planning horizon after which spatial constraints will be applied.

Old seral requirements for each BEC/BEO combinations are provided in Table 34. Specific LU/BEC BEO management zones are provided in Table 35.

Spatial Old Growth Management Areas (OGMAs) have been developed by MoAL – Integrated Land Management Bureau (ILMB) and will be reserved from harvest in the model for the first 80 years to meet the objectives of the higher level plan requirements for old seral retention. The areas associated with these spatial OGMAs are included in Table 35 and although there is some variation in reserved areas relative to targets, the goal for the operable portion of the TFL is met (+1.0%). When assessed over the entire CFLB area, the spatial OGMAs are within ±0.1%. In order to ensure full targets are reached within 240 yrs for low BEO areas, % constraints were implemented in the model at years 80 and 160 consistent with the %'s shown in Table 35. In addition, % constraints were also applied to ensure the mature +old targets were achieved within the intermediate BEO areas.

Table 34. Old and mature seral definitions and target levels from the HLP

				Mat + Old Targets			Old Targets				
BEC Zone	NDT	Mat Age (yrs)	Old Age (yrs)	Low BEO	Inter BEO	High BEO	Low * 1st Rot	Low * 2nd Rot	Low * 3rd Rot	Inter BEO Old	High BEO Old
ESSFvc	1	>120	>250	19	36	54	6.3	12.6	19	19	28
ICHvk / ICHwk	1	>100	>250	17	34	51	4.3	8.6	13	13	19
ICHmw3	3	>100	>140	14	23	34	4.7	9.3	14	14	21

* Old seral requirements in Low BEO areas start at 1/3 old for first 80 years, 2/3 old for the next 80 years, and full old beyond.

Table 35. Old seral forest requirements for TFL 56

LU	BEO	BEC Variant	Operable CFLB (ha)	THLB (ha)	Mature Age Defn	% Old + Mat Req.*	Old Age Defn	% Old Req.*	% OGMA/MMA Estab.
Downie	Inter	ESSFvc	71	42	120	36%	250	19%	0.7

LU	BEO	BEC Variant	Operable CFLB (ha)	THLB (ha)	Mature Age Defn	% Old + Mat Req.*	Old Age Defn	% Old Req.*	% OGMA/MMA Estab.
(R12)		ICH mw 3	1,664	974	100	34%	250	13%	13.6
		ICH vk 1	3,867	2,431	100	34%	250	13%	12.8
		ICH wk 1	2,755	1,582	100	23%	140	14%	13.9
	Low	ESSFvc	6,447	2,365	120	0%	250	6.3/12.6/19	11.5
		ICH mw 3	283	223	100	0%	250	4.3/8.6/13	2.2
		ICH vk 1	3,186	2,099	100	0%	250	4.3/8.6/13	4.6
		ICH wk 1	4,069	2,281	100	0%	140	4.7/9.3/14	5.0
Goldstream (R19)	Inter	ESSFvc	171	135	120	36%	250	19%	16.2
		ICH mw 3	21	6	100	34%	250	13%	18.3
		ICH vk 1	2,808	2,274	100	34%	250	13%	12.1
		ICH wk 1	839	573	100	23%	140	14%	14.2
	Low	ESSFvc	3,187	2,293	120	0%	250	6.3/12.6/19	7.2
		ICH vk 1	4,496	3,711	100	0%	250	4.3/8.6/13	4.8
		ICH wk 1	2,063	1,582	100	0%	250	4.3/8.6/13	4.7
Totals			**35,929**	**22,574**	**Wtd avg. target**			**8.0**	**9.0**

* Percent requirements are met within the productive operable forest of each LU/BEC/BEO combination. Variants with more than one target % are those that are reduced to 1/3 initially and then reach full target by 240 yrs.

10.5.2 Stand-level biodiversity — wildlife tree retention

Wildlife tree retention (WTR) at the stand level is one of the primary methods to address stand level biodiversity objectives in BC. RCFC's has committed to leaving 7% wildlife tree retention associated with each block harvested but much of this retention has already been accounted for under various other netdowns (i.e. riparian, etc). In order to estimate the net impact of the 7% WTR objective, an analysis was completed using the following steps:

All forested areas not part of the THLB as well as spatial OGMAs were buffered by 250m in order to identify areas in the THLB that would still require additional WTP's. The assumption is that WTP's need to occur roughly every 500m (consistent with MP3). Any THLB areas not covered by the buffer (5,548 ha) were assumed to require WTP's totaling an average of 7% or 388 ha. To determine the WTP percent reduction to apply to all future managed yield curves, this 388 ha requirement is divided by the total area of THLB (less OGMAs) in the TFL (388 ha required / 22,219 ha total THLB area = 0.0175). Therefore, a 1.75% yield reduction was applied to all yield curves.

10.5.3 Patch Size Distributions

RCFC works to be consistent with the patch size distribution regimes outlined in the *Landscape Unit Planning Guidebook*. It describes the desired future condition for the managed landscape as follows:

NDT 1

Small patches	(0-40 ha)	30-40% of landbase
Medium patches	(40-80 ha)	30-40% of landbase
Large patches	(80-250 ha)	20-40% of landbase

NDT 3 (with Douglas-fir)

Small patches	(0-40 ha)	20-30% of landbase
Medium patches	(40-80 ha)	25-40% of landbase
Large patches	(80-250 ha)	30-50% of landbase

Control of patches according to these targets will be applied in the model at the NDT level (the 2 LU's area lumped because of small areas) for young seral stands (<20 years) only (consistent with the *Landscape Unit Planning Guidebook*). The intent is to move the current patch size distribution toward the desired future condition but it will be given a low priority within the model as patch management in the TFL is considered secondary to meeting other objectives. For example, very large patches are often not possible in steep narrow valleys with frequent slide chutes, but can be more prominent on rounded landforms where fires would have naturally created large openings.

11.0 Timber Supply Modeling

11.1 Timber supply model

The following timber supply model will be used for this analysis:

Name: PATCHWORKS™

Type: Multiple-objective goal-programming model (optimization heuristic)

Description: Patchworks is a fully spatial forest estate model that can incorporate real world operational considerations into a strategic planning framework. It utilizes a goal seeking approach and an optimization heuristic to schedule activities across time and space in order to find a solution that best balances the targets/goals defined by the user. Targets can be applied to any aspect of the problem formulation. For example, the solution can be influenced by issues such as mature/old forest retention levels, young seral disturbance levels, patch size distributions, conifer harvest volume, growing stock levels, snag densities, CWD levels, ECA's, specific mill volumes by species, road building/hauling costs, delivered wood costs, net present values, etc. Patchworks continually generates alternative solutions until the user decides a stable solution has been found. Solutions with attributes that fall outside of specified ranges (targets) are penalized and the goal seeking algorithm works to minimize these penalties – resulting in a solution that reflects the user objectives and priorities. Weightings are designed such that hard constraints are either met immediately or as soon as possible given the initial conditions.

11.2 Initial harvest rate

Initial harvest levels will be attempted at the current AAC (100,000 m³/year) + unsalvaged losses from section 9.1. but may change in necessary to meet harvest flow policy.

11.3 Planning horizon and planning periods

The first year of modeling is referenced to 2008. Planning periods will be at a resolution of 5 years and the harvest horizon will be assessed over 300 years.

11.4 Harvest priorities and rules

Harvesting on the TFL will be split into 3 main stratums: Regular harvest, Pulpwood harvest, and aerial harvest. Dynamic limits will be placed on the pulpwood and aerial harvest stratums to ensure the decadal harvest volume coming from each of these stratums are realistic and reflect the anticipated contribution of each partition. Historically, pulpwood harvest volume percents have varied but RCFC feels that a desirable economic limit is 35%. Helicopter harvest will be limited to 10% of harvest volume. Harvest systems were assigned to the landbase as part of the detailed Total Chance Planning that occurred in the TFL. A summary of the harvest rules and priorities implemented in the model is shown in Table 36.

Table 36. Harvest priorities and rules.

Description	Maximum % of harvest in each decade
Regular harvest	100%
Pulpwood (Hw/Bl/Sx)	35%
Aerial	10%

Pulp wood contribution will be defined dynamically in each planning period using the following assumptions:

Species	Age<*120 yrs*	*120-180 years*	*>180 years*
Hemlock volume:	0% pulp	50% pulp	90% Pulp
Balsam volume:	0% pulp	50% pulp	50% Pulp
Spruce volume:	0% pulp	20% pulp	20% Pulp

This was implemented by assigning a pulp volume curve to each AU in the model that reflected the ages above and the unique species distribution for the AU. Weighted average percent Hw, Bl, and Sx were derived for each AU from the inventory for existing natural stands.

11.5 Harvest flow objectives for Base Case

As per provincial guidelines, the base case analysis will:

- Transition from short-term to medium- and long-term harvests, avoiding large and abrupt disruptions in supply (generally increases and decreases in steps of 10% per period). The initial harvest rate is described in an earlier section.
- Manage the degree to which mid-term timber supply drops below the long-term sustainable harvest level, avoiding very deep mid-term reductions in harvest, and;
- Correctly choose the timing of increase to the long-term sustainable timber supply if it is higher than mid-term levels. Long term harvest levels should generally be non-declining and begin at the period in which the majority of the harvest contribution is coming from managed stands.
- Not result in an Long-term harvest level (LTHL) that is less than the Long-Run Sustained Yield (LRSY) calculated for natural stand yields (VDYP natural stand yields).
- Ensure sustainability by ensuring that the LTHL does not result in a declining growing stock (m^3) on the THLB.

11.6 Sensitivity analyses

The data and assumptions used in timber supply analysis are often subject to uncertainty. To provide a perspective on the impacts to timber supply of uncertainty in the data or assumptions, sensitivity analysis is commonly performed.

Sensitivity analysis is a key component of any Management Plan Review process. Sensitivity analysis permits the determinant (the Chief Forester) to gauge the potential impact of uncertainty around assumptions and data that make up the Base Case. Sensitivity analyses help to frame the potential impacts of uncertainty by analyzing scenarios that are more pessimistic and more optimistic than the base case.

Sensitivities planned for TFL56 are shown in Table 37.

Table 37. Planned sensitivity analyses

Sensitivity analysis	Zone / group / analysis unit subject to uncertainty	Description	Expected Pressure
Alternative Harvest Flows for Base Case	All Stands	Vary the starting harvest flow to maximize 1st period harvest, and find the highest non declining flow.	n/a
Size of Timber Harvesting Land base	Timber Harvesting Land Base (THLB)	The timber harvesting land base will be increased and decreased by +/– 10%.	+/-
Satisfy Landscape Level Biodiversity with % Constraints	Timber Harvesting Land Base (THLB)	Remove spatial OGMAs and use % Landscape Level Constraints in place	+
Revelstoke HLPO Status Quo Caribou Constraints	Timber Harvesting Land Base (THLB)	Use HLPO requirements over SaRCO Spatial Reserves to Satisfy Status Quo Caribou	+
Managed Stand Yields	Managed Stands	The volume associated with managed stands will be increased and decreased by +/- 10%	+/-
Natural Stand Yields	Natural Stands	The volume associated with natural will be increased and decreased by +/- 10%	+/-
Site Productivity estimates for ESSF	Managed Stands	Use SIEBC SI's in ESSF stands.	+
No SIBEC	Managed Stands	Remove SIBEC adjusted SI's	-
Armillaria Root rot	Managed Stands	TIPSY low severity *Amillaria* OAF 2 applied to Douglas-fir in the ICH	-
Minimum Harvest Ages	All Stands	Minimum Harvest ages will be increased and decreased by +/- 10years.	+/-
Exclude Hw leading (>80%)	All Stands	Remove Hw (>80%) areas from THLB	-
Change pulp % limits	All Stands	Change pulp contribution to max 20% and/or max 40%	+/-

11.7 Long Run Sustained Yield

Long run sustained yield (LRSY) values calculated on the basis of both natural and managed stand yield curves are shown in Table 38. Managed stand yields are based on SIBEC adjusted site indices.

Table 38. LRSY values for natural and managed stands

Description	Natural (VDYP)	Managed (TIPSY)
THLB less OGMAs (ha)	22,219	22,219
- Future roads (ha)	0	459
- Wildlife tree patch retention (m^3/yr)	388	388
= Long term THLB (ha)	21,831	21,373
* Average MAI at culmination (m^3/ha)	2.50	5.28
= Theoretical Gross LRSY (m^3/yr)	**54,569**	**112,740**
- Non-recoverable losses (m^3/yr)	938	938
= Theoretical Net LRSY (m^3/yr)	**53,631**	**111,802**

12.0 Differences from MP3

Since the last management plan review for the TFL, several input datasets and assumptions have changed and they are summarized here.

Differences that affect the THLB Definition:

- Updated Inventory to VRI standards in 2002 with attributes updated to 2008.
- Revision of non-productive forest definition (based on VRI Inventory and logging history)
- Operability review (2008) – resulted in reduction of operable area relative to 1999 operability.
- Exclusion of the Downie Saltlick.
- Exclusion of Heli Hemlock stands in non-merchantable definition.
- Exclusion of WHA for Coeur d'Alene Salamander.
- No exclusion of any Keystone LRUP zones (although has no effect because the area is removed through caribou and old seral reserves anyways).
- New SaRCO caribou management guidelines (Draft GAR Order #U-3-005)and associated spatially explicit reserves.
- Use of spatially explicit Old Growth Management Areas to satisfy Old requirements set out in the Revelstoke Higher Level Plan.
- Mature Forest Retention Areas (MFRAs) are no longer used because they have been replaced by spatial OGMAs, Caribou Reserves, and % constraints for mature + old seral objectives – while retention for ungulate winter range is no longer required.

When compared to the THLB from MP3 (30,702 - 9,074 MFRAs = 21,628 ha), the new effective THLB, which includes reductions for Caribou and spatial OGMAs (22,575 -355 =22,220 ha) are considered, increases the THLB by **592 ha**.

Other differences include:

- Use of SIBEC adjusted site indexes in the ICH for managed stand yields. The use of SIBEC adjusted yields for the ICH was approved because the new PEM passed the accuracy assessment in the ICH.
- Revision of regeneration assumptions including:
    - Minor changes in species composition.
    - Inclusion of select seed gains for Spruce and Douglas-fir.
- No management for Ungulate Winter Range (deer and moose). Ungulate Winter Range was modeled in MP3 because draft recommendations for Ungulate Winter Range Management stemming from the *Revelstoke and Area Land Use Planning Final Recommendations* (often deemed the "MAC" plan) were adopted. However, none of the interim UWR management requirements were adopted when the Revelstoke Higher Level Plan was finalized in 2005. Under FPRA, GAR orders for Ungulate Winter Range Management have been implemented on the Revelstoke TSA but of these have impacted TFL 56.
- Revision of assumptions for wildlife tree retention – 1.75% reduction applied to all yield curves. A yield reduction approach was adopted over spatial netdowns because it is felt that differences in timber supply on a management unit level between the two methods are inconsequential.
- Limits were placed on the amount of pulpwood harvest and aerial harvest in each decade to ensure consistency with past performance.
- No longer modeling Complex Stand Yields. The analysis for MP3 modelled group selection however, this practice was primarily focused on caribou areas and is no longer common practice in these areas. Explicit caribou reserves have been defined and the areas outside of the reserves will be managed using clearcut with reserves silviculture systems.
- Use of PATCHWORKS^{TM} to conduct timber supply modeling.

13.0 References

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Timberline. 2008. Level 4 Map Accuracy Assessment of the Revelstoke TSA and TFL 56 Predictive Ecosystem Mapping – Analysis Report (Interim). Prepared for Downie Street Sawmills and Revelstoke Community Forest Corporation.

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Appendix 1 — Acronyms

AAC	Allowable Annual Cut
Analysis	Timber Supply Analysis
AU	Analysis Unit
BCTS	BC Timber Sales (Formerly Small Business Forest Enterprise Program)
BEC	Biogeoclimatic Ecosystem Classification
BEO	Biodiversity Emphasis Options
BGB	Biodiversity Guidebook
BL	Balsam Fir
CF	Chief Forester
CFLB	Crown Forested Land base
CW	Western Red Cedar
DBH	Diameter at breast height (1.3m)
DFO	Department of Fisheries and Oceans
DM	District Manager
ESA	Environmentally Sensitive Area
FD	Douglas Fir
FIP/FC1	Old Forest Cover Digital Files
FIZ	Forest Inventory Zone
FPC	Forest Practices Code
FRPA	Forest and Range Practices Act
GIS	Geographic Information System
HLPO	Higher Level Plan Order
HW	Western Hemlock
ILMB	Integrated Land Management Bureau
KBHLPO	Kootenay Boundary Higher Level Plan Order
LA	Alpine Larch
LRMP	Local Resource Management Plan
LU	Landscape Unit
LW	Western Larch
MoAL	Ministry of Agriculture and Lands
MoE	Ministry of Environment
MoF	Ministry of Forests
MSY	Maximum Sustained Yield
MSYT	Managed Stand Yield Tables
MP	Management Plan
NCC	Non-Commercial Cover
NDT	Natural Disturbance Type
NP	Non Productive
NRL	Non-Recoverable Losses
NSR	Not Satisfactorily Restocked
NSYT	Natural Stand Yield Tables
OAF	Operational Adjustment Factor
OGMA	Old-Growth Management Areas
PA	Whitebark Pine
PEM	Predictive Ecosystem Mapping
PL	Lodgepole Pine
PSP	Permanent Sample Plot
PSYU	Public Sustained Yield Unit
PW	White Pine
PY	Ponderosa Pine
RIC	Resources Inventory Commission
RM	Regional Manager
RMZ	Riparian Management Zone
ROS	Recreation Opportunity Spectrum
RTEB	Resource Tenures and Engineering Branch
TFL	Tree Farm License
THLB	Timber Harvesting Land base
TIPSY	Table Interpolation Program for Stand Yields (growth and yield model)
TSA	Timber Supply Area
TSR	Timber Supply Review
UREP	Use, Recreation, and Enjoyment of Public
VDYP	Variable Density Yield Predictor (growth and yield model)
VEG Ht	Visually Effective Greenup Hieght
VQO	Visual Quality Objective

Appendix 2 – Analysis Unit Volumes

TFL 56 Yield Curves (As used in Model - includes reductions for WTPs And RTLs where Applicable)

Age	Exisitng Natural Yields (VDYP)																								
	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	10	2	0	4	0	0	0	5	1	0	0	0	0	4	0	0	1	0	0	0	0	0	0	0	0
40	56	26	9	29	5	20	1	63	43	1	56	29	3	54	4	0	37	1	0	60	10	0	44	2	0
50	111	65	39	67	26	52	9	116	90	31	110	77	38	123	40	1	107	37	2	142	55	4	122	38	2
60	162	106	75	105	49	86	25	165	133	66	160	121	75	184	92	24	168	93	21	211	112	25	189	95	15
70	210	145	110	142	79	121	50	208	170	97	205	160	107	237	140	64	221	143	59	268	162	62	244	145	45
80	254	181	143	172	102	150	72	247	205	125	247	197	138	284	182	104	268	188	100	314	205	102	291	189	81
90	292	215	173	198	123	174	92	275	230	147	277	223	160	318	217	138	302	224	136	349	240	138	328	227	116
100	327	246	199	220	141	195	109	298	250	165	301	245	179	346	245	166	329	253	168	376	269	169	357	258	146
110	355	274	224	240	157	215	125	316	266	180	320	262	194	368	269	191	350	277	196	397	294	197	382	285	174
120	379	297	245	258	171	232	139	331	278	192	335	275	206	385	289	212	367	297	219	414	314	221	402	308	198
130	403	320	266	278	188	252	154	354	298	209	360	297	225	408	312	235	390	321	245	433	334	245	421	329	222
140	425	341	286	297	204	271	169	376	318	225	385	318	242	428	332	256	410	342	267	449	352	266	438	348	243
150	445	360	303	314	220	289	183	396	335	241	408	338	259	446	350	276	428	361	288	463	368	286	453	365	262
160	464	377	319	331	235	307	196	415	351	255	430	357	274	461	366	293	444	378	306	476	382	304	465	380	279
170	481	392	333	346	249	324	209	432	366	269	451	375	289	475	380	309	457	393	323	486	394	320	476	393	295
180	497	407	347	361	263	340	221	449	380	281	471	392	303	487	392	323	469	406	338	496	405	335	486	405	310
190	512	422	360	375	277	355	233	465	394	293	490	408	316	498	403	336	479	418	351	504	415	348	494	415	322
200	527	435	374	388	290	370	244	480	407	305	509	424	329	508	415	349	490	430	364	513	424	360	502	424	334
210	541	448	386	401	302	384	254	495	420	317	527	439	341	518	426	361	500	441	377	520	432	372	509	433	346
220	554	460	398	413	314	397	265	512	434	330	548	457	356	527	436	372	508	452	388	527	440	383	515	441	356
230	566	472	410	424	325	410	275	529	449	343	568	474	370	535	446	384	516	462	400	534	447	393	521	448	365
240	578	483	421	435	337	423	284	545	463	356	588	492	384	542	455	394	523	472	411	540	454	402	525	454	374
250	590	494	432	446	348	434	294	561	476	369	607	509	398	549	463	404	530	480	421	546	460	411	530	460	382
260	591	496	434	448	349	435	296	562	477	371	609	510	400	552	466	410	533	484	428	548	463	416	532	463	388
270	592	497	437	450	350	437	298	563	479	374	610	512	402	555	470	415	536	488	434	549	466	421	534	467	393
280	594	499	440	452	350	438	300	564	480	375	611	513	404	557	473	419	539	491	440	550	468	425	536	469	398
290	595	500	442	454	351	439	302	565	481	377	612	514	406	559	476	422	541	494	445	551	470	429	537	472	403
300	596	502	445	455	352	440	304	566	482	379	613	515	408	561	479	425	543	497	450	552	472	432	539	474	407
310	597	503	447	457	353	440	306	567	482	381	614	516	409	563	482	428	545	499	454	553	474	435	539	476	411
320	598	504	449	458	354	441	307	567	483	382	614	517	411	564	484	431	547	502	457	554	475	438	540	477	414
330	598	505	452	460	354	442	309	568	484	383	615	518	412	566	487	433	549	504	461	554	477	440	541	479	417
340	599	506	454	461	355	442	310	569	484	384	616	519	413	567	489	435	551	506	464	554	478	442	541	480	420
350	600	507	456	462	355	443	312	569	485	385	616	519	414	568	491	437	552	508	467	555	479	444	541	481	422

Age	Future Managed Yields (TIPSY)																								
	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	45	34	39	0	0	0	0	5	4	2	6	4	2	3	2	1	1	1	0	32	4	1	34	10	0
40	156	133	148	14	0	2	0	72	71	52	86	69	52	63	59	29	35	33	5	149	64	35	151	94	1
50	267	246	256	72	6	32	1	178	177	148	198	173	148	162	155	112	121	118	46	264	160	113	267	200	12
60	355	334	346	144	34	89	11	282	280	244	301	276	242	257	249	199	210	206	115	366	250	192	370	296	50
70	431	412	425	209	80	151	39	366	364	327	390	359	326	337	330	279	291	287	185	445	329	264	448	378	102
80	487	477	488	271	130	204	78	449	446	402	472	442	401	412	404	347	360	355	251	505	397	328	508	442	154
90	536	526	544	324	175	255	121	520	518	470	542	513	468	477	468	412	425	420	308	552	450	378	555	492	199
100	578	572	593	366	216	301	161	578	576	528	599	572	526	531	523	467	481	476	360	591	492	416	594	532	242
110	578	609	593	398	256	340	196	625	623	575	649	619	573	576	567	515	527	523	409	622	526	446	625	568	282
120	578	609	593	424	291	370	229	678	676	616	702	671	614	618	608	554	566	562	452	647	557	470	650	595	316
130	578	609	593	443	322	394	262	723	721	661	745	715	659	659	650	588	604	597	490	667	582	491	670	618	346
140	578	609	593	460	348	413	290	759	757	698	779	752	697	691	683	626	641	636	521	685	602	508	688	637	369
150	578	609	593	474	368	429	316	789	786	727	809	783	726	719	711	658	671	666	548	685	619	518	688	652	389
160	578	609	593	486	385	443	336	816	813	753	836	809	752	743	735	683	695	691	573	685	633	528	688	666	405
170	578	609	593	493	399	454	354	840	838	776	860	833	774	765	756	705	717	712	601	685	646	537	688	677	419
180	578	609	593	498	411	463	368	862	860	797	881	855	795	785	777	724	736	732	626	685	656	544	688	688	431
190	578	609	593	502	421	471	381	881	878	815	900	874	814	803	794	741	754	749	647	685	665	550	688	688	441
200	578	609	593	506	430	478	392	898	895	832	916	891	831	818	809	757	770	765	663	685	673	555	688	688	449
210	578	609	593	510	437	481	400	912	910	846	916	906	845	832	823	772	785	780	677	685	680	559	688	688	457
220	578	609	593	512	443	484	408	912	910	860	916	906	858	844	836	785	797	793	690	685	685	562	688	688	464
230	578	609	593	514	449	486	415	912	910	870	916	906	869	844	847	795	807	803	701	685	685	564	688	688	470
240	578	609	593	515	453	488	421	912	910	880	916	906	879	844	847	805	817	813	712	685	685	565	688	688	473
250	578	609	593	517	457	489	425	912	910	880	916	906	879	844	847	814	826	822	722	685	685	568	688	688	476
260	578	609	593	517	459	490	429	912	910	880	916	906	879	844	847	821	834	829	730	685	685	569	688	688	478
270	578	609	593	517	460	491	433	912	910	880	916	906	879	844	847	828	841	836	739	685	685	570	688	688	480
280	578	609	593	517	461	492	436	912	910	880	916	906	879	844	847	834	847	842	746	685	685	570	688	688	481
290	578	609	593	517	461	492	439	912	910	880	916	906	879	844	847	840	847	842	752	685	685	570	688	688	483
300	578	609	593	517	461	492	439	912	910	880	916	906	879	844	847	840	847	842	752	685	685	570	688	688	483
310	578	609	593	517	461	492	439	912	910	880	916	906	879	844	847	840	847	842	752	685	685	570	688	688	483
320	578	609	593	517	461	492	439	912	910	880	916	906	879	844	847	840	847	842	752	685	685	570	688	688	483
330	578	609	593	517	461	492	439	912	910	880	916	906	879	844	847	840	847	842	752	685	685	570	688	688	483
340	578	609	593	517	461	492	439	912	910	880	916	906	879	844	847	840	847	842	752	685	685	570	688	688	483
350	578	609	593	517	461	492	439	912	910	880	916	906	879	844	847	840	847	842	752	685	685	570	688	688	483

Age	Existing Managed Yields (TIPSY)						Future Managed Yields (TIPSY)					
	501	502	503	504	505	506	601	602	603	604	605	606
0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0
30	1	2	2	23	15	0	7	5	2	22	23	1
40	30	53	50	116	110	23	81	73	52	115	135	34
50	86	144	143	222	222	97	181	170	146	217	247	114
60	151	229	237	320	325	181	274	257	238	312	352	196
70	212	310	318	412	409	252	354	339	318	402	424	272
80	278	378	394	492	467	322	426	396	391	480	475	338
90	337	425	465	565	509	381	485	437	457	549	514	390
100	387	460	525	631	545	425	535	469	514	613	542	429
110	433	489	574	683	574	457	579	495	561	663	560	459
120	480	513	617	728	587	484	620	515	602	706	573	484
130	521	532	664	767	598	506	654	524	647	744	583	504
140	557	544	704	802	608	527	683	531	685	778	590	522
150	586	551	738	833	616	543	709	537	715	808	597	533
160	614	556	765	861	622	556	732	542	742	835	597	540
170	639	561	790	886	622	562	752	547	766	858	597	547
180	660	565	813	886	622	569	770	550	788	858	597	553
190	680	569	834	886	622	574	786	551	809	858	597	558
200	698	571	852	886	622	578	800	553	826	858	597	562
210	713	573	869	886	622	582	800	555	842	858	597	565
220	726	575	884	886	622	584	800	556	856	858	597	567
230	726	575	897	886	622	586	800	556	869	858	597	568
240	726	575	908	886	622	587	800	556	880	858	597	569
250	726	575	919	886	622	588	800	556	880	858	597	569
260	726	575	928	886	622	588	800	556	880	858	597	569
270	726	575	936	886	622	588	800	556	880	858	597	570
280	726	575	936	886	622	588	800	556	880	858	597	570
290	726	575	936	886	622	588	800	556	880	858	597	570
300	726	575	936	886	622	588	800	556	880	858	597	570
310	726	575	936	886	622	588	800	556	880	858	597	570
320	726	575	936	886	622	588	800	556	880	858	597	570
330	726	575	936	886	622	588	800	556	880	858	597	570
340	726	575	936	886	622	588	800	556	880	858	597	570
350	726	575	936	886	622	588	800	556	880	858	597	570

Appendix 3 – Unsalvaged Losses Memorandum

Revelstoke Community Forest Corporation

Management Plan #4 Memorandum

To: **Information Package Report**
From: **Kevin Bollefer, R.P.F.**
Subject: **Non-Recoverable Losses**
Date: **July 1, 2008**

An estimate of unsalvaged losses is required in order to net down growth estimates on forest sites in TFL 56. In this memo, losses due to fire, windthrow, and pests are estimated. They are then reduced to account for the portion of the losses that are salvaged. A brief discussion of each loss category, and those potential categories not accounted for here, are presented below.

Fire: To calculate fire losses, information regarding wildfires was collected using the Ministry of Forests Protection Branch "Fire reporting system". Data from 1955 to 2007 was available but the information from 1979 to present was used, as it was the cutoff date used from the RCFC Management Plan #3 and was thought to best represent our level of fire suppression success.

A number of assumptions were used when calculating losses due to fire. The first assumption was that the fires are evenly distributed across the forested landbase. This will have a tendency to over-estimate the fires in the THLB as the majority of fires occur on steep ridge tops, caused by lightning, which is typically above the operability line. The second assumption of an 80% salvage rate was used, as it was the same proportion used in MP #3 and RCFC strives to salvage all economical burnt timber. The final assumption was to use 364 m^3/hectare over the 1.8 hectares of unsalvaged timber. This volume value was calculated by averaging five Cutting Permit blocks in the ESSF and five in the ICH.

Table 1. Fire Losses

Description	*Area, proportion, or volume*
Average annual loss on entire forested landbase	34.4 hectares
Proportion of forested landbase that is in THLB	25.6%
Average annual loss on THLB	8.8 hectares
Rate of salvage	80%
Unsalvaged loss due to fire	1.8 hectares (655 m^3)
	0.0057% of THLB annually

The Ministry of Forests' data for the TSA suggests a loss of 30.1 hectares over the THLB of 78,018 hectares (a loss of 0.038%). RCFC's estimated loss is 0.0057%, somewhat lower, most likely reflecting the lower fire rate in our climatically wetter portion of the district and our more developed network of roads (for salvage and control).

Windthrow: Windthrow losses are those losses caused by catastrophic windthrow events – not individual or small groups of trees, but patches or stands. Non-catastrophic windthrow events are accounted for through the growth curve formulation. Catastrophic events were "captured" by reviewing recent records (1995 to 2007 inclusive) for windthrow events in the TFL area. Annual overview flights are completed to check for windthrow, pest activities and road problems. Any windthrow events over 0.5

hectares would likely be spotted during these flights and other observations. Data is summarized in the table below and fully displayed in the attachment.

Table 2. Windthrow Losses

Description	*Area, proportion, or volume*
Average annual loss on THLB	516 m^3
Average rate of salvage	78.6%
Unsalvaged loss due to fire	110 m^3

The above table includes all known windthrown stands within the THLB and the actual harvest salvage rates. The Ministry of Forests, in their recent TSR, found windthrow losses on the TSA to be 230 m^3. Considering their timber harvesting landbase is over twice as large as the TFL, the numbers are roughly equivalent.

Pest: Pest loss estimates were obtained in the same way that the windthrow estimates were. Records and observations from annual overview flights and general observations were compiled (see attachment). Harvest data was used to quantify salvage rates.

Significant pest losses were observed for three species of insects – spruce bark beetle, Douglas-fir bark beetle and hemlock looper. The hemlock looper historic cycle has been observed twice on the TFL 1992/1993 and 2002/2003 and is expected again around 2010/2012. Although many other pests inhabit the area, they are considered to be at endemic levels and are accounted for in the growth curve compilation.

Table 3. Pest Losses

Description	*Area, proportion, or volume*
Average annual loss on THLB	1206 m^3
Average rate of salvage	85.6%
Unsalvaged loss due to fire	173 m^3

The Ministry of Forests, in their recent TSR, found pest losses on the TSA to be 660 m^3. Considering their landbase is over twice as large as the TFL, the numbers are roughly equivalent.

Avalanche: There have been no significant avalanche losses. This is expected as the avalanches are usually confined to existing tracks. RCFC has observed no significant activity in harvested cutblocks on the TFL.

Armillaria: We have assumed losses to Armillaria to be endemic rather than catastrophic. Armillaria is widespread and can be found in a high proportion of TFL 56 stands. Observed mortality has been very light and dispersed. The growth curve data for the TFL captures such losses so no further deductions are needed.

Summary: Losses are summarized in the table below.

Table 4. Summary of Non-salvageable Losses

Description	*Annual unsalvaged volume*
Fires Losses	655 m^3
Windthrow Losses	110 m^3
Pest Losses	173 m^3
Other	0 m^3
Total	***938 m^3***

The attached spreadsheets provide a rationale and data for each of the loss categories above.

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