

Revelstoke Timber Supply Area Timber Supply Review

Data Package

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1. Introduction

This data package outlines the basic information and assumptions that are required for the Revelstoke Timber Supply Area (TSA) timber supply analysis.

The completed data package contains those inputs that are a part of current performance for the timber supply area. For the purpose of the timber supply review, "current performance" can be defined:

by the current forest management regime — the productive forest land available for timber harvesting, the silviculture treatments, the harvesting systems and the integrated resource management guidelines used in the area;

- by the standards used to approve or reject forest development (5-year development) plans;
- by fully implemented land-use plans;
- by land-use decisions approved by Cabinet;
- by approved higher level plans under the Forest Practices Code, and
- by other approved B.C. Forest Service and joint agency forest management practices and policy.

This idea of current performance should be kept in mind at all times when reviewing the data package. In other words, the purpose of the timber supply review program is to model "what is" not "what if". Changes in forest management objectives and data, when and if they occur, will be captured in future timber supply analyses.

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

- 1) A short explanation of the data needed to properly fill out the data table;
- 2) Data table;
- 3) The source of the data and comments.

This data package, while representing the best available knowledge and information today, is subject to change. As noted in several sections, until the timber harvesting land base is determined, it is not possible to finalize the values shown in some of the tables in this package. In some cases the criteria are shown but the final value is not yet filled in. In these cases the columns show as gray shaded in the tables. In addition, if any major changes to management regimes occur over the next few months, the timber supply analysis will attempt to capture these changes. The final timber supply analysis report will include a technical appendix which will highlight any changes made to this package.

2. Current Forest Management Considerations and Issues

2.1 Base case management assumptions

These assumptions reflect current performance with respect to the status of forest land, forest management practices and knowledge of timber growth and yield. The harvest forecast developed from these assumptions is termed the base case harvest forecast and is used as a baseline term of reference. Section 7, "Sensitivity Analyses to be Performed," outlines areas where it is felt there is uncertainty with respect to any of the assumptions and outlines sensitivity analysis to be performed.

The Kootenay-Boundary Land Use Plan Implementation Strategy has just been approved by government as a policy statement and the Minister's Advisory Committee (MAC) is in the process of making recommendations to government as to how the Kootenay-Boundary Use Plan should be implemented in the Revelstoke TSA portion of the Columbia Forest District. The district manager on October 22, 1997 released the "Supplement to the Forest Development Plan Guidebook for the Nelson Forest Region and Columbia Forest District, 1998-2002 Forest Development Plans." In addition, a "Memeorandum of Understanding between Ministry of Forests and Ministry of Environment, Lands and Parks Regarding Instructions for the Preparation of the 1998 Forest Development Plans" was released in October 1997. This data package reflects the directions in these documents.

2.2 Statement of major forest management considerations and issues

The major forest management issues and considerations are listed in the table below. Where issues are defined within legislation, regulations or standards, a timber supply assessment will be made. Issues and factors that are difficult to quantify or assess using a timber supply model may be either analysed separately or noted as upward or downward pressure on the timber supply.

2. Current Forest Management Considerations and Issues

Table 1. Major forest management considerations and issues

	Description
Growth and yield	
1. Mature volumes in existing stands	An ongoing study to update the 25-year old decay and breakage factors which affect the standing gross volumes in the inventory. Sensitivity analysis will be used to examine the uncertainty around mature volumes.
2. Site indices of mature stands	It is generally agreed that site indices for older stands are underestimated. Old-growth site indices will be eventually refined based on ongoing studies. Factors for adjusting spruce and balsam types which reflect preliminary results of these studies will be examined using sensitivity analysis.
2. Root rot	Growth of some forests are affected by root rot. This may make the growth rates indicated by the managed stand yield tables optimistic. A sensitivity analysis will be conducted to review this.
Size of timber harvesting land base	
1. Operable land base	A district review and update of the operability line was done for this analysis to account for helicopter and other harvesting innovations. Changes in operable areas and operability designations are included in the forest inventory used for this analysis.
2. Problem forest types and low sites	The amount of problem forest types and low sites used in the last timber supply was evaluated and changes were made which are reflected in this analysis.
Kootenay-Boundary land use plan Implementation Strategy and Minister's Advisory Committee	The Kootenay-Boundary land use plan Implementation Strategy has been approved by the government, and the Ministry Advisory Committee (MAC) is in the process of proposing a strategy to government. Where these initiatives have been incorporated in the 1998 district manager's development plan directional letter they have <u>been addressed in either the base case or as sensitivity analysis</u>

(continued)

2. Current Forest Management Considerations and Issues

Table 1. Major forest management considerations and issues

	Description
Biodiversity, ungulate and riparian habitat	
1. Landscape level biodiversity	Draft landscape unit boundaries have been defined and in the analysis weighted biodiversity emphasis option assignment will be used. A sensitivity analysis will be done to examine the timber supply impact of applying the draft emphasis options. Contributions by inoperable areas, including high elevations and national/provincial parks will be considered.
2. Stand-level biodiversity	The wildlife tree requirements of the biodiversity guidebook will be addressed, as per current practice.
3. Wildlife	The Revelstoke TSA contains habitat which supports a provincially important population of mountain caribou as well as other key wildlife species. The non-caribou ungulate habitat information has been updated for this timber supply review. Caribou habitat management will be modelled as outlined in the forest development plan guidelines.
4. Riparian habitats	The Revelstoke TSA has an abundance of riparian habitats. Riparian reserve zones have been established for these habitats under the Forest Practices Code (FPC). This analysis addresses the FPC management requirements for protecting these reserves.
Water conservation	
1. Important watersheds	There are several community and domestic watersheds where special management will be undertaken to protect water quality and quantity and other resources. Forest cover guidelines for these watersheds will restrict the rate of timber harvesting.

(continued)

2. Current Forest Management Considerations and Issues

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

Description	
Scenic landscapes	
1. Highway corridors and populated areas	Tourism and recreation are important industries in the Revelstoke Timber Supply Area (TSA). The 1997 forest development plan directions to the licensees state that visual management must be addressed along the Trans-Canada highway and in the landscape visible from the City of Revelstoke. Visual quality objectives limit the amount of visible area that can be disturbed in these areas, and these guidelines will be factored into the analysis.

3. Inventories

3.1 Background information

The inventories which will be used to determine the timber harvesting land base and the associated management themes to be used in defining forest management activities are listed in Table 2. The data source and reliability of the information, including any irregularities in the data and assumptions used in deriving the information and quality assurance measures taken for non-standard data are also shown.

Table 2. Inventory information

Data	Source	Vintage	Update	Source scale
Revelstoke TSA forest cover FC1 files	Ministry of Forests (MoF) standard inventory files	1991/92	N/A	1:20,000
Federal (National) park forest cover	MoF Nelson Region files	1956	N/A	1:32,000
Operability	MoF non-standard inventory files	05/1997	N/A	1:20,000
Biogeoclimatic subzone (including natural disturbance types)	MoF standard inventory files	1991/92	N/A	1:20,000
Road systems	MoF standard inventory files	1991/92	N/A	1:20,000
Caribou habitat	MoF District non-standard inventory files	06/1995	N/A	1:250,000
Ungulate winter habitat (non-caribou)	MoF District non-standard inventory files	06/1997		1:250,000 (some digitizing done from 1:20,000 contour)
Terrain Resource Information Management (TRIM) data	Land Data BC	1980s — depends on area of interest	N/A	1:20,000
Draft landscape units boundaries	MoF District non-standard inventory files	1996/97	N/A	1:250,000
Visual landscape inventory	MoF District non-standard inventory files	1993	N/A	1:50,000
Connectivity corridors for biodiversity	MoF District non-standard inventory files	1997	N/A	1:50,000
Timber licence areas	MoF standard inventory files	1991/92	N/A	1:20,000

(continued)

3. Inventories

Table 2. Inventory information

Data	Source	Vintage	Update	Source scale
Land ownership	MoF standard inventory files	1991/92	N/A	1:20,000
Watershed atlas (includes stream classification and community and domestic watersheds)	MoF Nelson non-standard Region files	1997	N/A	1:20,000
1996 Forest Development Plan proposed cutblocks and roads	MoF District non-standard file	1996	N/A	1:20,000
ATLAS model harvest block and road data	District non-standard files	1992	N/A	1:20,000

Data source and comments:

Forest cover:

The Columbia Forest District is covered by NAD 83 mapsheets that are based on August 1992 air photography for the northern part of the district and September 1991 air photography for the southern half of the district. These standard inventory files contain biogeoclimatic subzones, timber licence areas and land ownership.

Federal (National) park forest cover:

Forest cover information for parks does not contribute to the harvest forecasts, but is used to contribute to required seral stage targets.

Operability:

Operability lines were revised in May 1997. The operable land base has been delineated according to whether it is operable using conventional equipment or innovative methods such as skyline and helicopter logging. Two operability lines were determined. The conventional line will be used to define the operable land base in the base case. The innovative line will be used in sensitivity analysis.

Biogeoclimatic subzones and natural disturbance types:

The biogeoclimatic inventory was completed in 1992. Natural disturbance types have been derived from the biogeoclimatic classification.

Existing and planned road systems:

Length for these roads systems were generated off of the ATLAS database.

Caribou habitat:

The caribou habitat maps that were initially developed by the Ministry of Environment, Lands and Parks (MELP) in June 1995 have been revised through the radio telemetry work done by Bruce McLellan and John Flaa of the Ministry of Forests (MoF) in 1996. The revised maps identify moderate- and high-value habitat only. The directions to licensees regarding preparation of the 1998-2002 forest development plans define the landscape units where Caribou habitat modelling guidelines will apply.

Ungulate winter habitat:

This non-standard overlay identifies important winter habitats for moose and mule deer. Boundaries were based on elevation bands and the professional judgment of district and regional Ministry of Environment, Lands and Parks staff.

3. Inventories

Terrain Resource Information Management (TRIM) data:

Elevational data from the Ministry of Environment, Lands and Parks in 20 metre contours.

Draft landscape unit boundaries:

Landscape unit boundaries were proposed in 1995. Minor revisions were made in 1996. Landscape unit boundaries and objectives have not been legally established by the District Manager but reference has been made to them in the last set of development plan directions approved by the District Manager. Sixteen landscape units have been proposed for the district.

Visual landscape inventory:

In 1993 the Revelstoke Forest District hired Mirkwood Consultants Ltd. to prepare a visual landscape inventory for the Trans-Canada and Highway 23. Only the visual inventories for landscape units R4 and R20 will be considered in the timber supply analysis.

Connectivity corridors:

This non-standard layer was developed by the district forest and environment staff in 1995 for deployment of high and intermediate biodiversity emphasis in the district. Based on this about 16% of the TSA gets assigned to a high emphasis biodiversity option and 16% to an intermediate, leaving potentially 68% for low emphasis. However, about 20% of the TSA that is in low emphasis areas is also managed according to caribou habitat guidelines stringent enough to meet intermediate emphasis biodiversity requirements. Thus, intermediate biodiversity requirements effectively get deployed on 36% of the TSA when caribou habitat management is taken into account. In the Revelstoke TSA biodiversity emphasis management will be deployed through a corridor method rather than via landscape units. Generally, the high emphasis corridors travel in a north-south direction along Lake Revelstoke and Upper Arrow Lake. The intermediate corridors extend in a east-west direction along the Downie, Goldstream, and Kirbyville drainages. Biodiversity objectives, and thus emphasis assignment have not been legally established by the district manager. The impact of the draft landscape units and corridors will be examined through sensitivity analysis.

Watershed atlas:

This non-standard layer contains streams, wetlands and lakes. It will be the source for determining areas in riparian reserve zone. This overlay also contains the boundaries of community and domestic watersheds. The following are considered community watersheds Greely Creek, Hamilton Creek, Bridge Creek and Dolan Creek. Domestic watersheds are also considered in areas adjacent to the City of Revelstoke.

1996 Forest Development Plan:

This file contains the 1996 to 2000 Forest Development Plan maps for the TSA. Its purpose is to evaluate management trends in the future (i.e., area of marginal analysis units harvested, area harvested in the helicopter zone, etc.).

ATLAS blocks and roads:

In 1992 map work was done to road and block the entire TSA land base. This work was done in preparation for running the ATLAS computer model. The amount to existing and proposed roads identified in this database will provided the basis for determining the land base reduction required to account for existing and future roads in the timber supply analysis.

4. Division of the Area into Management Zones

4.1 Management zones and tracking of multiple objectives (grouping)

The concept of management zones and groups is used to differentiate areas with distinct management emphasis and homogenous forest cover. For example, a zone may be based on a harvesting system, silviculture system, visual quality objective, age profile or wildlife consideration. In previous timber supply analyses, management zones were mutually exclusive with respect to the application of forest cover requirements. If wildlife habitat overlapped with visual quality areas, a choice had to be made as to which forest cover requirement would be applied. We can now track multiple objectives on the forested land base. In addition, the non-contributing forest (land considered unavailable for timber harvesting) may be included for consideration in attaining forest cover objectives. Grouping enables constraints to apply to different combinations of variables or zones as well as enhancing reporting structures. Groups may be thought of as layers of different objectives which must be tracked over time. Whether to put an objective into a group or a mutually exclusive management zone will be decided after data assessment by the timber supply analyst.

Further information on the forest cover requirements to be applied to these areas can be found in Section 6.4, "Integrated resource management."

4. Division of the Area into Management Zones

Table 3. Objectives to be tracked

Group level	Group numbers	Description	Function
1	101000 to 120000	Timber harvesting land base by LU	Reporting purposes. Provide an assessment of the timber harvesting land base by landscape unit. All Crown forest included.
2	151000 to 170000	All forested land by LU	Reporting purposes. Provide an assessment of the total forest by landscape unit. All Crown forest included.
3	101110 to 120390	Biodiversity — all forest	<i>Biodiversity Guide Book</i> assessment. Provides a means to implement biodiversity at the LU/Emphasis/biogeographic zone-variant level. All Crown forest included.
4	101001 to 120001	Caribou — ESSF	Resource emphasis area — Caribou ESSF. Provides a means to implement ESSF caribou guidelines by LU. Only <u>operable</u> ¹ forest included.
5	101002 to 120002	Caribou — ICH	Resource emphasis area — Caribou ICH. Provides a means to implement ICH caribou guidelines by LU. Only <u>operable</u> ¹ forest included.
6	101003 to 120003	Visual quality	Resource emphasis area — visual quality. Provides a means to implement VQO guidelines by LU. Only <u>operable</u> forest included.
7	101004 to 120004	Watersheds	Resource emphasis area — community and domestic watersheds. Provides a means to implement watershed guidelines by LU. Only <u>operable</u> forest included.
8	101005 to 120005	Ungulate winter range	Resource emphasis area - ungulate winter range (UWR). Provides a means to implement UWR guidelines by LU. Only <u>operable</u> forest included.
9	101006 to 120006	Integrated resource management	Resource emphasis area — Integrated Resource Management (IRM). Provides a means to implement adjacency concerns on remaining areas by LU — only <u>timber harvesting land base</u> forest included.

¹ Operable forest: is all forested area classified as operable in the forest inventory file. Thus the operable forest is larger than the timber harvesting land base as it includes areas in which no harvesting is projected to occur due to riparian areas, ESA's, low sites etc.

4. Division of the Area into Management Zones

Data source and comments:

Numbering system example 101001:

1	01	0	0	1
Place	Landscape	Biodiv	Biogeo	Resource
Holder	Unit	Emphasis	Unit	Emphasis

Group 2 has 50 added to the LU (LU 1 becomes 51 while LU 20 becomes 70).

4.2 Analysis units

An analysis unit represents a combination of stands dominated by specific tree species or a silvicultural regime with a specific timber growing capability — as indicated by the inventory type group and site index in the forest inventory file. Each analysis unit is assigned its own timber volume projections (volume tables) for existing and future stands.

Volume tables for existing natural stands are derived using the variable density yield projection (VDYP) growth and yield model. Volume tables for recent plantations and future stands are derived using the table interpolation program for stand yields (TIPSY).

Table 4. Definition of analysis units

Analysis unit	Species	Site class ^a	Inventory type groups	Site index range (metres)	Age
Existing natural stands					
11	F, L, PI	1	1 - 8, 27 - 34		> 20
12	F, L, PI	2	1 - 8, 27 - 34		> 20
21	F, L, PI	3	1 - 8, 27 - 34		> 20
31	H	1	13 - 17		> 20
32	C	1	9 - 11		> 20
33	H	2	13 - 17		> 20
34	C	2	9 - 11		> 20
41	H	3	13 - 17		> 20
42	C	3	9 - 11		> 20
51	S, B	1	20 - 26		> 20 - ≤ 140

(a) Based on site index range.

(continued)

4. Division of the Area into Management Zones

Table 4. Definition of analysis units (concluded)

Analysis unit	Species	Site class ^a	Inventory type groups	Site index range (metres)	Age
52	S, B	1	20 - 26		> 140
53	S, B	2	20 - 26		> 20 - ≤ 140
54	S, B	2	20 - 26		> 140
61	S, B	3	20 - 26		> 20 - ≤ 140
62	S, B	3	20 - 26		> 140
Existing second-growth stands					
118	F, L, PI	2	1 - 8, 27 - 34 ^b		≤ 20
138	H, C	2	9 - 17 ^b		≤ 20
158	S, B	2	18 - 26 ^b		≤ 20
146	Backlog ≥ 60% MSS	3	^b		any
147	Backlog < 60% MSS ^c	4	^b		any
Existing marginal					
36	H (Pure)	2	12		> 20 - ≤ 140
56	B	2	18 - 19		> 20 - ≤ 140

(a) Based on site index range.

(b) Also includes NSR land having inventory type group code 00.

(c) MSS: minimum stocking standards

Data source and comments:

The site index ranges used to define the analysis units will be determined after examining natural breaks in the distribution of the timber harvesting land base by site index for each inventory type group combination.

Generally, analysis units for existing natural stands are stratified by good, medium, and poor site by major species group, and represent for the most part stands older than 20 years (i.e., Douglas-fir/larch, hemlock leading, cedar leading, spruce/balsam).

4. Division of the Area into Management Zones

Lodgepole pine leading forest types are not abundant enough to warrant a separate analysis unit, despite their unique characteristics. The small amount of lodgepole pine will be included with the Douglas-fir and larch forest types.

Second growth is defined as inventory type groups between 1 and 34 having a age less than 21 (mostly plantations), or inventory type group 00 having a type identity of 4 or 9 (not satisfactorily restocked). Not satisfactorily restock land will be apportioned into the second growth analysis units using the method described in Section 6.3.3, "Not satisfactorily restocked (NSR) areas."

Marginal forest types are defined as forest types having a low probability of harvest. Included are:

(1) pure hemlock forest types (inventory type group 12) between 21 and 140 years of age, and (2) balsam leading forest types without spruce between 21 and 140 years of age (inventory type groups 18-19).

5. Timber Harvesting Land Base Definition

5.1 Identification of the timber harvesting land base

The timber harvesting land base for the Revelstoke TSA is determined by separating out the following categories of area which do not contribute to timber harvesting in the area. This section outlines the steps used to identify the timber harvesting land base (the productive forest expected to support timber harvesting) within the timber supply area. Land may be unavailable for timber harvesting for three principal reasons:

- it is not administered by the British Columbia Forest Service for timber supply purposes (e.g., private land, parks, etc.);
- it is not suitable for timber production purposes; and
- it is required for other forest values.

Land may also be added to the timber harvesting land base:

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

The classification of area unavailable for timber harvesting should apply only to land where no harvesting is anticipated to occur. Any area in which some timber harvesting will occur should remain in the timber harvesting land base, even if area will be subject to stringent constraints.

After all areas that do not contribute to the timber harvesting land base have been identified, the resulting productive forest land base is defined as the "current timber harvesting land base" for the TSA.

5.2 Details on land base classification

5.2.1 Land not administered by the British Columbia Forest Service for timber supply purposes

Ownership codes are generally used to identify whether the land can be considered to contribute to timber supply. Ownership codes 62C and 69C indicate Crown land in a forest management unit and miscellaneous reserves respectively. These are generally the only ownership codes which are considered to contribute to timber supply. Timber licence area — ownership code 70N, is considered under Section 5.2.14, "Timber licence reversions."

5.2.2 Land classified as non-forest

Type identity 6 and 8, areas such as alpine, lakes, rocks, etc. are separated from the land base considered for timber supply.

5.2.3 Non-commercial cover

Type identity 5 represents those areas which are classified as having non-commercial brush species growing on them. These areas are considered to be unlikely sites for timber production and are separated from the land base considered for timber supply.

5. Timber Harvesting Land Base Definition

5.2.4 Areas considered inoperable

Operability and inoperability codes are generally used to describe the presence or absence of physical barriers or limitations to harvesting, logging methods (e.g., cable), and the merchantability of stands. Since physical and economic conditions are highly variable across British Columbia, methodology, interpretation and mapping of these factors is highly variable.

Table 5. Description of inoperable areas

Inventory description	Operability code	Reduction per cent (%)
Conventional harvesting practices	A	0
Harvesting undertaken with helicopter or other innovative method	M	100
Inoperable areas	I	100
Not typed	N	0

Data source and comments:

In 1997 the operability lines were reviewed and updated for the Revelstoke TSA. Operability was determined by road chance associated with conventional harvesting practices (e.g., crawler tractor and high-lead systems) and innovative (helicopter and skyline) systems. The updated operability line was incorporated in the TSR FIP file as a non-standard overlay. For comparison purposes, standard operability information line information (1994 operability line) which was used in the previous analysis has been kept in the database.

An examination of the last 5 years and plans for the next 5 years shows that the innovative methods and equipment required for helicopter and skyline systems are starting to be used in the TSA. However, it is unknown if any harvesting could be done in the areas classified as “M” operability. The “M” class was created to look at new opportunities in the future. Thus, while the base case will not incorporate any of this area a sensitivity analysis will be done that examines the impact of adding a portion of the “M” class areas to the timber harvesting landbase.

5.2.5 Exclusion of specific, geographically defined areas

The purpose of this section is to specify the location and total area to be excluded from the timber harvesting land base to account for any area exclusions that are a part of current forest management but which have not already been accounted for in the inventory file.

While areas recognized in legislation or by Order-in-Council as not contributing to the timber harvesting land base may be excluded, areas which have been deferred from harvesting because they are contentious or are under study (e.g., planning deferrals, potential parks) are considered available for timber harvesting.

5. Timber Harvesting Land Base Definition

Table 6. Exclusion of specific, geographically defined areas

Name	Mapsheets	Reasons for exclusion	Area excluded (hectares)	
			Total	Operable
Greeley Creek watershed	82K091, 82L100, and 82M010	Community watershed for the city of Revelstoke. Marginal timber type. Geotechnical and engineering constraints.	4 625	1 552

Data source and comments:

The Greeley Creek watershed is mostly comprised of hemlock-leading stands greater than 140 years of age, i.e., problem forest types. Significant geotechnical and engineering constraints have to be overcome to harvest in the area. Given the low value for timber, high costs of road building and harvesting, and high risk to water quality for the city of Revelstoke, the area has been excluded from the timber harvesting land base.

5.2.6 Roads, trails and landings

Separate estimates are made to reflect the loss in productive forest land due to existing and future roads, trails and landings (RTL). Existing RTL estimates are applied as reductions to the current productive forest considered available for harvesting and future RTL reductions are applied after stands are harvested for the first time in the simulation model. Estimates can be applied as the amount or percentage of area to be removed from specified age classes and zones. Estimates should only account for the area that will be permanently removed from the timber harvesting land base.

Table 7. Estimates for permanent existing and future roads

Category of road	Road length (metres)	Road width (metres)	Reduction area (hectares)
Existing	1 125 880	20	2 252
Future	2 351 524	20	4 703

5. Timber Harvesting Land Base Definition

Table 8. Calculation of reduction factors (RFs) for temporary spur roads and landings

Harvest system	Season	Per cent (%) of annual harvest area	Per cent (%) disturbance	Per cent (%) productivity loss	Per cent (%) loss by category	Proportion of reduction
Calculation of RFs prior to 1988						
Cable	Summer	N/A	N/A	N/A	0.0	0.0000
	Winter	N/A	N/A	N/A	0.0	0.0000
Total cable		-	-	-	0.0	0.0000
Conventional	Summer	50.00	20	34 0.000	68.0	0.0 34 00
	Winter	50.00	20	10.000	2.0	0.0100
Total conventional		100.00	20	20.000	45.0	0.0 45 00
Total harvesting (conventional + cable)		100.00	-	-	-	0.0 45 00
Landings and on-block roads		100.00	3	100.000	-	0.0300
Total RF for harvesting prior to 1988						0.0 78 00
Calculation of RFs for harvesting (1988-1992)						
Cable	Summer	24.08	0	0.000	0.0	0.0000
	Winter	3.92	0	0.000	0.0	0.0000
Total cable		28.00	0	0.000	0.0	0.0000
Conventional	Summer	33.84	15	34 0.000	4.56.0	0. 0152 020
	Winter	38.16	15	10.000	1.5	0.0057
Total conventional		72.00	15	19.400 24.10	2.93.6	0.02 0960
Total harvesting (conventional + cable)		100.00	-	-	-	0.0209 60
Landings and on-block roads		100.00	3	100.000	-	0.0300
Total RF for harvesting 1988-1992						0.05 0960
Calculation of RFs for harvesting (1993-1994)						
Cable	Summer	35.20	0	0.000	0.000	0.0000
	Winter	19.80	0	0.000	0.000	0.0000
Total cable		55.00	0	0.000	0.000	0.0000
Conventional	Summer	18.00	13	34 0.000	3.900 5.200	0.00 70 94
	Winter	27.00	13	10.000	1.300	0.0035
Total conventional		45.00	13	22.000	2.340 860	0.01 05 29
Total harvesting (conventional + cable)		100.00	-	-	-	0.0 105 129
Landings and on-block roads		100.00	3	100.000	-	0.0300
Total RF for harvesting 1993-1994				0.0405		
Calculation of RF for harvesting (1995-1996)						
Cable	Summer	46.20	0	0.000	0.000	0.0000
	Winter	8.80	0	0.000	0.000	0.0000
Total cable		55.00	0	0.000	0.000	0.0000
Conventional	Summer	11.25	10	34 0.000	34.000	0.00 34 45
	Winter	33.75	10	10.000	1.000	0.003 44
Total conventional		45.00	10	17.500	1.750	0.00 68 79
Total harvesting (conventional + cable)		100.00	-	-	-	0.00 68 79
Landings and on-block roads		3.00	3	100.000	-	0.0300
Total RF for harvesting 1995-present				0.0368		

5. Timber Harvesting Land Base Definition

Table 8. Calculation of reduction factors (RFs) for temporary spur roads and landings (concluded)

Harvest system	Season	Per cent (%) of annual harvest area	Per cent (%) disturbance	Per cent (%) productivity loss	Per cent (%) loss by category	Proportion of reduction
Calculation of RFs for harvesting (1997 and beyond)						
Cable	Summer	49.14	0.0	0.000	0.000	0.0000
	Winter	13.86	0.0	0.000	0.000	0.0000
Total cable		63.00	0.0	0.000	0.000	0.0000
Conventional	Summer	10.85	7.5	20.000	1.500	0.0016
	Winter	24.15	7.5	10.000	0.750	0.0018
Total conventional		35.00	7.5	13.100	0.983	0.0034
Total harvesting (conventional + cable)		100.00	-	-	-	0.0034
Landings and on-block roads		100.00	3.0	100.000	-	0.0300
Total RF for harvesting 1996 and beyond				0.0334		

Data source and comments:

Main and operational roads that go to and through blocks and considered more or less permanent will be captured in the road category. Small spur roads to landings (not shown ~~in the ATLAS database on the forest cover~~ maps) will be captured in the productivity loss reduction factor calculation for temporary spur roads and landings.

Area reduction figures for roads are based on road overlay information contained in the TSR FIP data set. A 20 metre road right-of-way width is applied to mapped existing and planned roads. It is felt that the current digital road mapping provides a good estimate of the extent of the permanent road network. Both existing and future road lengths were determined from the ATLAS database (see Section 3.1, Table 2).

The area reduction for main and operational roads as shown in Table 7 will be adjusted to factor in what percentage of the timber harvesting land base needs to be reduced in order to account for the permanent road reduction area. Temporary spur roads and landings are dealt with separately (shown in Table 8).

In the context of the operational forest inventory used for planning and this analysis, temporary spur roads and landings conceptually become part of second growth and future regenerated stands. The proportion of the area in temporary spur roads and landings that is unlikely to grow timber to a merchantable size within a reasonable length of time essentially becomes an area lost to production, or a small opening. Small openings are accounted for in second growth and future stand volume curves by type 1 operational adjustment factors (OAF1s).

A default OAF1 of 15% is applied to account for natural openings. For artificial openings, openings due to spur roads and landings, reduction factors (RFs), or in effect OAF1s, have been calculated using the following methods.

For second-growth stands which includes immature plantations less than 21 years in age and land classified as not satisfactorily restocked the method was as follows:

5. Timber Harvesting Land Base Definition

The following assumptions were made given observations of the regional pedologist and district zone staff. Four periods were used for 'past' RF calculations: pre-1988, 1988 to 1992, 1993 to 1994, and 1995 to 1996. The amount of area lost on a per unit basis due to disturbance was determined according to harvest system, season of harvest, and per cent of disturbed area lost to production. Rates of 0.07008, 0.05096, 0.0405, and 0.03688 for the periods were found. These rates were averaged using weighting factors of 0.5, 0.25, 0.13, and 0.12. resulting in a combined RF of 0.057464.

Past RFs were calculated as follows:

Table 9.4 Past RF Calculations

Disturbance periods	RF	Weighting factor
pre-1988	0.07008	0.50
1988-1992	0.05096	0.25
1993-1994	0.04053	0.13
1995-1996	0.03688	0.12

Past RF = 0.0574

Check RF's relate to the area numbers in Table 8a

For future stands the method was as follows:

Most recent harvest records (1997 and beyond) and proposed harvest in forest development plans were examined. These rates resulted in an RF of 0.033.

The downward trend in disturbance rates likely reflects improved forest practices because of Forest Practice Code requirements.

RFs for temporary spur roads and landings will be incorporated into the analysis at the forest estate modelling stage. The managed stand yield tables for existing second growth stands will be reduced by 0.0574%. Future regenerated stands will be reduced by 0.033%.

5.2.7 Environmentally sensitive areas

Some forest lands are environmentally sensitive and/or significantly valuable for other resources. Many of these areas are identified and delineated during a forest inventory and are called environmentally sensitive areas (ESAs). The ESA system uses the following classification: soil (Es), forest regeneration problems (Ep), snow avalanche (Ea), recreation (Er), wildlife (Ew), water (Eh) and fisheries (fisheries symbols). With the exception of avalanche and fisheries, two ESA categories are recognized: high and moderately sensitive.

5. Timber Harvesting Land Base Definition

In the context of timber supply analysis, ESAs may result in a reduction in the harvesting opportunity on these sites. Two strategies for accounting for this are: per cent area reductions, and the specific evaluation of individual ESA polygons for harvesting opportunity.

As noted previously it is important to ensure that only areas in which harvesting is expected to take place are allowed to contribute to the timber harvesting land base. Thus, it is important to separate the areas in which some limited harvesting will take place and those areas which are unavailable. This table will only list those areas in which harvesting will not occur.

Table 10. Description of environmentally sensitive area

ESA category	ESA description	Reduction per cent (%)
A	Avalanche	100
AR	Avalanche/recreation	N/A
AP	Avalanche/plantation	90
H	Watershed	0
HR	Watershed/recreation	0
P	Plantation	90
PR	Plantation/recreation	N/A
Ep	Total plantation	90
R	Recreation	0
RW	Recreation/wildlife	0
S	Soil	90
SA	Soil/avalanche	90
SAP	Soil/avalanche/plantation	90
SAR	Soil/avalanche/recreation	90
SH	Soil/watershed	90
SHR	Soil/watershed/recreation	N/A
SP	Soil/plantation	90
SPR	Soil/plantation/recreation	90
SR	Soil/recreation	90
SRW	Soil/recreation/wildlife	N/A
SW	Soil/wildlife	90
Es	Total soils	90
W	Wildlife	0

5. Timber Harvesting Land Base Definition

Data source and comments:

There were not ESA reductions for wildlife because forest cover modelling guidelines are used to emulate management in ungulate and Caribou habitats.

Watershed ESA reductions were not felt necessary because of Forest Practice Code riparian requirements.

Recreation ESA reductions were not applied because of application of visual quality modelling guidelines in areas along the Trans-Canada highway and in areas that can be viewed from the city of Revelstoke.

No reductions were made for ESA 2 areas.

5.2.8 Riparian management areas

The riparian area indicated below will be excluded from the timber harvesting land base.

Table 11. Riparian management areas

Stream class	Stream length (metres)	Reserve zone width (metres)	Management zone width (metres)	Retention in management zone (%)	Total riparian area (metres)
S1		50	20	50	60
S2		30	20	50	40
S3		20	20	50	30
S5		0	30	25	8
W1		10	40	25	20
W3		0	30	25	15
W5		10	40	25	8
L1		10	0	0	10
L2		0	30	25	15

Data source and comments:

Riparian area reserve shall be applied to each side of the water course. Riparian area reserve consists of the riparian reserve zone plus the retention portion of the riparian management zone.

A Geographic Information System (GIS) analysis was performed to classify all streams, wetlands and lakes on the basis of slope and width. The resultant data was produced by stream class and length through the timber harvesting land base.

5. Timber Harvesting Land Base Definition

The total riparian area reserve is made up of the reserve zone plus the management zone multiplied by the retention. For example:

Reserve	50 metres	
Management	20 metres	$50 + (20 * 0.5) = 60$ metres
Retention in Management	50%	

On average, the above listed riparian reserve zone widths are not logged. While there are some instances where the zones have been logged, due to various management reasons, there are estimated to be equal areas where the reserve zone has been extended.

L1 lakes as designated by the forest district manager include Echo Lake, Beaver Lake, Begbie Lake, and Wetask Lake.

5.2.9 Sites with low timber growing potential

Sites may have low productivity either because of inherent site factors (nutrient availability, exposure, excessive moisture, etc.), or because they are not fully occupied by commercial tree species. Typically, these stands are intermixed with other stands within the forested land base. As these stands are not considered to be harvestable, they need to be identified and removed from consideration for the timber harvesting land base.

Table 12. Description of sites with low timber growing potential

Inventory type group	Site index	Reduction per cent (%)
1 - 34	< 8	100

Data source and comments:

Generally stands having a site index of less than 8 take longer than 120 years to reach 25 cm dbh. Any sites not capable of growing trees to 25 cm dbh in 120 years or less are considered to be of low productivity.

5.2.10 Description of deciduous types

For the purposes of this analysis, only coniferous (softwood) species leading forest stands are considered merchantable. The deciduous (hardwood) component of the forest can occur as relatively minor components of stands of mixed coniferous/deciduous species, and as predominately deciduous stands. The inventory is organized by inventory type group. Groups 35 to 42 have deciduous species leading, and have a smaller proportion of coniferous trees. These types are removed from the timber harvesting land base.

Table 13. Description of deciduous types

Inventory type group	Reduction per cent (%)
35 - 42	100

5. Timber Harvesting Land Base Definition

Data source and comments:

There is no demonstrated performance in deciduous types in the district.

5.2.11 Problem forest types

Problem forest types are stands which are physically operable and exceed low site criteria yet are not currently utilized or have marginal merchantability. These types are wholly or partially excluded from the timber harvesting land base. Examples of these types of stands in the Revelstoke TSA are balsam, and hemlock leading stands greater than 140 years of ages that contain a high proportion of decadent wood.

Table 14. Problem forest types criteria

Species	Inventory type group	Age	Operability code	Reduction per cent (%)
H (Pure)	12	> 140	A, M, N	100
B	18 - 19	> 140	A, M, N	100

Operability codes:

"A" refers to conventional harvesting machines i.e., highlead yarding and conventional ground based skidding;

"M" refers to innovative skyline or heli-logging systems;

"N" refers to no typing available.

Data source and comments:

Generally pure hemlock and balsam types greater than 140 years of age are being avoided in the timber harvesting land base due to the high degree of decadence. Small areas of these types may be harvested when combined with higher quality forest types.

5.2.12 Wildlife habitat reductions

There will be no area reductions for wildlife. Wildlife needs will be addressed through resource emphasis area forest cover requirements for caribou, other ungulates, and biodiversity. There is some uncertainty regarding the caribou habitat guidelines because part of the input to the guidelines development was the 1994 operability classification. As noted in Section 5.2.4 "Areas considered inoperable" the operability classification was updated in 1997. Sensitivity analysis which examines the timber supply impacts of changing the forest cover requirements in the caribou habitat zone will be completed.

5. Timber Harvesting Land Base Definition

5.2.13 Cultural heritage resource reductions

Cultural heritage values include traplines, and sites of archaeological or traditional use.

There will be no harvesting reductions for cultural heritage resources. An archaeological overview assessment has not been conducted for the Revelstoke TSA.

5.2.14 Timber licence reversions

Timber licences are old tenure arrangements that give a licensee exclusive rights to harvest merchantable timber within the licence area and do not contribute to the TSA allowable annual cut. Once these areas have been harvested, regenerated, and have attained free-growing status, the timber license area reverts to Forest Service jurisdiction. Accordingly, these areas are included in the timber harvesting land base after the first harvest and contribute to the TSA harvests in mid- to long-term.

Timber licence areas need to be accounted for from the time the stands have been harvested, and/or from the time the stands are estimated to be harvested. Time of harvest is used as the reference point so that the impact of these harvests on forest cover requirements is given full consideration in the timber supply analysis. In some cases stands that have been harvested and legally reverted have not had the necessary ownership change on the inventory file (e.g. change from 70N to 62C). In these cases manual changes have been made to the ownership codes to put these areas back into the timber harvesting land base.

Table 15a. Timber licences that have expired since the previous timber supply review

Tenure	Location	Total area (hectares)	Date expired
To 367 Block 1-5	Albert Canyon	151	1991
To 393	Wells Creek	34	1991
To 418	Bourne Creek	58	1991
To 643 Block A to D	Jordan River, Frisby Ridge	1 349	1996
To 724 Block A to H	Kirbyville, Fissure and Liberty Creeks	630	1996
To 737	Kirkup	165	1996
To 339	Greeley		Pre-1990
To 764	Soards Creek		Pre-1990

Table 15a is provided for information only as the return to Crown land of all these areas should have been captured in the inventory file. A check will be completed to ensure this has happened.

5. Timber Harvesting Land Base Definition

Table 15b. Timber licence harvest schedule

Analysis unit	Site class	Licences To 467 and To 451 Area harvested by period									
		1977-81 ^a	1982-86 ^a	1987-91 ^a	1992-96	1997-01	2002-06	2007-11	2012-16	2017-21	2022-26
138 (H,C)	1	0.0	0.0	0.0	0.0	0.0	2.5	2.5	2.5	2.5	2.5
	2	41.6	0.0	0.0	12.6	9.0	12.6	12.6	12.6	12.6	12.6
	3	0.0	0.0	0.0	0.0	12.5	1.9	1.9	1.9	1.9	1.9
158 (S,B)	1	0.0	28.0	45.7	46.6	59.4	29.5	29.5	29.5	29.5	29.5
	2	112.1	223.3	185.7	0.0	406.2	173	9.0	0.0	146.9	146.9
	3	44.8	40.0	0.0	0.0	32.4	52.1	19.7	19.7	19.7	19.7
Total		198.5	291.3	231.4	59.2	519.5	271.6	75.2	66.2	213.1	213.1

a) Area harvested between 1977 and 1991 was captured in the new inventory and thus no manual adjustment is required in the analysis.

Data source and comments:

Since the last TSR all timber licences expired except To 451 and 467. These timber licences are administered by the Revelstoke office. To 451 and 467 are held by Riverside Forest Products Ltd. Both of these timber licences will revert back to the Crown in 2025. To 467 straddles the district boundary. Approximately 19 % of the TL's area falls within the Columbia Forest District with the remaining 81% falling within the Arrow Forest District. After expiration of the licence it is expected that each respective district will administer the area within their boundaries, hence the reversion areas reflect this.

Data sources include ISIS, MLSIS and the 1997 to 2001 Forest Development Plan. Data stratified to the block level only.

The previous liquidation schedule is ~~no~~ longer applicable due to looper infestation.

Analysis unit and site class for future harvesting has been prorated based on historical data.

All timber licence areas will contribute towards biodiversity requirements.

6. Current Forest Management Assumptions

6.1 Harvesting

6.1.1 Utilization levels and waste and breakage (W2B) factors

The utilization levels define the maximum stump height, minimum top diameter (inside bark) and minimum diameter at breast height by species and is used in the analysis to calculate merchantable volume.

Table 16. Utilization levels

Analysis unit	Minimum dbh (cm)	Maximum stump height (cm)	Minimum top dib (cm)
Pine	12.5	30	10
Cedar > 140 years old	17.5	30	15 ^a
Cedar < 140 years old	17.5	30	10
All other species	17.5	30	10

a) Although listed as 15 cm — the volume curves reflect 10 cm.

Data source and comments:

These levels reflect current interior utilization standards, licence requirements and current performance. A study of the difference between a 10 cm and a 15 cm minimum top dib showed a less than 1% difference in volume.

An ongoing study of decay and breakage factors in the Revelstoke TSA is still incomplete at the time of publishing this data package. However, if the results of the study are completed prior to completion of the TSR2 analysis, a W2B sensitivity analysis will be conducted.

The yield tables used in this analysis are reduced for waste and breakage. Aggregated waste and breakage (W2B) factors are developed from the inventory metric diameter class loss factors manual by averaging over diameter class and risk group and combining the separate factors for waste and breakage.

6. Current Forest Management Assumptions

6.1.2 Volume exclusions for mixed species stands

One or more species in mixed species stands may be unmerchantable. For example, the deciduous species in a predominantly coniferous stand may not be harvested, or may only be partially harvested. The unharvested portion should not contribute to the estimated stand volume. Indicate which species, or a portion thereof, are excluded from affected stands, however, it is important to consider how this volume may contribute to biodiversity objectives.

Table 17. Volume exclusions for mixed species types

Inventory type group	Species	Volume exclusion (%)
All	All deciduous	100

Data source and comments:

The exclusion pertains to only the deciduous portions of these types. The deciduous portion may contribute to biodiversity and coarse woody debris objectives at the stand level.

6.1.3 Minimum harvestable age derivation

Minimum harvestable ages are simply minimum criteria. While harvesting may occur in stands at the minimum requirements in order to meet forest level objectives (e.g., maintaining overall harvest levels for a short period of time or avoiding large interdecadal changes in harvest levels), most stands will not be harvested until well past the minimum harvestable ages because of other resource values taking precedence (e.g., requirements for the retention of older forests).

The criteria used to define minimum harvestable ages for this analysis include: culmination age; a 25 cm minimum diameter; minimum volume per hectare; and professional judgment.

6. Current Forest Management Assumptions

Table 18. Minimum harvestable age criteria

Analysis unit		Minimum volume (m ³ /ha)	Minimum DBH (cm)	Minimum harvestable age-present stands	Minimum harvestable age-future stands
11	Fir, good site	150	25		
12	Fir, medium site	150	25		
21	Fir, poor site	150	25		
31	Hemlock, good site	150	25		
32, 36	Cedar, good site	150	25		
33	Hemlock, medium site	150	25		
34	Cedar, medium site	150	25		
41	Hemlock, poor site	150	25		
42	Cedar, poor site	150	25		
51, 52	Spruce or balsam, good site	150	25		
53, 54	Spruce or balsam, medium site	150	25		
56	Balsam leading	150	25		
61, 62	Spruce or balsam, poor site	150	25		
66	Balsam leading	150	25		
118	Fir immature plantations	150	25		
138	Cedar immature plantations	150	25		
158	Spruce immature plantations	150	25		
146	Backlog NSR meeting standards	150	25		
147	Backlog NSR below standards	150	25		

Data source and comments:

Minimum harvestable ages will be set so that stands will not be harvested prior to 85- 90% of the time required to achieve the culmination age (it has been district practice to limit harvesting in younger age classes, based upon knowledge that the achievement of culmination age will maximize the long-term harvest level).

6. Current Forest Management Assumptions

6.1.4 Harvest scheduling priorities

Priorities for minimum harvest levels have not been set on certain management zones or analysis units to account for insect infestations, salvage operations, or similar forest management activity. Therefore, harvest scheduling profile is not applied to the analysis. Generally, older available stands are favored for allocation when all other constraints have been met which the timber supply model will reflect.

6.1.5 Logging method

Table 19 below indicates the degree to which the three general logging methods are used in the Revelstoke TSA. The percentage breakdowns are for the total area actually harvested since 1991 and for the area proposed to be harvested over the next five years, according to 1997 forest development plans.

Table 19. *Logging method*

Logging method	Per cent of total area harvested in Revelstoke TSA	
	Actual harvest (1991-1997)	Proposed harvest (1997-2001)
Conventional ground based	50	36
Conventional cable	48	58
Innovative (skyline and helicopter)	2	6

Data source and comments:

Past harvesting records were retrieved and analysed using the Forest Tenure Administration System (FTAS) electronic database. The proposed harvest data are based on a review of all 1997 forest development plans for the Revelstoke TSA, including those from licensees and the Small Business Forest Enterprise Program (SBFEP). See Section 5.2.4 “Areas considered inoperable” for further details on the innovative systems.

6.1.6 Silvicultural systems

Table 20 below indicates the degree to which clearcut and alternate silvicultural systems are used in the Revelstoke TSA. The percentage breakdowns are for the total area actually harvested since 1991 and for the area proposed to be harvested over the next five years, according to 1997 forest development plans.

6. Current Forest Management Assumptions

Table 20. Silvicultural systems

Silvicultural system		Per cent (%) of total area harvested in the Revelstoke TSA	
		Actual harvest (1991-1997)	Proposed harvest (1997-2001)
Clearcut	Clearcut	96.6	25.0
	Clearcut with wildlife tree reserves	3.3	53.0
	Total clearcut	99.9	78.0
Alternate systems	Selection	0.1	0.3
	Patch/group	—	22
Total alternate		0.1	22.0

Data source and comments:

Past harvesting records were retrieved and analysed using the Forest Tenure Administration System (FTAS) electronic database. The proposed harvest data are based on a review of all 1997 forest development plans for the Revelstoke TSA.

The significant increase in clearcuts with wildlife tree reserves between past and proposed harvesting is due to the stand level biodiversity requirements of the Forest Practices Code. Patch harvesting/group selection is considered by Columbia Forest District operations staff to be an alternate system, although it remains an even-aged stand management method similar to clearcutting, except that it involves the harvesting of smaller areas. Group selection systems in the Revelstoke TSA are considered by district operations staff to be similar to patch systems, as both are generally deployed for similar purposes and results. Therefore, the areas harvested by patch and group selection systems have been combined in Table 20. The significant increase in the use of patch/group systems is due to the active management of caribou habitat areas and the development of district forest cover requirements for managing this habitat.

The current application of the patch/group system in the Revelstoke TSA (particularly the Caribou zone) can generally be described as follows: harvested openings approximately one hectare in size, with the occasional retention of wildlife trees and wildlife tree patches within the opening.

Current direction to licencees is that non-clearcut systems can be used in the ICH caribou zone providing that caribou habitat is maintained.

6.2 Unsalvaged losses

The purpose of this section is to provide an estimate of average annual unsalvaged volume loss to insect and disease epidemics, fires, wind damage or other agents on the timber harvesting land base. The unsalvaged loss column only reflects those areas in which the volume will not be recovered or salvaged.

6. Current Forest Management Assumptions

Table 21. *Unsalvaged losses*

Cause of loss	Annual unsalvaged loss (hectares)	Annual unsalvaged loss (m ³ /year)
Wildfire	18.3	3 239
Broadcast/fringe burn	11.2	4 389
Total fire	29.5	7 628
Hemlock	1.5	450
Spruce bark beetle	0.0	0
Douglas-fir bark beetle	0.6	210
Total pests/insects	2.1	660
Windthrow/blowdown	0.7	228
Avalanche	0.2	70
Total loss	32.5	8 586

Data source and comments:

Information regarding unsalvaged losses was collected from forest district staff, licensees, the protection fire reporting system, MLSIS/ISIS (harvesting databases), annual reports, and Forest Insect Disease Survey (FIDS) reports. The best data available was used for the analysis which often consisted of professional judgment as data sources. A permanent database has been constructed to update unsalvaged losses on an annual basis which will provide more accurate results for future TSR data package preparation.

6.3 Silviculture

6.3.1 Regeneration activities in managed stands

The silviculture program reflects the mix of treatments expected to be carried out in the Revelstoke TSA. Table 22 shows the proportion of each analysis unit to be treated under each silviculture regime and the expected average regeneration delay.

Recent plantations and future stands will be grown on managed stand yield tables (MSYTs) produced using the B.C. Forest Service table interpolation program for stand yields (TIPSY) growth and yield model. A MSYT may be built from a number of tables if more than one regeneration method is used within an analysis unit. When this is the case, tables are produced for the different regeneration methods (each method x species combination) are then aggregated into one table.

6. Current Forest Management Assumptions

Table 22. Regeneration assumptions by analysis unit

Existing stand analysis unit	Composition	Regen delay	OAFs		Regeneration method		Regenerated species		Density
			1	2	Type	%	Code	%	Initial
Natural stands									
11	F, L, PI	2	15	5	Plant	100	F Lw PI	60 30 10	1500
12	F, L, PI	2	15	5	Plant	100	F Lw PI	60 30 10	1500
21	F, L, PI	2	15	5	Plant	100	F PI	50 50	1500
31	H	2			Plant	100	S F Cw H	50 20 20 10	1500
32, 36	C	2	15	5	Plant	100	S C F	60 30 10	1500
33	H	2	15	5	Plant	100	S F Cw H	50 20 20 10	1500
34	C	2	15	5	Plant	100	S C F	60 30 10	1500
41	H	2	15	5	Plant	100	F S H	50 40 10	1500
42	C	2	15	5	Plant	100	S F Cw H	50 20 20 10	1500
51	S, B	2	15	5	Plant	100	S B	90 10	1500
52	S, B	2	15	5	Plant	100	S B	90 10	1500

(continued)

6. Current Forest Management Assumptions

Table 22. Regeneration assumptions by analysis unit (concluded)

Existing stand analysis unit	Composition	Regen delay	OAFs		Regeneration method		Regenerated species		Density Initial
			1	2	Type	%	Code	%	
53, 56	S, B	2	15	5	Plant	100	S B	90 10	1500
54	S, B	2	15	5	Plant	100	S B	90 10	1500
61	S, B	2	15	5	Plant	100	S B	90 10	1500
62	S, B	2	15	5	Plant	100	S	90 10	1500
Second growth									
118	F, L, PI	2	15	5	Plant	100	F Lw PI	60 30 10	1500
138	H	2	15	5	Plant	100	S F Cw H	50 20 20 10	1500
158	S,B	2	15	5	Plant	100	S B	90 10	1500
146	Backlog $\geq$ 60% H, C, S, B	3	15	5	Natural	100	H Cw S B	40 30 20 10	550
147	Backlog < 60% H, C, S, B	3	15	5	Natural	100	H Cw S B	40 30 20 10	350

Data source and comments:

All values in the above table are based on current performance as estimated by forest district staff.

No thinning is expected based on the initial density values.

Regeneration delays used reflect current operational practice. Regeneration delays will be applied in the FSSIM forest estate model not in the TIPSy yield model.

6. Current Forest Management Assumptions

Provincial average operational adjustment factors (OAFs) values are applied to the managed stand yield curves as recommended by the Ministry of Forests, Research Branch — as no local values are available. It should be noted that there is concern that these OAFs may underestimate the losses expected on some stands due to root rot disease, therefore sensitivity analysis around this issue will be performed.

6.3.2 Immature plantation history

This section identifies areas of existing immature forest where the density (stems per hectare) was controlled and therefore should be assigned to a managed stand yield curve (MSYT). All NSR areas and future harvested stands will be managed under MSYTs.

Table 23. Immature plantation history

Analysis unit	Area managed (%)	
	Age 1 - 10	Age 11 - 20
All	100	100

Data source and comments:

Recently regenerated areas (under 21 years old) are assumed to be performing as managed stands due to increased silvicultural activities during that time.

6.3.3 Not satisfactorily restocked (NSR) areas

Land classified in the TSA FIP file as type identity 4 or 9 is included in the current timber harvesting land base. These type identities indicate not satisfactorily restocked (NSR) land base. The purpose of this section is to identify the total area of NSR currently existing in the timber harvesting land base, and the estimated rate at which the NSR area will be restocked.

6. Current Forest Management Assumptions

Table 24. Not satisfactorily restocked (NSR) areas

Analysis unit	Profile of NSR land			
	Stocking 300 - 399 stems/ha (age between 10 - 20 years)	Stocking 400-700 stems/ha (age between 10 - 20 years)	Current NSR from silvicultural records	Total NSR area (from FIP file)
118 - Fir leading	0.0	0.0	81.1	
138- Cedar/hemlock leading	370.5	887.2	1 552.9	
158 - Spruce/balsam leading	158.8	380.2	577.2	
146 - Backlog ³ 60% MSS ^a		(1 267.4)		
147 - Backlog < 60% MSS	(529.3)			
Total	529.3	1 267.4	2 211.2	

a) minimum stocking standards

Data source and comments:

District silviculture data, ISIS and MLSIS, was used to develop a profile for land classified as NSR in the FIP file. This profile will be used to assign NSR land falling within the timber harvesting land base to analysis units.

District summaries of NSR denuded before 1988 indicate the amount of inoperable and yield reduced area. Generally, if the reported stocking was greater than 60% of the minimum stocking standard then 400 to 700 acceptable stems is assumed for modelling projected yields. This assumption roughly results in a 20% reduction in expected yields from currently regenerated stands. Based on the profile shown in Table 24, 1267 hectares of NSR land fit this category and will be assigned to analysis unit 146. Analysis unit 146 is an aggregate of backlog cedar/hemlock/spruce/balsam areas $\geq$ 60% MSS. If the stocking was less than 60% of the minimum stocking standard then 300 to 399 acceptable stems is assumed for modelling projected yields. Based on the profile in Table 24, 529.3 hectares fit this category and should be assigned to analysis unit 147. Analysis unit 147 represents low volume stands likely to contribute little to the overall timber supply. See Table 22 for details on how the volume tables for units 146 and 147 will be developed.

Because district silviculture data is more detailed and up-to-date than operational inventory data the 2211 hectares of current NSR identified in Table 24 may be more or less than that identified in the latest FIP file. It is assumed that all current NSR will reach satisfactory stocking within 10 years according to the same profile as indicated in the silvicultural records.

Most inoperable NSR is assumed to be removed during the process for determining the timber harvesting land base.

6.3.4 Rehabilitation areas

Rehabilitation areas are not a factor on the Revelstoke TSA timber harvesting land base. Therefore, consideration of rehabilitation areas is not applied to the analysis.

6. Current Forest Management Assumptions

6.4 Integrated resource management

6.4.1 Objectives which require forest cover requirements

As noted in Section 4.1, "Management zones and tracking of multiple objectives (grouping)," the discussion on multiple objectives, forest cover requirements can be examined at a number of different levels. These may be considered as layers in geographic information systems (GIS) terminology. One possible layer is landscape units, another may be ungulate winter habitat, while another may be biodiversity resource emphasis. With the requirement to retain different forest characteristics across the landscape, it is important to identify how non-contributing forest (forest which does not contribute to the timber harvesting land base) is considered in the forest cover requirements (i.e., maximum allowable disturbance or minimum area retention).

Tables 25a and 25b indicate the forest cover requirements for group levels 3 to 9. Table 25a figures apply to the total forest area. Table 25b covers the requirements for resource emphasis areas (group levels 4 through 9).

Note: In order to ensure the maintenance of older forests is spread out within the TSA the forest cover requirements shown in table 25a will be applied to the draft landscape units and corridors (level 3). The landscape unit boundaries are not yet finalized, however, as the draft units are available in digital form they will be used as a convenient modelling tool. This does not imply these units are final.

6. Current Forest Management Assumptions

Table 25a. Forest cover requirements for group level 3

Biogeoclimatic unit	Time frame	NDT	Mature and old-seral stage		Old-seral stage	
			Minimum retention area (%)	Minimum age (years)	Minimum retention area (%)	Minimum age (years)
ESSFwc1	now - 70 yrs	1	30.2	120	14.2	250
ESSFwc2	now - 70 yrs	1	30.2	120	14.2	250
ESSFwc4	now - 70 yrs	1	30.2	120	14.2	250
ESSFvc	now - 70 yrs	1	30.2	120	14.2	250
ICHwk1	now - 70 yrs	1	28.1	100	9.7	250
ICHvk1	now - 70 yrs	1	28.1	100	9.7	250
ICHmw2	now - 70 yrs	2	28.1	100	9.7	250
ICHmw3	now - 70 yrs	2	28.1	100	9.7	250
Parkland ^a	Now - 70 yrs	5	30.2	120	14.2	250
ESSFwc1	71 - 140 yrs	1	30.2	120	17.0	250
ESSFwc2	71 - 140 yrs	1	30.2	120	17.0	250
ESSFwc4	71 - 140 yrs	1	30.2	120	17.0	250
ESSFvc	71 - 140 yrs	1	30.2	120	17.0	250
ICHwk1	71 - 140 yrs	1	28.1	100	11.6	250
ICHvk1	71 - 140 yrs	1	28.1	100	11.6	250
ICHmw2	71 - 140 yrs	2	28.1	100	11.6	250
ICHmw3	71 - 140 yrs	2	28.1	100	11.6	250
Parkland ^a	71 - 140 yrs	5	30.2	120	17.0	250
ESSFwc1	141+ years	1	30.2	120	19.9	250
ESSFwc2	141+ years	1	30.2	120	19.9	250
ESSFwc4	141+ years	1	30.2	120	19.9	250
ESSFvc	141+ years	1	30.2	120	19.9	250
ICHwk1	141+ years	1	28.1	100	13.6	250
ICHvk1	141+ years	1	28.1	100	13.6	250
ICHmw2	141+ years	2	28.1	100	13.6	250
ICHmw3	141+ years	2	28.1	100	13.6	250
Parkland ^a	141+ years	5	30.2	120	19.9	250

(a) Some timber harvesting land base is typed as park land due to scale of biogeoclimatic classification mapping. In these instances — values for NDT1 ESSF will be used.

6. Current Forest Management Assumptions

Data source and comments:

Biodiversity guidelines will be modelled using information from the *Forest Practices Code Biodiversity Guidebook*. Operationally, draft landscape units and biodiversity emphasis options are being applied consistent with district manager directions. However, because the district manager's policy has draft emphasis assignments, and it is expected that biodiversity emphasis assignment will be completed within 1 to 2 years, the timber supply analysis will use constraints that do not prejudice what may be expected when the emphasis levels have been formally assigned. As it is unknown at this time which landscape units will be officially assigned low-, intermediate- or high-emphasis a single weighted constraint for each of the old plus mature-seral stage and the old-seral stage will be developed based on the anticipated distribution of 45% low-, 45% intermediate- and 10% high-emphasis. The values shown in Table 25a above reflect the weighted *Biodiversity Guidebook* values. However, the old-seral requirement within low emphasis biodiversity will be modelled based upon achievement of one-third the guidebook requirement but built up to 100% by the end of three rotations. Early-seral age requirements will not be modelled (the green-up requirement within the IRM and other zones replaces the early-seral requirement). The definition of forested land includes alpine forest for the model.

The *Biodiversity Guidebook* requirement for mature plus old, and old will first be met as much as possible from the non-contributing land base.

A sensitivity analysis will be conducted to examine the timber supply impacts of applying the draft emphasis options as outlined in the district manager's direction for 1998-2002 Forest Development Plans.

6. Current Forest Management Assumptions

Table 25b. Forest cover requirements for group levels 4 through 9

Resource emphasis		Forest cover objectives				
		Green-up height (metres)	Green-up age (years)	Green-up maximum allowable disturbance	Minimum older age (years)	Minimum older age retained area (%)
5	Caribou ESSF	2		25	140	40
					250	10
6	Caribou ICH	2		25	140	40
					250	10
7	Visual quality-retention	6		5	N/A	N/A
8	Visual quality-partial retention	6		15	N/A	N/A
9	Watersheds domestic	6		25	N/A	N/A
10	Watersheds community	9		25	N/A	N/A
11	Ungulate winter range	2		25	100	40
12	Integrated resource management	2		25	N/A	N/A

Data source and comments:

As per Table 3, for all resource emphasis zones except the integrated resource management (IRM) zone, the forest cover objectives apply to the “operable” forest. The IRM objectives apply only to the timber harvesting land base.

The non-contributing forest within each landscape unit is assumed to age over time.

The integrated resource management zone encompasses that portion of the timber harvesting land base not occupied by any other zone or group, aside from biodiversity emphasis.

6. Current Forest Management Assumptions

6.4.2 Reductions to reflect volume retention in cutblocks

Retention of volume within cutblocks may occur for a variety of forest management considerations. Provide the combination of groups, zones or analysis units where retention occurs and indicate the percentage or volume. For example, these may include wildlife tree patches, riparian management zones or partial cutting systems. All of the columns do not necessarily need to be completed if one or two of the columns adequately describes the issue (e.g., all fir analysis units must retain 2% of block volume).

Wildlife Trees (WT) and Tree Patches (WTP)

The *Biodiversity Guidebook* describes two methods for providing the maintenance of stand structure over time. One method is wildlife trees while the other is wildlife tree patches. Different silvicultural systems may provide the intended structural diversity through modifying the timing timber is available. Consideration should be given to whether the trees will ever be harvested and whether areas in riparian management zones are regularly being used to produce either wildlife trees or tree patches. Recognizing the overlap between these two objectives will eliminate inappropriate reductions in volume or timber harvesting land base.

The *Guidebook* also indicates that wildlife tree patches (group reserves) larger than two hectares in size within a cutblock boundary can contribute to old-seral stage forest requirements at the landscape level.

Table 26. Reductions to reflect volume retention in cutblocks

Management zone	Analysis unit	Reason for residual volume	Persistence	Per cent recommended in applicable guidebook	Per cent residual area estimate on the timber harvesting land base
All	All	WT and WTP	Long term	6	3

Data source and comments:

The figure of 3% shown in Table 26 is based on the assumption that one-half of the total requirement of 6% must be provided by the timber harvesting land base after considering areas already excluded for other reasons. The figure of 6% is the assumed average of all calculations, based on Table 20(a) of the *Forest Practices Code Biodiversity Guidebook*, made for each interim landscape unit across the former Revelstoke Forest District.

Because wildlife tree patches (WTPs) are considered a volume loss within the Revelstoke TSA timber harvesting land base, and not an exclusion from the timber harvesting land base to managed separately, WTPs will be factored into the analysis by reducing volume yield curves for existing and managed stands by 3%. It is assumed for the analysis that a 3% residual area in WTPs equates to a 3% reduction in overall yields.

Wildlife tree patches greater than 2 hectares are not common in the Revelstoke TSA. While operationally these patches contribute to seral stage requirements, they have not been modelled as such because they are not significant in occurrence.

7. Sensitivity Analyses to be Performed

Sensitivity analysis provides a measure of the timber supply impact if uncertainty in management assumptions and/or data integrity exists. The magnitude of the increase or decrease in a particular variable should reflect the degree of uncertainty surrounding the assumption. For instance, minimum harvestable age may be developed based on some minimum stand attributes which currently appear to dictate the earliest time stands are eligible for harvest. Sensitivity analysis may indicate that a small reduction in these attributes may alleviate anticipated harvest level reductions in the future. By developing and testing a number of sensitivity analyses, it is possible to determine which variables most affect results. The first table shows issues that are particular to this TSA. This is followed by a list of standard sensitivity analysis that are carried out in all TSAs.

Table 27. *Sensitivity issues specific to the Revelstoke TSA*

Issue to be tested	Sensitivity levels
Caribou zone	Use of alternative guidelines
Age when forest achieves "old" forest characteristics	+/- 50 years
Existing stand yields	+/- 25% volume in cedar / hemlock due to waste and breakage
Proposed MAC strategy	Perform analysis of draft biodiversity emphasis option assignments
Harvest rules	Test relative oldest first and youngest first

7. Sensitivity Analyses to be Performed

Table 28. Standard sensitivity analysis

Issue to be tested	Sensitivity levels
Minimum harvestable age	+ 10 years
Existing stand yields	+ 10%
Regenerated stand yields	+ 10 / 20%
Land base changes	+ 5 / 10% of mature net operable Addition a portion of helicopter land base
Harvest flow alternatives with base case	
Green-up periods	+ 5 years
Adjacency	Turn off
Old seral in low	Full target now vs 1/3
Mature + old	Turn on / off
Proportional	Turn on /off
Early seral	Turn on
Old/mature guidebook ages	Turn on / off
Visual quality objectives	Go one class lower